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THE ROLE OF TOURISM AND SOCIOBIODIVERSITY FOR TERRITORIAL DEVELOPMENT IN BRAZIL

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The role of tourism and sociobiodiversity for territorial development in Brazil

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THE ROLE OF TOURISM AND SOCIOBIODIVERSITY FOR TERRITORIAL DEVELOPMENT IN BRAZIL

LAURA MARIA GILDA SALLES BACHI

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To my parents and my sister.

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“Tourism can combine with elements of heritage, particularly of culture and environment, to help establish and maintain a level of stability in a community that allows it to approach sustainability in its overall form” (Richard Butler, Contributions of tourism to destination sustainability, 2019).

Resumo

A alta demanda pela produção de commodities agrícolas tem sido associada à perda da cobertura vegetal nativa e saberes tradicionais associados ao uso da biodiversidade no Brasil. A gestão sustentável das paisagens pode reverter esta tendência ao promover sinergias entre importantes serviços ecossistêmicos (por exemplo, provisão, regulação e recreação), a fim de garantir que estes estejam disponíveis para as gerações presentes e futuras. Esta tese explora por que, onde e como existe escopo para fomentar sinergias entre serviços de recreação e provisão de valores materiais e imateriais associados ao uso da biodiversidade, i.e., sociobiodiversidade. O objetivo deste trabalho é identificar quais são as variáveis biofísicas e culturais bem como e as condições-chave de governança, para que o turismo possa agregar aos valores materiais e imateriais associados à sociobiodiversidade Brasileira aliados à manutenção da vegetação nativa em pé. Abordagens de pesquisa multidisciplinar e interdisciplinar envolvendo ciências ambientais e ciências sociais aplicadas foram utilizadas para realizar a revisão de literatura, coleta de dados, modelagem espacialmente explícita e análise de estudos de caso para apoiar os resultados apresentados em cinco capítulos. Cada capítulo da dissertação foca em responder por que, onde e como implementar modalidades de turismo (turismo de base comunitária - TBC, ecoturismo e agroturismo) alinhadas com o uso da biodiversidade, incluindo uma variedade de produtos florestais não-madeireiros (PFNMs) que são coletados usando habilidades e conhecimentos das comunidades tradicionais como açaí, pequi, erva-mate, entre outros. Após a introdução e contextualização do problema, o capítulo 2 mostra que existem iniciativas de TBC, ecoturismo e agroturismo que já agregam valor à sociobiodiversidade Brasileira, mas que muitas vezes são fragmentadas e ocorrem apenas na escala local. Os capítulos 3, 4 e 5 exploram, em escala nacional, quais são as áreas que têm o potencial biofísico e cultural para maximizar as boas práticas das iniciativas locais. Os capítulos 3 e 4 mapeiam pontos quentes com base em variáveis espacialmente explícitas específicas para o TBC na Amazônia, Cerrado e Caatinga incluindo a definição e o mapeamento de 15 Povos e Comunidades Tradicionais (PCT) no Brasil. Por outro lado, o capítulo 5 inclui novas variáveis e identifica áreas potenciais para o ecoturismo também na Mata Atlântica. Finalmente, o capítulo 6 lista as condições-chave de governança para implementar o turismo e a sociobiodiversidade como estratégias à escala da paisagem em contextos específicos. Os resultados mostram que existem 131 iniciativas locais e a soma da área média dos pontos quentes capazes de fomentar modalidades de turismo e a sociobiodiversidade ultrapassa 2 milhões de hectares na Amazônia, Cerrado, Caatinga e Mata Atlântica. Contudo, os resultados também destacam que faltam ações concretas para transformar este potencial em realidade em contextos específicos nesses biomas. Esta tese discute 10 condições-chave para que o turismo e a sociobiodiversidade sejam promovidos sinergicamente para desempenhar seu papel para o desenvolvimento territorial no Brasil, alinhado com a conservação da vegetação nativa em pé.

Palavras-chave: Gestão integrada da paisagem, planejamento do turismo, serviços ecossistêmicos culturais, extrativismo vegetal, modelagem espacialmente explícita.

Abstract

The high demand for agricultural commodity production has been associated with the loss of native vegetation cover and traditional knowledge associated with biodiversity use in Brazil. Sustainable landscape management can reverse this trend by promoting synergies between important ecosystem services (e.g., provisioning, regulation, and recreation) to ensure that they are available for present and future generations. This thesis explores why, where and how there is scope to foster synergies between recreation services and the provision of material and immaterial values associated with the use of biodiversity, i.e., sociobiodiversity. The goal of this study is to identify what are the biophysical and cultural variables, as well as the key governance conditions for tourism to add to the material and immaterial values associated with Brazilian sociobiodiversity, while maintaining the standing native vegetation. Multidisciplinary and interdisciplinary research approaches involving environmental sciences and applied social sciences were used to conduct the literature review, data collection, spatially explicit modeling, and case study analysis to support the findings presented in five chapters. Each chapter of the dissertation focuses on answering why, where and how to implement tourism modalities (community-based tourism - CBT, ecotourism and agrotourism) aligned with the use of biodiversity, including a variety of non-timber forest products (NTFPs) that are collected using skills and knowledge of traditional communities such as açaí, pequi, mate herb, among others. After the introduction and contextualization of the problem, chapter 2 shows that there are CBT, ecotourism and agritourism initiatives that already add value to Brazilian sociobiodiversity, but they are often fragmented and occur only at the local scale. Chapters 3, 4 and 5 explore, on a national scale, which areas have the biophysical and cultural potential to maximize good practices from local initiatives. Chapters 3 and 4 map hot spots based on spatially explicit variables specific to CBT in the Amazon, Cerrado and Caatinga including the definition and mapping of 15 Traditional Peoples and Communities (TPCs) in Brazil. On the other hand, chapter 5 adds new variables and identifies potential areas for ecotourism also in the Atlantic Forest. Finally, chapter 6 lists key governance conditions for implementing tourism and sociobiodiversity as landscape-scale strategies in specific contexts. The results show that there are 131 local initiatives and the sum of the average area of hot spots capable of fostering tourism modalities and sociobiodiversity exceeds 2 million hectares in the Amazon, Cerrado, Caatinga and Atlantic Forest. However, the results also highlight that concrete actions to transform this potential into reality in specific contexts in these biomes are lacking. This thesis discusses 10 key conditions for tourism and sociobiodiversity to be synergistically promoted to play their role for territorial development in Brazil, aligned with the conservation of standing native vegetation.

Key-Words: Integrated landscape management, tourism planning, cultural ecosystem services, vegetal extractivism, spatially explicit modeling

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CBD Convention on Biological Diversity

CES Cultural Ecosystem Services

ES Ecosystem Services

FUNAI National Foundation of Indigenous Peoples

ICMBIO Chico Mendes Institute for Biodiversity Conservation

LPA Local Productive Arrangements

MMA Ministry of the Environment

MSVP Mosaico Sertão Veredas Peruaçu

MTUR Ministry of Tourism

IBGE Brazilian Institute of Geography and Statistics

SDGs Sustainable Development Goals

NGO Non-Governmental Organization

UN United Nations Organization

UNWTO World Tourism Organization

TPC Traditional Peoples and Communities

NTFPs - Non-Timber Forest Products

SDR Sustainable Development Reserve

RESEX Extractive Reserve

GIS Geographic Information System

IUCN International Union for Conservation of Nature

SUMMARY

1. CHAPTER 1: INTRODUCTION

1.1 Presentation

Rural landscapes, in developing countries such as Brazil, have been shaped by the relationships between people and native vegetation such as in Brazilian savannah (Cerrado), semiarid (Caatinga), tropical forests (Amazon and Atlantic Forest) and floodplains (Pantanal). Although rural landscapes in these biomes reflect Brazil's mega biological and cultural diversity, in the new geological era: the Anthropocene (STEFFEN et al., 2018), the physical, socioecological and economic structure of these landscapes are consecutively reorganized in order to meet the growing global demand for the production and export of agricultural commodities (BICUDO et al., 2020; KLINK; MACHADO, 2005). The export of agricultural commodities, also known as neo-extractivism (SVAMPA, 2019), has been predominantly promoted as a territorial development strategy in remote and isolated areas in Brazil (SANO et al., 2019). However, it is necessary to further explore paths for territorial development beyond commodity production (Box 1).

Box 1 – Territory and territorial development.

Territory is defined by biophysical and socio-economic elements distributed across both agricultural countryside and coastal areas (BOLFE et al., 2016). The concept of territory acknowledges the spatial heterogeneity and flows of ecosystem services allowing analysis of scale mismatch, outcomes of decision-making and support policy design (ZASADA et al., 2017). In this sense, a territorial approach introduce a integrative perspective, replacing a sectoral approach (PINTO-CORREIA et al., 2016), to focus on the development of interrelationships between biophysical and cultural resources and activities as assets, such as natural amenities for recreational activities, in order to define suitable areas where they can be successful (SENES; TOCCOLINI, 1998).

Landscapes reflect the interrelationships between biophysical and cultural resources of a territory, thus, the uses and values of landscapes entail significant patterns to a territory (RODRÍGUEZ-DARIAS; SANTANA-TALAVERA; DÍAZ-RODRÍGUEZ, 2016). In this regard, the structure of rural landscapes offers a wide range of functions and ecosystem services that directly or indirectly satisfy human needs by providing water, food, air quality,

scenic beauty, among others (GROOT, 2006) (Box 2). In return, society has different demands for material and immaterial values that rural landscapes provide (CARVALHO-RIBEIRO; CORREIA; PARACCHINI, 2016). Tackling the functions and important ecosystem services (e.g., provisioning, regulation, and recreation) offered by rural landscapes could support territorial development.

Box 2 – Landscape structure, functions and ecosystem services.

Landscape has a physical structure, e.g., composition and configuration of land uses, that create different spatial patterns performing a number of functions, such as the regulation of water, and these functions give rise to services that benefit and have value to people (SELMAN, 2009). Ecosystem services (ES) are all the material benefits that people receive from native standing ecosystems, such as food, water quality (MA, 2005). Meanwhile, cultural ecosystem services (CES) are the intangible benefits that people receive from native standing ecosystems as recreation, sense of place, scenic beauty, heritage (MA, 2005).

Thus, sustainable territorial development across rural landscapes can be understood as the ability of humans/society to enjoy the multiple benefits derived from ecosystems and landscapes. Often these benefits derived from nature directly or indirectly are incorporated into local livelihoods and human wellbeing (Box 3), and this does not compromise the ability of landscapes to meet the needs of present/future generations and the delivery of ecosystem services and functions at landscape scale (TROMMLER; PLIENINGER, 2015).

Box 3 – Livelihoods, Non-Timber Forest Products (NTFPs) and sociobiodiversity.

Livelihoods encompass people's capabilities, assets and activities to ensure means of making a living (STRONZA; FITZGERALD; HUNT, 2019). Over the past decades, governments, development agencies and non-government organisations have focused on understanding how people use non-timber forest products (NTFPs), any product or service other than timber that is produced from native vegetation (fruits, nuts and fibers), and encourage the marketing and sale of NTFPs. In Brazil, the of collection and trade of NTFPs using the knowledge of traditional communities and family farmers is called sociobiodiversity. Federal laws were created with the aim of promote sociobiodiversity productive chains.

In the opposite direction of sustainable territorial development, large scale agricultural commodity production (e.g., soy) represents the intentional conversion of the mosaic of rural landscapes into less diversified and intensive land uses (Box 4). Despite arguments that commodity production may have helped decrease poverty or hunger anyhow, in the medium and long term, this strategy can diminish the stock of landscape functions and ecosystem services that serve current and future generations, reducing the country's resilience in the face of climate change and economic crises (ANDRIJEVIC et al., 2019).

Box 4 – The role of land use and land cover for sustainable territorial development.

Land use (e.g., pasture) refers to the anthropic use of land covers (e.g., forest, grasslands) encompassing the structure (spatial patterns) of the landscape, so that a mix of land use classes (e.g., pasture, cropland, protected area) repeated over large areas forms a landscape mosaic, which is the basic element of a region (FORMAN, 1995). Various factors such as demographic, biophysical, economic conditions, individual, community and cultural values influence land uses, so that certain land uses create "roadblocks," facilitating the development of certain uses and inhibiting others (TURNER et al., 2020). Reconciling classes of land uses for food production, recreation and nature conservation can generate a wide range of functions and services for humanity (CARVALHO-RIBEIRO et al., 2013). Thus, land use is one of the central issues for territorial development (GROOT, 2006).

In developing countries like Brazil, rural landscapes are the areas where these conflicts between land uses, economic interests, social and environmental goals of sustainable territorial development take place (BARAL; HOLMGREN, 2015; SAYER et al., 2013). At the same time, these very rural landscapes hold the potential for innovative transitions from intensive commodity production to a sustainable multifunctional productive mosaic that support human well-being (MAXWELL et al., 2020; PINTO-CORREIA et al., 2016). This PhD thesis explores why, where and how there is scope to foster synergies between recreation services and the provision of material and immaterial values associated with the use of biodiversity, i.e., sociobiodiversity associated with native vegetation land covers as an alternative to land use intensification in Brazil.

ES provided by standing native vegetation land covers include provision of food, water, timber and fiber; regulation of climate, floods and water quality; recreation and CES such as

scenic beauty, heritage and spiritual benefits; and supporting services assist soil formation, photosynthesis and nutrient cycling (MA, 2005). The supply of these landscape functions and ES have been widely studied (DE GROOT; WILSON; BOUMANS, 2002). It is argued that the management of land uses associated with multiple landscape functions and ES (e.g., recreation services and the provision of material and immaterial values associated with the use of biodiversity (HOLMES, 2006)) derive greater benefits than from commodity production, yet demands from international markets for the latter are greater (COSTANZA et al., 1998).

The need to foster multiple landscape functions and ES has been pointed out as sustainable multifunctional production systems that arise from efficient planning and land use management. Planning is a long-term action for bridging efforts for the conservation and sustainable use of biodiversity and ES across to create landscapes (VON HAAREN; LOVETT; ALBERT, 2019). Meanwhile, land use management are routine actions to reconcile agricultural and other land uses associated, for example, with material and immaterial values associated with the use of biodiversity (e.g., forests, grassland, savannah, etc.), that offer numerous functions and ES benefiting both ecosystems and people (FREI et al., 2018).

Land use management for multifunctional production systems is associated to multifunctional landscapes (O'FARRELL; ANDERSON, 2010). Multifunctional landscapes or multifunctional land uses encompass a diversity of land uses simultaneously or sequentially over time in a given place (CARVALHO-RIBEIRO; LOVETT; RIORDAN, 2010), enabling the formation of mosaics that provide a diverse mix of landscape functions and ES of provision and regulation with recreation and heritage (HOLMES, 2006). The ultimate goal of multifunctional land uses is to meet social, economic and environmental objectives (SAYER et al., 2013). Hence, it is increasingly recognized as an asset to implement the 17 United Nations Sustainable Development Goals (SDGs) to prevent ecosystem services loss and to restore rural landscapes (PLIENINGER et al., 2020). Moreover, federal policies, plans and programs for territorial development in Brazil target at multifunctional production systems (Box 5).

Box 5 – Federal laws targeting multifunctional production systems.

National Policy for Regional Development (Decree Nº 9.810/2019):

- Promote the convergence of development levels and quality of life between and within Brazilian regions;
- Consolidate a polycentric network of cities, in support of the de-concentration and interiorization of regional development of the country, in a way that considers the specificities of each region;
- Stimulate gains in productivity and increases in regional competitiveness;
- Foster the aggregation of value and the economic diversification in strategic productive chains for regional development in regions with strong specialization in the production of agricultural or mineral commodities.

National Policy for the Sustainable Development of Traditional Peoples and Communities (Decree Nº 6.040/2007):

- Support and guarantee productive inclusion with the promotion of sustainable technologies, respecting the social organization system of traditional peoples and communities, valuing local natural resources and traditional practices, knowledge and technologies.

National Program for the Strengthening of Family Farming (Decree Nº 3.991/2001):

- Add value to the products and services of family-based units, contributing to their insertion in the market and the expansion of family income.

National Plan for the Promotion of Sociobiodiversity Chains (Interministerial Ordinance Nº 239/2009):

- Strengthen productive chains in each of the biomes adding value to sociobiodiversity products.

However, giving the extreme pressure imposed on rural landscapes by commodity production, at the present, in Brazil, the objectives from these policies, plans and programs targeting at sustainable multifunctional production systems need to be made fully operational and enforceable (CARVALHO-RIBEIRO; LOVETT; RIORDAN, 2010). One of the big

challenge to do so is precisely the fact that the management of multifunctional land use, especially agricultural and recreation services and the provision of material and immaterial values associated with the use of biodiversity, sociobiodiversity, often generate conflicts among actors that inhabit and make their livelihoods from a given rural landscape mosaic (SAYER et al., 2013). Therefore, foster sustainable multifunctional production systems depends heavily on involving a wide range of actors, objectives and promoting governance (Box 6).

Box 6 – Governance for land use management.

Governance promotes the coordination and coherence between the goals and responsibilities of a wide variety of actors in order to ensure that ecological, socio-cultural, and economic values are taken into consideration (OSTROM, 2007). Thus, governance is a key component of land use management for influencing outcomes in rural landscapes (BROWN, 2018). Actors in the landscape should always seek governance practices, rules (formal and informal) to foster transformations in specific socioecological contexts (CORSI et al., 2020). Both academic research and practice seek to identify toolkits to create and maintain robust governance systems (BENNETT et al., 2015).

Governance supports the management of land uses for sustainable multifunctional production systems by negotiating actors' interests and responsibilities using arrangements of formal laws and informal rules, investments and structures of social relations (DELABRE; ALEXANDER; RODRIGUES, 2020). Fully implementing governance might be achieved by using a landscape approach, that seek to provide tools and concepts for allocating and managing land to achieve social, economic and environmental objectives in areas where agriculture, mining, and other productive land uses compete with environmental and biodiversity goals (SAYER et al., 2013) (Box 7). Moreover, landscape approaches offer common ground and a path forward for interdisciplinary studies targeting at territorial development to unravel complex steps to operationalize sustainable production (ARTS et al., 2017).

Box 7 - Landscape approach main principles.

1. Learn from outcomes and results support continuous and adaptive land use management (SAYER et al., 2013);
2. Each actor will join the process only if they have an interest (SAYER et al., 2013);
3. Outcomes at any scale are shaped by processes operating at other scales, including synergies (SAYER et al., 2013);
4. Landscapes provide a diverse range of values, goods, and services (multifunctionality) (SELMAN, 2009);
5. All stakeholders should be recognized (ARTS et al., 2017);
6. Solutions to problems need to be built on shared negotiation processes based on trust (NUNKOO; RAMKISSOON; GURSOY, 2012);
7. Rights and responsibilities of different actors need to be clear and accepted by all stakeholders (SAYER et al., 2013);
8. Systems that integrate different kinds of information need to be developed for easy monitoring (SAYER et al., 2013);
9. Active recognition of threats and vulnerabilities allow recovery after perturbation through improving capacity to resist and respond (SAYER et al., 2013);
10. Develop the ability of actors to participate effectively and accept various roles and responsibilities (SAYER et al., 2013).

1.1.1 The role of tourism and sociobiodiversity for territorial development

While it is acknowledged that commodity production will hardly be surpassed or even replaced in the medium and long-term (RAJÃO et al., 2020), this PhD thesis assumes that there is the need to explore the role of recreation services and the provision of material and immaterial values associated with the use of biodiversity, sociobiodiversity, as an alternative for those rural areas that are occupied by protected areas, family farming and traditional peoples and communities, other than be under constant pressure or transformed into areas for commodities production. Hence, the goal of this work is not to replace, but rather suggest land uses associated with provision and recreational services as a complement to avoid that commodity production press protected areas and overtakes rural enclaves where there are traditional communities and the use of biodiversity in Brazilian biomes (RODRIGUES; BUSTAMANTE; SANO, 2018).

There are multiple landscape functions and provisioning, regulating ES and CES that can contribute to forge sustainable production landscapes (MA, 2005). Each one has a role, yet, no single ES or CES can contribute for sustainable multifunctional production alone, much less endure commodities production pressures alone. It require ensembles of landscape functions, ES and CES or bundles to be made stronger, together (ORSI et al., 2020). Bundles emerge from a set of conditions not always easily identified or managed by policymakers (HOLMES, 2006). Hence, to support decision making and the policies, plans and programs aiming at achieving territorial development it is ideal to identify bundles and the conditions for recreation services (tourism) and the provision of material and immaterial values associated with the use of biodiversity, sociobiodiversity, to instill sustainable multifunctional production systems (CROSSMAN et al., 2013). Provisioning and regulating services are more commonly studied, but the provision of material and immaterial values associated with the use of biodiversity have been lessened defined and quantified (SHACKLETON; TICKTIN; CUNNINGHAM, 2018). Further, it is fundamental to constantly acknowledge CES, such as tourism, which are believed to be important motivators to value, use and manage landscapes for amenity-related purposes (PLIENINGER et al., 2015).

The collection and trade of non-timber forest products (NTFPs) is a provision ES based on the standing native vegetation (GUÉNEAU; DINIZ; NOGUEIRA, 2020). NTFPs play a critical role in livelihoods, ecosystem conservation and rural economies around the world (SHACKLETON; TICKTIN; CUNNINGHAM, 2018). In Brazil, the interaction between biological diversity and cultural diversity, as in the collection and pre-processing of NTFPs using the knowledge and practices of family farmers and traditional peoples/communities, is called sociobiodiversity (NODA; NODA, 2003). Because it promotes the interaction between ecological and human systems through food production, as well as sense of belonging and historical heritage, one of the emerging properties of sociobiodiversity is its multifunctionality (ARAÚJO; GUIMARÃES; LOPES, 2017).

Since 1997, the National Plan for the Promotion of Sociobiodiversity Product Chains and the minimum prices guarantee national policy (ICMBIO, 2018a; LIMA; JÚNIOR; LUNAS, 2015), aim to improve income, productivity and safeguard the traditional use of biodiversity (DINIZ; CERDAN, 2017). However, sociobiodiversity has been marketed mostly in economic values based on the quantity (tons) produced (FREITAS et al., 2020; GUÉNEAU; DINIZ; NOGUEIRA, 2020; HOMMA, 2012). Thus, the knowledge and practices involved in the collection and trade of NTFPs do not translate into effective income for family farmers, which

causing collectors of seeds, flowers, and fruits in the Amazon, Cerrado, and Atlantic Forest farmers to abandon traditional practices (HOMMA, 2014).

Recreation is when people choose where to spend their free time based primarily on natural and cultural characteristics of rural landscapes in a particular area (MA, 2005). Recreation and tourism have been constant themes in the sustainable development discourse since the report “Our Common Future” (BRUNDTLAND, 1987), as activities that can and should contribute within the context where it occurs, integrated with political, social, economic aspects, to promote sustainability (HALL, 2019; INSKEEP, 1987) (Box 8). Since then, the impacts of tourism as a natural and cultural resource intensive activity has been recognized (DREDGE, 1999), and sustainable tourism has been defined as tourism that takes into account its current and future socioeconomic and environmental impacts, meeting the needs of visitors, industry, environment and host communities (UNWTO, 2017).

Box 8 – Background of the role of tourism in international sustainable development reports and conventions.

In 1972, the United Nations Conference on the Human Environment (Stockholm Conference), proclaimed that both aspects of the environment, the natural and man-made, are essential to Human welfare (ONU, 1972). In 1980, the Manila Declaration, convened by the World Tourism Organization (UNWTO), recognized tourism as an activity with global impact (UNWTO, 1980). In 1987, the "Our Common Future" report highlighted that governments need to strengthen and expand strategies such as the promotion of nature-based tourism (BRUNDTLAND, 1987). In 1992, the Earth Summit, held in Rio de Janeiro, Brazil, gave rise to Agenda 21 and highlighted the need for changes in consumption patterns, including Tourism (ONU, 1992). In the 21st century, in 2012, the United Nations conference for sustainable development Rio+20, held in Rio de Janeiro, Brazil, launched the document "The Future We Want" (The Future We Want), reinforcing that a well-designed and managed tourism can make a significant contribution to social, economic and environmental dimensions of sustainable development (ONU, 2012). The year 2015 was marked by the Paris Agreement during the Conference of the Parties (COP21), which recognized climate change as an urgent threat to humanity and the launch of the 17 SDGs of Agenda 2030 (ONU, 2017). The UNWTO stated that tourism can and must contribute directly and indirectly to the achievement of all 17 SDGs, if not well managed, however, tourism can harm the environment and disturbing social structures (UNWTO, 2017).

The Millennium Ecosystem Assessment report (MA), which introduced the concept of ES and CES in 2005, biodiversity became more directly associated with tourism (UNWTO, 2010), which enabled the understanding that the provision of material and immaterial values associated with the use of biodiversity, sociobiodiversity, are of interest to tourism (SAARINEN, 2006). In this perspective, tourism could instill recreational use of protected areas, family farms and rural settlements home of traditional communities in rural landscapes and influence people's perceptions and preferences for sociobiodiversity, as well as other CES such as scenic beauty, historical and cultural heritage (BACHI et al., 2020; CARVALHO RIBEIRO et al., 2018; SMITH; RAM, 2017), as a complimentary alternative to commodity production that can cause deforestation, loss of biodiversity, identity and in these areas (RAUDSEPP-HEARNE; PETERSON; BENNETT, 2010).

Over the past four decades, tourism modalities such as community-based tourism (CBT), a community-led visitation and management model, ecotourism, based on learning about nature, and agritourism, derived from rural tourism, have evolved from sectoral approaches to be directly associated with safeguarding traditional livelihoods, biodiversity conservation and poverty reduction in Brazil and worldwide (BARTHOLO; SANSOLO; BURSZTYN, 2009; BUCKLEY, 2011; HALL, 2010; LENZEN et al., 2018; LUPI et al., 2017; RASOOLIMANESH et al., 2017; SCOTT; HALL; GÖSSLING, 2019; STRONZA; FITZGERALD; HUNT, 2019). Ecotourism support protected areas, wildlife management, and host communities (BRANDT; BUCKLEY, 2018; STRONZA; FITZGERALD; HUNT, 2019). Similarly, it has been observed that agritourism promotes livelihoods and the sale of rural products (TAO; WALL, 2009). CBT contributes to natural and social capital enhancement and economic gains in rural areas (QIAN et al., 2017).

This PhD thesis holds the assumption that, under specific conditions, CBT, ecotourism and agritourism can promote the provision of material and immaterial values associated with the use of biodiversity, sociobiodiversity, in rural areas in Brazil and worldwide (GONÇALVES et al., 2021; LUPP; KONOLD; BASTIAN, 2013; SOUZA et al., 2020; TAO; WALL, 2009). It assumes that tourism modalities can help restore the pride and motivate people to demonstrate the knowledge and practices associated with the maintenance of biodiversity and standing native vegetation by fostering Brazilian sociobiodiversity, that has been decreasing as agricultural frontiers advance (GOMES; VADJUNEC; PERZ, 2012). Also, create new markets for both material and immaterial values of sociobiodiversity. Although NTFPs such as açaí and Brazil nut have a history of participation in long market chains, other products,

still do not participate in significant distribution circuits and are beginning to be promoted in the context of alternative food systems (DINIZ; CERDAN, 2017). Thus, tourism modalities could help to promote such material values, but also the traditional use of biodiversity in Brazilian biomes.

In turn, the use of biodiversity by traditional communities and family farming can ensure the supply of natural and cultural assets that attract tourists and increase the quality of tourism (UNWTO, 2010). Tourism that adds value to the use of biodiversity is understood as an alternative to land uses more likely to perpetuate negative impacts from commodity production (e.g., soy plantation) (STRONZA; FITZGERALD; HUNT, 2019). Thus, together, recreation through tourism modalities and the provision of material and immaterial values associated with the use of biodiversity, sociobiodiversity, can be explored as alternative to intensive land uses that put pressure on protected areas, family farming and rural settlements in agricultural countryside and coastal areas (BEZERRA; VIEIRA, 2016; BURKOWSKI; BOAS, 2014; LOUREIRO; GORAYEB, 2013). Together, tourism modalities and sociobiodiversity could form a stronger and more resilient bundle of functions and ES associated with standing native vegetation in these areas and complement mosaics of land uses associated with commodity production.

Although in theory there are linkages between tourism and sociobiodiversity that when implemented together can be alternative to land use intensification, there is the need to explore in practice where and how this bundle can be successfully implemented. Moreover, meeting multiple social, economic, and environmental objectives from one ES, especially provisioning, can decrease the offer of other services, causing tradeoffs and explicit competition among these objectives (SAYER et al., 2013). Hence, assessments of this bundle of tourism and the provision of material and immaterial values associated with the use of biodiversity needs to target in an explicit way places where there might be spatial integration and mutual benefit, i.e. synergies, between tourism modalities and sociobiodiversity (SELMAN, 2009) (Box 9).

Box 9 – Synergy for sustainable production landscapes.

Synergy is defined as a win-win situation (DE GROOT et al., 2010). Synergies, like trade-offs, describe relationships between and within social-ecological systems. Where this relationship is positive, i.e. an increase in element A causes the improvement of element B, advantageous situations tend to arise, such as a more self-sustaining landscape (GONZALEZ-OLLAURI; MICKOVSKI, 2017). Synergies between elements within the landscape can be the result of natural processes or management decisions (SELMAN, 2009). Synergy is an essential feature of multifunctional landscapes and needs to be constantly maximized (HOLMES, 2006). Considering that policymakers call for academic tools for supporting appropriate decisions to maximize synergies (PALACIOS-AGUNDEZ et al., 2015), there is the need to search where multiple socioecological and policy goals can be achieved simultaneously (VALLECILLO et al., 2018).

Synergies emerge from functional interactions and spatial integration, rather than mere placement, between landscape features such as cultural and biophysical elements in rural landscapes that can be directly linked to the supply of NTFPs and the material and immaterial values associated with the use of biodiversity, for instance, conservation units and Traditional Peoples and Communities (TPCs) in Brazil which ensure and support sociobiodiversity (GUÉNEAU; DINIZ; NOGUEIRA, 2020). Recreation or ecotourism, CBT and agritourism can be defined also by the location of conservation units, rural settlements and accessibility (e.g., distance to roads) (SCHMIDT et al., 2019). Further, when such elements occur at the same geographical place or even overlap, it can characterize a spatial integration of tourism and sociobiodiversity indicating suitable areas for sustainable production (FREI et al., 2018). An important challenge, however, is that all of these interactions and spatial integration can take place at more than one scale (e.g., the physical dimensions in space) (MA, 2005; SELMAN, 2009).

Thus, assessments of synergies between tourism and the provision of material and immaterial values associated with the use of biodiversity, needs to be conducted at two or more discrete scales (SCHOLES et al., 2013) (Box 10) and encompass a spatial explicit dimension (CROSSMAN et al., 2013). Multi-scale assessments contribute with useful methods such as conduct independent scale-specific studies and assess which the findings at one scale can be

upscaled towards other scales that can be assisted by conducting pilot studies (SCHOLES et al., 2013) to identify synergies.

The fact that landscape approach often operate at the landscape or regional scale (e.g., where agriculture and land uses associated with standing native vegetation often compete and where different actors can actively participate in land use management) (SAYER et al., 2013), does not prevent other scales from being analyzed. In fact, it is important to gather findings about interactions at upward (national) and downward (local) scales to better inform the scale at which decision-making take place, such as landscape scale (SELMAN, 2009). So, findings about synergies from independent scale-specific studies need to be synthesized to make it useful for sustainable production (SCHOLES et al., 2013). Therefore, it is desirable in multi-scale assessments to harmonize methods and core datasets across scales (SCHOLES et al., 2013).

Box 10 – Multiple-scale assessments for sustainable production landscapes.

Multi-scale is defined in this study as the perspectives at local, regional, national and global scales (AGUIAR et al., 2020). Local decision making about land uses can be driven by forces from regional and national scales, such as a set of laws and formal rules that govern people's actions and land use (CAILLAULT et al., 2013). Moreover, when land use changes become sufficiently pervasive, multi-scale processes become more important and linked to the global system (BUTLER, 2000). Yet, multifunctionality is often discussed in relation to the landscape or regional scale, which connects smaller (local) and greater (national, global) scales, offering the perspective of an integrated policy and sense of place to assist in the management of land uses and sustainable production landscapes (SELMAN, 2009). Hence, the three main reasons for conducting multi-scale assessments are (adapted from SCHOLES et al., 2013):

- Assess individual ecological and social processes at the scale at which they operate and to be linked to processes at different scales;
- Allows validation of larger-scale conclusions by smaller scale studies and create a context at larger scales for findings at smaller scales;
- Report and response options to match the scales at which social decision-making occurs, with which people can relate and act (e.g., landscape scale).

To identify synergies between tourism and the provision of material and immaterial values associated with the use of biodiversity, sociobiodiversity, in addition to include landscape features such as cultural and biophysical elements, including the definition and mapping of 15 TPCs in Brazil, multi-scale assessments must also involve a range of social capital, institutional capacity, investments and other aspects of socioecological systems (ZIELINSKI et al., 2020). When put together and arranged in a such way, these aspects or mechanisms (including policies, plans and programs targeting at sustainable production operational and enforceable (ESTRADA-CARMONA et al., 2014)), make up governance systems operating from local to national scales (OSTROM, 2007), that can maximize or hinder synergies (Box 11).

Therefore, although this PhD thesis acknowledges that the National Plan for the Promotion of Socio-biodiversity Product Chains (PNPSB) focuses on promote productive chains and that today local productive arrangements (LPA) of the goods and services from the use of local biodiversity by traditional communities and family farmers are supported in the Amazon, Caatinga, Cerrado and Atlantic Forest (ICMBIO, 2018a), it proposes to explore where there is potential synergies between sociobiodiversity and tourism modalities and governance mechanisms by covering the entire Brazilian territory, including both the areas where chains exist and do not yet exist, as means to provide an comprehensive overview of where and how synergies could be implemented and upscaled according to biophysical potential and supply of mechanisms on the Brazilian territory.

Box 11 – Governance systems and mechanisms.

- Social capital, a network of relationships recognized in the format of associations and cooperatives that underlies the construction of competitive advantages and the transmission of knowledge to all who are part of the network of partners (SANTOS et al., 2017);
- Institutional capacity also make up governance systems and are the sets of formal rules, laws, informal norms or shared understandings that structure political, economic and social interactions (STRONZA; FITZGERALD; HUNT, 2019);
- Partnerships, as the relationship between stakeholders (ROMERO-BRITO; BUCKLEY; BYRNE, 2016);
- Funding given by governments, non-governmental organizations (NGOs) to implement projects and management (PEÑA-AZCONA et al., 2021).

This study acknowledge the national tourism policy that aims to promote tourism's role for territorial development in Brazilian biomes (GALDINO; COSTA, 2011; LANZARINI; BARRETTO, 2014) (Box 12). However, official data from the Ministry of Tourism (MTUR) state that tourism economy is strongly rooted on coastal tourism in coastal cities and urban centers (MTUR E FIPE, 2021). Further, despite the efforts of the National Tourism Regionalization Program that tried to implement regional governance of Tourism (SETTE; VALLE; COUTINHO, 2014), there is still lack of clarity in guidelines, communication and investment (SETTE, 2017). Lack of investment in accessibility is also appointed as one of the challenges to develop CBT, ecotourism and agritourism in rural landscapes (MORAES; MENDONÇA; PINHEIRO, 2017). Furthermore, the regional governance of tourism is dependent on the political environment (VALENTE; DREDGE; LOHMANN, 2015).

Regarding the challenges for fostering governance systems for sociobiodiversity, recent programs suggest the structuring of regional sociobiodiversity itineraries in Brazilian biomes (SCHWANKE, 2019), including in those that receive less attention from policies, such as the Caatinga (ANDRADE; DANTAS, 2020). Yet, rural communities have been self-organizing at local scale (CIADELLA et al., 2022; GUÉNEAU et al., 2017; PÔVOA; VINHA, 2019). Further, there are doubts that public policies are able to consolidate and expand the local market of sociobiodiversity products (LIMA; JÚNIOR; LUNAS, 2015; VILHENA; JÚNIOR; FREITAS, 2019).

Box 12 – Goals of the National Tourism Policy.

National Tourism Policy (Law Nº 11.771/2008):

- Reduce regional social and economic disparities, promoting social inclusion through the growth of the work offer and better income distribution;
- Stimulate the creation, consolidation, and diffusion of Brazilian tourist products and destinations, with the purpose of attracting national and foreign tourists, diversifying the flows among the Federation units and seeking to benefit, especially, the regions with the lowest levels of economic and social development;
- Promote, decentralize, and regionalize tourism, stimulating States, Federal District, and Municipalities to plan, in their territories, tourist activities in a sustainable and safe way, including among themselves, with the involvement and effective participation of the receiving communities in the benefits resulting from the economic activity;
- Propitiate the practice of sustainable tourism in natural areas, promoting the activity as a vehicle for environmental education and interpretation and encouraging the adoption of conducts and practices of minimal impact compatible with the conservation of the natural environment;
- Preserve the cultural identity of communities and traditional populations eventually affected by tourist activities.

Although sustainability science and the complexity of Brazilian contexts emphasize the challenges to identify synergies and governance systems for tourism and sociobiodiversity to instill sustainable production (BÉLAIR et al., 2010), existing tourism initiatives involving rural communities, organizations, associations and cooperatives in regions facing intensive commodity production, are already transforming the ways of thinking and doing towards sustainable production (BENNETT et al., 2016). In Brazil, these initiatives are understood as place-based local efforts to confront intensive commodity production, however, they are often overlooked and not currently dominant at national scale (BRONDIZIO et al., 2021). So far, little is known about initiatives aimed at promote tourism modalities and sociobiodiversity in Brazil (LOUREIRO; GORAYEB, 2013). Nevertheless, this PhD thesis also assumes that, even though these initiatives are often local and context-specific, they can accelerate the study of synergies and governance systems for sustainable production (BALVANERA et al., 2017).

Account for local contexts is mandatory for multifunctionality and assessments at the local scale are believed to bring in lessons for land use management (DUNCAN et al., 2020). Thus, once the information available in peer review literature and in government reports, NGOs, institutes official websites about the practice of local initiatives is collected and mapped using methods that explicitly incorporates interactions among local actors, including 15 TPCs in Brazil, cultural and biophysical elements describing contexts, the lessons learned from the implementation of a set of initiatives that promote tourism modalities and sociobiodiversity can inform about local synergies (BALVANERA et al., 2017). In this sense, initiatives can also be a starting point to assess governance systems that motivate the adoption of sustainable development dimensions (social, economic and environmental) (SAARINEN, 2006) and land use management, including co-management by the government and local communities, or by a NGOs with community input, and community-based management (NYAUPANE; POUDEL; YORK, 2020).

Although local tourism initiatives *per se* cannot be upscaled and are rather geographically fragmented, the lessons learned from them can assist assessments of synergies and governance systems at larger scales (BALVANERA et al., 2017). National scales offer an overview of inextricably links between cultural and biophysical elements and human action across rural landscapes influencing interactions at smaller-scales (KÁDÁR; GEDE, 2021). The use of geographic information systems (GIS) can support the mapping and spatial explicit modelling of cultural and biophysical elements and 15 TPCs that make up interactions at local scale and identify suitable areas for spatial integration at national scales (CROSSMAN et al., 2013) (Box 13). Governance mechanisms can also be mapped at national scales to clarify where and how diverse actors are knitted together to focus on common problems, stimulate collaboration, build trust, provide information and encourage the development of common perspectives on policy issues at local and national scales (FOLKE et al., 2005).

Box 13 - Spatial explicit modelling.

GIS-based modelling and mapping approach are used to understand the supply, demand and flows of ecosystem services (BURKHARD et al., 2013). Although modelling and mapping approaches have made practical application in science and policy, there are still uncertainties and risks associated with modelling and mapping. Therefore, researchers and practitioners must always seek to create a standard process to develop comprehensive models, maps and use long lists of indicators (BURKHARD et al., 2013). The interpretations of maps and models outputs must also be viewed with regard to spatial resolution and scale (VIZZARI, 2011). Different methods can be used to map each ecosystem service, such as GIS spatial analysis derived from multicriteria techniques (VIZZARI, 2011). Even though, it is assumed that material ES such as food provision are easier to map than cultural ES such as recreation (CROSSMAN et al., 2013). Data used to model and map can involve the location of important natural features or other landscape characteristics (CROSSMAN et al., 2013).

Finally, specific-scale studies within multi-scale assessments, such as case studies at regional scale, can be especially useful to uncover key conditions and suggest governance systems to implement synergies at regional scale by identifying actors for leveraging system change and bring about sustainable production (SCHOLES et al., 2013). In this sense, both landscape and region are understood as human scales (FORMAN, 1995). Therefore, the selection of regions for case studies must encompass a broad geographical area (e.g., a set of municipalities) comprised by biophysical elements, mosaics of land uses and connected by transport, communication, natural and cultural heritage contributing to a shared territorial identity that is particularly strong, being state or nationally recognized (FORMAN, 1995; NOGUÉ; VICENTE, 2004; RAMOS et al., 2016).

Studies on multifunctionality and land use management have been developed worldwide since the multifunctional rural transition (MRT) conceptual framework proposed by (HOLMES, 2006). Studies on multifunctionality and land use management supported by landscape approach principles have been also growing in Latin America, the Caribbean and also in Brazil. Research has been giving emphasis on identifying examples of initiatives that apply landscape approach principles (ESTRADA-CARMONA et al., 2014), meanwhile others evaluate synergies between territorial development and agricultural mitigation in Brazil (BRANCA et al., 2013; ESTRADA-CARMONA et al., 2014). However, little has been done

to study multifunctionality in rural landscapes whether there are synergic effects between tourism modalities and the provision of material and immaterial values associated with the use of biodiversity, sociobiodiversity, and where there is potential for both to be promoted at the same time and what governance systems able to promote sustainable production in the Anthropocene.

Since 1970, the literature assessed the relationships between tourism and biodiversity, in protected and rural areas (STRONZA; FITZGERALD; HUNT, 2019). Since the 80s, the literature on NTFPs has studied the variety of uses, material and immaterial values of non-timber species, quantity produced, access to markets, and solutions to preserve traditional use (JACOBS, 1984; MEINHOLD; DUMENU; DARR, 2022; SHACKLETON; TICKTIN; CUNNINGHAM, 2018; ZHANG et al., 2021). In Brazil, since 2005, studies on NTFPs and sociobiodiversity vary from conceptualizing NTFPs extractivism, livelihoods, food security, social relations, heritage, identity, justice, and participation in public policies (ARQMO, 2005; CONTINI; CASTILHO; COSTA, 2012; FONTE, 2015; FREITAS et al., 2020; HOMMA, 2012, 2018; HOMMA; SANTANA; ZANDER, 2020; NETO, 2017; VILHENA; JÚNIOR; FREITAS, 2019).

National case studies on protected areas, local communities and rural properties analyze limitations and contributions of tourism in fostering the maintenance of standing native vegetation for recreation and multifunctionality by valuing ecological and cultural elements in rural areas (BASTOS; FILHO, 2020; CARVALHO MARTINS et al., 2022; COSTA-ALVES; GUIMARÃES, 2009; GALVÃO; CASTRO; MARQUES, 2018; KLEIN; SOUZA, 2013; SILVA; FOLMER, 2020), but do neither explicitly nor empirically relate standing native vegetation for recreation and food provision as a way to instill sustainable production. In 2012, a study linked tourism and local sociobiodiversity based on the contribution of CBT to the conservation of traditional livelihoods and the preservation of biodiversity (SAMPAIO; ZAMIGNAN, 2012).

In the Amazon, a study explored the interaction between recreational ecosystem services and NTFP extractivism (CARVALHO RIBEIRO et al., 2018). International studies link NTFPs and tourism as a strategy for income generation for communities and biodiversity conservation (ADOM; BOAMAH, 2020; KE et al., 2020; MORGAN et al., 2022; ZHU; LO, 2021). The majority of this work develops at the case study and local scales. In general, studies that focus on upscaling local tourism and sociobiodiversity synergies to promote multifunctional uses at

the landscape scale are still lacking in Brazil. In addition, information on sociobiodiversity and NTFPs collection and its synergies with different tourism modalities is very fragmented and/or non-existent (PEREIRA et al., 2012; RODRIGUES; SOUZA, 2015).

To explore the role of tourism and sociobiodiversity for territorial development as alternatives to land use intensification and to meet goals of reducing poverty (SDG 1), hunger (SDG 2), improving employment and income (SDG 8), and biodiversity conservation (SDG 15), it is necessary to study why, where and how there is scope to foster synergies between tourism modalities and sociobiodiversity in Brazilian biomes and inform policymakers. Regarding the approaches to do so, multi-scale assessments and tourism initiatives provide a sound scientific basis for identifying synergies between recreation and food provision, where there is potential for both to be promoted at the same time. Furthermore there is the need to include what governance systems will be able to promote sustainable multifunctional production by maintaining the standing native vegetation (BALVANERA et al., 2017; SCHOLES et al., 2013). However, a central challenge of this methodology is data availability and use conceptual frameworks and the most appropriate spatial explicit methods to conduct such complex analysis.

Data and information on tourism modalities and sociobiodiversity are often fragmented in literature and across governmental and NGOs, institutes and foundation databases. Furthermore, few studies have gathered significant amount of information to analyze a set of CBT initiatives (ZIELINSKI et al., 2020). Although it is difficult to find and access available databases with relevant information, it is argued that data on tourism initiatives that add to the material and immaterial values of sociobiodiversity might exist. Furthermore, given the growing understanding that rural landscapes are becoming laboratories for initiatives that promote sustainable development dimensions and represent the demand for change, but are not yet recognized beyond the local scale (HAMANN et al., 2020; RAUDSEPP-HEARNE et al., 2020). It is the duty of academic research to collect, organize and analyze available information to understand factors and processes that can lead to the emergence and growth of synergies with sociobiodiversity for sustainable multifunctional production (e.g., producing food and fiber without compromising environmental functions and fostering social wellbeing (SHACKLETON; TICKTIN; CUNNINGHAM, 2018)).

Previous studies already identified initiatives that might encompass several key principles from landscape approach and sustainability dimensions such as ecological,

economic, sociocultural and political (BRONDIZIO et al., 2021; HAMANN et al., 2020; RAUDSEPP-HEARNE et al., 2020). Conceptual frameworks such as the STEEPV, including social, technological, economic, ecological, political and ethical values aspects (LOVERIDGE, 2016), can be used to evaluate interactions in social-ecological systems involving these six themes and help to explicitly consider impacts from tourism on sociobiodiversity and, vice-versa, to promote change (HAMANN et al., 2020). Other frameworks designed to assess how integrated landscape approaches are used in practice and focus on the location and context, motivations, actors involved, investments, and governance structures of landscape initiatives (ESTRADA-CARMONA et al., 2014), can also support the analysis based on tourism initiatives.

Methods that use Geographic Information Systems (GIS) for mapping biophysical and cultural elements, as well as infrastructure and other relevant variables including TPCs (BUTLER, 2000; UNWTO, 2010) have been used throughout the globe. In this sense, spatially explicit analysis such as simulation models and decision support analysis such as multi-criteria analysis (MCA) (ALLAIN; PLUMECOCQ; LEENHARDT, 2017), can estimate where biophysical and cultural elements, as well as including the definition and mapping of 15 TPCs, socio capital and institutional capacity supply areas simultaneously exist at national scale (BROWN, 2018; LUBELL; MORRISON, 2021; PINTO-CORREIA; KRISTENSEN, 2013; VON HAAREN, 2002). However, so far neither the landscape approach nor spatially explicit tools have been comprehensively used to assess synergies between tourism and sociobiodiversity at different scales.

1.2 Hypothesis and research questions

Following from the above, this study proposes to test the hypothesis that tourism integrated with sociocultural, economic, political, biophysical elements and immaterial values of sociobiodiversity can promote transitions towards sustainable land uses in Brazilian biomes. Based on this hypothesis and based on the scarcity of empirical data in national and international literature, this study seeks to answer three general questions: a) why tourism and sociobiodiversity can be synergically linked to enhance the value of rural landscapes its native vegetation and traditional livelihoods; b) where and at what scales there are possibilities and limitations in Brazilian biomes to synergistically establish tourism and sociobiodiversity; and c) how to implement the synergies between tourism and biodiversity use in distinct socioecological contexts? More specifically, the following questions will be examined:

1) To what extent local initiatives synergistically integrate the collection and trade of NTFPs, practices and knowledge with tourism modalities at the present across the Brazilian biomes?
2) Where can the benefits of tourism modalities for rural landscapes, its native vegetation and the use of NTFPs and its linked sociobiodiversity be strengthened at multiple scales?
3) How can tourism and sociobiodiversity be implemented in distinct contexts in Brazilian biomes to foster land use management at the landscape scale?

1.3 Research goals

1.3.1 General goal

The overall goal of this thesis is to identify what are the biophysical and cultural variables, as well as the key governance conditions, i.e., overarching aspects, for tourism to add to the material and immaterial values associated with Brazilian sociobiodiversity, while maintaining the standing native vegetation, within multifunctional management and landscape approaches as an alternative to land use intensification in Brazil.

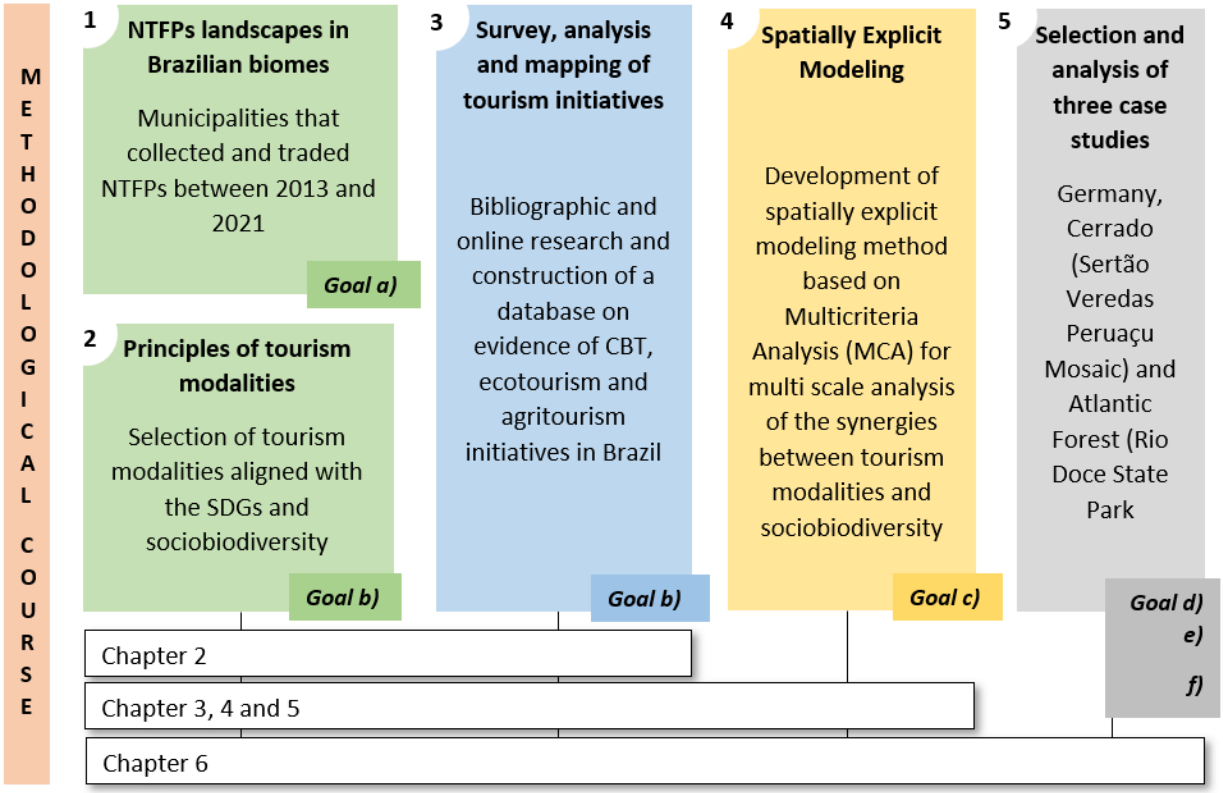
1.3.2 Specific goals

a) Characterize and analyze Brazilian rural landscapes from the overall perspective of sociobiodiversity material and immaterial values, and NTFPs collection and trade;
b) Characterize and analyze tourism initiatives describing the main goals and structure in rural landscapes where sociobiodiversity and NTFPs extractivism is taking place;
c) Estimate areas with biophysical and cultural elements and aspects of governance systems to foster synergies between tourism and sociobiodiversity at multiple scales;
d) Identify key conditions to promote multifunctional synergies between tourism and material and immaterial values in the use of biodiversity at landscape scale based on case studies;
e) Explore the perceptions of actors in the case studies regarding the role of CBT, ecotourism and agritourism in promoting biodiversity use for territorial development;
f) Suggest key conditions for fostering governance systems for multifunctional land use management in specific contexts at landscape scale in the Cerrado and Atlantic Forest.

1.4 Methodological course

The methodological course was developed based on five phases to answer the questions and objectives of this research (Figure 1). Research question 1 was related to specific objectives a) and b) and is answered in Chapter 2. Research question 2 was related to specific objectives b) and c) and is answered in Chapter 3, 4 and 5, while research question 3 was related to specific objectives d); e); and f) and is answered in Chapter 6.

Figure 1 - Flowchart of the five phases involved in the methodological course.



Source: Elaborated by the author.

The first phase of the methodological course began by identifying areas where the provision of material and immaterial values associated with the use of biodiversity, i.e., sociobiodiversity takes place in Brazilian biomes. In Brazil, there are official statistics on the collection and commercialization of 33 NTFPs cataloged in the categories of: food, aromatic, medicinal, dyes, rubbers, waxes, fibers, non-elastic gums, oil seeds and tannins, according to the Brazilian Institute of Geography and Statistics (IBGE). According to information on the quantity of the main products obtained through the process of exploitation of non-timber forest resources, called vegetal extractivism, from IBGE, between the years 2013 and 2021, the NTFPs with the highest quantity produced (tons) throughout the national territory were mate-

herb, açaí, Brazil nut, pequi, babaçu, carnaúba, Araucária seed[1] and piaçava (ICMBIO, 2018). Data on the quantity produced of the 33 NTFPs at the municipal level from 2013 to 2021 were selected to identify areas where NTFPs collection exists in the Brazilian biomes, taking into account annual variations in quantity collected and commercialized (HOMMA, 2018). We complemented this data with information from gray literature about the material and immaterial values associated with the use of biodiversity, such as NTFPs collection, i.e., sociobiodiversity.

Next, we assumed that it is necessary to define the tourism modality being studied to advance the existing knowledge about sustainable forms of tourism associated with the standing native vegetation (BUTLER, 1999), in order to explore further the synergies between tourism and sociobiodiversity (Box 14). Therefore, three tourism modalities were defined to be analyzed in the geographical area where NTFPs collection and trade occurs and that can contribute to achieving SDGs such as: poverty reduction, by providing income through job creation at local and community levels (SDG 1); reducing hunger, by stimulating sustainable agriculture and the sale of local products to tourists (SDG 2); economic growth, by providing decent work opportunities and diversification of activities (SDG 8); sustainable use of terrestrial ecosystems, in managing, conserving biodiversity, generating income as an alternative livelihood for local communities (SDG 15) (UNWTO, 2017).

[1] Ombrophylous Mixed Forest, also known as Araucaria Forest, is where the Araucaria angustifolia (Bertol.) species predominates. Araucária seed or “pinhão” is produced by the Araucária tree. The remnants of Araucaria Forests in the south of the country occur at altitudes between 500m and 1,200m, in the scattered patches in the states of São Paulo and Minas Gerais, are located in higher areas, mainly in the Serra da Mantiqueira, and can reach 1,800m (FICHINO, 2014).

Box 14 – Tourism modalities.

Tourism modalities based in rural landscapes, its native vegetation and traditional livelihoods can support socioeconomic alternatives and use of biodiversity associated with livelihoods (MACHAR, 2020). Community tourism occurs when governments, tourists, hosts, tour operators assume ethical responsibilities (CHOI; SIRAKAYA, 2006; JAMAL; GETZ, 1995). Outdoor recreation deals with the supply and demand of natural resources for recreational purposes (MCCONNELL, 1985). Rural tourism is any tourism activity within rural areas (STREIFENEDER, 2016). However, some tourism modalities have definitions and a clear set of principles (NASH; BUTLER, 1990; STRONZA; FITZGERALD; HUNT, 2019), and can favor the analysis of synergies with sociobiodiversity. CBT is a management and visitation model centered on the effective participation of traditional communities, valuing their history, identity, sense of place, culture, and the sustainable use of biodiversity (BARTHOLO; SANSOLO; BURSZTYN, 2009). In Brazil, CBT is associated with a political and social movement directed to the history of struggles for land ownership (MORAES; MENDONÇA; PINHEIRO, 2017). Ecotourism is a non-invasive form of nature-based tourism that focuses on learning about nature, environmental education, and traditional ecological knowledge with low impact to host communities (STRONZA; FITZGERALD; HUNT, 2019). Agritourism is part of the rural tourism modality, however its principles are focused on valuing family farming and livelihoods associated with farming (LUPI et al., 2017; PHILLIP; HUNTER; BLACKSTOCK, 2010). Agritourism takes place on farms where the main source of income is the agricultural activity and does not simulate or stage agricultural activities to show tourists (STREIFENEDER, 2016).

From these two initial phases, the third phase consisted in the development of a survey, data analysis and mapping of CBT, ecotourism and agritourism initiatives (Box 15). First, data was surveyed throughout Brazil, then in the areas where NTFPs collection and trade was mapped. At this stage it was assessed if, at present, there are synergies between tourism initiatives and sociobiodiversity across the Brazilian biomes.

Box 15 – Tourism initiatives.

Tourism initiatives are understood in this study as destinations, itineraries, routes, projects, programs or circuits that exist, even if in the form of prototypes, that put into practice the principles or define themselves as exercising CBT, ecotourism and agritourism (BUTLER, 1999). The concept of initiatives emerged in association with the Anthropocene, as "seeds of good Anthropocene" that represent a diversity of social, technological, economic or socioecological worldviews, values and regions, but that are not currently dominant (BENNETT et al., 2016). For this reason, the scale of action and impacts of these initiatives is highly variable and may be predominantly at the local scale (BRONDIZIO et al., 2021). Still, in light of the urgency to promote sustainable management of rural landscapes and multifunctional land use, initiatives that exist in areas where NTFPs have been collected and traded, but that are not currently dominant, can be used to optimize the analysis of synergies between tourism and sociobiodiversity and support transformative change.

From the local tourism initiatives analyzed in the third phase, the fourth phase consisted in the spatially explicit modeling of potential areas for upscaling or maximizing potential synergies between tourism and sociobiodiversity at national scale. The execution of this phase is an opposition to generalized statements that often take the relationships between tourism and socio-ecological systems for granted (BUTLER, 2000). Although today there is an understanding that tourism modalities are associated with biophysical and cultural elements found in rural landscapes (BUTLER, 2000; UNWTO, 2010), there is little evidence as to mapping these interactions using spatial variables to highlight potential areas where synergies between tourism and the use of biodiversity can be upscaled at bigger scales (BOYD; BUTLER; HAIDER, 1994). Hence, a deterministic model was developed to simulate potential areas to upscale the synergies between tourism and sociobiodiversity at national scale. A model is deterministic when it has a known set of input data and from which will result a single set of outputs (HENEIN; MERRIAM, 1990). The constraint of such a model, however, is that under slightly differences in values of scores and weights used in simulations, it can generate two different outcomes (GREBOGI et al., 2002a). Thus, a deterministic model is considered good when the set of outcomes of two or more simulations are similar (GREBOGI et al., 2002b).

Thus, in this phase we selected sets of spatially explicit variables (e.g., biophysical and cultural elements, 15 TPCs, road infrastructure) associated with tourism modalities and

sociobiodiversity (Box 16). Scores and weights were allocated to the variables following the method for multi-criteria analysis (MCA) (SHEPPARD; MEITNER, 2005), to simulate where are potential areas to upscale the synergies between tourism and sociobiodiversity at national scale. The definition of the values of scores and weights was done analytically and based on literature review to assess the optimal scale for rating each variable and criteria (YAN; GAO; ZHANG, 2017).

Box 16 – Biophysical and cultural aspects in rural landscapes associated with tourism and sociobiodiversity.

CBT: is centered in the effective participation of traditional people and communities promoting intercultural exchange, valuing the history and culture and sustainable use for recreational and educational purposes of the resources in Conservation Units and rural settlements (QIAN et al., 2017).

Ecotourism: can be associated with natural monuments used in the observation of the fauna of birds, endemic animals, the vegetation of ornamental and scenic exuberance, geological formations in contemplation activities in interpretive hikes and trails (MTUR, 2008b), as well as in state forest, national forest, municipal natural park, wildlife refuge, biological reserve, sustainable development reserve where the nature interpretation can be done in partnership with local communities (STRONZA; FITZGERALD; HUNT, 2019).

Agritourism: take place in family working farms (STREIFENEDER, 2016). According to the Federal Decree 9.064/2017, family farming occupy an area up to four fiscal modules and strictly family management. Also, visit historical farm buildings and appreciation of the natural environment surrounding of the farm such as natural pasture, native forests, rivers and waterfalls (CIOLAC et al., 2019). Organic agriculture and rural products such as cane brandy, coffee, jellies are also important for agritourism (LUPI et al., 2017; PHILLIP; HUNTER; BLACKSTOCK, 2010).

Similarities: CBT and Ecotourism can take place in Conservation Units and involve traditional livelihoods such as indigenous lands and quilombola communities (NYAUPANE; POUDEL, 2011). Agritourism and CBT can also take place in rural settlements in both the countryside and coastal areas (LOUREIRO; GORAYEB, 2013). Sociobiodiversity is also associated with Conservation Units that allow the collection and trade of NTFPs (ICMBIO, 2018a).

Only after careful analysis of the synergies between tourism and sociobiodiversity at the local and national scale (INSKEEP, 1987), in the fifth and final phase of the methodological course, three regional case studies representing distinct socio-ecological contexts inside and outside Brazil were selected and analyzed in order to define a set of key conditions for fostering governance systems for multifunctional land use management at landscape scale.

1.4.1 Detailing of methodological course

To answer question 1, an empirical chapter was developed and submitted to peer review. In this chapter, data on the quantity produced of the 33 NTFPs at the municipal level (scale 1:250,000) in the period 2013 to 2021 were used to calculate the diversity of NTFPs extractivism in Brazilian municipalities. This approach aimed to empirically highlight the relationship between NTFPs and sociobiodiversity, based on the assumption that the greater the number of different NTFPs collected/sold in the municipality (greater NTFPs diversification), the greater the likelihood that this may be associated with the material and immaterial values in the use of biodiversity by traditional livelihoods (e.g., indigenous, quilombola, riverine, family farmers) in protected areas, rural settlements and indigenous lands, therefore representing different sociobiodiversity values (CONTINI; CASTILHO; COSTA, 2012; GONÇALVES et al., 2021; NETO, 2017; PINTO et al., 2016). The quantity produced and the value of production of the 33 NTFPs where annual data exist were specialized by municipality and Simpson's diversity index was then calculated (MCGARIGAL; MARKS, 1994), and the results were presented as maps so that they could be overlaid on the mapping of tourism initiatives.

In parallel with the calculation and mapping of the diversity of NTFPs extractivism, to answer question 1, related to specific objective b), data on CBT, agritourism, and ecotourism initiatives were collected from the literature and from government reports, official websites of nongovernmental organizations (NGOs), institutes, and foundations. The initiatives were mapped at the municipal level (scale 1:250,000) and overlaid with the diversity of NTFPs collection and trade at the municipal level (scale 1:250,000), to assess whether there is spatial overlap between them, at the local scale. This spatial analysis was accompanied by a characterization of tourism initiatives in the NTFPs extractive landscapes in the Brazilian biomes. Soon after, the conceptual framework of social, technological, economic, environmental, policy and ethical values (STEEPV) aspects (LOVERIDGE, 2016), was used to assess sustainability dimensions addressed by initiatives and detail the interactions and possible impacts of three tourism initiatives on local economy, environment and social aspects

in municipalities where NTFPs extractivism occurs (OSTROM, 2007). The spatial analysis based on the overlap of tourism initiatives and diversity of NTFPs in Brazilian biomes revealed that such spatial interaction occurs at small local scale and present fragmented spatial patterns. Furthermore, NTFPs collection and trade is not explicitly used as a tourist product by the initiatives.

On the other hand, the initiatives directly address other material and immaterial values of sociobiodiversity, such as protected areas, involve livelihoods and value local knowledge of traditional communities and promote family farming. The findings in chapter 2 reinforce that even if it is difficult to scale up existing initiatives, it is necessary to identify where to upscale the synergies between tourism and sociobiodiversity at different scales (BALVANERA et al., 2017). Therefore, to answer question 2, three empirical chapters were conducted and submitted for peer review, two of which were published in the year 2022 and 2023. Two of the chapters analyze in depth the specificities of the synergies between tourism and sociobiodiversity promoted by CBT initiatives, given that such initiatives promote greater interaction with the different material and immaterial values of sociobiodiversity, if compared to ecotourism and agritourism initiatives, according to the results analyzed in chapter 2.

Chapter 3, published as an international Nature Springer book chapter (BACHI; CARVALHO-RIBEIRO, 2022), was an exploratory pilot study and involved the analysis of three CBT initiatives, as case studies, adapting an approach in which spatially explicit variables of biophysical and cultural elements, including the definition and mapping of 15 TPCs in Brazil, are derived and associated with tourism modalities (BUTLER, 2000; UNWTO, 2010). In chapter 3, the variables are associated with both sociobiodiversity and CBT in order to test spatially explicit modeling methods and multicriteria analysis (MCA) (ALLAIN; PLUMECOCQ; LEENHARDT, 2017), to identify where these variables are repeatedly occurring together in areas where NTFPs extractivism has been mapped, thus indicating areas with supply of biophysical, cultural elements such as 15 TPCs in Brazil and with potential to amplify synergies between CBT and sociobiodiversity on a national scale (BROWN, 2018; LUBELL; MORRISON, 2021; PINTO-CORREIA; KRISTENSEN, 2013; VON HAAREN, 2002). The weights used for the multicriteria analysis represent an importance scale (from 0 to 3), which was adapted from a previous study (BURKHARD et al., 2009).

This exploratory study used spatially explicit data from conservation units, such as sustainable development reserve (SDR) and extractive reserves (RESEX) that allow public

visits for recreational and educational purposes and livelihoods (ICMBIO, 2019). This data was acquired in polygonal geometry, with an area greater than 100,000m², at a scale compatible with the map of Brazilian municipalities (1:250,000) (IBGE, 2019). Also, the location of traditional peoples and communities recognized in the National Policy for the Sustainable Development of Peoples and Communities (Decree 6,040/2007) and Decree No. 8,750/2016, which establishes the National Council of Traditional Peoples and Communities, acquired in point, line and polygonal geometry. In addition, family farming in rural settlements, small farms and indigenous lands (NODA; NODA, 2003), acquired in polygonal geometry. Also, institutional capacity and human capital, as individuals potential (KLINE; MCGEHEE; DELCONTE, 2019), acquired in point-type geometry.

Then, considering that half of these cartographic bases available are compatible with the original scale of the study of 1:250,000 (Brazilian municipalities) and for the other half the scale was not informed by the original source, the evaluation on 100 m grid cells scale for the spatial explicit modeling was selected with a view to the cartographic compatibility between the levels of detail foreseen for the survey and the final maps to be presented (SILVA; CANDEIA; ARAÚJO FILHO, 2015). Thus, all data were converted to raster data with a spatial resolution of 100 m (or a 100x100 m grid), which provides sufficient detail for national level analyses while still being computable on a desktop PC (HERMES; ALBERT; VON HAAREN, 2018; SCHIRPKE et al., 2018). Our final maps from Chapter 3, with a spatial resolution of 100 m (or a 100x100 m grid), show that there are 113 million hectares where there is potential for spatial integration between tourism and sociobiodiversity in Brazilian biomes.

Next, the methodology was refined in chapter 4 by including the refinement of the large number of CBT initiatives (44 initiatives) and the use of a more robust conceptual framework based on integrated landscape approaches to characterize a larger number of CBT initiatives according to location and context, motivations, actors involved, investments and governance structures of initiatives in the landscape (ESTRADA-CARMONA et al., 2014). Soon after, the refinement of scores and weights based on literature review to better address the importance of each variable and criteria, as well as the mapping of a set of biophysical, cultural and 15 TPCs, as well as cluster analysis of institutional variables and social capital was performed with a spatial resolution of 100 m (or a 100x100 m grid), to further define potential areas to maximize synergies between CBT and sociobiodiversity at the national scale. This chapter also highlight the first set of key conditions for multifunctional land uses management and sustainable production. This chapter was published in the journal Forests (BACHI;

CARVALHO-RIBEIRO, 2023). The results of the refinement of the methodology in chapter 4 reinforce the findings made in chapter 3 that there are hotspots to maximize synergies between CBT and sociobiodiversity at the national scale. However, the results in chapter 4 details the potential of synergies between CBT and sociobiodiversity in the Amazon, Cerrado and Caatinga, where institutional capacity and social capital also exist.

Chapter 5 aims to answer question 2 evaluating the synergies between ecotourism and sociobiodiversity. This chapter was accepted for publication in the Brazilian Journal of Ecotourism (RBEcotur) in the August 15, 2023 issue (Volume 16, Number 3). Considering that ecotourism initiatives, as well as CBT initiatives, have interactions with different material and immaterial values of sociobiodiversity, this chapter aimed to evaluate if the areas with potential to promote synergies between ecotourism with sociobiodiversity at the national scale would be similar as the areas found in the CBT analysis, to test the overall hypothesis of this PhD thesis. Thus, spatially explicit modeling and Multicriteria Analysis (MCA) were again used based on a new set of biophysical and cultural variables (including the definition and mapping of 15 TPCs) with a spatial resolution of 100 m (or a 100x100 m grid), but the same institutional capacity and social capital variables. The scores and weights used for the multicriteria analysis were defined based on literature review to better address the importance of each variable and criteria for ecotourism and sociobiodiversity. Next, 23 ecotourism initiatives in Brazilian biomes were analyzed by combining STEEPV conceptual frames and integrated landscape approaches (ESTRADA-CARMONA et al., 2014; HAMANN et al., 2020), which gave rise to more key conditions for multifunctional land use management. The results reveal potential areas with a spatial resolution of 100 m (or a 100x100 m grid) for synergies between ecotourism and sociobiodiversity in the Amazon and Cerrado, but also in the Atlantic Forest.

In order to answer question 3, chapter 6 (still in preparation to be submitted) explores key conditions of governance for sustainable production based on the synergies between tourism modalities and the use of biodiversity at landscape scale. The methodology of chapter 6 consisted of selecting regions and analyzing case studies (GUTIERREZ; MARTINS; PIMENTEL, 2020), in distinct socioecological contexts inside and outside Brazil. The case study selected outside Brazil was the Lüneburg Heath nature park, and was analyzed on during 5 months stay by a PhD internship at the Leibniz University in the city of Hannover, Germany. The first case study in Brazil was selected from the results in chapters 3, 4 and 5, which highlighted a geographical region in the Cerrado, covering the north of the state of Minas Gerais, where the Mosaic Sertão Veredas Peruaçu CBT/ecotourism initiative is located. The

second case study is a region in the Atlantic Forest known as Rio Doce State Park (PERD) and surrounding area, which is receiving funding to consolidate Local Productive Arrangements (LPA) to promote tourism and the sustainable use of biodiversity. Data collection on key factors for governance at the landscape scale consisted of semi-structured questionnaires and fieldwork during the five-month exchange in Germany at the MSVP and PERD, and statistical analysis of respondents' answers.

1.5 Thesis structure

The PhD Thesis is structured in manuscript format. The first introductory conceptual chapter presents the problem, hypothesis, questions, objectives, and the methodological course of the research, which guided the preparation of five manuscripts (chapters) as independent empirical contributions to the state of the art (Table 1). The chapters, therefore, present some repetition in context. The final chapter presents general and specific conclusions and suggests new research questions.

Table 1 - Overview of Thesis's research questions, concepts, methods and which chapter answers each question.

RQ	Research Question	Concept	Method	Chapter
1	To what extend the material and immaterial values in the use of biodiversity, such as the collection and trade of NTFPs, are synergistically integrated with tourism modalities in Brazilian biomes?	Land use management, Multifunctionality, Tourism modalities, synergy, diversity, initiatives	Literature review, data collection from official databases, Simpson's diversity index, mapping of spatial explicit data, conceptual framework of STEEPV, case studies	2
2	What are the biophysical and cultural variables for tourism to add to the material and immaterial values associated with Brazilian sociobiodiversity and where the benefits can be strengthened at multiple scales?	Land use management, Multifunctionality, CBT, initiatives, synergy, MCA, sustainability dimensions	Spatial modelling, download and spatial analysis of official geographical data, conceptual framework of STEEPV	3
		Land use management, Multifunctionality, CBT, initiatives, synergy, MCA, landscape approach	Spatial modelling, download and spatial analysis of official geographical data, conceptual framework of integrated	4

			landscape management	
		Land use management, Multifunctionality, ecotourism, initiatives, synergy, MCA, sustainability dimensions and landscape approach	Spatial modelling, download and spatial analysis of official geographical data, conceptual framework of STEEPV and integrated landscape management	5
3	How can tourism and sociobiodiversity be implemented in distinct contexts in Brazilian biomes to foster land use management at the landscape scale?	Land use management, Governance systems, synergy, landscape scale	Case studies, semi-structured questionnaire, statistical analysis	6

Source: Elaborated by the author.

Chapter 2 is a diagnostic study that brings together a large database to assess in detail whether, in practice at present, synergies between tourism and sociobiodiversity are promoted and at what scales. This is the first study to characterize rural landscapes according to NTFPs and sociobiodiversity, by calculating the diversity of NTFPs collected and traded, and mapped 131 initiatives of CBT, ecotourism and agritourism in these landscapes in Brazilian biomes. In order to inform policymaking about the opportunities and challenges for fostering the role of tourism and sociobiodiversity for sustainable production in Brazil. The data used for these analyses are presented in full in a supplementary file (Appendix A). The contents of Chapter 2 were submitted to a journal and are in the process of peer review.

Chapter 3 develops and tests a methodology based on methods such as Multicriteria Analysis (MCA) and spatially explicit modeling to identify potential areas for maximizing synergies between CBT and sociobiodiversity at the national scale. Chapter 3 was published as a book chapter: BACHI, L.; CARVALHO-RIBEIRO, S. The Sustainability of Non-timber Forest Products (NTFPs) and Sociobiodiversity in Rural Brazil Through Community-based Tourism. In: A. FARMAKI ET AL. (EDS.) (Ed.). Planning and Managing Sustainability in Tourism, Tourism, Hospitality & Event Management. Springer Nature, 2022. p. 24, https://doi.org/10.1007/978-3-030-92208-5_14. The data used for these analyses are presented in full in a supplementary file (Appendix B).

Chapter 4 refines the methodology based on the methods of Multi-Criteria Analysis (MCA) and spatially explicit modeling and finds that CBT can add to the value of sociobiodiversity and expand area synergies in the Amazon, Cerrado, and Caatinga. This chapter defines the first set of key conditions to inform multifunctional land use management in Brazilian biomes. Chapter 4 is published as a research article: BACHI, L.; CARVALHO-RIBEIRO, S. Markets for Non-Timber Forest Products (NTFPs): The Role of Community-Based Tourism (CBT) in Enhancing Brazil' s Sociobiodiversity. Forests, v. 14, n. 298, 2023. The data used for these analyses are presented in full in a supplementary file (Appendix C).

Chapter 5 assesses in detail the role of ecotourism in adding value to the material and immaterial values of sociobiodiversity and areas where synergies can be maximized at the national scale in Brazilian biomes, thus advancing the identification of key conditions for sustainable land use management based on tourism and sociobiodiversity. This chapter was accepted for publication in the Brazilian Journal of Ecotourism (RBEcotur) in the August 15, 2023 issue (Volume 16, Number 3). The data used for these analyses are presented in full in a supplemental file (Appendix D).

Chapter 6 identifies key conditions for fostering governance systems that can trigger multifunctional land use management at the landscape scale by applying semi-structure questionnaires with key actors in specific contexts in Brazil's biomes. The chapter uses exploratory case study regions in Germany and two in Brazil, the Mosaico Sertão Veredas Peruaçu (MSVP) in the Cerrado biome and the Rio Doce State Park (PERD) in the Atlantic Forest. This chapter is a partnership with the Leibniz University Hannover, Germany. Chapter 6 is in the process of being submitted to a peer-reviewed journal with Sónia Carvalho Ribeiro (supervisor), Diomira Faria and Johannes Hermes as co-authors. The data used for these analyses are presented in full in a supplementary file (Appendix E).

Chapter 7 concludes with a summary of the main conclusions of the previous chapters and presents reflections on the key conditions for fostering governance systems for multifunctional land use management and the role of tourism and sociobiodiversity for territorial development in Brazilian biomes. The chapter also suggests new research questions on this topic.

2. CHAPTER 2: SYNERGIES BETWEEN TOURISM AND SOCIOBIODIVERSITY IN BRAZILIAN BIOMES[2]

2.1 Abstract

Combining tourism and forest-based livelihoods such as the gathering non-timber forest products (NTFPs) into multifunctional land management approaches can be an alternative to land use intensification in Brazil. Sociocultural and biological diversity merge as sociobiodiversity when traditional communities use NTFPs. However, the relationships between tourism and sociobiodiversity that can add to the material and immaterial values of forest-based livelihoods and, in turn, increase the quality of tourism, remain unknown. This study explores to what extent are sociobiodiversity and tourism modalities synergistically integrated, in practice at present, in Brazilian biomes. We map community-based tourism (CBT), ecotourism and agritourism initiatives and analyze spatial relationships with sociobiodiversity based on the diversity of NTFPs extractivism. Then, we characterize the initiatives regarding goals, location, actors involved and benefits to livelihoods. Finally, three initiatives were selected as case studies to explore in detail the linkages and the aspects that underpin them. The results show that CBT, ecotourism and agritourism initiatives exist in all six Brazilian biomes and that 71% of these initiatives are located in municipalities that collecte and trade NTFPs. CBT and ecotourism initiatives are located on public lands, meanwhile agritourism takes place in private lands, and directly benefit the material and immaterial values of traditional livelihoods such as fishing and agriculture. However, few initiatives are directly associated with NTFPs extractivism. The three case studies analyzed in the Amazon, Cerrado and Atlantic Forest show that promoting synergies with sociobiodiversity, requires community participation, developing objectives and goals within the context and nature conservation, encouraging partnerships and seeking funding. This study highlights the importance of analyzing the existing synergies between sociobiodiversity and tourism, and presents opportunities and challenges for tourism and sociobiodiversity to be assets for territorial development in Brazil.

[2] Article submitted to the journal for peer review.

2.2 Introduction

The Anthropocene, a new geological era that highlights the effects of humans on the Earth's ecosystems (LEWIS; MASLIN, 2015). In Brazil the Anthropocene has been associated to consecutive transformations of rural landscapes in order to adapt their physical spatial structure and land uses to meet the growing global demand for food production (LECLÈRE et al., 2020; ROQUE; NETO; DE FARIA, 2022; SVAMPA, 2019). The focus on the production of agricultural commodities for export is promoted by local and federal governments as the mainstream "development" strategy in easily accessible areas, but also in remote areas in Brazilian biomes (SANO et al., 2019). However, it has been argued that in the medium and long term, this strategy decreases the stock of ecosystem services that meet people's needs for food, water, recreation and historical/cultural values, and may also decrease the country's resilience in the face of climate change and economic instability (ANDRIJEVIC et al., 2019).

Brazil's rural landscapes are mosaics built by the relationships between people and ecosystems such as the Brazilian savanna (Cerrado), tropical forests in the Amazon and Atlantic Forest, and floodplains in the Pantanal (BICUDO et al., 2020; KLINK; MACHADO, 2005). Although large farms are required to follow environmental laws such as the forest code (SOARES-FILHO et al., 2014), removing deforestation from commodity chains is neither a guarantee nor the only solution to increase resilience and meet the needs of current and future generations in Brazil (SCHROTH et al., 2016). Rural landscapes need proactive land planning, as the action to restore and build landscapes, and effective management which are routine actions to ensure that planning goals are achieved (PLIENINGER et al., 2015). Both are supported by governance systems, structures created to represent different actors, negotiate goals and responsibilities of these actors that need to act based on social capital, interests, and access to natural capital using mechanisms and policies beyond governmental action (DELABRE; ALEXANDER; RODRIGUES, 2020).

Multifunctionality, the diversity and abundance of land uses that provide functions and services with value to people, is a guiding concept for landscape planning and management (PINTO-CORREIA et al., 2016). A landscape becomes multifunctional when and where functional interaction and spatial integration of land uses such as agriculture, agroforestry, recreation, and biodiversity conservation occur simultaneously on the same piece of land and benefits people (SELMAN, 2009). For this reason, multifunctionality has been positioned at the center of territorial development, as it favors the maintenance of material and immaterial

values of landscapes and can give better response in facing socioecological crises (HOLMES, 2006; KEANE, 1992).

Non-timber forest products (NTFPs) and tourism initiatives, if planned and managed in synergy, can be an alternative to land use intensification in Brazil within multifunctional land use management, as they are associated to rural landscapes, its standing native vegetation and traditional livelihoods (MORGAN et al., 2022). If framed together, both activities are believed to be able to enforce and support provision ES and recreation CES in Brazilian rural landscapes, thus contributing to multifunctionality, beyond commodity production (CARVALHO RIBEIRO et al., 2018).

In 5 million km², comprising 43% of Brazilian municipalities, the collection and sales of 33 NTFPs, including foods such as Açaí, waxes such as Carnaúba, fibers such as piassava and Brazil nuts, totaled R$1.6 billion in 2019 (ALCÂNTARA; DE LUCENA; DA CRUZ, 2022). Sociocultural and biological diversity merge as sociobiodiversity when NTFPs are collected and pre-processed using the skills and knowledge of extractivists in extractive reserves (RESEX), and indigenous peoples in Amazonian indigenous lands, family farmers and other 28 traditional peoples and communities (PCTs) in the Cerrado, Caatinga, and Atlantic Forest (NODA; NODA, 2003). The use of native species and biodiversity by traditional peoples and communities is aligned with the Sustainable Development Goals (SDGs) of reducing poverty (SDG 1) and hunger (SDG 2) (SHACKLETON; TICKTIN; CUNNINGHAM, 2018).

Despite the efforts of the National Sociobiodiversity Plan to add value to sociobiodiversity in production chains (MMA, 2009), NTFPs are valued and traded only by the quantity produced (HOMMA, 2018). Those with less economic viability due to low market access and higher production costs are likely to be discontinued soon (FREITAS et al., 2020). Tourism modalities such as community-based tourism (CBT), ecotourism and agritourism are considered as alternatives to activities more prone to cause environmental impacts (e.g., soy, timber) (STRONZA; FITZGERALD; HUNT, 2019) and to promote material and immaterial values attached to the use of biodiversity worldwide (MOHAMADI et al., 2022).

CBT promotes a management model led by local communities (ZAPATA; HALL; LINDO, 2011) and values extractivists and indigenous peoples, in accordance with the premises of the Convention on Biological Diversity (CBD) (CBD, 2015). Ecotourism is based on learning about ecosystems and biodiversity along with respect for host communities (ORTEGA; RAFAEL; PARRA, 2021). Agritourism, on the other hand, is a modality that

comes from rural tourism, based on the appreciation of the daily life of family farmers and rural products, as a complementary activity to family farming (PHILLIP; HUNTER; BLACKSTOCK, 2010). After the pandemic of COVID-19, investment in these modalities became the focus to meet the SDGs targets by 2030 (ROBINA-RAMÍREZ et al., 2022; UNWTO, 2020a). These synergies could inform current socioecological policies that aim to create sociobiodiversity routes for territorial development in Brazilian biomes (SCHWANKE, 2019), also inform tourism policies, which are still rooted on economic indicators that favor coastal and big (MARANHÃO; AZEVEDO, 2019).

Although in theory there are synergistic effects and a likely spatial integration of tourism and sociobiodiversity, only a small universe of empirical studies in China, Africa and Brazil reveal positive interactions (socioeconomic, cultural, ecological) between CBT and ecotourism with NTFPs, protected areas and rural communities (ADOM; BOAMAH, 2020; CARVALHO RIBEIRO et al., 2018; KE et al., 2020; SAMPAIO; ZAMIGNAN, 2012; SANTOS; SILVA; QUARESMA, 2021). Most studies present single case studies at local scale. One study revealed positive outcomes of CBT to the sustainability of NTFPs collection in the Amazon (CARVALHO RIBEIRO et al., 2018). Other studies have evaluated aspects that influence synergistic effects of tourism with agriculture and governance of sociobiodiversity (BASTOS; FILHO, 2020; CIADELLA et al., 2022; HOEFLE, 2016; PÔVOA; VINHA, 2019). However, there is a lack of empirical evidence on the reality of the relationship between different tourism modalities, NTFPs and sociobiodiversity in rural areas in Brazil.

The synergies between tourism and sociobiodiversity cannot be seen as a panacea. More studies are needed that advance spatial analysis and use conceptual frameworks to evaluate interactions (BRONDIZIO et al., 2021). Mapping tourism initiatives that promote worldviews and have an impact, even if local, on the context where they occur (BALVANERA et al., 2017), is a valuable, yet scarce approach to explore spatial interactions, synergies between tourism and sociobiodiversity modalities. The framework of social, technological, ecological, economic, political, and ethical value (STEEPV) dimensions can help evaluate tourism initiatives, as other studies have been doing (RAUDSEPP-HEARNE et al., 2020). Although studies have evaluated individual destinations, routes, and tourism circuits as case studies (ZIELINSKI et al., 2020), few evaluated a great set of initiatives in Brazil (BARTHOLO; SANSOLO; BURSZTYN, 2009).

The goal of this study is to explore to what extent are sociobiodiversity and tourism modalities synergistically integrated, in practice at present, in Brazilian biomes. The methodology developed in this study starts by mapping a list of high-impact tourism initiatives across Brazil. Next, the diversity of NTFPs collection and trade in the six Brazilian biomes was calculated and mapped in order to assess the spatial integration between CBT, ecotourism and agritourism initiatives with NTFPs extractivism. We then, performed a qualitative and statistical analysis of the initiatives within these landscapes regarding the types of livelihoods, location, and use of biodiversity addressed by each initiative in practice. Finally, three case studies were selected to define in detail the aspects that support the synergies using the STEEPV dimensions framework (LOVERIDGE, 2016). Our main questions are: 1) to what extent are tourism initiatives and NTFPs diversity geographically overlapping in Brazilian biomes? 2) are there CBT, ecotourism and agritourism initiatives that value sustainable uses of biodiversity and traditional livelihoods? 3) what social, economic and environmental aspects support the synergies?

2.3 Methods

2.3.1 Research design

To explore to what extent are sociobiodiversity and tourism modalities synergistically integrated, in practice, at the present, our methodology starts with data collection of tourism initiatives and the quantity collected and traded of NTFPs in Brazilian biomes. We then performed a spatial explicit analysis of the relationships between tourism modalities and sociobiodiversity using the diversity of NTFPs extractivism, complemented by statistical analysis of the types of livelihoods involved, location and the use of biodiversity addressed by the initiatives (Section 2.3.2). This was followed by the selection of three case studies for a detailed qualitative analysis of the relationships between tourism modalities and sociobiodiversity and aspects that promote synergic outcomes (Section 2.3.3).

2.3.2 Data collection and analysis

2.3.2.1 Selection and mapping of tourism initiatives

We define tourism initiatives as projects, itineraries or destinations that call themselves and present principles of CBT, ecotourism and agritourism and that involve collective actions in the promotion of sustainable territorial development (BALVANERA et al., 2017;

BRONDIZIO et al., 2021). Based on this definition, a keyword search was conducted online in governmental institutions including reports, websites of nongovernmental organizations (NGOs), institutes and foundations for biodiversity conservation and sustainable use of biological and cultural diversity, travel agencies and tourism operators in Brazil. A search was also made in the academic literature for careful, well-documented, and theoretically sound case studies of tourism initiatives. In total, 185 initiatives were pre-selected. Hence, we used two criteria for the final selection of the initiatives. The first criteria stablished that the tourism initiatives should be located within municipalities that collected and traded more than 1 ton of NTFPs between 2013 and 2019 (2,450 of 5,572), acquired from the official database of the Brazilian Institute of Geography and Statistics (IBGE), to take into account the annual variations in the quantity collected and traded (HOMMA, 2014). The second stablished that each initiative should have sufficient information (in governmental reports, websites of NGOs, institutes, foundations, travel agencies and tourism operators) about its location and activities developed in order to highlight the biophysical and cultural elements involved and whether NTFPs are explicitly or implicitly included in practice (e.g., promote the sale of NTFPs or conduct visits to collection sites). The location and description of the initiatives was sorted into two tables in Appendix A. At the end 131 initiatives were selected. Table 2 summarizes the CBT, ecotourism and agritourism initiatives included in the study. Next, the initiatives were mapped using the municipality where they are located as a reference.

Table 2 - Summarized table of the tourism initiatives included in the study.

Biome	Tourism modality	Name of the initiative	Nº of initiatives
Amazon	CBT	RESEX Rio Unini; RDS Rio Negro; APA Margem Esquerda do Rio Negro Tarumã-Açu/ Tarumã-Mirim; RESEX Tapajós-Arapiuns; Segredos e Temperos da Amazônia; Vivência Yawanawá; Associação Amazônia, Baixo Rio Branco; Projeto de Assentamento Extrativista Lago Grande; Comunidade de Boa Vista do Acará; São Manoel Bar and Rio Juruena; Amapá National Forest; Associação Agroextrativista da RESEX Rio Liberdade; Associação de Produtores Agroextrativistas da FLONA de Tefé e Entorno (APAFE); Cooperativa Mista Agroextrativista do Rio Unini – COOMARU; Associação de Moradores e Produtores Rurais e Extrativistas da comunidade de Jamaraquá-Rio Tapajós (ASMORJA); Associação de Moradores do Acaratinga; Associação de Moradores e Produtores Rurais e Extrativistas da Comunidade de	24

		Piquiatuba; RESEX Marinha de Caeté-Taperaçu; Associação dos Seringueiros e Agroextrativista do Baixo Rio Ouro Preto (ASAEX); Marine RESEX Soure; Associação dos Seringueiros do Rio Ouro Preto (ASROP); RDS do Uatumã; Rio Negro Community Tourism Itinerary (Tucorin); TURIARTE - Cooperativa de Turismo e Artesanato da Floresta;	
	Ecotourism	Monte Alegre: patrimônio natural e pinturas rupestres; Riverside Belém/Combu; Uacari Lodge (CBT/ecotourism); Macapá – Amapá Amazon River; RESEX Cazumbá Iracema; Projeto Serras Guerreiras de Tupuruquara; Aldeia dos Lagos Lodge; Comunidade Santo Amaro; Vivência Baré; Pra manter a floresta em pé: Comunidade Tumbira; Cristalino Lodge; YARIPO: Yanomami Ecotourism; Associação de Auxiliares e Guias de Ecoturismo do Mamirauá;	13
	Agritourism	Marajoaras farms – Marajó island; Vitória Farm Hotel; Lakes and Flowered Fields Tourist Region; Local productive arrangements (LPA) Turismo de Marajó; Turismo Ecológico e Rural; Boi da Floresta;	6
Cerrado	CBT	Community-Based Tourism in Campo Buriti-Jequitinhonha Valley; Community-Based Tourism in Mambaí; Mosaico Sertão Veredas do Peruaçu (MSVP) (CBT/ecotourism); Cooperativa Mista dos Agricultores Familiares Extrativistas Pescadores Vazanteiros Assentados e Guias Turísticos do Cerrado (COOPCERRADO)	4
	Ecotourism	Plano de Apoio a Taquaruçu; Povoado de Mandacaru e Canto de Atins; queimada dos Britos e Baixa Grande; Quilombo Kalunga; Bonito	5
	Agritourism	Turismo de vilarejo no distrito de Cuiabá; LPA da Rota Pantanal Bonito; LPA da Rota Pantanal Bonito; Gemas, Joias, Artesanato Mineral e Turismo de Cristalina;	4
Caatinga	CBT	Prainha do Canto Verde; Ponta Grossa; Quilombo do Cumbe; Jenipapo-Kanindé; RESEX do Batoque; Assentamento Maceió; Curral Velho; Caetanos de Cima; Associação dos Moradores de Tatajuba Vivência Xavante; RESEX Lago do Cunhã; Tremembé Community Vila da Volta; AGEMA - Associação de Guias, Ecoturismo e Meio Ambiente;	13
	Ecotourism	Trilhas Griô	1
	Agritourism	Assentamento Rural Tijuca Boa Vista; Assentamento Coqueirinho; Green Coffee Route;	11

		Brejo Paraibano; Serra Negra and Bezerros Rural Area; Visit Pedro II; Paraíba: 35 days of experiencies; Rural Tourism in Gravatá; Mountains of Agreste Potiguar; LPA Turismo de Mossoró; Turismo - PRODETER – Território Mirantes da Ibiapaba;	
Atlantic Forest	CBT	Associação Remanescente do Quilombo Salamina Putumuju; Associação de Moradores, Agricultores e Pescadores do Puxim da Praia (AMAPPP); Boa Vista Village; Quilombo Campinho da Independência; Liberty Route;	5
	Ecotourism	Associação Peixe-boi; Lagoa do Cassange lodge; Bonito's Waterfalls; Socorro; Route Caminho de São Francisco da Esperança;	5
	Agritourism	Turismo rural em Turvo; Acolhida na Colônia; Passeio Caminhos de Guajuvira; Ecorrural Caminhos do Brejal Circuit; Pedras do Taquaril Circuit; Stone Paths Itinerary; Valley of the vineyards; Cocoa Coast; Serras Verdes do Sul de Minas; Agritourism Circuit; Emperor's Paths; Lower Sweet Creek; Gonçalves; Rural Mantiqueira; Silva Jardim; Carlópolis; Marrecas' Ways Tour; Women's Coffee Paths; Flavors of the Earth Route; São Luiz do Purunã Rural Tourism Circuit; Rural Green Tourism Circuit I Want You Green; The Wine Route; Vineyard Valley; Paths of the Colony; Agritourism in Gramado; Western Charms; Rural Tourism in the Santa Catarina Mountains; LPA Fortalecimento do Turismo em Natal e região metropolitana; LPA Turismo; LPA Turismo; LPA Território do Brejo Paraibano; LPA Território do Vale do Paraíba; LPA Região de São Luís e Munim; LPA Turismo de Natal; LPA Turismo Religioso; LPA Turismo Religioso do Vale do Paraíba; Route of the Faxinais;	38
Pantanal	Ecotourism	Poconé; Cáceres Water Route Region	2

Source: elaborated by the author.

2.3.2.2 The diversity of NTFPs extractivism

To assess the spatial integration between the selected CBT, ecotourism and agritourism initiatives and sociobiodiversity in Brazilian biomes, we used the concept of diversity to express that the greater the number of NTFPs collected/traded in the municipality (greater diversification of NTFPs), the greater the likelihood that this may be associated with different practices and knowledge of traditional communities and family farming (GONÇALVES et al., 2021; NETO, 2017; PINTO et al., 2016). For example, the collection and trade of NTFPs take place in extractive reserves (RESEX), quilombola communities and family farming properties

that use Açaí as food and in rituals by indigenous peoples (OLIVEIRA; NETO; PENA, 2007). In the Caatinga, Carnauba is associated with the livelihoods of quilombola communities, family farming, and indigenous lands (SUCUPIRA et al., 2018). In the Cerrado, Babaçu collection is associated with food security for quilombola and indigenous communities and income through handicrafts (FRANCO; BARROS, 2004). In the Atlantic Forest, family farmers in the "Faxinal" system, a socialized use of land to collect Mate-Herb and Araucaria seeds, benefit from food security and income (CONTINI; CASTILHO; COSTA, 2012; DALLABRIDA, 2012).

To calculate the diversity of NTFPs extractivism, was used the Simpson's Diversity Index, a landscape-level metric that accentuates the occurrence of NTFPs collected and traded within municipalities (STÜRCK; VERBURG, 2017). Thus, the higher the value of the index, the more likely that different types of NTFPs are randomly present in the county (MCGARIGAL; MARKS, 1994). The data for the calculation of the index is the quantity collected and traded (above 1 ton) of the 33 NTFPs in Brazilian municipalities in 2019[3], from the Brazilian Institute of Geography and Statistics (IBGE). The equation was based on the count of the 33 NTFPs (n) and the relative quantity produced by each of the 2.450 municipalities that collected and traded more than 1 ton of 33 NTFPs in 2019 (N). The final value of the index (Λ) was multiplied by 100 to take values between 0 and 1, as infinite diversity. The index was calculated as follows:

$$\Lambda = 1 - \left(\frac{\sum n(n-1)}{N(N-1)}\right)^2 * 100 \quad (1)$$

Finally, the diversity of NTFPs extractivism was mapped and overlaid with the location of the 131 tourism initiatives. We then used the non-parametric Kruskal-Wallis test was applied to the municipalities with CBT, ecotourism, and agritourism initiatives and the diversity of NTFPs extractivism to assess significant differences in the value of Simpson's diversity index in the municipalities with one of the three tourism modalities (OSTERTAGOVÁ; OSTERTAG; KOVÁČ, 2014). The null hypothesis assumes that there are no differences in the diversity index and tourism modalities in each pair of municipalities (BICUDO et al., 2020). In order to

[3] The year 2020 and 2021 were not used for the analysis due to the COVID-19 pandemic, which may have influenced the quantity collected and traded of NTFPs in the municipalities.

determine which tourism modalities are significantly different from each other, using SPSS software (OSTERTAGOVÁ; OSTERTAG; KOVÁČ, 2014).

2.3.2.3 Classification of tourism initiatives

In order to further the analysis on the synergies between tourism and sociobiodiversity modalities in Brazilian biomes, the 131 initiatives were classified according to their type of land tenure categories described by (SPAROVEK et al., 2019). Also, which actors are involved in the initiative and have knowledge and skills about biodiversity use (indigenous peoples, quilombolas, extractivists, fishermen under the broad category of traditional communities and family farmers) (NYAUPANE; POUDEL, 2011) and biodiversity use (e.g., NTFPs, fisheries, small-scale family farming) (MMA, 2009). We then calculated relative frequencies to assess differences and similarities among the initiatives.

2.3.3 Case studies

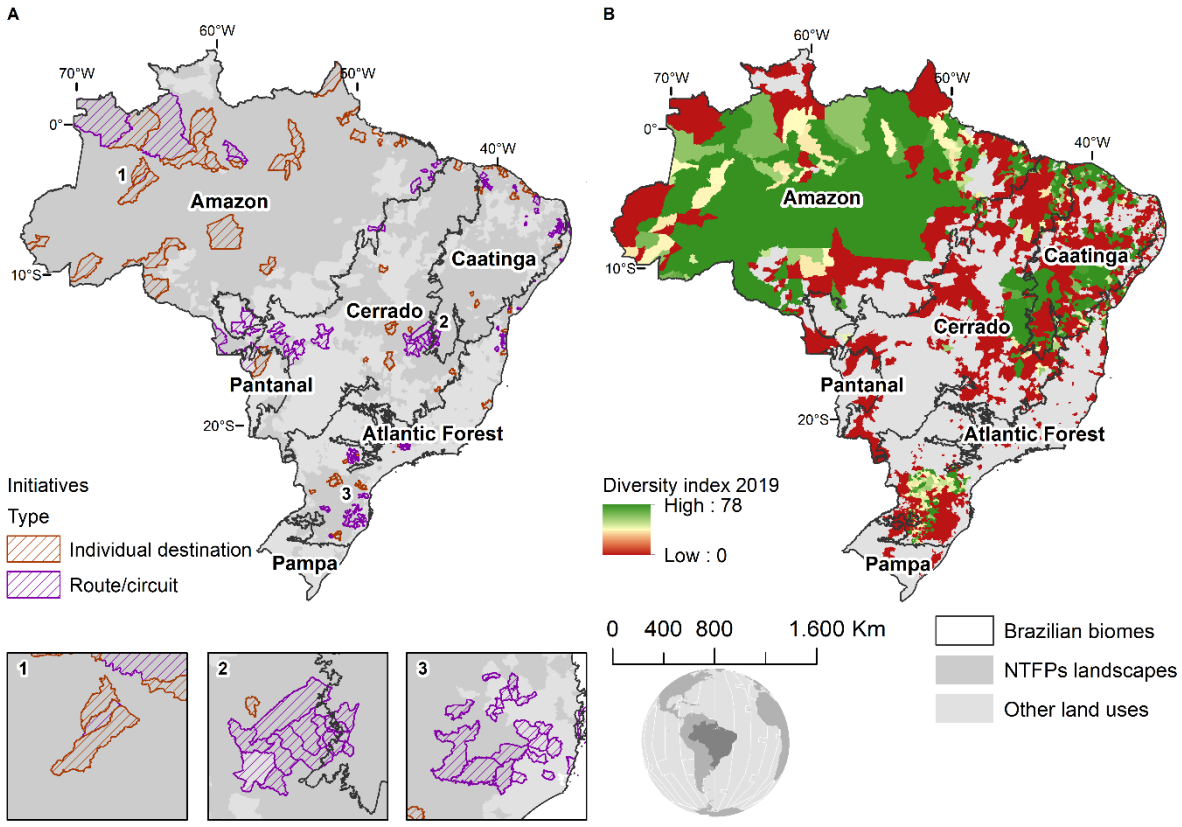
From the previous classification of the tourism initiatives, we selected three initiatives as case studies to evaluate in detail the different relationships between tourism modalities and sociobiodiversity. These initiatives were selected as they offer over 580 publications on Google Scholar, and information in government reports, non-governmental organizations, tourism agencies and operators for the qualitative analysis of the aspects that support such relationships. We do not focus on making any comparisons between these three selected case studies, but rather assess their STEEPV dimensions in order to highlight its specificities in terms of social, technological, economic, ecological, political, and ethical values, as ways of thinking or doing they represent a diversity of world views, values and regions (BENNETT et al., 2016). A list with 68 aspects from the social, technological, economic, ecological, political, and ethical values dimensions (LOVERIDGE, 2016), was created based on literature review on the most important STEEPV aspects associated with tourism modalities and sustainable development. Then, the case studies were ranked using a binary system (1 = yes, if the initiative addresses a certain STEEPV aspect; 0 = no) (detailed information in Appendix A). We summed these values for each case study to obtain the total number and frequency.

2.4 Results

2.4.1 Relationships between tourism modalities and sociobiodiversity in Brazilian biomes

In 2019, the diversity index ranged from 0, indicating low diversity (one NTFP), to 78, indicating that municipalities collected and traded up to 7 different NTFPs. Precisely, 806 municipalities collected and traded bundles of NTFPs such as Araucaria seed and Mate-Herb in Atlantic Forest biome, Açaí, Brazil nut, coagulated latex and palm heart in Amazon, and Carnaúba, Pequi and Babaçu in Cerrado biome in 2019. Figure 2 shows that, at a broad scale of analysis, the 131 individual destinations and itineraries/circuits spatially overlap with 239 municipalities that collected and traded more than 1 ton of NTFPs in 2019. About 36% of the initiatives are located in Atlantic Forest, followed by initiatives in Amazon (34%), Caatinga (17%) and Cerrado (12%). There are two initiatives in Pantanal. We documented 32 initiatives located in municipalities with high diversity of NTFPs (24% of the total 131 initiatives), they are eight CBT and four ecotourism initiatives in Amazon (44%), five agritourism and four CBT initiatives in Caatinga (27%), three agritourism, two CBT and two ecotourism initiatives in Atlantic Forest (22%) and a CBT and an ecotourism initiative in Cerrado (6%).

Figure 2 - Spatial distribution of A) tourism initiatives and B) diversity of NTFPs in 2019 at national scale, as well as case studies: 1) Uacari lodge, 2) MSVP and 3) Acolhida na Colônia.

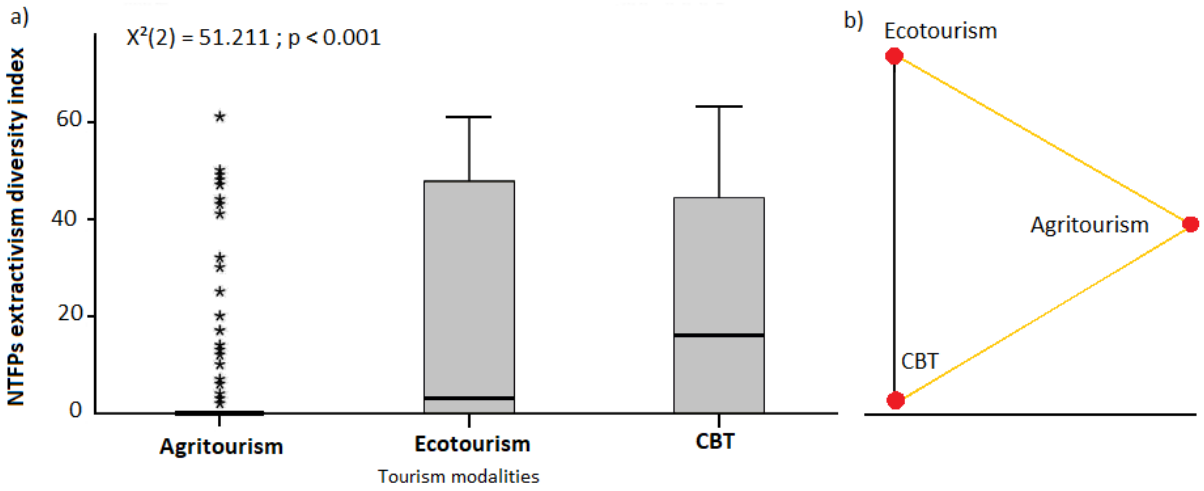


Source: elaborated by the author.

The result of Kruskal-Wallis test indicate that the null hypothesis stating that the distribution of the values of NTFPs diversity index is the same across the municipalities with

one of the three tourism modalities should be rejected. Since the significance level is bellow ,000 we reject the null hypothesis and assume that there is a statistically significant difference between agritourism and the diversity index of NTFPs extractivism (Figure 3a). The post hoc pairwise comparisons test confirms that the distribution of agritourism initiatives in the municipalities with diversity of NTFPs collected and traded is significantly different from CBT and ecotourism (Figure 3b).

Figure 3 - Kruskal-Wallis test a) and pair-wise comparison test b) between tourism modalities and the diversity of NTFPs in 2019.



Source: elaborated by the author.

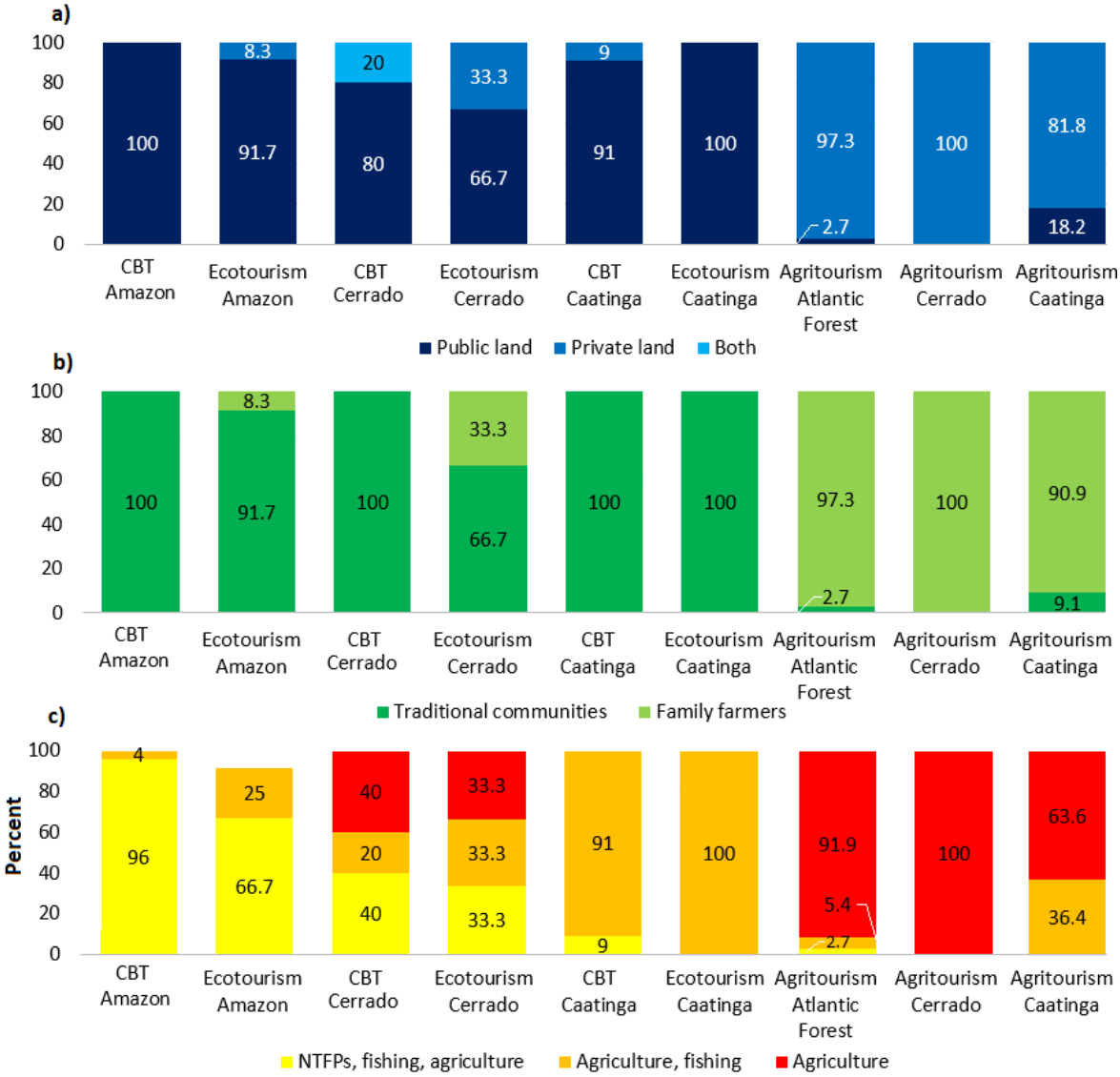
The mapping of these tourism modalities informs that 60% of agritourism (62 initiatives) are located in the Atlantic Forest, where the collection and trade of only two NTFPs (Araucaria seed and Mate-Herb) predominates. Meanwhile, 23 ecotourism initiatives (52%) are located in the Amazon and in the Cerrado, that collect and trade a great variety of NTFPs (Açaí, Brazil nut, clotted latex, palm heart, Pequi, Carnaúba powder, Babaçu, Umbu). Likewise, 53% of the CBT initiatives (47), are located in the Amazon and in the Caatinga (23%).

2.4.2 Detailing the relations between tourism modalities, NTFPs and rural livelihoods

CBT and ecotourism initiatives in Amazon, Cerrado and Caatinga are characterized by taking place in public lands, involving traditional communities and promoting the bundle of biodiversity uses such as NTFPs, fishing and family agriculture. Meanwhile, agritourism initiatives in Atlantic Forest, Cerrado and Caatinga take place in private lands, involving family farmers and promote small-scale agriculture (Figure 4). CBT initiatives in the Amazon are located in national forests, RESEX and RDS, national and state parks and indigenous lands, such as the initiatives Uacari Lodge, RESEX of Rio Unini, Tapajós-Arapiuns, RDS Rio Negro

and Uatumã and Tefé National Forest. In the Caatinga, CBT initiatives are associated with traditional communities such as quilombola community Quilombo do Cumbe and rural settlements and fisherman communities in the initiative Curral Velho and Vila da Volta. The only CBT initiative in Cerrado take place in both private and public lands in the Mosaic Sertão Veredas Peruaçu (MSVP).

Figure 4 - Relative frequency of tourism initiatives based on land tenure type, livelihoods and use of biodiversity.



Source: elaborated by the author.

In CBT initiatives in Amazon such as Cotijuba Island, Lago Grande, São Manuel and Rio Juruena and Boa Vista do Acará, tourists can experience the Açaí and Brazil nut harvest. In Cerrado, the quilombola community of Prata involve and promote the daily life of sempre-viva pickers. Agritourism initiatives in the Atlantic Forest and Cerrado involve family farmers

and promote small-scale agriculture. In Caatinga, the agritourism initiatives Tijuca Boa Vista and Coqueirinho are located in rural settlements and are managed by fishermen. The agritourism initiative Stone paths in the Atlantic Forest sale Mate-Herb to tourists that visit the route.

2.4.3 Review of STEEPV dimensions in the three case studies

The first case study is the Uacari Lodge, an initiative that merge CBT and ecotourism principles created in 1999 in the Amazon. This initiative is located in municipalities with Simpson Diversity index of NTFPs collected and traded in 2019 equal to 50. It promotes a circular pattern of sustainable growth by integrating community-based tourism with sustainable fishing, NTFPs extractivism, sustainable timber management, and family farming. The second case study is Acolhida na Colônia, an agritourism initiative in the southern of the Atlantic Forest. This initiative was also created in 1999 by a farmers' association. Today, it is a network that promotes appreciation of the family farmers and daily life on small farms that produce vegetables, fruits, cheeses, and jams. Finally, the third case study is the MSVP initiative, located in municipalities with Simpson Diversity index of NTFPs collected and traded in 2019 equal to 47, in the state of Minas Gerais. This initiative that merges CBT and ecotourism principles was created in 2008 as a Mosaic of Protected Areas, part of the National System of Conservation Units (SNUC). The MSVP aims to promote territorial development through the material and immaterial values of traditional communities, such as Babaçu coconut breakers, indigenous people, quilombola communities and family farmers in and around the protected areas (Table 3).

Table 3 - General information about the three case studies.

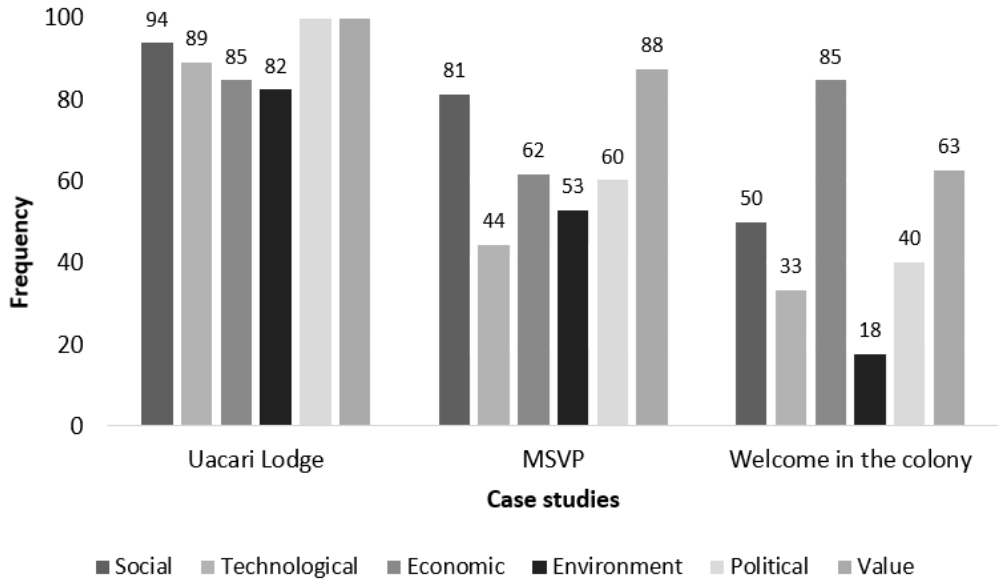
Case studies	Livelihoods	Location	Area (ha)
Uacari Lodge (CBT/ecotourism)	Riverside communities, extractivists, fisherman	Mamirauá SDR	2 million
Acolhida da Colonia (Agritourism)	Family farmers	Private properties in 21 municipalities	969 thousand
MSVP (CBT/ecotourism)	Extractivists, fisherman, indigenous, quilombola communities and family farming	15 conservation units	3 million

Source: elaborated by the author.

Uacari lodge addressed 90% of STEEPV aspects, followed by MSVP (65%) and Acolhida da Colônia (47%) (Figure 5). Uacari lodge and MSVP initiatives excelled in social

aspects, which include improve the livelihoods of traditional peoples and communities, indigenous people, in and near protected areas. Meanwhile, Acolhida da Colônia benefit family farming. Concerning ecological aspects, Uacari Lodge is the only case study that institutionalized the payment for ecosystem services (PES), a popular practical issue in the forestry context (TIKKANEN et al., 2017). Acolhida da Colônia stands out in economic (85%) dimension, such as increase employment opportunities, expansion of local market and secure the benefits of tourism for local community once family farmers are the ones managing experiences and must follow clear and common sense set of rules. Regarding political aspects, MSVP promotes technical cooperation and created funds with the Word Wildlife Fund (WWF), Chico Mendes Institute for Biodiversity Conservation (ICMBio), the National Indigenous Foundation (FUNAI) and universities. Uacari lodge is funded by the Amazon Fund.

Figure 5 - Frequency of STEEPV aspects addressed by the three case studies.



Source: elaborated by the author.

Table 4 shows the main 25 STEEPV aspects reported by all three case studies to create and nurture synergies between CBT and agritourism with sociobiodiversity.

Table 4 - STEEPV aspects addressed by all three case studies.

Dimensions	Aspects	Source
Social	Traditional communities, indigenous people, family farming	(BARRETO; TAVARES, 2017; BARTHOLO; SANSOLO; BURSZTYN,
	Preserve values and beliefs attached to places and local products	
	Value local knowledge systems	
	Promote common sense of cultural pride	

	Provide cultural exchanges	2009; BOYD; BUTLER; HAIDER, 1994; ICMBIO, 2019; LOUREIRO; GORAYEB, 2013; NYAUPANE; POUDEL, 2011; OZÓRIO; PERALTA; VIEIRA, 2016; STRONZA; FITZGERALD; HUNT, 2019; ZIELINSKI et al., 2020)
	Incentive community cooperatives, micro-businesses, associations	
	Enables community to be employed and manage local business	
Technologic	Encourage the creation of official website	
	Creation of informative content and for dissemination	
Economic	Increase employment opportunities	
	Attract investment opportunities	
	Construct a diverse portfolio of activities	
	Construct social support capabilities to assist survival	
	Improve standards of living	
	Poverty alleviation	
	Promote the creation of social capital	
Environment	Promote activities and enforcement of conservation practice	
	Reduction of land degradation through specific activities	
	Promote landscape multifunctionality through specific activities	
Political	Create funding mechanisms	
	Promotes technical cooperation between local, national/international actors	
Ethical value	Build awareness about cultural and ethnical mutual respect	
	Promote cultural exchange	
	Enhance social equity	
	Promotes gender equality	

Source: elaborated by the author.

2.5 Discussion

2.5.1 Where and why tourism and sociobiodiversity can be assets for sustainable transitions in Brazilian biomes?

This study shows where and why CBT, ecotourism and agritourism and sociobiodiversity can be alternative to land use intensification in Brazil within multifunctional land use management based on spatial integration and synergies in Brazilian biomes. This study is aligned with the demand made by previous studies to address, explore and map the linkages between extractive activities associated with NTFPs and tourism, and examine cases where there is (or is not) a multifunctional link between these two activities in Brazilian biomes (CARVALHO RIBEIRO et al., 2018). By analyzing a large set of tourism initiatives in the six Brazilian biomes, this study adds to the efforts made by recent studies that unveiled initiatives as “bright spots” for sustainable transitions in Brazilian biomes (BRONDIZIO et al., 2021).

With respect to where, the mapping of tourism initiatives with the NTFPs extractivism diversity index showed that more than 71% of the total number of surveyed initiatives, which follow CBT, ecotourism and agritourism principles, are within the landscapes that collected and traded NTFPs. Further, a small portion of these initiatives are located in municipalities with high diversity of NTFPs collected and traded. Although the largest number of initiatives are in the Atlantic Forest on private lands based on family farmer visitation, another significant number of initiatives are located in the Amazon, reinforcing the findings of previous studies that call this biome "a laboratory for development interventions for over 50 years" (BRONDIZIO et al., 2021, p.66). However, our study complements the state of the art by highlighting that the Caatinga, Cerrado, and Atlantic Forest have a significant number of tourism initiatives that need to be recognized and supported. Furthermore, the study shows that the location of initiatives in these biomes, including the Amazon, is determined by the presence of protected areas and traditional communities and family farming.

As to why tourism and sociobiodiversity can be assets for sustainable transitions, our qualitative and statistical analysis of 131 initiatives, evidenced that CBT and ecotourism initiatives in the Amazon and in the Cerrado are located on public lands. These value traditional communities and the use of NTFPs, fisheries, and small-scale agriculture for recreational and/or educational purposes in indigenous lands, quilombola communities, extractive reserves (RESEX), and national forests. In the Caatinga, TBC initiatives are associated with marine RESEX and fishing communities in coastal municipalities. In the Atlantic Forest, the majority of initiatives are placed on family farming (GUZZATTI; SAMPAIO; CORIOLANO, 2013). In the Cerrado, the links between initiatives and protected areas could be a stimulus to expand protected areas and value traditional communities (Santos et al., 2022). Even though few initiatives that directly address the collection and trade of NTFPs, this and other pre-existing sociobiodiversity material and immaterial values (e.g., protected areas, traditional communities and family farming) those are key assets for the quality of CBT, ecotourism, and agritourism initiatives.

Furthermore, the analysis of the three case studies highlighted that CBT and agritourism initiatives have developed governance structures with the participation of local communities, partnerships, financing and marketing mechanisms that foster spatial integration and synergies between tourism and sociobiodiversity. Although each initiative is based on different STEEPV dimensions s implementing in different ways and intensity, a common structure was identified that starts from the community's willingness to take the lead in conserving and using their skills,

knowledge proactively to benefit nature conservation and socioeconomic development. This has also been shown by socioecological studies (NYAUPANE; POUDEL, 2011; QIAN et al., 2017). The case studies also show that there is a sense of place and shared responsibility to mobilize stakeholders to work towards the same goals, formalize funding, exploit marketing tools such as websites, build partnerships and invest in capacity building, that are key-features of integrated landscape management initiatives (ESTRADA-CARMONA et al., 2014).

2.5.2 Methodological contributions, gaps and future research needs

Our approach to select, map and analyze CBT, ecotourism and agritourism initiatives contribute for the characterization of sustainable tourism in Brazilian biomes. From the analysis of tourism initiatives, we found that traditional communities are willing to take the lead in conservation and conscious use of different natural and cultural resources, while generating jobs, income, and quality of life for the community and native ecosystems in Brazilian biomes, as has also been found in similar contexts in China (QIAN et al., 2017). Furthermore, this analysis contribute for the understanding that, even if fragmented, initiatives that explicitly promote tourism and sociobiodiversity on the same piece of land could affect governance structures at local and regional scales and improve social, ecological, and economic dynamics (BENNETT et al., 2016).

Another contribution was the calculation of the diversity index of the collection and trade of NTFPs in Brazilian biomes. Our methodology used a large official database on the 33 NTFPs collected and traded in Brazil in 2019 and attested that there is a high diversity of these products being collected and traded in municipalities and, as a consequence, instill sociobiodiversity values that later overlap with tourism initiatives. The diversity of NTFPs extractivism can be associated with policies and programs supporting sociobiodiversity on a national scale, such as the National Policy for Sustainable Development of Traditional Peoples and Communities (PNPCT), National Program for Strengthening Family Agriculture (PRONAF), Technical Assistance and Rural Extension Policy, General Policy of Minimum Prices for Sociobiodiversity Products, Food Acquisition Program (PAA), and the National Plan for the Promotion of Sociobiodiversity Product Chains (PNPSB), created between 1995 and 2021 (SCHWANKE, 2019).

As for the mapping and spatial analysis, this study prioritized the mapping of the initiatives as municipalities due to the lack of information on the exact location of the initiatives. This is one of the major challenges of spatial analysis in this study. Although the spatial

analyses favor points over polygons, we found that there was no detriment to the quality of the analyses and interpretations. The methodology based on the STEEPV framework made it possible to identify that the three tourism initiatives analyzed were created by quilombolas, family farmers and fishermen, artisans who maintain the use of the land for subsistence agriculture and fishing, along with the provision of accommodation and food and already have the support of local and federal government and international and national funds. This analysis could have been expanded to all 131 initiatives selected. However, there is a lack of in-depth information, precisely about the income generated by the initiatives and other resulting benefits to the communities and environments, which made it difficult to conduct a more detailed analysis of the relationships with livelihoods and biodiversity use, for example.

Another point that needs to be better assessed is the capacity of local communities to undertake landscape management by exploring which governance mechanisms (participation, partnerships, financing, marketing) could be used and how they could be organized by multiple actors (CARVALHO-RIBEIRO; LOVETT; RIORDAN, 2010). There are still research gaps on how to enhance the synergies between tourism and sociobiodiversity to favor multifunctional land use management of rural landscapes at multiple scales (SELMAN, 2009). Many studies from the literature review made it clear that synergies are context-based (GHOSH; GHOSH, 2019). Therefore, further multiscale analysis and context-specific studies in Brazilian biomes are still needed.

2.6 Conclusion

This study highlights the importance of employing different methods to assess and understand the opportunities and challenges regarding the synergies between tourism and sociobiodiversity in order to foster multifunctional land use management in Brazilian biomes. As such, it is argued that the spatial integration and synergies between CBT, ecotourism, agritourism and sociobiodiversity could and should be used more effectively by those responsible for the analysis and formulation of public policies to establish a new transition path for sustainable production for territorial development in Brazil. Thus, from the results of this study, the synergies between sociobiodiversity and tourism is a kind of essential foundation for policies and practical actions towards multifunctional management in rural landscapes.

3. CHAPTER 3: THE SUSTAINABILITY OF NON-TIMBER FOREST PRODUCTS (NTFPS) AND SOCIOBIODIVERSITY IN RURAL BRAZIL THROUGH COMMUNITY-BASED TOURISM[4]

3.1 Abstract

Socio-cultural and biological diversity merge as sociobiodiversity when traditional communities use wild species such as Non-timber Forest Products (NTFPs). Brazil's megadiversity, embracing both biological and socio-cultural diversity, spans across six Brazilian biomes. While the use of biodiversity by traditional communities might be sustainable or unsustainable depending on the context for and scale of use, the pressure for gathering "quantity of NTFPs" has led to the unsustainability of traditional management systems, barely considered as a territorial development asset. Tourism in rural landscapes can, under specific conditions, add value to the material and immaterial values of sociobiodiversity, as a development asset to guide the transition towards sustainability. A critical aspect is to effectively assess where there is biophysical potential and how the institutional capacity for tourism can enhance NTFPs extractivism and sociobiodiversity in order to reduce the emphasis on the production of raw materials and foster its immaterial values, such as folklore. Here, we characterize NTFPs' extractivism landscapes and evaluate social, technological, economic, environmental, political, and value (STEEPV) aspects of tourism initiatives to support the spatially explicit modeling of likely successful hotspots where the use of biodiversity can be nurtured through community-based tourism (CBT). Our spatially explicit approach shows that although there are hotspots available, existing infrastructure and institutional capacity are highly variable. We offer ways forward of how to reconcile tourism and the use of Brazil's sociobiodiversity in such a way those synergies can foster transitions towards sustainability.

[4] BACHI, L.; CARVALHO-RIBEIRO, S. The Sustainability of Non-timber Forest Products (NTFPs) and Sociobiodiversity in Rural Brazil Through Community-based Tourism. In: A. FARMAKI ET AL. (EDS.) (Ed.). . **Planning and Managing Sustainability in Tourism, Tourism, Hospitality & Event Management**. Springer Nature, 2022. p. 24.

3.2 Introduction

In Brazil, socio-cultural and biological diversity merge when wild species including a variety of Non-Timber Forest Products (NTFPs) are gathered and pre-processed using the skills and knowledge of traditional communities. Traditional practices have long been championed by nut gatherers in the Amazon and by family farmers in Caatinga and the Atlantic Forest biome (Noda and Noda, 2003). Brazilian sociobiodiversity material and immaterial values, associated with the use of NTFPs, are critical for meeting the UN's Sustainable Development Goals (SDGs) of reducing poverty (Goal 1) and securing food (Goal 2). The knowledge and skills of women collecting fruits and flowers (e.g., quebradeiras de coco Babaçu, "Sempre-Viva" pickers) in Cerrado biome importantly address gender equity (Goal 5). The gathering, processing, and commercialization of emblematic Brazilian NTFPs span across 12 million hectares of 94 Extractive Reserves (RESEX), 355 indigenous, and 253 quilombola lands, and involve over 15 groupings of traditional peoples and communities (TPCs), and family farming. In Brazil, the National Plan for sociobiodiversity chains seeks to value practices and knowledge of traditional communities that use natural resources (MMA, 2009).

However, immaterial values embedded within sociobiodiversity chains have heretofore been barely considered as a territorial development asset. NTFPs tend to be valued by the production (yield) of raw materials alone. Official statistics proudly report that, in total, from Açaí and Brazil nut in the Amazon to Babaçu and Pequi in Cerrado and other NTFPs, 753 thousand tons were gathered generating a revenue of over US$ 395 million in 2019. While the use of biodiversity by traditional communities might be sustainable or unsustainable depending on the context for and scale of use, the pressure for gathering "quantity of NTFPs" in order to boost output for large scale commodity chains has been led to the unsustainability of traditional management systems (HOMMA, 2018). Recently, there have been put forward arguments suggesting that RESEX, a symbol of traditional livelihoods empowerment, tends to be unsustainable and therefore should be discontinued (FREITAS et al., 2020).

Tourism in these rural landscapes can be assessed as an alternative to foster sustainability of NTFPs extractivism. Tourism, if associated with sociobiodiversity in specific conditions, can trigger traditional communities to not only exhibit the NTFPs they collect but also demonstrate the practices and knowledge that are attached to the use of biodiversity. This can reestablish the pride in communities of being extractivist, which has been fading away as "cowboy imagery" emerges (GOMES; VADJUNEC; PERZ, 2012). In Brazil, due to the

increasing demand of traditional communities to develop tourism activities in the surrounding and within protected areas (FONTOURA et al., 2019), initiatives promote community-based management of tourism and the sustainable use of biodiversity through the appreciation of traditional livelihoods and valuing sociobiodiversity associated with NTFPs extractivism (BARTHOLO; SANSOLO; BURSZTYN, 2009).

Despite this, tourism and NTFPs extractivism have been only superficially treated as an asset for sustainable development in Brazil. As a result, traditional communities are vulnerable to external companies that can hamper their organizational capacity for sustainable tourism (BENI, 2007). In the municipalities that gathered and traded NTFPs, the mean revenue of people employed in the lodging sector in 2019 is estimated at US$ 317, according to the Ministry of Tourism (MTUR) (Appendix B). Meanwhile, it is reported that Açaí gathering and trade contributes to 17% of household rents (LOPES et al., 2019). If reconciled and associated, tourism and NTFPs extractivism could increase the income of traditional livelihoods, such as in Uacari Lodge created from the demand for community-based tourism in Mamirauá Sustainable Development Reserve, where a stay ranges from US$761 to US$ 1418/per person per week (COELHO, 2013).

We are well aware that this cannot offer a panacea. There is the need for carefully evaluating the advantages of associating tourism and NTFPs extractivism. One way is exploring where initiatives that address tourism modalities regarding the integration of social, economic, and environmental aspects for sustainable tourism can be scaled up and how human-nature interrelationships can be reconciled to support transformative change toward sustainability (CARVALHO RIBEIRO et al., 2018). Community-based tourism (CBT) initiatives build from an alternative tourism management and governance model that value the practices and knowledge of traditional communities from the use of biodiversity for socio-cultural, environment, and economic development, fostering sustainable tourism (MORAES; MENDONÇA; PINHEIRO, 2017; OLIVEIRA; DIÓGENES; ALMEIDA, 2021; PERALTA, 2012). They can provide spatially explicit information for mapping where tourism and NTFPs extractivism are more likely to be self-reinforcing. Also, provide knowledge about how socio-cultural values and biophysical elements are integrated within collaborative networks (URANO; SIQUEIRA; NÓBREGA, 2016). This knowledge can help to converge toward common goals and collective action for sustainable use of wild species in landscape contexts, which may bring about sustainable production (SAYER et al., 2013).

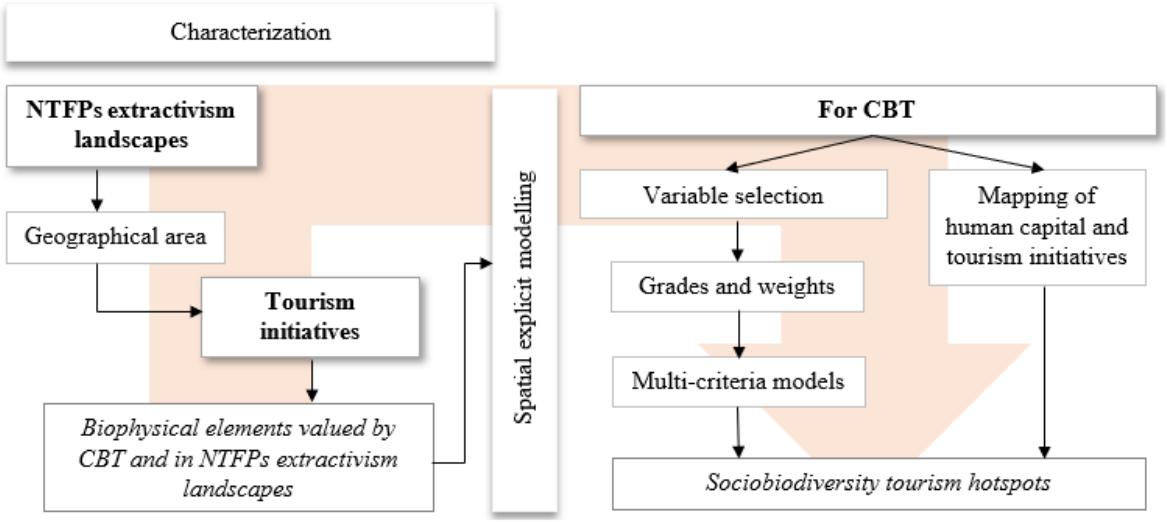
Previous studies have identified positive associations between recreational ecosystem services and NTFPs extractivism (CARVALHO RIBEIRO et al., 2018). However, a national assessment of where and how CBT and NTFPs extractivism can be an asset for territorial development has not yet been provided. Studies propose the mapping of cultural ecosystem services (CES) to foster sustainability in landscapes with a tourist vocation (BACHI et al., 2020). Yet, few address the problems of upscale tourism across larger scales (ZHANG; SONG; HUANG, 2009), as community-based tourism was reported as beset by the low quality of services and inadequate infrastructure for large-scale connections (BARTHOLO; SANSOLO; BURSZTYN, 2009). Hence, studies stress the need to evaluate natural and human capital for upscaling sustainable tourism (RAHMAN et al., 2021). While rigorous state-of-art reviews and empirical studies have summarized the successes of CBT initiatives to foster socio-ecological integration and networks for strengthening traditional communities (CARVALHO RIBEIRO et al., 2018; QIAN et al., 2017; URANO; SIQUEIRA; NÓBREGA, 2016). Hereupon, spatial explicit modeling is useful for mapping natural resources and associated socio-cultural values over large scales (WU, 2013). Yet, a spatially explicit approach for assessing where and how CBT can enhance NFTPs extractivism and sociobiodiversity values in specific locations across Brazil has not been developed.

Our goal is to assess where there is biophysical potential and institutional capacity for CBT to be associated so as to enhance NTFPs extractivism and sociobiodiversity and suggest how best planning to integrate CBT into these networks across Brazilian biomes. We provide a hard-hitting list of CBT initiatives and use spatially explicit modeling to develop wall-to-wall maps of likely successful areas where and how the uses of biodiversity, both material and immaterial, can be nurtured via CBT. This should connect with sustainable transitions for tourism planning in any post COVID-19 era (UNWTO, 2020b). The work we here develop shows advantages to previous national tourism maps (MTUR, 2019), in two major ways. First, we characterize NTFPs extractivism landscapes and evaluate social, technological, economic, environmental, political and value (STEEPV) aspects from CBT initiatives to map large datasets of biophysical elements, cultural and socioeconomic attributes of NTFPs extractivism and sociobiodiversity, including infrastructure and political/administrative aspects. Then, qualitative and quantitative grades and weights are assigned to each dataset regarding the likelihood of CBT to enhance the sustainability of NTFPs extractivism by valuing sociobiodiversity material (NTFPs) and immaterial values. Second, we explored human capital and institutional capacity within sociobiodiversity tourism hotspots.

3.3 Methods

To identify areas where there is biophysical potential and institutional capacity and suggest how best planning for CBT be associated so as to enhance NTFPs extractivism, we started by characterizing NTFPs extractivism landscapes in Brazilian biomes, based on production data and the diversity of NTFPs collected and traded. Then, we performed the characterization of CBT initiatives that value biophysical elements in these landscapes. Based on these findings, we selected variables representing biophysical elements of NTFPs extractivism and sociobiodiversity and defined grades and weights for the mapping of sociobiodiversity tourism hotspots. Afterward, we analyzed human capital and institutional capacity by mapping CBT initiatives in NTFPs extractivism landscapes (Figure 6).

Figure 6 - Workflow of the methodological steps.



Source: elaborated by the author.

3.3.1 Characterization of NTFPs Extractivism Landscapes

We characterized NTFPs extractivism landscapes by comprising all the municipalities in Brazil that between 2013 and 2019 reported harvest and trade of above 1 ton of 33 NTFPs, from the annual survey of the Brazilian Institute of Geography and Statistics (IBGE in its Portuguese acronym). We used these criteria as a reference for the demand for NTFPs in domestic and international markets. We chose a 6-year period to take into account the annual variations in quantity collected and traded (HOMMA, 2018). We add to this analysis a "diversity" approach to assess the diversification of NTFPs extractivism. We assumed that the higher the number of the NTFPs gathered/traded in the municipality (higher diversification of

NTFPs) the more likely that this can be associated with multiple livelihoods (indigenous, quilombola, ribeirinhos), and sociobiodiversity practices (CONTINI; CASTILHO; COSTA, 2012; GONÇALVES et al., 2021; NETO, 2017; PINTO et al., 2016). We calculated the Simpson diversity index based on the individual 33 NTFPs (n) and the relative quantity produced by each in the 2450 municipalities that collected and traded above 1 ton of NTFPs in 2019 (N). This index (ʎ) was multiplied by 100 to take values between 0 and 1, as infinite diversity. This index is calculated as follows:

$$ʎ = 1 - \left(\frac{\sum n(n-1)}{N(N-1)}\right)^2 * 100 \quad (2)$$

3.3.2 Reviewing Social, Technical, Ecological, Economic, and Values of CBT Initiatives

We surveyed Brazilian tourism initiatives that actively promote local community engagement and use biophysical elements of NTFPs extractivism landscapes. We collected data from both peer-review articles and gray literature (governmental reports, websites of non-governmental organizations (NGOs), foundations, community associations, travel agencies, and tour operators) in English, Spanish and Portuguese. We pre-selected 113 initiatives; however, due to the lack of information, the selection went down to 49 initiatives that explicit address and call themselves as CBT. We define three initiatives for detailed analysis of social, technological, economic, environmental, political, and value aspects (STEEPV). The social aspect relates to direct or indirect actions for livelihoods development (QIAN et al., 2017). Technological aspect associates advancing the processing of goods from raw material (e.g., Açaí pulp) and innovation in sustainable management, increasing efficiency and knowledge transfer for human capital (UNWTO and UNDP, 2017). Economic aspect associates enhance rents and livelihood diversification, businesses and women entrepreneurial success (Bires and Raj, 2020). Environmental associates to the positive impacts on conserving biodiversity and protected areas, gearing away from unfavorable land-use trends, such as deforestation (STRONZA; FITZGERALD; HUNT, 2019). Political aspect refers to policies and funding to support tourism initiatives. And values refer to contributions to ethical issues (UNWTO, 2001).

3.3.3 Mapping Sociobiodiversity Tourism Hotspots

3.3.3.1 Data Collection

We compiled large official datasets comprising the main biophysical elements that underpin NTFPs extractivism landscapes and sociobiodiversity into five categories (Table 5). We used data about municipal, state, and federal conservation units (UCs), called "reserves." This dataset is a compilation of areas of ecological interest, state and national forest, wildlife refuges, biological reserves, and sustainable development reserve (SDR) that allow public visitation for recreational and educational purposes (ICMBIO, 2019). We also used the typology provided by the National Policy for Sustainable Development of Traditional Peoples and Communities (TPC) and characteristics of family farming (<100 ha) to map focal communities representing cultural and socioeconomic dimensions influenced by biophysical elements (De Assis & Barros, 2014). To address infrastructural issues, we gathered data on international airports and federal roads to account for accessibility. We collected data on the number of lodging establishments and the total number of people employed in tourism-related activities (e.g., food, transport, tour operators). We also collected data on NTFPs cooperatives and tourism official departments to address political/administrative issues.

Table 5 - Details of the data collected allocated into five categories.

Categories	Variable	Literature source	Dataset source
Landscape and wildlife	Reserves	(LUPI et al., 2017), (STRONZA; FITZGERALD; HUNT, 2019), (BARTHOLO; SANSOLO; BURSZTYN, 2009)	Ministry of the Environment, Chico Mendes Institute
Focal communities	Sociobiodiversity chain; RESEX; Quilombola community; Indigenous lands TPCs; Diversity of NTFPs extractivism; family farming	(LUPI et al., 2017) (Dolezal and Novelli, 2020)	Ypadê Portal of the Ministry of Environment and 2017 Agriculture Census
Service and organizational field	Lodging establishments	(DREDGE, 1999) (LAWRENCE; WICKINS; PHILLIPS, 1997)	Institute of Applied Economic Research
	People employed in tourism related activities		
	NTFPs Cooperatives		Varied sources
Supportive policy	Tourism official department	(Jackson and Murphy, 2002)	Ministry of Tourism
Accessibility	International airports	(Nyaupane and Poudel, 2011)	Ministry of Infrastructure
	Federal roads		

Source: elaborated by the author.

3.3.3.2 Spatial Datasets

The data collected was compiled into datasets of raster-based maps (100 m x 100 m cell grid) to obtain a set of 26 variables distributed into the five categories. We calculated a Euclidean distance between the features recorded as point, lines, and polygon by its coordinates (x, y). For the accessibility data (airports, roads) recorded as lines and points, it was expected that the distance between infrastructure spatial distribution might explain accessibility across the study area (WEIDENFELD; BUTLER; WILLIAMS, 2010). For the datasets at the municipal level, we used the information field to transform from vector to raster-based maps.

3.3.3.3 Qualitative and Quantitative Weights

From the characterization of CBT initiatives, we distinguished how CBT is likely to value NTFPs extractivism landscapes biophysical elements and sociobiodiversity material and immaterial values for being associated with sustainability issues, such as the responsible use of natural and cultural assets in recreational and educational purposes, include local communities, promote identity, cultural exchange and enhance socioeconomic systems addressing to goals of end poverty (Goal 1), gender equality (Goal 5), reduce inequalities (Goal 10) and protect terrestrial ecosystems (Goal 15) (BARTHOLO; SANSOLO; BURSZTYN, 2009). Then, we conducted a literature review and defined three classes of qualitative and quantitative weights ranging from 0 to 3 (Table 6). These values were assigned to the set of 26 variables.

Table 6 - Matrix of the weights assigned to the 26 variables.

Variables	**CBT**
Landscape and wildlife Σ	3
Reserves	3
Focal communities Σ	24
Sociobiodiversity chain	3
Extractive Reserves (RESEX)	3
Quilombola community	3
Indigenous lands	3
TPCs (Veredeiros, Riverside, Araguaia retreators, Pomerano people, Marroquianos, Vazanteiros, Caatingueiros, Geraizeiros, “Sempre-viva” pickers, Faxinalenses, Terreiro, marine extractivist).	3
NTFPs extractivism diversity index	3
Family farming from concession of indigenous land	3
Family farming from title of quilombola community	3
Service and organizational Σ	7
Lodging establishments up to 9 employers	2
People employed in tourism related activities	2
NTFPs extractivism cooperatives	3
Supportive policy Σ	2
Tourism official department	2
Accessibility Σ	4

International airports	2
Federal roads	2

Source: elaborated by the author.

A variable assigned to the qualitative weight "likely", for example, is understood as having a direct influence on CBT. For instance, indigenous lands and reserves under conservation, financial, and monitoring mechanisms, can support livelihood diversification through CBT (CARR; RUHANEN; WHITFORD, 2016), and therefore was assigned a quantitative weight of "3." Variables believed to have a "complementary" role or indirect influence for CBT were assigned a weight of "2." Federal roads are assigned with a weight of "2" as they connect places of attractiveness in large-scale regions and are often the only way to access destinations (Kádár and Gede, 2021). The weight "unlikely" (0) informs no association. Accordingly, variables from the landscape and wildlife category evidence the capacity of CBT to value protected areas and natural features (PERALTA, 2012). Focal communities' category variables, represent the capacity of CBT to value socio-cultural values from traditional livelihoods and family farming, such as from concession of indigenous land and quilombola communities (BARRETO; TAVARES, 2017). NTFPs diversity index has a direct influence on CBT to foster the monitoring of collected yields, thereby reinforcing collecting practices beyond the production of goods to make biomes more attractive for visitation. CBT can also take place in small inns and family lodgings (BARTHOLO; SANSOLO; BURSZTYN, 2009).

3.3.3.4 Spatial Explicit Modeling

We used the set of 26 variables as raster-base maps as inputs to a multicriteria analysis model (Si). We use DINAMICA EGO software, to assess the spatial arrangements between the different datasets in specific locations (hotspots). We attributed grades (xi), ranging from 1 (no relevant) to 10 (very high spatial explicit diversity and intensity) assigned to the 26 variables. Then, we derived the weights (wi) from 0 to 3, expressed as:

$$S_i = \sum_{\text{categories/variables}} x_i w_i \quad (3)$$

We equalized the output values ranging from hotspots, representing likely areas for CBT to be associated so as to enhance NTFPs extractivism, to cold spots. Then, we used landscape metrics at the patch level, to quantify the spatial patterns of hotspots and cold spots. Following,

we used quantitative analysis to characterize the hotspots based on the presence of the 26 variables.

3.3.3.5 Assessing Human Capital and Institutional Capacity

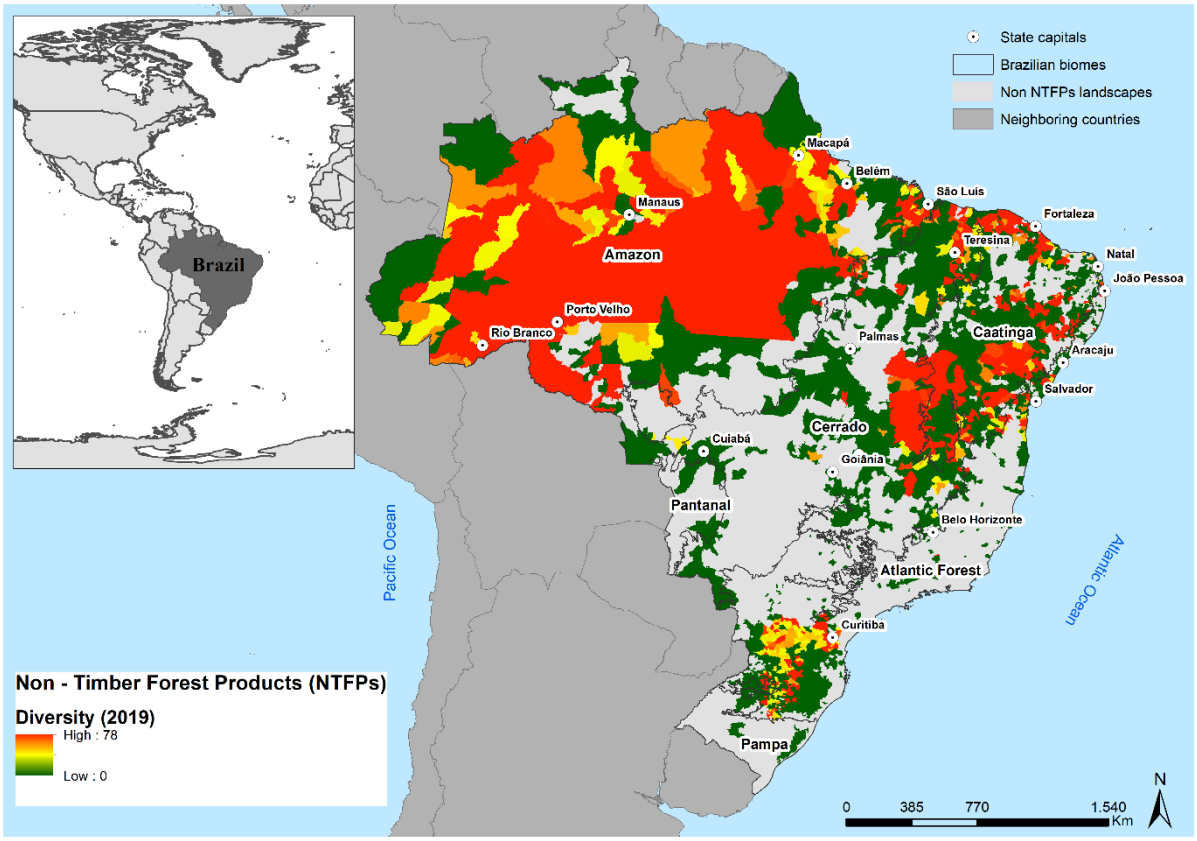
To explore where there is a human capacity and institutional potential for CBT to be associated so as to enhance NTFPs extractivism, we mapped municipal administrative headcounters, villages, urban areas, rural settlements (small and agricultural villages, nuclei, and town), called as “localities” to represent human capacity. Besides the tourism official departments and cooperatives used in the spatial modeling, we mapped the 49 CBT initiatives to represent institutional capacity. We overlapped these data with sociobiodiversity tourism hotspots and cold spots.

3.4 Results

3.4.1 NTFPs Extractivism Landscapes in Brazilian Biomes

Up to 43% (2.450 out of 5.572) of municipalities in Brazil gathered/traded at least one ton of NTFPs, such as Açai and Brazil nut in Amazon, Carnaúba in Caatinga, Pequi and Babaçu in Cerrado and Mate-herb, Araucaria seed and Piaçava in Atlantic Forest biome. The 2.450 municipalities cover over 5 million km 244 2 where 5 million tons of different NTFPs were collected and traded from 2013 to 2019, according to the annual survey (in tons) of IBGE. The municipalities that collected and traded up to 1 ton of NTFPs are concentrated in Caatinga (813), Atlantic Forest (753), Amazon (439), Cerrado (437), Pampa (5), and Pantanal (3) biome. In 2019, the diversity index ranged from 0 indicating low diversity (one NTFP) to 78 indicating high diversity in municipalities that collected and traded up to 7 different NTFPs in Amazon, Caatinga, and east of Cerrado biome (Figure 7).

Figure 7 - Spatial explicit patterns of NTFPs extractivism landscapes and NTFPs diversity index in 2019.



Source: elaborated by the author.

3.4.2 STEEPV of CBT Initiatives: Case Studies

Table 7 summarizes the key issues and drivers from STEEPV aspects for sustainable tourism in three relevant CBT initiatives in Brazilian biomes. The Uacari Lodge in Mamirauá Sustainable Development Reserve is a CBT initiative in the heart of the Amazon biome. This initiative was created in 1999 and promotes a circular pattern of sustainable growth merging all STEEPV aspects. It promotes social development based on the inclusion of traditional communities and investments in human capital on all fronts of resource management. Using research, technology, and innovation for the regular improvement of the business management models of community-based tourism in Uacari lodge integrates sustainable fishing, NTFPs extractivism, timber production, and family farming. As a result, there is an economic diversification for riverside dwellers, extractivist, and family farmers within the reserve. Such activities are supported by political aspects such as the adoption of public strategies and policies for conservation and sustainable use of Amazon's biodiversity with a broad base of funding partners. Therefore, ethical rights such as appreciation and respect for the culture and identity of communities, transparency, sustainable use of resources are appreciated.

Table 7 - Key issues and drivers from STEEPV aspects.

	Uacari Lodge	Quilombo do Cumbe	MSVP
Social	Value traditional knowledge and community associations and cooperatives in decision-making. Invest in capacity building for territorial and resource management.	Values and promotes the knowledge and ways of doing quilombolas, artisans and fishermen.	Community-based management by quilombolas, indigenous people, extractivist and family farmers through as advisory council.
Technology	Innovation and technical support for agriculture management model, fishing, community forestry. Research and technical assistance to family farmers.	Official website to communicate trails and family home accommodations.	Official website to inform about attractions, family home accommodations.
Economy	Uacari lodging; Sale of wood extracted from community management; Income from fishing and agroforests by family farmers.	Tourists are hosted by community members. Sale of handicrafts and fishing and culture festivals.	Tourists are hosted by community members; Sale of handicrafts; Fruits and nuts; Finance support through partnerships.
Environment	Sustainable management practices for fisheries, community forest management and family farming agriculture.	Ecological hikes for natural and archaeological heritage protection and monitoring.	Developed in a mosaic of 12 Conservation units. Conservation of natural and archaeological and heritage sites.
Political	Amazon Fund, Gordon and Betty Moore Foundation, USAID, Amazonas State Government and Ministry of Science, Technology and Innovations.	State Secretary of Culture, Rede Cearense de Cultura Viva; National law Nº 13,018/2014, State Law Nº 16,602 / 2018.	Chico Mendes Institute for Biodiversity Conservation (ICMBio) Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA).
Value	Community empowerment Gender equality and ethnic tolerance.	Gender equality and ethnic tolerance, right to land.	Gender equality, right to land, community empowerment.

Source: elaborated by the author.

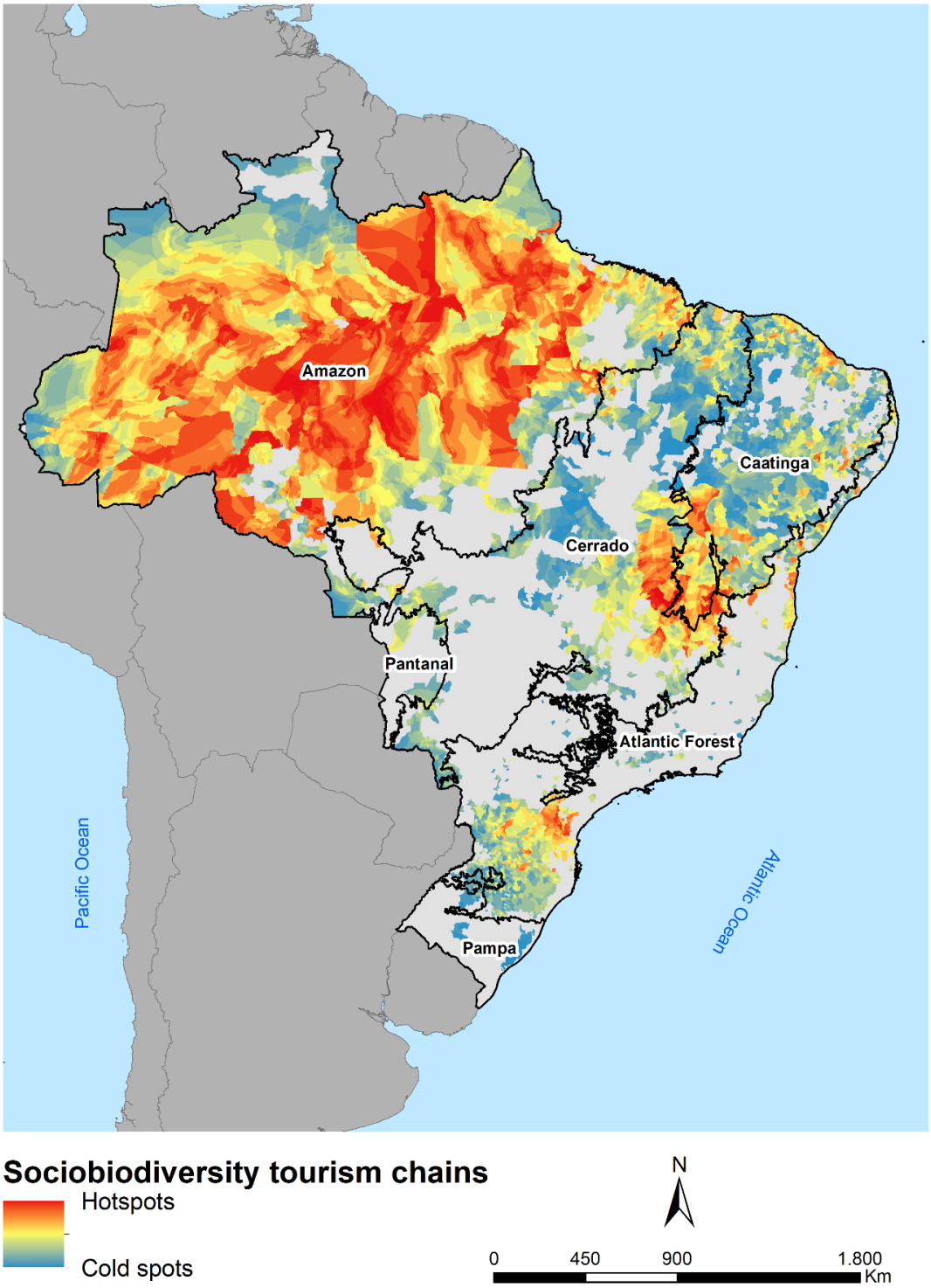
Quilombo do Cumbe, is a CBT initiative on the coast of the Caatinga biome. This initiative was created in 2003 and helped traditional communities to protect their right to the land. It promotes social development based on the appreciation of 168 quilombola families, fishermen, farmers, and artisans. Major technology investments are focused on information technology for the official website that promotes the community as a tourist destination. As a

result, there is economic diversification since the community members are entrepreneurs, owners of family homes, restaurants, and boats used by tourists to get to know natural and historical points and enjoy the local cuisine. Community members are also tour guides to ecological hikes and boat trips to see mangroves, dunes, and rivers that are part of the livelihoods of quilombola communities and fishermen. The community also monitors environment threats. Activities are supported by Palmares Cultural Foundation and state cultural policies. Ethical values such as the right to land, gender equality, and the sustainable exploitation of resources, are appreciated. The MSVP initiative takes place in an area formed by 12 conservation units in the Cerrado biome. This initiative was created in 2008 and is known as a Mosaic of Protected Areas part of the National System of Conservation Units (SNUC). It promotes social development by valuing material and immaterial values from quilombolas, indigenous peoples, NTFPs extractivist, such as the Babaçu coconut breakers, and family farmers with the protected areas. Major technology investments are focused on an official website as means to communicate a diversified portfolio of activities and promote the MSVP as a tourist destination. The community is employed and/or manages community accommodations and tours to the protected areas, caves, and cultural manifestations for recreational and educational purposes. This initiative promotes technical cooperation and is supported by the World Wildlife Fund (WWF), the National Indian Foundation (FUNAI), universities, and indigenous associations. Ethical values such as the right to land, socio-cultural respect, and the sustainable use of resources are appreciated.

3.4.3 Spatial Explicit Sociobiodiversity Tourism Hotspots

The results of the multicriteria analysis show scattered distribution of CBT hotspots in a total area of 113 million hectares across all six Brazilian biomes (Figure 8). The higher mean patch area in these hotspots is located in Amazon (874,278 ha), Caatinga (496,711 ha), and also in Cerrado (61,563 ha). This evidence suggests that Amazon is the most suitable for developing CBT and addressing poverty (Goal 1), securing food (Goal 2), creating reliable jobs (Goal 8), and smoothing inequalities (Goal 10). Such hotspots in Amazon are characterized by municipalities with average NTFPs extractivism diversity index (ʎ ¼ 29) that overlap 48 million ha of sustainable development reserves (SDR) (20), RESEX (35), indigenous lands (152), and quilombola communities (64), alongside 35,776 km of rivers home to riverside communities.

Figure 8 - Wall-to-wall map of sociobiodiversity community-based tourism (CBT) hotspots.

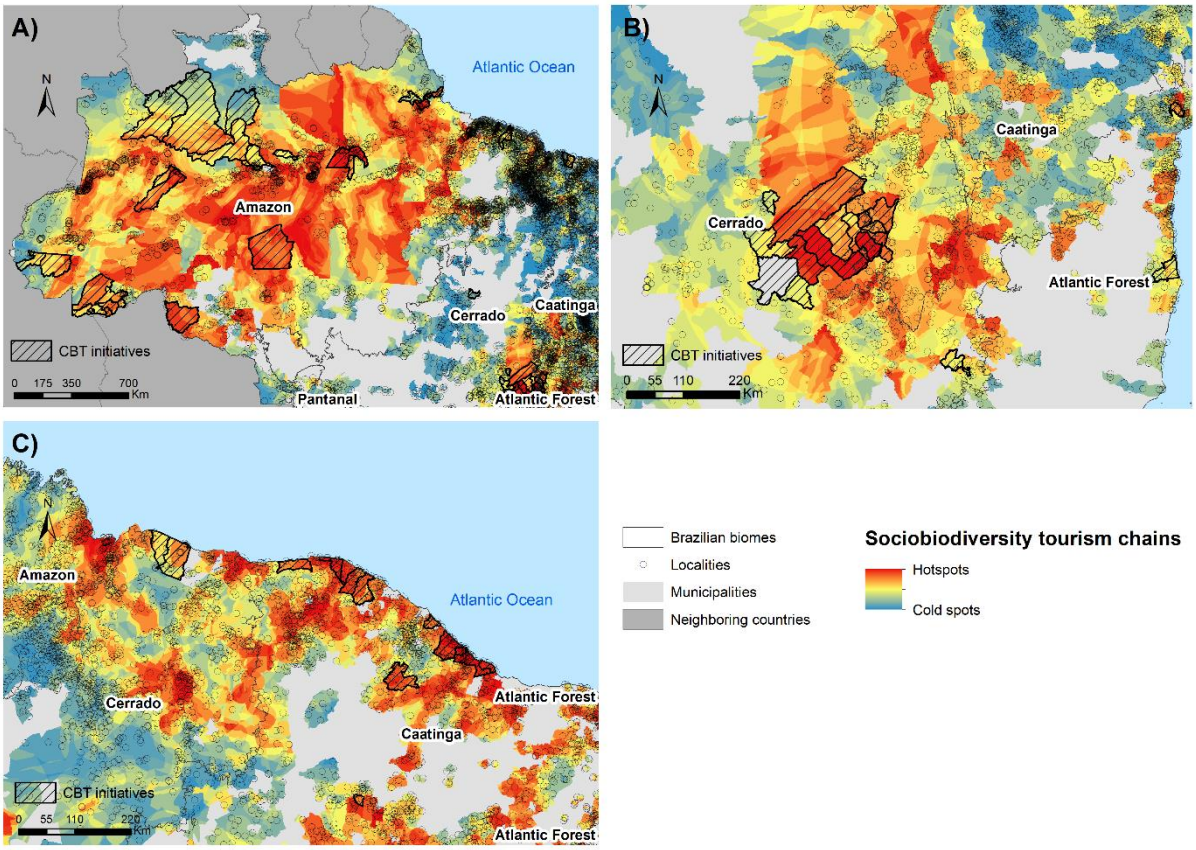


Source: elaborated by the author.

When looking at the human capital and institutional capacity, the human capacity comprised of over 10 thousand localities, overlap the sociobiodiversity tourism hotspots across Brazilian biomes. Strikingly, the institutional capacity represented by 49 CBT initiatives,

located in Amazon (29), Caatinga (12), Cerrado (6), and Atlantic Forest (2), are more sparsely distributed in the hotspots (Figure 9).

Figure 9 - Human capital and institutional capacity overlap hotspots and cold spots of A) CBT in Amazon, B) CBT in Cerrado, and C) CBT in Caatinga and Cerrado.



Source: elaborated by the author.

Although there are 51 NTFPs extractivism cooperatives, these are the very same 40% of the human and 59% of the institutional capacities, represented by CBT initiatives such as Uacari Lodge in RDS Mamirauá, overlap CBT hotspots in Amazon (Table 8). Serras Guerreiras de Tupuruquara, managed by the Association of Indigenous and Riparian Communities (ACIR), and "Baré experience" and "Yawanawá experience" initiatives allow visitors to experience the culture and traditional livelihoods of indigenous people (Baré and Yawanawá tribes) and participate in parties, flour production and Açaí and Brazil nut gathering. RESEX Tapajós-Arapiuns initiative enables local lodging services, addressing directly Goal 1 and empowerment of women (Goal 5). São Manuel Bar and Rio Juruena and RESEX Cazumbá Iracema initiatives also have a diverse portfolio of income activities, such as local hostel, local handicrafts, and extractivism of Brazil nut. Tourists can also experience Açaí, Brazil nut and Babaçu extractivism, trekking with an overnight stay at REXES Rio Ouro managed by rubber tapper and agroextractive association.

Table 8 - political/administrative and infrastructure, human capital (localities) and institutional capacities (CBT initiatives) in sociobiodiversity tourism hotspots and cold spots.

		CBT					
		Amazon	Caatinga	Cerrado	Atlantic Forest	Pampa	Pantanal
Service / Organizational	Nº lodging establishments	6.041	1.153	1.796	3.320	-	-
	Nº people employed tourism	463.701	16.158	61.565	374.938	-	-
	Nº NTFPs coop.	51	3	14	2	-	-
Supportive policy	Nº tourism department	104	21	47	49	-	-
Accessibility	Nº international airport	4	0	0	1	-	-
	Federal roads (km)	9.582	509	1.804	292	-	-
Human capacity	Cold spot	161	1.858	906	1.189	54	-
	% in the biome	7,6%	46%	47%	46%	71%	-
	Hotspot	406	51	152	44	-	-
	% in the biome	40%	1.2%	8%	1,7%	-	-
Institutional capacity	Cold spot	9	8	5	1	-	-
	% in the biome	23%	72%	83%	50%	-	-
	Hotspot	23	3	1	1	-	-
	% in the biome	59%	27%	16%	50%	-	-

Source: elaborated by the author.

There are 6 thousand lodging establishments, 104 official tourism departments 4 international airports, and 9 thousand km of federal roads to support the upscale of these initiatives in CBT hotspots in the Amazon. CBT hotspots in Cerrado (Figure 9b) are characterized by the highest livelihoods (e.g., caatingueiros, sempre-viva pickers, veredeiros, geraizeiros, vazanteiros, and communities), national and state parks, among UC's, such as in MSVP initiative, that overlap municipalities with average NTFPs diversity index (ʎ ¼ 29). The CBT in Campo Buriti initiative also values women artisans from traditional communities of Cerrado, who produce unique ceramic of Jequitinhonha Valley. However, there are no international airports, a limited 1.804 km of federal roads for accessibility, and 47 tourism official departments for coordination within the hotspots. In CBT hotspots located in Caatinga there are 95 thousand ha of RESEX, including marine, and indigenous lands. The maximum overlap of 8% of human and institutional capacities, concentrated mostly in the coast of this biome within the hotspots. This

highlights widespread uncertainty regarding effective collaboration for CBT to enhance NTFPs extractivism and sociobiodiversity in other areas of the biome (Figure 9c). In CBT initiatives such as RESEX do Batoque, Curral Velho, Caetanos de Cima, traditional communities offer their homes as lodging where tourists can experience local recipes. In Quilombo do Cumbe and Prainha do Canto Verde, tourists can experience artisanal fishing and enjoy local community lodging and gastronomy, also visit the small fishing village Mandacaru and Canto de Atins. In Sertão do Cariri and Tijuca Boa Vista Rural Settlement, the only initiatives located off the coast of Caatinga biome, tourists experience folkloric manifestations. All these activities address directly Goal 1 (reducing poverty) and Goal 8 (providing decent employment). Although there are 509 km of federal roads, there are no international airports in this hotspot area.

3.5 Discussion

3.5.1 Implications for Planning CBT Integration and Governance in Sociobiodiversity Tourism Hotspots

Although the socio-cultural values can help implement SDGs (MUGO; VISSEREN-HAMAKERS; DUIM, 2020), Brazil's emblematic sociobiodiversity has not yet been a development asset often associated with underdevelopment and "empty land". Development pathways in rural landscapes often focus on commodities exports such as agribusiness (e.g., soybean) and mining (BENDINI et al., 2019). Added to this main scenario, Brazil was severely hit by the COVID-19 pandemic and it is likely that this image will hamper international tourism. For Brazil to recover from it there is the need to go well beyond the prevailing mass tourism industry and instill a new market of low-density tourism in sparsely populated landscapes.

Brazil has great examples of CBT initiatives (BARTHOLO; SANSOLO; BURSZTYN, 2009), as also highlighted in this study. The main characteristics of CBT initiatives in Brazil regarding the integration of STEEPV aspects show that, although local, they provide action-oriented knowledge to associate CBT with NTFPs extractivism, as a way to strengthen sociobiodiversity chains in rural landscapes (MMA, 2009; URANO; SIQUEIRA; NÓBREGA, 2016). The Uacari Lodge, Quilombo do Cumbe and MSVP case studies evidence the diversity of biophysical elements in NTFPs extractivism landscapes valued through CBT in trails, forests, and lakes for recreation purposes to traditional communities to learn about and understand their livelihoods (MORAES; MENDONÇA; PINHEIRO, 2017; OLIVEIRA; DIÓGENES; ALMEIDA, 2021; PERALTA, 2012). As a consequence, as far as the where is concerned, we show that there are many likely successful areas for integrating biophysical

elements, NTFPs extractivism, and CBT initiatives. Despite being rare, this integration can help convert overexploitation lands to promote wide ranging socio-cultural, economic, and ecological benefits in specific socio- environmental contexts.

As far as the how is concerned, the mapping of sociobiodiversity tourism hotspots brings up the relevance of planning CBT integration and as a powerful governance model that value natural, physical, human, social, and economic capitals of NTFPs extractivism landscapes (QIAN et al., 2017), into such complex arrangements. CBT hotspots in Amazon presented human capital and institutional capacity for valuing sociobiodiversity material and immaterial values and upscale tourism initiatives. However, hotspots in Cerrado and Atlantic Forest lack infrastructure, fundamental for the efficiency of sociobiodiversity tourism hotspots (BARTHOLO; SANSOLO; BURSZTYN, 2009). There is also an urgent need to go beyond the marketing of undifferentiated raw biodiversity products. The planning we highlight here calls for innovative markets aligning production and consumption in CBT and NTFPs extractivism, rewarding and strengthening relationships across traditional livelihoods (e.g., forests and reserves). However, studies have illustrated the difficulties facing governance in putting sustainable development concepts into practice (CARVALHO-RIBEIRO; LOVETT; RIORDAN, 2010).

The suggested planning and governance build on the areas where there is potential for a comprehensive alternative territorial development strategy based on CBT and the material and immaterial uses of biodiversity that so far have been overlooked. First, planning and governance in sociobiodiversity tourism hotspots in rural Brazil require integrated socio-environmental policies. Second, CBT governance in these hotspots will likely be successfully implemented through collaboration between traditional communities, institutions, and tour operators. However, there is the need to deal with governmental failure and power politics that afflict rural enclaves. For example, studies report that there is much doubt as to whether indigenous and quilombola peoples will be consulted in the process of reopening federal road BR-319, in Brazil's "arc of deforestation" in Amazon (FERRANTE; GOMES; FEARNSIDE, 2020).

We suggest that because the hotspots and sociobiodiversity values rely greatly on biophysical elements, planning CBT integration, as well as governance, must start with both tourism and non-tourism policies enforcing environmental laws through strict supervision and use of technology to reconcile the demands of multiple land uses and prevent illegal logging

(WEAVER, 2011). Also, upgrading the quality of protected areas (JONES et al., 2019). Such measures can increase trust among traditional communities, governments, and institutions, as found in CBT management models in China (QIAN et al., 2017). In sociobiodiversity tourism hotspots, plans and policies to upgrade the quality of existing nature reserves need to consider sociobiodiversity practices and the particular knowledge of traditional communities (PRINGLE, 2017). This is crucial for better governance of Amazon's hotspots, where illegal logging and fires threaten subsistence food production and climate regulation (STRAND et al., 2018). Increasing the importance of legal reserves in family farming can contribute to sustainable NTFPs extractivism of Mate-herb and Araucaria seed in Atlantic Forest, Carnaúba in Caatinga and Pequi in Cerrado (GUERRA et al., 2020). Communities can also be trained to monitor natural attractions, conduct environmental education activities about NTFPs and forest ecosystem services (Stronza et al., 2019).

From the overlap of human and institutional capacities in CBT hotspots, good governance starts with respect identity of small-scale agriculture and NTFPs extractivism in CBT hotspots (Tao and Wall, 2009). The overlap of human and institutional capacities, such as Uacari Lodge, Quilombo do Cumbe and MSVP case studies, also evidenced that capacity building and collaboration are imperative for traditional communities to self-organize and actively participate in native ecosystems protection and economic management of NTFPs extractivism within the hotspots (Santos and Santos, 2020). This can be done through public-private partnerships and creating consulting boards and community associations to include traditional communities in decision-making and discuss processes for allocating the profits (SU et al., 2019). These associations are the node for traditional communities to take on a more insightful part in the planning and governance of sociobiodiversity tourism hotspots as community-based networks (URANO; SIQUEIRA; NÓBREGA, 2016).

Although not free from conflicts of interest, strong feedback communication and articulation between community associations within the hotspots is essential to share identity and create common values within a decentralized network (COSTA et al., 2003). Brazil has two major network examples, the Brazilian Network of Solidarity and Community Tourism (Rede Turisol), and the Cearense Community Tourism Network (Rede Tucum), from which the same CBT initiatives were mapped in this study. We here suggest upscaling these networks and planning new ones from sociobiodiversity tourism hotspots, as the areas where CBT can enhance the sustainability of NTFPs extractivism and sociobiodiversity material and immaterial values. This can lead to empowerment networks of traditional communities, institutions and

tour operators working toward the same goals of reconciling CBT and the use of Brazil's megadiversity across landscapes (SAYER et al., 2013; URANO; SIQUEIRA; NÓBREGA, 2016), fostering transitions toward sustainability.

3.6 Conclusion

The findings from this study connect with sustainable transitions toward sustainability in a post-COVID-19 era. First, the transition of tourism as a sustainable development asset is due to the diverse biophysical, socio-cultural, economic, environmental, and political elements presented by rural landscapes that collected and traded NTFPs between 2013 and 2019, unveiling a rich potential for upscale tourism initiatives into sociobiodiversity tourism hotspots and help address end poverty (Goal 1), gender equality (Goal 5), and protect terrestrial ecosystems (Goal 15) at a landscape scale. Second, CBT and NTFPs extractivism, are reinforcing and might give a new breath to NTFPs extractivism and sociobiodiversity values that have been regarded as obsolete in terms of current market value. Therefore, the overarching conclusion from our wall-to-wall spatially explicit assessment is that CBT hotspots can enhance the sustainability of NTFPs extractivism by valuing biophysical elements and sociobiodiversity material and immaterial values. These findings reinforce the importance of exploring CBT capacities to associate with socio-cultural values and NTFPs extractivism as a driver to transition away from lock-ins and toward internationally competitive tourist products and destinations. Although infrastructure and fractured institutional capacity remain key challenges, human capital can give rise to community associations and networks as a way to how CBT can value sociobiodiversity values and rescale tourism initiatives. We argue that efforts to close development gaps in rural Brazil would be more effective if tourism and NTFPs extractivism are considered as a sustainability development asset. This study reflects the preliminary stages of a broader research effort to answer why, where, and how tourism and sociobiodiversity can support territorial development for transitions in Brazilian biomes in line with the global sustainability agenda.

4. CHAPTER 4: MARKETS FOR NON-TIMBER FOREST PRODUCTS (NTFPS): THE ROLE OF COMMUNITY-BASED TOURISM (CBT) IN ENHANCING BRAZIL'S SOCIOBIODIVERSITY[5]

4.1 Abstract

Under detailed settings, tourism can add to the material and immaterial values of the use of biodiversity, such as non-timber forest products (NTFPs) collected by traditional communities, towards sustainability in rural landscapes. A critical aspect is to effectively assess where to implement tourism modalities that enhance NTFP extractivism and reduce the emphasis on the quantities extracted (yields). Here, we map NTFP extractivism and community-based tourism initiatives in Brazil to explore local markets, use a spatially explicit modeling approach and map landscape-scale governance mechanisms to upscale where sociobiodiversity can be successfully cherished through a community-led visitation and management model. Our results show suitable large areas to upscale community-based tourism (CBT) markets for NTFP extractivism in the Amazon and Cerrado, which can be supported by available social capital and partnerships. However, there is a lack of infrastructure and institutions to support their implementation. We evidence innovative ways for enhancing the role of tourism for Brazil's sociobiodiversity and fostering transitions towards multifunctional sustainable land uses.

[5] BACHI, L.; CARVALHO-RIBEIRO, S. Markets for Non-Timber Forest Products (NTFPs): The Role of Community-Based Tourism (CBT) in Enhancing Brazil ' s Sociobiodiversity. **Forests**, v. 14, n. 298, 2023.

4.2 Introduction

Sociobiodiversity is the conjunction of socio-cultural and biological diversity associated with the collection and pre-processing of native species, such as non-timber forest products (NTFPs), using the skills and knowledge of traditional communities. In Brazil, this encompasses 12 million ha of indigenous lands and extractive reserves (RESEX), 15 traditional peoples and communities (TPCs) and family farming in Brazilian biomes (NODA; NODA, 2003). Sociobiodiversity fulfills material and immaterial livelihood needs of extractivists in the Amazon that collect açaí and Brazil nuts for subsistence and use in agroforestry systems, indigenous lands produce the "açaí wine" used in rituals (CARDOZO; JUNIOR, 2012; SILVA; SANTANA; REIS, 2006). Caatinga NTFPs include carnaúba, which is used by family farming to produce and sell ropes, hats and bags (SUCUPIRA et al., 2018). In Cerrado, pequi and babaçu are used by family farmers, extractivists and indigenous people for food security, house construction and in rituals (CAA, 2013). In the Atlantic Forest, indigenous people use Mate-Herb in rituals and medicine, while family farmers use it in historical territorial occupation (Faxinal systems) (CONTINI; CASTILHO; COSTA, 2012).

However, NTFPs are appreciated mostly for their yields and the "quantity produced". Thus, the pressure to boost commodity chains has led to unsustainability and claims that these multifunctional land-use systems should be discontinued (FREITAS et al., 2020). In Brazil, there are public policies in place, such as the National Plan for Sociobiodiversity, that establish "citizenship territories" focused on NTFP chains (MMA, 2009), while another policy establishes the minimum price guarantee (in Portuguese Política de Garantia de Preços Mínimos by National Supply Company) (LIMA; JÚNIOR; LUNAS, 2015). Yet, examples focusing on valuing the immaterial values of NTFPs (other than yields) are scarce.

Tourism has been a constant theme in sustainable development discourse since the "Our Common Future" report (BRUNDTLAND, 1987), as an asset for sustainability transitions and achieving the United Nations' Sustainable Development Goals (SDGs) (HALL, 2019; INSKEEP, 1988). Tourism modalities have evolved over the last three decades to meet sustainable development targets within the context where they occur and have been in greater demand since the COVID-19 pandemic (UNWTO, 2020a). For example, community-based tourism (CBT) is a community-led visitation and management model that directly promotes cultural and ethical values for rural livelihood improvement (QIAN et al., 2017) and enhances income and women's entrepreneurial success (SAVAGE; BARBIERI; JAKES, 2020). CBT

also has positive impacts on conserving biodiversity and bringing political and financial support to protected areas and rural settlements (DODDS; ALI; GALASKI, 2018).

If associated, CBT can trigger traditional communities to demonstrate the traditional knowledge and skills of NTFP extractivism in new markets and reestablish the pride that has been devalued as "cowboy imagery" (GOMES; VADJUNEC; PERZ, 2012). This could support the sustainable management of multiple land uses, which is a key strategy for increasing revenue for traditional livelihoods (SDG 1) (BARTHOLO; SANSOLO; BURSZTYN, 2009), securing food (SDG 2), creating work opportunities for youth and women (SDG 8) and protecting biological diversity (SGD 15) across production landscapes (FAGERHOLM et al., 2020). Multifunctional land use can be addressed by pursuing different goals across land use types such as forestry, agriculture, biodiversity conservation and food production simultaneously on the same land plot or sequentially in time (CARVALHO-RIBEIRO; LOVETT; RIORDAN, 2010). In turn, sociobiodiversity can improve experiences and the overall quality of CBT (UNWTO, 2010).

Despite the theoretical appeal, CBT and sociobiodiversity have been treated superficially by public policies and decision-makers as a sustainable alternative strategy in Brazil (HOMMA; SANTANA; ZANDER, 2020). The tourism industry in Brazil relies on mass coastal and urban tourism alone. In 2019, coastal tourism represented 65% of the motivation for leisure trips, versus 32% for nature and culture (MTUR E FIPE, 2021). Coastal cities and state capitals are the most visited destinations and leaders in the tourism economy, based on the number of jobs and lodging (MTUR, 2019). As a result, there is a lack of policies, funding and information on where and how to develop tourism in rural areas, especially in association with the collection and trade of NTFPs (SILVA; VILARINHO; DALE, 1998). Such an effort need to consider that the material and immaterial values of sociobiodiversity, and its viability as a form of land use, are place-dependent (HOMMA, 2018). Therefore, a key question that this study addresses is: Where can CBT enhance the material and immaterial values of the use of biodiversity by traditional livelihoods in a post-COVID-19 era?

Research on tourism's role in sustainable transitions within the neo-extractivism context in Brazilian biomes is on the rise (MARQUES; FAZITO; CUNHA, 2022). Yet, studies have focused on diagnostics of the possibilities and limitations of CBT to foster sustainable use of resources in protected areas and local communities (BARTHOLO; SANSOLO; BURSZTYN, 2009; SAMPAIO; ZAMIGNAN, 2012; SILVA; VILARINHO; DALE, 1998). Few studies

have explored positive associations between recreational ecosystem services and NTFP extractivism in biomes such as the Amazon (CARVALHO RIBEIRO et al., 2018). Still, a national assessment of where CBT and sociobiodiversity are likely to be self-reinforcing is lacking. The gap lies in mapping the links between NTFP extractivism and examples of CBT initiatives that value the material and immaterial values of sociobiodiversity and foster sustainable land uses. Place-based initiatives in Brazil are championing interactions between social, technological, economic, ecological, political and ethical values (BRONDIZIO et al., 2021), but data on CBT initiatives within NTFP extractivism landscapes are scarce. Further, studies conclude that scale, market and accessibility shape the capacity for tourism to contribute to rural livelihoods (HOEFLE, 2016). However, knowledge of landscape-scale governance mechanisms operating across scales, such as partnerships and financing (ROMERO-BRITO; BUCKLEY; BYRNE, 2016), to support synergies still needs to be addressed.

This study aimed to assess the explicit spatial synergies between CBT and sociobiodiversity in Brazilian biomes to inform public policies. To do this, we map and characterize the linkages between NTFP extractivism and a hard-hitting list of CBT initiatives. We then adopted a spatially explicit multi-criteria analysis (MCA) modeling approach (KOSCHKE et al., 2012) to explore potential hotspots of biophysical, cultural and accessibility aspects and governance mechanisms where synergies can be upscaled. Our main questions were: 1) Where is there spatial integration between NTFP extractivism and CBT in Brazilian biomes, and by what factors does it develop and sustain? 2) Where is the potential to upscale good practices of CBT that add value to sociobiodiversity in NTFP extractivism landscapes?

4.3 Methods

We first analyzed the spatial integration of NTFP extractivism landscapes and CBT initiatives and characterized such synergies using a qualitative framework (Section 2.1). We then introduced a two-step spatial MCA for the mapping of sociobiodiversity tourism hotspots where local synergies can be upscaled (Section 2.2).

4.3.1 Assessment of Spatial Explicit and Qualitative Synergies between NTFP Extractivism and CBT

4.3.1.1 Mapping of NTFP Extractivism Landscapes

Between 2013 and 2019, 43% of the municipalities of Brazil (2450 out of 5572), representing an area of over 5 million km², collected and traded at least one ton of NTFPs, such

as mate-herb in the Atlantic Forest, açaí and Brazil nuts in the Amazon and pequi in Cerrado (data available). We used a diversity approach and indicators to detect the diversity of NTFPs collected and traded by each municipality, to capture material and immaterial values from production and rural livelihoods (STÜRCK; VERBURG, 2017) (such as indigenous people, African descendants (Quilombola) and riverside communities), land uses and values (CONTINI; CASTILHO; COSTA, 2012; GONÇALVES et al., 2021; NETO, 2017; PINTO et al., 2016) (see Appendix C). We used production data from the Brazilian Institute of Geography and Statistics (IBGE in Portuguese) to calculate the Simpson diversity index (data available). This calculation was based on the count and relative quantity collected and traded, above 1 ton, of 33 NTFPs (n) for each of the 2450 municipalities in 2019 (N). We multiplied the index (ʎ) by 100 to obtain values between 0 and 1, with 1 being high diversity. The calculation used the following formula:

$$ʎ = 1 - \left(\frac{\sum n(n-1)}{N(N-1)}\right)^2 * 100 \quad (4)$$

4.3.1.2 Mapping CBT Initiatives within NTFP Extractivism Landscapes

We surveyed for CBT initiatives (associated with the involvement of communities and direct interaction with tourists in the daily lives of communities), in peer-reviewed articles, official government reports and websites, domains of non-governmental organizations, institutes and foundations, community associations, tour operators and travel agencies, in Portuguese and, when suitable, in English and Spanish. We then selected 47 initiatives that explicitly or implicitly address NTFP collection in rural landscapes and refer to themselves as CBT.

4.3.1.3 Qualitative Characterization of the Synergies

We used an evaluation framework to assess whether the CBT initiatives in NTFP extractivism landscapes add value to sociobiodiversity through the involvement of communities and direct interaction with tourists as integrated landscape initiatives (REED et al., 2017). The framework included information on spatial context (in terms of where the initiative takes place according to land tenure categories (SPAROVEK et al., 2019)), date of establishment, structure (in terms of community-led visitation and community-led management), funding, main attractions, variety of stakeholders involved, channels of information dissemination, aims and

intended outcomes (such as natural resources management and conservation, building social capital, cooperation, protecting cultural heritage and identity and landscape management) (BARTHOLO; SANSOLO; BURSZTYN, 2009; GARCÍA-MARTÍN et al., 2016; NYAUPANE; POUDEL, 2011) (Table S3). The information was analyzed by calculating relative frequencies.

4.3.2 Spatial Multi-Criteria Analysis

4.3.2.1 Criteria and Spatial Datasets

To explore where to upscale the synergies, we conducted a literature review and defined four categories of attributes: biophysical and cultural/livelihood categories, accessibility and touristic structure (criteria). We also defined the likelihood of a set of variables to be valued by CBT (sub-criteria) as input data for the spatial model. We defined a qualitative scale consisting of "complementary" and "likely" to be assigned to each variable (Table S4). For example, when supported by funding mechanisms and monitoring, CBT is expected to assist rural livelihoods in indigenous lands and reserves (BUTCHER, 2011). Variables such as federal roads in large-scale regions are often the only way to access destinations and connect high attractive places and (KÁDÁR; GEDE, 2021), therefore, are complementary. We then downloaded datasets for all the variables selected. For example, municipal, state and national forests and sustainable development reserves (SDRs), were collectively called "reserves" as conservation units that allow tourists for recreational and educational purposes (ICMBIO, 2019). We collected data about traditional people and communities from the National Policy for Sustainable Development of TPCs (BARTHOLO; SANSOLO; BURSZTYN, 2009). We also gathered data on federal roads and international airports (NYAUPANE; POUDEL, 2011) and the total number of people employed in lodging, food, transport and tour operations as well as the number of lodging establishments (LAWRENCE; WICKINS; PHILLIPS, 1997). We transformed these data into raster-based maps (100 m × 100 m pixels). For datasets recorded as points, lines and polygons, we used the coordinates (x, y) to calculate the Euclidean distance in ArcMap 10.8 software; for example, distance from federal roads and airports to assess the accessibility (WEIDENFELD; BUTLER; WILLIAMS, 2010). We converted the datasets at the municipal level to vector to raster-based maps using the information field.

4.3.2.2 Spatially Explicit Modeling

We assessed the spatial clustering (hotspots) using the set of variables and categories as input data for a multi-criteria analysis model (S_i) in the DINAMICA EGO software. First, we assigned grades (x_i), ranging from 1 (not relevant) to 10 (very relevant), to each variable within a given category. High grades indicate a higher spatially explicit intensity of one variable, such as the intensity of reserves in a given region, for example. Second, we derived weights (w_i) for the most important categories. All weights summed to 1. The multi-criteria analysis models are expressed as:

$$S_i = \sum_{\text{categories/variables}} x_i w_i \quad (5)$$

4.3.2.3 Output Data Analysis

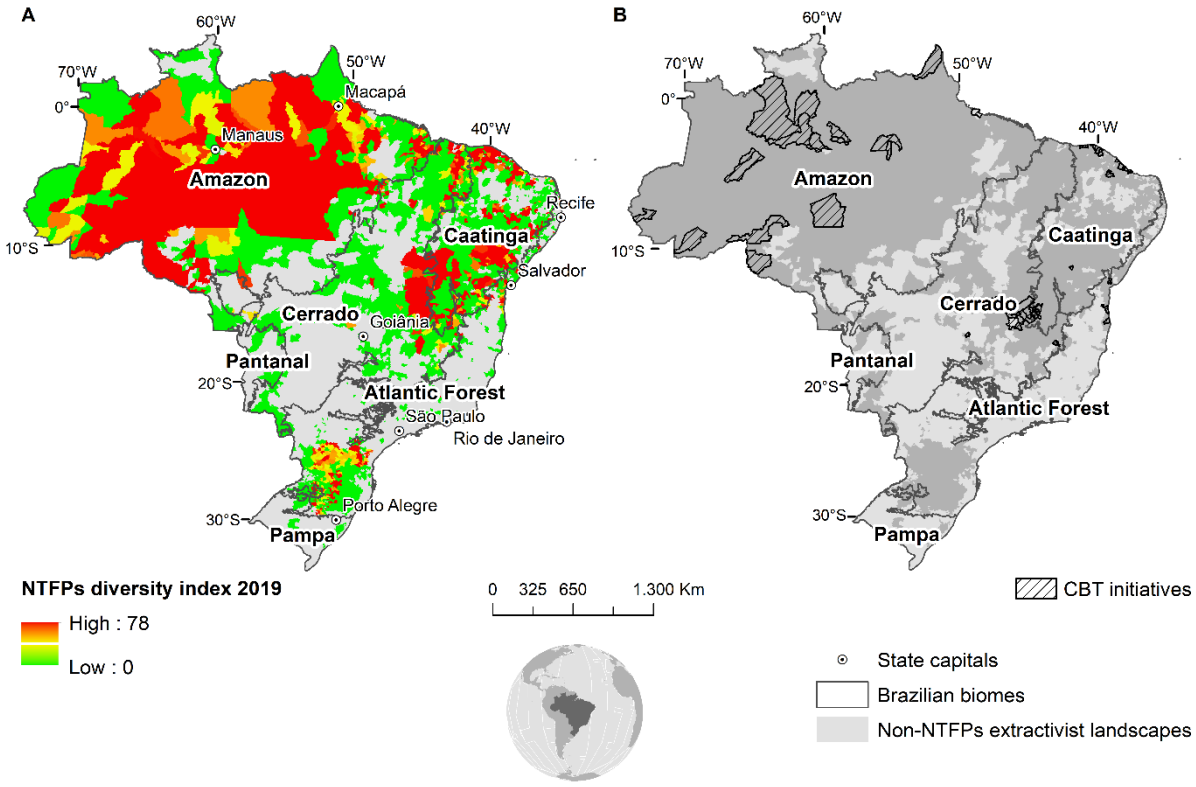
Output raster data were displayed using the histogram equalization technique in ArcGIS 10.8, which shows the distribution of the image pixels by stretching out the intensity range of the image, thereby evidencing hotspots (SANO et al., 2010). We then used composition and configuration metrics (e.g., patch size standard deviation and mean patch size) (MCGARIGAL; MARKS, 1994) to quantify the total amount and the physical distribution of the most likely areas (hotspots) where to upscale synergies between CBT and sociobiodiversity in Brazilian biomes. We added to this analysis by tracing and quantifying the total area and number of variables present in the hotspots. Finally, we mapped the governance mechanisms available in NTFP extractivism landscapes. We mapped cooperatives and associations representing the involvement of the people who live, work and shape NTFP landscapes in planning and management (ZIELINSKI et al., 2020) (Appendix C). We also mapped institutes, foundations and NGOs that could be partners and sources of funding to support local associations and cooperatives (ROMERO-BRITO; BUCKLEY; BYRNE, 2016). Data were acquired from government reports and official websites. We calculated kernel density in ArcMap 10.8 based on a default radius to produce a smooth surface of the distance between each point (VIZZARI, 2011). We also mapped the official municipal tourism departments (JACKSON; MURPHY, 2002).

4.4 Results

4.4.1 Synergies between NTFP Extractivism and CBT in Brazilian Biomes

In 2019, 62% of Brazilian municipalities registered a low NTFP diversity index (one NTFP collected and traded). Meanwhile, 32% had diversity indexes ranging from 1 to 78, meaning that up to seven different NTFPs were collected and traded in the municipalities (Figure 10A). The main groups of NTFPs collected and traded per biome were araucaria seed and mate-herb in the Atlantic Forest, Brazil nut and açaí in the Amazon, carnaúba and babaçu in the Caatinga and palm heart and pequi in the Cerrado. Under this context, 54% of the CBT initiatives surveyed were located in NTFP extractivism landscapes in the Amazon, 24% in the Caatinga and 11% in the Cerrado and the Atlantic Forest. A total of 15 initiatives were located in municipalities with a high NTFP diversity index, of which 53% were in the Amazon, 27% in the Caatinga, 13% in the Atlantic Forest and 7% in the Cerrado (Figure 10B).

Figure 10 - Spatial explicit location of (A) NTFP diversity 2019 index and (B) CBT initiatives within NTFP extractivism landscapes in Brazilian biomes.



Source: elaborated by the author.

CBT initiatives were founded from 1974 until 2018, with 15% being created between 2005 and 2006. The surveyed CBT initiatives acted at local or regional scales. Target areas of the initiatives were rural settlements (28%), such as public lands; RESEX (19%; Tapajós-

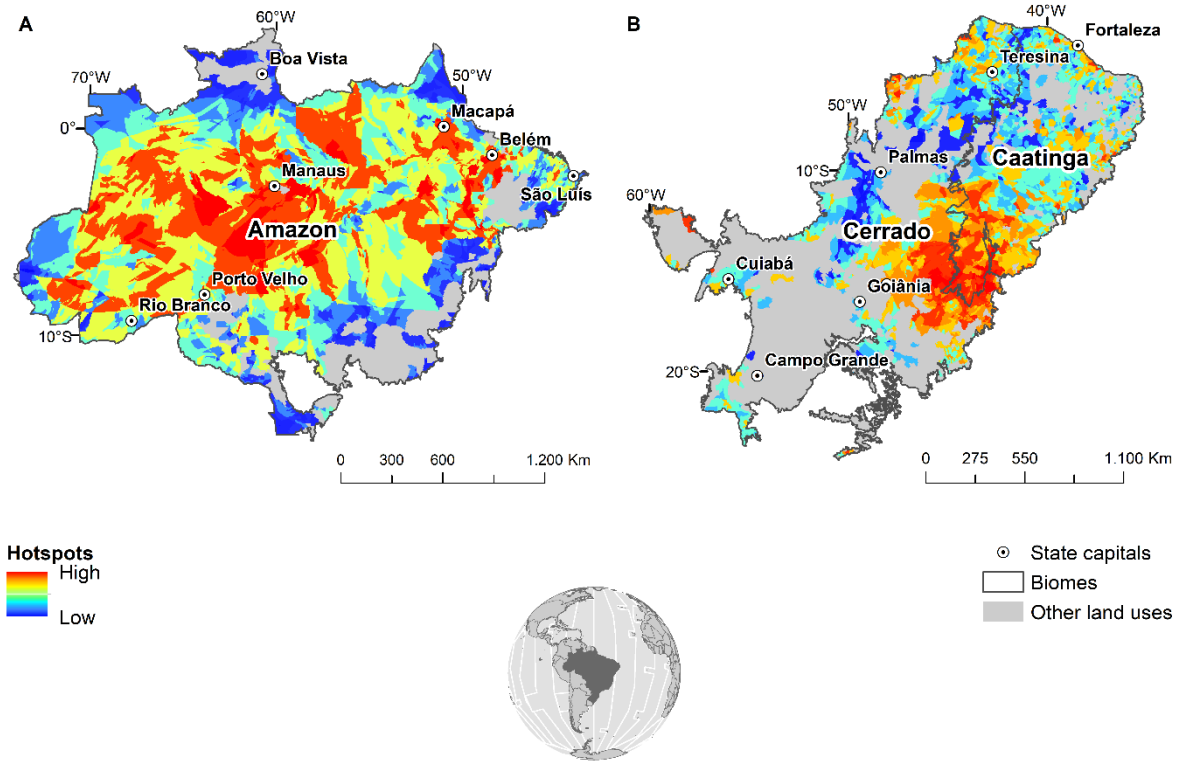
Arapiuns, Cazumbá Iracema, Unini river, Cuniã lake and Botoque); national forest (11%; Amapá National Forest, Tefé, Rio Tapajós Community), marine RESEX (9%; Caeté-Taperaçu and Soure), SDR (9%; Uatumã, Uacari Lodge and Rio Negro, Right Bank), all public lands in the Amazon. Other target areas were indigenous lands (4%; Yamaná in the Amazon biome and Xavante in the Cerrado), island (2%), rural settlement in the Amazon (2%) and environmental protection area (2%); all public lands. Quilombola communities represent 9% of the initiatives and are considered as private lands (e.g., Kalunga, Campinho da Independência and Cumbe), located in the Amazon, Cerrado and Caatinga. The mosaic Sertão Veredas Peruaçu (MSVP) initiative is a mosaic of 12 protected areas in the Cerrado. These initiatives likely merge investments from federal government transfers, donations and international funds. All initiatives promote community-led visitation. The structure of 32% of the initiatives is based on local community partnerships with associations and government, while 23% were based on local community partnerships with tour operators. The main actors and sectors involved were NTFP extractivists, the Ministry of Environment and the Chico Mendes Institute for Biodiversity Conservation (ICMBio) (19%), followed by initiatives based on NTFP extractivists, fisherman and family farmers alone (15%). The core attractions were to experience the life, culture and activities of local communities. Initiatives such as Uacari Lodge, in the Amazon, promote lodging, the sale of wood extracted from community management, fishing and agroforestry. Initiatives in the Caatinga promote fishing, the sale of handicrafts and local cultural festivals (Prainha do Canto Verde). In Boa Vista of Acará, in the Amazon, tourists can experience artisanal flour production, açaí extractivism and Brazil nut extractivism in the São Manoel and Juruena initiatives. The MSVP initiative in the Cerrado promotes the daily lives of communities and regional biodiversity. The dissemination channels for 40% of the CBT initiatives are management plans, government reports and the websites or sustainable tourism operators and local CBT association website (19%). Only 4% of the initiatives have an official website. The main goals and intended outcomes of the initiatives are natural resources management and conservation, safeguarding cultural heritage and identity and improving traditional livelihoods (87%). The other 13% of the initiatives also aim to promote landscape management through cooperation among stakeholders, enhance empowerment of local communities and build social capital.

4.4.2 *Where to Upscale Local Synergies*

The results of the multicriteria analysis show that most of the suitable areas for upscaling good CBT practices are in the Amazon (a mean area of 432,907 ha) (Figure 11A). Suitable

areas for developing CBT were also found in the Cerrado and Caatinga (mean area of 95.962 ha) (Figure 11B).

Figure 11 - Wall-to-wall maps of sociobiodiversity tourism hotspots within NTFP extractivism landscapes in (A) the Amazon and (B) in the Cerrado and Caatinga.



Source: elaborated by the author.

Hotspots in the Amazon have area of 432 thousand ha and a standard deviation of over 2 million ha of land, encompassing 266 RESEX and indigenous lands and 21 sustainable development reserves (SDR) (11 million ha), alongside 37,797 km of rivers that are home to riverside communities (Table 9).

Table 9 - Total area and number of variables within socio-biodiversity tourism hotspots.

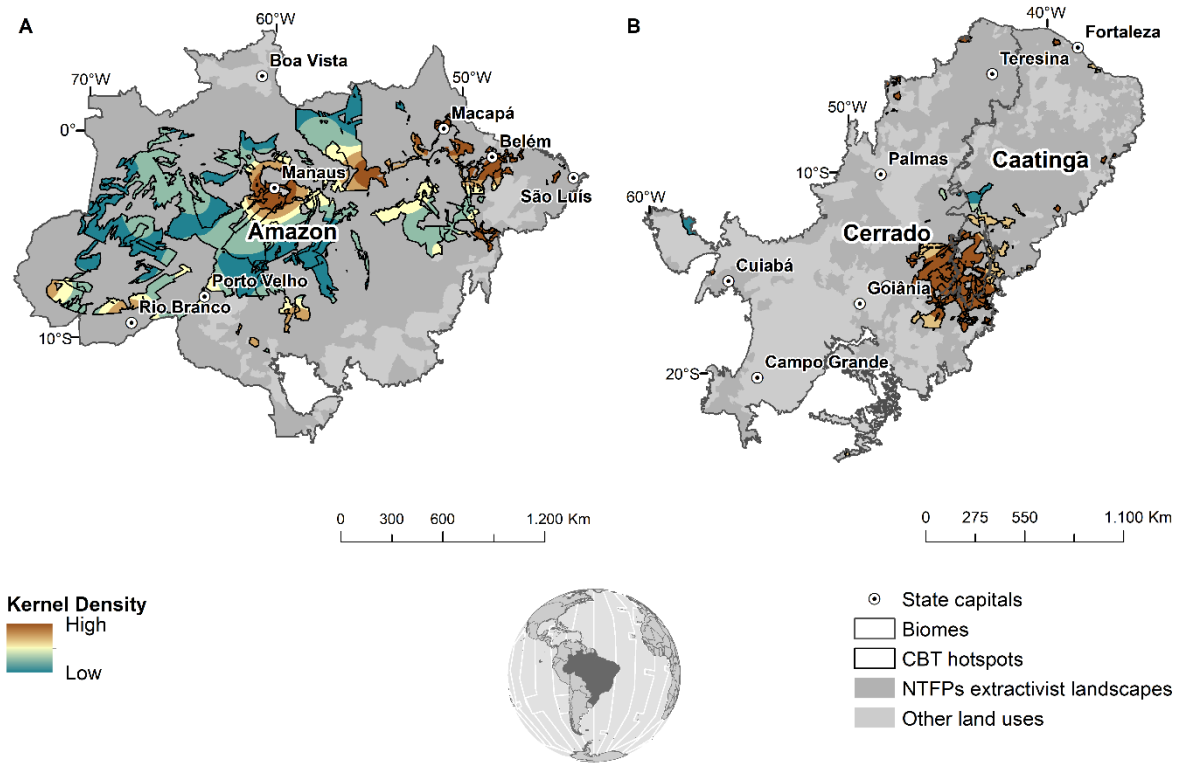
Biome	Variables	Area (ha)	Number
Amazon	International airport	-	5
	RESEX and indigenous lands	74 million	266
	Riverside people	37.797 km	-
	SDR	11 million	21
	People employed in tourism related activities	-	384.383
	Lodging	-	5.179
	Federal roads	5.071 km	-
Cerrado/	International airport	-	None

Caatinga	Riverside people	5.412 km	-
	Indigenous lands, RESEX, National Park, lands of other traditional people	6 million	-
	SDR	98.303	2
	People employed in tourism related activities	-	278.156
	Lodging	-	5.162
	Federal roads	3.920 km	-

Source: elaborated by the author.

In the area of the hotpots, there are five thousand lodging establishments and over 384 thousand people are employed in tourism-related activities. Furthermore, there are five international airports and five thousand km of federal roads. The hotspots in the Cerrado and Caatinga have a standard deviation of 417 thousand ha and encompass 5412 km of rivers, home to riverside communities, six million ha of indigenous lands, RESEX, a national park and lands of other traditional people (caatingueiros and veredeiros) and 98,303 hectares of SDR. The hotpots in the Cerrado and Caatinga also have five thousand lodging establishments and over 278 thousand people employed in tourism. There is no international airport in the hotspots of these two biomes, so access is mainly through federal roads (3920 km). CBT hotspots in the Amazon have 165 associations and cooperatives and 93 municipalities with official tourism departments, with sparse spatially explicit distribution in this biome being concentrated in state capitals (Figure 12A). Meanwhile, for the CBT hotspots in the Cerrado and Caatinga, the 125 associations/cooperatives, 32 institutes/foundations/NGOs and 109 municipalities with official tourism departments are geographically closer (Figure 12B).

Figure 12 - Spatial explicit overlap between (A) kernel density of landscape-scale governance mechanisms and sociobiodiversity tourism hotspots in the Amazon and (B) in the Cerrado and Caatinga.



Source: elaborated by the author.

4.5 Discussion

4.5.1 New Perspectives and Study Limitations

This study sought to identify where CBT enhances sociobiodiversity across Brazilian biomes. Brazil's emblematic sociobiodiversity has not yet been used as a development asset, being often associated with "empty land". Development strategies for rural areas in Brazil are focusing on mining, soy bean plantations and cattle raising (BENDINI et al., 2019). Furthermore, rural Brazil was severely hit by the COVID-19 pandemic. The combination of these scenarios can hinder the country's image for international tourism. For Brazil to reverse this situation, there is a need to go well beyond the prevailing neo-extractivist and mass tourism "business as usual" scenario and instill a new market of low-density and sustainable tourism in rural landscapes (RIBEIRO; SANTOS; TAKASAGO, 2022).

Using mapping and spatial modeling approaches along with qualitative analysis, this study demonstrates CBT as a potentially prosperous market for sociobiodiversity values. Our findings reveal municipalities with a high diversity of NTFPs collected and traded across Brazilian

biomes, which are overlapped by CBT initiatives whose main goals and predicted outcomes are to promote community-based visitation and management models that value biological and cultural diversity. These include trails and forest expeditions for recreation purposes and to learn about traditions and livelihoods and experience the daily lives of fisherman, riverside communities, indigenous people, quilombola communities, family farmers and NTFP extractivists. These characteristics reinforce the conclusions made by previous studies that CBT is a sustainable tourism model that can enhance rural livelihoods (BARTHOLO; SANSOLO; BURSZTYN, 2009).

Further, our spatial explicit modeling approach revealed that there are large areas in all three of the studied biomes (the Amazon, the Cerrado and the Caatinga) where the upscale synergies into sociobiodiversity tourism hotspots are likely to be successful. These findings complement those from studies that assessed the capacity of large areas in these biomes to offer scenic beauty and recreation opportunities to people, specifically near protected areas (CARVALHO RIBEIRO et al., 2018; RODRIGUES; BUSTAMANTE; SANO, 2018). In this sense, our modeling approach represents a step forward, because it encompasses biophysical and cultural, as well as infrastructure and tourism structure variables, which could support the upscale of the synergies between CBT and sociobiodiversity towards an effective market for NTFPs in innovative futures. Even though this is an exploratory analysis, the models are important in the sense that there is a need to better inform those responsible for elaborating and approving public policies about the potential role of CBT to enhance sociobiodiversity in certain areas within Brazil's major biomes. Studies in the lower Rio Negro of the Amazon reported that local actors were not aware of the potential of protected areas for tourism (SOUZA et al., 2010).

Furthermore, studies revealed the importance of accessibility and scale for the integration of tourism and family agriculture in the Amazon (HOEFLE, 2016). Our study adds to these findings by showing that there is a spatial overlap between sociobiodiversity tourism hotspots and key landscape-scale governance mechanisms, predominantly in Cerrado and Caatinga. This scenario could increase the appeal of upscale local CBT markets for NTFPs in these biomes. On the other hand, the governance mechanisms mapped in the Amazon are concentrated in state capitals, forming large gaps in the rural landscapes of the northern states of Brazil, reinforcing the findings of (FEARNSIDE, 2006). However, some caution needs to be taken regarding our work. The study did not evaluate the full broad range of tourism modalities known in the literature. Furthermore, it is reasonable to argue that any future analysis targeting

sustainable tourism hotspots would need to be context-specific to assess trade-offs between SDGs, tourism and other competing activities to ensure long-term sustainable development.

4.5.2 Implications of the Role of CBT in Enhancing Brazilian Sociobiodiversity for Sustainable Development and Multifunctional Landscapes in Rural Brazil

We argue that our findings connect with studies worldwide that rely on the value of sociobiodiversity and NTFPs to foster sustainable transitions toward sustainability in a post-COVID-19 pandemic (MEINHOLD; DUMENU; DARR, 2022; ZHANG et al., 2021; ZHU; LO, 2021). First, NTFPs have market value beyond the undifferentiated raw biodiversity products (WEISS et al., 2020). Second, our study evidence material and immaterial values of NTFP extractivism landscapes (e.g., food provision, shelter, leisure, heritage, sense of place), complementing the findings of studies that characterized these landscapes according to raw material provision, greenhouse gas mitigation and climate regulation (STRAND et al., 2018). Our findings unveil a rich potential of these characteristics to develop CBT initiatives, which, in turn, can nurture sociobiodiversity by tackling poverty (SDG 1), food (SDG 2), decent jobs (SDG 8) and secure terrestrial ecosystems (SDG 15) (MBAIWA, 2011a). Third, the synergies between CBT and sociobiodiversity can yield more material and immaterial benefits when accompanied by governance mechanisms that promote collaboration between local communities, organizations and institutions to market the cumulative attractions (DODDS; ALI; GALASKI, 2018).

There is a need for effective governance and management to support CBT markets for NTFP extractivism and sociobiodiversity across Brazilian biomes. Our study evidenced the existence of funding institutes, associations and partnership mechanisms in the hotspots of the Amazon and Cerrado/Caatinga. However, we argue that important, interrelated socioenvironmental policies are missing (DODDS; ALI; GALASKI, 2018; MBAIWA, 2011b). For example, studies reveal that there is much doubt as to whether traditional people and family farmers will be part of decision-making processes in sensitive areas (FEARNSIDE, 2006). A study of the federal road BR-319 in Brazil's "arc of deforestation" in the Amazon concludes that indigenous and Quilombola peoples will not be consulted in the process of reopening the road (FERRANTE; GOMES; FEARNSIDE, 2020). We suggest, and reinforce previous claims of researchers (VALENTE; DREDGE; LOHMANN, 2015), that both tourism and non-tourism policies enforce laws regarding regional development, food security (LIMA; JÚNIOR; LUNAS, 2015) and environmental protection, including those aimed at upgrading the quality

of existing protected areas, through strict supervision to reconcile multiple land uses (CRONKLETON; BRAY; MEDINA, 2011).

Nevertheless, these plans and policies need to consider and include traditional knowledge in decision-making (PRINGLE, 2017). In addition, communities can guide and conduct environmental education activities and locally advance seed production with support from institutional systems, as evidenced previously (BARTHOLO; SANSOLO; BURSZTYN, 2009). These actions can increase confidence among traditional communities, governments and institutions, as found for Uacari Lodge and MSVP (MORAES; MENDONÇA; PINHEIRO, 2017). These initiatives, and previous studies, also show that capacity building is essential for local communities to participate and self-organize (CRONKLETON; BRAY; MEDINA, 2011), which, in the case of the hotspots evidenced in our study, is mandatory. This is particularly crucial for the hotspots in the Amazon and Cerrado, where deforestation and devaluation of rural livelihoods are on the rise, accelerating climate change (SANO et al., 2010; STRAND et al., 2018). Therefore, this calls for the strengthening of collaborations across traditional livelihoods, other sectors and tour operators (DOLEZAL; NOVELLI, 2020). This can be done by creating consulting boards with institutes, foundations, governments, tour operators and local associations to plan and govern hotspots and encourage transitions towards sustainability.

4.6 Conclusion

Our overarching conclusion is that CBT can enhance the material and immaterial values of NTFPs and can span across hotspots with a mean area of 432 thousand ha, making it a valuable market for Brazil's NTFPs. These results strengthen the need for assessing frameworks to integrate sociobiodiversity and tourism to guide transformative change away from bleak scenarios and towards internationally competitive tourist destinations and developed rural regions. We conclude that, although there is the supply of biophysical and cultural elements, there key challenges of infrastructure and fragmented social capital for considering CBT and NTFPs extractivism as an alternative to intensive land uses for rural landscapes in Brazil.

5. CHAPTER 5: WHERE DOES ECOTOURISM ENHANCE SOCIOBIODIVERSITY? OPPORTUNITIES AND CONSTRAINTS FOR MULTIFUNCTIONAL LAND USE MANAGEMENT IN BRAZIL[6]

5.1 Abstract

Ecotourism has evolved as a strategy for conserving biodiversity and improving livelihoods in rural landscapes around the world. A critical gap, however, is assessing where ecotourism adds to the tangible and intangible values of sociobiodiversity, such as the collection of non-timber forest products (NTFPs), and reduces the emphasis on quantity produced. Land uses in rural landscapes in Brazil are transformed to meet the global demand for agricultural commodities, as the only development strategy for remote areas in Brazil's biomes. If associated, ecotourism and sociobiodiversity can contribute to the management of recreation and food production with standing native vegetation multifunctional land uses in rural landscapes in Brazil. Sociobiodiversity is when traditional communities and family farmers use their knowledge and practice in the use of biodiversity such as NTFPs, but NTFPs tends to be valued for the quantity produced (tons). Ecotourism, under specific conditions, can add value to native ecosystems and sociobiodiversity. In turn, sociobiodiversity can increase the quality of ecotourism, which has been partially inserted in tourism policies in Brazil. Therefore, this study adopts a multi-scale approach to assess where and how biodiversity use can be enhanced by ecotourism. Multi-criteria analysis and spatially explicit modeling were used to identify potential areas at national scale. We then evaluated a high-impact list of local ecotourism initiatives to validate interrelationships, explore constraints, as well as key conditions for ecotourism and sociobiodiversity to contribute to the management of multifunctional landscapes in Brazilian biomes. The results show large areas in rural landscapes that collected and traded NTFPs in the Amazon, Cerrado and Atlantic Forest, where ecotourism principles could enhance the material and immaterial values of sociobiodiversity. However, there is a mismatch between the potential areas and the existence of federal roads and international airports, as well as the social capital such as associations and cooperatives, foundations and institutes for funding and partnerships. These governance arrangements are uneven among the potential areas in the Amazon, Cerrado and Atlantic Forest. The analysis of initiatives shows

[6] Paper named as “ONDE O ECOTURISMO MELHORA A SOCIOBIODIVERSIDADE? OPORTUNIDADES E LIMITAÇÕES PARA A GESTÃO DE USOS MULTIFUNCIONAIS DA TERRA NO BRASIL”, was accepted for publication in the Brazilian Journal of Ecotourism (RBEcotur) in the August 15, 2023 issue (Volume 16, Number 3).

that few explicitly address the provision of material and immaterial values associated with the use of biodiversity, i.e., sociobiodiversity based on the collection and trade of NTFPs. In general, ecotourism initiatives reinforce values of the use of biodiversity by traditional communities through community-based management models and investments in social capital and partnerships. This study provides a step forward in understanding the synergies between ecotourism and sociobiodiversity in Brazil and recognizes the opportunities and limitations for such synergies to foster multifunctional land use management in Brazil.

5.2 Introduction

Ecotourism is a nature-based tourism modality that focuses primarily on learning about nature, typically, in natural and rural areas and ethically managed to contribute to the conservation of such areas and be low-impact to host communities (STRONZA; FITZGERALD; HUNT, 2019). Wildlife-based tourism has been a constant theme in the sustainable development discourse in the report "Our Common Future" (BRUNDTLAND, 1987). Since the late 1980s when ecotourism emerged, it has evolved as a strategy for fostering transitions towards sustainability in the context of rural areas (JAYA; IZUDIN; ADITYA, 2022), natural resource conservation and improve livelihoods in developing countries (SHOO; SONGORWA, 2013). However, ecotourism cannot offer a panacea for prompting territorial development. Thus, there is the need to explore where and why ecotourism can foster the use of biodiversity and rural livelihoods in countries such as Brazil.

In Brazil, land use change and loss of native vegetation has been associated to the growing global demand for agricultural commodities (ALENCAR et al., 2020). However, the simplification of landscape mosaics often by intensive monocultures (e.g., soy) has serious repercussions for the supply of ecosystem services, material and immaterial benefits that humans receive from ecosystems such as food, water, climate, recreation and sense of place (MA, 2005), which may diminish the country's response to climate change and socioeconomic crises. Despite this bleak scenario, traditional land uses persist through sociobiodiversity, as the conjunction of sociocultural and biological diversity when non-timber forest products (NTFPs), are collected and pre-processed using traditional skills and knowledge of rural communities (NODA; NODA, 2003).

Sociobiodiversity is associated with the provision of food, shelter, income and cultural traditions in protected areas of sustainable use such as extractive reserves (RESEX), which cover more than 12 million hectares, also indigenous lands, 28 traditional peoples and communities (PCTs) and family farming in the six Brazilian biomes (MMA, 2009). Although public policies such as the National Plan for the Promotion of Sociobiodiversity Chains seek to enhance these values (MMA, 2009), NTFPs tend to be valued mostly by its yields and for the quantity produced (tons). The collection and trade of NTFPs and sociobiodiversity, as historical forms of social organization and preservation of native ecosystems, are under pressure to be discontinued (MOREIRA et al., 2011).

Under specific conditions, ecotourism can trigger traditional communities to demonstrate their knowledge and skills in gathering and processing NTFPs (OLIVEIRA, 2011), and meet United Nations Sustainable Development Goals (SDGs) such as food (SDG 2), income (SDG 8) and biodiversity conservation (SDG 15) (MBAIWA, 2011a). In turn, sociobiodiversity can improve the quality of ecotourism (MARANHÃO; AZEVEDO, 2019). In 2019, coastal tourism represented 65% of the motivation for leisure travel to Brazil, against 32% for nature and culture (MTUR E FIPE, 2021). Coastal cities and capital cities lead the tourism economy based on the number of jobs and accommodations (MTUR, 2019). Meanwhile, tourism development policies for rural areas are lacking (SILVA; VILARINHO; DALE, 1998). Ecotourism was once considered as a sustainable development asset in the Amazon, but was discontinued due to lack of monitoring (FARIAS, 2014).

If associated, ecotourism and sociobiodiversity, can be alternatives for land uses beyond commodity and livestock production that are more prone to lead to environmental degradation and rural livelihoods (STRONZA; FITZGERALD; HUNT, 2019). Sustainable management of multiple land uses is a key strategy in production landscapes (PLIENINGER et al., 2020). Multifunctional land use can be achieved by pursuing different goals in different land use classes, such as forestry, biodiversity conservation, with food production on the same land or sequentially in time (CARVALHO-RIBEIRO; LOVETT; RIORDAN, 2010). Despite this, synergies between tourism and sociobiodiversity have been superficially treated as an asset for sustainable territorial development in Brazil (CARVALHO RIBEIRO et al., 2018).

The global literature on ecotourism dates back to the 1970s (STRONZA; FITZGERALD; HUNT, 2019). However, studies assessing the impacts of ecotourism for sociobiodiversity, and vice versa, are lacking. Some studies have evaluated a case of ecotourism associated with Faxinais, collective production systems, associated with sociobiodiversity in the Atlantic Forest (MOREIRA et al., 2011). Other studies evaluate tourism in RESEX and riverside communities in the Amazon (BARRETO; TAVARES, 2017; BASTOS; FILHO, 2020; CAMPOS; NASCIMENTO; MENDONÇA, 2017; COELHO, 2013; SOUZA et al., 2010). Still, few studies have explored positive associations between recreational ecosystem services and NTFP extractivism (CARVALHO RIBEIRO et al., 2018). One study defined landscape units based on relief, soil and vegetation for ecotourism planning (OLIVEIRA et al., 2007). To date, there

are no studies that spatially explicitly characterize and assess the synergies between ecotourism and sociobiodiversity in Brazilian biomes.

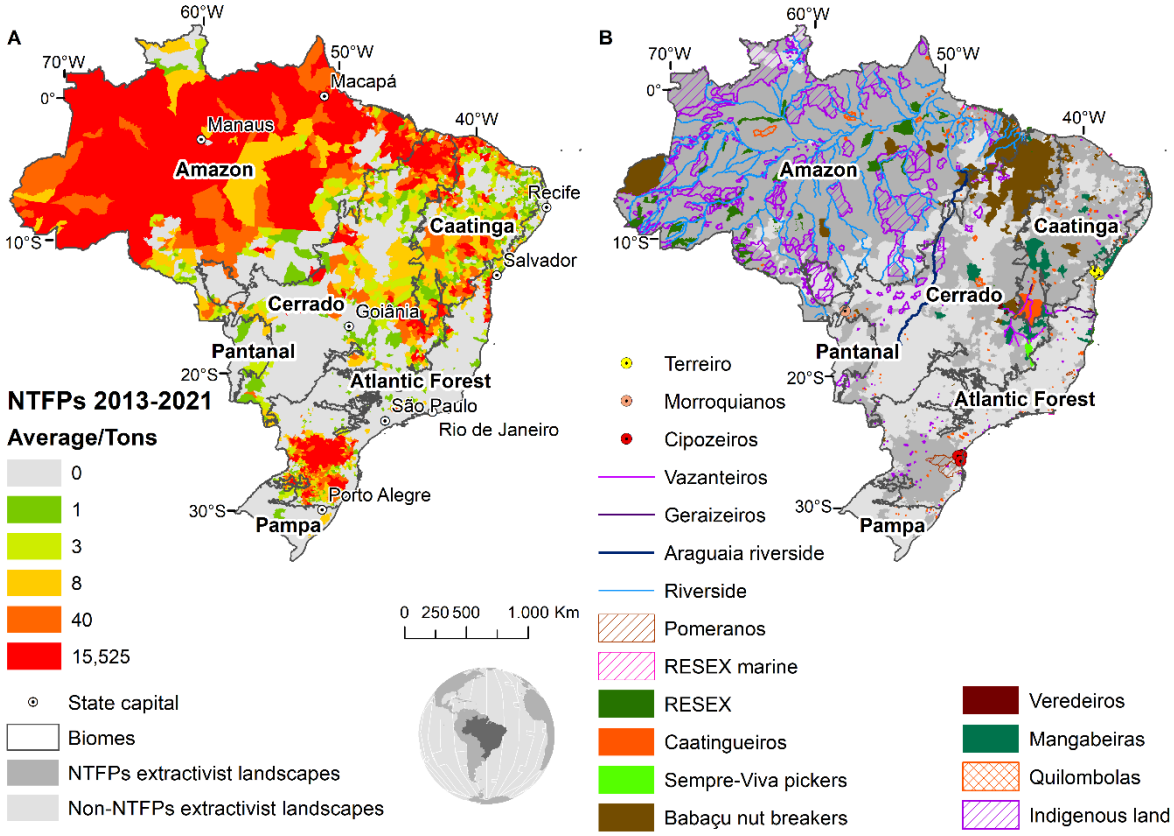
The goal of this study is to assess where and how the use of biodiversity can be enhanced by ecotourism and inform multifunctional management of land uses in Brazilian biomes. To do so, a multi-scale approach was used to guide multi-criteria analysis (KOSCHKE et al., 2012) and spatial modeling to identify the most likely areas where ecotourism can enhance sociobiodiversity at regional to national scales. Then, a conceptual framework was developed to evaluate a list of ecotourism initiatives, validate the linkages, and explore the limitations of whether synergies between ecotourism and sociobiodiversity contribute to multifunctional landscapes in Brazilian biomes. Our study aims to answer the following questions: 1) where is there spatial integration between ecotourism principles and biophysical and cultural aspects of sociobiodiversity in Brazilian biomes? 2) how do local ecotourism initiatives value sociobiodiversity?

5.3 Methods

5.3.1 Study area

The basis of sociobiodiversity is the junction of biodiversity, represented by plant species such as fruits, nuts, seeds and flowers, and cultural diversity in the economic use, subsistence and identity of these products by traditional peoples and communities and family farmers in Brazilian biomes (DINIZ; CERDAN, 2017). Therefore, the study area defined for this research consists of 45% of Brazilian municipalities (2,506 of 5,572) (mapping scale 1:250,000), representing an area of more than 5 million km², which between 2013 and 2021 collected and traded more than 7 million tons of NTFPs, according to the Brazilian Institute of Geography and Statistics (IBGE) (Figure 13A). Considering the annual variations in the quantity collected and commercialized (HOMMA, 2018), the main NTFPs in Brazil in the period from 2013 to 2021, in terms of quantity produced (ton) are açaí, rubber and Brazil nut collected and pre-processed by Brazil nut gatherers, riverside communities and indigenous peoples in the Amazon (CARVALHO RIBEIRO et al., 2018) (Figure 13B).

Figure 13 - Map of A) the quantity of NTFPs collected and commercialized in the Brazilian municipalities and B) the ways of life associated with sociobiodiversity in the Brazilian biomes.



Source: Elaborated by the author.

In indigenous lands in the Amazon, açaí and Brazil nut are used for subsistence and in traditional rituals (SARDINHA, 2017). In Extractive Reserves (RESEX), a protected area of sustainable use (SCHROTH; DA MOTA, 2013), extractivists practice sustainable management of açaí (CARDOZO; JUNIOR, 2012). While quilombola communities use pequi and babassu in the Cerrado for food security, handicrafts, and medicine (FRANCO; BARROS, 2004). Also in the Cerrado, babaçu oil is extracted by babaçu coconut breakers (NETO, 2017). Family farming also uses pequi in agroforestry systems (SAFs) (ARRUDA; SILVA; SANDER, 2014). Other livelihoods associated with NTFP extractivism in the Cerrado are the "sempre-viva" harvesters, people who collect dried flowers native to the Cerrado, geraizeiros as extractivists and family farmers, vazanteiros and veredeiros who use reforested lands on the banks of the São Francisco River and the Veredas ecosystem to practice subsistence agriculture (AFONSO; ANGELO; DE ALMEIDA, 2015). In the Caatinga, family farming uses carnauba (wax and powder) in income generation (SUCUPIRA et al., 2018). The collection and trade of NTFPs in Caatinga are also part of the subsistence of caatingueiros, a social group in the northern region of Minas Gerais, and extractivists in marine RESEX (DE SOUSA et al., 2015). As for the Atlantic Forest, quilombola communities use yerba mate in medicine and indigenous peoples

in daily rituals (CONTINI; CASTILHO; COSTA, 2012). Family farmers cultivate yerba mate and pinhão, seed of the Araucaria tree in the Faxinal system, a socialized land use (FICHINO, 2014).

5.3.2 Multi-criteria spatial analysis

To identify the most likely areas where ecotourism can enhance sociobiodiversity at regional to national scales, a literature review was conducted to identify characteristics of rural landscapes that collected and traded NTFPs. From this, biophysical and cultural, tourism infrastructure and governance were defined as key aspects of these landscapes and for ecotourism development. For example, national forests (FLONA), sustainable development reserves (RDS) and RESEX are conservation units that allow the sustainable use of biodiversity and public visitation for recreational and educational purposes (ICMBIO, 2020). Ecotourism, under governance mechanisms (e.g., cooperatives and associations (ZIELINSKI et al., 2020), institutes and foundations, NGOs (ROMERO-BRITO; BUCKLEY; BYRNE, 2016)), is likely to support livelihood diversification and protected areas (BUTCHER, 2011). In particular, federal roads and international airports, the number of establishments and people employed in accommodation, food, transportation, tour operators, connect places of attractiveness and support visitation (KÁDÁR; GEDE, 2021). Finally, institutes, foundations, NGOs could be partners and sources of funding for cooperatives and associations representing local communities (ROMERO-BRITO; BUCKLEY; BYRNE, 2016). After the variables were selected, its datasets were downloaded (Table 10).

Table 10 - Summary of categories, variables and database used in the study.

Aspects	Variables	Source of the data	Mapping scale
Biophysical and cultural	Reserves	Ministry of Environment; Chico Mendes Institute; Brazilian Forest Service; Amazon Protected Areas Program; Brazilian Agricultural Research Company; National Institute of Historical and Artistic Heritage; National Cave Research and Conservation Center; UNESCO World	Scale compatible with the municipalities file (1:250,000)
	Natural Monuments		Not informed
	Natural heritage		
	Caves		
	Livelihoods (indigenous lands, extractive reserves (RESEX))		Scale compatible with the municipalities file (1:250,000)
	Natural and Cultural World Heritage Sites (Brazil)		Not informed
	Number of family farms with PPA and legal reserve		Scale compatible with the

	Number of family farms with rivers protected by forests	Heritage List; IBGE Automatic Retrieval System; 2017 Census of Agriculture.	municipalities file (1:250,000)
Tourist structure	Accommodation establishments with up to 9 employees	Institute for Applied Economic Research (IPEA).	Scale compatible with the municipalities file (1:250,000)
	People employed in tourism-related activities		
Infrastructure	International airports	Ministry of Infrastructure; National Civil Aviation Agency.	Not informed
	Federal highways		
Governance	Institutes, NGOs, foundations, associations (social capital)	National Supply Company (CONAB); Instituto Socioambiental; Conexsus - Sustainable Connections Institute.	Not informed

Source: Elaborated by the author.

The database was transformed into maps in matrix (raster) format. For the bases mapped as point, lines and polygon, the calculation of Euclidean distance and groupings was done using ArcMap 10.8 software (VIZZARI, 2011). Then, the software DINAMICA EGO was used to build the multicriteria analysis model and identify the most likely areas where ecotourism can enhance sociobiodiversity at regional to national (S_i) scales. The multicriteria analysis model is expressed as:

$$S_i = \sum_{categories/variables} x_i w_i \quad (6)$$

First, we assigned degrees (x_i), ranging from 1 (not relevant) to 10 (very relevant) for each variable within a given category, indicating a higher explicit spatial intensity, e.g., reserves in a given region. Second, we derived the weights (w_i) for the most important categories (Table 11). The sum of the aggregate weights sums to 1.

Table 11 - Summary of degrees and weights used for the multicriteria analysis model.

Variable	Data processing	Values and scores	Category	Weight	Source
Reserves	Euclidean distance, divided into five classes	< 5346.28235 - 10 < 29404.55294 - 8	Biophysical	0.40	(ALAZAIZEH et al., 2016; ANDRIJEVIC et al., 2019;

	using quartile.	< 56135.96471 - 6 < 93559.94118 - 4 ≤ 340825.5 - 1			CHIODO et al., 2019; DHAMI et al., 2014; ICMBIO, 2018b; JACKSON; MURPHY, 2006; KIRKBY et al., 2010; STEELE-PROHASKA, 2018; ZANOTTI et al., 2008)
Natural Monuments	Values at county level, range divided into two classes.	= 0 - 1 = 1 - 10			
Natural heritage	Values at county level, range divided into three classes.	= 0 - 1 = 1 - 6 = 2 - 10			
Caves	Euclidean Distance from caves, range divided into five classes using quartile.	< 36779.8970 - 10 < 84593.76324 - 8 < 161831.5471 - 6 < 268493.2485 - 4 = < 937887.37 - 1			
Extractive Reserves (RESEX)	Euclidean Distance, range divided into five classes using quartile.	< 56552.4201 - 10 < 137341.5917 - 8 < 242367.5147 - 6 < 387788.0235 - 4 < 2060123.875 - 1	Cultural	0.30	(BOYD; BUTLER; IIAIDER, 1992; DHAMI et al., 2014; KIRKBY et al., 2010; LAWRENCE; WICKINS; PHILLIPS, 1997; PERALTA, 2012; STEELE-PROHASKA, 2018; STRONZA; FITZGERALD; HUNT, 2019; WEAVER; LAWTON, 2007; ZANOTTI et al., 2008)
Indigenous Lands	Euclidean Distance, divided into five classes using quartile.	< 4137.18235 - 10 < 35166.05 - 8 < 76537.87353 - 6 < 151007.1559 - 4 < 527490.75 - 1			
World Heritage Sites (Brazil)	Point density, divided into five classes	< 338046.025 - 10 < 510383.2142 - 8			

	using quartile.	< 702605.4637 - 6 < 894827.7132 - 4 =< 1683601.77 - 1			
Family farming w/ PPA and legal reserve	Values at county level, divided into three classes.	< 0 – 1 = 0 - 1 >0 - 10			
Family farming w/forest protected rivers	Values at county level, divided into three classes.	< 0 – 1 = 0 - 1 >0 - 10			
Lodging establishment up to 9 employers	County-level values, range divided into five classes using quartile.	= 0 - 1 < 8 - 4 < 18 - 6 < 50 - 8 = < 1101 - 10	Touristic Structure	0.10	
People employed in tourism-related activities	Values at the county level, range divided into five classes using quartile.	< 5 - 1 < 60 - 4 < 201 - 6 < 826 - 8 = < 342831 - 10			
Proximity to federal roads	Euclidean distance, divided into five classes using quartile.	<12395.0098 - 10 < 29438.14828 -8 < 54228.16789 - 6 < 100709.4547 - 4 < 395090.9375 - 1	Infrastructure	0.10	(BARTHOLO; SANSOLO; BURSZTYN, 2009; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; SMITH; RAM, 2017)
Proximity to international airports	The density, divided into five classes using quartile.	< 223541.403 - 10 < 351279.349 - 8 < 487000.9157 - 6 < 634697.9147 - 4			

		< 1017911.75 - 1		
Density of Institutes, NGOs, foundations, associations (social capital)	County-level values, range divided into five classes using quartile.	1 = 1 2 = 5 3 = 7 4 = 8 5 = 10	Governance	0.10

Source: Elaborated by the author.

The final maps were displayed using histogram equalization so that areas of lower local contrast can gain higher contrast, therefore highlighting "hot spots" (SANO et al., 2010). Calculations were also made on the total area (hectare) and the number of variables present in the hot spots.

5.3.3 Selection and analysis of ecotourism initiatives

An extensive search of peer-reviewed articles, government reports and websites, non-governmental organizations (NGOs), institutes, foundations, community associations, travel agencies and tour operator websites were conducted to identify and select ecotourism initiatives located within NTFP extractive landscapes (Appendix D). This primary research was conducted in Portuguese, and complemented by research in English and Spanish. In all, 22 ecotourism initiatives were selected (Table 12).

Table 12 - Summary of ecotourism initiatives in Brazilian biomes selected for the study.

Initiative	Biome	Year	Source
Plano de Apoio a Taquaruçu	Cerrado	2001	Turismo Tocantins
Monte Alegre: patrimônio natural e pinturas rupestres	Amazônia	2001	Vivejar; Estação Gabiraba
Belém/ Ilha do Combu	Amazônia	1997	Vivejar; Estação Gabiraba
Uacari lodge	Amazônia	1990	Mamirauá Sustainable Development Institute
Rio Amazonas em Macapá	Amazônia	2004	Estação Gabiraba
RESEX Cazumbá Iracema	Amazônia	2002	(MMA et al., 2007); (MORAES, 2010)
Projeto Serras Guerreiras de Tupuruquara	Amazônia	2017	Association of Indigenous and Riparian Communities.
Povoado de Mandacaru e Canto de Atins	Cerrado	-	Secretariat of State of Maranhão
Queimada dos Britos e Baixa Grande	Cerrado	-	State Secretariat of Maranhão

Aldeia dos Lagos lodge	Amazônia	-	(MONCAYO; RIBEIRO, 2005)
Santo Amaro community	Amazônia	-	Forest and Biodiversity Development Institute of the State of Pará
Vivência Baré	Amazônia	1990	UIKA
Associação Peixe-boi	Mata Atlântica	1997	Associação Peixe-boi
Pra manter a floresta em pé: Comunidade Tumbira	Amazônia	2008	Garupa, https://www.poranduba-amazonia.com/sobre-nos
Trilhas Griô, Chapada Diamantina	Caatinga	2013	Garupa
Lagoa do Cassange lodge	Mata Atlântica	1999	Garupa
Cristalino lodge	Amazônia	-	Garupa
YARIPO: Ecoturismo Yanomami	Amazônia	1979	ISA
Mosaico Sertão Veredas do Peruaçu	Cerrado	2009	https://mosaicosvp.com.br/o-mosaico/
Socorro	Mata Atlântica	-	(MTUR, 2020)
Rota Caminho de São Francisco da Esperança	Mata Atlântica	-	(MTUR, 2020)
Bonito	Cerrado	-	(JOSÉ et al., 2011)

Source: Elaborated by the author.

The conceptual framework used to evaluate the initiatives is based on socioeconomic and environmental dimensions (LOVERIDGE, 2016), such as promoting activities that are directly or indirectly associated with the development of social capital in and around protected areas, preserving values and beliefs linked to local places and products (QIAN et al., 2017). Also enhancing community income, livelihood diversification (SAVAGE; BARBIERI; JAKES, 2020), support for protected areas, endangered species, and payment for ecosystem services. These aspects were combined with principles of integrated landscape management, such as establishing a set of clear rules, roles and equitable responsibilities (SAYER et al., 2013). In all, 14 variables were created for the analysis (Table 13).

Table 13 - List of variables for the analysis of ecotourism initiatives.

Category	Variables	Code
Social	Benefit traditional communities, indigenous peoples, family farmers living in and around protected areas, heritage sites	V1
	Valuing and preserving knowledge systems linked to local places and products	V2
	Enable the creation of content for information and dissemination	V3
Economic	Allows community members to be employed and manage businesses	V4
	Encourages businesses created by local people	V5
	Promotes expansion of local market	V6

Ecological	Part of a specific conservation mechanism (protected areas)	V7
	Improve environmental monitoring and education for tourists	V8
	Reduce land degradation, promote recycling, water reuse, clean energy, reforestation	V9
	Protect IUCN Red List species	V10
Integrated landscape management	Establish a set of rules, roles and responsibilities	V11
	Encourage community cooperatives, micro-enterprises, and associations	V12
	Promoting community-based natural resource management	V13
	Partner with wildlife institutes and foundations, and other stakeholders	V14

Source: Elaborated by the author.

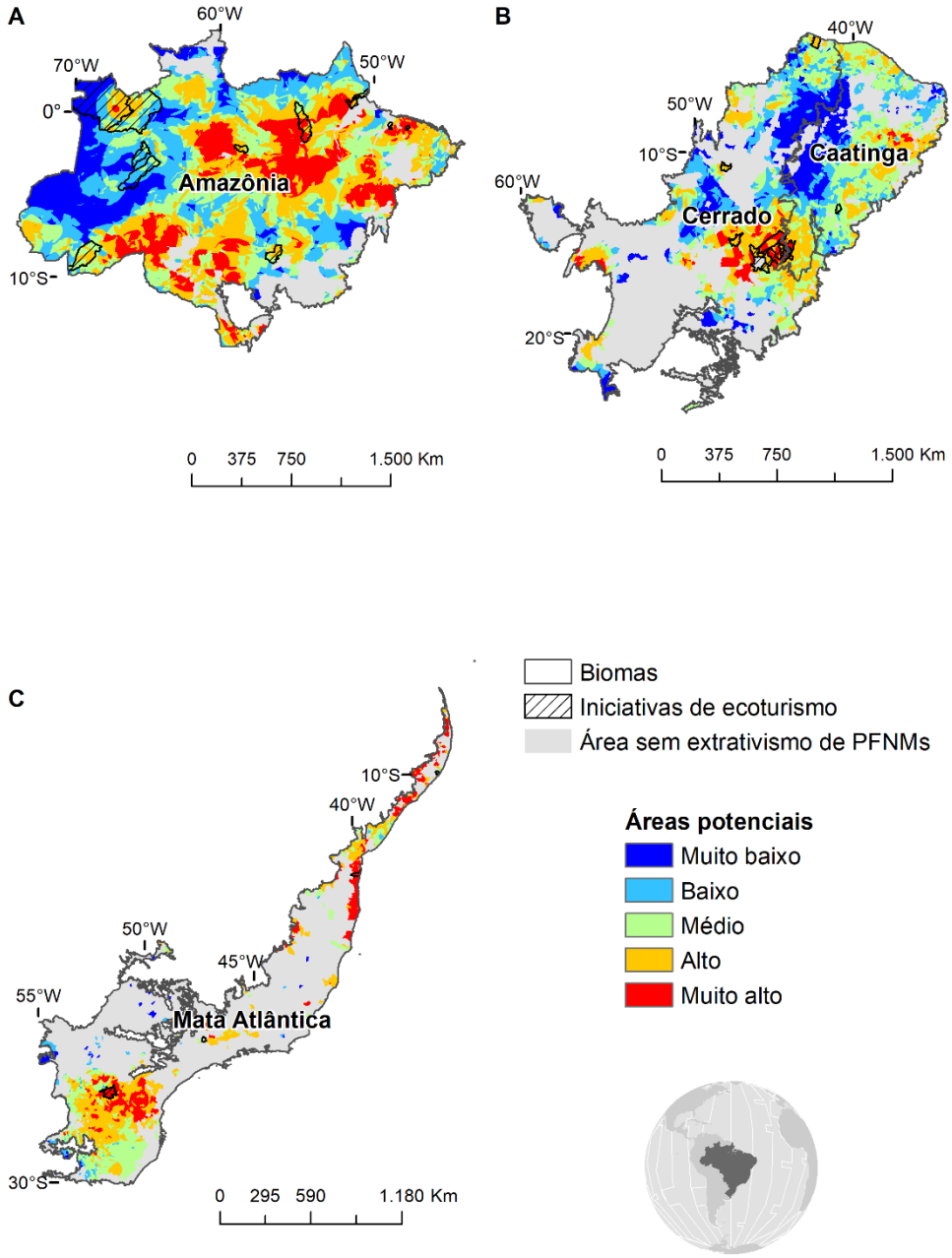
Detailed information about each of the initiatives was collected from peer-reviewed articles, government reports and websites, NGOs, and tour operators. The information was analysed using relative frequency analysis. Next, hierarchical weights were assigned to each group of variables, starting with social, economic, environmental, to integrated landscape management principles. Then, the weights were multiplied by the number of variables addressed by each initiative and the value added in order to identify common characteristics and particularities among the set of initiatives.

5.4 Results and discussion

5.4.1 Synergies between ecotourism and sociobiodiversity at large scales in Brazilian biomes

The most likely areas where ecotourism can enhance sociobiodiversity were found in the Amazon (average area of 1 million hectares), Cerrado/Caatinga (average of 457,490 hectares) and Atlantic Forest (average of 74,406 hectares) (Figure 14).

Figure 14 - Map of the most likely areas where ecotourism can enhance sociobiodiversity in A) Amazonia B) Cerrado/Caatinga and C) Atlantic Forest and selected ecotourism initiatives.



Source: Elaborated by the author.

The area of hotspots in the Amazon brings together biophysical and cultural aspects such as caves, national, state and national forest parks, indigenous lands and RESEX. As for the infrastructure that favors accessibility, four international airports are also located in these areas. Governance mechanisms related to social capital, partnerships and financing, there are twenty-three institutes, foundations and NGOs (Table 14).

Table 14 - Total area and number of variables in the priority areas for ecotourism and sociobiodiversity in the Brazilian biomes.

Biomes	Variables	Area (hectares) e length (km)	Quantity (nº)
Amazon	International Airport	-	4
	Caves	-	2,128
	Reserves	10 million	60
	RESEX	8 million	25
	Indigenous Lands	55 million	81
	People employed in tourism-related activities	-	379,587
	Lodging	-	5,746
	Federal roads	5 thousand	-
	Associations and cooperatives	-	111
	Foundations, NGOs, and institutes	-	23
Cerrado/ Caatinga	International Airport	-	2
	Caves	-	2,018
	Reserves	186 thousand	20
	RESEX	25 thousand	3
	Indigenous Lands	6 million	31
	People employed in tourism-related activities	-	949,451
	Lodging	-	11,188
	Federal roads	7 thousand km	-
	Associations and cooperatives	-	197
	Foundations, NGOs, and institutes	-	114
Atlantic Forest	International Airport	-	3
	Caves	-	-
	Reserves	929 thousand	223
	RESEX	310 thousand	3
	Indigenous Lands	461 thousand	54
	People employed in tourism-related activities	-	3 million
	Lodging	-	88,636
	Federal roads	3 thousand	-
	Foundations, NGOs, and institutes	-	12

Source: Elaborated by the author.

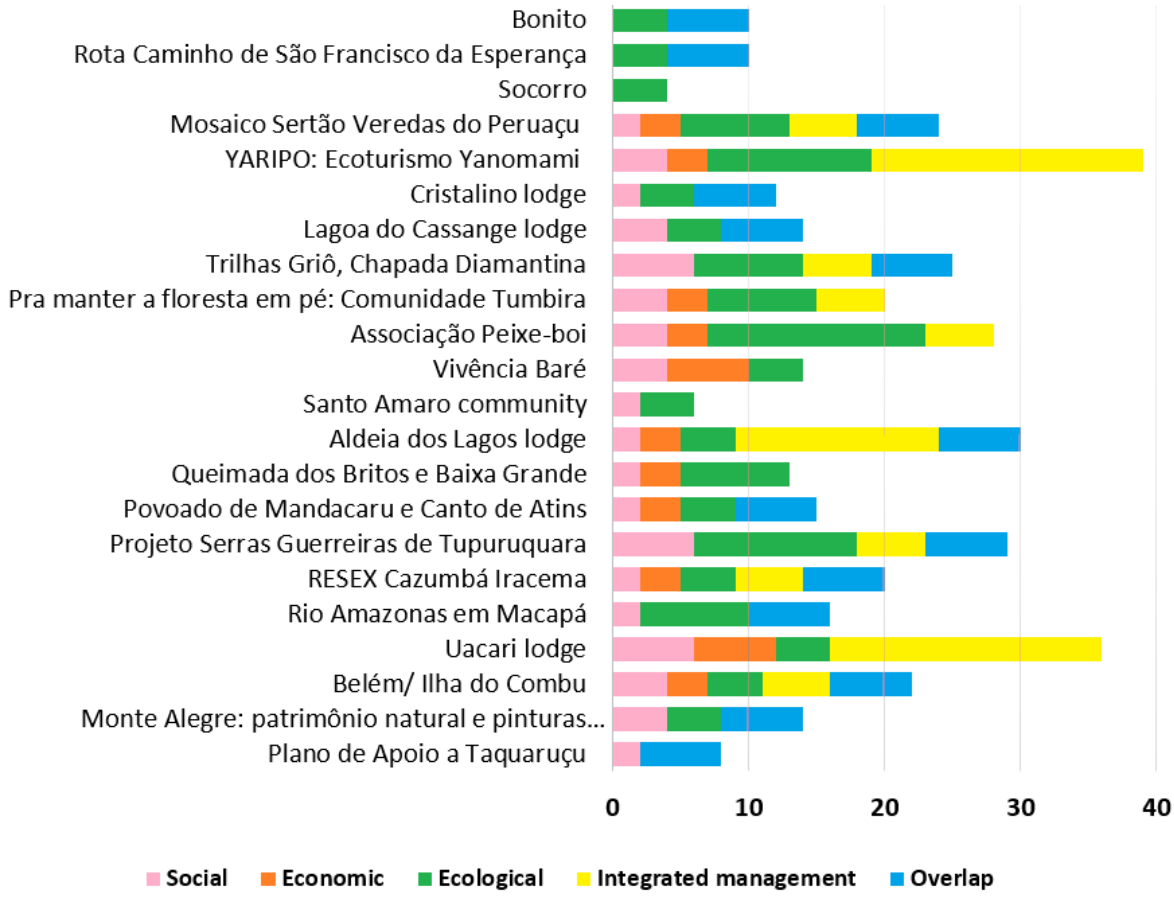
Hot spots in the Cerrado and Caatinga also gather caves, national, state and national forest parks, RESEX and indigenous lands. However, unlike the areas in the Amazon, in the Cerrado and Caatinga the priority areas gather a larger number of associations and cooperatives (197) and institutes, foundations and NGOs (114). Finally, the priority areas in the Atlantic Forest include indigenous lands and RESEX. In these areas there are also three international airports and 3,000 km of federal roads. With regard to governance mechanisms, the hot spots cover the location of only twelve institutes, foundations, and NGOs. The priority areas in the

Atlantic Forest have more lodgings and people employed in tourism-related activities, than in the Cerrado/Caatinga and the Amazon hotspots.

5.4.2 Ecotourism initiatives

More than half of the ecotourism initiatives analysed in this study were created between 1979 and 2017. Approximately half of the ecotourism initiatives are located in the Amazon, 30% in the Cerrado, 17% in the Atlantic Forest, and 3% in the Caatinga. Fifteen initiatives (60%) overlap "hot spots" in the Amazon, Cerrado/Caatinga, and Atlantic Forest (Figure 2). Overall, the initiatives address up to 71% of the 14 variables, with highlights including Aldeia dos Lagos Lodge in the Amazon, YARIPO: Yanomami Ecotourism, Uacari Lodge and the Peixe-Boi Association in the Atlantic Forest (Figure 15).

Figure 15 - Histogram of the sum of weighted variables and hotspot overlap for each of the 25 ecotourism initiatives.



Source: Elaborated by the author.

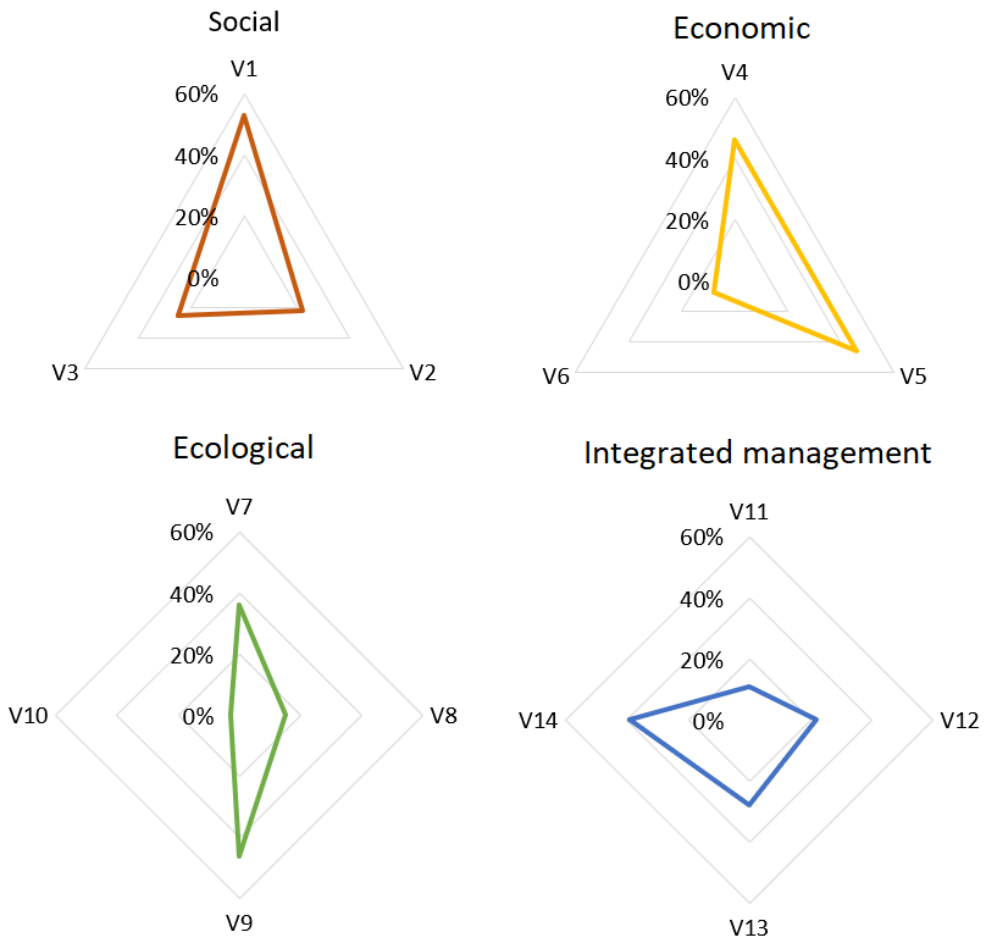
The results reveal that the main set of aspects of the ecotourism initiatives analysed in this study is to benefit traditional communities, indigenous people, family farmers living in and around protected areas, heritage sites (V1), allow these actors to be employed and manage the businesses (V4) or at the same time encourage businesses to be created by them (V5), also

reduce land degradation, promote recycling, water reuse, clean energy, reforestation (V9) and promote partnerships with wildlife conservation institutes and foundations (V14) (Figure 16). Therefore, these may be key aspects for ecotourism initiatives to contribute to improving sociobiodiversity, while increasing the quality of visitor experiences and tourism activity in Brazilian biomes (GUÉNEAU et al., 2017; PERALTA, 2012).

5.4.2.1 Social aspects

The most common social aspect addressed by 80% of ecotourism initiatives is to benefit traditional people and communities, indigenous peoples, riverine communities, and family farmers living in and around protected areas, cultural and heritage sites. Another 32% of the initiatives are dedicated to valuing and preserving the values and knowledge systems linked to local places and products. For example, the initiative Warrior Sierras of Tupuruquara, located in one of the priority areas identified in the previous section in the Amazon. This initiative takes place in a sacred indigenous territory and envisages a visitation guided by the indigenous people. The initiative YARIPO: Yanomami Ecotourism, aims to promote ecotourism in line with the mission to protect indigenous land and biodiversity, while promoting the well-being of the Yanomami communities. On the other hand, the Trilhas Griô initiative, located in priority areas in the Caatinga, has the mission of strengthening the identity and heritage of the region. Only the initiatives Pousada Cassange, Pousada Cristalino, Pousada Uacari, Trilhas Griô, Associação Peixe-Boi and Serras Guerreiras de Tupuruquara have an official website for the dissemination of information content. This aspect is essential to improve the quality of the protected areas, which depends on considering the traditional knowledge of the communities (PRINGLE, 2017).

Figure 16 - Breakdown of the frequency of social, economic, environmental and integrated management aspects addressed by ecotourism initiatives.



Source: Elaborated by the author.

5.4.2.2 Economic aspects

Thirty-two percent of the ecotourism initiatives encourage the creation of local businesses by the local population. The businesses created are community lodging, restaurants, tourist reception and crafts, as in the Mosaico Sertão Veredas do Peruaçu (MSVP), Vivência Baré, RESEX Cazumbá-Iracema and Associação Peixe-Boi. Another 24% of the initiatives employ local community members. For example, local communities provide services at the Pousada Uacari. In the Pousada Aldeia dos Lagos initiative, ecotourism generates income for the 36 members of the local association who work in the community hotel (and manage it collectively). In initiatives in the Cerrado, local communities offer food services such as home cooking on wood-burning stoves (Queimada dos Britos and Baixa Grande) and community lodging (Mandacaru and Canto de Atins community).

5.4.2.3 Ecological aspects

More than half of the ecotourism initiatives are part of specific conservation mechanisms. In the Amazon, the initiatives occur in RESEX (Cazumbá Iracema), RDS (Pousada Uacari and Tumbira community), national and state parks (YARIPO: Yanomami) and indigenous lands (Projeto Serras Guerreiras de Tupuruquara). Other initiatives are lodges (Cristalino and Aldeia dos Lagos) and rural settlements (Santo Amaro). In the Cerrado, the initiatives are located in rural settlements and the national park (Chapada dos Veadeiros). In the Caatinga, the only initiative is the Griô trails in the Chapada Diamantina national park. In the Atlantic Forest, the initiatives occur in an environmental protection area (Associação Peixe-Boi) and private properties. In total, 76% of the ecotourism initiatives analyzed take place on public lands. In addition, 56% of the initiatives develop activities aimed at reducing land degradation, use clean energy, and support reforestation. Examples are the tours conducted by rangers and indigenous people to learn about nature, territory and ways of life in the Amapá Amazonas River and the initiative Projeto Serras Guerreiras de Tupuruquara. Other activities are to promote hiking and trails, rafting, adventure sports in unique ecosystems (Trilhas Griô, Socorro, Caminho de São Francisco da Esperança Route, Bonito, Tumbira community, YARIPO: Yanomami Ecotourism, Santo Amaro community), also sustainable extractivism of PFNMs (MSVP), manatee observation in the Tatuamunha River (Associação Peixe-Boi) and visit to Lençóis Maranhenses (Mandacaru and Canto de Atins communities, Queimada dos Britos and Baixa Grande). In this sense, 20% of the initiatives promote community monitoring and environmental education of tourists. Only the Associação Peixe-Bo, in the Atlantic Forest, has the explicit goal of protecting the manatee, a species listed on the International Union for Conservation of Nature (IUCN) Red List. Although the initiatives promote the monitoring of natural attractions by the local community and the realization of environmental education activities (BUTCHER, 2011), there is a need for improved training and workshops to structure local communities so that they have the autonomy to seek financial resources and actively manage the use of investments (RODRIGUES; SOUZA, 2015).

5.4.2.4 Integrated landscape management

Regarding the principles of integrated management, 28% of ecotourism initiatives promote partnerships with the Institute for Forest Development and Biodiversity of the State of Pará (Ideflor-bio), such as the initiative Belém/Ilha do Combu. Partners of the initiative Manatee Association, Griô Trails, Uacari Lodge, YARIPO: Yanomami Ecotourism are the Chico Mendes Institute for Biodiversity Conservation (ICMBio) and the National Foundation of Indigenous Peoples (FUNAI). Other partnerships are with the Brazilian Service of Support

to Micro and Small Enterprises (Tumbira community). The Aldeia dos Lagos lodge has a partnership with WWF-Brazil. This principle of integrated management addressed by the initiatives is key to achieving integrated socio-environmental policies (DODDS; ALI; GALASKI, 2018). In addition, the initiatives have partnerships with tourism operators and agencies, which should practice fair prices with local communities (ICMBIO, 2019). Strengthening collaboration between traditional livelihoods and external actors, such as institutes, foundations, and tourism operators, as well as respecting local identity and knowledge linked to sociobiodiversity (TAO; WALL, 2009), can help address conflicts between conservation and sustainable development objectives in the Brazilian "arc of deforestation" in the Amazon and Cerrado (ALENCAR et al., 2020; FERRANTE; GOMES; FEARNSIDE, 2020) and foster multiple land use management (DOLEZAL; NOVELLI, 2020).

Added to this, 20% of the initiatives encourage community cooperatives, associations. The Uacari lodge promotes the strengthening of community organizations, associations, and cooperatives, encouraging the participation of the local population in territorial management and the management of natural resources. The Projeto Serras Guerreiras de Tupuruquara is supported and promoted by the Association of Indigenous and Riverine Communities. Two other local associations also participated in the YARIPO: Yanomami Ecotourism initiative. The Silves Association for Environmental and Cultural Preservation (Aspac) plays a key role in the management of the Aldeia dos Lagos lodge. Less than 16% of the initiatives explicitly state that they develop a community management model (RESEX Cazumbá Iracema), consultative council (MSVP), forest and fishery management plan with the communities (Uacari lodge). Since its inception the process of elaborating the YARIPO- Ecoturismo Yanomami Visitation Plan has relied on the active participation of the Yanomami people, and with this establish a set of clear and common-sense rules, roles and responsibilities (8%), such as the Uacari lodge and the YARIPO: Ecoturismo Yanomami, both outside the "hot spots" of sociobiodiversity.

5.5 Conclusion

This study aimed to assess where and how biodiversity use can be nurtured through ecotourism to inform multifunctional management of land uses in Brazilian biomes. The study was based on the assumption that there is a need to move beyond the current focus on agricultural commodity exports and mining for sustainable territorial development in Brazil. This research therefore adds to the state of the art by introducing new questions about where

and how there could be win-win situations between ecotourism and Brazil's emblematic sociobiodiversity, which are not yet been used as a mainstream development asset.

The exploratory analysis on synergies between ecotourism and sociobiodiversity in large areas and scales revealed that there are large areas (average 216 million hectares) in the Amazon, Cerrado and Caatinga and Atlantic Forest that bring together biophysical, cultural, infrastructure, tourism structure and governance aspects that could support synergies at the regional to national scale. In this sense, the multicriteria analysis and explicit spatial modelling used in the study can be applied to different contexts and scales. The explicit spatial modelling developed in this study allowed at exploring and allocating elements of the NTFP extractivism landscape in order to identify priority areas where synergies between ecotourism and sociobiodiversity can be fostered at large scales.

The multi-scale approach adopted in this study allowed us to analyse ecotourism initiatives operating today and assess whether or not they overlap with priority areas in the Amazon, Cerrado, and Caatinga and Atlantic Forest. The conceptual framework adopted for such an analysis also allowed to deepen the knowledge about the synergies between tourism and sociobiodiversity at the local scale. It was observed that the social, economic, environmental aspects and integrated management principles addressed by the initiatives are highly variable. Initiatives outside the priority areas added higher values in relation to integrated management principles. In contrast, the sum of the integrated management weights in initiatives within the Amazon and Cerrado/Caatinga priority areas was low. However, while there are good initiatives outside the "hot spots," they are isolated. In addition, few initiatives explicitly address NTFP extractivism in social, economic and environmental aspects.

It is concluded that ecotourism can enhance sociobiodiversity by valuing different material and immaterial values of rural livelihoods in biodiversity use and biodiversity conservation within and outside priority areas. This finding reinforces the importance of exploring methods to assess the synergies between ecotourism and sociobiodiversity in order to offer new pathways to guide transformative change towards multiple land uses and integrated networks. Unfortunately, challenges across rural enclaves must be addressed, such as a lack of accessibility that hinders information exchange, investment, and social capital building, and a lack of explicit integration of NTFP extractivism. Therefore, while efforts to close development gaps in rural Brazil would be much more effective if tourism and sociobiodiversity were considered together as assets, the management of synergies between ecotourism and

sociobiodiversity needs to be improved so that they can foster multiple land uses from native vegetation in rural Brazil. Actions can start with ecotourism initiatives and priority areas as mapped in this study.

6. CHAPTER 6: THE ROLE OF TOURISM AND SOCIOBIODIVERSITY FOR TERRITORIAL DEVELOPMENT: KEY-CONDITIONS FROM CASE STUDIES IN GERMANY AND BRAZIL[7]

6.1 Abstract

Extensive commodity production is shaping rural landscapes in Brazil. While this has been promoted as a mainstream territorial development strategy, instilling multifunctional land uses from land cover native vegetation could be a way out of “lock-ins” from intensive production of commodities (soy, mining) created in rural areas. Synergies between tourism and sociobiodiversity, encompassing the way that material and immaterial values in the use of biodiversity such as non-timber forest products (NTFPs) by traditional communities and family farmers can, under certain circumstances, be an alternative to intensive land uses. But managing land uses in such a way that meet production, biodiversity use, conservation and recreation goals need innovative governance systems. This paper aims to identify key conditions for fostering governance systems to promote synergies between tourism and sociobiodiversity and multifunctional land use management through case studies in distinct socio-ecological contexts. The cases include 1) a nature park in Germany; 2) a mosaic of protected areas in Cerrado, Brazil; 3) a state park in the Atlantic Forest in Brazil. We conducted semi-structured questionnaires with key-actors to explore a particular set of rules for the use of biodiversity and tourism, financial inducements, a particular configuration of actors and marketing tools in order to identify a set of key conditions to promote synergies and foster multifunctional land use management. Our results indicate ten key conditions to promote synergies between community-based tourism (CBT), ecotourism and agritourism alongside the collection and trade of NTFPs, family farming, agroforestry and in protected areas. The ten key conditions are: 1) defining objectives and responsibilities of the protected areas as an actor within the region, 2) promoting tourism modalities that "match" the region's development objectives with 3) complementary activities and zoning, 4) building partnerships and networks, 5) financing for infrastructure and supporting local cooperatives, 6) staff, 7) encourage people to participate in the actions and 8) believing in the region's potential, valuing livelihoods, 9) developing a regional brand and 10) regional promotion. This study illustrates that although there’s a willingness of actors to forge governance systems in case studies in Brazil, aligned with good practice in Germany case study, it is uncertain who will be able to put these key conditions in practice.

[7] Article in preparation to be submitted to the journal for peer review.

6.2 Introduction

Brazil's rural landscapes have been massively used for the expansion of agricultural commodity production in the last decades (ALENCAR et al., 2020). Although the expansion of large-scale agricultural frontiers are promoted as a mainstream development strategy for rural areas, this adds pressure on soil and native ecosystems and is creating less institutional and financial support to nonagricultural employment opportunities and traditional livelihoods (HILHORST; ZEVENBERGEN; DEININGER, 2021).

The Cerrado is a biodiversity hotspot and a target biome for agricultural expansion and livestock in Brazil (ALENCAR et al., 2020). Biodiversity and scenic beauty hotspots (RODRIGUES; BUSTAMANTE; SANO, 2018), that still remain in this biome are fragmented and often threatened by the development of new agricultural frontiers, such as Matopiba (SOUZA et al., 2020). The Atlantic Forest biome is also a global biodiversity hotspot and has been the most deforested Brazilian biome since the 16th century (BICUDO et al., 2020). Since then, logging and mining have been putting the biodiversity and livelihoods of family farmers and indigenous people in this biome at risk (DIAS et al., 2018).

Multifunctional landscapes, where different objectives such as agriculture, agroforestry, leisure and biodiversity conservation are achieved simultaneously in the same spatial unit or subsequently in time (CARVALHO-RIBEIRO; LOVETT; RIORDAN, 2010), could be a way out of lock-ins towards land use transitions in rural areas in Brazilian biomes impacted by intensive agriculture and deforestation. Multifunctional land uses is based on landscape structure and synergies between functions and services to instill production, conservation and consumption values in rural landscapes (HOLMES, 2006).

To a large extent, tourism can trigger the United Nation's Sustainable Development Goals of end poverty (SDG 1), economic boost (SDG 8), and biodiversity conservation (SDG 15) (MILETI et al., 2022) in Brazilian biomes. Under specific conditions, CBT, a visitation and management model, ecotourism, based on learning about nature, and agritourism that value family farming and local products (BARTHOLO; SANSOLO; BURSZTYN, 2009; BEZERRA; FERKO, 2018; OLIVEIRA, 2011), support local communities and ecosystems in Brazilian biomes. In parallel, sociobiodiversity, the conjunction of cultural and biological diversity when livelihoods use their skills and knowledge for collecting and pre-process NTFPs,

it is directly associated with multifunctional land use systems in rural Brazil (ARAÚJO; GUIMARÃES; LOPES, 2017).

Research at local scale suggests that ecotourism and NTFPs extractivism stimulate agroforestry systems and increased income of traditional communities and family farming in protected areas and farms, while supporting biodiversity conservation (ARAÚJO; GUIMARÃES; LOPES, 2017; COSTA-ALVES; GUIMARÃES, 2009; GALVÃO; CASTRO; MARQUES, 2018; GONÇALVES et al., 2021; KLEIN; SOUZA, 2013; SILVA; FOLMER, 2020). Despite the promising role of NTFPs and tourism for fostering territorial development, in practice, NTFPs are often valued by the quantity produced and the tourism economy is based on sun, beach and urban tourism (65%) (HOMMA, 2014; MTUR E FIPE, 2021). Thus, there is the need to explore what are the key factors for associating synergically, tourism and sociobiodiversity instilling multifunctional land mosaics based on native vegetation in rural Brazil.

However, manage multifunctional land uses for food production, use of biodiversity and conservation and enhancement of the recreational value needs to be sensitive to many actors often with conflicting objectives and values at landscape scale (or regional scale) (SAYER et al., 2013). Socioecological contexts, also called as human–environment systems, involve resource systems (e.g., forests), resource units (e.g., economic value), actors and rules, and usually present complex governance challenges (OSTROM, 2007). Apart from these mechanisms through which socioecological systems work, the success of governance of complex socioecological contexts are attributable to an overall set of conditions and learning process (WILLIAMS; SHAW, 2009). Therefore, mechanisms and key conditions could affect the incentives and actions of actors to promote synergies between tourism and the use of biodiversity and foster multifunctional land use management in a specific technological, socioeconomic, and political environment. But, it remains to be seen what are the key conditions to enhance governance systems for fostering tourism and sociobiodiversity synergies prompting sustainable land use management in different socioecological contexts.

Governance of tourism and sociobiodiversity, as well as other land uses in Brazil, are often studied separately. The international literature, shows that governance of tourism impacts in the context of land use change, highlighting the important role of collaborative approaches (ALMEIDA; COSTA; NUNES DA SILVA, 2018; WONDIRAD; EWNETU, 2019). Studies

of tourism governance in Brazil report lack social capital (FARHAD; GUAL; RUIZ-BALLESTEROS, 2015; VALENTE; DREDGE; LOHMANN, 2015). Similarly, the governance of sociobiodiversity evidence lack of efficient institutions and rules, access to markets and actor's collaboration (HOMMA, 2018; LIMA; JÚNIOR; LUNAS, 2015). To date, few studies evaluated case studies as complex socioecological contexts and suggest governance systems for synergies between tourism and sociobiodiversity to foster multifunctional land use management in Brazil (BRANCA et al., 2013; CARVALHO RIBEIRO et al., 2018).

This study aims to identify key conditions for fostering governance systems to promote synergies between tourism and the use of biodiversity and multifunctional land use management. To do so, we selected different case studies in Germany and in Brazil representing specific socioecological contexts to explore a particular set of rules for the use of biodiversity and tourism, financial incentives, a particular configuration of actors and marketing tools, also called in this study as mechanisms. It is expected that these mechanisms, put together can result in patterns of interactions and outcomes, such as synergies and governance systems to manage multifunctional land uses. The data was collected through a semi-structured questionnaire with key-actors (e.g., national park managers, institutes and foundation officers) and field trips in the study areas. Specific questions examined are as follows: 1) How case studies instill services and activities and contribute to territorial development? 2) What is the role of tourism to support the use of sociobiodiversity in each case? 3) What mechanisms have been or could be put together and arranged to promote synergies between tourism and the use of sociobiodiversity? 4) What key conditions for fostering governance systems can be identified from each socioecological context?

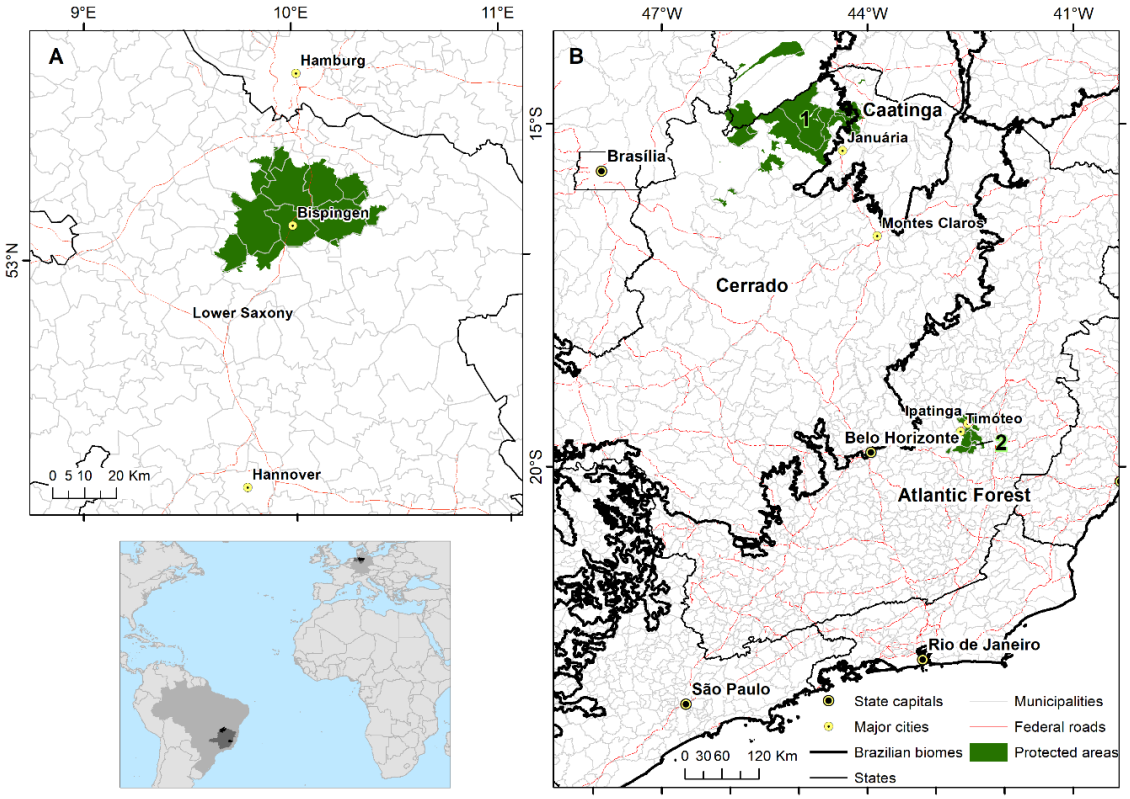
6.3 Methods

6.3.1 Case studies

The selection of case studies representing specific socioecological contexts was based on where particular types of forests, heaths and other ecosystems; particular species; or even individual plants or animals are strongly associated with cultural identity, practices, knowledge and sense of place of traditional livelihoods (DANIEL et al., 2012). Part of this research was conducted during a five-month doctoral exchange in Germany, therefore, the first study case selected is the Luneburg Heath (German: Lüneburger Heide) in Lower Saxony. Nature Parks are government recognized or government-designated protected areas that have the objective

of protecting nature and landscapes characterized by long-term human use (cultural landscapes) and promote sustainable territorial development (BÜHLER-NATOUR; HERZOG, 1999). In Brazil, few socioecological contexts are well documented at landscape scale. The second case study is the Mosaic Sertão Veredas Peruaçu (MSVP), a well-documented mosaic of conservation units involving state, federal and private conservation units, quilombola communities, Xakriabás indigenous lands, NTFPs extractivist populations and family farming, representing the most endangered and endemic species of Cerrado fauna and flora, in addition to the cultural diversity of traditional peoples and communities (WWF, 2009). The third case study represent a complex socioecological context of the Rio Doce State Park and its surroundings (PERD), as the first conservation unit of the Atlantic Forest biome created in the state of Minas Gerais and one of the first in the country with family agriculture, forestry and mining in the surrounding area (OLIVEIRA; CARVALHO-RIBEIRO; MAIA-BARBOSA, 2020). Since the collapse of an iron ore dam in 2015, that drastically affected the Rio Doce (VASCONCELLOS et al., 2021), the region has turned into a beneficiary of compensation aid for the environmental damage and to support tourism development (Figure 17).

Figure 17- Case studies A) Lüneburg Heath in Germany and B) MSVP (1) and PERD (2) in Brazil.



Source: Elaborated by the author.

6.3.1.1 Luneburg Heath, Germany

The Luneburg Heath is a nature park designated under the Federal Nature Conservation Act (§ 27), within the Lüneburg Heath Natural Park Region encompassing 100,000 inhabitants (Table 15). Nature Parks in Germany are assigned a category V in the International Union for Conservation of Nature (IUCN) system as protected landscapes where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic. Lüneburg Heath nature conservation park was created in 1910 and in 1921, the area was declared a nature reserve. In 1956, Lüneburg Heath Nature Park is the first nature park in Germany created to protect the heathlands, a historic agricultural landscape based on sheep farming mixed with arable farming. The largest nature conservation area is "Lüneburg Heath" Nature Reserve with approximately 23,440 hectares. Tourism of the nature park and is a recreation hotspot for the Hamburg metropolitan area, whose epicenter is the city of Bispingen[8]. Heathlands are the tourist's main attraction.

Table 15 - Case studies' main characteristics.

Name	Creation	Policy	Scale	Socioeconomic, cultural activities
Luneburg Heath	1956	Federal Nature Conservation Act (§ 27)	1070 km^2	heathlands, a historic agricultural landscape based on sheep farming, arable farming, recreation
MSVP	2009	SNUC	1,783,799 hectares	collect and trade of NTFPs, family farming, nature conservation
PERD	1944	SNUC		forestry and mining, family farming

Source: Elaborated by the author.

6.3.1.2 MSVP Cerrado, Brazil

The Mosaic Sertão Veredas Peruaçu (MSVP) is a mosaic of protected areas encompasses 12 municipalities in the north and northwest regions of Minas Gerais and part of southwestern Bahia state[9]. The MSVP is currently under a territorial planning to promote the development of the region on a sustainable basis and integrated with the management of protected areas, sustainable collection and trade of NTFPs and ecocultural tourism (FUNATURA, 2008). Therefore, an Advisory Council for the integrated management of MSVP was created and is composed of representatives from the conservation units, the government, and local leaders (FUNATURA, 2008). The municipalities within MSVP are part of tourism circuits as a regional tourism organization (RTOs) (VALENTE; DREDGE; LOHMANN, 2015). Tourism economy in MSVP has average amount of 7 people employed in lodging establishments in 2017. Also in 2017, the average number of estimated international visitors

[8]Official website of the Lüneburg Heath Nature Park at <https://www.lueneburger-heide.de/en>.
[9] Official website of the MSVP at <https://mosaicosvp.com.br/>.

was 147, and no revenue of federal taxes from lodging establishments was recorded by the Ministry of Tourism (MTUR, 2013). Even tough, these numbers may not represent the totality of lodging, once lodging in family homes in the community, or "bed and breakfast" is a common practice in the region and has no official records.

6.3.1.3 PERD Atlantic Forest, Brazil

The third case study is the Rio Doce State Park (PERD) the first conservation unit created in the state of Minas Gerais and one of the first in the country, besides being considered the largest continuous area of preserved Atlantic Forest in the state and 10 surrounding municipalities. The state park is governed by means of a Consulting Council of the Rio Doce State Park, through an edict issued by the State Forest Institute, representatives from public agencies/entities and representatives from the organized civil society, aiming at pointing out paths for growth and valorization of the Rio Doce State Park and surroundings in the medium and long term (IEF, 2020). Aside from the above-mentioned activities, agriculture and livestock are minor source of employment and income in the region. Official data from the Brazilian Institute of Geography and Statistics (*IBGE* acronym in Portuguese), report the collection of NTFPs such as pequi until 2013. PERD and surroundings is part of tourism circuit as a regional tourism organization (RTOs) (VALENTE; DREDGE; LOHMANN, 2015). Tourism economy in PERD, has average amount of 48 people employed in lodging establishments in 2017. Also in 2017, the average number of estimated international visitors was 1,000, and the revenue of federal taxes from lodging establishments was R$ 277,000, according to the Ministry of Tourism (MTUR, 2013).

6.3.3 Semi-structured questionnaire and data analysis

To identify key conditions for fostering governance systems to promote synergies between tourism and the use of biodiversity and multifunctional land use management, we used a semi-structured questionnaire consisting of closed questions in combination with open questions (ALMEIDA; COSTA; NUNES DA SILVA, 2018) (Table 16). We tested the semi-structured questionnaire during face-to-face, online and phone interviews in English with actors from the Luneburg Heath Nature Park and field trips in February 2022. Later, we added in-depth closed questions to the open questions in a semi-structured questionnaire for face-to-face, online and phone interviews conducted in Portuguese with actors from MSVP and PERD case

studies bearing in mind that do not yet implement multifunctional management and during field trips to the municipality of Marliéria for the PERD and the municipality of Januária for the MSVP, during the months of September and October 2022. The interviews duration was on average 30 min. In the first phase of open questions, the interviewees were asked to describe the role of the Luneburg Heath Nature Park, MSVP and PERD in territorial development goals by instilling activities and services. This allowed us to study the structure, goals and challenges of each specific socioecological context. We adopted a content analysis to extract valid inferences from verbal responses to open questions (KRIPPENDORFF, 1989). The transcriptions in Portuguese were coded by considering the literal words and phrases in the answers of the interviewees and assigning them to a category of meaning. We repeated this process to revise the code description and add new ones. Once it has all been coded, we grouped the codes and sub-codes in a hierarchical frame (PERRONI; EDUARDO, 2015). We performed qualitative analysis to identify common themes and map the links between them (MASCARENHAS et al., 2015).

Table 16 - List of questions from the semi-structured questionnaire.

	Key questions of each phase	
Phases	Luneburg Heath Nature Park	MSVP and PERD
Phase 1	What is the role of nature parks in Germany and what is the role of Luneburg Heath nature park?	Whether and how can the PERD/MSVP help stimulate activities and services for the development of the region?
Phase 2	Do you think that tourism in nature parks is important to help accomplish development goals set for rural landscapes? If yes, why and what are the challenges? How important is tourism in relation to land uses in the region?	Do you think it is important what kind of tourism (show photos) together or separately from the agroextractivist production, rural way of life for the development of the region? Why and what are the challenges? And where? (hand out the image, select the quadrants).
Phase 3	What mechanisms are used in management and governance of the nature park? How they are applied? What are the key factors (other actors, financing, partnerships) that can be associated with failures or success?	To implement tourism and sociobiodiversity, which legislation, partnership, funding, social capital and marketing tools you consider most effective? What will determine the success of the implementation? (ranking)

Source: Elaborated by the author.

In the second phase, the interviewees from case studies in Brazil were asked to associate tourism modalities (e.g., community-based tourism – CBT, ecotourism and agritourism) with the use of biodiversity relevant to their case (e.g., collection and trade of NTFPs, family farming, agroforestry, biodiversity conservation). CBT, ecotourism and agritourism take place

in rural landscapes being directly associated with safeguard of traditional livelihoods, biodiversity conservation, family farming and poverty reduction (CHRIST et al., 2003). Therefore, we aimed to assess actors' perceptions regarding synergies between tourism and use of biodiversity and how it may help to improve outcomes in the specific socioecological context. We used photos and maps so that interviewees could choose from tourism modalities and inform where they and the use of biodiversity could take place in the study area. Such close questions were analyzed using relative frequency analysis (Appendix E). In the case of the Luneburg Heath Nature Park, we asked an open question about the importance of tourism in relation to land uses. In the third phase, we assess actors' perceptions regarding mechanisms, as a particular set of rules for the use of biodiversity and tourism, financial inducements, a particular configuration of actors that put together and arranged in such a way, can result in patterns of interactions and outcomes, such as synergies and governance systems. Open questions were asked in the case of the Luneburg Heath Nature Park. Meanwhile, in MSVP and PERD, we listed federal, state and municipal institutions, for example, protect environmental and socio-cultural resources (BRAMWELL, 2011). Public–private sector partnerships (Williams and Shaw, 2009). Also, financing or funding from national and international funds. Social capital such as associations and cooperatives of local communities and civil societies (NUNKOO, 2017; PERSHA; AGRAWAL; CHHATRE, 2011), and marketing tools. These mechanisms were coded and presented to the interviewees that could choose an unlimited number of mechanisms from the list of options. Then, we asked each actor to rank legislation, partnership, funding, social capital and marketing tools, from most = 1 to less important = 5.

6.3.4 Selection of key-actors for interviews

To select key actors for the application of the semi-structured questionnaire, we conducted a documentary analysis of the three case studies. For the case study in the Luneburg Heath Nature Park, we pre-selected 9 interviewees, as members of the foundation involved with the management of the Luneburg Heath nature reserve, members of the umbrella organization of Nature Parks in Germany (Association of German Nature Parks), also the manager of the Luneburg Heath Nature Park and the private sector association. In total, 6 people were interviewed. For PERD, we pre-selected 24 interviewees (1 conservation unit manager, 8 municipal tourism secretaries, 12 institutes and foundations, 2 associations and 8 participants from the local tourism productive arrangement). In total, 16 people were interviewed (1 conservation unit manager, 1 municipal secretaries of tourism, 5 institutes and foundations, 1

association, and 6 participants of the local tourism productive arrangement). In the MSVP, 33 interviewees were pre-selected (11 federal and state conservation units, 4 municipal governments, 9 institutes and foundations, 10 associations and cooperatives). A total of 10 people were interviewed (1 federal and state conservation unit, 2 municipal government, 5 institutes and foundations and 2 associations and cooperatives).

6.4 Results

6.4.1 Presentation of findings

We present our findings under five headings, as follows: description of the structure, goals and challenges of specific socioecological contexts (6.4.2). Synergies between tourism and biodiversity use and how it may help to improve outcomes in the specific socioecological context (6.4.3). Mechanism-by-mechanism to promote synergies and governance (6.4.4). Summary of key conditions for governance systems identified from the case studies (6.4.5).

6.4.2 Specific socioecological contexts

According to the interviewees, the role of Luneburg Heath Nature Park is to protect cultural landscape, whose main attributes are goat and sheep grazing, heath land and old buildings. Also, nature conservation and promote quality of life, associated with mobility and public transport, health, sense of place and education and overall territorial development. Interviewees also state that the nature park is an actor that stands for rural regions and can cooperate with other actors to put projects and programs into practice. In MSVP, the mosaic has the role of value the communities, cooperatives, NTFPs extractivism, biodiversity conservation, instill community development, capacity building, research, disseminate information about the region and integrate protected areas, and manage conflicts and the mosaic territory as a whole. Interviewees add that the idea of a mosaic generate a sense of belonging and that the mosaic council and protected areas invest in trails, information center, training of guides, owners of inns and restaurants. In PERD, interviewees establish a direct relationship between the park and the community in the surrounding area. According to interviewees, the park needs to collaborate and listen to the needs of the people in the surroundings of the park. The park could, but not yet is fostering and stimulating, food and lodging services and activities such as visit to lagoons, trails and bird watching associated with nature conservation and environmental education, which would attract tourists to the region and create jobs, income and sales.

Despite considerable differences in the biophysical settings, the interviewees of these specific socioecological contexts report similar challenges (Table 17). In Luneburg Heath Nature Park, challenges are the participation of the people who live in rural areas. Interviewees in Luneburg Heath Nature Park, MSVP and PERD report the lack of staff to check whether the visitors stick to the rules and promote environmental education activities. Also, instill public-private partnerships competence and coordination that can undermine partnerships and access to financing opportunities. In addition, interviewees in Luneburg Heath Nature Park state that nature protection law have to be more tailored to the needs of tourism, as well as tourism laws need to be more tailored to the needs of protected areas.

Table 17 - Main challenges of specific socioecological contexts.

Main challenges	Case study
Participation of the people who live in rural areas	Lüneburg Heath
Financing has to be sufficient and accessible	Lüneburg Heath; MSVP; PERD
Lack of staff in protected areas to promote environmental education	Lüneburg Heath; MSVP; PERD
Integration of the park with the surroundings	PERD
Integration in practice between the actors in the territory	MSVP
Mistrust about tourism and the potential of the region	PERD
Park is underused and isolated	PERD; MSVP
Lack of dialogue between actors	PERD; MSVP
Expansion of agricultural frontiers	MSVP
Lack of tourist signaling, restaurants, inns, public transport and sazonality	PERD

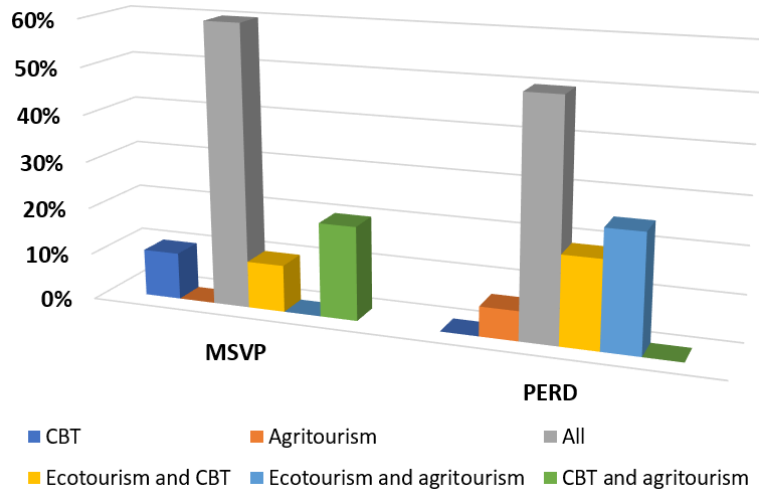
Source: Elaborated by the author.

Specific challenges in MSVP were associated with the geographical area, the work of protected areas is isolated and there is no integration between the actors in the territory. On top of that, there's the expansion of agricultural frontiers, sand mining, construction of dams and fish farms on São Francisco River. Challenges in PERD were associated with the integration of the park with the surroundings, especially the lack of support to the needs of the surrounding. The park is considered underused and isolated, which instill mistrust about the potential of tourism and the region.

6.4.3 Synergies between tourism and the use of biodiversity

In Luneburg Heath Nature Park, tourism is important for nature conservation and the economy of the region through job generation, that support the argument that nature parks provide income in rural areas. In addition, interviewees state a synergic effect between tourism and land uses are heath, associated with sheep farming as grazing animals to protect the landscape. Also, forestry, tourist structure, crops and agriculture. such as farms, sheep and shepherds, that are important for maintaining the landscape, without them, there would be no heath land and no tourists. Therefore, to achieve the development goals of nature parks and territorial development, interviewees did not specify a tourism modality, but stated that it must be a sustainable version of tourism, with good cooperation with nature protection, so that both can profit from each other. Together with environmental education, in terms of visitor guidance and the registration and monitoring of visitor numbers, tourism help nature parks to offer sustainable recreation. Tourism is also important for regional development and marketing of agricultural products in the area of the Lüneburg Heath. Land use planning in the nature park make it clear which areas are a priority for nature protection and which areas could be used for tourism and visitor guidance. In this case the nature park act as mediator and develop guidance for the planning of land use by networking, and together with agriculture/farmers. Finally, stablish close connection between tourism, nature conservation and rural economy, and increase accessibility through projects such as the "Heideshuttle", which is a mobility offer during the high season, explain successful outcomes such as expand the brand into the common mindset of all Germans. In MSVP and PERD case studies, interviewees expressed that CBT, ecotourism and agritourism should be implemented at the same time with agroextractivist activities (Figure 18).

Figure 18 - Tourism modalities to be implemented with agroextractivist activities in MSVP and PERD case studies.



Source: Elaborated by the author.

According the interviewees in MSVP, all three tourism modalities offer benefits to rural livelihoods, traditional communities, culture and gastronomy, the collection and trade of NTFPs, agroforestry and family farming which, in turn, improve the quality of CBT, ecotourism and agritourism. In PERD, ecotourism can promote trails and lagoons, wildlife observation and learning about nature inside the park. Meanwhile, CBT, ecotourism and agritourism can also promote nature conservation, improve the immaterial value and sale of local agricultural products, fairs, handicrafts, gastronomy, agroforestry, involve family farmers and communities and safeguard historical heritage in the park's surroundings. Interviewees argue that agritourism promote agroforestry, which protects the park, create ecological corridors for wild animals on rural properties, which could attract more tourists. In both cases, MSVP and PERD, interviewees state that ecotourism can take place inside and outside protected areas. Meanwhile, CBT and agritourism can take place in the surrounding of protected areas in rural settlements and small-scale rural properties. The challenges to do so described by interviewees in both case studies is lack of information, participation, skilled labor and investments the emptying of the productive capacity of family farming in PERD.

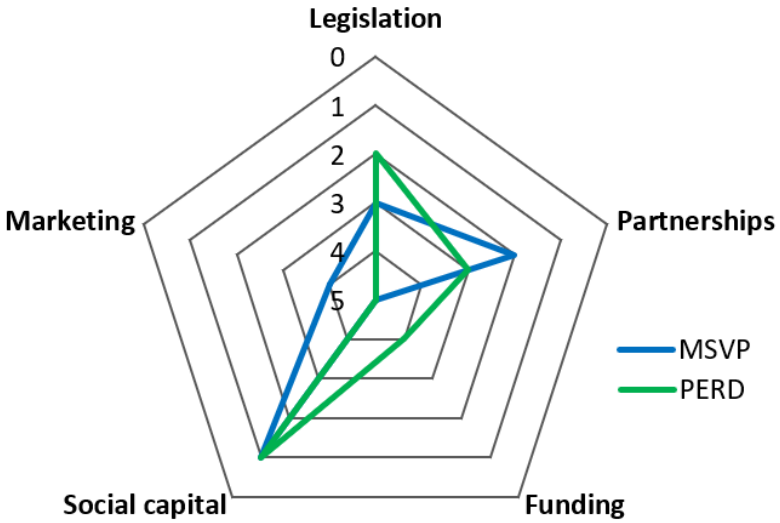
6.4.4 Mechanism-by-mechanism to promote synergies and governance

In the case of Luneburg Heath Nature Park, the quality initiative, nature park plan, Natura 2000, social capital, partnerships and financing and marketing are mechanisms that when put together result in positive outcomes for rural areas, support synergies and governance of the nature park. According to the interviewees, the Quality Initiative Nature Parks assesses the strength and weaknesses of a nature park by a questionnaire. A nature park plan is an important instrument at regional scale, because it sets the aims, larger projects or “lighthouse projects” and framework for action for the next ten years, as well as determinate priority areas for nature protection and recreation coordinated with the regional planning. GIS programs are used frequently for general mapping and planning. The Luneburg Heath Nature Park also rely on the development planning of the Natura 2000[10]. Social capital, according to interviewees, highlight civic engagement, coordination and connection of different actors to create committees. Build partnerships and networks allows communication with different actors such as the nature park, local actors, conservation authorities and politicians. Interviewees state that social capital and partnerships are necessary so that all actors work in the same direction for the

[10] Natura 2000 is a network of core breeding and resting sites for rare and threatened species, and some rare natural habitat types which are protected in their own right. Source: < https://ec.europa.eu/environment/nature/natura2000/index_en.htm>.

success of planning. The idea is to be satisfactory as possible for all actors, so that motivate land owners to implement selected measures. In this sense, LEADER[11] is essential for maintaining the engagement of all actors and the provision of the multiple funding pots to improve infrastructure for tourism, but to improve the overall quality of life in the region. Marketing focus on develop the Luneburg Heath regional brand through printed tourism information material, homepage and social-marketing with the support from the umbrella brand of the Luneburg Heath GmbH, whose overarching aim is to market the Luneburg Heath Nature Park. In the case of MSVP, interviewees ranked social capital as the most important mechanism, followed by partnerships, legislation, marketing and funding. Similarly, in PERD interviewees also ranked social capital as most important, but it was followed by legislation, partnerships, funding and marketing (Figure 19).

Figure 19 - Rank of mechanisms in MSVP and PERD case studies.



Source: Elaborated by the author.

Interviewees in MSVP describe social capital as valuing traditional ways of life and promoting ideals and collective action, capacity building, promoting understanding among local people about the potential of the region and increasing participation and income distribution. In PERD, social capital means to enhance participation by the local community and encourage people to organize themselves into associations and cooperatives to act as guides and give information about the region to the tourist and to better understand the potential of the region. MSVP and PERD ranked partnerships as the second and third most important

[11] LEADER was launched in 1991 with the aim of improving the development of rural areas through non-agricultural activities based on a multifunctional, territorial and participative approach through Local Action Groups (LAGs), a public-private body in which the main actors of the territory are represented and which enjoys legitimacy regarding the allocation of European funds (BALLESTEROS; HERNÁNDEZ, 2019).

mechanism. Partnerships for interviewees in MSVP and PERD means increase and strengthen partnerships with federal and state governments and municipalities for nature conservation and value traditional communities, the production chain of NTFPs and tourism. The second most important mechanism in PERD is legislation related to accessibility and public transportation and needs to become more participative. In MSVP, legislation focus on access and public transportation, income generation and distribution, payment for ecosystem services (water), and food policies that support the collection and trade of NTFPs and family agriculture. The last mechanisms ranked by interviewees from MSVP and PERD was funding and marketing. Funding in MSVP is associated with increase and efficiently apply financing and improve access to funding sources for associations and cooperatives of traditional communities and NTFPs. On the other hand, funding in PERD is to promote cultural activities, infrastructure, tourism structure. The focus of marketing in PERD is to increase the promotion of the region and the park, structure the region as a unique tourism product and promote natural attractions through social media and event calendars. In MSVP marketing also focus on increasing the internal and external publicity of the mosaic as a single tourism product and to promote natural and cultural attractions.

The interviewees from MSVP and PERD selected a particular set of associations and cooperatives representing social capital from the detailed list of mechanisms (Table 15). In the case of MSVP, social capital is represented by cooperatives of family farmers, agroextractivist and indigenous associations. In PERD, the association of friends of PERD (DuPERD) (22%), association of small rural farmers (17%), tourism local productive arrangement (15%) and the Marlierense women's association (11%), were more frequently selected by interviewees. Regarding main partnerships, in MSVP is the city hall and several institutes such as EKOS Brasil, Sertão Vereda and the State Forestry Institute also a network of Brazilian parastatal institutions (SESI), professional education institution (SENAC), federation of commerce of goods, services and tourism of the state of Minas Gerais (FECOMÉRCIO) and the Brazilian Service of Support to Micro and Small Enterprises (SEBRAE). In PERD, interviewees also selected city hall, State Forestry Institute, SESI, SENAC, FECOMERCIO and SEBRAE. Apart from these mechanisms, interviewees selected the non-governmental organization SOS Mata Atlântica, mining company VALE and forestry company CENIBRA. The legislation selected by interviewees in MSVP and PERD encompass laws that support the environment and protected areas such as the National System of Nature Conservation Units (SNUC) (Law No. 9.985/2000) and tourism such as the State Policy of Community-Based Tourism (Law No.

23763/ 2021). Interviewees in MSVP and PERD selected similar laws that support family farming and NTFPs extractivism (Table 18).

Table 18 - Legislation selected by interviewees in MSVP and PERD case studies.

	Case studies	
Mechanisms	**MSVP**	**PERD**
Tourism	National Tourism Policy, Tourism Regionalization Program, Brazilian Tourism Map, Registration for Tourism Service Providers, State Policy for Community-Based Tourism	National Tourism Policy, Tourism Regionalization Program, Brazilian Tourism Map, Registration of Tourist Service Providers State Tourism Policy, State Policy for Community Based Tourism
Environment	National System of Nature Conservation Units, Forest Code, Ecological ICMS	National System of Nature Conservation Units, Ecological ICMS, National Policy for Environmental Education
Family farming, NTFPs extractivism	National Policy for Sustainable Development of Traditional Peoples and Communities, Bioeconomy Brazil Sociobiodiversity Program, National Plan for the Promotion of Sociobiodiversity Product Chains	National Policy for Sustainable Development of PCTs, Bioeconomy Program Brazil Sociobiodiversity, Policy to Guarantee Minimum Prices for Sociobiodiversity Products, National Policy for Regional Development, National Environmental Council, National Policy for Sustainable Development of Aquaculture and Fishing, State Policy for Food Acquisition from Family Agriculture, Municipal Master Plan

Source: Elaborated by the author.

As far as funding, in MSVP sources are Municipal Efficiency Program of the Bank of Brazil, Partnership Fund for Critical Ecosystems (CEPF - Cerrado) and the World Wildlife Fund (WWF-Brazil). Meanwhile in PERD, the main funding source is the Renova Project Foundation, a private, non-profit non-governmental organization formed in 2016 by a Transaction and Conduct Adjustment Agreement with the mission to implement and manage the reparation programs for those impacted by the iron ore dam collapse. As far as marketing, social media, official websites and events calendar were the main tools selected by interviewees in MSVP and PERD.

6.4.5 Key conditions identified from the three case studies

Ten key-conditions were identified from answers to the semi-structured questionnaire in Luneburg Heath Nature Park, MSVP and PERD case studies (Table 19). The first key

condition is that protected areas need to assume their role as “active” actors in the region where they are a part. Then, the second key condition consists of developing tourism modalities that enhance the specific natural and cultural attributes of the region. The third condition comprises the need to develop a set of synergic activities and define the areas where each will take place. The following key conditions are focused on creating partnerships, funding for infrastructure, motivate people to participate in decision-making and the management of rural areas and promoting a regional brand.

Table 19 - Key conditions to promote synergies and governance systems for multifunctional land use management in specific socioecological contexts.

Nº	Key-conditions	Luneburg Heath	PERD	MSVP
1	Protected areas define their goals and responsibilities as an actor within the region	Natural Park mediates stakeholders' interests, helps implement projects, defends rural area interests, nature conservation and generate jobs	Interviewees ask that PERD support communities in the surrounding, local products, economic growth	Value the communities, cooperatives, NTFPs extractivism, conservation, capacity building, biodiversity preservation
2	Develop tourism modality that “match” with the goals of the region	To achieve the development goals of nature parks and territorial development, it must be a sustainable version of tourism	Develop ecotourism, CBT and agritourism to support local products, nature conservation	Develop ecotourism, CBT and agritourism to support local products, nature conservation
3	Promote bundles of activities, zooning	Nature conservation, tourism (leisure and employment generation), environmental education and some level of quality of life for the people in the region, transportation	Nature conservation, in the park and in the surrounding forestry and support family farmers	Nature conservation, in the parks and livelihoods, collection of NTFPs in the surrounding
4	Build partnerships and network	Implementation can only work if all stakeholders work in the same direction	Promote efficient partnerships and strengthening municipalities and the federal government as partners	Support local communities, associations and cooperatives
5	Funding for infrastructure and to support associations and cooperatives	Provision of the multiple funding pots to improve infrastructure for tourism, but to	Promote cultural activities, infrastructure, tourism structure	Efficiently apply the funds and improve access of associations and

		improve the quality of life		cooperatives to funding pots
6	Staff	People working and providing services for the nature park, especially the quality of training for the tour guides	-	-
7	Encourage people to participate, leadership and valuing livelihoods	-	Encourage people to self-organize into associations and cooperatives, participation of the local community. Value and use the existing social capital and increase the training of people to act as guides	Value traditional livelihoods and promote the ideals, collective action, capacity building, and increasing participation and income distribution
8	Developing a regional brand	Develop nature parks as regional brand “Lüneburg Heath”, image video, develop a narrative, so people in the region would also identify with the nature park itself	Structure the region as a unique tourism product, format and promote natural attractions	Structure the mosaic as a single tourism product, and formatting and promoting natural attractions
9	Regional promotion	Print tourism information material, good working homepage, become even more active in the field of social-marketing, support from the umbrella brand of the Lüneburg Heath GmbH	Increase the publicity of the region and the park	Increasing the internal and external publicity of the mosaic
10	Local people need to believe in the potential of the region	-	Understand the benefits and believe in the potential of the region	Understand the benefits and believe in the potential of the region

Source: Elaborated by the author.

6.5 Discussion

6.4.6 Key findings and contributions from the methodology

In this study, the selection of three case studies inside Brazil highlight the importance of recognizing and conducting in-depth studies to clarify the structure, goals and challenges of complex socioecological contexts that make up the Brazilian rural landscapes, so we can understand how synergies between tourism and the use of biodiversity may help to improve outcomes going beyond panaceas. In this sense, the selection of case study outside Brazil reinforce the importance of learning the range of instruments that have been put into place for maintaining and developing the unique character whilst protecting biodiversity and economic development of rural landscapes, as demonstrated previously (BOHNET; KONOLD, 2015). Therefore, from the beginning, the goal of this study was not to compare the case studies in Brazil and Germany, as they represent different realities, but rather gather information to learn from the different contexts and the perceptions of key actors in each study area.

Despite very different contexts it is overall highlighted the need of protected area to assume goals and responsibilities within the region where it is located. This calls for protected areas to contribute to strategic activities such as nature conservation, tourism (leisure and create jobs), environmental education and quality of life for the people in the region, such as transport. Similarly, the challenges for governance and multifunctional management pointed out in all areas are the lack of people to work in the protected areas, funding and mobilizing people to take an active part in governance. However, the cases in Brazil present slightly more complex challenges such as isolation in the PERD and accessibility in the case of MSVP.

The interviewees in the three case studies have critical perceptions about the role of tourism and use of biodiversity. In the case of Luneburg Heath Nature Park, actors state that it is necessary to develop tourism that is sustainable in the sense of being aligned with environmental education. In MSVP and PERD, from the pictures of tourism modalities, respondents stated that CBT, ecotourism, and agritourism could be associated with rural livelihoods, biodiversity conservation and family farming. Also, they were able to inform where each set of activities could be developed, being aligned with the zoning practice in Luneburg Heath Nature Park case.

The three case studies are aligned regarding the mechanisms needed to promote synergies between tourism and use of biodiversity and governance systems. In the Luneburg Heath Nature Park, MSVP and PERD participation and social capital are understood to be an essential mechanism. Likewise, legislation and funding. This result fits the findings described by (BOHNET; KONOLD, 2015), that bottom-up action and legal planning frameworks support

more effective management and development of cultural landscapes. In this sense, the list of specific mechanisms used alongside the semi-structured questionnaire in the Brazil cases was useful in helping to detail and customize the package of social capital, financing, legislation and marketing tools available in the study areas to implement the synergies between tourism and biodiversity uses and governance.

In this work we list ten key conditions for fostering governance systems to promote synergies between tourism and the use of biodiversity and multifunctional land use based on native vegetation. The first three conditions were derived from the first and second phases of the semi-structured questionnaire. These conditions relate to structuring the role of protected areas and defining the tourism modalities that are synergistic with the activities for the use of biodiversity, which generally involve traditional communities, family agriculture and native ecosystems. These key conditions, therefore, form the basis for the other conditions that are associated with seeking effective partnerships, increasing the access of local cooperatives and associations to financial resources, hiring people to work in the parks, developing a regional brand and formatting a unique tourism product or destination. Finally, better informing local people about the potential of the region.

6.4.7 Challenges to implement the key conditions in the cases in Brazil

Our results suggest that even though the socio-ecological contexts are distinct among the three case studies, the key conditions identified from the answers of interviewees have similarities among the case in Germany and the two in Brazil. However, even though the challenges might be similar, the paths for implementation might be different. Further, the interviewees in MSVP and PERD were able to inform in detail the set of mechanisms, but so far, none of the key conditions have yet to be applied by the actors. Therefore, there are still challenges for governance systems in MSVP and PERD.

Thus, one has to question how far these specific contexts, and other occurring in Brazil, are from making tourism and sociobiodiversity effective alternatives. The interviewees in MSVP and PERD listed one by one, who the partners could be, sources of funding, social capital and existing marketing tools. Furthermore, in Luneburg Heath Nature Park, the role of nature parks is defined and monitored following the guidelines of a civil organization dedicated to nature conservation, the International Union for Conservation of Nature (IUCN), and a series of federal laws and Natura 2000 areas. In MSVP and PERD in Brazil, the National System of

Conservation Units also follows IUCN's guidelines to establish conservation units (UCs) categories in two major groups of integral protection areas, where no resource use is allowed, and sustainable use areas, where a certain level of resource use is allowed (FÉLIX; FONTGALLAND, 2021). Added to this, the actors in these case studies point out that existing federal tourism, environment and family farming laws could help guide actions in the region. So, these results prove that there are governance mechanisms available.

Then, it is a matter to answer who will be able to put these mechanisms together and arrange them with key conditions in a way that create outcomes such as synergies between tourism and the use of biodiversity and governance systems to foster multifunctional land use. Interviewees in MSVP and PERD report challenges related to social capital issues. In MSVP, interviewees state that local communities need to get more involved in decision-making, there is also the need to value local people, their knowledge and practices in the use of biodiversity, so that they can benefit from tourism and NTFPs extractivism together. The Luneburg Heath Nature Park case informs that it takes the participation of a wide range of actors, the dialogue is not always easy, and there are conflicts, but all actors are aware that their actions should contribute to achieve the territorial development goals.

Furthermore, the region where PERD case is located began to receive financial aid after the collapse of the Fundão iron ore dam, known as the biggest environmental disaster in Brazil, in 2018. This financial aid was selected as the main source of funding for projects by the interviewees from this case study. However, this benefit has a deadline until 2025, which raised awareness of interviewees that this is a limited source of funding and that new partnerships and funding need to be promoted. Among the options, the selected partnerships and funding are forestry and mining companies located in the municipalities surrounding the park. In PERD, interviewees also state that convincing such actors, municipal governments, state and federal tourism secretariats, local people and tourists that tourism and the use of biodiversity are able of promoting changes toward territorial development. Often stakeholders lack awareness that their region has potential. This has also been reported in previous studies of integrated landscape management initiatives in Latin America (ESTRADA-CARMONA et al., 2014; GROOT, 2006).

According to these results, it can be stated that, in PERD, people still do not believe in the role of tourism and sociobiodiversity in the specific contexts analyzed in Brazil. Thus, increasing investments and increasing people's mobilization to implement the synergies

between tourism and sociobiodiversity requires deeper analyses on cost-benefit (TORRES-DELGADO; SAARINEN, 2014). On the other hand, in MSVP the challenge is also train members of associations how to access funding pots, write and execute projects. Capacity building can be a way out, but associations can't sustain themselves because they don't earn enough money. This is when is when tourism and NTFPs extractivism give visibility to traditional livelihoods, jobs and income (CARVALHO RIBEIRO et al., 2018). But there is a need to go beyond potential to implement it into practice.

Perhaps the knowledge of the interviewees regarding which legislation would be meaningful and which would work for each study area could be a starting point for fostering governance systems in each context. Further, rely and better explore the capacity of instruments for participation such as workshops the councils that exist already in MSVP and PERD, could be possible attempts and approaches to raise awareness of actors e about the benefits of tourism, local livelihoods and the potential of the study areas. Furthermore, “take-home” messages learnt from the Luneburg Heath Nature Park could be taken in consideration to guide the course of action in MSVP and PERD. A message is that cooperative territorial development includes both tourism and local interests. In general, it is important that protected areas assume their roles as mediator to include the locals on site for the successful area-wide implementation of mechanisms and key conditions. Above all, partnerships and networking are fundamental but there is still lack of evidence on how to implement those in different socio ecological contexts.

6.6 Conclusion

This study purposively selected case studies inside and outside Brazil to explore a particular set of rules for the use of biodiversity and tourism, financial inducements, a particular configuration of actors and marketing tools, that put together and arranged in such way, can result in synergies and governance systems to instill multifunctional land uses based on native vegetation. Our results highlight the importance to study complex socioecological contexts that make up the Brazilian rural landscapes and learn from the instruments that have been put in place in good practices for land use management worldwide. Therefore, through learning process this study has identified key conditions to be included into the existing governance systems to promote synergies between tourism and the use of biodiversity, encompassing NTFPs, traditional communities in rural settlements and protected areas, a way out of lock-ins created in rural areas. The ten key conditions from the application of semi-structured questionnaires in the case study in Germany, Cerrado and Atlantic Forest are: define objectives

and responsibilities of protected areas as an actor within the region, foster tourism modalities that "match" the region's development objectives with a set of complementary activities and zoning, build partnerships and networks, guarantee funds for infrastructure and supporting local cooperatives, encourage people to participate, value local livelihoods, develop a regional brand and regional promotion, provide better information, planning and evidence so that local people believe in the region's potential. We conclude that even though the case studies in Brazil and Germany represent different social-ecological contexts, the set of mechanisms used and suggested by the interviewees and the key conditions for fostering governance systems have similarities amongst between them. However, although the interviewees in MSVP and PERD share similar territorial development goals and have the capacity to select a set of mechanisms to do so, so far, none of the 10 key conditions identified by this study have been fully applied by the actors.

7. CHAPTER 7 - CONCLUSION

7.1 General conclusion

This PhD thesis sought to answer empirically why, where and how there is scope to foster synergies between recreation services and the provision of material and immaterial values associated with the use of biodiversity, i.e., sociobiodiversity, as an alternative to intensive land uses in Brazil. In recent decades, rural landscapes in Brazil have been transformed to meet the growing global demand for commodity production. Therefore, it has been argued that it is necessary to promote sustainable management of Brazilian rural landscapes, avoiding the loss of native vegetation and important ecosystem services, ensuring that these are available for present and future generations. To ensure that this effort is evidence-based, this study aimed at identifying what are the biophysical and cultural variables, as well as the key governance conditions, i.e., overarching aspects, for tourism to add to the material and immaterial values associated with Brazilian sociobiodiversity, while maintaining the standing native vegetation.

The methodological course employed different methods to explore possible synergies between tourism modalities and sociobiodiversity as an alternative to land use intensification in Brazil, rooted on sustainable production and multifunctional land use management concepts and landscape approach principles. This study, by adopting multi-scale assessments and analysis of tourism initiatives, has put great efforts to collect, organize and analyze new datasets of CBT, ecotourism and agritourism initiatives and the collection and trade of NTFPs and sociobiodiversity in Brazil, as well as conduct literature review from multiple disciplines, defined conceptual frameworks and methods using Geographic Information System (GIS) and spatially explicit modeling in order to add to the emerging state of the art on the synergies between tourism and sociobiodiversity.

The empirical chapters of this thesis were designed to test the hypothesis that tourism integrated with sociocultural, economic, political, biophysical elements and immaterial values of sociobiodiversity can promote transitions towards sustainable production land uses in Brazilian biomes. It concludes that there are synergies between recreation services represented by CBT, ecotourism, agritourism, and the provision of material and immaterial values associated with the use of biodiversity, i.e., sociobiodiversity, informing existing the policies, plans and programs, as well as policymakers, to foster sustainable territorial development in Brazil. This study has shown that there are 131 local tourism initiatives that add value to the material and immaterial values of sociobiodiversity. Furthermore, there is potential for

upscaling local synergies between tourism modalities and the use of biodiversity across 2 million hectares based on the average area of CBT and Ecotourism hotspots, representing the supply and spatial integration of biophysical and cultural elements across rural landscapes in Brazilian biomes. Furthermore, actors in the two case studies analyzed in Brazil expressed 10 key conditions for fostering governance systems for multifunctional land use management including tourism and the use of biodiversity in specific socioecological contexts. These key conditions are aligned with the ones in Luneburg Heath Nature Park. However, none of the 10 key conditions summarized in this study have yet been put into practice in the case studies in Brazil.

7.2 Specific conclusions

7.2.1 Synergies between Tourism modalities and sociobiodiversity today in Brazilian biomes

The first diagnosis about the synergies between tourism and sociobiodiversity in practice, at present, in Brazilian biomes were mainly presented in chapter 2. This chapter shows that from a dataset of 186 initiatives, 71% are located in municipalities that collected and traded NTFPs between 2013 to 2021. The first statistical analysis in this chapter showed that there is a stronger relationship between CBT and ecotourism initiatives and the provision of material and immaterial values associated with the use of biodiversity, i.e., sociobiodiversity, through NTFPs extractivism. We derived these statistics through a new dataset that gathered a long list of 131 CBT, ecotourism and agritourism initiatives.

The main contributions from this chapter to the state of art is the characterization of these local tourism initiatives regarding the goals, location and structure, which are further associated with sociobiodiversity material and immaterial values. Even though previous studies have also gathered CBT experiences in rural areas in Brazilian biomes (BARTHOLO et al., 2008), no study analyzed the synergies between tourism modalities and sociobiodiversity to inform public policies. The findings reveal that CBT and ecotourism initiatives in NTFPs extractivist landscapes are located on public lands such as national and state parks and indigenous lands that are important actors for nurturing synergies between tourism and sociobiodiversity in the Amazon, Cerrado, and Caatinga. On the other hand, agritourism initiatives are located in private lands, such as small-scale farms in Atlantic Forest.

We found that Brazil has good examples of CBT, ecotourism and agritourism initiatives that promote community-based management of the diversity of biophysical elements in NTFPs

extractivism landscapes, trails and forest expeditions, and in family farms for recreation purposes and learn about traditions livelihoods (Moraes et al., 2017; Oliveira et al., 2021; Peralta, 2012). This findings complement the synthesis of initiatives in Brazil presented by (BRONDIZIO et al., 2021). In general, the initiatives involve and value traditional livelihoods, fishing and agriculture and the use of NTFPs with less intensity. Tourism development, especially in RESEX is still in the diagnostic phase in management plans, so plans to reconcile the two activities still need to be made (TOLENTINO et al., 2019). This finding is aligned with previous studies (BASTOS; FILHO, 2020).

The conceptual framework of STEEPV used to analyze three case studies of CBT/ecotourism and agritourism in the Amazon, Cerrado, and Atlantic Forest, allowed to conclude that the synergies between CBT, ecotourism, agritourism and sociobiodiversity are promoted on the protected areas or small rural properties, as well by valuing specific cultural identity aspects of local communities through community-based management models, such as Uacari lodge in the Amazon. Or as an association, such as Acolhida na Colônia, an agritourism initiative in the Atlantic Forest. These factors were also used to describe subsistence systems elsewhere (LAKAPUNRAT; THAPA, 2017).

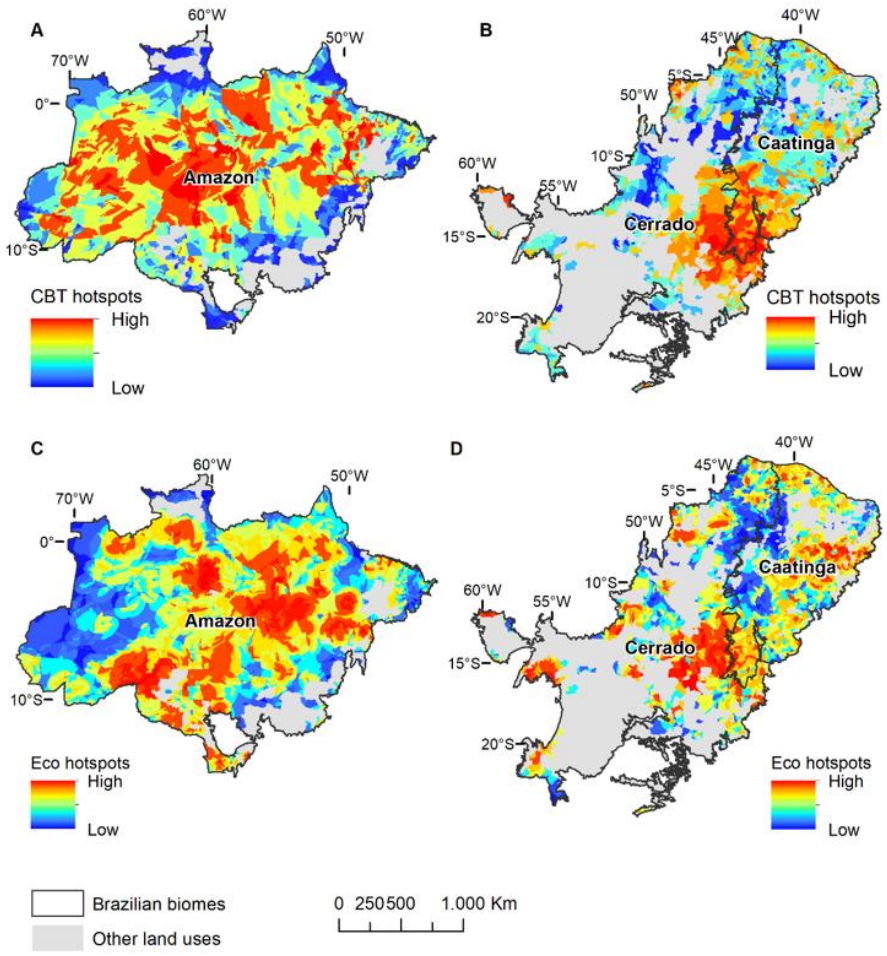
Even though our analysis illustrated that the 131 initiatives are associated and add value to sociobiodiversity nurtured through community participation, nature conservation goals, partnerships and financing, are often framed at the local scale. Therefore, in these local-scale contexts, it can be stated that tourism and sociobiodiversity play a role for territorial development in Brazil. But for multifunctional land use management in a post Covid-19 era (UNWTO 2020) these findings at local scales are not enough to state that tourism and sociobiodiversity play an effective role for territorial development in Brazilian biomes. For this reason, the refinement of conceptual frameworks, spatially explicit analyses from tourism initiatives and case studies in specific contexts, presented in the empirical chapters 3, 4, 5 and 6, represent an effort to deepen the study of the possibilities for assessing the role of tourism and sociobiodiversity as alternatives to intensive land use at multiple scales in Brazil.

7.2.2 Spatially explicit analysis focusing in upscaling areas for fostering synergies

A spatial explicit modeling approach was used to upscale local synergies at national scale by exploring and allocating cross-scale complex biophysical and cultural elements,

infrastructure, institutional capacity and social capital present in rural landscapes using multi-criteria analysis (BOYD; BUTLER; HAIDER, 1994). We, therefore, reinforce previous statements made by authors, that multi-criteria analysis and spatial explicit modeling approaches can be applied to different study contexts (ALLAIN; PLUMECOCQ; LEENHARDT, 2017). In this sense the map of mechanisms from governance systems was also an useful approach (OOSTEN; MOELIONO; WIERSUM, 2017), evidencing that clusters of mechanisms are concentrated in agritourism hotspots in Atlantic Forest, ecotourism and CBT in the Cerrado and near state capitals in the Amazon, being aligned with previous findings from (HOEFLE, 2016). Our results show that, adding up the average area of CBT and ecotourism hotspots, there are 2 million hectares to upscale local synergies at national scale in Brazilian biomes. This PhD thesis also conclude that the spatial patterns of hotspots for both CBT and ecotourism are similar in the Amazon, Cerrado, and Caatinga (Figure 20).

Figure 20 - Overall location of hotspots of A) CBT in Amazon, B) CBT in Cerrado and Caatinga, as well as C) ecotourism hotspots in Amazon and D) in Cerrado and Caatinga.



Source: elaborated by the author.

The conclusion from chapter 3 was that there is an average area of 874,278 hectare of hotspots in Amazon, 496,711 ha in Caatinga and 61,563 ha in Cerrado. Infrastructure, traditional communities are determinant variables for the success of CBT and sociobiodiversity implementation on the ground, as shown elsewhere (NYAUPANE; POUDEL, 2011). In chapter 4, the variables of NTFPs cooperatives and tourism departments were removed, and the weights were calibrated to the importance of the remaining variables. The result was the refinement of the average areas of hotspots in the Amazon and Cerrado/Caatinga. Variables such as tourism department and social capital encompassing associations, cooperatives, foundations and institutes were extensively mapped based on available data in official databases, and were added to the analysis as a cluster map, which shows the uneven distribution across the hotspots in Amazon, but covers the entire area of the hotspots in the Cerrado/Caatinga.

Hence, the average area of hotspots in chapter 4 decreased by virtue of including the analysis a larger set of CBT initiatives and refining variables and weights. Therefore, the average area of 874,278 hectare in Amazon, 496,711 ha in Caatinga and 61,563 ha in Cerrado went to 432,907 ha in the Amazon and 95,962 ha in Cerrado/Caatinga to upscale synergies between CBT and sociobiodiversity. Finally, in chapter 5, new variables have been added to identify potential areas for enhancing synergies between ecotourism and sociobiodiversity. New variables are caves, natural monuments and natural patrimony across Brazilian biomes, as well as social capital, included directly into spatial explicit MCA model. As a result, average areas with potential for enhancing synergies between ecotourism and sociobiodiversity in three biomes stand out, Amazon, Cerrado/Caatinga, but in ecotourism includes the Atlantic Forest. Average area of hotspots is 1 million ha in the Amazon, 457,490 ha in Cerrado/Caatinga and 74,406 ha in Atlantic Forest by including new variables and refining weights in the model.

Furthermore, from the main results from chapter 3, 4 and 5, there was an overlap of CBT and ecotourism hotspots in the central region of the Amazon, more precisely, in the eastern and southern Amazonas state and western Pará state. There are particularities, however. Ecotourism hotspots are more restrictive about the potential of the western Amazon region, on the contrary the CBT hotspots are well represented in this region. The CBT and ecotourism hotspots in the Cerrado and Caatinga occupy the same areas in the southeast of the Cerrado biome, in the northern region of Minas Gerais, where the Sertão Veredas Peruaçu Mosaic is located. Nevertheless, mechanisms of governance systems such as social capital, e.g., actors self-organize and actively participate in consulting boards alongside NGOs, institutes and tour operators, is imperative where CBT and ecotourism hotspots overlap. In this respect, future

studies may include more variables and improve the multi-criteria analysis to further explore and ask for expert feedback for model validation (CROSSMAN et al., 2013).

Another conclusion for this study that needs attention is that the 2 million hectares, identified using spatial explicit modelling, to upscale the synergies between CBT, ecotourism and sociobiodiversity represent the supply/offer of bundles of recreation CES and provisioning ES. This supply is understood as the potential interactions and benefits from tourism and sociobiodiversity for sustainable production, irrespective of whether the society demands this bundles occurs or not (BALVANERA et al., 2012), which is critical to improving land use management (LAMY et al., 2016). Thus, maintain this supply require actions in land use management and the deployment of governance systems (OSTROM, 2007).

As far as the demand for this supply of ES bundles in rural landscapes will depend on the perceptions and preferences of people to actually use and value them for sustainable production in Brazil (FAGERHOLM et al., 2020). Hence, it remains to be evaluated whether the demand for these bundles exists in order to increase the appeal for sustainable production. Evaluations of the economic value of standing native vegetation for recreation and food provision is also valid (COSTANZA et al., 2014). Otherwise, both governments and private funds will not invest and develop such land use mosaics within large areas (BUTLER, 1999).

7.2.3 Key-conditions to promote multifunctional synergies between tourism and the use of biodiversity through enhanced governance systems at the landscape scale

Chapter 6 aimed to define a set of key conditions to foster synergies and governance to promote multifunctional management of land uses in distinct socioecological contexts in Brazilian biomes. This chapter presents ten key conditions from the application of semi-structured questionnaires in the case study in Germany, Cerrado and Atlantic Forest, such as: defining objectives and responsibilities of protected areas as an actor within the region, fostering tourism modalities that "match" the region's development objectives with a set of complementary activities and zoning, building partnerships and networks, funding for infrastructure and supporting local cooperatives, encouraging people to participate in the actions, believing in the region's potential, valuing local ways of life, developing a regional brand and regional promotion.

According to the actors interviewed in the case studies in Brazil, both CBT, ecotourism and agritourism are synergistic with the use of biodiversity. These results, therefore, reinforce

and validate the spatially explicit analyses conducted in the previous chapters, which simulated where there could be synergies between CBT and ecotourism at the national scale. Further, these maps can be used to support zoning at landscape scale. It is also concluded that actors in the three case studies have critical perceptions about the role of tourism and biodiversity use and were able to select governance mechanisms for the multifunctional management of land uses. Even though the socio-ecological contexts are distinct among the three case studies, the key conditions mentioned do have similarities among the case studies, including between the case in Germany and the two in Brazil.

However, since the key conditions are the same, one has to question how far these specific contexts in Brazil from making tourism and sociobiodiversity effective alternatives and who can operationalize these key conditions for tourism and sociobiodiversity to play their role for territorial development in practice. The responses of the interviewed actors regarding the challenges to implement the set of 10 key conditions is related to engaging the private sector, political structures and stakeholders in the long time horizon and communicating the importance of supporting, safeguarding and promoting the multiple services and values of the landscape in socioeconomic and monetary terms (ESTRADA-CARMONA et al., 2014; GROOT, 2006).

In general, the results of chapter 6 show that actors know what needs to be done, as they listed key conditions such as defining objectives and responsibilities of protected areas as an actor within the region and fostering tourism modalities that "match" the region's development objectives. In this sense, considering that all the case studies involve categories of protected areas, the first key condition is fundamental to form the basis for suggesting the other policy key conditions. In Germany, the role of nature parks is defined and monitored following the guidelines of a civil organization dedicated to nature conservation, the International Union for Conservation of Nature (IUCN), and a series of laws. In Brazil the National System of Conservation Units establishes the categories of conservation units. Added to this, the actors in the case studies in Brazil point out that existing federal tourism, environmental, and family farming and supply laws could help guide actions in the region.

The interviewees in the contexts in Brazil listed one by one, who the partners could be, sources of funding, social capital, and existing marketing tools. So, another finding is that there are governance mechanisms available and already in place. We argue that the knowledge of interviewees regarding which legislation would be senseful and which would work for each

study area it is a starting point for fostering governance systems in each context. After all actors need to clarify the structure of socioecological contexts of which are part and understand the complexity to develop governance systems (OSTROM, 2007).

Thus, who will be able to order and arrange these mechanisms in place is an important question that emerged from these findings. The Luneburg Heath Nature Park case informs that the management of multifunctional land uses takes the participation of a wide range of actors, the dialogue is not always easy, and there are conflicts, but all actors are aware that their actions should contribute to achieve the territorial development goals. In the cases in Brazil, participation was perceived as with the highest priority ranking among governance mechanisms. However, in PERD the interviewees themselves state that convincing other actors such as the civil population, the private sector, municipal governments, state and federal tourism secretariats and tourists, about the potential benefits of tourism and the use of biodiversity for territorial development is the key challenge.

According to these results from chapter 6, it can be stated that people still do not believe in the role of tourism and sociobiodiversity for territorial development in the specific contexts analyzed in Brazil. Previous studies also confirmed that motivation had the greatest positive effect on the low level of community participation in the management in a World Heritage Site (WHS) (RASOOLIMANESH et al., 2017). Landscape principles also state that each actor will only join the process if they judge it to be aligned with their interests (SAYER et al., 2013). Thus, increasing people's motivation to implement the synergies between tourism and sociobiodiversity requires deeper analyses on cost-benefit (TORRES-DELGADO; SAARINEN, 2014), but also focusing on easy-to-reach intermediate targets may provide a basis for actors to begin to work together (SAYER et al., 2013). Above all, as shown previously, local political structures and the existence of open channels of communication make possible and facilitate the participation of local actors, has the greatest effect on the high level of community participation (RASOOLIMANESH et al., 2017).

The lack of an open communication channel between the state park and the surrounding community of one of the main challenges in PERD case study. Hence, rely on instruments for participation such as workshops and the councils that exist already in MSVP and PERD, could be possible attempts and approaches to inform people about the benefits of tourism, local livelihoods and the potential of the study areas. Furthermore, it is important that protected areas assume their roles as mediator to include the locals on site for the successful area-wide

implementation of mechanisms and key conditions. Above all, partnerships and networking, such as the LPA in PERD case study and the several associations and cooperatives in MSVP, are fundamental and a step further. Further, at MSVP case study, another challenge reported by interviewees was to coordinate and finance the actions of the actors that already exist such as associations and cooperatives, but are fragmented. In another word, actors need the ability to proceed with the process (RASOOLIMANESH et al., 2017). A part of such ability comes from building capacity, but also have access to funding and political structure (NYAUPANE; POUDEL, 2011).

In a nutshell, efforts to implement synergies between tourism and sociobiodiversity for sustainable production strongly shaped by a particular community, require multi-level governance system (RUIZ-BALLESTEROS; BRONDIZIO, 2013), as the structure in the public sector and governmental institutions, private sector and the role of NGOs, foundations and institutes in the specific socioecological contexts (ALIPOUR; AREFIPOUR, 2020). As this study contribute to identify the key conditions and the challenges for fostering governance systems, further research is needed to develop ways to put together and arrange governance systems in such way, that can result in synergies and governance systems to instill multifunctional land uses based on native vegetation.

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Appendix A - Chapter 2 Supplemental Information

Table S.1 Summary of tourism initiatives found in Brazilian biomes

ID	Name	Biome	Municipality and state	Description	Source
1	Turismo de vilarejo no distrito de Cuiabá	Cerrado	Gouveia Minas Gerais	Visit organic gardens that produce vegetables, garlic and spices.	Portal Minas Gerais
2	Turismo rural em Turvo	Atlantic Forest	Turvo, Paraná	Experience the rural daily life of indigenous Guarani Koe Ju Porã and quilombola Campina dos Morenos, visit old farm houses and waterfalls;	(CALEGARI, 2012) Paraná Turismo Website.
3	Associação de Agroturismo Acolhida na Colônia	Atlantic Forest	Campo Alegre, Joinville, São Bento do Sul, Anitápolis, Gravatal, Imbituba, Rancho Queimado, Rio Fortuna, Santa Rosa de Lima, São Bonifácio, Florianópolis, Ibirama, Presidente Nereu, Witmarsum, Atalanta, Aurora, Agrolândia, Agronômica, Lontras, Rio do Sul, Alfredo Wagner, São Joaquim, Urubici, Lauro Muller in Santa Catarina and Casimiro de Abreu in Rio de Janeiro state.	Family farmers who receive tourists to show their work and the environment in which they live. In 2022 started a project that seeks the Productive Structuring and valorization in the Acolhida na Colônia initiative and strategies in the scope of the Bioeconomy Program Brazil Sociobiodiversity, by surveying and valuing the Mate Herb and the Araucaria seed.	Associação de Agroturismo Acolhida na Colônia https://acolhida.com.br/
4	CBT in RESEX Rio Unini	Amazon	Novo Airão, Amazonas	Experience the daily life of the community.	(ICMBIO, 2018b)
5	RDS Rio Negro, Margem Direita	Amazon	Iranduba, Amazonas	Visits to riverside family farmers and indigenous communities; Experience the daily life of the communities.	Fundação Amazonas Sustentável (FAS)
6	APA Margem Esquerda do Rio Negro Tarumã-Açu/ Tarumã-Mirim	Amazon	Manaus, Amazonas	Visits to riverside family farmers and indigenous communities; Experience the	Fundação Amazonas Sustentável (FAS)

				daily life of the communities.	
7	Reserva Extrativista Tapajós-Arapiuns	Amazon	Santarém, PA	Living the routine of an Amazonian riverside community in extractivism and subsistence agriculture.	Garupa, Vivejar
8	Plano de Apoio a Taquaruçu	Cerrado	Palmas, Tocantins	Tourism of leisure and experience nature.	Turismo Tocantins
9	Turismo Social e Cultural de Base Comunitária no Sertão do Cariri	Caatinga	Nova Olinda, Ceará	Family accommodations; Visitation to local crafts and gastronomic production.	Garupa, Fundação Casa Grande
10	Assentamento Rural Tijuca Boa Vista	Caatinga	Quixadá, Ceará	Rural tourism in family farming	(MAIA, 2015)
11	Monte Alegre: patrimônio natural e pinturas rupestres	Amazon	Monte Alegre, Pará	Experience traditional way of life; Visit rock painting sites.	Vivejar and Estação Gabiraba
12	Riverside Belém/Combu	Amazon	Belém, Pará	Experience traditional cultivation of cocoa.	Vivejar and Estação Gabiraba
13	Uacari Lodge | Reserva Mamirauá	Amazon	Tefé, Amazonas	Living and learning the way of life of Amazonian communities.	Mamirauá Sustainable Developmen t Institute
14	Segredos e Temperos da Amazônia	Amazon	Belém, Pará	Know the seasonings of the region through community-based entrepreneurs.	Vivejar
15	Vivência Yawanawá	Amazon	Cruzeiro do Sul, Acre	Experience traditional way of life of indigenous tribe Yawanawá.	Garupa, Vivejar,
16	Prainha do Canto Verde	Caatinga	Beberibe, Ceará	Local community manages lodging and the restaurant; Artisanal fishing.	Garupa, Organização Prainha do Canto Verde
17	Ponta Grossa	Caatinga	Icapuí, Ceará	One of the most beautiful beaches in the coast of Ceará, on raft, boat or buggy rides, and hear the incredible stories of the local fishermen	Garupa, Rede TUCUM
18	Associação Amazônia,	Amazon	Rorainópolis, Roraima	Tourism in communities	Garupa

	Baixo Rio Branco			surrounding the Amazon rivers.	
19	Projeto de Assentamento Extrativista Lago Grande	Amazon	Santarém, Pará	Discover the knowledge of a riverside community, trails through the Amazonian Forest.	Garupa, TURIARTE, Projeto Saúde e Alegria
20	Comunidade de Boa Vista do Acará	Amazon	Belém, Pará	Lifestyle of riverside community in the production of artisanal flour and harvesting of typical fruits (Açaí).	Garupa, Estação Gabiraba.
21	Quilombo do Cumbe	Caatinga	Aracati, Ceará	Aims the preservation of biodiversity and our traditional way of life.	Quilombo do Cumbe
22	São Manoel Bar and Rio Juruena	Amazon	Apuí, Amazonas	Experience the production of cassava flour, local handicrafts and extractivism of Brazil nut.	Estação Gabiraba
23	Amapá National Forest	Amazon	Oiapoque, Amapá	Visit national forests and riverside communities.	Estação Gabiraba
24	Macapá - Amapá Amazon River	Amazon	Macapá, Amapá	Tours conducted by park rangers to experience nature and local communities.	Estação Gabiraba
25	Reserva Extrativista do Cazumbá Iracema	Amazon	Sena Madureira, Acre	Experience community-based tourism management model.	(MORAES, 2010)
26	Associação Agroextrativista da Reserva Extrativista do Rio Liberdade	Amazon	Cruzeiro do Sul, Acre	Experience Açaí extractivism.	(ICMBIO, 2018a)
27	Associação de Produtores Agroextrativistas da FLONA de Tefé e Entorno (APAFE)	Amazon	Tefé and Alvarães, Amazonas	Experience Brazil nut extractivism. Trails and community's regional food.	(ICMBIO, 2018a)
28	Cooperativa Mista Agroextrativista do Rio Unini - COOMARU	Amazon	Barcelos e Novo Airão, Amazonas	Experience Brazil nut extractivism.	(ICMBIO, 2018a)

29	Associação de Moradores e Produtores Rurais e Extrativistas da comunidade de Jamaraquá-Rio Tapajós (ASMORJA)	Amazon	Belterra, Pará	Sociobiodiversity chain in Tapajós National Forest;	(ICMBIO, 2018a)
30	Associação de Moradores do Acaratinga	Amazon	Belterra, Pará	Sociobiodiversity chain in Tapajós National Forest;	(ICMBIO, 2018a); (FONTOURA et al., 2019)
31	Associação de Moradores e Produtores Rurais e Extrativistas da Comunidade de Piquiatuba	Amazon	Belterra, Pará	Sociobiodiversity chain in Tapajós National Forest and experience Açaí extractivism.	(ICMBIO, 2018a); (FONTOURA et al., 2019)
32	Reserva Extrativista Marinha de Caeté-Taperaçu	Amazon	Bragança, Pará	Experience community-based tourism management model.	(FREITAS, 2013)
33	Associação dos Seringueiros e Agroextrativista do Baixo Rio Ouro Preto (ASAEX)	Amazon	Guajará Mirim, Rondônia	Trekking with overnight stay at Rio Ouro Extractive Reserve, and experience Açaí, Brazil nut and Babaçu extractivism.	(ICMBIO, 2018a)
34	Marine Extractive Reserve of Soure	Amazon	Soure, Pará	Experience community-based tourism management model.	(ICMBIO, 2018a); (BASTOS; FILHO, 2020)
35	Associação dos Seringueiros do Rio Ouro Preto (ASROP)	Amazon	Guajará Mirim, Rondônia	Overnight stay at Rio Ouro Extractive Reserve.	(ICMBIO, 2018a)
36	Associação Remanescente do Quilombo Salamina Putumuju	Atlantic Forest	Maragogipe, Bahia	Visit to the ruins of the ancient slavery mill, forest trails and walks mangrove and estuary.	(ICMBIO, 2018a)
37	Associação de Moradores, Agricultores e Pescadores do Puxim da Praia (AMAPPP)	Atlantic Forest	Canavieiras, Bahia	Boat ride mangrove swamp, visitation to the “black mud” and visits to the association headquarters.	(ICMBIO, 2018a)

38	Projeto Serras Guerreiras de Tupuruquara	Amazon	Santa Isabel do Rio Negro, Amazonas	Community tourism in indigenous territory.	Associação das Comunidades Indígenas e Ribeirinhas (ACIR).
39	Community-Based Tourism in Campo Buriti, Jequitinhonha Valley	Cerrado	Turmalina, Minas Gerais	Visit women artisans who produce the ceramic dolls of Jequitinhonha Valley.	Garupa and Vivejar
40	Community-Based Tourism in Mambaí	Cerrado	Mambaí, Goiás	Waterfalls, canyons and caves.	Goiás government
41	Passeio Caminhos de Guajuvira	Atlantic Forest	Araucária, Paraná	Tourist route where tourists can enjoy the rural area and try cheeses, salami, liqueurs, seasonal fruits, jams and stroll on foot or on horseback.	Associação de Turismo Rural Caminhos de Guajuvira (ATRCG)
42	Povoado de Mandacaru e Canto de Atins	Cerrado	Barreirinhas, Maranhão	Small fishing village	Secretaria de Estado do Maranhão
43	Queimada dos Britos e Baixa Grande	Cerrado	Barreirinhas, Maranhão	Lençóis Maranhenses National Park;	Secretaria de Estado do Maranhão
44	RDS do Uatumã	Amazon	Itapiranga e São Sebastião do Uatumã, Amazonas	Experience community-based tourism management model.	Instituto para Conservação e Desenvolvimento Sustentável do amazonas (IDESAM)
45	Aldeia dos Lagos Lodging	Amazon	Silves, Amazônia	Tourism in the ecological lodging with the local communities.	(MONCAYO; RIBEIRO, 2005)
46	Comunidade Santo Amaro	Amazon	Belém, Pará	Experience the life, culture and activities of the riverside communities.	Instituto de Desenvolvimento Florestal e da Biodiversidade do Estado do Pará (Ideflor-bio)
47	Vivência Baré	Amazon	Manaus, Amazonas	Experience the life, culture and activities of indigenous communities.	UIKA
48	Assentamento Coqueirinho	Caatinga	Fortim, Ceará	Experience the life, culture and	Rede TUCUM

				activities of local communities.	
49	Jenipapo-Kanindé	Caatinga	Aquiraz, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM
50	RESEX do Batoque	Caatinga	Aquiraz, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM
51	Assentamento Maceió	Caatinga	Itapipoca, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM
52	Curral Velho	Caatinga	Acaraú, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM
53	Caetanos de Cima	Caatinga	Amontada, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM
54	Associação dos Moradores de Tatajuba	Caatinga	Camocim, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM
55	Vivência Xavante	Cerrado	Canarana, Mato Grosso	Experience the life, culture and activities of indigenous communities.	https://turismo.ambiental.tur.br/vivencia-xavante
56	RESEX LAGO DO CUNIÃ	Amazon	Porto Velho, Rondônia	Experience the life, culture and activities of local communities.	(TOLENTINO et al., 2019)
57	Tremembé community	Caatinga	Icapuí, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM
58	Centro de Formação Frei Humberto	Caatinga	Fortaleza, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM
59	Vila da Volta	Caatinga	Aracati, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM
60	Associação Peixe-boi	Atlantic Forest	São Miguel dos Milagres, Porto de Pedras, Alagoas	Experience the life of local communities and Peixe-oi preservation program	Associação Peixe-boi
61	Pra manter a floresta em pé: Comunidade Tumbira	Amazon	Iranduba, Amazonas	Experience the life, culture and activities of local communities.	Garupa, https://www.poranduba-amazonia.com/sobre-nos

62	Trilhas Griô, Chapada Diamantina	Caatinga	Lençóis, Bahia	Experience the life, culture and activities of local communities and experience unique ecosystems.	Garupa
63	Pousada Lagoa do Cassange	Atlantic Forest	Maraú, Bahia	Occupies an area of four hectares in the Maraú Peninsula, with reefs, hills waterfalls and Vila do Saleiro	Garupa
64	Capivari village	Cerrado	Serro, Minas Gerais	Experience the life, culture and activities of local communities.	Garupa
65	Cristalino Lodge	Amazon	Alta Floresta, Mato Grosso	Located in a Private Natural Heritage Reserve (RPPN)	Garupa
66	Caiman Ecological Refuge	Pantanal	Miranda, Mato Grosso do Sul	Covers 53,000 hectares and is home to the Private Natural Heritage Reserve (RPPN), where research projects are developed.	Garupa
67	Rural Paths Project	Atlantic Forest	Porto Alegre, Rio Grande do Sul	Experience the life, culture and activities of rural establishments.	Garupa
68	Poço das Antas Biological Reserve	Atlantic Forest	Silva Jardim, Rio de Janeiro	Visit a family of golden lion tamarins in their natural habitat and learn all about this endemic species.	Garupa
69	Fisherman Stories: Araújo Island	Atlantic Forest	Paraty, Rio de Janeiro	Canoeing, hiking through the forest, fishing in the company of the island's residents.	Garupa
70	Quilombo da Fazenda	Atlantic Forest	Ubatuba, São Paulo	Experience the life, culture and activities of quilombola communities.	Garupa
71	Boa Vista Village	Atlantic Forest	Ubatuba, São Paulo	Experience the life, culture and activities of indigenous communities.	Garupa
72	Golden landscape: Community of Prata, Jalapão	Cerrado	São Félix do Tocantins, Tocantins	Experience the life, culture and activities “Sempre-Viva” pickers.	Garupa

73	Quilombo Campinho da Independência	Atlantic Forest	Paraty, Rio de Janeiro	Experience the life, culture and activities of quilombola communities.	Garupa
74	YARIPO: Yanomami Ecotourism	Amazon	Santa Isabel do Rio Negro and São Gabriel da Cachoeira, Amazonas	Located in Parque Pico da Neblina, which overlaps with 4 demarcated indigenous lands.	ISA
75	Araras–Videiras Circuit	Atlantic Forest	Petrópolis, Rio de Janeiro	Experience the life, culture and activities of rural establishments.	Petrópolis City hall
76	Ecorrural Caminhos do Brejal Circuit	Atlantic Forest	Petrópolis, Rio de Janeiro	Experience the life, culture and activities of rural establishments.	Petrópolis City hall
77	Pedras do Taquaril Circuit	Atlantic Forest	Petrópolis, Rio de Janeiro	Experience the life, culture and activities of rural establishments.	Petrópolis City hall
78	Marajoaras farms Ilha de Marajó	Amazon	Anajás, Pará	Experience the life, culture and activities of local communities from Marajó insland.	Pará Tour
79	Quilombo Mumbuca	Cerrado	Mateiros, Tocantins	Experience the life, culture and activities of quilombola communities.	Tocantins tourism
80	Liberty Route	Atlantic Forest	Cachoeira, Bahia	Experience the life, culture and activities of quilombola communities.	Rural Brazil Institute
81	Green Coffee Route	Caatinga	Mulungu, Guaramiranga, Pacoti and Baturité, Ceará	Part of the sustainable development of the Baturité Massif Region, linking Tourism, Agribusiness and Creative Economy.	SEBRAE
82	Brejo Paraibano	Caatinga	Areia, Bananeiras, Alagoa Grande, Pilões, Pirpirituba, Serraria, Belém, Guarabira, Duas Estradas, Borborema, Serra da Raiz, Remígio, Dona Inês, Solânea, Alagoa Nova, Matinhas, Mari and Sapé in Paraíba	Tourist region for experiences and contact with the local culture.	Destino Brejo website https://brejoparaibano.com.br/
83	Serra Negra and Bezerros Rural Area	Caatinga	Bezerros, Pernambuco	Experience the life, culture and activities of rural establishments.	(GUIMARÃES et al., 2020)

84	Visit Pedro II	Caatinga	Pedro II, Piauí	Experience the life, culture and activities of local communities.	(GUIMARÃES et al., 2020)
85	Visit Pirenópolis	Cerrado	Pirenópolis, Goiás	Located in Serra dos Pirineus State Park.	(GUIMARÃES et al., 2020)
86	Venda Nova do Imigrante	Atlantic Forest	Venda Nova do Imigrante, Espírito Santo	Has several farms and sites open for visitation and participation in some activities practiced on the properties.	(GUIMARÃES et al., 2020)
87	Conceição do Castelo	Atlantic Forest	Conceição do Castelo, Espírito Santo	Has several farms and sites open for visitation and participation in some activities practiced on the properties.	(GUIMARÃES et al., 2020)
88	Stone Paths Itinerary	Atlantic Forest	Bento Gonçalves, Rio Grande do Sul	Has several farms and sites open for visitation and participation in some activities practiced on the properties.	(GUIMARÃES et al., 2020)
89	Valley of the vineyards	Atlantic Forest	Bento Gonçalves, Garibaldi e Monte Belo do Sul, Rio Grande do Sul	Has several farms and sites open for visitation and participation in some activities practiced on the properties.	(GUIMARÃES et al., 2020)
90	Mosaico Sertão Veredas do Peruaçu - APA and PARNA Cavernas do Peruaçu	Cerrado	Formoso, Arinos, Chapada Gaúcha, Urucuia, Cônego Marinho, Januária, Itacarambi, Bonito de Minas, São João das Missões, Miravânia e Manga in Minas Gerais and Cocos in Bahia state.	Experience the life, culture and activities of local communities within a mosaic of Conservation Units, promote community-based tourism, biodiversity conservation and sustainable extractivism of PFNMs.	Mosaico Sertão Veredas do Peruaçu website
91	Rio Negro Community Tourism Itinerary (Tucorin)	Amazon	Novo Airão, Amazonas	Get to know the culture and way of life of the riverside populations with visits to the cassava flour artisanal production process, forest trail participation	Ministry of Tourism (MTUR, 2020)

				in an indigenous ritual. The communities are São João do Tupé, São Sebastião, Nova Esperança, Terra Preta, and Bela Vista do Baixo Rio Negro, located within Conservation Units.	
92	Vitória Farm Hotel	Amazon	Tracuateua, Pará	Known for the buffalo crossing, they swim the distance of the branches of the Tracuateua River, Buffalo also grazes freely, exploring the territory.	Ministry of Tourism (MTUR, 2020)
93	Lavrado Route	Amazon	Boa Vista, Roraima	Route that receives visitors interested in a new alternative of rural tourism in the surroundings of the capital of Roraima state.	Ministry of Tourism (MTUR, 2020)
94	Cocoa Coast	Atlantic Forest	Ilhéus, Itacaré, Ipiaú, Maraú, Una, Canavieiras, Itabuna, Uruçuca, Santa Luzia, Pau Brasil e São José da Vitória in Bahia state	Honors the period when the production and export of cocoa was the main activity of the Brazilian economy. Redoubt of natural beauty, rivers bordered by cocoa farms, untouched beaches, vast coconut groves and dense mangroves.	Ministry of Tourism (MTUR, 2020)
95	Lakes and Flowered Fields Tourist Region	Amazon	Arari, Penalva, Cajapió, Conceição de Lago Açu, Maranhão state.	Area formed by vast natural fields, savanna and Babaçu forests (NTFPs), lakes, rivers and estuaries and preserved Amazon rainforest with trails and lakes.	Ministry of Tourism (MTUR, 2020)
96	Paraíba: 35 days of experiences	Caatinga	Areia, Bananeiras, Conde, Pitimbu, Lucena,	Experience visit natural pools, the	Ministry of Tourism

			Cabedelo, Pilões, Alagoa Grande, Boqueirão, Cabaceiras, Ingá, Guarabira, Remígio, Solânea, João Pessoa, Campina Grande, Rio Tinto, Mamanguape e Marcação, Paraíba state.	manatee and sea turtle habitat, ecological trails, historical churches, handcrafts, gastronomic tour, cultural presentations, sport fishing, boat trips on a fisherman's boat.	(MTUR, 2020)
97	Paths of the Baron of Araruna	Caatinga	Araruna, Paraíba state.	Historical, cultural and natural tour with visits to sanctuaries, rockoutcrops, historical center, farms and waterfalls.	Ministry of Tourism (MTUR, 2020)
98	Bonito's Waterfalls	Atlantic Forest	Bonito, Pernambuco state	Natural attractions such as waterfalls.	Ministry of Tourism (MTUR, 2020)
99	Rural Tourism in Gravatá	Caatinga	Gravatá, Pernambuco state	Gastronomic tourism, horseback riding or off-road, visit protected areas, hiking and waterfalls.	Ministry of Tourism (MTUR, 2020)
100	São Benedito do Sul waterfalls	Atlantic Forest	São Benedito do Sul, Pernambuco state	Visit waterfalls, quilombola community, handicrafts, and gastronomy, where you can learn about the process of making homemade flour and candy “biju”.	Ministry of Tourism (MTUR, 2020)
101	Costa Branca Tourist Region	Caatinga	Areia Branca, Grossos, Mossoró, Serra do Mel e Tibau, Rio Grande do Norte state.	Caatinga vegetation, dunes, cliffs, beaches. This region is a great producer of salt, oil, and fruit. It gathers archeological and paleontological sites	Ministry of Tourism (MTUR, 2020)
102	Mountains of Agreste Potiguar	Caatinga	Monte das Gameleiras, Passa e Fica e Serra de São Bento, Rio Grande do Norte state.	Mountains, caves, trails, hiking and gastronomy.	Ministry of Tourism (MTUR, 2020)
103	São Francisco River Canyons	Caatinga	Canindé de São Francisco, Sergipe state.	Natural attractions such as canyons, local gastronomy	Ministry of Tourism

					(MTUR, 2020)
104	Poconé	Pantanal	Poconé, Mato Grosso state.	Wildlife Tour in the Pantanal biome.	Ministry of Tourism (MTUR, 2020)
105	Cáceres Water Route Region	Pantanal	Chapada dos Guimarães, Nobres, Poconé/Pantanal, Rondonópolis, Jaciara, Juscimeira, Poxoréu, Cáceres, Vila Bela da Santíssima Trindade, Tangará da Serra, Campo Novo dos Parecis, Barra do Garças e Nova Xavantina, Mato Grosso state.	Tourist Circuit of Natural Attractions of Mato Grosso.	Ministry of Tourism (MTUR, 2020)
106	Serras Verdes do Sul de Minas	Atlantic Forest	Bom Repouso, Bueno Brandão, Cachoeira de Minas, Camanducaia, Cambuí, Conceição dos Ouros, Congonhal, Consolação, Córrego do Bom Jesus, Estiva, Extrema, Gonçalves, Itapeva, Munhoz, Sapucaí-Mirim, Paraisópolis, Senador Amaral, Senador José Bento, Tocos do Moji e Toledo in Minas Gerais state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)
107	Hat Circuit	Atlantic Forest	Domingos Martins, Espírito Santo state	The circuit offers lodging in a calm environment, ecological hikes, homemade products, and good food.	Ministry of Tourism (MTUR, 2020)
108	Agritourism Circuit	Atlantic Forest	Venda Nova do Imigrante, Espírito Santo state	Agritourism is a family-based tourist activity practiced on small properties where tourists can follow the production process and experience the local culture. The circuit offers: cookies, handicrafts, cachaças, wines, fishing, cheeses, coffee, sweets, jams, dairy products.	Ministry of Tourism (MTUR, 2020)

109	Caparaó Capixaba Circuit	Atlantic Forest	Divino São Lourenço, Dores do Rio Preto, Guaçuí e Ibitirama, Espírito Santo state	From the Caparaó Mountains descend crystalline waters that form falls, rapids, and natural pools.	Ministry of Tourism (MTUR, 2020)
110	Troopers' Trail	Atlantic Forest	Ibatiba, Iúna, Irupi e Muniz Freire, Espírito Santo state	On these paths, one can pass through 11 rural properties.	Ministry of Tourism (MTUR, 2020)
111	Caravaggio Circuit	Atlantic Forest	Santa Teresa, Espírito Santo state	Along the Caravaggio Road, several activities and enterprises dedicated to agritourism have been established, most of them run by Italian immigrant descendants, producers of handicrafts, rustic furniture, liqueurs, wines, cachaça, sparkling wines, and sweets, natural attractions.	Ministry of Tourism (MTUR, 2020)
112	Pomeranian Lands	Atlantic Forest	Santa Maria de Jetibá, Espírito Santo state	Originally formed by family farmers, it has a great diversity of agricultural production, being characterized as an important pole of primary production, based, mainly, on poultry farming, olericulture, and coffee farming.	Ministry of Tourism (MTUR, 2020)
113	Pontões Capixabas Circuit	Atlantic Forest	Pancas, Espírito Santo state	This circuit has countless natural and cultural attractions of great relevance, such as the Pontões Capixaba Natural Monument, valleys, peaks, and mountains surrounded by remnants of the preserved Atlantic Forest and waterfalls.	Ministry of Tourism (MTUR, 2020)

114	Caminhos da Roça	Atlantic Forest	Afonso Cláudio, Espírito Santo state	This is a route through exuberant landscapes where you can enjoy the best the town has to offer in gastronomy and lodging. Visitors can enjoy inns in the middle of farms and woods, typical cuisine from the countryside, cachaça distilleries, homemade wines, and also get to know and purchase local handicrafts.	Ministry of Tourism (MTUR, 2020)
115	Emperor's Paths	Atlantic Forest	Conceição do Castelo, Espírito Santo state	has a natural and cultural wealth that has been little explored. With areas of Atlantic Forest preservation and mountainous climate, the town has several tourist attractions.	Ministry of Tourism (MTUR, 2020)
116	Green Valley	Atlantic Forest	Marechal Floriano, Espírito Santo state	Rural lodgings, restaurants with homemade food, sweets, cheeses, sausages, waterfalls, historical collections, and several leisure options who seek immediate contact with the country life.	Ministry of Tourism (MTUR, 2020)
117	Grape and Coffee Circuit	Atlantic Forest	Vargem Alta, Espírito Santo state	The grape has been in the region for about 50 years and serves as the basis for wines, jellies, and juices. Coffee is strong in the highland region.	Ministry of Tourism (MTUR, 2020)
118	Cliffs and Lagoons Circuit	Atlantic Forest	Marataízes, Espírito Santo state	Family agroindustry for the processing of the fruits produced in the	Ministry of Tourism (MTUR, 2020)

				region, especially the pineapple.	
119	Agritourism Circuit Paths	Atlantic Forest	Serra, Espírito Santo state	The delicious food cooked on a wood-burning stove, fishing, handcrafts, lodging, trails, pools, and horseback riding.	Ministry of Tourism (MTUR, 2020)
120	Highlands Circuit	Atlantic Forest	Cariacica, Espírito Santo state	Family agriculture, and typical cuisine in rural properties that promote perfect integration with nature and country life.	Ministry of Tourism (MTUR, 2020)
121	Demetrio Ribeiro	Atlantic Forest	João Neiva, Espírito Santo state	Visit historical houses, traditional parties, waterfalls, typical Italian gastronomy, agro-industrial products, especially cheese production and handcrafts.	Ministry of Tourism (MTUR, 2020)
122	Lower Sweet Creek	Atlantic Forest	Linhares, Espírito Santo state	Visitors can learn about the production of handcraft in coconut, wood and banana tree fiber, local artisanal agroindustry, visit a cheese factory, a buffalo farm, lagoon, trail in the sandbanks, get to know the turtles from the Tamar Project.	Ministry of Tourism (MTUR, 2020)
123	Sapé Quilombo	Atlantic Forest	Brumadinho, Minas Gerais state	Built by former slaves and their descendants still cultivate many customs and cultural traditions inherited from their predecessors.	Ministry of Tourism (MTUR, 2020)
124	Gonçalves	Atlantic Forest	Gonçalves, Minas Gerais state	Natural beauty and a pleasant climate, the old houses, the wood-burning stoves, and the ovens still exist and can be	Ministry of Tourism (MTUR, 2020)

				visited. In these ovens, cookies, cornbread, and doughnuts are baked.	
125	Rural Mantiqueira	Atlantic Forest	Bueno Brandão e Munhoz, Minas Gerais state	Natural beauty, rivers, waterfalls, rural old houses and farms.	Ministry of Tourism (MTUR, 2020)
126	Minas Gerais' Villages and Farms Circuit Circuit	Atlantic Forest	Santana dos Montes, Minas Gerais state	Rural property dated from 1741 transformed into a farm hotel and integrated to the Estrada Real, wine tasting, beer and cachaças.	Ministry of Tourism (MTUR, 2020)
127	Silva Jardim	Atlantic Forest	Silva Jardim, Rio de Janeiro state	Natural beauty, rivers, waterfalls, rural old houses and farms.	Ministry of Tourism (MTUR, 2020)
128	Rural Tourism in the countryside of Rio de Janeiro	Atlantic Forest	Angra dos Reis, Barra do Piraí, Cantagalo, Guapimirim, Madalena, Nova Friburgo, Paraty e Trajano de Moraes, Rio de Janeiro state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)
129	Coffee Valley	Atlantic Forest	Vassouras, Rio de Janeiro state	Visit old houses, churches, roads and farms.	Ministry of Tourism (MTUR, 2020)
130	Freedom Trail	Atlantic Forest	Taubaté, São Luíz do Paraitinga, Cunha, São Paulo state	Tourism agency focused on the valorization of Traditional Black Communities through tourist itineraries, generating income and work for the members of the communities.	Ministry of Tourism (MTUR, 2020)
131	Fruit Circuit	Atlantic Forest	Atibaia, Indaiatuba, Itatiba, Itupeva, Jarinu, Jundiaí, Louveira, Morungaba, Valinhos, São Paulo state	Visit farms that produce fruit such as strawberries.	Ministry of Tourism (MTUR, 2020)
132	Brotas	Atlantic Forest	Brotas, São Paulo state	Rivers, waterfalls, rafting, adventure sports.	Ministry of Tourism (MTUR, 2020)
133	Socorro	Atlantic Forest	Socorro, São Paulo state	Rivers, waterfalls, rafting, adventure sports.	Ministry of Tourism (MTUR, 2020)
134	Carlópolis	Atlantic Forest	Carlópolis, Paraná state	Small and medium family farms, reference in the production	Ministry of Tourism (MTUR, 2020)

				of coffee and table guava.	
135	Marrecas' Ways Tour	Atlantic Forest	Francisco Beltrão, Paraná state	Experience the life, culture and activities of rural establishments, wine making.	Ministry of Tourism (MTUR, 2020)
136	Route Caminho de São Francisco da Esperança	Atlantic Forest	Guarapuava, Paraná state	Natural attractions, having almost 100 waterfalls and small-area family producers	Ministry of Tourism (MTUR, 2020)
137	Women's Coffee Paths	Atlantic Forest	Andirá, Barra do Jacaré, Carlopolis, Conselheiro Mairinck, Ibaiti, Jaboti, Jacarezinho, Japira, Joaquim Távora, Jundiaí do Sul, Pinhalão, Ribeirão Claro, Ribeirão do Pinhal, Salto do Itararé, Santana do Itararé, Santo Antonio da Platina, Siqueira Campos, Tomazina, Paraná state	Experience the life, culture and activities of rural establishments, coffee plantations.	Ministry of Tourism (MTUR, 2020)
138	Flavors of the Earth Route	Atlantic Forest	Sapopema, Paraná state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)
139	São Luiz do Purunã Rural Tourism Circuit	Atlantic Forest	Balsa Nova, Paraná state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)
140	Italian Rural Tourism Circuit	Atlantic Forest	Colombo, Paraná state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)
141	Rural Green Tourism Circuit I Want You Green	Atlantic Forest	Campo Magro, Paraná state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)
142	Sabiá Circuit - Tourism in Family Farming	Atlantic Forest	Matelândia, Paraná state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)
143	The Wine Route	Atlantic Forest	São José dos Pinhais, Paraná state	Experience the life, culture and activities of rural establishments, wine making.	Ministry of Tourism (MTUR, 2020)
144	Vineyard Valley	Atlantic Forest	Garibaldi, Monte Belo do Sul e Bento Gonçalves, Rio Grande do Sul state	Experience the life, culture and activities of rural establishments, wine making.	Ministry of Tourism (MTUR, 2020)
145	Paths of the Colony	Atlantic Forest	Caxias do Sul e Flores da Cunha, Rio Grande do Sul state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)

146	Agritourism in Gramado	Atlantic Forest	Gramado, Rio Grande do Sul state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)
147	Western Charms	Atlantic Forest	Concórdia, Itá, Seara, Peritiba, Ipira e Alto Bela Vista, Rio Grande do Sul state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)
148	Rural Tourism in the Santa Catarina Mountains	Atlantic Forest	Lages, São Joaquim e Bom Jardim da Serra, Rio Grande do Sul state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)
149	Turismo Comunitário em Seritinga	Atlantic Forest	Seritinga, Minas Gerais	Experience the life, culture and activities of rural establishments.	(MORAES; MENDONÇA; PINHEIRO, 2017)
150	Boas práticas de turismo de base comunitária no Território da Serra do Brigadeiro	Atlantic Forest	Araponga, Minas Gerais	Experience the life, culture and activities of rural establishments.	(MORAES; MENDONÇA; PINHEIRO, 2017)
151	Local productive arrangements (LPA) Destinos Turísticos Inteligentes no RN	Atlantic Forest	Natal, Rio Grande do Norte	Lodging, receptive tourism agencies, tour guides, and tourism-related production entrepreneurs	http://www.observatorioapl.gov.br/
152	Local productive arrangements (LPA) Fortalecimento do Turismo em Natal e região metropolitana	Atlantic Forest	Natal, Rio Grande do Norte	Information not found	http://www.observatorioapl.gov.br/
153	Local productive arrangements (LPA) Ovinos e Turismo do Alto Camaquã	Pampa	Bagé, Caçapava do Sul, Canguçu, Encruzilhada do Sul, Lavras do Sul, Piratini, Pinheiro Machado e Santana da Boa Vista, Rio Grande do Sul	Information not found	http://www.observatorioapl.gov.br/
154	Local productive arrangements (LPA) Turismo	Atlantic Forest	Alcobaça, Bahia	Information not found	http://www.observatorioapl.gov.br/
155	Local productive arrangements (LPA) Turismo	Atlantic Forest	João Pessoa, Paraíba	Information not found	http://www.observatorioapl.gov.br/
156	Local productive arrangements (LPA) Turismo	Cerrado	Araguaína, Tocantins	Information not found	http://www.observatorioapl.gov.br/
157	Local productive arrangements	Atlantic Forest	Areia, Paraíba	Accommodation, restaurant services, snack	http://www.observatorioapl.gov.br/

	(LPA) Território do Brejo Paraibano			shops and bars, other tourist services	
158	Local productive arrangements (LPA) Território do Vale do Paraíba	Atlantic Forest	Sapé, Paraíba	Incentive to local and regional tourism - activities of associative organizations linked to culture and art	http://www.observatorioapl.gov.br/
159	Local productive arrangements (LPA) Região de São Luís e Munim	Atlantic Forest	São Luís, Maranhão	Information not found	http://www.observatorioapl.gov.br/
160	Local productive arrangements (LPA) da Rota Pantanal Bonito	Cerrado	Campo Grande, Minas Gerais	Information not found	http://www.observatorioapl.gov.br/
161	Local productive arrangements (LPA) da Rota Pantanal Bonito	Cerrado	Campo Grande, Minas Gerais	Information not found	http://www.observatorioapl.gov.br/
162	Local productive arrangements (LPA) Turismo de Marajó	Amazon	Soure, Pará	Information not found	http://www.observatorioapl.gov.br/
163	Local productive arrangements (LPA) Turismo de Mossoró	Caatinga	Mossoró, Rio Grande do Norte	Information not found	http://www.observatorioapl.gov.br/
164	Local productive arrangements (LPA) Turismo de Natal	Atlantic Forest	Natal, Rio Grande do Norte	Information not found	http://www.observatorioapl.gov.br/
165	Local productive arrangements (LPA) Turismo na Costa Doce	Atlantic Forest	Pelotas, Rio Grande do Sul	Services aimed at technical assistance to promote local tourism, business and events tourism, sun and beach, shopping, rural and cultural tourism.	http://www.observatorioapl.gov.br/
166	Local productive arrangements (LPA) Turismo Recife	Atlantic Forest	Pernambuco, Recife	Information not found	http://www.observatorioapl.gov.br/
167	Local productive arrangements	Atlantic Forest	Dias d`Ávila, Bahia	Information not found	http://www.observatorioapl.gov.br/

	(LPA) Turismo Religioso				
168	Local productive arrangements (LPA) Turismo Religioso do Vale do Paraíba	Atlantic Forest	Aparecida, São Paulo	Information not found	http://www.observatorioapl.gov.br/
169	Route of the Faxinais	Atlantic Forest	Prudentópolis, Paraná	Transform the Faxinais into a sustainable economic model of tourism, improving quality of life through economic income, demonstrating the importance of the community for the conservation of the Araucaria Forest.	(MOREIRA et al., 2011)
170	AGEMA - Associação de Guias, Ecoturismo e Meio Ambiente	Cerrado	São João d'Aliança, Goiás state.	Works at the Chapada dos Veadeiros National Park, environmental education, tour guide.	https://ispn.org.br/editais-ppp-ecos/
171	Associação de Auxiliares e Guias de Ecoturismo do Mamirauá	Amazon	Uarini, Amazonas state	The Association was born in June 2000 as an initiative of the service providers of Uacari Lodge as a way to improve the organization of the work in the enterprise. Residents of the 11 communities of the Mamirauá sector of the Mamirauá Reserve can become members. Recently, residents from other communities or the urban area who are related to someone from one of the 11 communities have been accepted. For this, it is necessary to become a member	https://www.conexsus.org/

				of a community, with the consent of the residents.	
172	Turismo Ecológico e Rural	Amazon	Manaus, Amazonas state	Services aimed at tourists who are interested in the Amazon nature.	https://www.gov.br/empresas-e-negocios/pt-br/observatorioapl/apls-brasileiros
173	Madalena Ecoturismo	Atlantic Forest	Santa Maria Madalena, Rio de Janeiro state	Market with a more pleasant and above all trustworthy outlook, trading energy-sustainable know-how and products.	https://www.conexsus.org/
174	Associação de Ecoturismo Pataxó de Aldeia Velha	Atlantic Forest	Porto Seguro, Bahia state.	The Association was created by the local indigenous community in order to support it in the articulation and development of projects that can contribute to the sustainability of the community. It has sought to improve communication between the Association and members, bringing proposals to expand its actions to strengthen development in a sustainable way, generating income and strengthening local production systems, giving income generation opportunities to women and young people.	https://www.conexsus.org/
175	Turismo - PRODETER - Território Mirantes da Ibiapaba	Caatinga	Carnaubal, Guaraciaba do Norte, Ipu, Ipueiras, São Benedito, Ubajara, Viçosa do Ceará in Ceará state.	Part of the Bank of Nordeste's Tourism Territorial Development Program.	https://www.gov.br/empresas-e-negocios/pt-br/observatorioapl/apls-brasileiros
176	Gemas, Joias, Artesanato Mineral e	Cerrado	Cristalina, Goiás	Supported by Construction of Mercado do Cristal and Fundo	https://www.gov.br/empresas-e-negocios/pt-

	Turismo de Cristalina			de Fomento a Mineração (FUNMINERAL)	br/observatorioapl/apls-brasileiros
177	Boi da Floresta	Amazon	São Luís, Maranhão	Services; Cultural Experience Tourism.	https://www.gov.br/empresas-e-negocios/pt-br/observatorioapl/apls-brasileiros
178	Vitivinicultura de Jundiaí	Atlantic Forest	Itatiba, Itupeva, Jarinu, Jundiaí, Louveira, Vinhedo in São Paulo state	Grape, wine and wine tourism.	https://www.gov.br/empresas-e-negocios/pt-br/observatorioapl/apls-brasileiros
179	Região Turística Encantos do Jalapão	Cerrado	Lagoa do Tocantins, Lizarda, Mateiros, Novo Acordo, Ponte Alta, Rio Sono, Santa Tereza, São Félix in Tocantins state	Tourism packages (visitation to the attractions, lodging, food services, and guiding).	https://www.gov.br/empresas-e-negocios/pt-br/observatorioapl/apls-brasileiros
180	TURIARTE - Cooperativa de Turismo e Artesanato da Floresta	Amazon	Santarém, Pará state	Formed by a group of women from the Anã community who then, seeing the potential of handicrafts and tourism in the region joined with seven other communities and currently comprise 70 cooperative members, 54 women and 16 men.	Artesol
181	Quilombo Kalunga	Cerrado	Alto Paraíso de Goiás, Goiás state	Kalunga Historical Site and Cultural Heritage is known for its natural beauty and richness of fauna and flora. Here we offer the visitor several trails and walks between mountains and footpaths and countless ecological tourist attractions such as rivers, canyons, waterfalls and	http://quilombokalunga.org.br/

				thermal waters, as well as some sites that in the future will be released for visitation.	
182	Bonito	Cerrado	Bonito in Mato Grosso do Sul state	Hydric and rural tourism in a balanced way the relationship between the human being and nature, adventure sports, floating, waterfalls, caves, rappelling, contemplation, diving, and spas.	(JOSÉ et al., 2011)
183	Marine Mussel Farm	Atlantic Forest	Caraguatatuba, São Paulo	Artisanal mussel farm cultivated with environmental responsibility and traditional caiçara (traditional marine fishermen) knowledge. Visits are pre-scheduled, licensed boats take visitors to the cultivation site, pre-determined stops are made for explanations of the main stages and phases of mussel farming.	https://www.caragua.tur.br/atrativos/visita-a-fazenda-marinha-de-mexilhoes/
184	Cooperativa Mista dos Agricultores Familiares Extrativistas Pescadores Vazanteiros Assentados e Guias Turísticos do Cerrado (COOPCERRADO)	Cerrado	Goiânia, Goiás state	Sociobiodiverse community network that involves more than 5,000 agroextractivist families carrying out agroecological, organic, and sustainable management. Associated to the e-commerce "Empório do Cerrado".	https://emporiodocerrado.org.br/site/ (WWF, 2022)
185	Small Farmers' Agroecological Technology Center (Agrotec)	Cerrado	Diorama, Goiás state	Promote the use of the Cerrado's biodiversity resources with 21 families in the collection, cultivation, extraction of oils,	(SAWYER et al., 2015)

				such as Baru and Pequi, handicrafts and ecotourism.		

Table S.2 List of place-based tourism initiatives within NTFPs landscapes selected.

ID	Name	Biome	Municipality and state	Description	Source	Tourism modality
1	Turismo de vilarejo no distrito de Cuiabá	Cerrado	Gouveia Minas Gerais	Visit organic gardens that produce vegetables, garlic and spices.	Portal Minas Gerais	Agritourism
2	Turismo rural em Turvo	Atlantic Forest	Turvo, Paraná	Experience the rural daily life of indigenous Guarani Koe Ju Porã and quilombola Campina dos Morenos, visit old farm houses and waterfalls;	(CALEGARI, 2012) Paraná Turismo Website.	Agritourism
3	Associação de Agroturismo Acolhida na Colônia	Atlantic Forest	Campo Alegre, Joinville, São Bento do Sul, Anitápolis, Gravatal, Imbituba, Rancho Queimado, Rio Fortuna, Santa Rosa de Lima, São Bonifácio, Florianópolis, Ibirama, Presidente Nereu, Witmarsum, Atalanta, Aurora, Agrolândia, Agronômica, Lontras, Rio do Sul, Alfredo Wagner, São Joaquim, Urubici, Lauro Muller in Santa Catarina and Casimiro de Abreu in Rio	Family farmers who receive tourists to show their work and the environment in which they live. In 2022 started a project that seeks the Productive Structuring and valorization in the Acolhida na Colônia initiative and strategies in the scope of the Bioeconomy Program Brazil Sociobiodiversity, by surveying and valuing the Mate Herb and the Araucaria seed.	Associação de Agroturismo Acolhida na Colônia https://acolhida.com.br/	Agritourism

			de Janeiro state.			
4	CBT in RESEX Rio Unini	Amazon	Novo Airão, Amazonas	Experience the daily life of the community.	(ICMBIO, 2018b)	CBT
5	RDS Rio Negro, Margem Direita	Amazon	Iranduba, Amazonas	Visits to riverside family farmers and indigenous communities; Experience the daily life of the communities.	Fundação Amazonas Sustentável (FAS)	CBT
6	APA Margem Esquerda do Rio Negro Tarumã-Açu/ Tarumã-Mirim	Amazon	Manaus, Amazonas	Visits to riverside family farmers and indigenous communities; Experience the daily life of the communities.	Fundação Amazonas Sustentável (FAS)	CBT
7	Reserva Extrativista Tapajós-Arapiuns	Amazon	Santarém, PA	Living the routine of an Amazonian riverside community in extractivism and subsistence agriculture.	Garupa, Vivejar	CBT
8	Plano de Apoio a Taquaruçu	Cerrado	Palmas, Tocantins	Tourism of leisure and experience nature.	Turismo Tocantins	Ecotourism
9	Assentamento Rural Tijuca Boa Vista	Caatinga	Quixadá, Ceará	Rural tourism in family farming	(MAIA, 2015)	Agritourism
10	Monte Alegre: patrimônio natural e pinturas rupestres	Amazon	Monte Alegre, Pará	Experience traditional way of life; Visit rock painting sites.	Vivejar and Estação Gabiraba	Ecotourism
11	Riverside Belém/Combu	Amazon	Belém, Pará	Experience traditional cultivation of cocoa.	Vivejar and Estação Gabiraba	Ecotourism
12	Uacari Lodge | Reserva Mamirauá	Amazon	Tefé, Amazonas	Living and learning the way of life of Amazonian communities.	Mamirauá Sustainable Development Institute	Ecotourism
13	Segredos e Temperos da Amazônia	Amazon	Belém, Pará	Know the seasonings of the region through community-based entrepreneurs.	Vivejar	CBT
14	Vivência Yawanawá	Amazon	Cruzeiro do Sul, Acre	Experience traditional way	Garupa, Vivejar,	CBT

				of life of indigenous tribe Yawanawá.		
15	Prainha do Canto Verde	Caatinga	Beberibe, Ceará	Local community manages lodging and the restaurant; Artisanal fishing.	Garupa, Organização Prainha do Canto Verde	CBT
16	Ponta Grossa	Caatinga	Icapuí, Ceará	One of the most beautiful beaches in the coast of Ceará, on raft, boat or buggy rides, and hear the incredible stories of the local fishermen	Garupa, Rede TUCUM	CBT
17	Associação Amazônia, Baixo Rio Branco	Amazon	Rorainópolis, Roraima	Tourism in communities surrounding the Amazon rivers.	Garupa	CBT
18	Projeto de Assentamento Extrativista Lago Grande	Amazon	Santarém, Pará	Discover the knowledge of a riverside community, trails through the Amazonian Forest.	Garupa, TURIARTE, Projeto Saúde e Alegria	CBT
19	Comunidade de Boa Vista do Acará	Amazon	Belém, Pará	Lifestyle of riverside community in the production of artisanal flour and harvesting of typical fruits (Açaí).	Garupa, Estação Gabiraba.	CBT
20	Quilombo do Cumbe	Caatinga	Aracati, Ceará	Aims the preservation of biodiversity and our traditional way of life.	Quilombo do Cumbe	CBT
21	São Manoel Bar and Rio Juruena	Amazon	Apuí, Amazonas	Experience the production of cassava flour, local handicrafts and extractivism of Brazil nut.	Estação Gabiraba	CBT
22	Amapá National Forest	Amazon	Oiapoque, Amapá	Visit national forests and riverside communities.	Estação Gabiraba	CBT
23	Macapá - Amapá Amazon River	Amazon	Macapá, Amapá	Tours conducted by park rangers to experience nature and local communities.	Estação Gabiraba	Ecotourism

24	Reserva Extrativista do Cazumbá Iracema	Amazon	Sena Madureira, Acre	Experience community-based tourism management model.	(MORAES, 2010)	Ecotourism
25	Associação Agroextrativista da Reserva Extrativista do Rio Liberdade	Amazon	Cruzeiro do Sul, Acre	Experience Açaí extractivism.	(ICMBIO, 2018a)	CBT
26	Associação de Produtores Agroextrativistas da FLONA de Tefé e Entorno (APAFE)	Amazon	Tefé and Alvarães, Amazonas	Experience Brazil nut extractivism. Trails and community's regional food.	(ICMBIO, 2018a)	CBT
27	Cooperativa Mista Agroextrativista do Rio Unini - COOMARU	Amazon	Barcelos e Novo Airão, Amazonas	Experience Brazil nut extractivism.	(ICMBIO, 2018a)	CBT
28	Associação de Moradores e Produtores Rurais e Extrativistas da comunidade de Jamaraquá-Rio Tapajós (ASMORJA)	Amazon	Belterra, Pará	Sociobiodiversity chain in Tapajós National Forest;	(ICMBIO, 2018a)	CBT
29	Associação de Moradores do Acaratinga	Amazon	Belterra, Pará	Sociobiodiversity chain in Tapajós National Forest;	(ICMBIO, 2018a); (FONTOURA et al., 2019)	CBT
30	Associação de Moradores e Produtores Rurais e Extrativistas da Comunidade de Piquiatuba	Amazon	Belterra, Pará	Sociobiodiversity chain in Tapajós National Forest and experience Açaí extractivism.	(ICMBIO, 2018a); (FONTOURA et al., 2019)	CBT
31	Reserva Extrativista Marinha de Caeté-Taperaçu	Amazon	Bragança, Pará	Experience community-based tourism management model.	(FREITAS, 2013)	CBT
32	Associação dos Seringueiros e Agroextrativista do Baixo Rio Ouro Preto (ASAEX)	Amazon	Guajará Mirim, Rondônia	Trekking with overnight stay at Rio Ouro Extractive Reserve, and experience Açaí, Brazil nut and Babaçu extractivism.	(ICMBIO, 2018a)	CBT
33	Marine Extractive	Amazon	Soure, Pará	Experience community-based tourism	(ICMBIO, 2018a);	CBT

	Reserve of Soure			management model.	(BASTOS; FILHO, 2020)	
34	Associação dos Seringueiros do Rio Ouro Preto (ASROP)	Amazon	Guajará Mirim, Rondônia	Overnight stay at Rio Ouro Extractive Reserve.	(ICMBIO, 2018a)	CBT
35	Associação Remanescente do Quilombo Salamina Putumuju	Atlantic Forest	Maragogipe, Bahia	Visit to the ruins of the ancient slavery mill, forest trails and walks mangrove and estuary.	(ICMBIO, 2018a)	CBT
36	Associação de Moradores, Agricultores e Pescadores do Puxim da Praia (AMAPPP)	Atlantic Forest	Canavieiras, Bahia	Boat ride mangrove swamp, visitation to the “black mud” and visits to the association headquarters.	(ICMBIO, 2018a)	CBT
37	Projeto Serras Guerreiras de Tupuruquara	Amazon	Santa Isabel do Rio Negro, Amazonas	Community tourism in indigenous territory.	Associação das Comunidades Indígenas e Ribeirinhas (ACIR).	Ecotourism
38	Community-Based Tourism in Campo Buriti, Jequitinhonha Valley	Cerrado	Turmalina, Minas Gerais	Visit women artisans who produce the ceramic dolls of Jequitinhonha Valley.	Garupa and Vivejar	CBT
39	Community-Based Tourism in Mambaí	Cerrado	Mambaí, Goiás	Waterfalls, canyons and caves.	Goiás government	CBT
40	Povoado de Mandacaru e Canto de Atins	Cerrado	Barreirinhas, Maranhão	Small fishing village	Secretaria de Estado do Maranhão	Ecotourism
41	Queimada dos Britos e Baixa Grande	Cerrado	Barreirinhas, Maranhão	Lençóis Maranhenses National Park;	Secretaria de Estado do Maranhão	Ecotourism
42	RDS do Uatumã	Amazon	Itapiranga e São Sebastião do Uatumã, Amazonas	Experience community-based tourism management model.	Instituto para Conservação e Desenvolvimento Sustentável do amazonas (IDESAM)	CBT
43	Aldeia dos Lagos Lodging	Amazon	Silves, Amazônia	Tourism in the ecological lodging with the local communities.	(MONCAYO; RIBEIRO, 2005)	Ecotourism
44	Comunidade Santo Amaro	Amazon	Belém, Pará	Experience the life, culture and activities of the riverside communities.	Instituto de Desenvolvimento Florestal e da Biodiversidade do Estado do	Ecotourism

					Pará (Ideflor-bio)	
45	Vivência Baré	Amazon	Manaus, Amazonas	Experience the life, culture and activities of indigenous communities.	UIKA	Ecotourism
46	Assentamento Coqueirinho	Caatinga	Fortim, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM	Agritourism
47	Jenipapo-Kanindé	Caatinga	Aquiraz, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM	CBT
48	RESEX do Batoque	Caatinga	Aquiraz, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM	CBT
49	Assentamento Maceió	Caatinga	Itapipoca, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM	CBT
50	Curral Velho	Caatinga	Acaraú, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM	CBT
51	Caetanos de Cima	Caatinga	Amontada, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM	CBT
52	Associação dos Moradores de Tatajuba	Caatinga	Camocim, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM	CBT
53	Vivência Xavante	Cerrado	Canarana, Mato Grosso	Experience the life, culture and activities of indigenous communities.	https://turismo.ambiental.tur.br/vivencia-xavante	CBT
54	RESEX LAGO DO CUNIÃ	Amazon	Porto Velho, Rondônia	Experience the life, culture and activities of local communities.	(TOLENTINO et al., 2019)	CBT
55	Tremembé community	Caatinga	Icapuí, Ceará	Experience the life, culture and activities of local communities.	Rede TUCUM	CBT
56	Vila da Volta	Caatinga	Aracati, Ceará	Experience the life, culture and activities of	Rede TUCUM	CBT

				local communities.		
57	Associação Peixe-boi	Atlantic Forest	São Miguel dos Milagres, Porto de Pedras, Alagoas	Experience the life of local communities and Peixe-oi preservation program	Associação Peixe-boi	Ecotourism
58	Pra manter a floresta em pé: Comunidade Tumbira	Amazon	Iranduba, Amazonas	Experience the life, culture and activities of local communities.	Garupa, https://www.poranduba-amazonia.com/sobre-nos	Ecotourism
59	Trilhas Griô, Chapada Diamantina	Caatinga	Lençóis, Bahia	Experience the life, culture and activities of local communities and experience unique ecosystems.	Garupa	Ecotourism
60	Pousada Lagoa do Cassange	Atlantic Forest	Maraú, Bahia	Occupies an area of four hectares in the Maraú Peninsula, with reefs, hills waterfalls and Vila do Saleiro	Garupa	Ecotourism
61	Cristalino Lodge	Amazon	Alta Floresta, Mato Grosso	Located in a Private Natural Heritage Reserve (RPPN)	Garupa	Ecotourism
62	Boa Vista Village	Atlantic Forest	Ubatuba, São Paulo	Experience the life, culture and activities of indigenous communities.	Garupa	CBT
63	Quilombo Campinho da Independência	Atlantic Forest	Paraty, Rio de Janeiro	Experience the life, culture and activities of quilombola communities.	Garupa	CBT
64	YARIPO: Yanomami Ecotourism	Amazon	Santa Isabel do Rio Negro and São Gabriel da Cachoeira, Amazonas	Located in Parque Pico da Neblina, which overlaps with 4 demarcated indigenous lands.	ISA	Ecotourism
65	Ecorrural Caminhos do Brejal Circuit	Atlantic Forest	Petrópolis, Rio de Janeiro	Experience the life, culture and activities of rural establishments.	Petrópolis City hall	Agritourism
66	Pedras do Taquaril Circuit	Atlantic Forest	Petrópolis, Rio de Janeiro	Experience the life, culture and activities of rural establishments.	Petrópolis City hall	Agritourism

67	Marajoaras farms Ilha de Marajó	Amazon	Anajás, Pará	Experience the life, culture and activities of local communities from Marajó insland.	Pará Tour	Agritourism
68	Liberty Route	Atlantic Forest	Cachoeira, Bahia	Experience the life, culture and activities of quilombola communities.	Rural Brazil Institute	CBT
69	Green Coffee Route	Caatinga	Mulungu, Guaramiranga, Pacoti and Baturité, Ceará	Part of the sustainable development of the Baturité Massif Region, linking Tourism, Agribusiness and Creative Economy.	SEBRAE	Agritourism
70	Brejo Paraibano	Caatinga	Areia, Bananeiras, Alagoa Grande, Pilões, Pirpirituba, Serraria, Belém, Guarabira, Duas Estradas, Borborema, Serra da Raiz, Remígio, Dona Inês, Solânea, Alagoa Nova, Matinhas, Mari and Sapé in Paraíba	Tourist region for experiences and contact with the local culture.	Destino Brejo website https://brejoparaibano.com.br/	Agritourism
71	Serra Negra and Bezerros Rural Area	Caatinga	Bezerros, Pernambuco	Experience the life, culture and activities of rural establishments.	(GUIMARÃES et al., 2020)	Agritourism
72	Visit Pedro II	Caatinga	Pedro II, Piauí	Experience the life, culture and activities of local communities.	(GUIMARÃES et al., 2020)	Agritourism
73	Stone Paths Itinerary	Atlantic Forest	Bento Gonçalves, Rio Grande do Sul	Has several farms and sites open for visitation and participation in	(GUIMARÃES et al., 2020)	Agritourism

				some activities practiced on the properties.		
74	Valley of the vineyards	Atlantic Forest	Bento Gonçalves, Garibaldi e Monte Belo do Sul, Rio Grande do Sul	Has several farms and sites open for visitation and participation in some activities practiced on the properties.	(GUIMARÃES et al., 2020)	Agritourism
75	Mosaico Sertão Veredas do Peruaçu - APA and PARNA Cavernas do Peruaçu	Cerrado	Formoso, Arinos, Chapada Gaúcha, Urucuia, Cônego Marinho, Januária, Itacarambi, Bonito de Minas, São João das Missões, Miravânia e Manga in Minas Gerais and Cocos in Bahia state.	Experience the life, culture and activities of local communities within a mosaic of Conservation Units, promote community-based tourism, biodiversity conservation and sustainable extractivism of PFNMs.	Mosaico Sertão Veredas do Peruaçu website	CBT
76	Rio Negro Community Tourism Itinerary (Tucorin)	Amazon	Novo Airão, Amazonas	Get to know the culture and way of life of the riverside populations with visits to the cassava flour artisanal production process, forest trail participation in an indigenous ritual. The communities are São João do Tupé, São Sebastião, Nova Esperança, Terra Preta, and Bela Vista do Baixo Rio Negro, located within Conservation Units.	Ministry of Tourism (MTUR, 2020)	CBT
77	Vitória Farm Hotel	Amazon	Tracuateua, Pará	Known for the buffalo crossing, they swim the distance of the	Ministry of Tourism (MTUR, 2020)	Agritourism

				branches of the Tracuateua River, Buffalo also grazes freely, exploring the territory.		
78	Cocoa Coast	Atlantic Forest	Ilhéus, Itacaré, Ipiaú, Maraú, Una, Canavieiras, Itabuna, Uruçuca, Santa Luzia, Pau Brasil e São José da Vitória in Bahia state	Honors the period when the production and export of cocoa was the main activity of the Brazilian economy. Redoubt of natural beauty, rivers bordered by cocoa farms, untouched beaches, vast coconut groves and dense mangroves.	Ministry of Tourism (MTUR, 2020)	Agritourism
79	Lakes and Flowered Fields Tourist Region	Amazon	Arari, Penalva, Cajapió, Conceição de Lago Açu, Maranhão state.	Area formed by vast natural fields, savanna and Babaçu forests (NTFPs), lakes, rivers and estuaries and preserved Amazon rainforest with trails and lakes.	Ministry of Tourism (MTUR, 2020)	Agritourism
80	Paraíba: 35 days of experiences	Caatinga	Areia, Bananeiras, Conde, Pitimbu, Lucena, Cabedelo, Pilões, Alagoa Grande, Boqueirão, Cabaceiras, Ingá, Guarabira, Remígio, Solânea, João Pessoa, Campina Grande, Rio Tinto, Mamanguape e Marcação, Paraíba state.	Experience visit natural pools, the manatee and sea turtle habitat, ecological trails, historical churches, handcrafts, gastronomic tour, cultural presentations, sport fishing, boat trips on a fisherman's boat.	Ministry of Tourism (MTUR, 2020)	Agritourism
81	Bonito's Waterfalls	Atlantic Forest	Bonito, Pernambuco state	Natural attractions such as waterfalls.	Ministry of Tourism	Ecotourism

					(MTUR, 2020)	
82	Rural Tourism in Gravatá	Caatinga	Gravatá, Pernambuco state	Gastronomic tourism, horseback riding or off-road, visit protected areas, hiking and waterfalls.	Ministry of Tourism (MTUR, 2020)	Agritourism
83	Mountains of Agreste Potiguar	Caatinga	Monte das Gameleiras, Passa e Fica e Serra de São Bento, Rio Grande do Norte state.	Mountains, caves, trails, hiking and gastronomy.	Ministry of Tourism (MTUR, 2020)	Agritourism
84	Poconé	Pantanal	Poconé, Mato Grosso state.	Wildlife Tour in the Pantanal biome.	Ministry of Tourism (MTUR, 2020)	Ecotourism
85	Cáceres Water Route Region	Pantanal	Chapada dos Guimarães, Nobres, Poconé/Pantanal, Rondonópolis, Jaciara, Juscimeira, Poxoréu, Cáceres, Vila Bela da Santíssima Trindade, Tangará da Serra, Campo Novo dos Parecis, Barra do Garças e Nova Xavantina, Mato Grosso state.	Tourist Circuit of Natural Attractions of Mato Grosso.	Ministry of Tourism (MTUR, 2020)	Ecotourism
86	Serras Verdes do Sul de Minas	Atlantic Forest	Bom Repouso, Bueno Brandão, Cachoeira de Minas, Camanducaia, Cambuí, Conceição dos Ouros, Congonhal, Consolação, Córrego do Bom Jesus, Estiva, Extrema,	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)	Agritourism

			Gonçalves, Itapeva, Munhoz, Sapucaí-Mirim, Paraisópolis, Senador Amaral, Senador José Bento, Tocos do Moji e Toledo in Minas Gerais state			
87	Agritourism Circuit	Atlantic Forest	Venda Nova do Imigrante, Espírito Santo state	Agritourism is a family-based tourist activity practiced on small properties where tourists can follow the production process and experience the local culture. The circuit offers: cookies, handicrafts, cachaças, wines, fishing, cheeses, coffee, sweets, jams, dairy products.	Ministry of Tourism (MTUR, 2020)	Agritourism
88	Emperor's Paths	Atlantic Forest	Conceição do Castelo, Espírito Santo state	has a natural and cultural wealth that has been little explored. With areas of Atlantic Forest preservation and mountainous climate, the town has several tourist attractions.	Ministry of Tourism (MTUR, 2020)	Agritourism
89	Lower Sweet Creek	Atlantic Forest	Linhares, Espírito Santo state	Visitors can learn about the production of handcraft in coconut, wood and banana tree fiber, local artisanal agroindustry, visit a cheese factory, a buffalo farm, lagoon, trail in the sandbanks,	Ministry of Tourism (MTUR, 2020)	Agritourism

				get to know the turtles from the Tamar Project.		
90	Gonçalves	Atlantic Forest	Gonçalves, Minas Gerais state	Natural beauty and a pleasant climate, the old houses, the wood-burning stoves, and the ovens still exist and can be visited. In these ovens, cookies, cornbread, and doughnuts are baked.	Ministry of Tourism (MTUR, 2020)	Agritourism
91	Rural Mantiqueira	Atlantic Forest	Bueno Brandão e Munhoz, Minas Gerais state	Natural beauty, rivers, waterfalls, rural old houses and farms.	Ministry of Tourism (MTUR, 2020)	Agritourism
92	Silva Jardim	Atlantic Forest	Silva Jardim, Rio de Janeiro state	Natural beauty, rivers, waterfalls, rural old houses and farms.	Ministry of Tourism (MTUR, 2020)	Agritourism
93	Socorro	Atlantic Forest	Socorro, São Paulo state	Rivers, waterfalls, rafting, adventure sports.	Ministry of Tourism (MTUR, 2020)	Ecotourism
94	Carlópolis	Atlantic Forest	Carlópolis, Paraná state	Small and medium family farms, reference in the production of coffee and table guava.	Ministry of Tourism (MTUR, 2020)	Agritourism
95	Marrecas' Ways Tour	Atlantic Forest	Francisco Beltrão, Paraná state	Experience the life, culture and activities of rural establishments, wine making.	Ministry of Tourism (MTUR, 2020)	Agritourism
96	Route Caminho de São Francisco da Esperança	Atlantic Forest	Guarapuava, Paraná state	Natural attractions, having almost 100 waterfalls and small-area family producers	Ministry of Tourism (MTUR, 2020)	Ecotourism
97	Women's Coffee Paths	Atlantic Forest	Andirá, Barra do Jacaré, Carlopolis, Conselheiro Mairinck, Ibaiti, Jaboti, Jacarezinho, Japira,	Experience the life, culture and activities of rural establishments, coffee plantations.	Ministry of Tourism (MTUR, 2020)	Agritourism

			Joaquim Távora, Jundiaí do Sul, Pinhalão, Ribeirão Claro, Ribeirão do Pinhal, Salto do Itararé, Santana do Itararé, Santo Antonio da Platina, Siqueira Campos, Tomazina, Paraná state			
98	Flavors of the Earth Route	Atlantic Forest	Sapopema, Paraná state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)	Agritourism
99	Passeio Caminhos de Guajuvira	Atlantic Forest	Araucária, Paraná	Tourist route where tourists can enjoy the rural area and try cheeses, salami, liqueurs, seasonal fruits, jams and stroll on foot or on horseback.	Associação de Turismo Rural Caminhos de Guajuvira (ATRCG)	Agritourism
100	São Luiz do Purunã Rural Tourism Circuit	Atlantic Forest	Balsa Nova, Paraná state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)	Agritourism
101	Rural Green Tourism Circuit I Want You Green	Atlantic Forest	Campo Magro, Paraná state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)	Agritourism
102	The Wine Route	Atlantic Forest	São José dos Pinhais, Paraná state	Experience the life, culture and activities of rural establishments, wine making.	Ministry of Tourism (MTUR, 2020)	Agritourism
103	Vineyard Valley	Atlantic Forest	Garibaldi, Monte Belo do Sul e Bento Gonçalves, Rio Grande do Sul state	Experience the life, culture and activities of rural establishments, wine making.	Ministry of Tourism (MTUR, 2020)	Agritourism
104	Paths of the Colony	Atlantic Forest	Caxias do Sul e Flores da Cunha,	Experience the life, culture and activities of	Ministry of Tourism (MTUR, 2020)	Agritourism

			Rio Grande do Sul state	rural establishments.		
105	Agritourism in Gramado	Atlantic Forest	Gramado, Rio Grande do Sul state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)	Agritourism
106	Western Charms	Atlantic Forest	Concórdia, Itá, Seara, Peritiba, Ipira e Alto Bela Vista, Rio Grande do Sul state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)	Agritourism
107	Rural Tourism in the Santa Catarina Mountains	Atlantic Forest	Lages, São Joaquim e Bom Jardim da Serra, Rio Grande do Sul state	Experience the life, culture and activities of rural establishments.	Ministry of Tourism (MTUR, 2020)	Agritourism
108	Local productive arrangements (LPA) Fortalecimento do Turismo em Natal e região metropolitana	Atlantic Forest	Natal, Rio Grande do Norte	Information not found	http://www.observatorioapl.gov.br/	Agritourism
109	Local productive arrangements (LPA) Turismo	Atlantic Forest	Alcobaça, Bahia	Information not found	http://www.observatorioapl.gov.br/	Agritourism
110	Local productive arrangements (LPA) Turismo	Cerrado	Araguaína, Tocantins	Information not found	http://www.observatorioapl.gov.br/	Agritourism
111	Local productive arrangements (LPA) Território do Brejo Paraibano	Atlantic Forest	Areia, Paraíba	Accommodation, restaurant services, snack shops and bars, other tourist services	http://www.observatorioapl.gov.br/	Agritourism
112	Local productive arrangements (LPA) Território do Vale do Paraíba	Atlantic Forest	Sapé, Paraíba	Incentive to local and regional tourism - activities of associative organizations linked to culture and art	http://www.observatorioapl.gov.br/	Agritourism
113	Local productive arrangements (LPA) Região de São Luís e Munim	Atlantic Forest	São Luís, Maranhão	Information not found	http://www.observatorioapl.gov.br/	Agritourism
114	Local productive arrangements (LPA) da Rota Pantanal Bonito	Cerrado	Campo Grande, Minas Gerais	Information not found	http://www.observatorioapl.gov.br/	Agritourism
115	Local productive arrangements (LPA) da Rota Pantanal Bonito	Cerrado	Campo Grande, Minas Gerais	Information not found	http://www.observatorioapl.gov.br/	Agritourism

116	Local productive arrangements (LPA) Turismo de Marajó	Amazon	Soure, Pará	Information not found	http://www.observatorioapl.gov.br/	Agritourism
117	Local productive arrangements (LPA) Turismo de Mossoró	Caatinga	Mossoró, Rio Grande do Norte	Information not found	http://www.observatorioapl.gov.br/	Agritourism
118	Local productive arrangements (LPA) Turismo de Natal	Atlantic Forest	Natal, Rio Grande do Norte	Information not found	http://www.observatorioapl.gov.br/	Agritourism
119	Local productive arrangements (LPA) Turismo Religioso	Atlantic Forest	Dias d`Ávila, Bahia	Information not found	http://www.observatorioapl.gov.br/	Agritourism
120	Local productive arrangements (LPA) Turismo Religioso do Vale do Paraíba	Atlantic Forest	Aparecida, São Paulo	Information not found	http://www.observatorioapl.gov.br/	Agritourism
121	Route of the Faxinais	Atlantic Forest	Prudentópolis, Paraná	Transform the Faxinais into a sustainable economic model of tourism, improving quality of life through economic income, demonstrating the importance of the community for the conservation of the Araucaria Forest.	(MOREIRA et al., 2011)	Agritourism
122	AGEMA - Associação de Guias, Ecoturismo e Meio Ambiente	Cerrado	São João d'Aliança, Goiás state.	Works at the Chapada dos Veadeiros National Park, environmental education, tour guide.	https://ispn.org.br/editais-ppp-ecos/	CBT
123	Associação de Auxiliares e Guias de Ecoturismo do Mamirauá	Amazon	Uarini, Amazonas state	The Association was born in June 2000 as an initiative of the service providers of Uacari Lodge as a way to improve the organization of the work in the enterprise. Residents of the 11 communities of the Mamirauá	https://www.conexsus.org/	Ecotourism

				sector of the Mamirauá Reserve can become members. Recently, residents from other communities or the urban area who are related to someone from one of the 11 communities have been accepted. For this, it is necessary to become a member of a community, with the consent of the residents.		
124	Turismo Ecológico e Rural	Amazon	Manaus, Amazonas state	Services aimed at tourists who are interested in the Amazon nature.	https://www.gov.br/empresas-e-negocios/pt-br/observatorioapl/apls-brasileiros	Agritourism
125	Turismo - PRODETER - Território Mirantes da Ibiapaba	Caatinga	Carnaubal, Guaraciaba do Norte, Ipu, Ipueiras, São Benedito, Ubajara, Viçosa do Ceará in Ceará state.	Part of the Bank of Nordeste's Tourism Territorial Development Program.	https://www.gov.br/empresas-e-negocios/pt-br/observatorioapl/apls-brasileiros	Agritourism
126	Gemas, Joias, Artesanato Mineral e Turismo de Cristalina	Cerrado	Cristalina, Goiás	Supported by Construction of Mercado do Cristal and Fundo de Fomento a Mineração (FUNMINERAL)	https://www.gov.br/empresas-e-negocios/pt-br/observatorioapl/apls-brasileiros	Agritourism
127	Boi da Floresta	Amazon	São Luís, Maranhão	Services; Cultural Experience Tourism.	https://www.gov.br/empresas-e-negocios/pt-br/observatorioapl/apls-brasileiros	Agritourism
128	TURIARTE - Cooperativa de Turismo e	Amazon	Santarém, Pará state	Formed by a group of women from the Anã community who	Artesol	CBT

	Artesanato da Floresta			then, seeing the potential of handicrafts and tourism in the region joined with seven other communities and currently comprise 70 cooperative members, 54 women and 16 men.		
129	Quilombo Kalunga	Cerrado	Alto Paraíso de Goiás, Goiás state	Kalunga Historical Site and Cultural Heritage is known for its natural beauty and richness of fauna and flora. Here we offer the visitor several trails and walks between mountains and footpaths and countless ecological tourist attractions such as rivers, canyons, waterfalls and thermal waters, as well as some sites that in the future will be released for visitation.	http://quilombokalunga.org.br/	Ecotourism
130	Bonito	Cerrado	Bonito in Mato Grosso do Sul state	Hydric and rural tourism in a balanced way the relationship between the human being and nature, adventure sports, floating, waterfalls, caves, rappelling, contemplation, diving, and spas.	(JOSÉ et al., 2011)	Ecotourism
131	Cooperativa Mista dos Agricultores Familiares	Cerrado	Goiânia, Goiás state	Sociobiodiverse community network that involves more	https://emporiodocerrado.org.br/site/ (WWF, 2022)	CBT

Extrativistas Pescadores Vazanteiros Assentados e Guias Turísticos do Cerrado (COOPCERRADO)	than 5,000 agroextractivist families carrying out agroecological, organic, and sustainable management. Associated to the e-commerce "Empório do Cerrado".

Table S.3 CBT, ecotourism and agritourism principles used in the study.

Modality	Principles	Code	Source
Community-based tourism	Community-led visitation	T1	(BARTHOLO; SANSOLO; BURSZTYN, 2009; NYAUPANE; POUDEL, 2011)
	Community-led management model	T2	
	Capacity building, partnerships and collaboration	T3	
	Value traditional identity, history and culture	T4	
	Appreciate and protect natural resources	T5	
	Sustainable use of resources for recreational purposes	T6	
	Sustainable use of resources for educational purposes	T7	
	Equitable, accountable, and adaptable governance	T8	
Ecotourism	Non-invasive form of nature-based tourism	T9	(HOLLAND et al., 2021; STRONZA; FITZGERALD; HUNT, 2019)
	Focuses primarily on learning about nature	T10	
	Environmental interpretation and ethics	T11	
	Support for wildlife and protected areas	T12	
	Managed to be low impact for the integrity of host communities	T13	
	Strengthened resource management institution	T14	
Agritourism	Occur in rural areas	T15	(CHIODO et al., 2019; PHILLIP; HUNTER; BLACKSTOCK, 2010; SGROI; DONIA; MINEO, 2018)
	Conducted by family working farms	T16	
	Visit to family working farms	T17	
	Tourism is additional to agricultural income	T18	
	Interaction between the family farmers with tourists	T19	
	Learning and participating in agricultural process	T20	
	Ensure human health, environment and rural settlements	T21	
	Perception of authenticity	T22	

Promote heritage patrimony and identity	T23
Experience both material and immaterial representation of past and present	T24
Rely on original built elements of culture	T25

Figure S.1 Descriptive statistics and Kruscall-Wallis test.

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
VAR00002	228	8,6754	17,24506	,00	63,00	,0000	,0000	3,0000
VAR00001	228	1,4825	,80999	1,00	3,00	1,0000	1,0000	2,0000

Kruskal-Wallis Test

Ranks

	VAR00001	N	Mean Rank
VAR00002	1,00	164	98,88
	2,00	18	151,42
	3,00	46	155,76
	Total	228	

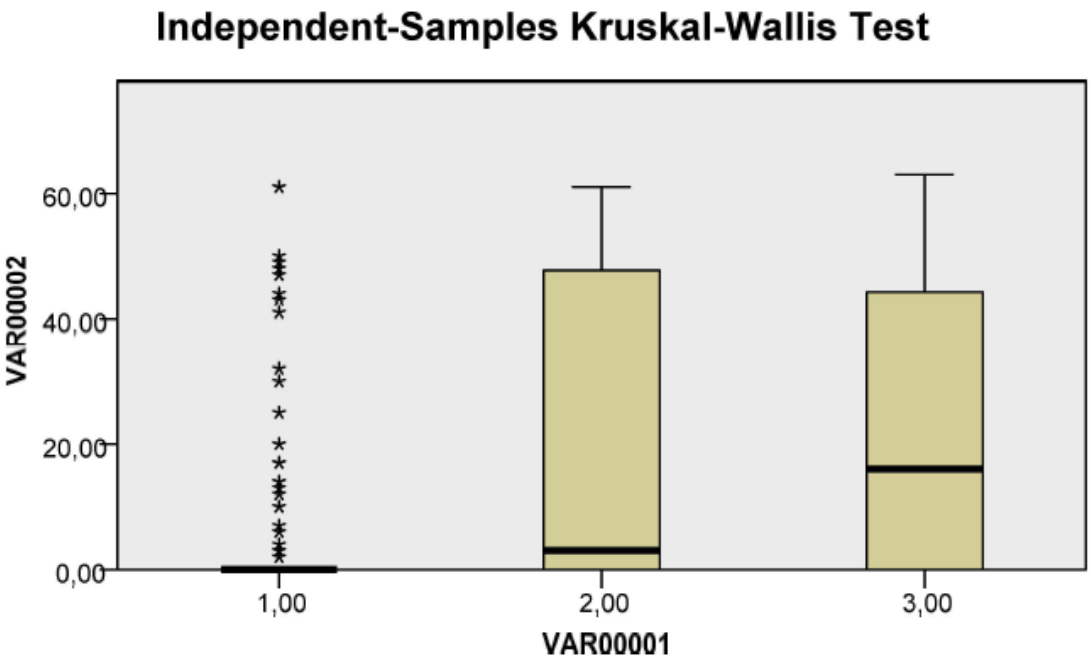
Test Statistics[a,b]

	VAR00002
Chi-Square	51,211
df	2
Asymp. Sig.	,000

a. Kruskal Wallis Test

b. Grouping Variable: VAR00001

Figure S.2 Graphic output and summary results of Kruscall-Wallis test.



Total N	228
Test Statistic	51,211
Degrees of Freedom	2
Asymptotic Sig. (2-sided test)	,000

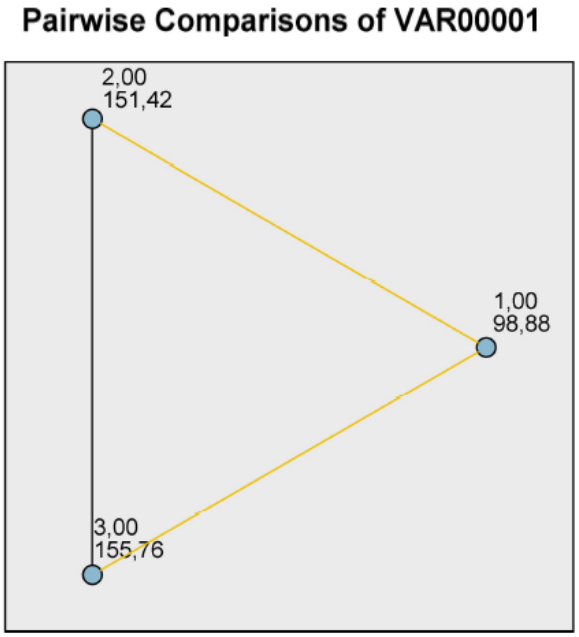
1. The test statistic is adjusted for ties.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of VAR00002 is the same across categories of VAR00001.	Independent-Samples Kruskal-Wallis Test	,000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is ,05.

Figure S.3 Graphic output and summary results of Pairwise comparisons.



Each node shows the sample average rank of VAR00001.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig.
1,00-2,00	-52,542	13,116	-4,006	,000	,000
1,00-3,00	-56,886	8,813	-6,455	,000	,000
2,00-3,00	-4,344	14,685	-,296	,767	1,000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is ,05.

Table S.4 STEEPV aspects

Dimensions	Aspects	Code
Social	Benefit people who live in and near protected areas	S1
	Benefit people who live in cultural and heritage sites	S2
	Traditional people and communities, indigenous people, family farming	S3
	Preserve the values and beliefs attached to places and local products	S4
	Value local knowledge systems	S5
	Promote common sense of cultural pride	S6
	Develop cultural activities and maintain/use agricultural land	S7
	Provide cultural exchanges	S8

	Incentive to community cooperatives, micro-businesses and associations	S9
	Appreciate community-based natural resource management	S10
	Enables community members to be employed in business	S11
	Enables community to be employed and manage local business	S12
	Promote interaction with external networks	S13
	Enhance the use of workshops as participatory tools	S14
	Enhance the use of group meetings as participatory tools	S15
	Enhance the use of lectures as participatory tools	S16
Technologic	Encourage the creation of official website	S17
	Or enables information to be available only at third party website	S18
	Enables the creation of informative content and for dissemination	S19
	Encourages the creation of communication channel	S20
	Provide skills to plan for exploitation of agricultural resources	S21
	Enable methods and techniques for social, economic and environment monitoring	S22
	Promotes innovation in capacity building training	S23
	Improve development strategy for family farming, NTFPs extractivism	S24
	Develop new equipment and techniques to support rural livelihoods	S25
Economic	Incentive more business created by local people	S26
	Incentive business created by external actors	S27
	Increase employment opportunities	S28
	Promotes the expansion of local market	S29
	Attract more investment opportunities	S30
	Construct a diverse portfolio of activities	S31
	Construct social support capabilities to assist the struggle for survival	S32
	Improve standards of living	S33
	Poverty alleviation	S34
	Secure the benefits of tourism for local community	S35
	Promote the creation of social capital	S36
	Establish clear and common sense set of rules	S37
	Good management of funds	S38
Environment	Part of specific conservation mechanism (e.g., protected areas)	S39
	Protect endangered species within IUCN Red-List mammal	S40
	Promote payment for ecosystem service program	S41
	Promote other conservation action	S42
	Local population receive direct economic benefits for conservation	S43
	Enhance community-oriented monitoring	S44
	Enhance community-oriented environment education	S45
	Promote environment education for tourists	S46
	Promote activities and enforcement of conservation practice	S47
	Partnerships with fauna and flora institutions and foundations	S48

	Enhance the reduction of land degradation through specific activities	S49
	Increase net reforestation through specific activities	S50
	Promote landscape multifunctionality through specific activities	S51
	Promote correct destination of solid waste	S52
	Promote water reuse	S53
	Invest in waste recycling	S54
	Invest in solar energy	S55
Political	Increase facilities for accessibility and mobility	S56
	Help local communities to meet their basic needs	S57
	Create funding mechanisms	S58
	Promotes technical cooperation between local and national/international actors	S59
	Incentive feedback mechanisms	S60
Value	Follow an environmental ethics framework	S61
	Work to build awareness of local resource scarcity	S62
	Build awareness about cultural and ethnical mutual respect	S63
	Promote cultural exchange	S64
	Enhance social equity	S65
	Promotes gender equality	S66
	Promote equitable roles and responsibilities	S67
	Framework for economic benefits to be distributed to residents fairly	S68

Table S.5 Matrix summarizing the STEEPV aspects addressed by three case studies

Case study / STEEPV aspects	**Uacari Lodge**	**MSVP**	**Welcome at the colony**
S1	1	1	0
S2	0	0	0
S3	1	1	1
S4	1	1	1
S5	1	1	1
S6	1	1	1
S7	1	0	1
S8	1	1	1
S9	1	1	1
S10	1	1	0
S11	1	1	0
S12	1	1	1
S13	1	0	0
S14	1	1	0
S15	1	1	0
S16	1	1	0
S17	1	1	1
S18	0	0	0

S19	1	1	1
S20	1	0	0
S21	1	0	1
S22	1	0	0
S23	1	1	0
S24	1	1	0
S25	1	0	0
S26	0	1	1
S27	0	0	0
S28	1	1	1
S29	1	0	1
S30	1	1	1
S31	1	1	1
S32	1	1	1
S33	1	1	1
S34	1	1	1
S35	1	0	1
S36	1	1	1
S37	1	0	1
S38	1	0	0
S39	1	1	0
S40	1	0	0
S41	1	0	0
S42	1	1	0
S43	1	0	0
S44	1	1	0
S45	1	1	0
S46	1	1	0
S47	1	1	1
S48	1	1	0
S49	1	1	1
S50	1	0	0
S51	1	1	1
S52	0	0	0
S53	0	0	0
S54	0	0	0
S55	1	0	0
S56	1	0	0
S57	1	1	0
S58	1	1	1
S59	1	1	1
S60	1	0	0
S61	1	1	0
S62	1	1	0
S63	1	1	1

S64	1	1	1
S65	1	0	1
S66	1	1	1
S67	1	0	1
S68	1	1	0

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Appendix B - Chapter 3 Supplemental Information

Table S.1 Assessment of tourist activity and lodging tourism income in the municipalities that collected and traded up to 1 ton of NFTPs in the six Brazilian biomes between 2013 to 2019

Biome	Classes	Nº of municipalities	Quantity produced 2013-2019 (tons)	Quantity produced 2013-2019 (%)	Mean revenue of people employed in lodging sector in 2019 (US$)
Amazon	A	6	29,710	1%	US$ 337 (R$ 1,331)
	B	9	5,421	0%	US$ 315 (R$ 1,246)
	C	36	147,460	3%	US$ 298 (R$ 1,176)
	D	107	352,348	7%	US$ 333 (R$ 1,317)
	E	13	19,464	0%	US$ 97 (R$ 384)
	NC	268	1,222,634	24%	US$ 303 (R$ 1,198)
Caatinga	A	1	126	0%	US$ 303 (R$ 1,199)
	B	28	26,622	1%	US$ 303 (R$ 1,196)
	C	54	30,272	1%	US$ 273 (R$ 1,081)
	D	167	52,494	1%	US$ 286 (R$ 1,131)
	E	32	4,236	0%	US$ 47 (R$ 188)
	NC	531	161,123	3%	US$ 287 (R$ 1,133)
Cerrado	A	8	839	0%	US$ 433 (R$ 1,709)
	B	19	7,668	0%	US$ 345 (R$ 1,362)
	C	20	49,604	1%	US$ 322 (R$ 1,271)
	D	81	65,740	1%	US$ 216 (R$ 854)
	E	21	10,789	0%	US$ 260 (R$ 1,028)
	NC	288	281,119	5%	US$ 103 (R$ 408)
Pantanal	A	-	-	-	-
	B	1	8	0%	US$ 766 (R$ 3,023)
	C	1	22	0%	US$ 313 (R$ 1,236)
	D	1	108	0%	US$ 453 (R$ 1,790)
	E	-	-	-	-
	NC	-	-	-	-
Atlantic Forest	A	11	94,785	2%	US$ 428 (R$ 1,692)
	B	40	93,311	2%	US$ 397 (R$ 1,569)
	C	68	119,023	2%	US$ 355 (R$ 1,404)
	D	263	652,980	13%	US$ 238 (R$ 942)
	E	88	248,161	5%	US$ 54 (R$ 214)
	NC	283	1,479,479	29%	US$ 317 (R$ 1,253)
Pampa	A	-	-	-	-
	B	1	1	0%	US$ 328 (R$ 1,295)
	C	-	-	-	-
	D	1	15	0%	-
	E	-	-	-	-
	NC	3	146	0%	US$ 450 (R$ 1,778)

Table S.2 Detailed information about the 26 variables of the study

Category	Variables	Source	Mapping scale
Landscape and wildlife	Reserves	Ministry of the Environment, Chico Mendes Institute, Brazilian Forest Service, Amazon Protected Areas Program, Brazilian Agricultural Research Corporation and the Brazilian Institute of Geography and Statistics (https://maps.csr.ufmg.br/).	Scale compatible with the municipalities file (1:250,000)

Focal communities	Socio-biodiversity chain	Catalog of Sociobiodiversity Products in Brazil(ICMBIO, 2018a) and Ministry of the Environment (https://www.mma.gov.br/).	Scale compatible with the municipalities file (1:250,000)
	Extractive Reserves (RESEX)	Ministry of Environment http://mapas.mma.gov.br/i3geo/datadownload.htm	Scale compatible with the municipalities file (1:250,000)
	Quilombola community	http://acervofundiario.incra.gov.br/acervo/acv.php	
	Indigenous lands	Ministry of the Environment, Chico Mendes Institute, Brazilian Forest Service, Amazon Protected Areas Program, Brazilian Agricultural Research Corporation and the Brazilian Institute of Geography and Statistics (https://maps.csr.ufmg.br/)	Scale compatible with the municipalities file (1:250,000)
	TPC Coastal and marine extractivists	Ministry of Environment (http://mapas.mma.gov.br/).	Not informed
	TPC Terreiro	Listed Goods and in Progress (1938 - 2019) of the National Historical and Artistic Heritage Institute (Iphan) (http://portal.iphan.gov.br/)	Not informed
	TPC Faxinalenses	Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/) and (ALMEIDA et al., 2009; MENIM, 2014; SAHR, 2008).	Not informed
	TPC "Sempre-viva" pickers	Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/) and Rede Cerrado Organization (https://redecerrado.org.br/). GeoNode (http://geonode.jbrj.gov.br/).	Not informed
	TPC Geraizeiros	Rede Cerrado Organization (https://redecerrado.org.br/) and Cerratinga Organization (http://www.cerratinga.org.br/).	Not informed
	TPC Caatingueiros	Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/).	Not informed
	TPC Vazanteiros	Centro da Agricultura Alternativa do Norte de Minas (https://www.caa.org.br/), Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/).	Not informed
	TPC Marroquianos	(VIEIRA et al., 2016), Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/)	Not informed
	TPC Pomerano people	(HACKENHAAR, 2018), Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/).	Not informed
	TPC Araguaia retreators	Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/)	Not informed
	TPC Riverside	Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/)	Not informed
	TPC Veredeiros	Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/) and Instituto Chico Mendes de Conservação da Biodiversidade (https://www.icmbio.gov.br/).	Not informed
	NTFPs diversity	IBGE Automatic Recovery System - SIDRA from the 2017 Census of Agriculture https://censos.ibge.gov.br/agro/2017/	Not informed
	Number of Family farming from concession of indigenous land	IBGE Automatic Recovery System - SIDRA from the 2017 Census of Agriculture https://censos.ibge.gov.br/agro/2017/ Table 6774 https://sidra.ibge.gov.br/tabela/6774#notas-tabela	Scale compatible with the municipalities file (1:250,000)

	Number of Family farming from title of Quilombola community	IBGE Automatic Recovery System - SIDRA from the 2017 Census of Agriculture https://censos.ibge.gov.br/agro/2017/ Table 6774 https://sidra.ibge.gov.br/tabela/6774#notas-tabela	Scale compatible with the municipalities file (1:250,000)
Service and Organizational field	Lodging establishments up to 9 employers	Information System on the Labor Market in the Tourism Sector – SIMT and the Institute of Applied Economic Research (IPEA) http://extrator.ipea.gov.br/	Scale compatible with the municipalities file (1:250,000)
	People employed in tourism related activities	Information System on the Labor Market in the Tourism Sector – SIMT and the Institute of Applied Economic Research (IPEA) http://extrator.ipea.gov.br/	Scale compatible with the municipalities file (1:250,000)
	NTFPs cooperatives	Catalog of Sociobiodiversity Products in Brazil(ICMBIO, 2018a); Association of Mangaba and Indiaroba Waste Pickers (Ascamai) (http://ascamai.com.br/); (MELO; HALLA, 2016); Mixed Agricultural Cooperative Prudentópolis CAMP (http://www.camp.coop.br/); The Central do Cerrado (https://www.centraldocerrado.org.br/); Cerratinga (http://www.cerratinga.org.br/); Ecoserra Ecological Cooperative (http://www.cooperativaecoserra.com.br/); Cooperative of Heart of Palm Producers in the Lower South of Bahia (Coopalm) (http://www.cultiverde.com.br/); (MELO, 2010); National Indigenous Foundation (FUNAI) (http://www.funai.gov.br/); Environmental Institute of Paraná (http://www.iap.pr.gov.br/); Institute of Agricultural Development of the State of Amazonas – IDAM (http://www.idam.am.gov.br/); Civil Society Organization of Public Interest IFT (http://www.ift.org.br/); Nordeste & Cerrado (http://www.nordestecerrado.com.br/); https://www.ruralcentro.com.br/; Acre News Agency (https://agencia.ac.gov.br/); Pará News Agency (https://agenciapara.com.br/); Vale do Amanhecer Farmers' Cooperative (https://coopavam.org.br/); Cooperative of Chestnut Beneficiaries – COOBEC (https://www.castanhasdocarrilho.com.br/); Brazilian Agricultural Research Corporation – EMBRAPA (https://www.embrapa.br/); (https://www.fundacaoodebrecht.org.br/); Chico Mendes Institute (https://www.icmbio.gov.br/); Slow food Brazil Organization (http://www.slowfoodbrasil.com/); Socioenvironmental Institute – ISA (https://www.socioambiental.org/); COOPERACRE (http://www.cooperacre.com/).	Not informed
Supportive policy	Tourism official department	Brazilian Tourism Map 2019/2021, in Ministry of Tourism (MTUR) website: http://www.regionalizacao.turismo.gov.br/	Scale compatible with the municipalities file (1:250,000)
Accessibility	International airports	Ministry of Transport, National Civil Aviation Agency and Brazilian Airport Infrastructure Company - INFRAERO https://maps.csr.ufmg.br/	Not informed
	Federal roads	Ministry of Infrastructure	Not informed

	https://maps.csr.ufmg.br/

Table S.3 Weights and scores for CBT multi-criteria model

Categories	Variables	Description	Valuation classes and scores	Weight	Source
Landscape and Wildlife	Reserves	Euclidean distance from reserves, range divided in five classes using Quantile.	< 107249.5588 - 10 < 219861.5956 - 7 < 348561.0662 - 5 < 541610.2721 - 3 = < 1367431.875 - 1	3	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)
Focal communities	Socio-biodiversity chain	Euclidean distance from Socio-biodiversity chain, divided in five classes using Quantile.	< 51013.03873 - 10 < 138463.9623 - 7 < 284215.5015 - 5 < 1858332.125 - 3	3	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)
	Extractive Reserves (RESEX), Quilombola community, Indigenous lands and Traditional People and Communities.	Euclidean Distance from RESEX, Quilombola community, Indigenous lands, Marine RESEX, Terreiro, Faxinalenses, “Sempre-viva” pickers, Geraizeiros, Artisanal fishing, Caatingueiros, Vazanteiros, Marroquianos, Pomerano people, Faxinal, Araguaia retreators, Riverside, Cipozeiros, Andiobeiras e Veredeiros. The density of these livelihoods, was divided in five classes using Quantile.	< 80.51764706 - 1 < 92.65882353 - 3 < 101.7647059 - 5 < 113.9058824 - 7 < 165 - 10	3	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)

	NTFPs production diversity	Values at municipality level, range divided in five classes using Quantile.	= 1 - 1 < 10 - 3 < 29 - 5 < 39 - 7 = < 70 - 10	3	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)
	Family farming from concession of indigenous land	Values at municipality level, range divided in five classes using Quantile.	< 4 - 3 < 29 - 5 < 167 - 7 = < 1929 - 10	3	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)
	Family farming from title of quilombola community	Values at municipality level, range divided in five classes using Quantile.	= 0 - 1 = 1 - 3 < 6 - 5 < 36 - 7 = < 249 - 10	3	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)
Service / Organizational field	Lodging establishments up to 9 employers	Values at municipality level, range divided in five classes using Quantile.	= 0 - 1 < 8 - 3 < 18 - 5 < 50 - 7 = < 1101 - 10	2	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)
	People employed in tourism related activities	Values at municipality level, range divided in five classes using Quantile.	< 5 - 1 < 60 - 3 < 201 - 5 < 826 - 7 = < 342831 - 10	2	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)

	NTFPs Cooperatives	Values at municipality level, range divided in five classes using Quantile.	< 1 - 1 < 2 - 3 < 3 - 5 < 4 - 7 = < 5 - 10	3	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)
Supportive policy	Tourism official department	Values at municipality level, presence or absence	= 0 - 1 = 1 - 10	2	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)
Accessibility	Proximity from Federal roads	Euclidean Distance for international airports and Federal roads. The density of federal roads and international airports (from 2 to 20), divided in five classes using Quantile.	<12395.0098 - 10 < 29438.14828 -7 < 54228.16789 - 5 < 100709.4547 - 3 < 395090.9375 - 1	2	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)
	Proximity from International airports		< 223541.4039 - 10 < 351279.349 - 7 < 487000.9157 - 5 < 634697.9147 - 3 < 1017911.75 - 1	2	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)

Table S.4 Landscape metrics from socio-biodiversity tourism hotspots

		Biome					
		Amazon	Caatinga	Cerrado	Atlantic Forest	Pampa	Pantanal
Mean Patch Size (MPS) (ha)	Low (cold spots)	226,996	225,568	218,683	54,221	179,170	84,003
	Medium	231,915	120,763	116,900	69,287	15,995	266,631
	High	368,503	707,213	805,783	63,269	0	0
	Very-high (hotspots)	874,278	496,711	61,563	30,177	0	0

Patch Size Standard Deviations	Low (cold spots)	100,007	175,857	106,587	212,225	410,369	246,343
	Medium	1,389,969	349,360	667,947	584,756	25,509	515,534
	High	324,132	259,036	341,516	133,630	0	0
	Very-high (hotspots)	486,285	110,066	261,252	78,677	0	0
LPI (%)	Low (cold spots)	3%	31%	13%	8%	44%	31%
	Medium	6%	4%	9%	25%	2%	42%
	High	15%	3%	4%	2%	0%	0%
	Very-high (hotspots)	13%	1%	2%	1%	0%	0%

Table S.5 Detailed quantitative analysis of the 40 variables within socio-biodiversity tourism hotspots in the six Brazilian biomes

Biome	Variables				
	Likely	*Nº*	*Area (ha) or length (km)*	*Complementary*	*Nº / length (km)*
Amazon	SDR	20	11,193,077	Lodging establishments	6,041
	RESEX	35	11,688,203	People employed in tourism related activities	463,701
	Indigenous lands	152	24,607,868	NTFPs Cooperatives	51
	Quilombola communities	64	796,033	Tourism official department	104
	Riverside community	67	35,776 km	International airports	4
				Federal roads	9,582 km
Caatinga	SDR	0	-	Lodging establishments	1.153
	RESEX	1	30,994	People employed in tourism related activities	16,158
	Indigenous lands	5	65,774	NTFPs Cooperatives	3
	Quilombola communities	3	28,536	Tourism official department	21
	Caatingueiros	1	106,735	International airports	0
				Federal roads	509 km
Cerrado	SDR	2	98,303	Lodging establishments	1,796
	RESEX	1	12,455	People employed in tourism related activities	61,565
	Indigenous lands	4	260,676	NTFPs Cooperatives	14
	Quilombola communities	6	62,566	Tourism official department	47
	Araguaia retreaters	1	134 km	International airports	0
	Geraizeiros and *vazanteiros*	6	2,648 km	Federal roads	1,804 km
	Riverside (Araguaia and *Tocantins river)*	2	1,380 km		
	Caatingueiros	1	3,310,205		
	Sempre-Viva pickers	1	125,956		
	Veredeiros	5	395,004		
Atlantic Forest	SDR	0	-	Lodging establishments	3,320
	RESEX	1	10,417	People employed in tourism related activities	374,938
	Indigenous lands	0	-	NTFPs Cooperatives	2

Quilombola communities	4	15,284	Tourism official department	49
Terreiro	1	-	International airports	1
Faxinais	89	-	Federal roads	292 km

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Appendix C - Chapter 4 Supplemental Information

Table S.1. Summary of place-based initiatives in Brazilian biomes, state and municipality and a brief description.

ID	Name	Biome	Municipality and state	Source
1	CBT in RESEX Rio Unini	Amazon	Novo Airão, Amazonas	(ICMBIO, 2018b)
2	RDS Rio Negro, Margem Direita	Amazon	Iranduba, Amazonas	Fundação Amazonas Sustentável (FAS)
3	APA Margem Esquerda do Rio Negro Tarumã-Açu/ Tarumã-Mirim	Amazon	Manaus, Amazonas	Fundação Amazonas Sustentável (FAS)
4	Reserva Extrativista Tapajós-Arapiuns	Amazon	Santarém, PA	Garupa, Vivejar
5	Segredos e Temperos da Amazônia	Amazon	Belém, Pará	Vivejar
6	Vivência Yawanawá	Amazon	Cruzeiro do Sul, Acre	Garupa, Vivejar,
7	Prainha do Canto Verde	Caatinga	Beberibe, Ceará	Garupa, Organização Prainha do Canto Verde
8	Ponta Grossa	Caatinga	Icapuí, Ceará	Garupa, Rede TUCUM
9	Associação Amazônia, Baixo Rio Branco	Amazon	Rorainópolis, Roraima	Garupa
10	Projeto de Assentamento Extrativista Lago Grande	Amazon	Santarém, Pará	Garupa, TURIARTE, Projeto Saúde e Alegria
11	Comunidade de Boa Vista do Acará	Amazon	Belém, Pará	Garupa, Estação Gabiraba.
12	Quilombo do Cumbe	Caatinga	Aracati, Ceará	Quilombo do Cumbe
13	São Manoel Bar and Rio Juruena	Amazon	Apuí, Amazonas	Estação Gabiraba
14	Amapá National Forest	Amazon	Oiapoque, Amapá	Estação Gabiraba
15	Associação Agroextrativista da Reserva Extrativista do Rio Liberdade	Amazon	Cruzeiro do Sul, Acre	(ICMBIO, 2018a)
16	Associação de Produtores Agroextrativistas da FLONA de Tefé e Entorno (APAFE)	Amazon	Tefé and Alvarães, Amazonas	(ICMBIO, 2018a)
17	Cooperativa Mista Agroextrativista do Rio Unini - COOMARU	Amazon	Barcelos e Novo Airão, Amazonas	(ICMBIO, 2018a)
18	Associação de Moradores e Produtores Rurais e Extrativistas da comunidade de Jamaraquá-Rio Tapajós (ASMORJA)	Amazon	Belterra, Pará	(ICMBIO, 2018a)
19	Associação de Moradores do Acaratinga	Amazon	Belterra, Pará	(ICMBIO, 2018a); (FONTOURA et al., 2019)
20	Associação de Moradores e Produtores Rurais e Extrativistas da Comunidade de Piquiatuba	Amazon	Belterra, Pará	(ICMBIO, 2018a); (FONTOURA et al., 2019)
21	Reserva Extrativista Marinha de Caeté-Taperaçu	Amazon	Bragança, Pará	(FREITAS, 2013)
22	Associação dos Seringueiros e Agroextrativista do Baixo Rio Ouro Preto (ASAEX)	Amazon	Guajará Mirim, Rondônia	(ICMBIO, 2018a)
23	Marine Extractive Reserve of Soure	Amazon	Soure, Pará	(ICMBIO, 2018a); (BASTOS; FILHO, 2020)
24	Associação dos Seringueiros do Rio Ouro Preto (ASROP)	Amazon	Guajará Mirim, Rondônia	(ICMBIO, 2018a)

25	Associação Remanescente do Quilombo Salamina Putumuju	Atlantic Forest	Maragogipe, Bahia	(ICMBIO, 2018a)
26	Associação de Moradores, Agricultores e Pescadores do Puxim da Praia (AMAPPP)	Atlantic Forest	Canavieiras, Bahia	(ICMBIO, 2018a)
27	Community-Based Tourism in Campo Buriti, Jequitinhonha Valley	Cerrado	Turmalina, Minas Gerais	Garupa and Vivejar
28	Community-Based Tourism in Mambaí	Cerrado	Mambaí, Goiás	Goiás government
29	RDS do Uatumã	Amazon	Itapiranga e São Sebastião do Uatumã, Amazonas	Instituto para Conservação e Desenvolvimento Sustentável do amazonas (IDESAM)
30	Jenipapo-Kanindé	Caatinga	Aquiraz, Ceará	Rede TUCUM
31	RESEX do Batoque	Caatinga	Aquiraz, Ceará	Rede TUCUM
32	Assentamento Maceió	Caatinga	Itapipoca, Ceará	Rede TUCUM
33	Curral Velho	Caatinga	Acaraú, Ceará	Rede TUCUM
34	Caetanos de Cima	Caatinga	Amontada, Ceará	Rede TUCUM
35	Associação dos Moradores de Tatajuba	Caatinga	Camocim, Ceará	Rede TUCUM
36	Vivência Xavante	Cerrado	Canarana, Mato Grosso	https://turismo.ambiental.tur.br/vivencia-xavante
37	RESEX LAGO DO CUNIÃ	Amazon	Porto Velho, Rondônia	(TOLENTINO et al., 2019)
38	Tremembé community	Caatinga	Icapuí, Ceará	Rede TUCUM
39	Vila da Volta	Caatinga	Aracati, Ceará	Rede TUCUM
40	Boa Vista Village	Atlantic Forest	Ubatuba, São Paulo	Garupa
41	Quilombo Campinho da Independência	Atlantic Forest	Paraty, Rio de Janeiro	Garupa
42	Liberty Route	Atlantic Forest	Cachoeira, Bahia	Rural Brazil Institute
43	Mosaico Sertão Veredas do Peruaçu - APA and PARNA Cavernas do Peruaçu	Cerrado	Formoso, Arinos, Chapada Gaúcha, Urucuia, Cônego Marinho, Januária, Itacarambi, Bonito de Minas, São João das Missões, Miravânia e Manga in Minas Gerais and Cocos in Bahia state.	Mosaico Sertão Veredas do Peruaçu website
44	Rio Negro Community Tourism Itinerary (Tucorin)	Amazon	Novo Airão, Amazonas	Ministry of Tourism (MTUR, 2020)
45	Uacari Lodge	Amazon	Tefé, Amazonas	Mamirauá Sustainable Development Institute
46	Quilombo Kalunga	Cerrado	Alto Paraíso de Goiás, Goiás state	http://quilombokalunga.org.br/
47	Pra manter a floresta em pé: Comunidade Tumbira	Amazon	Iranduba, Amazonas	Garupa, https://www.poranduba-amazonia.com/sobre-nos

Table S.2. General characteristics of the 47 place-based CBT initiatives analyzed in the study.

ID	Name	Where take place	Origin	Structure, financial resources	Stakeholders and sectors taking part	Activities developed	Dissemination channels	Aims
1	RESEX Rio Unini	RESEX	2006	Federal government transfer; community-led visitation	NTFPs extractivists	Experience the daily life of the community.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
2	RDS Rio Negro, Margem Direita	SDR	2008	Federal government transfer; community-led visitation	Family farmers and indigenous people, riverside community	Experience the daily life of riverside, family farmers and indigenous communities.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
3	APA Margem Esquerda do Rio Negro Tarumã-Açu/ Tarumã-Mirim	Environment protection area (EPA)	1995	Federal government transfer; community-led visitation	Family farmers and indigenous people, riverside community	Experience the daily life of riverside family farmers and indigenous communities.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
4	RESEX Tapajós-Arapiuns	RESEX	1998	Federal government transfer; community-led visitation	NTFPs extractivists and riverside communities	Experience the daily life of an Amazonian riverside community in extractivism and subsistence agriculture	Management plan, government report, website; Sustainable tourism operator official website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
5	Segredos e Temperos da Amazônia	Island	Information not found	Local community partnership with tour operator; community-led visitation; itinerary; profit from tourism	NTFPs extractivists, riverside communities and family farmers	Visit communities and experience the regional gastronomy through community-based entrepreneurs.	Sustainable tourism operator official website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
6	Vivência Yawanawá	Indigenous land	2002	Local community partnership with tour operator; community-led visitation; itinerary; profit from tourism	Indigenous people	Experience traditional way of life of indigenous tribe Yawanawá.	Sustainable tourism operator official website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
7	Prainha do Canto Verde	RESEX	Information not found	Local community partnership with tour	Rural community, fishermen, artisans	Local community lodging and the	Sustainable tourism operator	Natural resources management and conservation; cultural

				operator; community-led visitation and management; fishing and tourism		restaurant, artisanal fishing.	website; official website	heritage and traditions protection; rural livelihoods improvement; landscape management with cooperation among stakeholders, enhance the role of local communities, build social capital
8	Ponta Grossa	Rural settlement	1993	Local community partnership with tour operator; community-led visitation and management; fishing and tourism	Rural community, fishermen, artisans	Hear the incredible stories of the local fishermen, raft, boat or buggy rides	Sustainable tourism operator website and local CBT association website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
9	Associação Amazônia, Baixo Rio Branco	Rural settlement	Information not found	Local community partnership with tour operator; community-led visitation; itinerary	Riverside communities and family farmers	Experience the daily life of communities surrounding Amazon rivers	Sustainable tourism operator website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
10	Projeto de Assentamento Extrativista Lago Grande	Extractivist settlement	2005	Local community partnership with tour operator; community-led visitation; itinerary; community lodging, NTFPs	NTFPs extractivists, riverside communities and family farmers	Discover the knowledge of a riverside community, trails through the Amazonian Forest.	Sustainable tourism operator website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
11	Comunidade de Boa Vista do Acará	Rural settlement	Information not found	Local community partnership with tour operator; community-led visitation; itinerary; community lodging, NTFPs	NTFPs extractivists and riverside community	Lifestyle of riverside community in the production of artisanal flour and harvesting of typical fruits (Açaí).	Sustainable tourism operator website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
12	Quilombo do Cumbe	Quilombola community	2003	Local community partnership with tour operator; community-led visitation and management; community lodging, NTFPs	Quilombola community, fisherman	Aims the preservation of biodiversity and our traditional way of life.	Sustainable tourism operator website; official website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement; landscape management with cooperation among stakeholders, enhance the role of local communities, build social capital
13	São Manoel Bar and Rio Juruena	Rural settlement	2005	Local community partnership with tour operator; community-	NTFPs extractivists, riverside	Experience the production of cassava flour, local handicrafts	Sustainable tourism operator website	Natural resources management and conservation; cultural

				led visitation; itinerary; community lodging, NTFPs	communities and family farmers	and extractivism of Brazil nut.		heritage and traditions protection; rural livelihoods improvement
14	Amapá National Forest	National Forest	1989	Local community partnership with tour operator; community-led visitation; itinerary; fishing; federal government transfer	Riverside communities and family farmers; Chico Mendes Institute for Biodiversity Conservation (ICMBio)	Visit national forests and riverside communities.	Sustainable tourism operator website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
15	Associação Agroextrativista da Reserva Extrativista do Rio Liberdade	RESEX	2005	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio)	Experience Açaí extractivism.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
16	Associação de Produtores Agroextrativistas da FLONA de Tefé e Entorno (APAFE)	National Forest	1989	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio)	Experience Brazil nut extractivism; trails and community's regional food.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
17	Cooperativa Mista Agroextrativista do Rio Unini - COOMARU	RESEX	2006	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio)	Experience Brazil nut extractivism.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
18	Assoc. de Moradores e Produtores Rurais e Extrativistas da comunidade de Jamaraquá-	National Forest	1974	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio)	Sociobiodiversity chain in Tapajós National Forest.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement

	Rio Tapajós (ASMORJA)							
19	Associação de Moradores do Acaratinga	National Forest	1974	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio); Ministry of Environment	Sociobiodiversity chain in Tapajós National Forest;	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
20	Associação de Moradores e Produtores Rurais e Extrativistas da Comunidade de Piquiatuba	National Forest	1974	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio); Ministry of Environment	Sociobiodiversity chain in Tapajós National Forest and experience Açaí extractivism.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
21	Reserva Extrativista Marinha de Caeté-Taperaçu	Marine RESEX	2005	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio); Ministry of Environment	Experience community-based tourism management model.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
22	Associação dos Seringueiros e Agroextrativista do Baixo Rio Ouro Preto (ASAEX)	RESEX	1990	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio); Ministry of Environment	Trekking with overnight stay at Rio Ouro Extractive Reserve, experience Açaí, Brazil nut, Babaçu extractivism.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
23	Marine Extractive Reserve of Soure	Marine RESEX	2001	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio); Ministry of Environment	Experience community-based tourism management model.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement

24	Associação dos Seringueiros do Rio Ouro Preto (ASROP)	RESEX	1990	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio); Ministry of Environment	Overnight stay at Rio Ouro Extractive Reserve.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
25	Associação Remanescente do Quilombo Salamina Putumuju	Marine RESEX	1974	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio); Ministry of Environment	Visit to the ruins of the ancient slavery mill, forest trails and walks mangrove and estuary.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
26	Associação de Moradores, Agricultores e Pescadores do Puxim da Praia (AMAPPP)	Marine RESEX	Information not found	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio); Ministry of Environment	Boat ride mangrove swamp, visitation to the “black mud” and visits to the association headquarters.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
27	Community-Based Tourism in Campo Buriti, Jequitinhonha Valley	Rural settlement	Information not found	Local community partnership with tour operator; community-led visitation	Family farmers	Visit women artisans who produce the ceramic dolls of Jequitinhonha Valley.	Sustainable tourism operator website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
28	Community-Based Tourism in Mambaí	Rural settlement	Information not found	Local community partnership with associations, government; community-led visitation	Family farmers; State government	Waterfalls, canyons and caves.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
29	RDS do Uatumã	SDR	2004	Local community partnership with tour operator; community-led visitation and management; fishing and tourism	NTFPs extractivists, riverside communities, family farmers; Institute for	Experience community-based tourism management model.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement; landscape management with cooperation among stakeholders,

					Conservation and Sustainable Development of Amazonas (IDESAM)			enhance the role of local communities, build social capital
30	Jenipapo-Kanindé	Indigenous land	2002	Local community partnership with tour operator; community-led visitation and management; fishing and tourism	NTFPs extractivists, indigenous people, fisherman and family farmers	Experience the life, culture and activities of local communities.	Sustainable tourism operator website and local CBT association website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
31	RESEX do Batoque	RESEX	2003	Local community partnership with tour operator; community-led visitation and management; fishing and tourism	NTFPs extractivists, fisherman and family farmers	Experience the life, culture and activities of local communities.	Sustainable tourism operator website and local CBT association website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
32	Curral Velho	Rural settlement	2006	Local community partnership with tour operator; community-led visitation and management; fishing and tourism	NTFPs extractivists, fisherman and family farmers	Experience the life, culture and activities of local communities.	Sustainable tourism operator website and local CBT association website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
33	Caetanos de Cima	Rural settlement	1987	Local community partnership with tour operator; community-led visitation and management; fishing and tourism	NTFPs extractivists, fisherman and family farmers	Experience the life, culture and activities of local communities.	Sustainable tourism operator website and local CBT association website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
34	Associação dos Moradores de Tatajuba	Rural settlement	2001	Local community partnership with tour operator; community-led visitation and management; fishing and tourism	NTFPs extractivists, fisherman and family farmers	Experience the life, culture and activities of local communities.	Sustainable tourism operator website and local CBT association website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
35	Vivência Xavante	Indigenous land	Information not found	Local community partnership with associations, government;	Indigenous people	Experience the life, culture and activities of indigenous communities.	Management plan, government	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement

				community-led visitation			reports and website.	
36	RESEX Lago do Cuniã	RESEX	2018	Local community partnership with associations, government; community-led visitation	NTFPs extractivists; Chico Mendes Institute for Biodiversity Conservation (ICMBio); Ministry of Environment	Experience the life, culture and activities of local communities.	Management plan, government reports and website.	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
37	Pra manter a floresta em pé: Comunidade Tumbira	SDR	Information not found	Local community partnership with tour operator; community-led visitation; fishing and tourism	Riverside communities and family farmers	Experience the life, culture and activities of local communities.	Sustainable tourism operator website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
38	Mosaico Sertão Veredas do Peruaçu - APA and PARNA Cavernas do Peruaçu	Mosaic of conservation units	2008	Local community associations partnership with associations, foundations, institutes, community-led visitation; fishing and tourism	NTFPs extractivists, family farmers, riverside community, indigenous people, quilombola community, universities, institutes, associations, state and municipal government	Experience the life, culture and activities of local communities, biodiversity conservation and sustainable extractivism of NTFPs.	Official website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement; landscape management with cooperation among stakeholders, enhance the role of local communities, build social capital
39	Uacari Lodge	SDR	1999	Local community partnership with tour operator, associations, foundations, institutes; community-led visitation and management; fishing and tourism, agroforestry	NTFPs extractivists, riverside communities and family farmers, universities, institutes, associations, state and municipal government	Living and learning the way of life of Amazonian communities.	Sustainable tourism operator website; official website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement; landscape management with cooperation among stakeholders, enhance the role of local communities, build social capital
40	Quilombo Kalunga	Quilombola community	1991	Community-led visitation and management.	Quilombola community (the largest remaining	Kalunga Historical Site and Cultural Heritage offer trails and walks	Official website	Natural resources management and conservation; cultural heritage and traditions protection;

					quilombo community in Brazil)	between mountains and footpaths and rivers, canyons, waterfalls and thermal waters		rural livelihoods improvement; landscape management with cooperation among stakeholders, enhance the role of local communities, build social capital
41	Assentamento Maceió	Rural settlement	1980	Local community partnership with tour operator; community-led visitation and management; fishing and tourism	NTFPs extractivists, fisherman and family farmers	Experience the life, culture and activities of local communities.	Sustainable tourism operator website and local CBT association website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
42	Tremembé Community	Rural settlement	2000	Local community partnership with tour operator; community-led visitation and management; fishing and tourism	NTFPs extractivists, fisherman and family farmers	Experience the life, culture and activities of local communities.	Sustainable tourism operator website and local CBT association website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
43	Vila da Volta	Rural settlement	Information not found	Local community partnership with tour operator; community-led visitation and management; fishing and tourism	NTFPs extractivists, fisherman and family farmers	Experience the life, culture and activities of local communities.	Sustainable tourism operator website and local CBT association website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
44	Boa Vista Village	Indigenous territory	Information not found	Local community partnership with tour operator; community-led visitation	Indigenous people	Experience the life, culture and activities of indigenous communities.	Sustainable tourism operator website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
45	Quilombo Campinho da Independência	Quilombola community	Information not found	Local community partnership with tour operator; community-led visitation	Fisherman and family farmers	Experience the life, culture and activities of quilombola communities.	Sustainable tourism operator website	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
46	Liberty Route	Quilombola community	Information not found	Community-led visitation and management	Fisherman and family farmers, Rural Brazil Institute	Experience the life, culture and activities of quilombola communities.	Government and third-party websites	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement
47	Rio Negro Community Tourism	Rural settlement	Information not found	Local community partnership with tour operator; community-led visitation	Family farmers, riverside community, indigenous people,	Experience the culture and life of riverside populations, visit the cassava flour artisanal	Sustainable tourism operator website,	Natural resources management and conservation; cultural heritage and traditions protection; rural livelihoods improvement

Itinerary (Tucorin)	Ministry of Tourism	production, forest trails, participate in an indigenous ritual.	government reports

Table S.3. Likelihood of the variables be associated with CBT.

	Variables	CBT	
Biophysical	Reserves	Likely	(BOYD; BUTLER; HAIDER, 1994), (STRONZA; FITZGERALD; HUNT, 2019), (BARTHOLO; SANSOLO; BURSZTYN, 2009), (HERNÁNDEZ; SUÁREZ-VEGA; SANTANA-JIMÉNEZ, 2016), (STREIFENEDER, 2016), (ÖZKÖK; TATLI, 2020)
Cultural/ livelihoods	Socio-biodiversity chain	Likely	(BOYD; BUTLER; HAIDER, 1994), (STRONZA; FITZGERALD; HUNT, 2019), (BARRETO; TAVARES, 2017; BARTHOLO; SANSOLO; BURSZTYN, 2009; ICMBIO, 2019; MTUR, 2008a; PERALTA, 2012)
	Extractive Reserves (RESEX)	Likely	(BOYD; BUTLER; HAIDER, 1994), (STRONZA; FITZGERALD; HUNT, 2019), (BARRETO; TAVARES, 2017; BARTHOLO; SANSOLO; BURSZTYN, 2009; ICMBIO, 2019; MTUR, 2008a; PERALTA, 2012)
	Quilombola community	Likely	(BARRETO; TAVARES, 2017; BARTHOLO; SANSOLO; BURSZTYN, 2009; ICMBIO, 2019; MTUR, 2008b; PERALTA, 2012),
	Indigenous lands	Likely	(BOYD; BUTLER; HAIDER, 1994), (BUTLER; HINCH, 2007), (STRONZA; FITZGERALD; HUNT, 2019), (BARRETO; TAVARES, 2017; BARTHOLO; SANSOLO; BURSZTYN, 2009; ICMBIO, 2019; MTUR, 2008b; PERALTA, 2012)
	Traditional People and Communities	Likely	(BARRETO; TAVARES, 2017; BARTHOLO; SANSOLO; BURSZTYN, 2009; ICMBIO, 2019; MTUR, 2008b; PERALTA, 2012)
	NTFPs extractivism production diversity	Likely	(BARRETO; TAVARES, 2017; BARTHOLO; SANSOLO; BURSZTYN, 2009; ICMBIO, 2019; MTUR, 2008b; PERALTA, 2012)
	Family farming from concession of indigenous land	Likely	(BARTHOLO; SANSOLO; BURSZTYN, 2009)
	Family farming from title of quilombola community	Likely	(BARTHOLO; SANSOLO; BURSZTYN, 2009)
Tourist structure	Lodging establishments up to 9 employers	Complementary	(SANAGUSTÍN FONS; FIERRO; PATIÑO, 2011), (STREIFENEDER, 2016), (ÖZKÖK; TATLI, 2020)

	People employed in tourism related activities	Complementary	(SANAGUSTÍN FONS; FIERRO; PATIÑO, 2011), (STREIFENEDER, 2016), (ÖZKÖK; TATLI, 2020)
Accessibility	Distance from International airports	Complementary	(BARTHOLO; SANSOLO; BURSZTYN, 2009)
	Federal roads	Complementary	(HEAGNEY et al., 2017), (BARTHOLO; SANSOLO; BURSZTYN, 2009)

Table S.4. Detailed information about the variables and datasets used in the study.

Category	Visitor attraction types	Source	Mapping scale
Biophysical	Reserves	Ministry of the Environment, Chico Mendes Institute, Brazilian Forest Service, Amazon Protected Areas Program, Brazilian Agricultural Research Corporation and the Brazilian Institute of Geography and Statistics (https://maps.csr.ufmg.br/).	Scale compatible with the municipalities file (1:250,000)
Cultural / livelihoods	Socio-biodiversity chain	Catalog of Sociobiodiversity Products in Brazil(ICMBIO, 2018a) and Ministry of the Environment (https://www.mma.gov.br/).	Scale compatible with the municipalities file (1:250,000)
	Extractive Reserves (RESEX)	Ministry of Environment http://mapas.mma.gov.br/i3geo/datadownload.htm	Scale compatible with the municipalities file (1:250,000)
	Quilombola community	http://acervofundiario.incra.gov.br/acervo/acv.php	
	Indigenous lands	Ministry of the Environment, Chico Mendes Institute, Brazilian Forest Service, Amazon Protected Areas Program, Brazilian Agricultural Research Corporation and the Brazilian Institute of Geography and Statistics (https://maps.csr.ufmg.br/)	Scale compatible with the municipalities file (1:250,000)
	Coastal and marine extractivists	Ministry of Environment (http://mapas.mma.gov.br/).	Scale compatible with the municipalities file (1:250,000)
	Terreiro	Listed Goods and in Progress (1938 - 2019) of the National Historical and Artistic Heritage Institute (Iphan) (http://portal.iphan.gov.br/)	Not informed
	Faxinalenses	Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/) and (ALMEIDA et al., 2009; MENIM, 2014; SAHR, 2008).	Not informed
	"Sempre-viva" pickers	Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/) and Rede Cerrado Organization (https://redecerrado.org.br/). GeoNode (http://geonode.jbrj.gov.br/).	Not informed
	Geraizeiros	Rede Cerrado Organization (https://redecerrado.org.br/) and Cerratinga Organization (http://www.cerratinga.org.br/).	Not informed
	Caatingueiros	Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/).	Not informed
	Vazanteiros	Centro da Agricultura Alternativa do Norte de Minas (https://www.caa.org.br/), Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/).	Not informed
	Marroquianos	(VIEIRA et al., 2016), Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/)	Not informed

	Pomerano people	(HACKENHAAR, 2018), Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/).	Not informed
	Araguaia retreators	Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/)	Not informed
	Riverside	Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/)	Not informed
	Veredeiros	Ypadê Portal of the Ministry of Environment (http://portalypade.mma.gov.br/) and Instituto Chico Mendes de Conservação da Biodiversidade (https://www.icmbio.gov.br/).	Not informed
	NTFPs extractivism production diversity	IBGE Automatic Recovery System - SIDRA from the 2017 Census of Agriculture https://censos.ibge.gov.br/agro/2017/	Scale compatible with the municipalities file (1:250,000)
	Number of Family farming from concession of indigenous land	IBGE Automatic Recovery System - SIDRA from the 2017 Census of Agriculture https://censos.ibge.gov.br/agro/2017/ Table 6774 https://sidra.ibge.gov.br/tabela/6774#notas-tabela	Scale compatible with the municipalities file (1:250,000)
	Number of Family farming from title of Quilombola community	IBGE Automatic Recovery System - SIDRA from the 2017 Census of Agriculture https://censos.ibge.gov.br/agro/2017/ Table 6774 https://sidra.ibge.gov.br/tabela/6774#notas-tabela	Scale compatible with the municipalities file (1:250,000)
Tourist structure	Lodging establishments up to 9 employers	Information System on the Labor Market in the Tourism Sector – SIMT and the Institute of Applied Economic Research (IPEA) http://extrator.ipea.gov.br/	Scale compatible with the municipalities file (1:250,000)
	People employed in tourism related activities	Information System on the Labor Market in the Tourism Sector – SIMT and the Institute of Applied Economic Research (IPEA) http://extrator.ipea.gov.br/	Scale compatible with the municipalities file (1:250,000)
Accessibility	International airports	Ministry of Transport, National Civil Aviation Agency and Brazilian Airport Infrastructure Company - INFRAERO https://maps.csr.ufmg.br/	Not informed
	Federal roads	Ministry of Infrastructure https://maps.csr.ufmg.br/	Not informed

Table S.5. Grades and weights for CBT multi-criteria model.

	First part		**Second part**		
Variables	Description	Grades	Category	Weight	Source
Reserves	Euclidean distance, range divided in five classes using Quantile.	< 107249.5588 - 10 < 219861.5956 - 8 < 348561.0662 - 6 < 541610.2721 - 4 = < 1367431.875 - 1	Biophysical	0.30	(BARTHOLO; SANSOLO; BURSZTYN, 2009; CARVALHO RIBEIRO et al., 2018; ICMBIO, 2019; IMBAYA et al., 2019; LEE; JAN, 2019; MBAIWA, 2011b; MTUR, 2008a; SMITH; RAM, 2017)
Socio-biodiversity chain	Euclidean distance from Socio-biodiversity chain, divided in	< 51013.03873 - 10 < 138463.9623 - 8 < 284215.5015 - 6 < 1858332.125 - 4	Cultural/livelihoods	0.50	(Bartholo et al., 2009; Carvalho Ribeiro et al., 2018; Hung & Jan, 2019; ICMBIO, 2019;

	five classes using Quantile.				Imbaya et al., 2019; Mbaiwa, 2011; MTUR, 2008; Smith & Ram, 2017)
Extractive Reserves (RESEX), Quilombola community, Indigenous lands and Traditional People and Communities.	Euclidean Distance from RESEX, Quilombola community, Indigenous lands, Marine RESEX, Terreiro, Faxinalenses, "Sempre-viva" pickers, Geraizeiros, Artisanal fishing, Caatingueiros, Vazanteiros, Marroquianos, Pomerano people, Faxinal, Araguaia retreators, Riverside, Cipozeiros, Andiobeiras e Veredeiros. The density in five classes using Quantile.	< 80.51764706 - 1 < 92.65882353 - 4 < 101.7647059 - 6 < 113.9058824 - 8 < 165 - 10			(Bartholo et al., 2009; Carvalho Ribeiro et al., 2018; Hung & Jan, 2019; ICMBIO, 2019; Imbaya et al., 2019; Mbaiwa, 2011; MTUR, 2008; Smith & Ram, 2017)
NTFPs diversity 2019	Values at municipality level, range divided in five classes using Quantile.	= 1 - 1 >1- 10			(Bartholo et al., 2009; Carvalho Ribeiro et al., 2018; Hung & Jan, 2019; ICMBIO, 2019; Imbaya et al., 2019; Mbaiwa, 2011; MTUR, 2008; Smith & Ram, 2017)
Family farming from concession of indigenous land	Values at municipality level, range divided in five classes using Quantile.	< 0 – 1 = 0 - 1 >0 - 10			(Bartholo et al., 2009; Carvalho Ribeiro et al., 2018; Hung & Jan, 2019; ICMBIO, 2019; Imbaya et al., 2019; Mbaiwa, 2011; MTUR, 2008; Smith & Ram, 2017)
Family farming from title of quilombola community	Values at municipality level, range divided in five classes using Quantile.	< 0 – 1 = 0 - 1 >0 - 10			(Bartholo et al., 2009; Carvalho Ribeiro et al., 2018; Hung & Jan, 2019; ICMBIO, 2019; Imbaya et al., 2019; Mbaiwa, 2011; MTUR, 2008; Smith & Ram, 2017)
Lodging establishments up to 9 employers	Values at municipality level, range divided in five classes using Quantile.	= 0 - 1 < 8 - 4 < 18 - 6 < 50 - 8 = < 1101 - 10	Tourist structure	0.10	(Bartholo et al., 2009; Carvalho Ribeiro et al., 2018; Hung & Jan, 2019; ICMBIO, 2019; Imbaya et al., 2019; Mbaiwa, 2011; MTUR,

					2008; Smith & Ram, 2017)
People employed in tourism related activities	Values at municipality level, range divided in five classes using Quantile.	< 5 - 1 < 60 - 4 < 201 - 6 < 826 - 8 = < 342831 - 10			(Bartholo et al., 2009; Carvalho Ribeiro et al., 2018; Hung & Jan, 2019; ICMBIO, 2019; Imbaya et al., 2019; Mbaiwa, 2011; MTUR, 2008; Smith & Ram, 2017)
Proximity from Federal roads	Euclidean Distance for international airports and Federal roads. The density of federal roads and international airports (from 2 to 20), divided in five classes using Quantile.	<12395.0098 - 10 < 29438.14828 -8 < 54228.16789 - 6 < 100709.4547 - 4 < 395090.9375 - 1	Accessibility	0.10	(Bartholo et al., 2009; Carvalho Ribeiro et al., 2018; Hung & Jan, 2019; ICMBIO, 2019; Imbaya et al., 2019; Mbaiwa, 2011; MTUR, 2008; Smith & Ram, 2017)
Proximity from International airports		< 223541.4039 - 10 < 351279.349 - 8 < 487000.9157 - 6 < 634697.9147 - 4 < 1017911.75 - 1			(Bartholo et al., 2009; Carvalho Ribeiro et al., 2018; Hung & Jan, 2019; ICMBIO, 2019; Imbaya et al., 2019; Mbaiwa, 2011; MTUR, 2008; Smith & Ram, 2017)

Table S.6. Landscape metrics from sociobiodiversity tourism hotspots.

Tourism modalities	**Biomes**	**Mean Patch Size (MPS) (ha)**	**Patch Size Standard Deviations (ha)**
CBT	Amazon	432.907	2.348.473
	Cerrado/ Caatinga	95.962	417.521

Table S.7. Quantitative data regarding landscape-scale governance mechanisms in sociobiodiversity tourism hotspots.

Tourism modalities	**Biomes**	**Associations/ cooperatives**	**Foundations/ NGOs/ institutes**	**Total**	**Tourism official department**
CBT	Amazon	165	34	199	93
	Cerrado/ Caatinga	125	32	157	109

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Appendix D - Chapter 5 Supplemental Information

Tabela S.1. Lista de variáveis possíveis e as abordadas pelas iniciativas de ecoturismo baseadas em 22 lugares com exemplos.

Categoria	Variáveis e códigos	Exemplos das iniciativas
Social	Beneficiar comunidades tradicionais, povos indígenas, agricultores familiares que vivem em áreas protegidas e entorno, sítios patrimoniais (V1)	Experimente e aprenda o modo de vida das comunidades amazônicas (Uacari Pousada); vida das tribos indígenas (Projeto Serras Guerreiras de Tupuruquara e Vivência Baré, YARIPO: Ecoturismo Yanomami); Localizado em um patrimônio natural e sítio arqueológico (Monte Alegre); Experimente modos de vida tradicionais (comunidade Taquaruçu, Riverside Belém/Combu, Macapá - Amapá Rio Amazonas, RESEX Cazumbá Iracema; Mandacaru e Canto de Atins, Queimada dos Britos e Baixa Grande, Comunidade Tumbira e Santo Amaro, Associação Peixe-Boi, Trilhas Griô, Cassange Pousada, Mosaico Sertão Veredas do Peruaçu (MSVP)).
	Valorizar e preservar sistemas de conhecimento ligados a lugares e produtos locais (V2)	Vivenciar o cultivo tradicional do cacau e da castanha-do-pará (Belém/Combu); Visitar locais de pintura rupestre (Monte Alegre); missão de fortalecer a identidade e o patrimônio do povo brasileiro e a celebração da vida (trilhas do Griô); A experiência acontece a montante, em uma comunidade que se considera indígena e reivindica a demarcação de suas terras (Vivência Baré); Um lugar que respeita o ecossistema ao qual pertence (comunidade Tumbira); A experiência acontece em um território sagrado para a cultura indígena (projeto Serras Guerreiras de Tupuruquara); Promover o ecoturismo em sintonia com a missão de cada instituição, contribuindo para proteger a fronteira e a biodiversidade, ao mesmo tempo em que promove o bem-estar das comunidades Yanomami (YARIPO: Yanomami Ecoturismo); iniciativa dos moradores de Silves para defender os lagos do município (Aldeia dos Lagos Pousada);
	Possibilita a criação de conteúdo informativo e para divulgação (V3)	Site oficial (Cassange Pousada, Cristalino Pousada, Uacari Pousada, trilhas Griô, associação Peixe-Boi, projeto Serras Guerreiras de Tupuruquara);
Econômico	Permite que os membros da comunidade sejam empregados e gerenciem os negócios (V4)	Instituto Mamirauá auxilia as comunidades locais na prestação de serviços turísticos (Pousada Uacari); Café da manhã, almoço e jantar na exposição e oficina de artesanato (Vivência Baré); Loja aberta para que os membros da comunidade compartilhem histórias, o modo de vida e a comida típica, na natureza exuberante do entorno (comunidade Tumbira); Jovens Yanomami que desejam trabalhar com ecoturismo veem a atividade como uma oportunidade de obter algum tipo de renda mas, ao mesmo tempo, como uma oportunidade de aprender mais sobre sua própria cultura (YARIPO: Yanomami Ecoturismo); comida caseira, cozida em fogão à lenha (Queimada

		dos Britos e Baixa Grande); alojamentos comunitários (comunidade Mandacaru e Canto de Atins);
	Incentiva negócios criados pela população local (V5)	Hospedagem, alojamento comunitário (Mosaico de Unidades de Conservação (Mosaico Sertão Veredas do Peruaçu (MSVP)); Café da manhã, almoço e jantar e artesanato (Vivência Baré); A comunidade de Cazumbá construiu duas estruturas de hospedagem para os visitantes (RESEX Cazumbá-Iracema); o ecoturismo gera renda para os 36 associados da Aspac que trabalham no hotel (e o administram coletivamente) (Aldeia dos Lagos Pousada); Apoia as mulheres da comunidade na fabricação de peixe-boi (associação Peixe-Boi).
	Promove a expansão do mercado local (V6)	Região que cultiva cacau é hoje utilizada por renomados chefs de Belém e São Paulo (Riverside Belém/Combu);
	Parte de um mecanismo específico de conservação (áreas protegidas) (V7)	Localizada em uma Reserva Particular do Patrimônio Natural (RPPN) (pousada Cristalino); Localizada no Parque Pico da Neblina, que se sobrepõe a 4 terras indígenas demarcadas (YARIPO: Ecoturismo Yanomami); Mosaico de Unidades de Conservação (Mosaico Sertão Veredas do Peruaçu (MSVP)); Outras áreas protegidas e terras indígenas (Macapá - Rio Amazonas Amapá, associação Peixe-Boi, projeto Serras Guerreiras de Tupuruquara, RESEX Cazumbá Iracema, Queimada dos Britos e Baixa Grande, trilhas Griô, pousada Uacari, Monte Alegre, comunidade Tumbira).
	Melhorar o monitoramento e educação ambiental para turistas (V8)	Promover trilhas ecológicas (Riverside Belém/Combu); Passeios realizados por povos indígenas para vivenciar a natureza (Projeto Serras Guerreiras de Tupuruquara e Vivência Baré, YARIPO: Ecoturismo Yanomami); Todos os motoristas, remadores e artesãos envolvidos na atividade estão unidos através da Associação Peixe-Boi (Associação Peixe-Boi);
Ambiental	Reduzir a degradação do solo, promover reciclagem, reutilização da água, energia limpa, reflorestamento (V9)	Passeios realizados por guarda-parques para vivenciar a natureza (Macapá - Rio Amapá Amazonas); caminhadas e trilhas em ecossistemas únicos (trilhas Griô, associação de guias de Ecoturismo); extrativismo Sustentável NTFPs (Mosaico Sertão Veredas do Peruaçu (MSVP)); Rafting, esportes de aventura (Socorro, Rota do Caminho de São Francisco da Esperança); visita a cachoeiras, rafting (Bonito); produção de energia através de quase 300 m² de painéis solares (Cassange Pousada). Observação de peixes-boi no Rio Tatuamunha (associação Peixe-Boi); Caminhadas em ecossistemas nativos, pesca, canoagem e praias (comunidade Tumbira); Expedições Serras Guerreiras de Tapuruquara são viagens de experiência para apresentar ao visitante nosso território e nossos modos de vida (projeto Serras Guerreiras de Tupuruquara); Trilhas e escaladas nas encostas do Yuripo (YARIPO: Yanomami Ecoturismo); visita a espécimes da flora e fauna regional (comunidade de Santo Amaro); visita aos Lençóis Maranhenses (dunas, deserto e lagoas) (Mandacaru e Canto de Atins, Queimada dos Britos e Baixa Grande); atividades de proteção de quatro lagos, incluindo a remuneração de quatro seguranças que se revezam

		continuamente supervisionando o maior deles (Purema) (pousada Aldeia dos Lagos);
	Proteger as espécies listadas na Lista Vermelha da IUCN (V10)	Programa de preservação do Peixe-Boi (Associação Peixe-Boi).
	Estabelecer um conjunto de regras, papéis e responsabilidades (V11)	A participação da população local em fóruns de negociação e tomada de decisões (Uacari Pousada); o ecoturismo também ganhou crescente atenção nas assembleias anuais do maior órgão representativo dos Yanomami na região um espaço legítimo para discutir e deliberar sobre projetos de interesse para a comunidade (YARIPO: Ecoturismo Yanomami);
	Incentivo às cooperativas comunitárias, microempresas e associações (V12)	Fortalecimento das organizações comunitárias, associações e cooperativas, estimulando a participação da população local na gestão territorial e no manejo dos recursos naturais em Unidades de Conservação (Uacari Pousada); comunidades indígenas, a ACIR (Associação de Comunidades Indígenas e Ribeirinhas) (Projeto Serras Guerreiras de Tupuruquara); duas associações locais, AYRCA e Kumirayoma, também participaram (YARIPO: Yanomami Ecoturismo): Yanomami Ecoturismo); Associação Silves para a Preservação Ambiental e Cultural (Aspac) (Aldeia dos Lagos Pousada);
	Promover a gestão de recursos naturais baseada na comunidade (V13)	Modelo de manejo comunitário (RESEX Cazumbá Iracema); extrativismo e conselho consultivo das NTFPs sustentáveis (Mosaico Sertão Veredas do Peruaçu (MSVP)); plano de manejo florestal e pesqueiro com as comunidades (pousada Uacari); desde seu início o processo de elaboração do Plano de Visitação YARIPO-Yanomami Ecoturismo tem contado com a participação ativa do povo Yanomami (YARIPO): Yanomami Ecoturismo); O hotel é uma empresa comunitária sem fins lucrativos (Aldeia dos Lagos lodging);
Gestão integral	Parcerias com institutos e fundações de fauna e flora, e outros atores (V14)	Parceria com o Instituto de Desenvolvimento Florestal e Biodiversidade do Estado do Pará (Ideflor-bio) (Riverside Belém/Combu); parceria com o Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) (associação Peixe-Boi, trilhas Griô, pousada Uacari, YARIPO: Yanomami Ecoturismo); parceria com o Serviço Brasileiro de Apoio às Micro e Pequenas Empresas (comunidade Tumbira); Fundação Nacional dos Povos Indígenas (YARIPO: Yanomami Ecoturismo); WWF-Brasil (Aldeia dos Lagos Pousada);

Tabela S.2. Resumo das variáveis abordadas pelas 22 iniciativas de ecoturismo.

ID	Nome	Social	Econômico	Ambiental	Gestão integrada
1	Plano de Apoio a Taquaruçu	V1	-	-	-

2	Monte Alegre: patrimônio natural e pinturas rupestres	V1, V2	-	V7	-
3	Belém/ Ilha do Combu	V1, V2	V6	V8	V14
4	Pousada Uacari	V1, V2, V3	V5, V4	V7	V11, V12, V13, V14
5	Rio Amazonas em Macapá	V1	-	V7, V9	-
6	Reserva Extrativista do Cazumbá Iracema	V1	V5	V7	V13
7	Projeto Serras Guerreiras de Tupuruquara	V1, V2, V3	-	V7, V8, V9	V12
8	Povoado de Mandacaru e Canto de Atins	V1	V4	V9	-
9	Queimada dos Britos e Baixa Grande	V1	V4	V7, V9	-
10	Pousada Aldeia dos Lagos	V2	V5	V9	V12, V13, V14
11	Comunidade Santo Amaro	V1	-	V9	-
12	Vivência Baré	V1, V2	V4, V5	V8	-
13	Associação Peixe-boi	V1, V3	V5	V7, V8, V9, V10	V14
14	Pra manter a floresta em pé: Comunidade Tumbira	V1, V2	V4	V7, V9	V14
15	Trilhas Griô, Chapada Diamantina	V1, V2, V3	-	V7, V9	V14
16	Pousada Lagoa do Cassange	V1, V3	-	V9	-
17	Pousada Cristalino	V3	-	V7	-
18	YARIPO: Ecoturismo Yanomami	V1, V2	V4	V7, V8, V9	V11, V12, V13, V14
19	Mosaico Sertão Veredas do Peruaçu	V1	V5	V7, V9	V13
20	Socorro	-	-	V9	-
21	Rota Caminho de São Francisco da Esperança	-	-	V9	-
22	Bonito	-	-	V9	-

Tabela S.3. Soma das variáveis ponderadas abordadas pelas 22 iniciativas.

ID	Nome	Social Peso 2	Econômico Peso 3	Ambiental Peso 4	Gestão integrada Peso 5	Sobreposição Peso 6	Total
1	Plano de Apoio a Taquaruçu	1*2 = 2	-	-	-	6	8
2	Monte Alegre: patrimônio natural e pinturas rupestres	2*2 = 4	-	1*4 = 4	-	6	14
3	Belém/ Ilha do Combu	2*2 = 4	1*3 = 3	1*4 = 4	1*5 = 5	6	16
4	Pousada Uacari	3*2 = 6	2*3 = 6	1*4 = 4	4*5 = 20	-	36
5	Rio Amazonas em Macapá	1*2 = 2	-	2*4 = 8	-	6	16
6	Reserva Extrativista do Cazumbá Iracema	1*2 = 2	1*3 = 3	1*4 = 4	1*5 = 5	6	20
7	Projeto Serras Guerreiras de Tupuruquara	3*2 = 6	-	3*4 = 12	1*5 = 5	6	29
8	Povoado de Mandacaru e Canto de Atins	1*2 = 2	1*3 = 3	1*4 = 4	-	6	15
9	Queimada dos Britos e Baixa Grande	1*2 = 2	1*3 = 3	2*4 = 8	-	-	13
10	Pousada Aldeia dos Lagos	1*2 = 2	1*3 = 3	1*4 = 4	3*5 = 15	6	43
11	Comunidade Santo Amaro	1*2 = 2	-	1*4 = 4	-	-	6
12	Vivência Baré	2*2 = 4	2*3 = 6	1*4 = 4	-	-	20
13	Associação Peixe-boi	2*2 = 4	1*3 = 3	4*4 = 16	1*5 = 5	-	48
14	Pra manter a floresta em pé: Comunidade Tumbira	2*2 = 4	1*3 = 3	2*4 = 8	1*5 = 5	-	20
15	Trilhas Griô, Chapada Diamantina	3*2 = 6	-	2*4 = 8	1*5 = 5	6	25
16	Pousada Lagoa do Cassange	2*2 = 4	-	1*4 = 4	-	6	14
17	Pousada Cristalino	1*2 = 2	-	1*4 = 4	-	6	12
18	YARIPO: Ecoturismo Yanomami	2*2 = 4	1*3 = 3	3*4 = 12	4*5 = 20	-	39
19	Mosaico Sertão Veredas do Peruaçu	1*2 = 2	1*3 = 3	2*4 = 8	1*5 = 5	6	24

20	Socorro	-	-	1*4 = 4	-	-	4
21	Rota Caminho de São Francisco da Esperança	-	-	1*4 = 4	-	6	10
22	Bonito	-	-	1*4 = 4	-	6	10

Appendix E - Chapter 6 Supplemental Information

Table S.1 List of potential interviewees from Luneburg Heath case study.

Category	ID	Name	Municipality/ region	Interviewee	Method of contact
Federal and state conservation units	1	Lüneburger Heide Nature Park	Lüneburger Heide Nature Park region	Park manager	E-mail
City hall / tourism department	2	Local tourism board	Bispingen municipality	Tourism department official	E-mail
Institutes and foundations, research group	3	Alfred Toepfer Academy for Nature Conservation (NNA)	Lower Saxony	Official agent	E-mail
	4	LEADER Regional Management	European Union	Official agent	E-mail
	5	Luneburg Heath Nature Park Region Local Action Group (LEADER)	Lüneburger Heide Nature Park region	Official agent	E-mail
	6	Association of German Nature Parks (VDN)	National	Official agent	E-mail
	7	The EUROPARC Federation	European Union	Official agent	E-mail
	8	VNP - Verein Naturschutzpark eV, Luneburg Heath Nature Conservation Park Foundation e VNP Nature Park GmbH	Lüneburger Heide Nature Park region	Official agent	E-mail
	9	Lüneburger Heide GmbH (LHG)	Lüneburger Heide Nature Park region	Official agent	E-mail

Table S.2 List of potential interviewees from PERD case study.

Category	ID	Name	Municipality/ region	Interviewee	Method of contact
Federal and state conservation units	1	Rio Doce State Park	Marliéria	Park manager	In person

City hall / tourism department	2	Municipal Secretariat of Environment and Tourism	Marliéria	Tourism department official	E-mail
	3	Municipal Secretariat of Economic Development and Tourism	Timóteo	Tourism department official	E-mail
	4	Municipal Secretariat of Culture and Tourism	Bom Jesus do Galho	Tourism department official	E-mail
	5	Municipal Secretariat of Culture, Sports and Leisure	Ipatinga	Tourism department official	E-mail
	6	Municipal Secretariat for Economic Development and Tourism	Caratinga	Tourism department official	E-mail
	7	Municipal Department of Sports, Leisure, Culture and Tourism	Córrego Novo	Tourism department official	E-mail
	8	Secretariat of Culture, Sports, Leisure and Tourism	Dionísio	Tourism department official	E-mail
	9	Municipal Development Coordination of Environment, Tourism and Culture	Jaguaraçu	Tourism department official	E-mail
Institutes and foundations, research group	10	Renova Foundation	Rio Doce river	Official agent	E-mail
	11	Brazil Fund	National	Official agent	E-mail
	12	EKOS Brazil	Minas Gerais state	Official agent	E-mail
	13	IEF	Minas Gerais state	Official agent	E-mail
	14	Canastra Armadillo Research group	Rio Doce State Park	Official agent	E-mail
	15	ARMVA - Development	Steel Valley	Official agent	E-mail

		Agency of the Steel Valley Metropolitan Region			
	16	Primates UFV	Rio Doce State Park	Official agent	E-mail
	17	Aperam Foundation	Steel Valley	Official agent	E-mail
	18	Waita Research and Conservation Institute	Rio Doce State Park	Official agent	E-mail
	19	University research group	Rio Doce State Park	Official agent	E-mail
	20	CeMAIS / Seed Platform	Minas Gerais state	Official agent	E-mail
	21	Rotary Ipatinga	Steel Valley	Official agent	E-mail
Cooperatives and associations	22	Local Productive Arrangement - Tourism of Marliéria and region	Steel Valley	Official agent	E-mail
	23	Association of Friends of the Rio Doce State Park	Rio Doce State Park	Official agent	E-mail
	24	Association of Small Rural Producers of Marliéria	Marliéria	Official agent	E-mail

Table S.3 List of potential interviewees from MSVP case study.

Category	**ID**	**Name**	**Municipality/ region**	**Interviewee**	**Method of contact**
Federal and state conservation units	1	Grande Sertão Veredas National Park	Chapada Gaúcha (MG)	Official agent	E-mail
	2	Peruaçu Caves National Park	Januária (MG)	Official agent	E-mail
	3	Serra das Araras State Park	Chapada Gaúcha (MG)	Official agent	E-mail
	4	Veredas of Peruaçu State Park	Januária (MG)	Official agent	E-mail
	5	Mata Seca State Park	Manga (MG)	Official agent	E-mail
	6	Pandeiros River State Wildlife Refuge	Januária (MG)	Official agent	E-mail
	7	Peruaçu Caves Environmental Protection Area	Januária (MG)	Official agent	E-mail

	8	Pandeiros River Environmental Protection Area	Januária e Bonito de Minas	Official agent	E-mail
	9	Cochá and Gibão Environmental Protection Area	Januária, Cônego Marinho, Bonito de Minas	Official agent	E-mail
	10	Veredas of Acari State Sustainable Development Reserve	Chapada Gaúcha (MG)	Official agent	E-mail
	11	Sagarana State Park	Arinos	Official agent	E-mail
City hall / tourism department	12	Municipal secretariat for culture, tourism, sports and leisure	Chapada Gaúcha	Official agent	E-mail
	13	Municipal secretariat of tourism and culture	Januária	Official agent	E-mail
	14	Municipal secretariat for sports, leisure, culture and tourism	Miravânia	Official agent	E-mail
	15	Municipal secretariat for environment and tourism	São João das Missões	Official agent	E-mail
Institutes and foundations, research group	16	Pro-Nature Foundation - FUNATURA		Official agent	E-mail
	17	Rosa and Sertão Institute	MSVP	Official agent	E-mail
	18	Chico Mendes Institute for Biodiversity Conservation - ICMBio	National	Official agent	E-mail
	19	Agency for Integrated and Sustainable Development of the Chapada Gaúcha	Chapada Gaúcha	Official agent	E-mail
	20	CARITAS Diocesan of Januária - MG	Januária - MG	Official agent	E-mail
	21	EKOS Brazil	Minas Gerais state	Official agent	E-mail
	22	Sertão Vereda Institute	MSVP	Official agent	E-mail
	23	Minas Gerais Institute of Water Management	Minas Gerais state	Official agent	E-mail
	24	State Forestry Institute - IEF	Minas Gerais state	Official agent	E-mail
Cooperatives and associations	25	Cooperative Sertão Veredas LTDA	MSVP	Official agent	E-mail
	26	Association of Environmental Agents of the Peruaçu Valley	MSVP	Official agent	E-mail

	27	COOPAE - Cooperative of Small Agroextractivist Producers of Pandeiros	MSVP	Official agent	E-mail
	28	Natural Equilibrium Ecotourism and Adventure Sports	MSVP	Official agent	E-mail
	29	Cooperative of Family Farmers and Agro-Extractivists of the Peruaçu Valley - Cooperuaçu	MSVP	Official agent	E-mail
	30	ASSUSBAC - Association of Users of the Cochos River Sub-Basin	MSVP	Official agent	E-mail
	31	Sabores do Agreste Group	MSVP	Official agent	E-mail
	32	Ana Maria Association	MSVP	Official agent	E-mail
	33	Pequi Nucleus	MSVP	Official agent	E-mail

Table S.4 Final list of interviewees from Lüneburger Heide case study.

Category	**ID**	**Name**	**Municipality / region**	**Interviewee**	**Interview method**
City hall / tourism department	1	Local tourism board	Bispingen municipality	Tourism department official	Phone call
Institutes and foundations, research group	2	Alfred Toepfer Academy for Nature Conservation (NNA)	Lower Saxony	Official agent	Video conference
	3	Association of German Nature Parks (VDN)	National	Official agent	Phone call
	4	Association of German Nature Parks (VDN)	National	Official agent	Phone call
	5	VNP - Verein Naturschutzpark eV, Luneburg Heath Nature Conservation Park Foundation e VNP Nature Park GmbH	Lüneburger Heide Nature Park region	Official agent	Phone call
	6	VNP - Verein Naturschutzpark eV, Luneburg Heath Nature Conservation Park Foundation e VNP Nature Park GmbH	Lüneburger Heide Nature Park region	Official agent	Phone call

Table S.5 Final list of interviewees from PERD case study.

Category	ID	Name	Municipality / region	Interviewee	Interview method
City hall / tourism department	1	Municipal Secretariat of Culture and Tourism	Bom Jesus do Galho	Tourism department official	Phone call
Institutes and foundations, research groups	2	EKOS Brazil	Minas Gerais state	Official agent 1	In person
	3	EKOS Brazil	Minas Gerais state	Official agent 2	In person
	4	IEF	Minas Gerais state	Official agent 1	Video conference
	5	IEF	Minas Gerais state	Official agent 2	Video conference
	6	Canastra Armadillo Research group	Rio Doce State Park	Official agent	Video conference
	7	University research group	Rio Doce State Park	Official agent	In person
	8	ARMVA - Development Agency of the Steel Valley Metropolitan Region	Steel Valley	Official agent	Video conference
	9	Primates UFV	Rio Doce State Park	Official agent	Video conference
Cooperatives and associations	10	Local Productive Arrangement - Tourism of Marliéria and region	Steel Valley	Official agent 1	In person
	11	Local Productive Arrangement - Tourism of Marliéria and region	Steel Valley	Official agent 2	Video conference
	12	Local Productive Arrangement - Tourism of Marliéria and region	Steel Valley	Official agent 3	Video conference
	13	Local Productive Arrangement - Tourism of Marliéria and region	Steel Valley	Official agent 4	Video conference
	14	Local Productive Arrangement - Tourism of Marliéria and region	Steel Valley	Official agent 5	Video conference
	15	Local Productive Arrangement - Tourism of Marliéria and region	Steel Valley	Official agent 6	Video conference
	16	Association of Friends of the Rio Doce State Park	Rio Doce State Park	Official agent	In person

Table S.6 Final list of interviewees from MSVP case study.

Category	ID	Name	Municipality/ region	Interviewee	Method of contact

Federal and state conservation units	1	Sagarana State Park	Arinos	Official agent	Video conference
City hall / tourism department	2	Municipal secretariat of tourism and culture	Januária	Official agent	In person
	3	Municipal secretariat for environment and tourism	São João das Missões	Official agent	Phone call
Institutes and foundations, research groups	4	Rosa and Sertão Institute	MSVP	Official agent	Video conference
	5	Chico Mendes Institute for Biodiversity Conservation - ICMBio	National	Official agent	In person
	6	EKOS Brazil	Minas Gerais state	Official agent	Video conference
	7	Sertão Vereda Institute	MSVP	Official agent	In person
	8	Sertão Vereda Institute	MSVP	Official agent	In person
	9	Minas Gerais Institute of Water Management	Minas Gerais state	Official agent	In person
Cooperatives and associations	10	Pequi Nucleus	MSVP	Official agent	E-mail

Table S.7 Questionnaire used in the semi-structured interviews for the case study in Lüneburger Heide Nature Park.

Number	**Question**
1	Could you briefly describe your work?
2	What is the role of nature parks in Germany and what is the role of Luneburg Heath nature park?
3	What are the main development goals set for rural landscapes in the nature reserve? How they are defined? And what are the main challenges?
4	Do you think that tourism in nature parks is important to help accomplish development goals set for rural landscapes? If yes, why and what are the challenges?
5	What are some examples of land uses (farming, cattle ranching, forestry, fisheries, protected areas, energy, mining, others) in the region? How important is tourism in relation to them?
6	The Luneburg Heath nature park can be considered a success tourism case? Why?
7	What mechanisms are used in management and governance of the nature park? How they are applied?
8	What are the key factors (other actors, financing, partnerships) that can be associated with failures or success?
9	Which obstacles still exist to achieve territorial development goals and how should evolve to support the role of nature parks?

Table S.8 Questionnaire used in the semi-structured interviews for the case study in the PERD and the MSVP.

Number	Question
1	Whether and how can the PERD/MSVP help stimulate activities and services for the development of the region?
2	a. Do you think it is important what kind of tourism (show photos) together or separately from the agroextractivist production, rural way of life for the development of the region? Why and what are the challenges? b. And where? (Hand out the image, select the quadrants).
3	To implement tourism and sociobiodiversity, which legislation (hand out the list of legislation) are/could be used that you consider most effective?
4	To implement tourism and sociobiodiversity, which partnership (deliver the partnership list) are/can be used that you consider most effective?
5	To implement tourism and sociobiodiversity, which funding (hand out the funding list) are/could be used that you consider most effective?
6	To implement tourism and sociobiodiversity, which social capital (hand out the social capital list) are/can be used and which do you consider most effective?
7	To implement tourism and sociobiodiversity, which marketing (deliver list marketing) are/can be used that you consider most effective?
8	What will determine the success of the implementation? (ranking) a) Social capital ( ) b) Financing ( ) c) Partnerships ( ) d) Policies ( ) e) Marketing ( )
9	How should the mechanisms evolve to support tourism and conservation, agroextractivist production and rural livelihoods in the region's development?

The photos used as a complement to Question 2a, represent the tourism modalities surveyed in our study (e.g., ecotourism, CBT and agritourism). The same set of photos were used to interview people from PERD and MSVP case studies (Figure S.1).

Figure S.1 Photos used in the questionnaire that represent tourism modalities: ecotourism (a), CBT (b) and agritourism (c). Source: internet.

We used different images of the study area from PERD and MSVP to assist Question 2b and divided into quadrants so that interviewees could choose from (Figure S.2 and S.3).

Figure S.2 Image of the study area from PERD case study. Source: Google Maps.

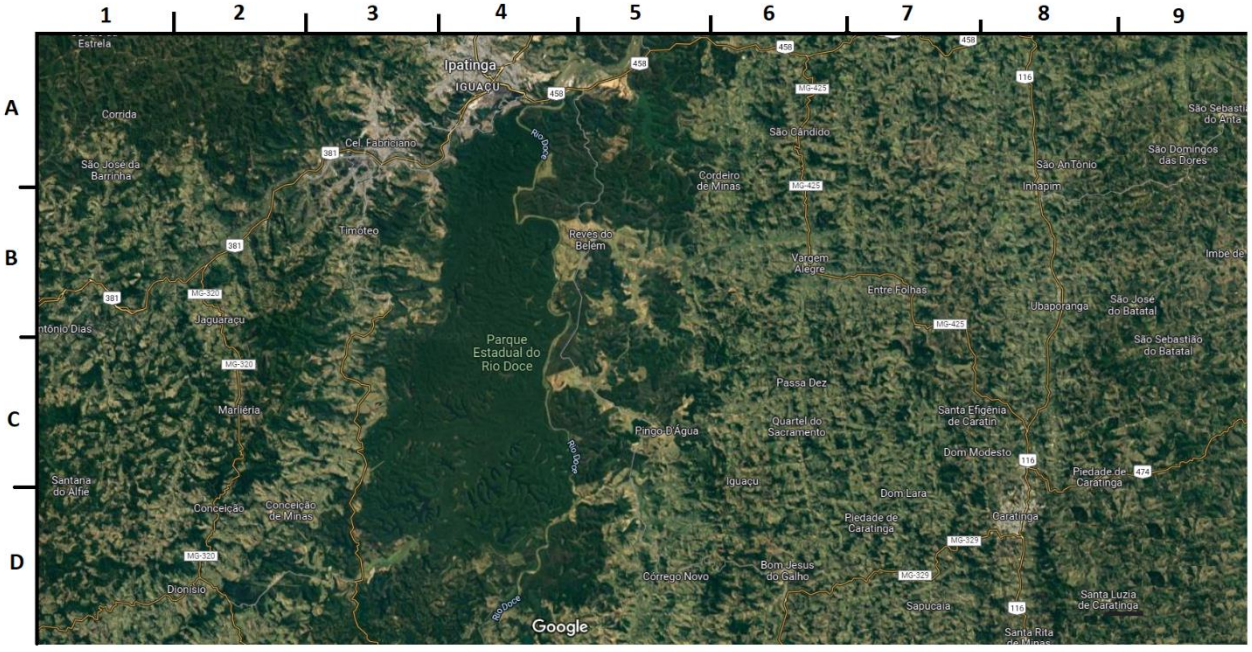


Figure S.3 Image of the study area from MSVP case study. Source: Google Maps.

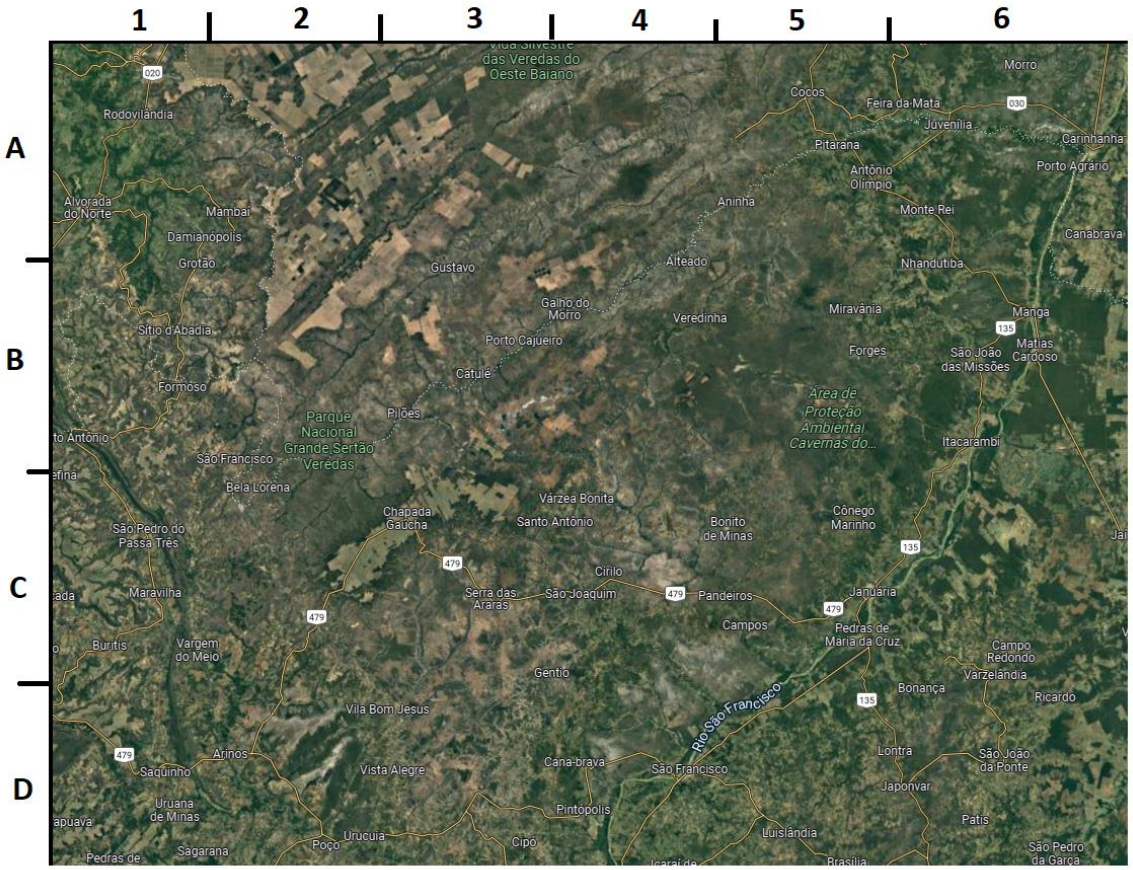


Table S.9 List of legislations and codes.

Legislation	Code
Lei da Mata Atlântica (Lei Nº 11.428/2006)	**L1**
Política Nacional de Turismo (Lei Nº 11.771/2008)	**L2**
Programa de Regionalização do Turismo (Portaria MTUR Nº 105/2013), Mapa do Turismo Brasileiro (Portaria nº 313/2013)	**L3**
Cadastro de Prestadores de Serviços Turísticos (CADASTUR) (Portaria MTUR nº 130/ 2011)	**L4**
Sistema Nacional de Unidades de Conservação da Natureza (SNUC) (Lei No 9.985/2000)	**L5**
Chancela de paisagem cultural (Portaria Iphan nº 127/2009)	**L6**
Código Florestal (Lei Nº 12.651/2012)	**L7**
Política Nacional de Desenvolvimento Sustentável dos PCTs (Decreto Nº 6.040/2007)	**L8**
Programa Bioeconomia Brasil Sociobiodiversidade (Portaria nº 121/2019)	**L9**
Plano Nacional da Promoção das Cadeias de Produtos da Sociobiodiversidade (PNPSB)	**L10**
Política Nacional de Assistência Técnica e Extensão Rural (PNATER) (Lei Nº 12.188/2010)	**L11**
Política de Garantia de Preços Mínimos para os Produtos da Sociobiodiversidade (PGPM-Bio)	**L12**
Programa de Garantia de Preços para Agricultura Familiar (PGPAF)	**L13**

Programa de Aquisição de Alimentos (PAA) (Lei nº 10.696/2003)	**L14**
Selo Nacional da Agricultura Familiar (SENAF)	**L15**
Programa Brasil Mais Cooperativo (Portaria nº 129/2019)	**L16**
Programa Rotas da Integração Nacional (Portaria MI nº 80/2018)	**L17**
Política Nacional de Desenvolvimento Regional (PNDR)	**L18**
Conselho Nacional do Meio Ambiente (CONAMA) (Lei nº 6.938/1981)	**L19**
Política Nacional de Desenvolvimento Sustentável da Aquicultura e da Pesca (Lei Nº 11.959/2009)	**L20**
Política Estadual de Turismo de Base Comunitária (Lei Nº 23763/2021)	**L21**
Política Estadual de Turismo (Lei Nº 22.765/2017)	**L22**
Política Estadual de Aquisição de Alimentos da Agricultura Familiar (Lei Nº 22.819/2018)	**L23**
ICMS Ecológico (Deliberação Normativa COPAM Nº 234/2019)	**L24**

Table S.10 List of partnerships and codes.

Partnerships	**Code**
SOS Mata Atlântica	**P1**
Portal de Investimentos do Ministério do Turismo	**P2**
Conselho Municipal de Turismo (COMTUR)	**P3**
VALE	**P4**
CENIBRA	**P5**
Fundação Projeto Renova CCSS	**P6**
Parque Estadual do Rio Doce	**P7**
Secretaria Municipal de Meio Ambiente e Turismo	**P8**
Secretaria Municipal Desenvolvimento Econômico e Turismo	**P9**
Departamento Municipal de Cultura e Turismo	**P10**
Secretaria Municipal de Cultura, Esporte e Lazer -SEMCEL	**P11**
Secretaria de Desenvolvimento Econômico e Turismo	**P12**
Diretoria Municipal de Esporte, Lazer, Cultura e Turismo	**P13**
Secretaria de Cultura, Esporte, Lazer e Turismo	**P14**
IEF	**P15**
Instituto de Pesquisa e Conservação Waita	**P16**
CeMAIS / Plataforma Semente	**P17**
Rotary Ipatinga	**P18**
Plantuc	**P19**
Garupa (operadora de turismo sustentável)	**P20**
SESI, SENAC, FECOMERCIO e SEBRAE	**P21**
Associação Brasileira de Agências de Viagens de Minas Gerais-ABAV	**P22**

Table S.11 List of financing and codes.

Financing	**Code**
Fundo Geral de Turismo (FUNGETUR)	**F1**
Fundo Municipal de Turismo (FMT)	**F2**
Banco Nacional de Desenvolvimento Econômico e Social (BNDES)	**F3**
Programa Nacional de Fortalecimento da Agricultura Familiar	**F4**
Fatura Verde (SOS Mata Atlântica)	**F5**
Crédito Rural	**F6**
Global Climate Change Alliance Plus (GCCA+)	**F7**

Fundo Verde para o Clima (GCF)	**F8**
Plano Safra	**F9**
Seguro da Agricultura Familiar (SEAF)	**F10**
Terra Brasil – Programa Nacional de Crédito Fundiário (PNCF)	**F11**
Fundo Socioambiental Caixa	**F12**
IFC Financing	**F13**
Climate Resilience Fund (CRF)	**F14**
PROGRAMA RIO DOCE - Fundo Brasil	**F15**
Fundo Global para o Meio Ambiente (Global Environmental Facility - GEF)	**F16**
Programa Eficiência Municipal do Banco do Brasil	**F17**
Fundo Programa de Pequenos Projetos Ecossociais (PPP-ECOS)	**F18**
Fundação Grupo Boticário	**F19**
Programa Floresta +	**F20**
EKOS Brasil	**F21**

Table S.12 List of social capital and codes.

Social capital	**Code**
APL - Turismo Marliéria	**C1**
Associação Amigos do Parque Estadual do Rio Doce	**C2**
Associação dos Pequenos Produtores Rurais de Marliéria Minas Gerais	**C3**

Table S.13 List of marketing mechanisms and codes.

Marketing	**Code**
Mídias sociais	**M1**
Websites	**M2**
Calendário de eventos (feiras, festas, congressos, exposições, competições culturais e esportivas)	**M3**
Planejamento de oferta de produtos (serviços, pessoas e lugares)	**M4**
Definição do mercado consumidor	**M5**
Convention & Visitors Bureau	**M6**
Imagem turística	**M7**
"Trade" turístico (promoção, divulgação, comercialização do produto	**M8**
Funtrip	**M9**

The lists of governance mechanisms for MSVP case study are presented below (Table S.14 - 18), in Portuguese.

Table S.14 List of legislations and codes.

Legislation	**Code**
Política Nacional de Turismo (Lei Nº 11.771/2008)	**L1**
Programa de Regionalização do Turismo (Portaria MTUR Nº 105/2013) e Mapa do Turismo Brasileiro (Portaria nº 313/2013)	**L2**
Cadastro de Prestadores de Serviços Turísticos (CADASTUR) (Portaria MTUR nº 130/ 2011)	**L3**
Formalização de instrumentos de transferência voluntária de recursos, para execução de projetos (Portaria nº 39/2017)	**L4**

Sistema Nacional de Unidades de Conservação da Natureza (SNUC) (Lei No 9.985/2000)	**L5**
Chancela de paisagem cultural (Portaria Iphan nº 127/2009)	**L6**
Código Florestal (Lei Nº 12.651/2012)	**L7**
Política Nacional de Desenvolvimento Sustentável dos Povos e Comunidades Tradicionais (Decreto Nº 6.040/2007)	**L8**
Programa Bioeconomia Brasil Sociobiodiversidade (Portaria nº 121/2019)	**L9**
Plano Nacional da Promoção das Cadeias de Produtos da Sociobiodiversidade (PNPSB)	**L10**
Política Nacional de Assistência Técnica e Extensão Rural (PNATER) (Lei Nº 12.188/2010)	**L11**
Política de Garantia de Preços Mínimos para os Produtos da Sociobiodiversidade (PGPM-Bio)	**L12**
Programa de Garantia de Preços para Agricultura Familiar (PGPAF)	**L13**
Programa de Aquisição de Alimentos (PAA) (Lei nº 10.696/2003)	**L14**
Selo Nacional da Agricultura Familiar (SENAF)	**L15**
Programa Brasil Mais Cooperativo (Portaria nº 129/2019)	**L16**
Programa Rotas da Integração Nacional (Portaria MI nº 80/2018)	**L17**
Política Nacional de Desenvolvimento Regional (PNDR)	**L18**
Conselho Nacional do Meio Ambiente (CONAMA) (Lei nº 6.938/1981)	**L19**
Política Nacional de Desenvolvimento Sustentável da Aquicultura e da Pesca (Lei Nº 11.959/2009)	**L20**
Política Estadual de Turismo de Base Comunitária (Lei Nº 23763/2021)	**L21**
Política Estadual de Turismo (Lei Nº 22.765/2017)	**L22**
Política Estadual de Aquisição de Alimentos da Agricultura Familiar (PAAFamiliar) (Lei Nº 22.819/2018)	**L23**
ICMS Ecológico (Deliberação Normativa COPAM Nº 234/2019)	**L24**

Table S.15 List of partnerships and codes.

Partnerships	**Code**
Conselho Municipal de Turismo (COMTUR)	**P1**
Rotary	**P2**
Superintendência do Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis de Minas Gerais – IBAMA	**P3**
Garupa (operadora de turismo sustentável)	**P4**
SESI, SENAC, FECOMERCIO e SEBRAE	**P5**
Associação Brasileira de Agências de Viagens de Minas Gerais-ABAV	**P6**
Instituto Estadual de Florestas – IEF	**P7**
Conselho do Mosaico Sertão Veredas – Peruaçu	**P8**
Instituto Chico Mendes de Conservação da Biodiversidade - ICMBio	**P9**
Instituto Sociedade, População e Natureza – ISPN - CERRATINGA	**P10**
Fundação Nacional do Índio-FUNAI	**P11**
Universidade Estadual de Montes Claros-UNIMONTES	**P12**
Prefeitura Municipal	**P13**
Fundação Pró-Natureza – FUNATURA	**P14**
Instituto Rosa e Sertão	**P15**
Agência de Desenvolvimento Integrado e Sustentável da Chapada Gaúcha-ADISC	**P16**
Rede de Comercialização Solidária de Agricultores Familiares e Extrativistas do Cerrado - Empório do Cerrado	**P17**

Rede Cerrado	**P18**
Instituto Federal do Norte de Minas Gerais – Arinos	**P19**
CARITAS Diocesana de Januária – MG	**P20**
Universidade Federal dos Vales do Jequitinhonha e Mucuri – Turismo	**P21**
Secretaria Municipal de Cultura, Turismo, Esporte e Lazer - Chapada Gaúcha	**P22**
EKOS Brasil	**P23**
Parque Nacional Grande Sertão Veredas	**P24**
Parque Nacional Cavernas do Peruaçu	**P25**
Parque Estadual Serra das Araras	**P26**
Parque Estadual Veredas do Peruaçu	**P27**
Parque Estadual da Mata Seca	**P28**
Refúgio Estadual de Vida Silvestre do Rio Pandeiros	**P29**
Área de Proteção Ambiental Cavernas do Peruaçu	**P30**
Área de Proteção Ambiental do Rio Pandeiros	**P31**
Área de Proteção Ambiental Cochá e Gibão	**P32**
Reserva Estadual de Desenvolvimento Sustentável Veredas do Acari	**P33**
Estação Ecológica Estadual de Sagarana	**P34**
SETUR- Secretaria Municipal de Turismo e Cultura - Januária	**P36**
Secretaria Municipal de Esporte, Lazer, Cultura e Turismo - Miravânia	**P37**
Secretaria Municipal de Meio Ambiente e do Turismo - São João das Missões	**P38**
Empresa de Assistência Técnica e Extensão Rural - EMATER	**P39**
SENAR	**P40**
Instituto Sertão Vereda	**P41**

Table S.16 List of financing and codes.

Financing	**Code**
Fundo Geral de Turismo (FUNGETUR)	**F1**
Fundo Municipal de Turismo (FMT)	**F2**
Banco Nacional de Desenvolvimento Econômico e Social (BNDES)	**F3**
Programa Nacional de Fortalecimento da Agricultura Familiar	**F4**
Fundo Peruaçu, Instituto Ekos Brasil	**F5**
Crédito Rural	**F6**
Global Climate Change Alliance Plus (GCCA+)	**F7**
Fundo Verde para o Clima (GCF)	**F8**
Plano Safra	**F9**
Seguro da Agricultura Familiar (SEAF)	**F10**
Terra Brasil – Programa Nacional de Crédito Fundiário (PNCF)	**F11**
Fundo Socioambiental Caixa	**F12**
IFC Financing	**F13**
Climate Resilience Fund (CRF)	**F14**
Fundo Global para o Meio Ambiente (Global Environmental Facility - GEF)	**F15**
Programa Eficiência Municipal do Banco do Brasil	**F16**
Fundo Programa de Pequenos Projetos Ecossociais (PPP-ECOS)	**F17**
Fundação Grupo Boticário	**F18**
Programa Floresta +	**F19**
EKOS Brasil	**F20**
Fundo de Desenvolvimento do Nordeste (FDNE) (Decreto Nº 7.838/2012)	**F21**

Fundo de Parceria para Ecossistemas Críticos (CEPF - Cerrado)	**F22**
CeMAIS / Plataforma Semente	**F23**
SICOOB	**F24**
Banco de Desenvolvimento de Minas Gerais - BDMG	**F25**
Fundo Mundial para a Natureza (WWF-Brasil)	**F26**
Portal de Investimentos do Ministério do Turismo	**F27**

Table S.17 List of social capital and codes.

Social capital	**Code**
Associações de Pequenos Produtores Rurais, Associações Comunitárias e Quilombolas: APPR Várzea Grande, APPR Vereda Grande II, APAMPPR Olhos D´Água I, APPAFR Vereda Grande I, APPR Onça Quilombola, APRAF Araçá, APRP Pedras e Buritizinho	**C1**
Cooperativa Sertão Veredas LTDA	**C2**
Cooperativa dos Pequenos Produtores Agroextrativistas de Pandeiros – COOPAE	**C3**
Cooperativa dos Agricultores Familiares e Agroextrativistas do Vale do Peruaçu – Cooperuaçu	**C4**
Equilíbrio Natural Ecoturismo e Esportes de Aventura	**C5**
Sindicato dos Trabalhadores Rurais de Chapada Gaúcha – MG	**C6**
Grupo de Espeleologia e Estudos Orientados de Januária – MG	**C7**
Associação Indígena Xakriabá – Aldeias Sumaré/ Peruaçu	**C8**
Associação dos Agentes Ambientais do Vale do Peruaçu	**C9**
Núcleo do Pequi	**C10**
Associação Ana Maria	**C11**
ASSUSBAC - Associação dos Usuários da Sub-Bacia do Rio dos Cochos	**C12**
Grupo Sabores de Agreste	**C13**

Table S.18 List of marketing mechanisms and codes.

Marketing	**Code**
Mídias sociais	**M1**
Websites	**M2**
Calendário de eventos (feiras, festas, congressos, exposições, competições culturais e esportivas)	**M3**
Planejamento de oferta de produtos (serviços, pessoas e lugares)	**M4**
Definição do mercado consumidor	**M5**
Convention & Visitors Bureau	**M6**
Imagem turística	**M7**
"Trade" turístico (promoção, divulgação, comercialização do produto	**M8**
Funtrip	**M9**

The quantitative analysis of Questions 2a, 2b, 3-7 and 8 from the 26 interviews with actors from PERD and MSVP case studies were analyzed in detail using the calculation of relative frequencies, and presented below.

Table S.19 From Q2a, tourism modalities selected by interviewees from PERD and MSVP case study to implement with agroextractivist activities.

PERD			**MSVP**		
Tourism modalities	Frequency	Percent	Tourism modalities	Frequency	Percent
A	0	0	A	0	0
B	0	0	B	1	10
C	1	6.3	C	0	0
A, B, C	8	50	A, B, C	6	60
A, B	3	18.8	A, B	1	10
A, C	4	25	A, C	0	0
B, A	0	0	B, A	0	0
B, C	0	0	B, C	2	20

Table S.20 From Q2b, quadrants selected by interviewees from PERD and MSVP case study to where implement tourism modalities and agroextractivist activities.

PERD			**MSVP**		
Quadrant	Frequency	Percent	Quadrant	Frequency	Percent
1A	0	0	1A	0	0
1B	1	0.8	1B	0	0
1C	1	0.8	1C	0	0
1D	1	0.8	1D	2	3.3
2A	0	0	2A	0	0
2B	5	4.2	2B	6	10
2C	12	10.2	2C	5	8.3
2D	9	7.6	2D	2	3.3
3A	4	3.4	3A	0	0
3B	6	5.1	3B	2	3.3
3C	6	5.1	3C	6	10
3D	6	5.1	3D	0	0
4A	13	11	4A	0	0
4B	13	11	4B	1	1.7
4C	10	8.5	4C	8	13.3
4D	10	8.5	4D	0	0
5A	2	1.7	5A	0	0
5B	6	5.1	5B	7	11.7
5C	7	5.9	5C	10	16.7
5D	4	3.4	5D	0	0
6A	0	0	6A	0	0
6B	0	0	6B	7	11.7
6C	0	0	6C	4	6.7
6D	2	1.7	6D	0	0
7A	0	0	-	-	-
7B	0	0	-	-	-
7C	0	0	-	-	-
7D	0	0	-	-	-
8A	0	0	-	-	-

8B	0	0	-	-	-
8C	0	0	-	-	-
8D	0	0	-	-	-

The results from Q2b are visually represented on the images from the case studies of PERD (Figure S.4) and MSVP (Figure S.5).

Figure S.4 Image of the study area from PERD case study with the quadrants most frequently mentioned by interviewees. Source of the background image: Google Maps.

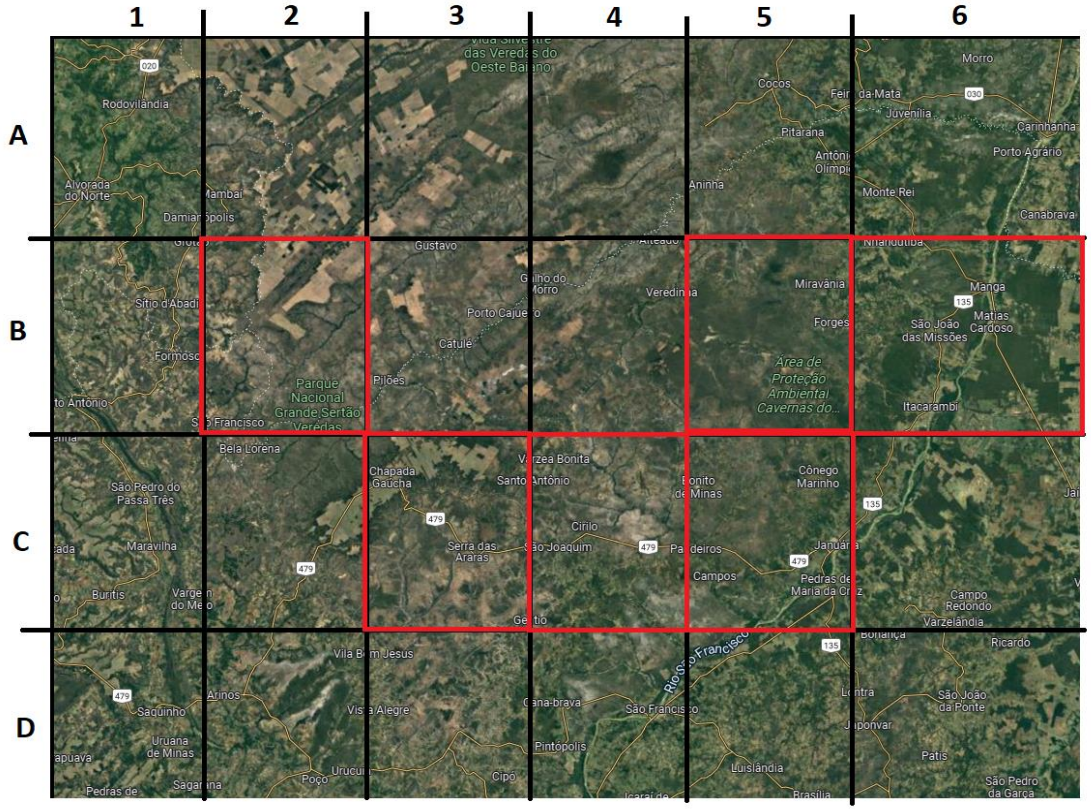
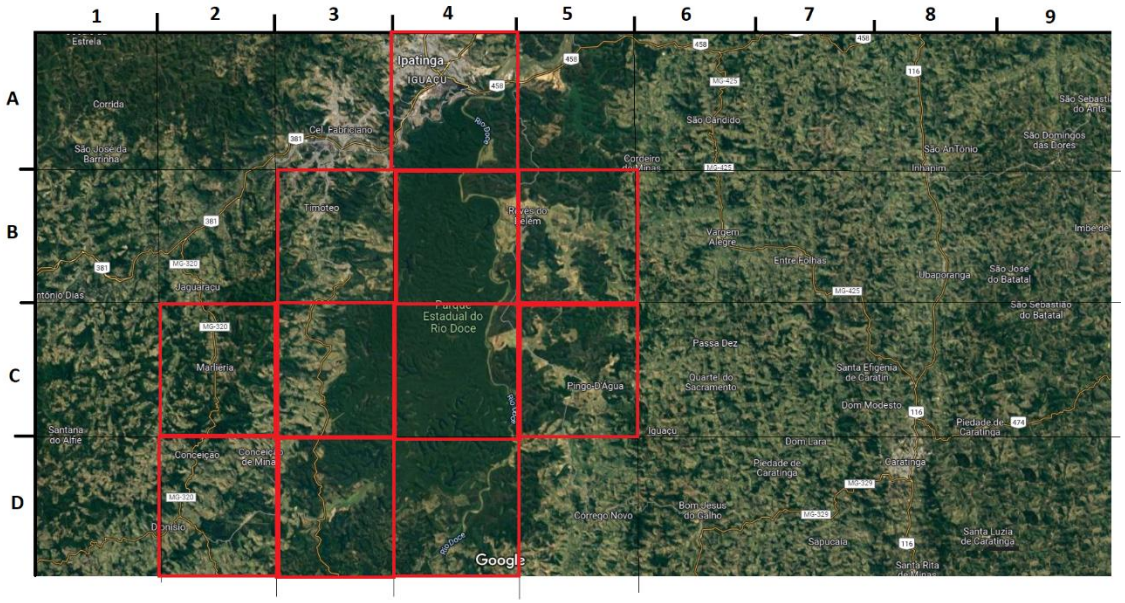


Figure S.5 Image of the study area from MSVP case study with the quadrants most frequently mentioned by interviewees. Source of the background image: Google Maps.



The governance mechanisms from Q3-7 selected by interviewees from PERD, are presented below (Table S.21 – 25).

Table S.21 Legislation selected by interviewees[12] from PERD case study to implement tourism modalities with agroextractivist activities.

Legislation	Code	Frequency	Percent
All	-	5	10.9
Nome	-	1	2.2
Lei da Mata Atlântica (Lei Nº 11.428/2006)	L1	2	4.3
Política Nacional de Turismo (Lei Nº 11.771/2008)	L2	1	2.2
Programa de Regionalização do Turismo (Portaria MTUR Nº 105/2013), Mapa do Turismo Brasileiro (Portaria nº 313/2013)	L3	3	6.5
Cadastro de Prestadores de Serviços Turísticos (CADASTUR) (Portaria MTUR nº 130/ 2011)	L4	3	6.5
Sistema Nacional de Unidades de Conservação da Natureza (SNUC) (Lei No 9.985/2000)	L5	4	8.7
Chancela de paisagem cultural (Portaria Iphan nº 127/2009)	L6	0	0
Código Florestal (Lei Nº 12.651/2012)	L7	0	0
Política Nacional de Desenvolvimento Sustentável dos PCTs (Decreto Nº 6.040/2007)	L8	2	4.3
Programa Bioeconomia Brasil Sociobiodiversidade (Portaria nº 121/2019)	L9	1	2.2

[12] Extra legislation that the interviewees mentioned that wasn't on the list.

Plano Nacional da Promoção das Cadeias de Produtos da Sociobiodiversidade (PNPSB)	L10	0	0
Política Nacional de Assistência Técnica e Extensão Rural (PNATER) (Lei Nº 12.188/2010)	L11	0	0
Política de Garantia de Preços Mínimos para os Produtos da Sociobiodiversidade (PGPM-Bio)	L12	2	4.3
Programa de Garantia de Preços para Agricultura Familiar (PGPAF)	L13	0	0
Programa de Aquisição de Alimentos (PAA) (Lei nº 10.696/2003)	L14	0	0
Selo Nacional da Agricultura Familiar (SENAF)	L15	0	0
Programa Brasil Mais Cooperativo (Portaria nº 129/2019)	L16	0	0
Programa Rotas da Integração Nacional (Portaria MI nº 80/2018)	L17	0	0
Política Nacional de Desenvolvimento Regional (PNDR)	L18	1	2.2
Conselho Nacional do Meio Ambiente (CONAMA) (Lei nº 6.938/1981)	L19	1	2.2
Política Nacional de Desenvolvimento Sustentável da Aquicultura e da Pesca (Lei Nº 11.959/2009)	L20	1	2.2
Política Estadual de Turismo de Base Comunitária (Lei Nº 23763/2021)	L21	3	6.5
Política Estadual de Turismo (Lei Nº 22.765/2017)	L22	3	6.5
Política Estadual de Aquisição de Alimentos da Agricultura Familiar (Lei Nº 22.819/2018)	L23	2	4.3
ICMS Ecológico (Deliberação Normativa COPAM Nº 234/2019)	L24	2	4.3
Plano de Manejo da unidade	L25	1	2.2
IUCN Green List of Protected and Conserved Areas	L26	1	2.2
IUCN Ramsar Convention on Wetlands	L27	1	2.2
Projeto de Lei Nº 2.268/2020 (Estrada-Parque Dom Helvécio)	L28	1	2.2
Plano Diretor Municipal	L29	2	4.3
Política Nacional de Educação Ambiental (LEI No 9,795/1999)	L30	2	4.3
Plano diretor de desenvolvimento integrado Região Metropolitana do Vale do Aço	L31	1	2.2
Lei do Microempreendedor Individual - MEI	L32	1	2.2

Table S.22 Partnerhips selected by interviewees from PERD case study to implement tourism modalities with agroextractivist activities.

Partnerships	**Code**	**Frequency**	**Percent**
All	-	3	2.7
SOS Mata Atlântica	P1	5	4.5

Portal de Investimentos do Ministério do Turismo	P2	2	1.8
Conselho Municipal de Turismo (COMTUR)	P3	2	1.8
VALE	P4	5	4.5
CENIBRA	P5	10	8.9
Fundação Projeto Renova CCSS	P6	4	3.6
Parque Estadual do Rio Doce	P7	8	7.1
Secretaria Municipal de Meio Ambiente e Turismo, Secretaria Municipal Desenvolvimento Econômico e Turismo, Departamento Municipal de Cultura e Turismo, Secretaria Municipal de Cultura, Esporte e Lazer, Secretaria de Desenvolvimento Econômico e Turismo, Diretoria Municipal de Esporte, Lazer, Cultura e Turismo, Secretaria de Cultura, Esporte, Lazer e Turismo	P8-14	9	8
IEF	P15	7	6.3
Instituto de Pesquisa e Conservação Waita	P16	1	0.9
CeMAIS / Plataforma Semente	P17	1	0.9
Rotary Ipatinga	P18	2	1.8
Plantuc	P19	1	0.9
Garupa (operadora de turismo sustentável)	P20	1	0.9
SESI, SENAC, FECOMERCIO e SEBRAE	P21	6	5.4
Associação Brasileira de Agências de Viagens de Minas Gerais-ABAV	P22	1	0.9
Acelor-Mital	P23	2	1.8
Instituto Ekos	P24	1	0.9
Associação Amigos do Parque Estadual do Rio Doce	P25	1	0.9
UNILESTE	P26	2	1.8
Harpia	P27	1	0.9
UFMG	P28	1	0.9
UFV	P29	1	0.9
UFOP	P30	1	0.9
APL Turismo de Marliéria e região	P31	3	2.7
EMATER	P32	4	3.6
Agência de desenvolvimento da região metropolitana do Vale do Aço - ARMVA	P33	2	1.8
Aperam	P34	1	0.9
PMMG	P35	1	0.9
CBH Piracicaba	P36	1	0.9
Associação dos Moradores do Residencial Alphaville	P37	1	0.9
Fundação APERAM Acesita	P38	1	0.9
Fundação Relictos	P39	1	0.9
CEMIG	P40	1	0.9
COPASA	P41	1	0.9
USIMINAS	P42	2	1.8
GPM	P43	1	0.9

Associação dos Produtores Rurais de Marliéria	P44	1	0.9
SENAR	P45	5	4.5
Secretaria de Estado de Desenvolvimento Econômico de Minas Gerais	P46	1	0.9
Secretaria de Estado de Cultura e Turismo de Minas Gerais	P47	1	0.9
Turismo no Vale	P48	1	0.9
Convention & visitors bureau (Destination marketing organization)	P49	2	1.8
SICOOB	P50	1	0.9
Circuito Turístico Mata Atlântica de Minas	P51	1	0.9
Secretaria Municipal de Assistência Social	P52	1	0.9

Table S.23 Financing selected by interviewees from PERD case study to implement tourism modalities with agroextractivist activities.

Financing	Code	Frequency	Percent
All	-	3	6.8
None	-	5	11.4
Fundo Geral de Turismo (FUNGETUR)	F1	1	2.3
Fundo Municipal de Turismo (FMT)	F2	3	6.8
Banco Nacional de Desenvolvimento Econômico e Social (BNDES)	F3	1	2.3
Programa Nacional de Fortalecimento da Agricultura Familiar	F4	0	0
Fatura Verde (SOS Mata Atlântica)	F5	2	4.5
Crédito Rural	F6	0	0
Global Climate Change Alliance Plus (GCCA+)	F7	0	0
Fundo Verde para o Clima (GCF)	F8	1	2.3
Plano Safra	F9	0	0
Seguro da Agricultura Familiar (SEAF)	F10	2	4.5
Terra Brasil – Programa Nacional de Crédito Fundiário (PNCF)	F11	0	0
Fundo Socioambiental Caixa	F12	1	2.3
IFC Financing	F13	0	0
Climate Resilience Fund (CRF)	F14	0	0
PROGRAMA RIO DOCE - Fundo Brasil	F15	2	4.5
Fundo Global para o Meio Ambiente (Global Environmental Facility - GEF)	F16	0	0
Programa Eficiência Municipal do Banco do Brasil	F17	0	0
Fundo Programa de Pequenos Projetos Ecossociais (PPP-ECOS)	F18	2	4.5
Fundação Grupo Boticário	F19	2	4.5
Programa Floresta +	F20	0	0
EKOS Brasil	F21	3	6.8
CeMAIS / Plataforma Semente	F22	4	9.1
Fundação Projeto Renova CCSS	F23	8	18.2
Fundo Municipal de Meio Ambiente - FMMA	F24	1	2.3

Banco de Desenvolvimento de Minas Gerais - BDMG	F25	2	4.5
Sistema de Cooperativas de Crédito do Brasil - SICOOB	F26	1	2.3

Table S.24 Social capital selected by interviewees from PERD case study to implement tourism modalities with agroextractivist activities.

Social capital	Code	Frequency	Percent
None	-	2	4.3
APL - Turismo Marliéria	C1	7	15.2
Associação Amigos do Parque Estadual do Rio Doce	C2	11	23.9
Associação dos Pequenos Produtores Rurais de Marliéria Minas Gerais	C3	8	17.4
Fundação Aperam/Acesita	C4	1	2.2
Fundação Relictos	C5	1	2.2
Instituto Cenibra	C6	1	2.2
Instituto Usiminas	C7	1	2.2
Associação Feminina Marlierense	C8	5	10.9
Turismo no Vale	C9	2	4.3
ACE Associação Comercial e Empresarial Timóteo	C10	1	2.2
CDL Timóteo	C11	2	4.3
CDL Ipatinga	C12	1	2.2
Associação Comercial, Industrial, Agropecuária e de Prestação de Serviços de Ipatinga (Aciapi)	C13	1	2.2
Associacao Comunitaria Da Comunidade Do Galho Velho	C14	1	2.2
Convention & visitors bureau (Destination marketing organization)	C15	1	2.2

Table S.25 Marketing selected by interviewees from PERD case study to implement tourism modalities with agroextractivist activities.

Marketing	Code	Frequency	Percent
Mídias sociais	M1	11	22.9
Websites	M2	5	10.4
Calendário de eventos (feiras, festas, congressos, exposições, competições culturais e esportivas)	M3	9	18.8
Planejamento de oferta de produtos (serviços, pessoas e lugares)	M4	3	6.3
Definição do mercado consumidor	M5	2	4.2
Convention & Visitors Bureau	M6	3	6.3
Imagem turística	M7	2	4.2
"Trade" turístico (promoção, divulgação, comercialização do produto	M8	3	6.3
Funtrip	M9	1	2.1
Tripadvisor	M10	1	2.1
Influenciadores digitais	M11	1	2.1

AbetaSummit - Congresso Brasileiro de Ecoturismo e Turismo de Aventura	M12	1	2.1
Totem no aeroporto, estação rodoviária e ferroviária	M13	2	4.2
Boca a boca	M14	1	2.1

The governance mechanisms from Q3-7 selected by interviewees from MSVP, are presented below (Table S.26 – 30).

Table S.26 Legislation selected by interviewees[13] from MSVP case study to implement tourism modalities with agroextractivist activities.

Legislation	Code	Frequency	Percent
Política Nacional de Turismo (Lei Nº 11.771/2008)	L1	4	5.6
Programa de Regionalização do Turismo (Portaria MTUR Nº 105/2013) e Mapa do Turismo Brasileiro (Portaria nº 313/2013)	L2	3	4.2
Cadastro de Prestadores de Serviços Turísticos (CADASTUR) (Portaria MTUR nº 130/ 2011)	L3	3	4.2
Formalização de instrumentos de transferência voluntária de recursos, para execução de projetos (Portaria nº 39/2017)	L4	0	0
Sistema Nacional de Unidades de Conservação da Natureza (SNUC) (Lei No 9.985/2000)	L5	5	6.9
Chancela de paisagem cultural (Portaria Iphan nº 127/2009)	L6	2	2.8
Código Florestal (Lei Nº 12.651/2012)	L7	3	4.2
Política Nacional de Desenvolvimento Sustentável dos Povos e Comunidades Tradicionais (Decreto Nº 6.040/2007)	L8	5	6.9
Programa Bioeconomia Brasil Sociobiodiversidade (Portaria nº 121/2019)	L9	4	5.6
Plano Nacional da Promoção das Cadeias de Produtos da Sociobiodiversidade (PNPSB)	L10	5	6.9
Política Nacional de Assistência Técnica e Extensão Rural (PNATER) (Lei Nº 12.188/2010)	L11	1	1.4
Política de Garantia de Preços Mínimos para os Produtos da Sociobiodiversidade (PGPM-Bio)	L12	1	1.4
Programa de Garantia de Preços para Agricultura Familiar (PGPAF)	L13	0	0
Programa de Aquisição de Alimentos (PAA) (Lei nº 10.696/2003)	L14	2	2.8
Selo Nacional da Agricultura Familiar (SENAF)	L15	3	4.2
Programa Brasil Mais Cooperativo (Portaria nº 129/2019)	L16	0	0
Programa Rotas da Integração Nacional (Portaria MI nº 80/2018)	L17	1	1.4

[13] Extra legislation that the interviewees mentioned that wasn't on the list.

Política Nacional de Desenvolvimento Regional (PNDR)	L18	0	0
Conselho Nacional do Meio Ambiente (CONAMA) (Lei nº 6.938/1981)	L19	2	2.8
Política Nacional de Desenvolvimento Sustentável da Aquicultura e da Pesca (Lei Nº 11.959/2009)	L20	2	2.8
Política Estadual de Turismo de Base Comunitária (Lei Nº 23763/2021)	L21	7	9.7
Política Estadual de Turismo (Lei Nº 22.765/2017)	L22	1	1.4
Política Estadual de Aquisição de Alimentos da Agricultura Familiar (PAAFamiliar) (Lei Nº 22.819/2018)	L23	2	2.8
ICMS Ecológico (Deliberação Normativa COPAM Nº 234/2019)	L24	5	6.9
ICMS ecológico	L25	1	1.4
Adote um Parque	L26	1	1.4
Política Nacional de Resíduos Sólidos	L27	1	1.4
Programa Mineiro de Incentivo ao Cultivo, à Extração, ao Consumo, à Comercialização e à Transformação do Pequi e Demais Frutos e Produtos Nativos do Cerrado - Pró-Pequi (Lei nº 13.965/2001)	L28	1	1.4
Plano de manejo	L29	1	1.4
Plano Estadual de Recursos Hídricos (PERH) (Lei 13.199/99)	L30	1	1.4
Lei Estadual nº 20.922/2013 – Código Florestal Estadual	L31	1	1.4
Lei Nº 2.683/2021 Política Municipal de Turismo de Base Comunitária e o Programa Municipal de Turismo de Base Comunitária de Januária – MG	L32	2	2.8
Decreto-Lei Nº 25/1937 Proteção do patrimônio histórico e artístico nacional	L33	1	1.4
Lei n° 12.343/2010 Plano Nacional de Cultura (PNC)	L34	1	1.4

Table S.27 Partnerhips selected by interviewees from MSVP case study to implement tourism modalities with agroextractivist activities.

Partnerships	Code	Frequency	Percent
Conselho Municipal de Turismo (COMTUR)	P1	2	1.3
Rotary	P2	1	0.6
Superintendência do Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis de Minas Gerais – IBAMA	P3	2	1.3
Garupa (operadora de turismo sustentável)	P4	2	1.3
SESI, SENAC, FECOMERCIO e SEBRAE	P5	7	4.4
Associação Brasileira de Agências de Viagens de Minas Gerais-ABAV	P6	1	0.6
Instituto Estadual de Florestas – IEF	P7	7	4.4
Conselho do Mosaico Sertão Veredas – Peruaçu	P8	4	2.5

Instituto Chico Mendes de Conservação da Biodiversidade - ICMBio	P9	6	3.8
Instituto Sociedade, População e Natureza – ISPN - CERRATINGA	P10	3	1.9
Fundação Nacional do Índio-FUNAI	P11	6	3.8
Universidade Estadual de Montes Claros-UNIMONTES	P12	3	1.9
Prefeitura Municipal	P13	8	5.1
Fundação Pró-Natureza – FUNATURA	P14	4	2.5
Instituto Rosa e Sertão	P15	5	3.2
Agência de Desenvolvimento Integrado e Sustentável da Chapada Gaúcha- ADISC	P16	1	0.6
Rede de Comercialização Solidária de Agricultores Familiares e Extrativistas do Cerrado - Empório do Cerrado	P17	2	1.3
Rede Cerrado	P18	5	3.2
Instituto Federal do Norte de Minas Gerais – Arinos	P19	3	1.9
CARITAS Diocesana de Januária – MG	P20	5	3.2
Universidade Federal dos Vales do Jequitinhonha e Mucuri – Turismo	P21	2	1.3
Secretaria Municipal de Cultura, Turismo, Esporte e Lazer - Chapada Gaúcha	P22	4	2.5
EKOS Brasil	P23	9	5.7
Parque Nacional Grande Sertão Veredas	P24	2	1.3
Parque Nacional Cavernas do Peruaçu	P25	2	1.3
Parque Estadual Serra das Araras	P26	3	1.9
Parque Estadual Veredas do Peruaçu	P27	2	1.3
Parque Estadual da Mata Seca	P28	3	1.9
Refúgio Estadual de Vida Silvestre do Rio Pandeiros	P29	2	1.3
Área de Proteção Ambiental Cavernas do Peruaçu	P30	2	1.3
Área de Proteção Ambiental do Rio Pandeiros	P31	2	1.3
Área de Proteção Ambiental Cochá e Gibão	P32	2	1.3
Reserva Estadual de Desenvolvimento Sustentável Veredas do Acari	P33	3	1.9
Estação Ecológica Estadual de Sagarana	P34	3	1.9
SETUR- Secretaria Municipal de Turismo e Cultura - Januária	P35	1	0.6
Secretaria Municipal de Esporte, Lazer, Cultura e Turismo - Miravânia	P36	3	1.9
Secretaria Municipal de Meio Ambiente e do Turismo - São João das Missões	P37	2	1.3
Empresa de Assistência Técnica e Extensão Rural - EMATER	P38	2	1.3
SENAR	P39	6	3.8
Instituto Sertão Vereda	P40	7	4.4
Agência Vale do Urucuia	P41	4	2.5
Instituto Rosáceas	P42	2	1.3
Cresertão - Centro de Referência em Tecnologias Sociais do Sertão	P43	1	0.6

Cine Baru	P44	1	0.6
Associação de artesãs e tecelãs de Sagarana	P45	1	0.6
Associação Rede Brasileira de Trilhas de Longo Curso (Rede Trilhas)	P46	1	0.6
WWF	P47	3	1.9
Instituto Grande Sertão	P48	1	0.6
Copaíbas	P49	1	0.6
APAE	P50	1	0.6
Escoteiros	P51	1	0.6
Núcleo do Pequi	P52	1	0.6
Instituto Federal de Januária	P53	1	0.6

Table S.28 Financing selected by interviewees from MSVP case study to implement tourism modalities with agroextractivist activities.

Financing	Code	Frequency	Percent
Fundo Geral de Turismo (FUNGETUR)	F1	1	1.8
Fundo Municipal de Turismo (FMT)	F2	2	3.6
Banco Nacional de Desenvolvimento Econômico e Social (BNDES)	F3	0	0
Programa Nacional de Fortalecimento da Agricultura Familiar	F4	1	1.8
Fundo Peruaçu, Instituto Ekos Brasil	F5	3	5.4
Crédito Rural	F6	2	3.6
Global Climate Change Alliance Plus (GCCA+)	F7	0	0
Fundo Verde para o Clima (GCF)	F8	0	0
Plano Safra	F9	1	1.8
Seguro da Agricultura Familiar (SEAF)	F10	2	3.6
Terra Brasil – Programa Nacional de Crédito Fundiário (PNCF)	F11	2	3.6
Fundo Socioambiental Caixa	F12	2	3.6
IFC Financing	F13	0	0
Climate Resilience Fund (CRF)	F14	0	0
Fundo Global para o Meio Ambiente (Global Environmental Facility - GEF)	F15	2	3.6
Programa Eficiência Municipal do Banco do Brasil	F16	4	7.1
Fundo Programa de Pequenos Projetos Ecossociais (PPP-ECOS)	F17	3	5.4
Fundação Grupo Boticário	F18	3	5.4
Programa Floresta +	F19	0	0
EKOS Brasil	F20	1	1.8
Fundo de Desenvolvimento do Nordeste (FDNE) (Decreto Nº 7.838/2012)	F21	2	3.6
Fundo de Parceria para Ecossistemas Críticos (CEPF - Cerrado)	F22	5	8.9
CeMAIS / Plataforma Semente	F23	0	0
SICOOB	F24	1	1.8
Banco de Desenvolvimento de Minas Gerais - BDMG	F25	1	1.8
Fundo Mundial para a Natureza (WWF-Brasil)	F26	5	8.9

Portal de Investimentos do Ministério do Turismo	F27	2	3.6
International Climate Initiative	F28	1	1.8
ICMS Ecológico	F29	1	1.8
Agência Vale do Urucuia	F30	1	1.8
Cresertão - Centro de Referência em Tecnologias Sociais do Sertão	F31	1	1.8
Instituto Rosáceas	F32	1	1.8
Estatuto Social do Instituto Sociedade, População E Natureza -ISPN	F33	2	3.6
ICMS turístico	F34	1	1.8
Fundo Nacional da Solidariedade	F35	1	1.8
ASA - Articulação Semiárido Brasileiro	F36	1	1.8
Fundo Nacional do Meio Ambiente	F37	1	1.8

Table S.29 Social capital selected by interviewees from MSVP case study to implement tourism modalities with agroextractivist activities.

Social capital	Code	Frequency	Percent
Associações de Pequenos Produtores Rurais, Associações Comunitárias e Quilombolas: APPR Várzea Grande, APPR Vereda Grande II, APAMPPR Olhos D´Água I, APPAFR Vereda Grande I, APPR Onça Quilombola, APRAF Araçá, APRP Pedras e Buritizinho	C1	1	2.4
Cooperativa Sertão Veredas LTDA	C2	2	4.8
Cooperativa dos Pequenos Produtores Agroextrativistas de Pandeiros – COOPAE	C3	0	0
Cooperativa dos Agricultores Familiares e Agroextrativistas do Vale do Peruaçu – Cooperuaçu	C4	3	7.1
Equilíbrio Natural Ecoturismo e Esportes de Aventura	C5	1	2.4
Sindicato dos Trabalhadores Rurais de Chapada Gaúcha – MG	C6	0	0
Grupo de Espeleologia e Estudos Orientados de Januária – MG	C7	1	2.4
Associação Indígena Xakriabá – Aldeias Sumaré/ Peruaçu	C8	3	7.1
Associação dos Agentes Ambientais do Vale do Peruaçu	C9	0	0
Núcleo do Pequi	C10	2	4.8
Associação Ana Maria	C11	1	2.4
ASSUSBAC - Associação dos Usuários da Sub-Bacia do Rio dos Cochos	C12	3	7.1
Grupo Sabores de Agreste	C13	3	7.1
Cooperativa Regional de Base na Agricultura Familiar e Extrativismo (COPABASE)	C14	1	2.4
Central Veredas	C15	1	2.4
Associação de produtores rurais de Marques e da Ilha	C16	1	2.4
Circuito turístico Urucuia Grande Sertão	C17	1	2.4
Agência Vale do Urucuia	C18	1	2.4

Cresertão - Centro de Referência em Tecnologias Sociais do Sertão	C19	1	2.4
Cooperativa Grande Sertão de Montes Claros	C20	2	4.8
COOPAVE Rio Pardo de Minas	C21	2	4.8
COOPERIACHÃO em Montes Claros	C22	1	2.4
COPANORTE	C23	1	2.4
Associação comunitária de Salto	C24	1	2.4
Cooperativa Mulheres do Cerrado	C25	1	2.4
Associação quilombola do Brejo do Amparo	C26	1	2.4
Associação comunitária Bonito de Minas	C27	1	2.4

Table S.30 Marketing selected by interviewees from MSVP case study to implement tourism modalities with agroextractivist activities.

Marketing	**Code**	**Frequency**	**Percent**
Mídias sociais	M1	7	18.9
Websites	M2	4	10.8
Calendário de eventos (feiras, festas, congressos, exposições, competições culturais e esportivas)	M3	6	16.2
Planejamento de oferta de produtos (serviços, pessoas e lugares)	M4	3	8.1
Definição do mercado consumidor	M5	2	5.4
Convention & Visitors Bureau	M6	1	2.7
Imagem turística	M7	2	5.4
"Trade" turístico (promoção, divulgação, comercialização do produto	M8	2	5.4
Funtrip	M9	2	5.4
Sign	M10	1	2.7
Feature in movies and television series	M11	1	2.7
Radio	M12	2	5.4
Mouth-to-mouth	M13	2	5.4

Finally, for Q8, the order of governance mechanisms from 1st to 5th place for each of the 26 interviewees from PERD and MSVP case studies were inserted into a table, to improve visualization (Table S.31).

Table S.31 Rank of governance mechanisms from PERD and MSVP case studies.

Governance mechanisms	1º	2º	3º	4º	5º
PERD					
Interviewee 1	Social capital	Legislation	Partnerships	Marketing	Financing
Interviewee 2	Legislation	Financing	Social capital	Partnerships	Marketing
Interviewee 3	Social capital	Partnerships	Legislation	Financing	Marketing
Interviewee 4	Financing	Legislation	Marketing	Social capital	Partnerships
Interviewee 5	Social capital	Legislation	Partnerships	Financing	Marketing
Interviewee 6	Partnerships	Legislation	Marketing	Financing	Social capital
Interviewee 7	Partnerships	Marketing	Social capital	Financing	Legislation

Interviewee 8	Social capital	Legislation	Partnerships	Financing	Marketing
Interviewee 9	Social capital	Partnerships	Financing	Legislation	Marketing
Interviewee 10	Legislation	Financing	Partnerships	Social capital	Marketing
Interviewee 11	Social capital	Legislation	Partnerships	Marketing	Financing
Interviewee 12	Financing	Partnerships	Social capital	Legislation	Marketing
Interviewee 13	Partnerships	Social capital	Legislation	Financing	Marketing
Interviewee 14	Social capital	Partnerships	Financing	Legislation	Marketing
Interviewee 15	Partnerships	Social capital	Legislation	Marketing	Financing
Interviewee 16	-	-	-	-	-
MSVP					
Interviewee 1	Financing	Legislation	Social capital	Marketing	Partnerships
Interviewee 2	Financing	Marketing	Legislation	None	None
Interviewee 3	Social capital	Partnerships	Legislation	Marketing	Financing
Interviewee 4	Social capital	Legislation	Financing	Partnerships	Marketing
Interviewee 5	Social capital	Partnerships	Legislation	Financing	Marketing
Interviewee 6	Financing	Social capital	Partnerships	Legislation	Marketing
Interviewee 7	Social capital	Partnerships	Legislation	Marketing	Financing
Interviewee 8	Social capital	Partnerships	Financing	Marketing	Legislation
Interviewee 9	Social capital	Financing	Marketing	Partnerships	Legislation
Interviewee 10	Social capital	Legislation	Partnerships	Financing	Marketing

For the final rank, we calculated the frequency in which governance mechanisms was most mentioned from 1st to 5th by the interviewees from PERD and MSVP case studies (Table S.32).

Table S.32 Final rank of governance mechanisms from PERD and MSVP case studies.

Case studies	**1º**	**2º**	**3º**	**4º**	**5º**
PERD	Social capital (7)	Legislation (6)	Partnerships (5)	Financing (6)	Marketing (9)
MSVP	Social capital (7)	Partnerships (4)	Legislation (4)	Marketing (4)	Marketing (4)

The qualitative analysis of the open-ended questions from the semi-structured questionnaire were analyzed in detail using an inductive coding approach and hierarchical frame to organize the data.

Figure S.6 Hierarchical coding frame for Q1 from PERD case study.

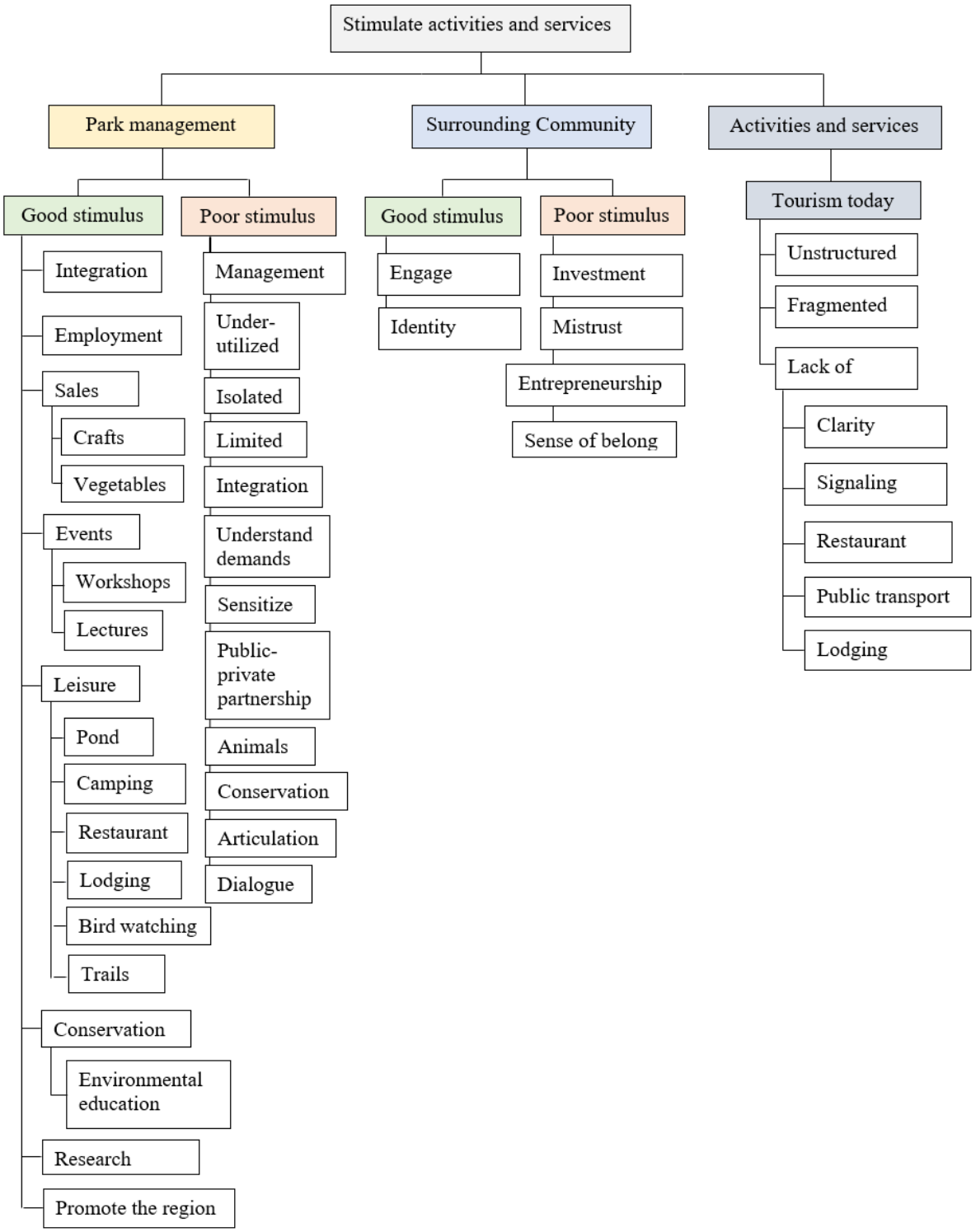


Figure S.7 Hierarchical coding frame from Q1 from MSVP case study.

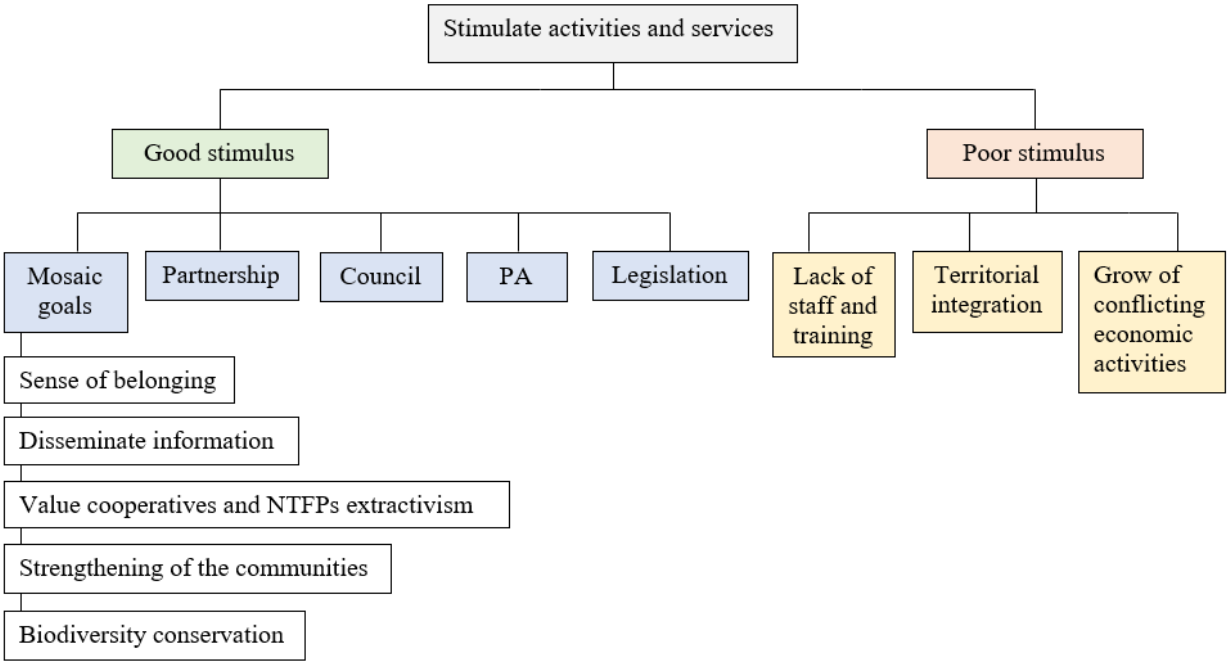


Figure S.8 Hierarchical coding frame from Q2a from PERD case study.

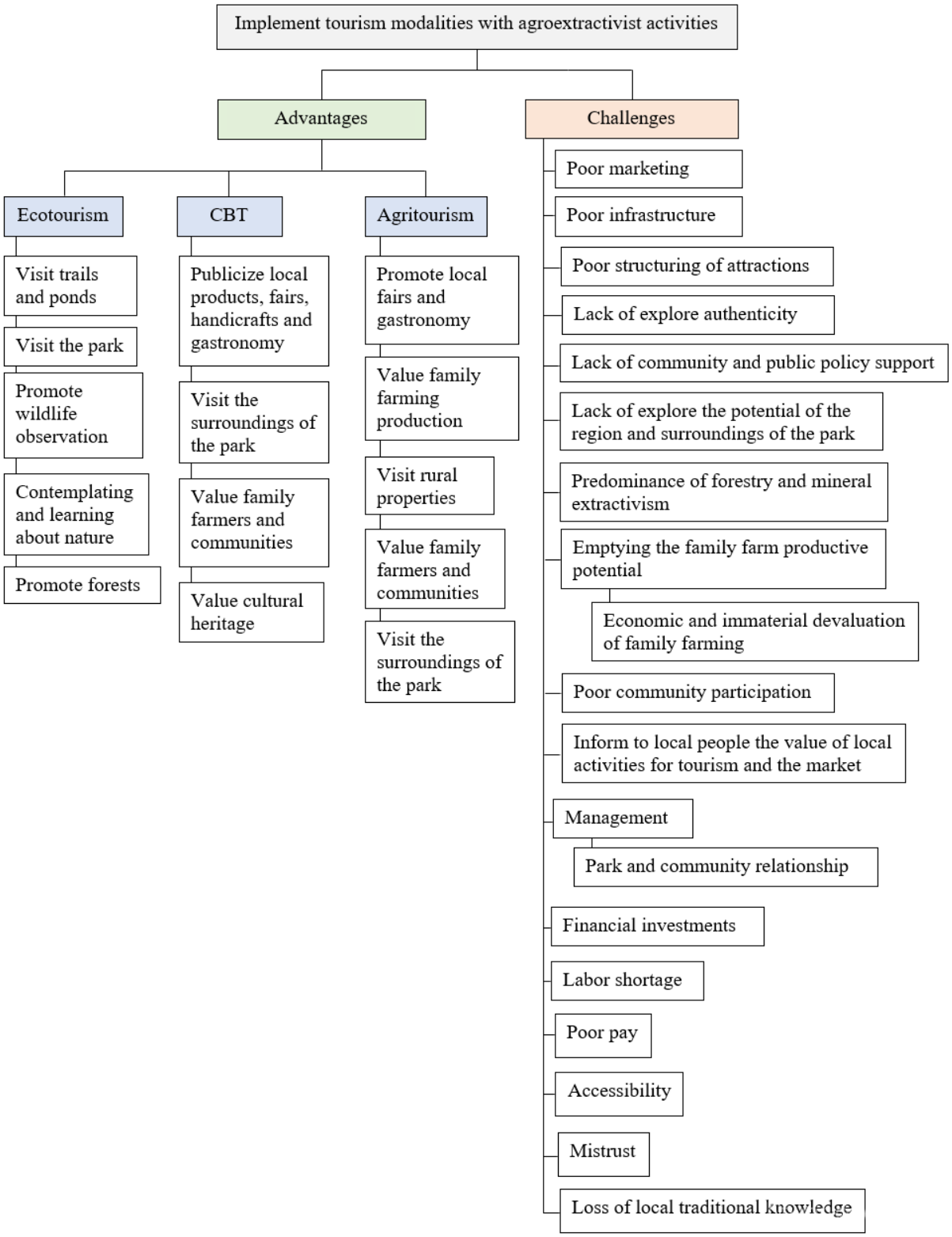


Figure S.9 Hierarchical coding frame from Q2a from MSVP case study.

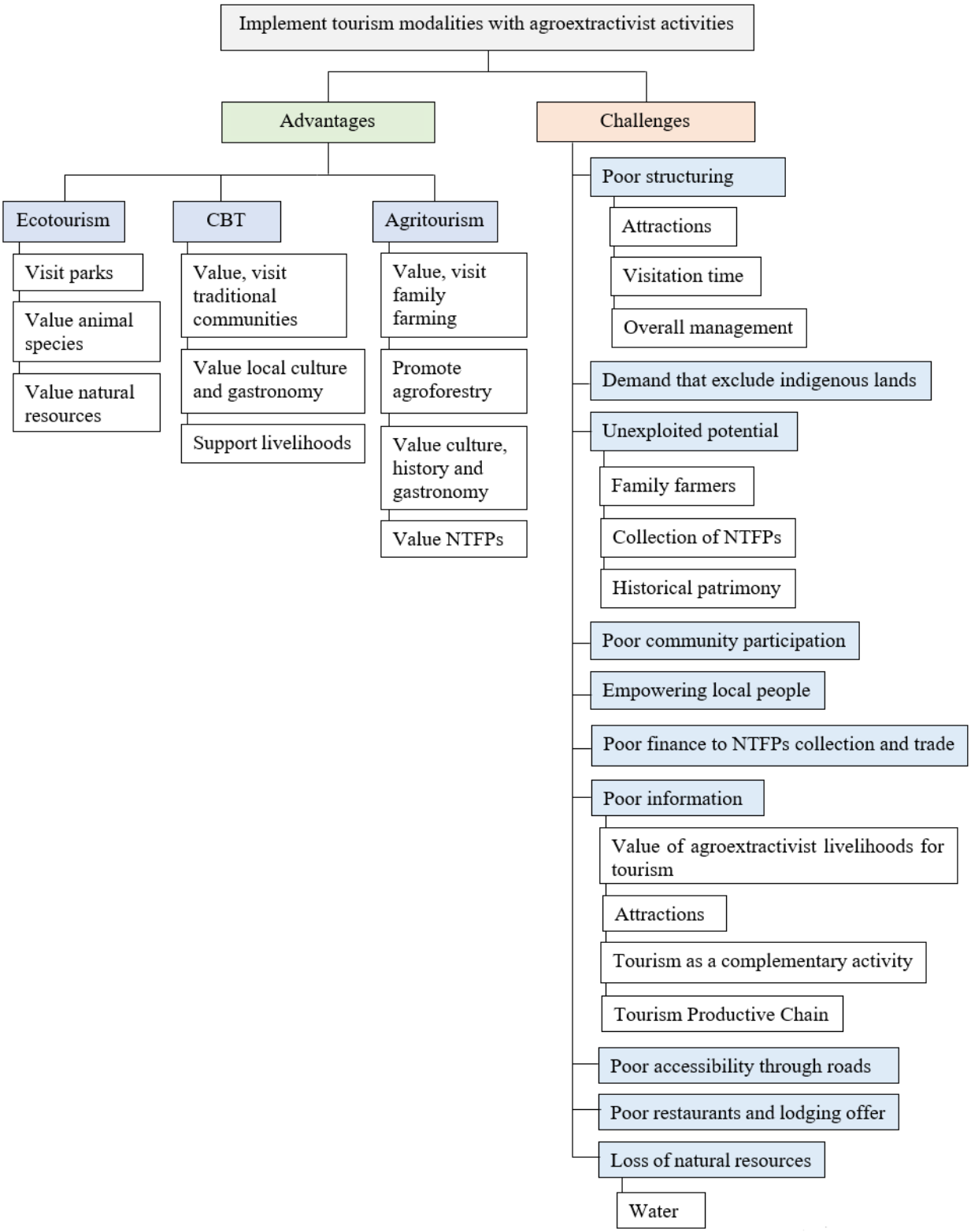


Figure S.10 Hierarchical coding frame from Q9 from PERD case study.

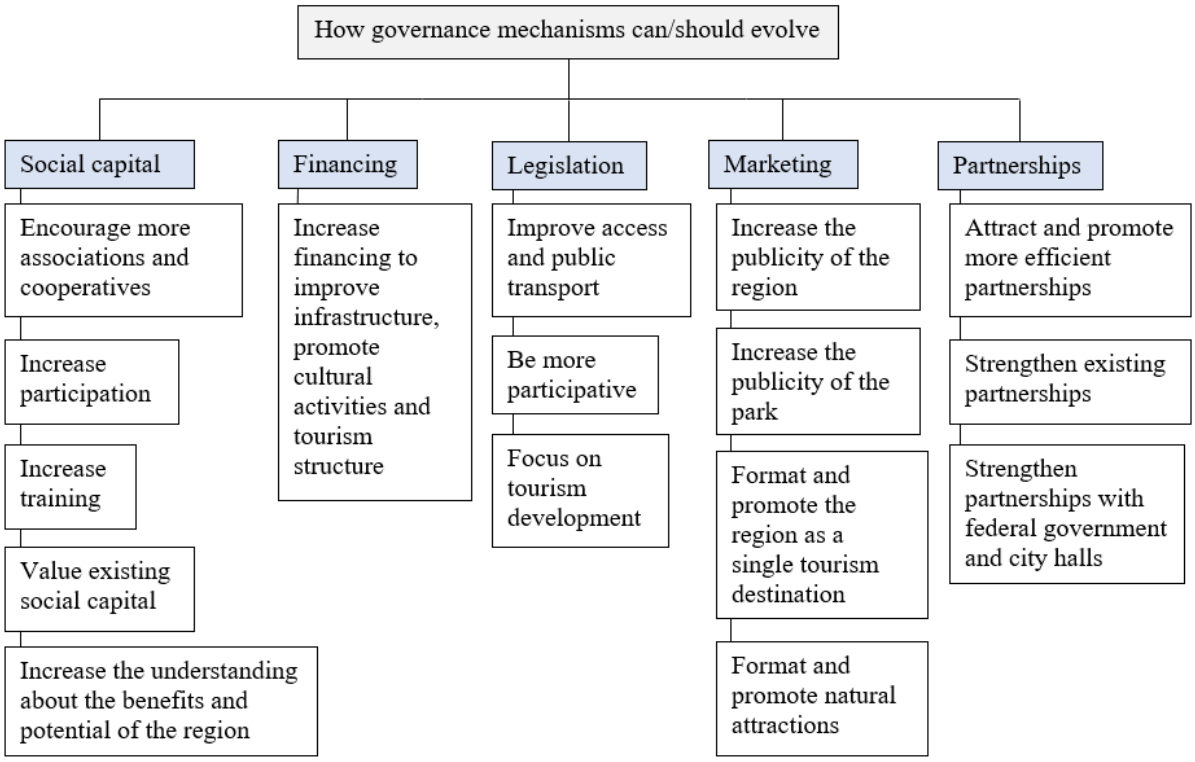


Figure S.11 Hierarchical coding frame from Q9 from MSVP case study.