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UNCOVERING SOCIAL INNOVATION OF BRAZILIAN FOREST AND LANDSCAPE RESTORATION INITIATIVES

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There is a will: there is a way...

This thesis is dedicated to the invisible local agents who continuously innovate to improve social-ecological relations within the living landscape.

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PERSONAL PATH THAT HAS LED TO THIS RESEARCH

This research was inspired by my empirical observations of more than 15 years of working with forest and landscape restoration (FLR) initiatives towards a possible sustainable transformation. In the following paragraphs of this section, I will explore how my career intertwined with the FLR evolution and how this path led to this research.

My FLR journey began with the challenge of restoring ecological relationships and functions of specific sites degraded by human action and choices, aiming to ensure water security and habitats for biodiversity. Back then, I believed that applied restoration ecology was the best tool to perform this task. In this regard, I was well-trained by my university. I knew the local reference ecosystems, the ecological aspects of its major indigenous species, their most important functions and evident ecological, biotic, and abiotic interactions. I learned about landscape ecology, models, techniques to introduce the right species in the right places, and how to manage them to promote secondary succession.

It did not take me long to realise that ecological restoration should be done by people and for people. That "all" my technical knowledge did not work well alone, and that the restoration needed to make sense and fit into the context, beliefs, and values of local people. Even the noble goals of fostering water security and habitat for biodiversity cannot be taken for granted, as landowners, local communities, and restoration workers, while mostly recognising these goals, have their own aspirations and action proposals to deal with that.

To grasp socio-cultural and political power challenges involved in FLR initiatives and, at the same time, to keep my technical-academic beliefs and expand its scale of influence, I started to support capacity building of restoration workers, to develop institutional arrangements, instruments, and tools to increase the landowner's adherence to FLR programmes, such as payment for environmental services, economical use of native species, restoration monitoring protocols and restoration guidelines. This way, three main gaps could be filled: 1) dissemination of prevailing knowledge on how, where, what and why to restore; 2) defining parameters to evaluate the application of the dominant academic knowledge, and; 3) engage key stakeholders through regulatory, financial, and informational instruments.

In a relatively short time (about three years), this approach helped to expand the restoration scale in proof-of-concept sites where it was implemented and maintained. More than thirteen years ago, new financial mechanisms, institutional arrangements, monitoring protocols and public policies were developed, which continue to be experimented and improved. Backed by a strong ecological modernisation rhetoric ([Christoff, 1996](#)), this approach privileged the development of intermediary instruments (e.g. carbon markets, tree planting, land use monitoring) and middle organisations (e.g. big NGOs, restoration chain enterprises) instead of rather strengthening grassroots organisations' human, social and political capital, which are fundamental for landscape stewardship groups to undertake the protagonist role in long-term FLR collective actions.

The first whopping sign of an insufficiently empowered national network of local organisations pro-FLR was felt in 2011-2012 when the Brazilian Forest Code (2012) was replaced by the Native Vegetation Protection Law (LPVN) by the National Congress that introduced legal procedures and policy instruments to support landowners to restore and protect natural areas but reduced their obligations.

The new rules of the game required several administrative adaptations, overloading the public system of environmental management. On top of that, the greater flexibility made possible by the LPVN negatively affected the entire restoration service chain in Brazil. Many of these chain organisations are no longer active, and the remaining ones have to adjust their discourses, experiment with new processes, generate new knowledge and networks, and adapt to new governance, opening windows

of opportunity for social innovation and allowing international NGOs to occupy an environmental advocacy niche in the country, at both national and subnational scales.

From 2008 to 2018, I worked for international NGOs operating in Brazil and could closely follow the growing investment in national environmental advocacy. I venture to write that without their capital (human, social, financial, and political), the policy, the national plan, and the council for native vegetation recovery would not have been enacted in 2017. In partnership with several national organisations and subnational governments, I (representing an international NGO) also worked to develop landscape restoration plans at the subscale level. These plans sought to strengthen a local governance system, identify opportunities to maintain and increase native vegetation cover, promote environmental-friendly agricultural practices, estimate costs, and identify funding opportunities and gaps to overcome for FLR implementation. Some of these plans have guided regional strategies and local projects, and others merely become a grey reference, but all contributed to strengthening local social capital around an FLR perspective. Throughout the development of these plans, I was struck by the spontaneous emergence of dwellers intent on carrying out actions - some of them innovative - to promote landscape restoration and, at the same time, enhance local wellbeing.

Facing a continued weakening of environmental policies and institutions in Brazil, the limitations of market mechanisms for supporting nature conservation and restoration, and the difficulty of both companies and governments in improving local livelihoods and wellbeing by pursuing nature-based solutions, I began to recognise that bottom-up movements that co-create innovative solutions are the most feasible option to accomplish this dual task. At this moment, my desire to further investigate the role of social innovation in forest and landscape restoration initiatives was sparked. This thesis represents a compilation of analyses and reflections in this regard.

SUMMARY

Forest and Landscape Restoration (FLR) has gained attention on the international policy agenda as a promising approach to address complex challenges such as climate change, biodiversity loss, and food and water insecurity while promoting economic development. Despite increasing investments in FLR worldwide, the implementation process remains challenging due to the historical, cultural, political and ecological characteristics unique to each landscape restoration process. Governments and markets struggle to effectively align capital and interests in a parsimonious, transparent and agile manner to achieve FLR objectives. This research employs mixed methods and integrates world and conceptual views to forge the theme "Social Innovation - Forest and Landscape Restoration" (SI-FLR). SI-FLR represents an inclusive process of social, economic and land-use transformation that prioritises local, sustainable livelihoods and socio-ecological resilience. Furthermore, SI-FLR acts as a spotlight to highlight social innovation as one avenue to increase FLR's social inclusion and efficiency. This study uses structuration theory to explore the SI-FLR phenomenon from two distinct perspectives. First, adopting a bottom-up (agent of change) approach, it investigates seven case studies in Brazil, focusing on networks of seed collectors and other actors involved in FLR efforts. Second, employing a top-down (social structure) lens to identify 102 policy instruments and their governance structures potentially influences SI-FLR in Brazil. Through the analysis of these perspectives, ten determinant factors for the emergence, development and structuration of SI-FLR in contemporary societies were highlighted. Furthermore, examining cases of SI-FLR in Brazil revealed that, although marginalised and often invisible, local initiatives involving traditional peoples and rural communities play a central role in caring for landscapes. Thus, this thesis has contributed to the understanding of the relationship between SI and FLR, investigates the role of seed collection networks in promoting SI-FLR in Brazil and explores the determinants that contribute to the emergence of SI-FLR in the Brazilian context.

Keywords: Social Innovation, Forest and Landscape Restoration, Social Ecological-System, Landscape Governance, Brazil, Mix Methods, Native Seed Collectors, Agency Power, Networks, Policy Instruments.

SOMMARIO (italiano)

Il Ripristino delle Foreste e del Paesaggio (RFP) ha guadagnato attenzione nell'agenda politica internazionale come approccio propizio per affrontare complesse sfide come il cambiamento climatico, la perdita di biodiversità e l'insicurezza alimentare e idrica, promuovendo al contempo lo sviluppo economico. Nonostante l'aumento degli investimenti nella RFP in tutto il mondo, il processo di attuazione rimane impegnativo a causa delle caratteristiche storiche, culturali, politiche ed ecologiche uniche di ogni processo di restauro del paesaggio. I governi e i mercati hanno difficoltà ad allineare efficacemente il capitale e gli interessi in modo parsimonioso, trasparente e agile per raggiungere gli obiettivi della RFP. Questa ricerca impiega metodi misti e integra diverse visioni del mondo per forgiare il tema "Innovazione sociale - Ripristino delle Foreste e del Paesaggio" (IS-RFP). La S-RFP rappresenta un processo inclusivo di trasformazione sociale, economica e dell'uso del suolo che dà priorità ai mezzi di sussistenza sostenibili locali e alla resilienza socio-ecologica. Inoltre, la IS-RFP agisce come un riflettore per evidenziare l'innovazione sociale come una via per aumentare l'inclusione sociale e l'efficienza della RFP. Questo studio utilizza la teoria della strutturazione per esplorare il fenomeno IS-RFP da due prospettive distinte. In primo luogo, adottando un approccio dal basso verso l'alto (agente di cambiamento), indaga sette casi di studio in Brasile, concentrandosi sulle reti di raccoglitori di semi e altri attori coinvolti negli sforzi del IS-RFP. In secondo luogo, impiegando una lente top-down (struttura sociale) per identificare 102 strumenti politici e le loro strutture di governance che possono influenzare il RFP in Brasile. Attraverso l'analisi di queste prospettive, sono stati evidenziati dieci fattori determinanti per la nascita, lo sviluppo e la strutturazione della IS-RFP nelle società contemporanee. Inoltre, l'esame dei casi di IS-RFP in Brasile ha rivelato che, sebbene emarginate e spesso invisibili, le iniziative locali che coinvolgono i popoli tradizionali e le comunità rurali svolgono un ruolo centrale nella cura dei paesaggi. Pertanto, questa tesi ha contribuito alla comprensione della relazione tra IS e RFP, indaga il ruolo delle reti di raccolta di semi nella promozione della IS-RFP in Brasile ed esplora i fattori determinanti che contribuiscono all'emergere della IS-RFP nel contesto brasiliano.

SUMÁRIO (português)

A Restauração de Florestas e Paisagens (RPF) ganhou atenção na agenda política internacional como uma abordagem promissora para enfrentar desafios complexos, como mudanças climáticas, perda de biodiversidade e insegurança alimentar e hídrica, ao mesmo tempo em que promove o desenvolvimento econômico. Apesar do aumento dos investimentos em RPF em todo o mundo, o processo de implementação continua desafiador devido às características históricas, culturais, políticas e ecológicas exclusivas de cada processo de restauração de paisagens. Os governos e os mercados têm dificuldades para alinhar efetivamente o capital e os interesses de forma parcimoniosa, transparente e ágil para atingir os objetivos da RPF. Esta pesquisa emprega métodos mistos e integra visões de mundo e conceituais para forjar o tema "Restauração Socio-Inovadora de Paisagens" (RESIP). A RESIP representa um processo inclusivo de transformação social, econômica e de uso da terra que prioriza os meios de subsistência sustentáveis locais e a resiliência socioecológica. Além disso, a RESIP serve como um holofote para destacar a inovação social como uma forma de aumentar a inclusão social e a eficiência da RPF. Com base na teoria da estruturação, este estudo explora o fenômeno da RESIP a partir de duas perspectivas distintas. Em primeiro lugar, adotando uma abordagem de baixo para cima (agente de mudança), investiga sete estudos de caso no Brasil, com foco em redes de coletores de sementes e outros atores envolvidos nos esforços de RPF. Em segundo lugar, empregando uma lente de cima para baixo (estrutura social), para identificar 102 instrumentos políticos e respectivas estruturas de governança que potencialmente influenciam a RESIP no Brasil. Por meio da análise dessas perspectivas, dez fatores determinantes para o surgimento, o desenvolvimento e a estruturação da RESIP nas sociedades contemporâneas foram evidenciados. Além disso, o exame de casos de RESIP no Brasil revelou que, apesar de marginalizadas e muitas vezes invisíveis, as iniciativas locais envolvendo povos tradicionais e comunidades rurais desempenham um papel central no cuidado das paisagens. Desta forma, presente tese contribui para a compreensão da relação entre IS e RFP, investiga o papel das redes de coleta de sementes na promoção da RESIP no Brasil e explora os fatores determinantes que contribuem para o surgimento da RESIP no contexto brasileiro.

CHAPTER 1. INTRODUCTION

Globally, it is estimated that humanity needs to double agricultural land to meet the demand for food, fibre, and energy for 9.8 billion people by 2050, threatening the conversion of more than 500 million hectares of natural forests (Searching, 2018). Although the need to maintain and recover native vegetation is increasingly recognised, farmland expansion is putting pressure on old-growth and secondary forest remnants, which will increasingly be required to meet multiple needs for people, biodiversity, and ecosystem services.

The search for solutions to alleviate this scenario is one of the most urgent challenges of contemporary times, demanding many social actors to adopt so-called Nature-based Solutions (NbS) (Cohen-Shacham et al., 2019) as a tool for mitigating and adapting to climate change, to improve sustainable living and protect biodiversity (Griscom et al., 2017). Forest and Landscape Restoration (FLR) is an NbS tool which aims to restore ecological integrity while improving human well-being (Maginnis et al., 2012; Mansourian et al., 2005).

Financial investments are already flowing to support FLR, signalling increased interest in this topic. From 2004 to 2015, about USD 8 billion of private capital was invested in FLR (Hamrick, 2016). This is a remarkable amount. However, it represents only 16% of the total annual funding (USD 50 billion) (Parker et al., 2012), which is less than 10% of the estimate (USD 350 to 450 billion) needed to fund the Bonn Challenge; a global call that aims to restore 350 million hectares of degraded forest landscapes by 2030 (Verdone & Seidl, 2017). In other words, FLR investments are largely public and much lower than needed to fund announced global commitments. Moreover, opportunities for FLR projects have been chiefly mapped on degraded lands in developing countries in the global South, where economically vulnerable communities depend on remaining natural resources and compete for farmland space with international agribusiness for food and commodity production.

Increasingly, impact investors discover in FLR a profitable opportunity for the commercial production of timber and non-timber goods, generating profits associated with climate change mitigation and adaptation actions (Brancalion et al., 2017). However, FLR does not always benefit local, sustainable livelihoods (Adams et al., 2016). Therefore, it is crucial that in addition to the profits and tonnes of carbon stored, investments in FLR also generate benefits for local communities, which increases the success and potential perpetuity of FLR businesses and landscapes.

Although historical experiences (Hanson et al., 2015) reported FLR's effectiveness in coping with social-environmental goals, there are still challenges in technical (Chazdon et al., 2017; D. Lamb, 2005), finance mechanism (Brancalion et al., 2017; FAO, 2015), progress measuring, and governance (Mansourian et al., 2016; van Oosten, 2013) issues to overcome. Rare are cases¹ able to fully attend to FLR's socio-ecological dimensions, probably because it requires a complex translation of local restoration needs and degradation reasons into a long-term engaging theory of change (Soe & Yeo-Chang, 2019; Mansourian et al., 2017).

¹ <http://www.forestlandscaperestoration.org/case-studies>.

It is also important to recognise that adopting the FLR approach to maintain and recover native vegetation, promote sustainable agri-food systems², and, at the same time, deal with other land-use interests requires a high level of trust and engagement among stakeholders (Chazdon et al., 2020). Nevertheless, such an approach can be promoted by well-orchestrated participatory governance (Kleinschmit et al., 2018) that will likely result in feasible agreements and adaptive management processes spearheaded or, at least, supported by the local livelihoods and, eventually, triggering sparks of social innovation.

Social Innovation (SI) is an effective way to overcome contemporary socioeconomic challenges by creating or accelerating transformative social values (Adams & Hess, 2010). SI can refer to any processes or outcomes where mobilised people share ideas and knowledge and engage in collective actions to come up with new technologies, adjustments in social institutions, or new ways of managing natural resources to overcome a specific common challenge (Murray et al., 2010; Mulgan et al., 2007). Although considered a driving force for sustainable development and improvement in many knowledge areas, SI research in forest-dependent communities and restoration projects is just beginning (Nijnik et al., 2019).

Concerning FLR effectiveness, an emerging question is whether SI would be helpful to amplify the FLR transformation process by empowering local livelihoods through knowledge and practice networks, thus, reinforcing the role of collective action in landscape governance. Or whether SI could foster (or have been benefited by) FLR policy instruments, considering that: a) policies can be drivers or outcomes of the SI transformation process (Ludvig et al., 2021) and; b) that the main driving force for FLR is the legal demand (Bustamante et al., 2019).

Although some case studies, such as (Paudyal et al., 2017), showed that there are intrinsic and extrinsic factors (social, political, ecological, and economic) that can motivate communities to take a leading role in FLR implementation, insufficient understanding of these factors may impede FLR from moving forward (Sayer et al., 2013). As the FLR development process seeks to harmonise the needs for human socioeconomic wellbeing with ecological functionality, identifying and describing the SI on FLR initiatives can unfold new ways for achieving these ends.

This research aimed to understand better the role of SI in supporting and accelerating the FLR transformation process. To this end, it investigated whether SI is happening in Brazilian forest restoration initiatives, the role it has played in this agenda, and the determinant factors to its emergence and development.

1.1 GENERAL AND SPECIFIC OBJECTIVES

The guiding assumption to structure the questions and objectives of this research is that although ignored so far, social innovations happen and have been crucial to leverage inclusive and transformative Forest and Landscape Restoration (FLR) initiatives.

² Agri-food systems encompass all processes and infrastructures related to animal husbandry, crop cultivation, and harvesting; the processing, preparation, packaging, and distribution of food; and the act of consumption itself and the management of associated waste (Institute of Medicine & National Research Council, 2015). Sustainable Agri-food Systems (SAS) connect producers and consumers directly, recognise and adequately reward the workers involved, and are harmoniously connected to the surrounding nature elements (Feenstra, 2002).

Thus, the main objective of this research is to reveal SI under FLR initiatives, creating a theoretical basis to subsidise the investigation of whether, how and why Social Innovation has been happening in the context of Brazilian Forest and Landscape Restoration (SI-FLR). In doing so, it is intended to contribute to a better understanding of the determining factors for its emergence and development.

To organise both the investigation process and the presentation of the results and reflection on specific topics, specific objectives were established that are linked to the research questions as follows:

Specific Objective 1: To establish the bridges of understanding between Social Innovation (SI) and Forest and Landscape Restoration (FLR).

Research question 1. a: What conceptual bridges link Social Innovation and Forest and Landscape Restoration?

Research question 1. b: Could a merged conceptual framework explain the phenomenon of "Social Innovative - Forest and Landscape Restoration" (SI-FLR)?

Specific Objective 2: To identify and describe SI-FLR cases in Brazil.

Research question 2. a: Are there SI-FLR cases happening in Brazil?

Research question 2. b: What kind of Brazilian initiatives can be considered cases of SI-FLR?

Specific Objective 3: To explore and analyse intrinsic and extrinsic factors shaping and propelling SI-FLR in the Brazilian context.

Research question 3. a: Have Networks of Native Seed Collectors been protagonists of SI-FLR in Brazil?

Research question 3. b: Are there policy instruments supporting SI-FLR in Brazil?

Specific Objective 4: To support FLR stakeholders and decision-makers in leveraging SI-FLR.

Research question 4. a: What are the determinant factors for the emergence, development, and structuration of the SI-FLR in the Brazilian context?

Research question 4. b: What events or actions might lever these determinant factors?

In chapter 8, the conclusion, the main findings were concisely organised to answer the research questions. It also points out determinant factors to the emergence, development, and structuration of SI-FLR and insights on actions that can inspire decision-makers and other actors involved in FLR initiatives to leverage the SI-FLR approach.

1.2 OVERVIEW

In this section, the general structure of this document is outlined. Besides a brief presentation about the main contents explored in detail throughout the following chapters, the current section intends to elucidate the logical flow running through and connecting the whole document.

Chapter 1 introduces and defines this research field within the context of Forest and Landscape Restoration (FLR) as an emerging nature-based solution to address the complex contemporary problems of climate change, biodiversity loss and decrease of sustainable livelihoods. The chapter

points out the virtuous but insufficient volume of investment being directed towards implementing FLR programmes, which currently makes governments and markets need to catch up in achieving the scale desired by society. To address this issue, attention turns to Social Innovation (SI) as a possible route to more inclusive FLR programmes. And presents the general and specific objectives and respective research questions that guided this scientific investigation's development.

Chapter 2 presents the main conceptual pillars that support the entire research argumentation. Those pillars are: Socio-Ecological Systems, Landscape and Forest Restoration, Landscape Governance, Social Innovation and Social Network Theory, and Structuration theory. The concept of Social-Ecological Systems (SES) highlights the interaction between social and ecological systems in time and space, reflecting the complex and multiscale dynamics in the landscape. Ecological Restoration was differentiated from Forest and Landscape Restoration (FLR), highlighting that FLR represents a political approach to extend the scale of action of the former through a dialogue with other stakeholders in the design of landscape mosaics, and considering socioeconomic opportunities, local dwellers' wellbeing, as well as the role of natural ecosystems in the maintenance of SES. Conceptual aspects of Social Innovation (SI) were explored, and the justifications were exposed for choosing the definition constructed by the SIMRA project (Social Innovation in Marginalized Rural Areas). Possible interactions between SI and FLR, although the conceptual bridges between these themes were developed later in chapter 5. The relationship between politics and SI is also briefly introduced, which is covered in more detail in chapter 8. Finally, the concepts of landscape governance and network theory are presented. Both are relevant to grounding and investigating the role of social innovators as agents of transformation through RPF initiatives; and, together with structuration theory, help to highlight the mutually influential nature of the determinants of SI-FLR. Other concepts relevant to understanding specific topics are elucidated along the course, predominantly in chapters 5-8.

Chapter 3 presents the general methodological path of the research. chapter 3 presents the overall methodological path of the research that was structured on two worldviews, transformivist and pragmatic, and organised into four phases: 1) Conceptual framework; 2) Empirical cases of SI-FLR; 3) In-depth analysis: networks and policy instruments; 4) Research compilation. The main methods used were: systematic literature review, text mining and coding, key informant interviews, case studies, documentary analysis, participant observation, social network analysis, content analysis, policy gap analysis and information triangulation. However, the materials and research methods applied to each sub-theme of the investigation are detailed throughout chapters 4, 5, 6 and 7. These chapters are presented in a structured and independent scientific paper format, as their contents have already been published as papers are currently under review for being published or are under development for being submitted soon at the time this thesis is submitted, thus contributing to the advancement of the scientific knowledge on this topic and debate related to the research's specific objectives.

Chapter 4 proposes five conceptual bridges between social innovation and forest and landscape restoration. These are: 1) "Landscape as a primary context"; 2) "Nature as a social need"; 3) "Landscape management groups"; 4) "Governance capacities"; 5) "Adaptation and transformation to increase resilience". This work reveals the "Social Innovation - Forests and Landscape Restoration" (SI-FLR), a phenomenon which takes the policy option to prioritise sustainable livelihood needs by envisioning social innovation as a key driver of socially and economically inclusive FLRs to ensure SES resilience. The SI-FLR is also a framework that allows us to explore the determinant factors of the phenomenon it represents. This chapter's content was published in 2022 in Environmental Policy and Governance Journal.

Chapter 5 explores three case studies (the establishment of agroecology nuclei in agrarian reform settlements; the participatory repopulation of the Juçara palm (*Euterpes edules*) surrounding a protected area; and the participatory elaboration of a Forest Landscape Development Plan) through the lens of the SI-FLR theoretical framework. In doing so, I assess how the five conceptual bridges of SI-FLR help to understand the emergence and development of inclusive FLR initiatives that generate benefits to nature and local people, and at the same time, I analyse the determinant social factors. The content of this chapter was published in 2022 in *Estudos Avançados* Journal.

Chapter 6 explores nine Brazilian native seed networks (NNSCs), reinforcing the argument that traditional (local) people, rural and peri-urban communities, in synergy with other stakeholders, play a central role in SI-FLR. To this end, an actor-oriented approach to rural development was adopted, and a social network analysis was conducted in four Brazilian NNSCs where it was identified and described five more cases of SI-FLR. Based on empirical observations, reflections and discussions were made on the relevance of the agency power of grassroots organisations, government agencies, collective actions and governance models in hindering or driving SI-FLR initiatives. The content of this chapter was submitted to the *People and Nature* Journal in 2023 and is currently under review.

Chapter 7 applies qualitative inductive content analysis to policy documents from four Brazilian policy domains (Environment, Agriculture, Regional Development, and Science and Innovation). This allowed us to identify 102 potentially SI-FLR-friendly policy instruments and their respective governance structures governing those instruments. This policy analysis was completed by identifying gaps and elaborating structural recommendations to promote the SI-FLR in Brazil, empowering local actors and regional networks. The content of this chapter was submitted to *Land Use Policy* magazine in 2022 and is currently under review.

After defining a worldview, making use of different and complementary disciplines and mixed methods to investigate different time-space scales and multiple perspectives, in chapter 8, I present the research conclusions, objectively answering, based on data collection, analysis and interpretation, the research questions and bringing some final ideas to support decision-makers and actors involved in FLR initiatives to consider the SI-FLR approach to promoting more inclusive and transformative landscape restoration.

Right after chapter 8, the literature cited throughout the thesis is gathered alphabetically. The annexes are an important part of this work; it is where you can find materials for data collection, such as questionnaires, workshop structure, list of policy documents consulted and spreadsheets detailing some of the information presented. Specifically, **Annex 7** presents an emerging movement called "Redário", which, by articulating a network of seed networks (some of which are cases of SI-FLR explored in this thesis), may represent a transformative social innovation underway in the Brazilian native seed market. **Figure 1** depicts a visual overview of the chapters' presentation.

This document was organised to enable readers to follow the evolution of logical thought. Thus, the first chapter's present contents subsidise the understanding of the following discussions. However, for those readers interested in a specific chapter, we were careful to repeat - synthetically and objectively - the conceptual foundations explored previously and indispensable for understanding the proposed dialogue.

Enjoy your reading!

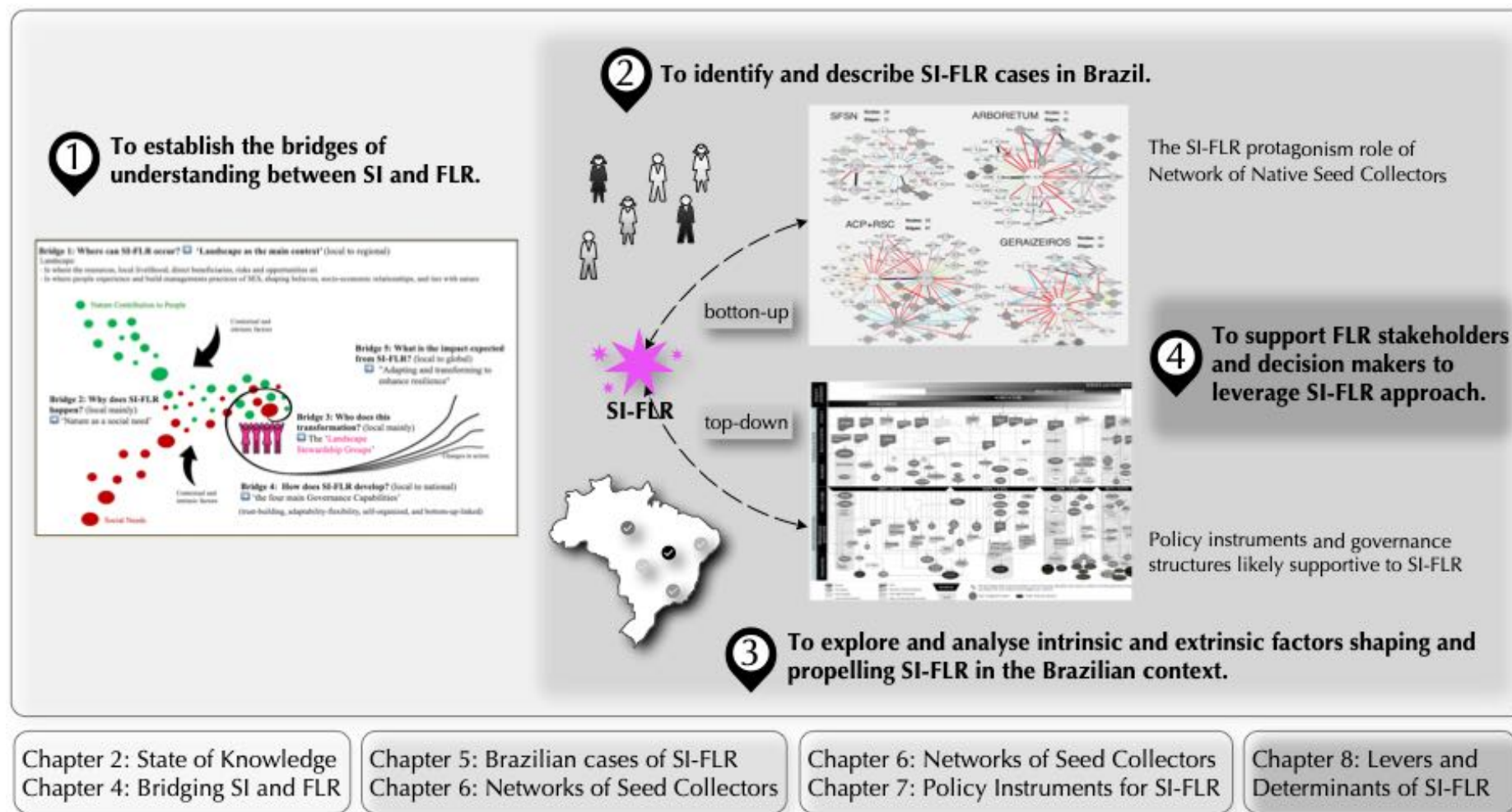


Figure 1. The investigative path. The relationship between the specific research objectives and the chapters of this document.

CHAPTER 2. STATE OF KNOWLEDGE ON THE KEY RESEARCH TOPIC

This section presents a literature review of the pillar concepts of this research. From the most general to the most specific, they are: I) Socio-Ecological Systems (section 2.1); II) Forest and Landscape Restoration (2.2), III) Social Innovation (2.3), IV) Governance and Collaborative Networks (2.4); and; V) The Structuration theory (2.5). The different theoretical strands presented in this section are global, i.e., applicable to any region of the globe.

2.1 SOCIO-ECOLOGICAL SYSTEMS (SES)

Almost all human activity has some impact on natural ecosystems; on the other hand, bio-geophysical contexts and changes strongly influence people's decisions (Thomas, 1956; Marsh, 1964). Dealing with contemporary forest conservation, restoration, and management threats requires a multiscale, multidisciplinary understanding. For example, deforestation, monoculture, wildfires, windstorms, and forest regeneration are responses to multiple and simultaneous socioeconomic and political causes, which can influence the system's future conditions (Fischer, 2018).

Socio-Ecological Systems (SES) seek to explain how social-ecological interactions shape landscapes across space and time. It is a holistic concept that aims to represent the assets and processes of the interconnections between social (human society) and ecological (biophysical) subsystems, coupled with reciprocal feedback cycles (McGinnis & Ostrom, 2014; Liu et al., 2007). The ecological subsystem is represented by ecosystems (Odum, 1989), which provide essential services and products (e.g., food, energy, water, climate regulation, etc.) to people who live in it (IPBES, 2019). Thereby, understanding SES provides a more robust recognition of the role of knowledge systems and cultural contexts in human-nature relationships (Govigli & Bruzzese, 2023).

Two distinct classes of variables that drive SES have been conventionally recognised: 1) *ecologically driven*, such as geologic, climate, and hydrologic processes, primary productivity patterns and other bio-geophysical factors, and; 2) *human-driven*, such as agriculture, natural resources exploitation, and fauna-flora management (Likens, 1991). A third category: ecology-and-human-interrelationship-driven, such as cultural and institutional factors (e.g., attachment to place, spirituality, informal laws and norms, etc.), should also be considered once they play a key role in driving SES evolution (Govigli & Bruzzese, 2023). The outcomes from the interactions of these variables return as input, which influences the dynamic stability of the system, strengthening its resilience (positive feedback)³, or contributing to its transformation (negative feedback), leading to a new equilibrium state. Thus, an organised local action among human agents (e.g., natural resources exploitation) can transform macro-scale ecological mechanisms (e.g., availability of these resources), which can feedback into social issues (e.g., marketing, legal restrictions), influencing the behaviour of these same agents. In complex SES, feedback mechanisms usually occur slowly and diffusely, challenging agents to perceive the cause-effect relationships involved (Levin et al., 2013). Therefore, an essential step for studying SES is to recognise that social and ecological subsystems have mutual influence and share common properties, including resilience, complexity, and adaptation (Walker et al., 2004).

³ Resilience can be wicked if it keeps the ecosystem on an unsustainable path (Steffen et al., 2018).

While the complexity represents the uncertainty of predicting the multiple possibilities between the infinite outcomes and feedback mechanisms between the interaction of those variables, adaptation reflects the system's capacity to adjust its responses to them (Starzomski, 2004).

Resilience has been explained in two very particular forms in the SES literature. The first focuses on stability in a presumed stable state, resilience and the speed of return to equilibrium after a disturbance or stress. This is the conventional, linear, equilibrium-centered, cause-and-effect view of predictive science, which leads to the premise that resources are manageable and yield predictable. Instead, the second meaning of resilience stresses the conditions in which disturbances (or perturbations) can flip a system from an equilibrium state to another. In this case, the critical measure of resilience is the extent of disturbance that can be absorbed before changing variables and processes that command the system's dynamic equilibrium. It represents a different view of science, in which casual effects and predictions are uncertain. Instead, SES are complex, non-linear, multi-equilibrium, and self-organised, permeated by uncertainties and disruptions. In this context, resilience assumes the meaning of a robustness measure, or in other words, the buffering capacity of systems in constant transformation (Berkes et al., 2000). As the introduction highlights, the socio-ecological system (SES) is influenced by intricate and nonlinear interactions between ecological, socio-economic, and cultural factors. Consequently, disturbances can potentially degrade not only the ecological aspects but also the social and cultural infrastructures. For instance, depopulation may lead to the disappearance of traditional human management practices, thereby intensifying the risk of wildfires.

SES adopts a people-oriented approach since it centres on the users of resources instead of natural resources and is grounded in the idea that "resource management is people management" (Berkes et al., 2000: p.2). The human component of SES is much more complex than other organisms since people (individually and in groups) are self-aware, react differently to risks, quickly acquire new knowledge and skills, convey meanings through symbols, and promote extensive communication networks. In addition, people organise themselves into societies guided by political and economic issues, which generate social disparities, alter ecosystems, and can support forming institutions to influence individual behaviour (Redman et al., 2004).

Ostrom and associated scholars developed a framework to analyse SES sustainability (McGinnis & Ostrom, 2014; Ostrom, 2009) (Figure 2). It is represented by connected concepts and variables constructed through the analysis of numerous case studies in the context of common pool resources use. Although these cases represent users extracting resource units (RU) from a system (RS), the framework can also be applied to analyse a provision situation (Hinkel et al., 2015), such as FLR aiming to reintroduce RUs (e.g., native species) into the RS. This framework allows the description of SES elements and infers whether the system is stable or moving toward a degradation or restoration situation and can help to identify the factors that may be contributing to it. All these variables presented in Figure 2 are important to SES understanding, but governance is a key element to comprehending the changes in this system. The governance system represents the organisations (government, private companies, NGOs) that manage the resources, the rules related to its use, and how these rules are made (Ostrom, 2009). The action situation is the negotiation space where land users interact with each other and jointly affect the outcomes of the SES (McGinnis & Ostrom, 2014; Ostrom, 2009). Although I did not apply this framework directly in this research, exploring the interrelationships between SI and FLR was fundamental.

Intensive feedback mechanisms such as natural disasters, extreme weather events and long-term political, socio-economic or demographic disturbances can lead the SES to a tipping point, in which the supporting ecosystem degrades, and local livelihoods can lose the autonomy to manage it (Fernández-Manjarrés et al., 2018; Levin et al., 2013).

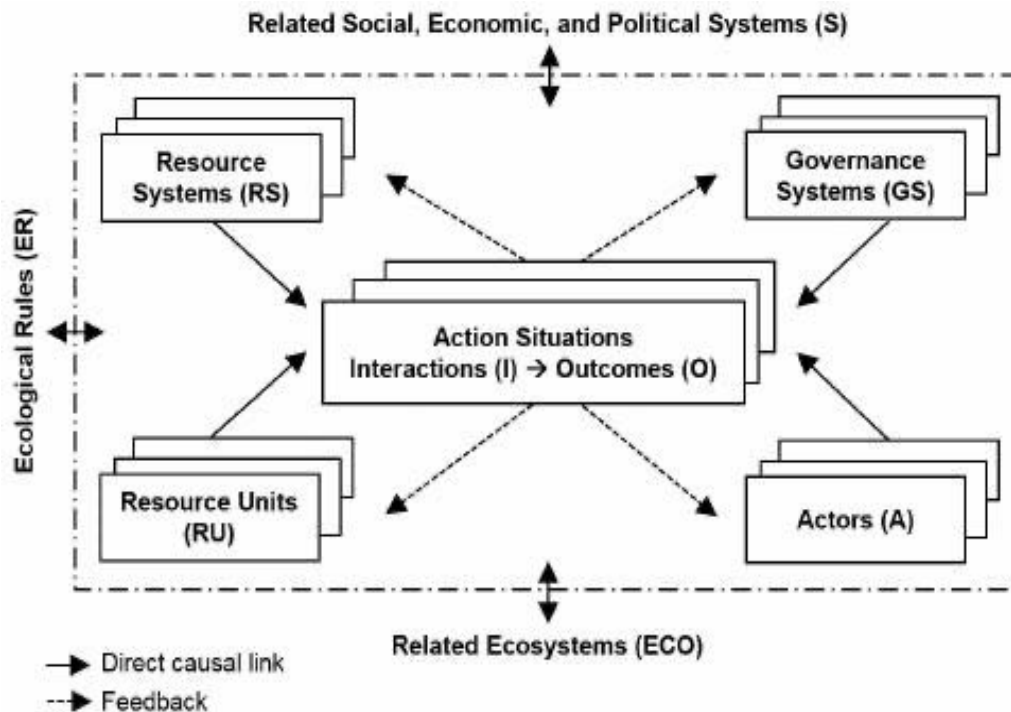


Figure 2. Ostrom's Social-Ecological System Framework (Vogt et al., 2015: p. 1: Fig. 1).

2.2 FOREST AND LANDSCAPE RESTORATION (FLR)

The alarming rates of tropical forest deforestation detected in the 1980s, coupled with slow and often imperceptible advances in large-scale restoration actions, have reinforced the need for a more inclusive approach that emphasises the multiple uses of restored forests by incorporating restoration into a broader context: the rural landscape (D. Lamb, 2005). Therefore, the joint planning and implementation of multiple interventions should improve the ecological resilience of the landscape, presenting itself as an attractive and promising alternative land use for landowners, investors, and decision-makers (*ibid.*). The Forest and Landscape (FLR) approach accommodates a diversity of interests in the landscape, resulting in a more flexible and negotiable compromise aiming at a feasible sustainable mosaic of land uses (Mansourian et al., 2005). FLR was conceptualised to broaden the thinking on how reforestation could better articulate industrial plantations, community-level forest management and biodiversity conservation goals.

The FLR approach is built on but differs from Ecological Restoration (ER). While ER is an intentional action to accelerate ecosystem recovery in a specific degraded site (Higgs, 1997), FLR focus is to increase the socio-ecological resilience and socio-biodiversity through a constant dialogue with stakeholders about landscape use (Chazdon et al., 2020b; Lamb, 2014). FLR is based on a “landscape approach” (Jeffrey Sayer et al., 2013), which aims to balance social, economic, and environmental needs in places where agriculture, mining, and other productive activities compete for space with nature, marking a shift from conservation-oriented outlook toward achieving an undisturbed reference state.

From a biophysical perspective, a landscape can simply be defined as all visible features in a given place (of any scale); from a sociological perspective, it is a symbolic environment created by people who share similar values and beliefs, grounded in their culture (Greider & Garkovich, 1994). For FLR, landscapes represent an arena where its elements, including people, interact according to rules (physical, biological, and social) that determine their role and relationships within the system (Jeffrey Sayer et al., 2013); it is also large-enough scale where different socio-economic and ecological aims can be sustainably balanced (McCall, 2016). In this thesis, forest restoration landscapes are understood as complex social-ecological systems (SSE), which are characterised by coupling ecological and social systems with feedback and adaptation mechanisms (Mansourian & Sgard, 2019; Folke et al. 2005).

The FLR actions affect people and spaces outside their intervention borders in multiple scales, as well as trigger complex processes that return as feedback mechanisms, influencing local practices and the results of FLR actions themselves. Consequently, the two scales of intervention (spatial and temporal) and the generation of results do not necessarily coincide (Wiegant et al., 2020) and are generally not aligned with political jurisdiction, creating specific governance challenges (Chazdon et al., 2020b). Therefore, FLR reinforces the need for a more inclusive and innovative approach, emphasising the possible multiple uses of the rural landscape (Lamb, 2005).

Governance is a critical factor in allowing the necessary flexibility to manage a mosaic composed of forests and agri-food systems, to improve socio-economic resilience and, at the same time, involve landowners, investors, decision-makers, and other categories of stakeholders to make the best use of the landscape (Mansourian et al., 2005). The potential benefits of FLR can include but go beyond forest cover (or the number of trees) increase, contributing to rural poverty alleviation, improvement of sustainable food production and quality of ecosystem services, diversification of local livelihoods, social justice, welfare, climate resilience, habitat connectivity and biodiversity conservation (Sabogal et al., 2015). This diversity of objectives is only possible while maintaining the non-prescriptive nature of the FLR definition, which favours project design and implementation flexibility, fundamental to adapting interventions to each local context. This way, “FLR implies different things to different people” (Chazdon et al., 2020a; p.5).

Over the last decade, FLR has gained momentum and is an important topic in international environmental policies designed to reach Social Development Goals (SDG) (Reinecke et al., 2018). In 2003, the Global Partnership on Forest Landscape Restoration (GPFLR) was created, a consortium of public organisations to catalyse efforts, strengthen experience-sharing networks and develop a capacity for action (van Oosten, Runhaar, & Arts, 2019). Today, the GPFLR is a group of high-level international organisations involved in FLR policy and implementation. In 2011, the Bonn Challenge launched an international articulation to restore 150 million hectares of deforested and degraded land by 2020, after which the goal of 350 million hectares was added until 2030. These goals were defined based on a global map depicting the FLR opportunities (Laestadius et al., 2011).

The FLR's main goal has evolved over the years. Initially, it was more centred on the dual objective of recovering the integrity of ecosystems and enhancing human well-being in deforested or degraded landscapes. Nowadays, it has widened to a less forest-centred approach, encompassing non-forest ecosystems, a focus on recovering ecosystem functionality instead of its integrity and seeking to look more carefully at the local livelihood needs. Thus, FLR has been increasingly understood as a progressive process emerging from the local landscape context, which engages local stakeholders in

regaining, improving, and maintaining vital social and ecological processes and continuously promoting more resilient and sustainable landscapes (Chazdon et al., 2020a; p.5).

Today, FLR is a strategic objective in numerous international agreements, such as the United Nations Ecosystem Restoration Decade, and many implementation initiatives are running in Africa, Latin America, and Asia (Chazdon et al., 2020b). Currently, dozens of countries are voluntarily committed to restoring more than 170 million hectares of degraded forest landscapes under the Bonn Challenge (Besseau et al., 2018). For example, Brazil joined the Bonn Challenge in 2017 and committed to restoring 12 million hectares of forest landscapes. To support decision-makers and practitioners in meeting these goals, six fundamental principles were established to describe the ‘heart’ of FLR, representing the current shared understanding of GPFLR members (Table 1). These principles can also be taken as a road map for planning and adaptive management of FLR initiatives.

Table 1. The six principles of Forest and Landscape Restoration (FLR) (based on Besseau et al., 2018).

Principle	Brief principles’ explanation
1. Focus on landscapes	FLR occurs within and across entire landscapes, not individual sites, representing mosaics of interacting land uses and management practices under various tenure and governance systems. At this scale, ecological, social, and economic priorities can be balanced.
2. Engage stakeholders and support participatory governance	FLR actively engages stakeholders at different scales, including vulnerable groups, in planning and decision-making regarding land use, restoration goals and strategies, implementation methods, benefit sharing, monitoring, and review processes.
3. Restore multiple functions for multiple benefits	FLR interventions aim to restore multiple ecological, social, and economic functions across a landscape and generate a range of ecosystem goods and services that benefit multiple stakeholder groups.
4. Maintain and enhance natural ecosystems within the landscapes	FLR does not lead to the conversion or destruction of natural forests or other ecosystems. It enhances the conservation, recovery, and sustainable management of forests and other ecosystems.
5. Tailor to the local context using a variety of approaches	FLR uses a variety of approaches that are adapted to local social, cultural, economic, and ecological values, needs, and landscape history. It draws on the latest science and best practice, and traditional and indigenous knowledge, and applies that information in the context of local capacities and existing or new governance structures
6. Manage adaptively for long-term resilience	FLR seeks to enhance the resilience of the landscape and its stakeholders over the medium and long-term. Restoration approaches should enhance species and genetic diversity and be adjusted over time to reflect changes in climate and other environmental conditions, knowledge, skills, stakeholder needs, and societal values. As restoration progresses, information from monitoring activities, research, and stakeholder guidance should be integrated into management plans.

In a review of ten FLR case studies (Brazil, Cambodia, China, Ethiopia, Peru, Philippines (3) and Thailand), each one within its own socioeconomic and ecological contexts, Ota et al., 2020 observed that none of them succeeded in covering the above-mentioned six FLR principles. While principles 3,

4 and 5 were adopted in all case studies, just a few assumed principles 2 and 6. Surprisingly, none was grounded on principle 1 once their landscape boundaries were defined according to local conditions, available resources, and implementation capacity. On the one hand, the case studies perceived challenges included financial limitations and lack of long-term views, low uptake of lessons learned by regional agencies, limited reporting capacity, poor governance structures, and many organisational implementation weaknesses. On the other hand, case studies outcomes included land-use conflict reduction, increased tenure security, and enhancement of human and social capital in bridging, bonding, and linking capitals. They also observed that while government agencies tended to be more interested in conservation outcomes, local communities' attention lay in direct benefits.

Despite its 20-year conceptual history and rapidly wide adoption as a global solution with multiple benefits, the reality is that FLR still needs to demonstrate the extent of its transformative potential (Fagan et al., 2020; Mansourian & Sgard, 2019). One main reason can be that FLR encompasses complex-multi-dimensions (biophysical, political, socioeconomic, and governance) that are challenging to integrate, measure, and monitor at the landscape scale (Mansourian & Sgard, 2019; Djenontin et al., 2018).

2.3 SOCIAL INNOVATION (SI)

In recent decades, Social Innovation (SI) has positioned itself at the forefront of different sectors of society (e.g., public, private, social, educational, economic, and health). This was motivated mainly by its perspective of solving social, economic, environmental, and institutional problems through societal transformation. The SI concept is positioned as an alternative approach for seeking solutions that current institutions, policies, and markets still need to be able to solve (BEPA, 2011). In this sense, it represents a possible alternative path towards the United Nations Sustainable Development Goals (Portales, 2019). Social Innovation unites and encompasses two complex concepts: '*innovation*' and '*social*.' Therefore, to understand its meaning, it is necessary to understand what the innovation is and what it means when associated with the "social" concept.

'Innovation' is something new, somehow unknown before and foreign to us. It can also encompass a renewal perspective, especially regarding processes or relations. Although scholars and public thinkers (Secco et al., 2019; BEPA, 2014; Adams & Hess, 2010; MacCallum, 2009; Mulgan et al., 2007) have explored the nature and scope of innovation in multiple fields of science, much ambiguity remains. That is because novelty is a point of view, and frequently, it is interpreted according to the context where it is inserted, and contexts are always subject to changes and divergent interpretations. Furthermore, within innovation research, there is a distinction between the processes of invention (e.g., new ideas and approaches) and outputs of implementation (that is, new successful practices) which defines an absolute novelty (Nicholls & Murdock, 2012).

The meaning of 'Social' has been discussed by economists, sociologists, political scientists, and anthropologists (among others) for over a century, but ambiguities remain. For sociologists, 'social' is the domain of all human activities (Burns et al., 2015); for anthropologists, it is in a community environment, among its rituals and communal relations (O'Brien & Shennan, 2010). For economists, the 'social' is generally understood as an externality generated by the market or as a variable factor that interferes with the individual's workforce (Mulgan, 2006). For political scientists, 'social' is usually framed as a public asset directly influencing politics (Parés et al., 2017).

Under some lenses, any innovation can be seen as social. This is because all innovations should be considered social once all new products and services impact people's lives. However, not all

innovations deserve special attention; only those truly enable a better quality of life for people. Others argue that innovation's 'social' feature requires social engagement in the production and diffusion of novelty or transformation. Hence, SIs are, above all, a sociological matter, highlighting that problems are to be solved by the ones involved in searching for responses (Rhule & Allotey, 2020).

The development of SI academic studies reveals two central universes of meaning: a school of thought more related to social entrepreneurship (Portales, 2019; Dees & Anderson, 2006) and another one more associated with local development processes (MacCallum & Haddock, 2016; Howaldt et al., 2012; Moulaert, 2009). This thesis is based on the latter.

For the social entrepreneurship approach, SI refers to an economic enterprise with a social purpose, an initiative that, despite generating revenue, does not have profit as a primary purpose but positive impacts in solving a given social problem (Mulgan, 2006). When associated with a local development process, SI pursues the interaction of global-local contexts with groups of people seeking change. This emphasises the combination of two central dimensions: social structures (e.g., laws, regulations, institutions, and behaviours); and agency, which highlights the role of collective social action in transforming status quo social structures (e.g., resistance, reproduction, transformation, and subversion) (Moulaert et al., 2005). Therefore, it is an approach that considers SI at different cross-scales through a network of different agents responding and transforming social structures in multiple contexts and the impacts resulting from their agency power and social-ecological feedback.

In this sense, when connected to local development processes, SI expresses a clear need to promote social inclusion through bottom-up approaches and capacity-building capable of transforming power relations and governance structures and incentivising political participation, as well as social (and organisational) learning, transcending the realm of economic relations but also affecting them (*ibid.*). This SI approach is represented by a set of new ideas (products, services, or actions) seeking to satisfy human needs by generating new social relationships, which benefit society and enhance their capacity to act (Murray et al., 2010). Therefore, socially innovative initiatives promote social inclusion by giving voice to social groups often deprived of participation and protagonism in political-administrative systems (Moulaert et al., 2005).

In that sense, SI supports local development through new arrangements in social relationships which improve people's well-being. It implies participation through structured relationships among various social actors, individually or in groups, in activities that contribute to achieving the participants' objectives. The results of these processes can be institutionalisation as new social practices (Howaldt et al., 2012).

Social-Ecological Systems (SES) experiencing wicked problems (Buchanan, 1992), such as economically marginalised communities living in degraded landscapes, offer a fertile ground for SI since new solutions to local social needs can emerge through interactions among stakeholders facing common problems (Neumeier, 2017; Baker & Mehmood, 2015; Howaldt et al., 2014). Therefore, SI refers to "*innovations that are social in both their ends and their means*" (Murray et al., 2010; p.3).

Alternatively, SI is a spark for something new, collectively designed to overcome wicked problems while generating shared social benefits. Within an SES, SI can be triggered by approaching an unacceptable situation (e.g., biodiversity loss, water shortage and soil degradation that are no longer sustainable/acceptable for the community) or confronting a situation that brings new opportunities or limitations (e.g., new environmental policies or regulations, or market requirements). It can come

from a single or cumulative event resulting in a concrete (re)action and can spread to several scales (Secco et al., 2019). When the spark frames new strategies, ideas, concepts, processes, institutions, or organisations capable of enhancing Nature's Contributions to People (IPBES, 2019), it can be named as Social-Ecological Innovation (SEI) (Dennis et al., 2016; Olsson & Galaz, 2012).

2.3.1 Policy as a Driver and Outcome of Social Innovation

Innovation drives firms, sectors, and countries (Schumpeter, 1934). Innovation results from a new knowledge generation, which paradoxically adds to and contradicts what is already known (Antonelli, 1999). Firms and other economic actors, research and education organisations, and political-institutional actors consolidate the triple-helix of a classical innovation ecosystem model (industry, university, and government) (Leydesdorff, 2012). Later, a fourth helix was added, considering society (users, producers, and innovators) equally important (Carayannis & Campbell, 2010). In the same vein, approaches to sociotechnical systems (Geels, 2004), user-centred innovation (von Hippel, 2005), open innovation (Chesbrough, 2003), and Social Innovation (SI) (Moulaert et al., 2005) followed.

Innovation can be an instrument of competitiveness, but it can also represent dynamics with strong civil society participation that benefit socially disadvantaged groups⁴. We take the perspective that SI emerges when new institutional arrangements are created in response to societal challenges, with the engagement of civil society and aiming at collective benefits as an outcome. When innovation is not merely entrepreneurial, when multiple actors are involved in its creation and affected by its outcome, institutional innovation can also be understood as SI. Institutional change is a collective action process in which rules and opinions change with the involvement of individuals and organisations in the process (Ruttan, 2006). In this sense, SI processes only occur when the local communities are empowered and involved in the policy design process through a participatory approach among citizens and other stakeholders.

Regardless of the type of innovation, from new goods and services to process (marketing, organizational, institutional, policy or social aspects), the politico-institutional background that enables its development and consolidation is progressively recognised (Weiss et al., 2021). For this reason, innovation has received increasing attention from policymakers and is now commonly included in the frameworks of research programs.

Global economic and ecological challenges have increased political awareness of sustainable economic growth and given a new impulse to innovation (Pätäri et al., 2016). Moreover, it is increasingly evident that wicked problems such as biodiversity erosion, climate change, water, and food security, are interdependent with social and economic drivers (local and global) and thus require transformational governance innovations to leverage new technologies, economies, and societies (Nakicenovic et al., 2018). Consequently, interdisciplinary visions and systemic or integrated innovation models have gained relevance on the political scene.

Innovations are based on interactive learning, which results in feedback effects that alter the innovation ecosystem. It is an iterative and complex process that redefines its limits, constantly expanding due to its evolutionary nature (Weiss et al., 2021). The complexity involved illustrates why

⁴ Innovations can also be deleterious for certain societal groups, representing an instrument of power.

its governance cannot be reduced to policy instruments, although they are fundamental to their development.

Policies can be drivers or outcomes of the SI transformation process (Ludvig et al., 2021). The policies that foster SI often address the inclusion of vulnerable groups, coupled with regional and rural development, and promote civil society's participation and collective action (Ludvig et al., 2018). To this end, SI governance should pursue stakeholder involvement (Gamborg et al., 2019), use participatory tools (Sarkki, Parpan et al., 2019), and seek broad socioeconomic benefits (Sinclair & Baglioni, 2014). Policies and well-orchestrated participatory governance can build feasible agreements and adaptive management processes spearheaded or, at least, supported by local communities that, eventually, can trigger SI that would result in new ways of managing natural resources.

2.3.2 The dark side of social innovation

As stated, SI is a process of seeking local well-being improvement through social changes, which outcomes depend on the context and those who interact and get engaged along the transformation process. Beliefs, social and power structures highly influence this adaptive process. Thus, it is possible that SI outcomes may be deleterious for certain social groups, representing an instrument of power and producing negative impact feedback to the social-ecological system (SES) where it happens. This is the '*dark side*' of SI; when a prominent social solution changes its target and becomes a social problem.

The negative side effect of SI depends on the managing forces and the most influential partners during its development and implementation (Nicholls & Murdock, 2012). To avoid it, social innovators need to think beyond how their solutions work to solve punctual social issues and consider the broader impact that its outcomes can have on SES (F. R. Westley et al., 2013). The transformative nature of SI involves an essentially disruptive dimension, which claims for an assessment of the broader impacts it can cause. The SI's disruptive power is not a problem itself since any innovation implies some degree of disruptive change, but the rising of its dark side could be. Based on Fougère & Meriläinen (2019), there are three ways to guide an SI to the dark side: a) *The bad copy*; b) *The deaf and blind*; c) *Slipped out of the way*.

The bad copy

After an extreme situation (e.g., environmental disaster, pandemic, or sudden shifts in political realms, ideology, or macroeconomic structures), societal vulnerability increases, and "windows of opportunity" may stimulate social innovation leading to a reconfiguration of social relations and a rebalancing of power in favour of marginalised communities. On the other hand, it can also catalyse neo-liberal policies and extreme rights movements, ultimately increasing marginalised people. In such situations, groups with different visions of the future struggle for power. The presence of partners intentionally infiltrated or manipulated by external groups (e.g., secret societies or extremist political parties) can cause ruptures or even break up societal unity driving SI. When powerful political groups disorder an SI, it is challenging for less powerful and negatively affected groups to succeed in sustaining their vision of the future.

Deaf and blind

In political discourse, SI is an argument often used to highlight the capacity of vulnerable groups to construct their solutions. Such discourse tends to push the responsibility towards marginalised communities while alleviating structural issues working to maintain the prevailing mainstream. Following this logic, while performance indicators point towards more productive and inclusive societies, particular cases are perceived as individual failures. With the necessary capital (human, social, financial, and political), marginalised communities may find their proper path. Moreover, some social innovations may harm other vulnerable groups of people, resulting in even broader marginalisation processes.

Slipped out of the way

The conceptualisation of SI as "a good thing" and "something better than before" is often used by elites to foster their interests under the excuse of "solving the problems of marginalised communities and society". Historically, crises and disasters are *Machiavelically* used by elites to mobilise capital towards their interests. The top three mechanisms for dominant groups to co-opt social innovation are: (1) "defining the social problem," which does not consider the totality of problems faced by the most marginalised groups; (2) the speed and technical-argumentative skill of crafting "proposals in response to complex problems," which present solutions of low complexity (silver bullets), and; (3) the minimisation of proposals from groups with less political influence. Powerful think tanks usually lead these mechanisms with a vast repertoire of ready-made market-based solutions. Thus, the elites who support and are supported by these think tanks use the positivity of SI discourse - effectiveness, equity, and social inclusion - to legitimise their neo-liberal interventions.

The insights into the dark side of SI, briefly explored above, shed light on aspects of power relations intrinsic to top-down (maintenance of dominant power through social structures) vs bottom-up (rebalancing of power through social transformations led by local agents) approaches, often overlooked by scholars on forest and landscape restoration.

2.3.3 Social Innovation in Rural Areas and the Forestry Sector

Successful social innovations come from collective action and creative social learning to address unmet social needs. The rural context usually includes social needs such as income, employment, health care, other public services, biodiversity conservation, sustainable natural resources, sustainable management, and landscape stewardship. Moreover, considering the recent historical changes in rural-urban relationships, rural societies should also ensure cultural and social-ecological resilience (Bock, 2016).

Rural marginalised areas have often been characterised by geographical remoteness, primary sector dominance, debilitated infrastructure, little access to public services, rising unemployment, and the out-migration of young and economically active groups (Copus et al., 2011). Moreover, these areas are usually far from urban centres and close to border regions of difficult access or frontier areas, which have been changed through new technologies, mobility advancements, and increasing network connection to national and global society (Cresswell, 2010). Today, marginalisation or 'peripheralisation' processes can occur anywhere, facing discontinuities in strategic socio-economic, and political connections (Shucksmith, 2011).

Regardless of the drivers that led to this situation, marginalised rural areas continually lose their human, social, political and cultural capital, threatening their prosperity, reducing the well-being of the population and their ability to act, react and regenerate after unexpected events. Moreover, austerity policies that have reduced public spending and reforms that have led to the centralisation of social services have brought hardship to residents of marginalised rural areas. In some cases, especially in more developed countries, this scenario induces depopulation, affecting the productive capacity of the landscape and the capacity for cultural reproduction. Thus, marginalised rural areas run a significant risk of entering a cycle of capital loss that can harm their socioeconomic development and cultural maintenance. (Bock, 2016).

In this situation, SI can become a 'neo-endogenous' rural development driver (Raymond & Brown, 2006). Since it represents local people's mobilisation towards meeting their social needs by improving their assets (human, social, political, financial, and physical), SI can trigger the replacement of inefficient participation of the state and business in the local socio-economic development by an endogenous option, that is, provided by the local community itself (Bock, 2016). In this sense, even in marginalised rural areas, communities with active civil postures who take the responsibility to pursue solutions for their local problems are more likely to prosper (Neumeier, 2017). However, several contextual factors influence the success of SI in these communities, such as motivation, commitment, cooperation, individual capabilities, network, organisational structure, and access to financial and political resources (ibid.).

Recently, society's growing interest in the articulation between forest's multiple services (social and ecological) has influenced political support for the expansion of the so-called bioeconomy. Furthermore, the forest is where human beings deepen their relations with nature and its manifestations, shaping their knowledge and cultural systems. In this sense, the forestry sector demonstrates a growing potential for (social) innovation and new business opportunities in various fields, including non-timber forest products, tourism, recreation, and new wood-based products (Ludvig et al., 2016). However, policymakers in this sector often downplay the crucial role of civil society in SI and generally pay more attention to market-oriented policies, such as supporting social entrepreneurship. This is the case in policies encouraging SI in the European Union Forest sector and its member countries such as Slovenia (Rogelja et al., 2018).

Globally, measures to promote SI have yet to be directed at forest landscapes and forest-dependent communities. However, evidence shows that this can be a viable path for many contemporary problems governments and markets still need to solve, such as sustainable forest resources management and life quality improvement for forest-dependent communities (Nijnik et al., 2019). In this regard, policy measures and associated administrative processes can have a decisive impact on sustainable development (Ludvig et al., 2018).

Although there is practically no scientific description of SI in FLR initiatives, the attentive observation of both agendas indicates that such connections exist and, in many cases, are mutualistic. To start demonstrating them, examples of FLR initiatives are used to illustrate the SI concepts of 'levels' and 'possibilities' in the following two subsections. However, it is important to highlight that these examples are merely illustrative since they all need to be adequately analysed from any social innovation school's perspective.

2.3.4 Levels of social innovation

Nicholls & Murdock (2012) mention three levels of objectives and approaches to conceptualise SI: 'incremental', 'institutional' and 'disruptive'.

The '*incremental social innovation*' occurs when existing goods and services are offered more effectively or efficiently to meet social needs. This approach is *the reason d'être* of most charities, non-profit organisations, and some so-called 'bottom of the pyramid' companies. In this outlook, SI can become an excellent business opportunity. It can also be observed in some biological conservation strategies where, for instance, a social-economic mechanism is introduced to encourage a behaviour change to achieve a conservation goal.

Depending on how landscape residents are involved in designing and implementing Payment for Ecosystem Services (PES) schemes and its novelty for those interested, PES can be seen as an 'incremental social innovation' promoting environmental conservation through economic incentives. The PES programs' global portfolio is estimated to represent an annual investment of over USD 36 billion (Ruggiero et al., 2019). These authors demonstrate that the PES mechanism efficiently promotes conservation; however, it has a low (incremental) contribution, resulting in an increase of 2.8–5.6% of additional forest cover over five years. At this rate, it would take 180 years to achieve adequate regional forest cover to support biological integrity (33% of the landscape: Banks-Leite et al., 2014).

The second level is '*institutional social innovation*', which aims to (re)direct existing organisations to generate a new value or purpose capable of expanding social results. This level of social innovation is often - but not always - driven by specialised intellectual capital, focused on repositioning new technologies, services, or products for a social purpose rather than purely economic ones. However, although encapsulated as a social approach, this innovation has primarily a commercial purpose. Thus, '*institutional social innovation*' is usually associated with and is an economic response to some problem between the productive sector and society.

The Consumer Goods Forum (CGF) Resolution, published in 2010 in Brazil to achieve zero net deforestation by 2020 in key commodity sectors (soybeans, palm oil, paper & pulp/timber, and beef), is a good example of organisations trying to create a new purpose to impact social-environmental results (The Consumer Goods Forum, 2017). In addition, Nestlé, McDonald's, Unilever, Bunge, and 495 giant companies from different sectors publicised their commitments towards sustainable forest landscapes by supporting actions to reduce deforestation and increase restoration (under the zero-net deforestation commitment) (supply-change.org, 2020). The potential impact is substantial since the supplier chain of those commodities has driven the conversion of 5 million hectares/year of tropical forests (more than 70% of all deforestation in tropical forests during the assessed period), which has severe consequences for global ecosystem services, biodiversity, and forest communities (Curtiset et al., 2018). Unfortunately, a recent report revealed that most companies are not on track to reach the targets set for 2020 and that more than 50 million hectares have been deforested through those supply chains since 2010 (Greenpeace, 2019).

Finally, '*disruptive social innovation*' aims to rebalance power, leveraging new social structures. This is the nature of social-political movements, in which actors, groups, and networks seek to change power relationships and social hierarchies, promoting reforms to benefit marginalised social groups. It can also be conducted within state structures by politicians connected to social movements or governance structures that promote social participation (e.g., through technical chambers and

deliberative councils). Disruptive social innovations can also emerge in loose coalitions of individuals and organisations interested in uniting efforts to overcome a common issue. As with the transformation of any socio-ecological system, the '*disruptive social innovation*' can provoke violent and rapid changes, like revolution, or be peaceful and gradual, accommodating the political interests of elites and emerging movements.

The agroecology movements are a prominent example of '*disruptive social innovation*', which is gradually gaining ground in rural properties, backyards, and urban areas in Latin America, Sub-Saharan Africa, and Southeast Asia, as part of national food security strategies and international debates on climate change, biodiversity, small farmers wellbeing, and economic development. Agroecology has key concepts, principles, and tools for transforming agri-food systems, which requires an articulated understanding of science, practice, and social movements (Wezel et al., 2009).

As a science, agroecology has a theoretical, research, practical and methodological approach that articulates different fields of knowledge in a transdisciplinary and systemic way, aiming at the development of sustainable food systems in all their dimensions (economic, social, ecological, cultural, political, and ethical). In Latin America, agroecology converges with the livelihoods of people historically related to forests. The concept of agroecology as a movement and practice was born from the encounter between the struggle of social movements and the practices of peasants (Bustamante et al., 2017). As a practice, agroecology proposes the design and sustainable management of agroecosystems with ecological criteria (Gliessman, 2015) through collective action and participatory development proposals that encourage the production and commercialisation of agricultural products to help prevent food insecurity while establishing a sustainable foundation for future food systems. Gomes et al. (2020) showed that a combination of government environmental protection measures, together with financial support for family farmers and the local and perennial agroecological movement, was able to increase forest cover by more than 7% after 20 years in the 'Zona da Mata' region, Minas Gerais state, Brazil, and, at the same time, improving the resistance of the coffee production system under the worst-case scenarios of climate change.

Table 2. Levels of Social Innovation and examples of their application in forestry.

Level	Objective	Focus	Example
Incremental	To deal with market failures more effectively: e.g., negative externalities and institutional voids.	Products and services	Payment for Ecosystem Services
Institutional	To reconfigure business structure and market patterns to enlarge new social value	Markets	Zero-Net deforestation
Disruptive	To change the power-balance, reconfiguring social systems and structures	Socio-political system	Agroecology

(Inspired by Nicholls & Murdock, 2012).

2.3.5 The many possibilities for social innovation

Social innovation can occur in all public, private, and non-profit sectors. Indeed, SI most often emerges from the overlap among these sectors and depending on which side it bends, it can assume different ownership and governance structures, benefit-sharing strategies, accountability systems, and organisational and management forms (Moulaert, 2009). A remarkable SI feature is that it usually emerges from a combination of interests between private, public, and civil society sectors (Figure 3).

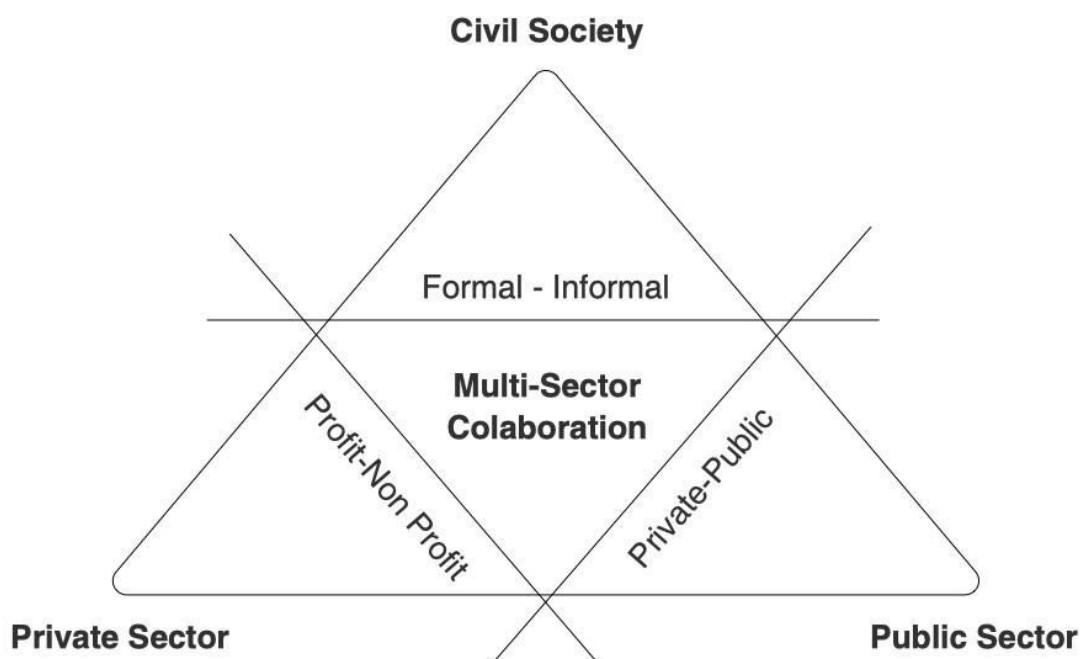


Figure 3. The many possibilities of Social Innovation to emerge by Nicholls & Murdock (2012).

Thus, between civil society and the private sector, several models combine the business approach with social objectives, such as mutual and cooperative societies. An example could be the Atlantic Forest Reforestation Cooperative of the Extreme South of Bahia (*Cooplantar*), Brazil (Mesquita et al., 2010). In 2004 the 'Natureza Bela' NGO mobilised rural communities and local fishermen to design an ambitious project to restore an ecological corridor between 'Pau Brasil' and 'Monte Pascoal' protected areas, a critical region for biodiversity conservation and an Atlantic Forest hotspot. Sensing the opportunity for work and income, community leaders encouraged others to create Brazil's first forest restoration cooperative. Within a favourable context and linked to a regional strategy, *Cooplantar* established a network of partners (big NGOs, pulp and paper companies and universities) to train its more than 30 members in forest restoration field techniques and business management, which enabled a conciliation between regional environmental gains and local income generation. By the end of 2014, *Cooplantar* was responsible for forest restoration operations on more than 400 hectares (Brancalion et al., 2015).

New models of social services delivered through Public-Private Partnerships (PPP), usually privately managed jointly or heavily regulated by the state, represent an opportunity for public-private connections to leverage SI. An example of this agreement comes from Ghana, where 'Form International,' a world company that manages forest assets in Africa in partnership with the national government, founded *Form Ghana Ltd*. This PPP raised USD 24 million in investments from the African Development Bank and Climate Investment Funds (AfDB, 2017) to implement a silviculture and restoration project that aims to expand an existing forest plantation from 5,000 to almost 12,000

hectares consisting of a mixed plantation of 10% indigenous tree species and 90% of teak (*Tectona grandis*). The project is certified by the Forest Stewardship Council and Verified Carbon Standard. In addition to trading planted teak, the project's business model also considers the commercialisation of stored carbon, whose net potential is about 2.8 million tCO₂ in 40 years.

Finally, examples of collaboration between the state and civil society are the variations of the 'shadow state', in which civil society organisations such as charities, non-governmental organisations and even local associations function as a proxy state. One potential example is the Collaborative Forest Landscape Restoration Program (CFLRP) in the USA. In 2009, the United States Congress enacted the Forest Landscape Restoration Act (CFLRP), which established the general rules for competing organisations to conduct restoration activities in National Forests. The law established the CFLRP, a selection mechanism for restoration projects, which must demonstrate economic viability and social and ecological gains. This mechanism has promoted a wide variety of landscape governance models to restore and manage forest assets in the long term (at least ten years), emphasising cooperation between the state and civil society (Schultz et al., 2012). Until now, the CFLRP accomplished three calls for proposals. The first two (2010 and 2011) resulted in 23 projects funded, totalling USD 40 million in investments. In 2019, twenty-two proposals were submitted (USFS, 2020).

Furthermore, social innovation can be expressed across cross-sectoral boundaries and can materialise in practice through the emergence of 'hubs', incubators, or cooperation networks, which aim to bring together different repertoires and organisations to stimulate new models of thinking, collaborative networks, and collective actions. For example, a crucial hub for restoration in Brazil is the Pact for the Restoration of the Atlantic Forest, a multi-stakeholder movement with about 260 members among NGOs, State Environmental Agencies, municipalities, and companies mainly, but not exclusively, from the forestry sectors, aiming to restore 15 million hectares of the Brazilian Atlantic Forest by 2050 in the 17 Brazilian states of this biome (Brancalion et al., 2016; Pinto et al., 2014).

2.3.6 Approaching Social Innovation to Forest and Landscape Restoration

Among the explored SI definitions, we consider SIMRA's⁵ definition as appropriate for this research: 1) It is specifically applied to rural areas, where FLR tends to be needed; 2) It results from a recent long-term EU-funded project with a multi-disciplinary approach; 3) It provides evidence of its application in many practical cases; 4) It has been applied to understand SI in forest-dependent communities and restoration projects, and 5) It considers the role of agency in the land use transformation process (Nijnik et al., 2020; Sarkki, Parpan, et al., 2019; Ludvig et al., 2018; Rogelja et al., 2018).

The SI SIMRA is defined in Polman et al. (2017), page 1, as:

“The reconfiguring of social practices, in response to societal challenges, which seeks to enhance outcomes on societal well-being and necessarily includes the engagement of civil society actors.”

⁵ "Social Innovation in Marginalized 1 Rural Areas" (2016-2020) is a project funded by the European Union's (EU) Horizon 2020 Research and Innovation Program (www.simra-h2020.eu), which aim to improve the understanding on SI and how it can enhance well-being in marginalized rural areas.

According to it, there are three issues to consider to assess whether a process or an output is a social innovation: 1) It has to result in the reconfiguration of social practices (e.g. new relationships, collaborations, network expansion, novel institutions or governance models; 2) it has to be new within the geographical boundaries, context or social group; 3) it has to have an active and voluntary engagement of the local civil society ([ibid.](#)).

New social connections or rules established as the first steps of SI development are examples of social reconfiguration. In general, there are three ways to characterise social reconfiguration: 1) changes in the stakeholders' relationships (networks), and; 2) change in their attitudes (connected to beliefs and values), and/or; 3) change in governance arrangements. A detailed manual to assess and evaluate SI and its impacts has been completed by the SIMRA project ([Secco et al., 2020](#)).

The EU-funded Horizon2020 SIMRA project has also organised a database with more than 300 examples of SI in marginalised rural areas. Some of them are related to FLR, such as, for example, the ARDAC project (Assisting Reforestation and Forest Development Activities in partnership with local Communities) in Lebanon. The project was designed in participatory workshops and executed by the local community and succeeded in reversing the socio-ecological degradation of the Mounjiza landscape through the sustainable repopulation and management of the laurel, *Laurus nobilis*, a native tree that produces an essential oil much in demand by the pharmaceutical and cosmetic industries.

Like this, some Brazilian FLR initiatives could potentially, but have never been, be characterised as social innovations, like the 'Rede de Sementes Xingu', a native seed collector network formed to attend to the seed demand of restoration projects in the Xingu region, Para State, Brazil ([Durigan et al., 2013](#)). Organised in groups, collectors formed nuclei with different social organisations, profiles, and motivations. After ten years, the network has 600 seed collectors and beneficiaries and has already produced 196 tons of seeds of more than 220 native species, generating more than US\$ 1MM as income. Another interesting potential example is the 'Pacto pela Restauração da Mata Atlântica', a multi-stakeholder movement that in 2011 pledged to restore 1Mha by 2020 to the Bonn Challenge and that, in 2019, communicated the restoration of 0,7Mha ([Crouzeilles et al., 2019](#)).

As discussed previously, Social Innovation (SI) is a local-scale sociological phenomenon that depends on local knowledge, agency, and networks to make viable proposals connecting local social needs to multiscale windows of opportunity. Although this phenomenon can only be captured locally, it can inspire or provoke the scaling out or up of other correlated initiatives in the same transformative direction. It can be adapted or replicated in other locations or by other groups of people, influencing public policy or even changing the attitudes and values of those who participate in or benefit from it. When properly orchestrated, a set of SI can transform the reality of the landscape and the people who live there, i.e., alter the social and power structures, and, in the case of SI connected to FLR, even the land-use design. When one or several articulated SI gain a regional scale, this phenomenon can be called Transformative Social Innovation (TSI) ([Avelino et al., 2019](#)).

2.4 GOVERNANCE AND COLLABORATIVE NETWORKS

The landscape is a heterogeneous mosaic of land uses within a geographic area where ecosystems and political jurisdictions may overlap (for a complementary understanding, visit chapter 4).

Landscape restoration involves favouring all life forms in its geographical area ([Chazdon et al., 2017](#); [Lamb, 2005](#)). In FLR, taking a landscape approach means recognising the multiple political and economic interests in land use and the spatial and temporal interrelationships of ecological and socio-economic systems. The socio-innovative perspective for landscape restoration (SI-FLR) takes the political stance to empower local livelihoods in designing and implementing solutions to leverage landscape restoration.

Adaptive governance can foster SI-FLR. SI-FLR is represented by multilevel, self-organised social networks guided by diverse knowledge systems (traditional, local, scientific, etc.) and experiences aimed at building a shared understanding of the problem and its probable causes and form the capitals and ties of trust necessary to identify possible solutions and leverage reality-transforming collective actions ([Folke et al., 2005](#)).

In this type of governance, the state is no longer central and instead takes a supportive role, creating a political and regulatory environment conducive to participation and collaboration among local stakeholders ([Long et al., 2018](#)). In addition, bridge (or intermediary) organisations can connect local actors with others of different scales and sectors, assuming the role of conflict facilitation, collective action planners, and brokers of long-term financing ([Visseren-Hamakers & Glasbergen, 2007](#)). Together, all these actors form the social landscape (or network) through which knowledge and influence transit to build legal, political, and financial support needed to implement restoration ([Singh et al., 2021](#)).

Empirical analyses have demonstrated the potential of collaborative governance through networks in leveraging innovation and collective action ([Ansell & Gash, 2007](#)). A network such as policy actors can be a starting point for policy implementation. However, while it may operate through informal patterns of brokerage and diplomacy, it must eventually develop a strategy and action plan to qualify as collaborative governance ([Provan & Kenis, 2007](#)).

The use of social network analysis (SNA or social landscape mapping) to better understand the actors in the landscape and what connections and exchange flows may facilitate (or hinder) forest and landscape restoration initiatives are recent. Social landscape mapping can support inclusive governance models and action plans more aligned with local social needs ([Singh et al., 2021](#)).

Social landscape mapping is an approach to environmental governance that seeks to understand the social capital flow between actors within landscapes and their priorities and values ([Buckingham et al., 2018](#)). To this end, its authors use social network analysis and value mapping to map specific social landscapes for FLR initiatives.

2.4.1 Network Theory and Social Network Analysis (SNA)

The basic assumption of network theory is that an actor's position in a social network partially determines the constraints and opportunities it will encounter, and therefore identifying that position is important for predicting actor outcomes such as performance, behaviour, and beliefs. Furthermore, networks are a way of thinking about a social system focusing on the relationships between the actors or nodes that make up the system (the network). Thus, SNA can help to understand the relationships between the actors participating in a Transformative Social Innovation (TSI).

Social networks may be more effective than formal institutions in effectively enforcing environmental regulations, as these exert greater influence on local environmental governance (Bodin & Crona, 2009). The actors in a social network can be people, organisations, elements of nature, or landscapes as long as there is a type of tangible (e.g., goods, materials, energy) or intangible (e.g., ideas, values, attitudes) exchange flow among them. Thus, a social network analysis map shows relationships which are either material (between things) or immaterial (between concepts) (Latour, 1996).

Over the past 40 years, SNA has been used to explain the processes and outcomes of collective action, exploring the relationships between actors seeking to persuade and influence themselves within a political subsystem (Paletto et al., 2016). The Network theory is also known as the Actor-Network Theory and emerged in the social sciences but has currently expanded to various areas of knowledge (Sayles et al., 2019). Pisani et al. (2014) applied SNA to evaluate transnational cooperation projects and demonstrated that the network structures and dynamics of local action groups facilitated knowledge and information sharing, stimulating social learning. Recently, SNA has been applied to map the social landscape of an FLR initiative (Buckingham et. al, 2020).

The principles and methods of social network analysis are complex, as they seek to represent the behaviour of social relationships (connections) that are influenced by different issues predating their establishment and political tendencies and coexistence network of each actor (network node).

Relationships between actors arise from their respective mutual interests, expressed in the configuration of social networks. Relationships between actors can be represented by different types, i.e., the different flows of exchanged information (e.g., knowledge, funding, political cooperation) and the intensity that these exchanges occur (e.g., frequency, volume, outcomes) (Granovetter, 1985).

In social networks, while some individuals have few connections, others are very well connected, being considered hubs; the more connections a node has, the greater the chance of increasing its network of connections (Barabási et al., 1999). On the other hand, very privileged positions (centrality and power), when removed, affect the whole structure of the network, weakening it. Centralisation in a few nodes raises concerns because it threatens the overall imbalance of the network. In general, social networks are linked both in the structural branch and in the subjectivity of their connections and nodes and characterise their pursuit of individual and network needs. According to Franco (2009), the essence of a social network is its format because its analysis permits the identification and inference of the exchange's efficiency (connections and respective exchange flows) established among actors (network nodes).

For Bodin & Crona (2009), network analysis should consider three main properties: centrality, density, and cohesion. These properties are intended to support investigating complex and multiple relationships between actors.

Centrality: The central position of a network is a privileged place. This is where the opportunities to access resources, power, and information of other actors in the network are greater. Two types of centrality exist: degree and betweenness. While the number of relations an actor has is called the degree of centrality, betweenness indicates the positioning of an actor among several others in the network.

Density: shows the intensity of interaction between actors in the network and represents its level of cohesiveness. The greater the interconnection, the greater the density of information, trust, increasing exchange and consolidating the relationship between two actors. Thus, a higher density may portray a pooling of efforts and resources to achieve a common goal. On the other hand, a lower density may reflect a possible lack of interest in collaborating (Pisani et al, 2020)

Cohesion: measures the strength of a connection (e.g., strong or weak) between actors and therefore the commitment, exchange of knowledge and practices, resources, and strategies.

Bridges: Refers to social actors that connect distinct subgroups in the network. These actors usually provide access to external resources and are often needed to help local actors initiate or leverage collective actions (Pisani et al, 2020).

2.5 THE STRUCTURATION THEORY

Structuration theory is an effort to bring together the social theories of structuralism and subjectivism (Giddens, 1986). While structuralism grounds human action on a social order, i.e., the set of rules and resources available in a specific time and space, subjectivism (or phenomenism) understands it as arising from social action resulting from people's agency and ability to make their own choices. The dilemma is that while social structures enable or constrain social action, social action creates, maintains, and transforms structures. Structuration theory solves this dilemma by suggesting that agents can either rely on social norms and reproduce the social structure or, through reflexive monitoring of their everyday actions, break with the norms and instigate transformations in the social structure (Giddens, 1986).

According to this study vision, the SI-FLR phenomenon (presented in detail in chapter 4) can be seen in dialogue with structuration theory. SI-FLR represents a bottom-up phenomenon that begins with a reflexive process on social-ecological issues that triggers the agency power of social-ecological innovators, which might develop through social and economic relations and, eventually, be structuralised in policies and beliefs. However, it is also strongly influenced by top-down mechanisms (policy instruments, economic relations), which determine the land-use possibilities of the landscape, regulating the SI-FLR transformative capacity.

From this perspective, structuration theory allows us to look at the process of emergence and development of SI-FLR from a non-linear and multi-scalar perspective, where several determining factors influence each other. It brings the context (space-time-power) to the present time and geography of the landscape since the context interferes but is also susceptible to the landscape's interferences.

CHAPTER 3. THE METHODOLOGICAL PATHWAY

This investigation was assembled over two worldviews, the transformivist and the pragmatist (Creswell & Plano Clark, 2018). While the first philosophical approach underpins a political approach adoption that local resilient livelihoods (marginalised in the current mainstream society) can provoke and lead to transformative social innovation through FLR, the second supports the articulation of methods to explain the phenomenon researched in its multiple dimensions (scalar, temporal, socioeconomic, political, and ecological).

In this sense, it has been adopted as a sequential exploratory research design (ibid.), which I present chronologically in four phases: 1) Conceptual framework; 2) Empirical cases of SI-FLR; 3) In-depth analysis: networks and policy instruments; 4) Research compilation (Figure 4).

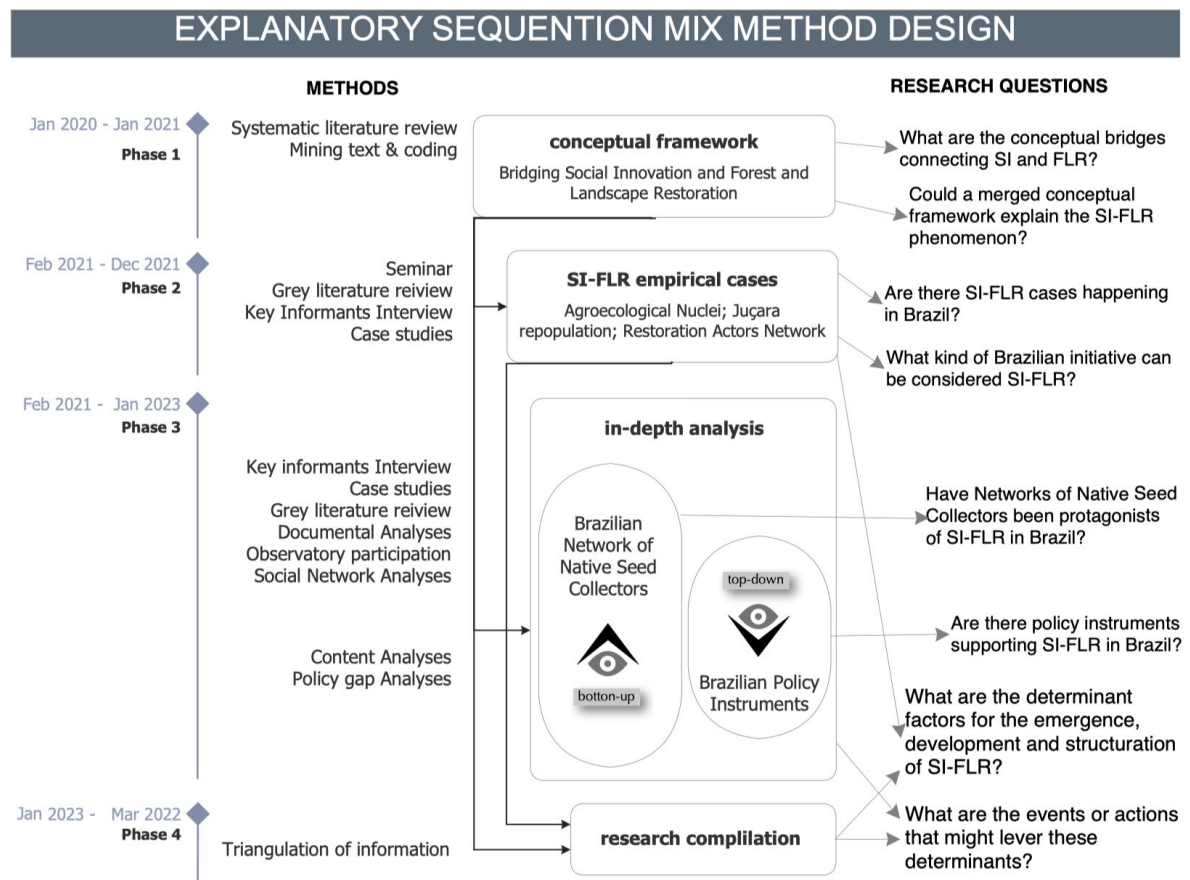


Figure 4. Sequential exploratory research design in chronology, presenting the main methods applied to answer the research questions.

3.1 PHASE 1 | CONCEPTUAL FRAMEWORK

The first phase connects to the specific objective 1: *“To establish the bridges of understanding between Social Innovation (SI) and Forest and Landscape Restoration (FLR)”*, aiming to establish a conceptual foundation to support the elaboration of subsequent investigation phases. It was produced through a systematic literature review (Snyder, 2019), combined with text mining techniques using MAXQDA Analytics Pro 2020 (Kuckartz et al., 2019). Its findings are presented in chapter 4. Its results were obtained through a systematic literature review (Snyder, 2019), combined with text mining techniques using MAXQDA Analytics Pro 2020 (Kuckartz et al., 2019).

3.2 PHASE 2 | SOCIAL INNOVATIVE - FOREST AND LANDSCAPE RESTORATION EMPIRICAL CASES

The second phase connects to the specific objective 2: "To identify and describe cases of SI-FLR in Brazil". In addition to the grey literature review on ongoing FLR projects in Brazil, I conducted exploratory interviews with 15 key informants (5 from NGOs; 5 from universities; 3 from Embrapa (Brazilian Agricultural Research Corporation); 2 from environmental agencies). I developed a list of 53 names engaged in the Brazilian and global FLR agendas to reach these key informants. I then contacted them via e-mail, introducing the research summary and objectives. The response rate was 28%. The interviews were conducted online with the Zoom application support, and each had an average duration of 1.5 hours. At the beginning of each interview, the research objective and the concepts of FLR and SI were presented, followed by a brief discussion on potential mutualistic connections between them; after that, interviewees were directly asked about FLR initiatives that could be or contain examples of this phenomenon. All interviews were conducted digitally and recorded with the support of the Zoom application. All interviews were conducted digitally and recorded with Zoom application support. A standard presentation, available in Annex 1, guided these interviews. All interviewees agreed with the "terms of free and clear consent" (Annex 2), allowing the use of shared information for this research.

Three experiences identified along these interviewees were invited by the Forest Governance Group of the University of São Paulo to be part of the panel "Governance and Innovation in Forest Restoration" at Web-International Seminar "Building Dialogues on Forest Governance: Conservation, Sustainable Management, and Landscape Restoration" (Box 1), available on https://youtu.be/KWp_fo1zWsQ. The criteria adopted for choosing these experiences as cases were: a) they are related to forest and land restoration in Brazil; b) they have social and environmental impacts; c) they have been developed adopting participatory approaches; d) where the theme 'governance' is prevalent, and; e) they have at least some of the key characteristics of social innovation. The dialogue established between the panellists of this table subsidised the second scientific paper of this thesis, chapter 5, being the first time that cases of inclusive restoration were described through the SI-FLR lens. Furthermore, the results of this initial round of interviews pointed to the Brazilian Networks of Native Seed Collectors (NNSCs) as a potentially fertile ground for SI-FLR, and this was explored in phase 3.

BOX 1. Web-International Seminar "Building Dialogues on Forest Governance: Conservation, Sustainable Management, and Landscape Restoration"

The International Seminar - Building Dialogues on Forest Governance: Conservation, Sustainable Management and Landscape Restoration aimed to discuss contemporary trends in Forest Governance, considering theoretical perspectives and experiences from international, national, regional, and local research and practice. The seminar was organized by the Forest Governance Research Group (<https://sites.usp.br/governancaflorestal/ggf/>), with support from PROCAM/IEE-USP, EACH-USP, Centre for the Analysis of Social-Ecological Landscapes (CASEL, Indiana University, USA), University of the Sunshine Coast (Australia), Università degli Studi di Padova (Italy) and Wageningen University & Research (Netherlands). Held in four meetings in October and November 2020, it was divided into two main blocks: the first on native forest governance and the second on forest restoration governance. Each of the blocks had two meetings consisting of an opening lecture with an international speaker, followed by a panel of experts in the field.

More details about the applied methodology are provided in chapters 5 and 6.

3.3 PHASE 3 | IN-DEPTH ANALYSIS

Phase 3 contributes to the specific objectives 2 and 3: "To explore and analyse the intrinsic and extrinsic factors that shape and drive SI-FLR in the Brazilian context".

The scope and analytical instruments employed in phase 3 were set considering the emergence and development of the SI-FLR phenomenon are determined by exogenous and endogenous factors and, according to structuration theory, these factors are expressed in the dialectics of bottom-up (Landscape Stewardship group, see chapter 4) and top-down (policy instruments, see chapter 7) perspectives. From the bottom-up angle, I looked at the relationships and exchange flows of key actors in networks where the SI-FLR phenomenon is expressed to a greater or lesser degree (4 cases of SI-FLR were described here). From the bottom-up angle, I observed the relations and exchange flows of key actors in networks where the SI-FLR phenomenon is expressed to a greater or lesser extent. Looking from the top-down, I sought to understand which policy instruments could foster SI-FLR initiatives and how are their organisational and governance structures.

3.3.1 Bottom-up perspective: Networks of Native Seed Collectors

The results of the initial round of interviews (phase 2) pointed to the Brazilian Networks of Native Seed Collectors (NNSCs) as a potentially fertile ground for SI-FLR. Thus, I delved deeper using a combination of the following methods: a) systematic literature review on these networks; b) 27 structured interviews, made on the Zoom platform for online meetings (the questionnaire used is in [Annex 3](#)) involving 18 organisations directly linked to 9 Brazilian NNSCs; c) case studies ([Yin et al., 2013](#)) of four NNSCs where I applied: participant observation, documentary research, face-to-face interviews (structured and semi-structured) ([Haguette, 2013](#)), and "Future Search Conference" workshops ([Hurworth, 2007](#)), involving a total of 65 people. The data collection enabled the identification and description of five other SI-FLR examples as well the social network analysis (SNA) of the networks they belong to.

The scripts of the Future Search Conference and semi-structured interviews were inspired by the Manual for the evaluation of Social Innovation in Rural Marginalised Areas ([Secco et al., 2020](#)) and are available in [Annex 4](#) (Portuguese only). More details about the applied methodology are provided in chapter 6.

3.3.2 Top-down perspective: Policy instruments

To identify policy instruments that potentially support SI-FLR initiatives and map their respective governance structures, I adopted an inductive method to scrutinise 64 policy documents (listed in [Annex 5](#)) representing policies, regulations, governance structures and instruments from four policy domains represented by the ministries: of Environment (MMA); Agriculture, Livestock and Food Supply (MAPA); Regional Development (MDR) and Science, Technology and Innovation (MCTI) (see chapter 7). I classify the policy instruments according to ([Krott, 2005](#)), map and draw their governance structure, and discuss the most evident policy gaps found to strengthen the SI-FLR approach. More details about the applied methodology are provided in chapter 7.

3.4 PHASE 4 | RESEARCH COMPILATION

Finally, specific objective 4: "To support stakeholders and decision-makers of the LRF in leveraging the LRF-SI", I made an overview of the investigative path taken by answering the research questions and angulating the information and reflections generated throughout the previous phases; I present the final insights, determining facts and actions that can positively influence the emergence, development, and structuration of the LRF-SI.

CHAPTER 4. BRIDGING SOCIAL INNOVATION WITH FOREST AND LANDSCAPE RESTORATION

This chapter is a published scientific paper⁶ written by me with the collaboration of my supervisors. It presents the conceptual basis underpinning this thesis's entire investigative path.

Author Contributions: All four authors conceptualised this paper; A.P. was the lead researcher, defined the methodology, collected, and analysed the data, and wrote the initial draft of the article, L.S., C.A. and R.L.C., provided reviews and editorial input into its refinement.

ABSTRACT: Mitigating climate change, preventing mass species extinctions, improving rural livelihoods, and disaster risk reduction are among today's most urgent challenges. To meet these challenges, many social actors need to agree to engage and act collectively on Forest and Landscape Restoration (FLR), ensuring its dual goal of restoring ecological functionality and improving people's well-being. Although FLR has gained momentum globally, the experiences so far continue to face socio-economic and governance challenges associated with the design and realisation of effective efforts. Social Innovation (SI) can be seen contemporarily as the process and the result of the interaction between stakeholders in the construction of solutions to social needs and problems, including those tackled by FLR. Here, using a content analysis approach applied to the existing literature, we propose five possible conceptual bridges between FLR and SI. The Social Innovative - Forest and Landscape Restoration (SI-FLR) process advocates that sustainable livelihood needs should be attended to first to ensure the Social-Ecological Systems' resilience. These bridges are: 1) 'Landscape as the main context'; 2) 'Nature as social need'; 3) 'Landscape stewardship groups'; 4) 'Governance capabilities'; 5) 'Adapting and transforming to enhance resilience'. Identifying these bridges will help decision-makers and project managers to improve the FLR initiatives by supporting the potential of SI and sparking the interest of other researchers to explore the possibilities of SI-FLR.

KEYWORDS: Social-Ecological System, Social-Ecological Innovation, Livelihood Resilience, Nature's Contribution to People, Nature-based Solutions, Ecosystem Stewardship, Governance, Landscape Approach.

⁶ Padovezi, A., Secco, L., Adams, C., & Chazdon, R. L. (2022). Bridging Social Innovation with Forest and Landscape Restoration. *Environmental Policy and Governance*, eet.2023. <https://doi.org/10.1002/eet.2023><https://doi.org/10.1002/eet.2023>

4.1 INTRODUCTION

Climate change crises, biodiversity loss and disaster risks for rural livelihoods are among today's most urgent challenges. The search for solutions to alleviate this scenario is aligned with the recognition of Nature's Contribution to People (NcP) (IPBES, 2019), demanding a large number of social actors to adopt Nature-based Solutions (NbS) (Cohen-Shacham et al., 2019) for mitigating-adapting to climate change, improving Livelihood Resilience (LR) (Tanner et al., 2015), protecting biodiversity, and supporting disaster risk reduction (UN, 2015). FLR is a NbS that aims to regain ecological functionality in landscapes while improving human well-being (Lamb, 2005).

Despite several successful experiences in FLR (Hanson et al., 2015), many obstacles remain regarding technical aspects, financial mechanisms, progress measures, and governance (Chazdon et al., 2020). Rarely are implementation cases able to fully address the social-ecological goals of FLR (Ota et al., 2020). The FLR process requires a complex translation of local restoration needs and degradation drivers into a long-term engaging, and adaptable theory of change (Soe & Yeo-Chang, 2019). FLR's approach focuses on maintaining and restoring ecosystems, promoting sustainable agri-food systems (Feenstra, 2002), and improving other landscape functions, requiring trust and engagement among stakeholders. Such an approach may entail well-organized participatory governance (Giessen & Buttoud, 2014) that seeks feasible agreements and adaptive processes supported by the local communities that lastly trigger Social Innovation (SI). SI refers to any processes or outcomes where mobilised people share ideas and knowledge and engage in collective actions to come up with adjustments in social institutions or new ways of managing natural resources to overcome a specific common challenge (Murray et al., 2010). Although considered a driving force for sustainable improvements in many fields, SI research in forest restoration is just beginning.

Social-Ecological System (SES) provides a context for interconnecting and aligning SI and FLR (Berkes et al., 2000). While it is known that various exogenous and endogenous social, political, ecological and economic factors can motivate communities to take a leading role in FLR (Paudyal et al., 2017), there is insufficient understanding of how these factors can promote FLR implementation (J. Sayer et al., 2013). We aim to identify conceptual bridges that describe potential convergences between basic concepts used to explore SI and FLR. This analysis can reveal new ways to achieve shared goals, recognising that enhancing NcP and LR are the main expected impacts of both SI and FLR, and explore Social Innovative - Forest and Landscape Restoration (SI-FLR) as an emerging FLR approach. Below, we review the underlying conceptual grounding of the key concepts mentioned above, describe the methodology, present and discuss the possible bridges between FLR and SI, and conclude by summarising key messages.

4.2 CONCEPTUAL BACKGROUND

4.3 Social-Ecological Systems (SES)

SES is a framework to assist systematic thinking in understanding how social-ecological interactions shape landscapes across space and time (Ostrom, 2009). This approach centres on the users of resources rather than on natural resources themselves (Berkes et al., 2000). The SES represents the assets and processes of the interconnection between human society and biophysics subsystems, coupled with reciprocal feedback cycles (Liu et al., 2007), recently conceptualised through the idea of ecosystem services. The relationship outcomes return as input, influencing the system's dynamic stability as a whole, strengthening its resilience or contributing to its transformation to a new status. Through local agents' actions, organised behaviour can transform macro-scale social-ecological mechanisms by creating feedback within the system and influencing the behaviour of these same agents. The ecological feedbacks generally occur more diffusely and slowly than social agents' actions (Levin et al., 2013). Intensive feedback mechanisms, such as natural disasters, extreme events and long-term political disturbances can lead SES to a tipping point, in which the supporting ecosystem degrades, ecosystem services decline and the local people can lose their agency (Fernández-Manjarrés et al., 2018). SES produce wicked problems, such as degraded landscapes and socio-economic crises, offering a fertile ground for FLR and SI.

4.3.1 Forest and Landscape Restoration (FLR)

FLR's approach is built on Ecological Restoration (ER) but differs in key ways. While ER is an intentional action to accelerate ecosystem recovery in a specific degraded site (Higgs, 1997), FLR is based on a 'landscape approach' which aims to balance social, economic, and environmental needs in places where agriculture, mining, and other productive activities compete for space with nature. Landscapes are the arena where its elements, including people, interact according to physical and biological properties and dynamics. Landscapes provide the spatial context of social institutions that determine roles and relationships (J. Sayer et al., 2013). FLR focuses on increasing the socio-ecological resilience and socio-biodiversity connections through dialogue with stakeholders using and living in the landscape (Chazdon et al., 2020), which is also a sufficiently large scale for different socio-economic and ecological aims to be sustainably balanced.

4.3.2 Social Innovation (SI)

SI can be seen as the process and the result of interactions between actors in the construction of solutions to social needs (Neumeier, 2017). Within a SES, SI can be triggered by approaching a situation (e.g., soil degradation) that is no longer acceptable for the community or confronting new opportunities or limitations (e.g. new regulations or market requirements). When SI frames new strategies, ideas, concepts, processes, institutions or organizations capable of enhancing NcP, it can be termed as Social-Ecological Innovation (Olsson & Galaz, 2012).

A specific definition for SI in marginalised rural areas, such as those where FLR typically occurs, has been recently proposed (Polman et al., 2017) and applied in forest restoration (Soe & Yeo-Chang, 2019). It identifies three criteria to assess whether a process or an output is a SI: it has to 1) have some reconfiguration of social practices (e.g., networks/institutions/governance); 2) be newly initiated

within a geographical boundary, context or social group; 3) actively and voluntarily engage the local civil society.

4.3.3 Livelihood Resilience (LR)

Livelihood frameworks encompass the capital assets, capabilities, management of risk factors, the political context, and institutions capable of improving or hindering different means of living (Scoones, 2009). Natural resources are vital for the social and biological functions of rural livelihoods (Ellis & Allison, 2004). These are resilient when they resist exogenous shocks and stresses, are independent of external assistance, capable of maintaining their assets for long-term, and do not harm other people's livelihood choices (Serrat, 2017).

Integrating a political goal to SES, LR is defined as the capacity of rural people to resist, adapt, and transform their capacities and assets; to maintain and improve their quality of life despite disturbances and SES feedback mechanisms (Tanner et al., 2015). Sustainability-oriented strategies and projects should first address the livelihood needs that sustain SES's general resilience. The vulnerability of livelihoods associated with particular rural SES should be reduced by actions promoting their wellbeing (Mallick, 2019).

4.3.4 Nature's Contribution to People (NcP)

Costanza et al. (1997) revealed that global natural capital's annual economic value exceeds more than twice the World's annual GDP. The Ecosystem Services (ES) concept strengthened advocacy for nature's benefits to human welfare, drawing global attention to social dependencies on ecological systems by using economic language (Quintas-Soriano et al., 2018). The Millennium Ecosystem Assessment (MA, 2005) presented econometric analyses reinforcing the positive linkages between ES and people's well-being: ES were organised in categories (supporting, provision, regulation, and cultural), also embracing intangible values (e.g. spiritual). The main criticisms on this anthropocentric approach rely on a prevailing economic and simplistic vision that assumes a necessary interconnection between the services offered by nature and the demands of society, which sometimes does not occur (Fedele et al., 2017).

To overcome these issues, a more ontological and pluralistic NcP framework was proposed (IPBES, 2019), amplifying the ES scope and incorporating non-Western narratives on human-nature interactions. It diversifies the narrow economic focus of ES, including other social sciences, recognizes the central role of culture and local/indigenous knowledge and considers negative contributions to the life quality of human beings.

4.4 METHODOLOGY

This paper is a literature review, systematically analysed to deductively identify conceptual bridges between FLR and SI occurring within a SES. We applied a content analyses through text mining techniques using MAXQDA Analytics Pro 2020 (Kuckartz & Rädiker, 2019). The literature search was performed using the SCOPUS database which is used by social and political scientists in forest-related fields (Arts, 2012). Scientific papers published from 2000⁷ to 16.02.2020 were filtered by keyword strings (Table 3) to capture the main guiding concepts from which our analyses began: SES, FLR, and SI⁸. A fourth category, named ‘connectors’ was created to assist the parameterisation of the literature search, aggregating keywords of the expected connection among the three main categories (Table 3). All keywords were searched on titles, keywords, and abstracts.

Table 3. Field of study, keyword combinations and the number of publications found from 2000 to 16.02.2020.

Field Research	Key word combination	Number of publications from 2000 to 2020
Social-Ecological System	“social-ecological system”, “eco-social system”, “social-eco system”	257
Forest and Landscape Restoration	“landscape restoration”, “landscape management”, “forest restoration”	297
Social Innovation	Social Innovation, Social-Ecological Innovation	117
Connectors	“governance”, “social capital”, “stakeholder”, “social network”, “new beliefs”, “new attitudes”, “adaptive management”	295,613

In total, 36 scientific articles were selected and analysed, 18 connecting SI, SES and ‘connectors’ categories, plus 18 connecting FLR, SES, and ‘connectors.’ No document was found bridging FLR and SI directly. All these selected articles are identified in the references with an asterisk mark.

The selected papers were analysed in a chronological sequence, following the concepts’ evolution. They were distilled in higher categories (e.g., ‘Means of measurement’) and related concept-codes (e.g., ‘Criteria’, ‘Methods’, ‘Frameworks’), which guided the analysis (Figure 5). In some cases, Boolean lexical searches were used to locate more complex sentences, which were interpreted and assigned to the most appropriate concept-code. Here we take simpler and more evident routes for bridging FLR and SI, and do not explore other possible but less visible conceptual connections.

⁷ We took 2000 as a starting point because it was when the FLR term was proposed by WWF and IUCN. Many years later, SI started to be studied in rural areas.

⁸ Other two concepts “LR” and “NcP” have emerged during the content analyses. Apart from having been used to explain the bridges (Section 4), they have been incorporated in Section 2 to provide a more comprehensive conceptual background.

With the support of MAXQDA functions, concept-codes were continuously reorganised into higher categories, mimicking some of the frameworks found in the reviewed literature⁹. This process enabled a deeper understanding of the meanings, resulting in the deductively extracted topics presented in Section 4. The analysis used a problem-solving-oriented approach, following key guiding questions aiming to disentangle the theoretical components of the SI-FLR process, from the problem identification to the effects of solutions, namely: ‘where’ the problems arise, and the solutions can be performed; ‘why’ solutions are necessary (which social needs should be met); ‘who’ perceived the problems and find solutions; ‘how’ the logic of intervention can be designed and implemented; and ‘what’ are the impacts derived from the solutions (Morra Imas & Rist, 2009).

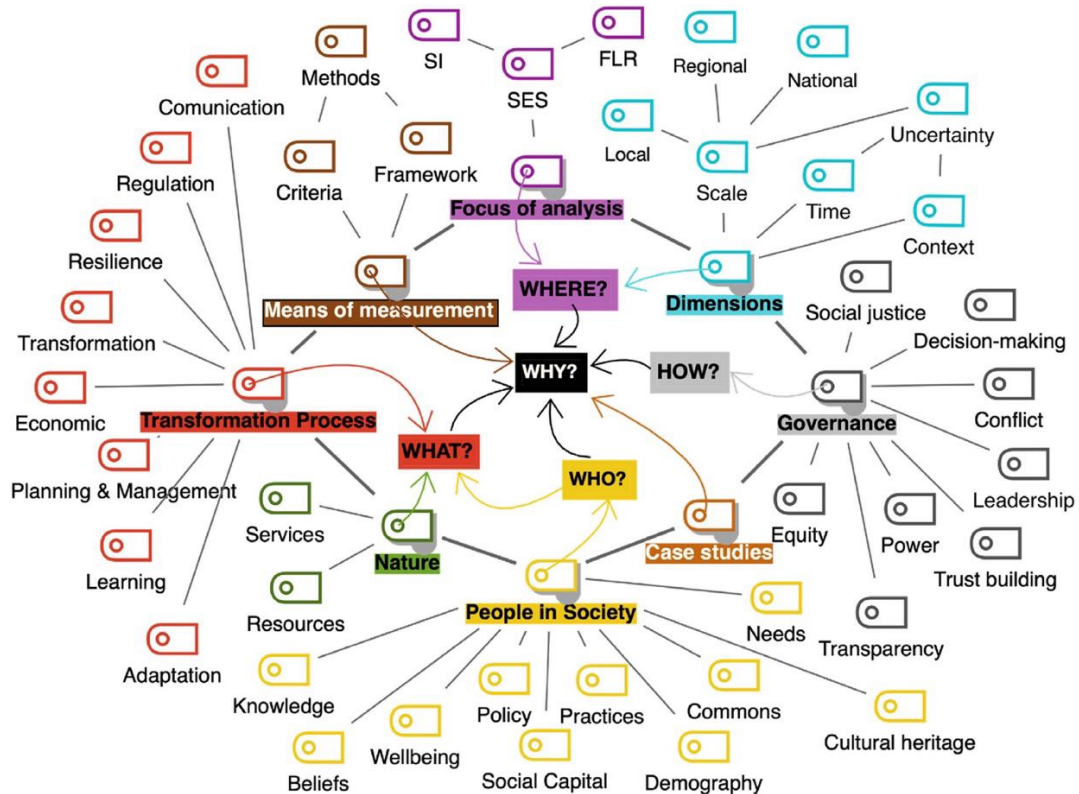


Figure 5. Guiding questions, categories, and the main finding codes bridging SI and FLR. Higher categories (in bold) and the main concept codes related to the five guiding questions that built the bridges of knowledge between FLR and SI in a SES.

4.5 RESULTS AND DISCUSSION: The Five FLR-SI bridges

The final concept-codes systematization resulted in five findings, which represent the bridges between FLR and SI. They are presented and discussed below, following the key guiding questions (where, why, who, how and what impact). General considerations complete the analysis.

⁹ e.g. social-innovation framework (Biggs et al., 2010); the multiple processes on SES subsystems (Moore et al., 2014); mediation mechanisms and factors in ecosystem service delivery (Fedele et al., 2017); and others.

4.5.1 Bridge 1: Where can SI-FLR occur? 'Landscape as the main context'

Both FLR and SI are place-specific transformation processes triggered and shaped by a multi-scalar context, local possibilities and interests (Gamborg, et al., 2019). Multi-scalar context emerges from the interrelated circumstances that intersect in a given time-place fact or situation. Its narrative is usually built on interwoven pieces of evidence (Bohnet & Konold, 2015), traces of social memory (Kim et al., 2017), traditional and scientific knowledge (Southern et. al, 2011), personal and collective interests and values (Fedele et al., 2017), aligned cause-effect perceptions (Zasada et al., 2017), and by the persuasion capacity of those who want the transformation (Westley et al., 2013).

Place is where the resources, local livelihoods, direct beneficiaries, risks, and opportunities sit (Fedele et al., 2017) and can be represented by different conceptions. In that sense, region and territory refer to geographic units, where the uniqueness of social-nature coevolution is imprinted through culture, religion, economic, administrative, or natural boundaries, not necessarily implying precise boundaries (Biggs et al., 2010). Landscapes are where people experience and build management practices of SES, shaping their beliefs, socioeconomic relationships, and ties with nature (Kim et al., 2017). Landscapes encompass NNSCs of design and management of a place bounded by biophysical (e.g. climatic), socio-economic (e.g. demography) and institutional (e.g. governance structures) characteristics, and their drivers (Zasada et al., 2017).

From a political point of view, territories delimit a specific power form, a higher hierarchical level of government aggregating unit than landscape, resulting in specific spheres and standards of ruling (Gibson et al., 2000). Because of less formal structures and proximity to livelihoods, the landscape's collective-choice arena is faster and more flexible in adapting its operational rules than higher political spheres in adjusting coexistence rules.

The landscape-based boundary contributes to a better understanding of context, capturing "the manifold dimensions of places where people live and work" (Angelstam et al., 2017: 300). It is at the landscape level that ecological and social systems operate interdependently, connecting the past and future of people and nature (Prager, 2015).

While each landscape is unique, scholars often refer to them in categories that share common elements. In that sense, natural landscapes are places mostly covered by natural ecosystems (e.g. forests, grasslands) and host nature-based livelihoods, which have been widely replaced by human-modified landscapes (Bohnet & Konold, 2015). Agricultural landscapes (Townsend & Masters, 2015) are designed as agri-food production systems to cater to the demands of a complex society, which manages the land through technology, markets, and policies. When a landscape degrades, its socio-political context may favour restoration interventions (Gamborg et al., 2019) that eventually transform it into a multifunctional landscape (Cockburn et al., 2019).

Landscapes can also be classified as rural, peri-urban, or urban. Whereas the rural landscape is the primary locus for FLR initiatives, SI tends to emerge more often in urban landscapes (McPhearson et al., 2015). In the latter, a greater variety of situations and social capital contributes to diversifying the 'windows of opportunity' (F. R. Westley et al., 2013) for transformative processes and "provide far better opportunities for scaling up the impacts of grassroots initiatives" (Wolfram & Frantzeskaki,

2016: 7), because they "connect consumers, producers and policy, thus co-shaping urban lifestyles and global consumption patterns" (ibid: 6).

Social-Ecological Innovation (SEI) can come up with solutions out of FLR conceptual boundaries to improve SES. For example, stimulating knowledge exchange between FLR initiatives with grassroots green movements expands local cultural diversity, contributes to social learning; sharpens reflective thinking; incites experimentation of new ways of living in the landscape; expands networking, and promotes producer-consumer direct channels, encourages SEI emergence (Dennis et al., 2016b).

Historically, landscapes have been shaped by economic and cultural changes. Today, landscapes are more interconnected, interdependent, and paradoxically less prepared to absorb unexpected environmental events (Bohnet & Konold, 2015).

4.5.2 Bridge 2: Why does SI-FLR happen? 'Nature as a social need'

Improving people's well-being is a trigger and one of the primary outcomes sought by FLR and SI. Often used to design and monitor the effects of social policies, the well-being concept has provoked divergent debate, as it aggregates objective and subjective characteristics, which can vary according to culture, life history, physical, psychological and economic conditions (Stiglitz et al., 2009). Nature is the ultimate source of well-being from which people discover, explore, manage, combine, and transform its elements, sceneries, and resources to improve their livelihoods (Angelstam et al., 2017). Forests, for example, are the place to live, the resource provider, and the cultural heritage for the communities that inhabit them (Balázs et al., 2019). However, for the majority of dwellers, well-being is also weighted by distinct values and socioeconomic factors that invoke other immediate social needs (e.g. income, housing, infrastructure, employment), which implies distinct land-use typologies (Angelstam et al., 2017). Non-forest-based dwellers also recognise the importance of nature for their own quality of life (Quintas-Soriano et al., 2018). The social need for NcP's changes over time and space, according to contextual conditions (e.g., crises) and the landscape's intrinsic features (e.g. demography, land use) (Rodima-Taylor, 2012).

Many of the ecological feedbacks resulting in social-ecological deprivation are caused by social agents' actions that take time to be perceived and understood due to processes of cascading effects (Fedele et al., 2017). However, changes in the context and landscape's intrinsic features can favour the connection between local social needs and multiscale and sectoral demands for NcP, strengthening the local-regional agents' network to search and develop SEI (Castro-Arce & Vanclay, 2019). Depending on the path taken, the emerging SEI can trigger or propel an SI-FLR process.

Two examples illustrate this. The first is when a threat to ecosystem services is perceived as the cause of damage to well-being, and people mobilise to transform this situation (Cockburn et al., 2018). For instance, the reduction in crucial ecosystem services supply caused by flora-fauna composition changes, together with water scarcity, provoked a *long-lasting national restoration program* in South Africa (Cockburn et al., 2019). The second example is when knowledge about nature is co-produced, facilitating the adaptation to changing environmental conditions. For instance, the identification of adaptations to improve the well-being of people living in grass-based *ecosystems in transition* in France (Lavorel et al., 2019).

Ecosystem and adaptation services can coexist, awakening distinct interests depending on the social agents' scale of action (Gibson et al., 2000). For example, farmers and the local rural extension company would likely be more interested in adaptation, while residents of a nearby urban centre and the regional environmental agency in ecosystem services. Both seek well-being improvement, yet this outcome will only be achieved when their attitudes are adjusted to circumvent the challenges (ignorance, mismatch, plurality) to cooperate in a cross-scale and level strategy that articulates different social-environmental needs and services (Cash et al., 2006).

4.5.3 Bridge 3: Who does this transformation? The 'Landscape stewardship groups' (LSG)

Both SI and FLR are human-centred processes. People act intentionally, alone or collectively, to exploit resources, and this differentiates social from ecological systems (Heslinga et al., 2017). The capacity to act depends on beliefs, interests, and power to manage the structural forces of domination and legitimisation as institutions and norms (McCarthy et al., 2014). A landscape steward is a person or group of people who deliberately act to maintain or (re)shape the landscape according to their wishes and possibilities (Raymond et al., 2016). A SI-FLR landscape-scale transformation will only take place when there is a combination of a favourable context and a qualified steward willing and empowered to make the change occur (Palomo et al., 2017).

Once social norms, beliefs and practices are embedded and influenced by the prevailing cultural hegemony, the capacity of some actors to reflect on the role and impact of the established institutions is a fundamental element to trigger an LSG (Moore et al., 2018). As local people are directly affected by the social and ecological elements and history of the landscape, they are usually aware of local limitations and opportunities and, thus, their reflexive capacity is connected to the local reality and needs; their ideas tend to be more tied to local social structures (Kim et al., 2017), and their livelihoods are more connected to the use of local resources (Quintas-Soriano et al., 2018). Intermediary organisations are crucial in strengthening local social capital, supporting LSGs to create relationships of trust between agents of various scales, and acting as brokers of connections, resources, and knowledge (Brown, 1991).

Landowners, rural workers and communities, and their networks are central actors influencing landscape conditions and potential LSGs (Zasada et al., 2017). Forestry, mining, and agribusiness companies are relevant actors who, together with local governments and regional agencies, impact landscape design (Prager, 2015). Non-local residents' choices and demands can also affect it.

The tension between the LSG desire for change and the conservative forces of existing social structures continues until a 'window of opportunity' (Biggs et al., 2010) arrives. At this moment, for a certain period, LSG will assume the resources and the power to remodel the landscape. When this new vision is built in a participatory manner aiming at a legitimate social demand, it can be named Social Innovation (Nijnik et al., 2019). When it also targets to enhance NcP it can be a Social-Ecological Innovation (SEI). However, an LSG's vision may not necessarily be an SEI; and an FLR initiative does not constitute an SEI when imposed by a specific law or market force in a top-down manner, responding to the will of dominant social groups. Yet, even when not established as an SEI, FLR can create favourable conditions for its future emergence through governance and management mechanisms.

A key LSG characteristic is the voluntary disposition of people to participate (Cockburn et al., 2019), a crucial condition being that participants are aware of the right to access natural resources for their livelihoods (Melnykovich et al., 2018). Furthermore, a minimal level of social, political, and financial capital is needed to support its self-organization. Effective local leaders are also vital for mobilizing people (Dennis & James, 2018).

LSG represents a unit of ecosystem stewardship, which is a strategy to manage uncertainties and reconfigure SES, whose future is in constant dispute (Cockburn et al., 2019). The interaction, diversity, trust and power balance between the LSGs units involved in land-use planning and management will influence the future landscape design (Fedele et al., 2017).

Therefore, a stewardship system favourable to increasing NcP and RL can be achieved through the construction, restoration, and strengthening of human and social capital within an LSG towards an SEI. The collaboration and engagement required to perform the set of landscape restoration activities improve social cohesion (Angelstam et al., 2017). When successful, an SI-FLR approach can positively impact wellbeing, inspiring people to search for more resilient livelihoods connected to the *Buen Vivir*¹⁰ principles (Acosta, 2008). Civil society can engage in many FLR phases: from diagnosing, monitoring, and managing activities to seed collection, seedling production, and planting.

The landscape transformation pathway through SI-FLR is linked with the reconfiguration of local economies, social relations, and power distribution and seeks to improve the natural and social capital and enhance political-economic and ecological resilience. Social movements guided by agroecological principles have demonstrated that it is possible to articulate individual practices within collective political actions to reshape their own landscape and social-cultural context, reverberating in other neighbours' mobilisation (Herrmann et al., 2018).

The design and implementation of FLR processes by formal state entities generally lack consideration of local livelihoods (van Oosten et al., 2019), potentially explaining the low LSGs' commitment to fostering FLR implementation and their sudden collapse right after a short and insufficient funding cycle. Accordingly, SI-FLR initiatives should be flexible enough to align with local needs and build on landscape governance and NcP, be contextual and continuously improve through praxis to understand SES limitations and opportunities. This approach tends to enhance the SES resilience and local community autonomy in the long-term and will demand and promote innovative and transformative power (Avelino, 2017) to accommodate the FLR vision, adjusted by LSGs.

¹⁰ *Buen Vivir* is a term which represents the ontological conception of the life of the indigenous peoples from Latin America. It is a proxy for the modern-Western of "development" and "progress" concepts.

4.5.4 Bridge 4: How does SI-FLR develop? 'Governance capabilities'

In an FLR process, deciding what, where, how, for whom, and by whom to restore should be the responsibility of landscape governance, which implies continuous negotiations between stakeholders within a large institutional environment (van Oosten et al., 2019). Governance is not necessarily a formal structure, it can house informal organisations and poorly defined administrative processes, which can compromise communication and generate legitimacy problems (Rodima-Taylor, 2012).

Governance principles are associated with a normative approach and imply value judgments on desirable conditions (Giessen & Buttoud, 2014), including efficiency, transparency, participation, accountability and capacity. Appropriate governance conditions are considered supportive of the necessary institutional environment for stakeholders to negotiate and implement a plan to redesign land use in degraded landscapes, transparently and democratically, fostering the connection between local social needs and NcP (van Oosten et al., 2019). This can also enable socioeconomic and political conditions for SEI emergence, which in turn can improve the efficiency and effectiveness of FLR, contributing to larger social-ecological outcomes (Castro-Arce et al. 2019).

While not strictly referring to governance principles as applied in forestry, we have been inspired by them in identifying four governance capabilities. As key features of resilient SES, at the basis of the bridge, they are deepened hereafter.

i) Trust-building: The success and quality of any transformative social-ecological process rely on the level of trust and integrity among stakeholders (Castro-Arce & Vanclay, 2019). The continuous search for information, either from secondary sources or ad hoc monitoring and evaluation systems, and its proper utilisation in supporting decision-making, is basic to create trust (Elmhagen et al., 2015). Equally, it includes transparency about data collection and its reliability and how decisions are taken, how resources are allocated, and what results are obtained (Westley et al., 2013). Besides, participatory spaces for knowledge-sharing, building proposals, and decision-making contribute notably to collaborative learning and trust-building, enhancing human and social capital, local capacity to adapt and transform, and improving SES resilience (Biggs et al., 2010).

ii) Self-organization: Governance is formed by self-organised networks of people who use different knowledge and experiences to structure an understanding of complex problems, design policies, and gather resources to act in favour of collective interests (Folke et al. 2005). Leadership is crucial in bringing people together and keeping them self-organised (Biggs et al., 2010). Respect is a crucial democratic principle for any self-organised process, connected with the right of distinct social groups to express themselves without discrimination, diversifying knowledge and perspectives and increasing the possibility of innovative solutions (Sarkki et al., 2019). Equally vital are the considerations about the '(ab)uses of power' (Mustonen, 2013), since each person or organisation defends its own interests and can act as a sector representative. To maintain social cohesion, it is also essential to promote vigilance over the rules that enable internal redistribution of power since changing institutional roles, responsibilities, and authorities is part of the governance game and can benefit the group as a whole (M.-L. Moore & Tjornbo, 2012).

iii) Adaptability-flexibility: Understanding environmental flows and socioeconomic changes in the SES allows more precise actions to adjust approaches rapidly. Thus, governance should focus on a particular landscape and well-known local context, where it is possible to identify key stakeholders and, somehow, measure the available local resources (Folke et al. 2005). Flexibility can be enhanced by social learning. New knowledge can be promoted by boosting local actors to investigate/experiment with their ideas in the same landscape (Wolfram & Frantzeskaki, 2016). A polycentric approach may increase the adaptive capacity of governance once it diversifies the perspectives and brings the local realities closer to decision-making (Dennis et al., 2016a). This applies in forest landscapes, too (Melnykovich et al., 2018), but its practice is very challenging, as it requires time, resources, and the right people to create confidence, relationships, and reflections. Similarly, SI is an adaptive process influenced by beliefs, social structures, and power vectors, which may vary over time and even completely change its goals while obtaining the necessary political power to be implemented (Fougère & Meriläinen, 2019). Its outcomes may prejudice some social groups or SES, emerging as a dark side of a poorly managed SI-FLR.

iv) Bottom-up-linked: It refers to a governance approach where an active process of SI bridges social groups, geographies, and sectors together while gaining scale and influencing regional transformation (Castro-Arce & Vancley, 2019). Spatial planning, co-management and polycentric governance are key instruments to connect social-political levels in different spatial scales with wider structures, making the process fluid, inclusive, transparent, and effective. Yet, this approach might be negatively susceptible to ‘institutional externalities’¹¹ (Mewhirter et al., 2018), favouring elites remaining in power through local cronyism and corruption. Abilities of network enablers, knowledge and resource brokers, conflict resolution agents, and shared vision creators can reduce this susceptibility.

These four Governance Capabilities indicate a flexible path to take adaptive and transformative decisions and have the potential to contribute to overcoming barriers to undertake effective SI-FLR processes. Governance Capabilities can enable SEI emergence in an FLR context by identifying local needs to redesign it, increasing social participation and local community empowerment, generating new multiscale integrative solutions and amplifying FLR social outcomes. The final impacts of this transformation are rarely measured empirically¹². They are influenced by seven drivers: politics, economics, ecology, society, culture, technology, and demography (Wolfram & Frantzeskaki, 2016). Landscape governance is a responsive subsystem within a more complex and less visible social system.

¹¹ when a decision-making body influences the political environment of other forums in the system

¹² Because of the limited empirical evidence, we mainly refer to “expected” rather than “actual impacts” in Bridge 4.4.5.

4.5.5 Bridge 5: What is the expected impact of SI-FLR? Adaptation and transformation to increase resilience".

The dynamic stability of any sustainable landscape depends on the outcomes of three key attributes: resilience, adaptability, and transformability. They are linked to the 'adaptive cycle', a conceptual tool that explains complex, multi-scalar SES processes in four phases (exploitation, conservation, release, and reorganisation) (Walker et al., 2004).

Resilience and adaptation mirror the upkeep or incremental adjustments to the system.

Transformation, instead, implies a radical innovation, usually stochastic, during a period of chaos followed by profound changes with uncertain outcomes. In some contexts (e.g., low NcP and many marginalised people), resilience is not desirable and small adjustments may be irrelevant; although less socially palatable, sometimes transformation is the best choice and political, economic, and social bumps occur along the way (Westley et al., 2013). In an SES approach, ecological processes and their outcomes for people are equally important to the socioeconomic and political dynamics and to explain the complexity and transformations along the time (Walker et al., 2004).

When applied as an attribute of the SES, the specific resilience (Folke, 2016) has been criticised for representing a unidirectional concept, built to give an ecological and biophysical perspective to landscape management in response to disturbances, disregarding the power game among the social groups and depoliticising disputes and tensions (Heslinga et al., 2017). The concept of general resilience (Folke, 2016) refers to the dynamic stability of the adaptive cycle as a whole, thus including the capacity of people, communities, societies, and cultures to adapt or transform themselves, turning a crisis into opportunities for change. As the SES change over time, general resilience depends on the intensity and quality of the undergoing innovations.

FLR and SEI can enhance general resilience by adapting or transforming some SES elements, subsystems, or the whole system. In degraded landscapes, marginalised rural people can be empowered by SI processes and lead profound societal changes by challenging, altering and replacing current dominant institutions in a transformative social innovation (Avelino, 2017). While social-ecological degradation has been the main driver of landscape transformation in recent years, SI-FLR could be the transformative social innovation process needed by suggesting other paths to restore local social-ecological interactions (Cowie et al., 2019).

4.5.6 General considerations

Whereas FLR acts by planning and implementing effective landscape configurations to accommodate sustainable agri-food production systems with NcP, SI focuses on reconfiguring social relations and structures to include marginalised people by adjusting or transforming people's attitudes and demands towards SES and, consequently, influencing landscape design. Therefore, SI and FLR can be complementary in promoting land use through local-global adaptive and transformative processes. To be successful, both FLR and SI should connect meaningful local realities to multiscale governance contexts. When the established governance system fails to satisfy local needs, and marginalised people are pushed to self-organize and develop solutions for enhancing their well-being, these people become social innovators (Melnykovich et al., 2018). In a favourable context, when their needs are

associated with NcP improvement, they are one step closer to becoming a Landscape Stewardship Group (LSG) towards an SI-FLR approach.

SI-FLR transformation processes are undertaken by LSG (Bridge 3), who organise themselves with other social actors through four basic governance capabilities: trust-building, self-organising, adaptability-flexibility and bottom-up-linking (Bridge 4). LSGs put actions in a course to change the landscape with the aim of enhancing its general resilience through adaptive and transformative attitudes (Bridge 5). These steps are visualised in (Figure 6) and we believe it helps to describe real examples, such as the Xingu Seed Collectors Network in Brazil (Box 2).

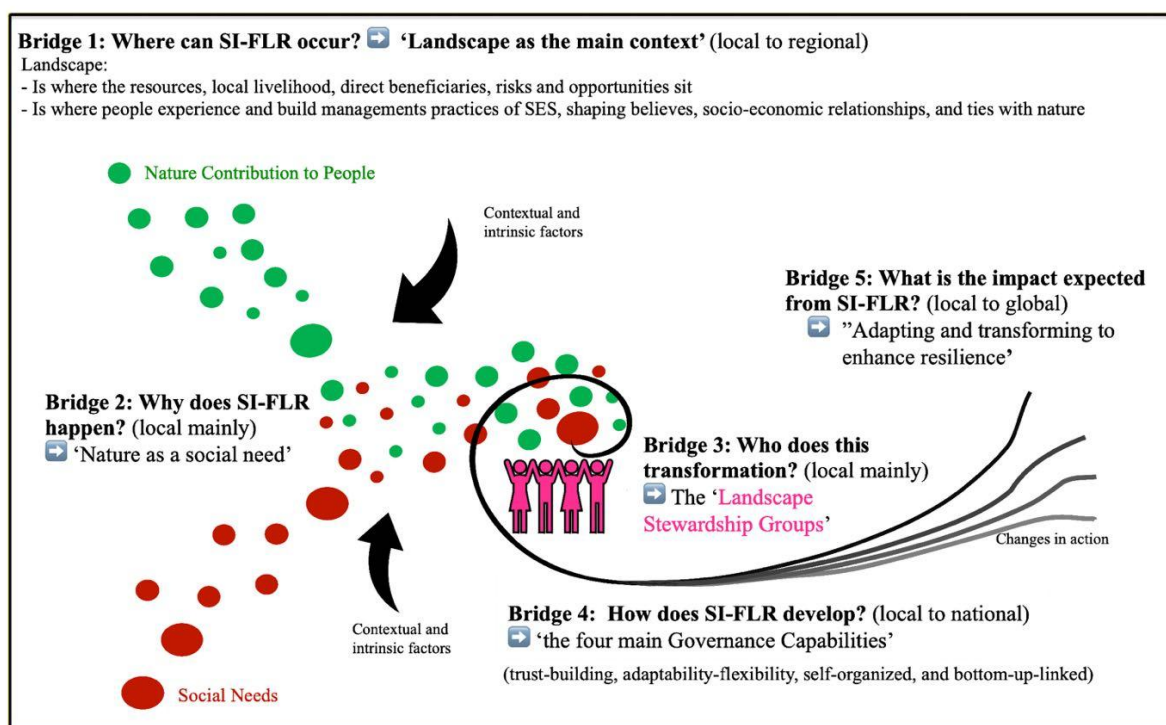


Figure 6. The Social Innovative – Forests and Landscapes Restoration (SI-FLR) process

BOX 2. The five bridges of SI-FLR applied to Xingu Seed Collectors Network in Brazil.

In this case, indigenous people perceived deforestation as a threat to their water resources and wellbeing (Bridge 2). Supported by a linking institution, they self-organised to assist the surrounding farmers to restore their landscapes (Bridge 1), offering forest restoration services and products, thus acting as a local LSG (Bridge 3). After a long process of social learning and reflexive thinking, a Social-Ecological Innovation emerged, the creation of the Xingu Seed Collectors Network (Bridge 4). After 10 years, the current Network is composed of more than 550 seed collectors, which have produced more than 200 tons of seed, generating more than US\$ 1.3 million as income to the indigenous communities while supporting forest restoration and thus improving the overall resilience of the social-ecological system (Bridge 5) (Urzedo et al., 2020). In this case, it is worthwhile to mention two SI-FLR enabling factors: (1) the context, landowners being pressured by market and environmental law to restore their lands, and (2) the governance capabilities, working on connecting local seed collectors to multilevel actors.

SI-FLR can be triggered in two main ways. In one way, when an SEI, like the Xingu Network, moves towards an FLR process, local networks of seed collectors act as LSGs. They self-organize and assume the responsibility to plan, execute, and monitor the course, supported by intermediary institutions that act in cross-scale and cross-level governance environments, sparking a bottom-up-linked SI-FLR process. In the other way around, a top-down-driven FLR (e.g., activated by a public funding program) can also provide a fertile ground for SI-FLR emergence. This may happen when local needs for NcP are identified, LSGs' experimentation towards SEI is supported, and a window of opportunity is opened to promote social learning while empowering and legitimate local authorities to take decisions. This second way could be prompted by a broader strategy, such as, for example, a Disaster Risk Reduction plan to action, once the SI-FLR contributes to the four priorities established by the Sendai Framework for Disaster Risk Reduction (Sendai's FP in the following) ([UN, 2015](#)). The adoption of the landscape as the main context (Bridge 1) is crucial to the understanding of all dimensions of vulnerability, capacity, and disaster risk exposure (Sendai's FP 1). The coherence among national-local institutions (Sendai's FP 2) can be facilitated by adopting governance capabilities (Bridge 4). Sendai's FP 3 highlights the role of innovation in driving planned disaster risk reduction investments to improve the overall resilience of the landscape, directly connecting to the impact expected by SI-FLR (Bridge 5). Finally, the connection between local needs and NcP (Bridge 2), the LSG empowerment (Bridge 3), and proper governance capabilities (Bridge 4) are supportive of enhancing the capacity for effective response and 'Build Back Better' actions (Sendai's FP 4).

In any direction, the general resilience of an SES tends to improve when the Governance Capabilities are put into practice and when local groups of motivated people decide to react to a challenge with a new solution that is often both social and environmental in focus ([Avelino, 2017](#)). Both social agents and institutional conditions are essential factors that should synergise within site-specific environmental conditions. For example, a real increment in native vegetation cover due to factors that somehow prejudice the local socio-economy does not necessarily contribute to the general resilience improvement expected as the major SI-FLR impact. This can be the case of the decline in agricultural activities that has led several European landscapes to regain native vegetation ([Pereira & Navarro, 2015](#)). The perception of this dynamic by the local population can be negative since it conflicts with the prevailing social memory about the land use history ([Martín-Forés et al., 2020](#)); natural regeneration represents an unwanted change and not an option built by LSG, NcP is disconnected from local social needs and from the broader understanding of wellbeing.

4.6 CONCLUSIONS

Bridging SI-FLR specifies a distinct and possible novel approach to FLR, which brings the Social-Ecological Innovation as a driving and desirable element for supporting sustainable rural livelihoods and restoring socio-ecological relationships on the landscape. Although the paper lacks empirical evidence through case studies, identifying the five conceptual bridges demonstrates that intrinsic theoretical connections exist between FLR and SI. They have been briefly narrated in relation to two real examples, i.e., the Xingu Seed Collectors Network (Brazil) and the Sendai Framework for Disaster Risk Reduction (United Nations) and seem to plausibly represent a real SI-FLR process. Our analysis reveals that the networking and vision-sharing mechanisms of self-organised LSGs, which are typical of SIs, are likely to accelerate or amplify FLR implementation. Vice-versa, the FLR implementation at the landscape level based on regional demands of ecosystem services, key governance capabilities, and linking institutions can activate or intensify people's mobilisation and transformative processes towards improving well-being and SES resilience. By revealing SI-FLR possible interconnections, we believe we have contributed to illuminating the key elements of the countless FLR initiatives underway and yet to come, as well as sparking the interest of other researchers to delve into the mechanisms of connections and the key aspects to explore ways of supporting the design and implementation of effective SI-FLR, in both policy and practice.

However, many pending questions remain to be answered about SI-FLR, such as: What would be its type and format? Where is it happening? For whom, in what situation and to what extent are its impacts? How can FLR funding enable SEI? What are the best variables to be empirically measured to demonstrate and quantify the social, together with ecological, impacts? Responses to these questions can help to structure and conduct a more inclusive FLR, in the sense of providing more attention and care towards innovators who take action to improve rural people's well-being and the general resilience of forest landscapes.

CHAPTER 5. BRAZILIAN CASES OF SOCIAL INNOVATIVE - FOREST AND LANDSCAPE RESTORATION

This chapter is a translation of a published scientific article in Portuguese¹³ presenting and describing the first cases of SI-FLR using the theoretical bases presented in the previous chapter. I wrote this article and counts with the collaboration of my co-supervisor, one member of the Forest Governance Research Group of the University of São Paulo, and four people directly involved with the cases presented.

Author Contributions: A.P and J.R conceived this article; A.P. was the principal researcher, defined the methodology, collected and analysed the data and wrote the initial draft of the article, J.R, D.C, L.A.S, M.C., P.A.A.A. and L.S., provided reviews and editorial contributions for its refinement.

ABSTRACT: The current trends in relationships between society and nature point to an unfavourable scenario for quality human life on Earth. In the political dispute to build solutions, an increasing number of people are organising to face the neo-populist wave that is gaining power and leading to a neo-centralizing agenda. Some social movements, socio-environmental projects, and civil society organisations have found a way to respond constructively to this environment of conflict and resistance. By promoting socio-ecological innovations, they share knowledge and practices, enabling new social relations that place the local community as the protagonist of a rural development design where natural capital takes the centre stage. In this article, we explore three case studies from the perspective of Social Innovative - Forest and Landscape Restoration, seeking to understand the determining factors for the emergence and development of this process.

KEYWORDS: Socio-ecological innovation; Landscape restoration; Forest governance

¹³ Padovezi, A., Roma, J., Coura, D., Silva, L. A. da, Campos, M., Assumpção, P. A. de, & Secco, L. (2022). Casos brasileiros de Restauração Socioinovadora de Paisagens. *Estudos Avançados*, 36(106), 239–255. <https://doi.org/10.1590/s0103-4014.2022.36106.014>

5.1 INTRODUCTION

Forests and Landscape Restoration (FLR) is a potentially transformative tool ([Besseau et al., 2018](#)) since it can influence values, behaviours and social relations, reconfiguring land-use dynamics in the landscape to improve the ecosystem. In practice, RPF means maintaining and expanding core ecosystem service areas, such as those protecting water resources and biodiversity, as well as sustainable agri-food systems ([Stanturf et al., 2019](#)).

The FLR is the subject of several international agreements and is materialised locally through a wide variety of actions around the World. To date, more than 60 countries have voluntarily committed to restore more than 170 million hectares by the "Bonn Challenge" ([The Bonn Challenge, 2019](#)).

The design and implementation of the FLR depend on an intricate power play between land use interests. Access to resources (land, labour), capital (financial, political, and technological) and participation in decision-making about how to use them are arrayed by organisations and institutions ([Meyfroidt et al., 2018](#)). Thus, depending on which way the power bends, the outcomes of the RPF may deviate from the expected impact, accentuating the causes of social inequality and environmental degradation ([Fougère & Meriläinen, 2019](#)).

Participatory and adaptive management of complex problems led or supported by local communities helps build viable agreements and stimulates Social Innovation (SI) ([Kleinschmit et al., 2018](#)). Social Innovations are processes and outcomes where people share ideas and knowledge and undertake collective actions to overcome a common challenge ([Mulgan et al., 2007](#)). When a SIs generates benefits for nature, it can be called a Socio-Ecological Innovation (SEI).

In the present paper, we explore three examples of SSE using the "Socio Innovative – Forest and Landscape Restoration" (SI-FLR) theoretical framework ([Padovezi et al., 2022](#)). Such examples are related to the initiatives: Sowing Agroforestry (MG); Sowing Sustainability (SP), and; Forest Restoration Actors of the Paraíba Paulista Valley (SP).

5.2 THEORETICAL FRAMEWORK: "SOCIO INNOVATIVE - FOREST AND LANDSCAPE RESTORATION"

Understanding the determinants for the emergence and maintenance of SEI can guide more inclusive, persistent, and adaptive FLR processes. Using a problem-solving-oriented approach. [Padovezi et al. \(2022\)](#) developed five conceptual bridges between SI and FLR. These bridges enable the narrative of SI-FLR, from its initial reasons to its impacts. These bridges are also guiding questions that help describe a peculiar process of FLR, where local dwellers take the lead in reclaiming the degraded landscape. The five bridges or guiding questions of SI-FLR are presented in [Figure 6](#) (in the previous chapter) and briefly presented below.

5.2.1 Bridge 1: Where does SI-FLR take place?

Because it represents the local scale while being large enough for socio-economic and ecological aspects to interact in a complex socio-ecological system, the landscape is the place, the arena where social, physical, and biological elements interact in multiple ways to delineate a context ([Sayer et al., 2013](#)).

Thus, narratives about landscape context are constructed by an intertwined set of evidence, traces of social memory, personal interests, collective values, traditions, perceptions of cause and effect and the capacity to persuade those who want to transform it (Padovezi et al., 2022).

SI-FLR takes place at the local landscape scale.

5.2.2 Bridge 2: Why does SI-FLR happen?

The search for a better quality of life is the trigger and one of the main desired outcomes of SI-FLR. However, this will only happen when local and regional actors cooperate in finding solutions that generate multiscale benefits (Cash et al., 2006).

Contextual changes (e.g. markets, policy, technologies) and intrinsic landscape characteristics (demographics, social capital, natural disasters) can connect local social needs with multiscale demands for ecosystem services, sparking a network of local-regional actors in pursuit of ESI (Castro-Arce & Vanclay, 2019).

SI-FLR happens when nature's benefits to people are perceived as a local need.

5.2.3 Bridge 3: Who does this transformation?

SI-FLR emerges locally and can spread across the landscape and other regions. However, this will only happen if a landscape stewardship group is organised, willing, and prepared to lead socio-environmental transformation when a window of opportunity opens (McCarthy et al., 2014). A landscape steward is a person, or group of people, who acts to maintain or (re)shape the landscape according to their wishes and possibilities (Raymond et al., 2016).

A landscape-scale SI-FLR will only occur when a combination of favourable context and a landscape stewardship group with technical and articulation capacities are willing and empowered to make this change (Padovezi et al., 2022). In addition, bridge organisations can cooperate by acting as political, resource and knowledge brokers (Buzati et al., no prelo).

5.2.4 Bridge 4: How does an SI-FLR develop?

Many SI-FLR initiatives can emerge, but only those that link up with other sectors and levels of governance will have access to the resources and power required to put their vision for the future into practice (Padovezi et al., forthcoming). The main characteristics of effective governance in this sense are:

1. *Building trust*: The likelihood of a group of social actors succeeding in social transformation is related to the level of trust and integrity created between them and other stakeholders (Biggs et al., 2010).
2. *Capacities and self-organisation*: Practical skills and knowledge, leadership, charisma, respect, process and conflict management are key characteristics for obtaining political support and thereby garnering the resources and power necessary to drive their vision for the future (McCarthy et al., 2014).
3. *Flexibility and adaptation to a changing context*: Understanding socioeconomic changes, environmental flow, and the cause-effect relationships between them should be reflected in

rapid adjustments in the direction of the actions designed by the group. Flexibility improves with increased trust and self-management capacity among those involved, stimulated by a continuous social learning process. Experimentation generates new knowledge (Newig & Fritsch, 2009).

4. *Bottom-up interaction*: Connecting landscape stewardship groups with other social groups, governance levels, and economic sectors help SEI gain scale. Spatial planning, co-management and polycentric governance¹⁴ connect people and spatial scales, making the process more fluid, transparent, visible, inclusive, and effective (Castro-Arce & Vanclay, 2019).

5.2.5 Bridge 5: What is the expected impact of the SI-FLR? "Adapting and transforming the context, improving the overall resilience of the socio-ecological system"

The desired impact of an SI-FLR is to establish new social and power relations that support the overall resilience of the socio-ecological system. However, as it involves multiple complex and dynamic mechanisms, resilience can, paradoxically, only come through a transformative process, a social learning continuously adapting to a changing context (Folke et al., 2010).

5.3 METHODOLOGY

To systematically understand the determinants for the emergence and maintenance of SEI within SI-FLR processes, we analysed three case studies: Agroecology Hubs in the Sowing Agroforestry project (MG); Social Learning in the Sowing Sustainability project (SP), and; Articulation of Forest Restoration Actors in the Paraíba Valley (SP).

These cases were chosen by the Forest Governance Research Group of the University of São Paulo (GGF-USP¹⁵) to compose panel four, "Governance and Innovation in Forest Restoration"¹⁶ during the "International Web-Seminar Building Dialogues on Forest Governance: Conservation, Sustainable Management, and Landscape Restoration". The criteria to choose these cases were: a) experiences related to forest restoration in Brazil; b) socio-environmental impact; c) participatory approaches; and d) SI-FLR characteristics. The presenters of this panel are co-authors of this article.

Based on the SI-FLR approach, we designed a script of questions (Table 4) to guide the dialogue of these presenters with the others involved in the case studies in constructing the narratives presented below.

¹⁴ Spatial planning: systematic planning process where the spatial and temporal distribution of human activities in natural areas are analysed;

Co-management: management exercised in common by more than one-person, political group or economic sector;

Polycentric governance: is a system of governance where multiple actors interact to devise and enforce rules within a specific arena or location.

¹⁵ Available at: <https://sites.usp.br/governancaflorestal/ggf/>

¹⁶ The video of this panel is available at: https://www.youtube.com/watch?v=KWp_fo1zWsQ

Table 4. Guiding questions for the description of the case studies.

What is SI-FLR?: Is it a product, a service, a new form of management, a new attitude or value towards the landscape and/or its inhabitants?
1. CONTEXT: What is the socio-economic and environmental context of the people and landscape where SI-FLR takes place?
2. WHY: In the context described above, why has nature restoration become a social need?
3. WHO: Who were the local people (organisations, movements, networks, or social groups) that saw the need to do something?
4. HOW: How did these people develop this change? How was the process of materialising the idea into concrete actions? In particular, how were the processes of: TRUST BUILDING: how was trust "created" between those involved at the local and regional scales? SELF-ORGANISATION: how was the process managed? ADAPTABILITY-FLEXIBILITY: how were the initial ideas adjusted to gain social adherence? GOVERNANCE STRUCTURATION: how was the governance process (decision making, monitoring and adaptive management ¹⁷) to plan, execute and evaluate SEI related activities?
5. IMPACTS: Did the initiative become public policy? Has the initiative been replicated in other places/landscapes? Has the initiative deeply affected the people who participated to the extent that their behaviours, perceptions, and values have changed since the implementation of the initiative?

Source: Elaborated by the authors.

5.4 RESULTS

Below we present the narrative of the case studies from the lens of the SI-FLR framework. We then discuss the consensus, dissensus, and SI-FLR determinants found.

5.4.1 Agroecology Nuclei, Sowing Agroforestry Project

In the Rio Doce Valley (MG), seven Agroecology Nuclei ("AN") have emerged in rural settlements with the aim of implementing agroforestry systems, in response to the stimulus of "Sowing Agroforestry", a project of the Landless Rural Workers Movement (MST) initiated in 2016. Funded by the Minas Gerais Economic Development Company (Codemig), executed in the legal entity of the Francisca Veras Training Centre (CFFV) and coordinated by the MST, the project was structured in a governance system establishing state, regional and local monitoring bodies. The project's multidisciplinary team was composed of settled families and professionals from the areas of agriculture, forestry, education, health, and culture.

The environmental degradation existing in the region has deep roots. The history of land use in the great cycles of timber exploitation, extensive cattle farming and mining consolidated highly

¹⁷ "Adaptive management" is understood as any form of management of natural resources in a landscape that adapts or modifies itself because of new knowledge acquired by observing the results obtained by previous RFP managements.

anthropized scenarios. The Atlantic Forest was transformed into extensive pastureland, exposed soil, and erosive processes that alter both the physiognomy and functionality of these ecosystems. The areas destined for agrarian reform in this region are no exception to this reality, increasing the challenge for settlers to reproduce their way of life locally. The integration between farming activities and the recovery of the Atlantic Forest through agroecological practices represents a path for the recovery of ecological services that directly influence the settlers' quality of life.

The AN had its origin linked to two major processes. The first is the organization of the MST's governance in grassroots groups, groups of families that have specific functions and tasks in the local decision-making structure. The second process arose from the need to integrate actions at different levels of governance to generate the necessary cooperation for the implementation of agroforestry systems.

Several practical interventions have been adopted as pedagogical actions by "Sowing Agroforestry". However, when carried out individually, these interventions proved to be inefficient. The need for the families involved to arrange the execution of collective tasks for implementing agroforestry systems emerged as a local demand. Thus, the need to foster agroforestry activities was the driving force behind the NA. Besides organising practical actions in collective self-help groups (*mutirões*), the NAs also articulate collective learning processes on themes relevant to developing agroecological production units.

The MST does not coordinate the NAs, since they are not part of the movement's decision-making body. Thus, the leaders of the AN were not necessarily the same as those of the grassroots nuclei. The AN was created by families who set out to discuss and materialise agroecology, and their leaders were forged and consolidated during the implantation of agroforestry systems, independently of the MST's governance structure.

The "Peasant to Peasant" methodology ([Sosa et al., 2012](#)) adopted by the "Sowing Agroforestry" project brings the name "promoters" to the families that develop techniques adapted to the local reality, facing their needs and challenges. These promoters - leaders of the AN - were key to carrying out the collective actions (*mutirões*) since they became references for the promotion of dialogue and exchange of knowledge related to the practice. The dialectic of this process has favoured the self-recognition of the settlers as agents of their reality, encouraging them to assume the role of social innovators.

The agroecology as a reference for food production made it possible to identify and give new meaning to practices and knowledge related to the tradition of planting intercropped crops and diversified orchards of fruit species common to the settlers of the region, encouraging the protagonism of local agents in the process of transforming the landscape.

In addition to promoting collective spaces for practical and reflective learning, the AN has also been fundamental in ensuring that the settlers involved have an active voice in directing the project's actions. The civil capacity represented by the AN enabled agroecological actions and reflections to remain present in the settlements, even after the end of project funding. Through the influence of the initial AN, three more have emerged in nearby settlements. The actions developed by the Sowing

Agroforestry program through the agroecology centres included the establishment of 3 hectares of agroforestry systems in the new AN, through collective joint efforts by the families and promoted by the CFFV's technical team.

The consolidation of these groups has made it possible to carry out other joint projects such as: erosion containment, agroforestry backyards, production of native seedlings, cleaning, and recovery of native vegetation in spring areas and other degraded areas. All these actions emerged as a demand from NA members.

5.4.2 The social learning process promoted by the "Sowing Sustainability" project

The social learning process promoted by the project "Sowing Sustainability" has changed values, social relations, agricultural production, and family farmers' income generation, enabling the repopulation of the Juçara palm tree (*Euterpe edulis*) in the surrounding area of the Santa Virgínia Centre (NSV), Serra do Mar State Park (PESM), in São Luiz do Paraitinga, São Paulo, Brazil. The social participation, the protagonism of local agents in the transformation process, as well as the favourable impacts on the local community and the restoration of natural ecosystems, characterise it as an SI-FLR.

Faced with forest fragmentation and loss of local biodiversity, "Sowing Sustainability" began in 2007, proposing actions for the repopulation of Juçara and sustainable management of the species to increase its population and, at the same time, stimulate its sustainable economy.

The main factors influencing the pressure on the local native vegetation are deforestation, wildfires for pasture expansion and maintenance and the illegal extraction of forest species such as the Juçara palm heart. These factors are reinforced by the lack of work and income generation alternatives for conserving the local natural heritage. Based on this scenario, the project donated 30,000 Juçara seedlings. It involved approximately 30 families of farmers from the surrounding area of the NSV in activities for learning about the use and sustainable management of Juçara, based on agroecological principles.

Throughout the project, young people saw the opportunity to generate economic gains from the Juçara management through its fruit pulp production, seeds, and seedlings. The rural landowners saw the possibility of restoring their degraded areas, while the women took the leading role in producing pulp, food and Juçara seedlings. The practical and participative learning, combined with active listening to the demands of the local community, provided an environment of mutual credibility and trust that favoured social and gender inclusion.

One of the biggest challenges faced was seed collection, since with deforestation and illegal extraction, Juçara matrices could only be found hours away. In this sense, the group encouraged the use of Juçara in the nearby recovery of native vegetation, thus facilitating the harvesting of its fruits. In addition, there was encouragement for the consumption and sale of food from fruits and other native species that could supplement the family income.

With this, more people joined the project, broadening its scope of action in ecological restoration and agroecological food production. The design and execution of this strategy were only possible due to the governance model adopted. The network of relationships created by the group generated trust and credibility among the other social players involved, and the coherence and constancy in the

actions planned and carried out in the short, medium, and long term enabled the group's proposals to be strengthened and multiplied.

The main impacts of this initiative were the employment of three young people as park rangers by the NSV and another four as environmental educators, agroecological production and commercialisation in regional trade fairs and public procurement programs, and; the creation of one Private Natural Heritage Reserve (RPPN). Furthermore, after 13 years of planting, the first individuals of Juçara are entering the second cycle of seed production and are already contributing to other projects of the species' repopulation.

The "Sowing Sustainability" project has brought environmental conservation closer to local social demands and, in this way, has advanced in the recuperation and enrichment of more than 300 hectares and the implementation of another 50 hectares of agroecological intercropping systems. Furthermore, support for organic and agroecological certification of products and properties; the introduction of agroecological and organic foods, including Juçara pulp in school meals; and facilitating access to short circuit markets and public purchases (e.g., PNAE and PAA Brazilian programs) leveraged the number of families involved in the process, which went from 30 to 100.

5.4.3 Restoration Actors Network of the Paraíba Paulista Valley

The Paraíba Paulista Valley (VPP) is a region of approximately 1.4 million hectares that provides water to about 2 million inhabitants. The region is the main technological hub of Brazil. However, its rural economy is fragile (it represents only 1.4% of the local GDP), and its predominant use is pastures (41%) and degraded forests (41%) ([Padovezi et al., 2019](#)). Since the beginning of the water crisis in 2013-14, the VPP region has received special attention from the authorities for its important role in water supply. In addition, the waters of the Paraíba watershed move a large part of the industrial park along the Rio-São Paulo axis, responsible for a significant contribution to the national GDP.

In 2016, representatives from various segments of the local landscape forest restoration chain came together with the proposal to build - participatively - a regional Forest Development Plan (FDP) and cooperate to restore the local landscape and, at the same time, generate income for the local rural community. The FDP of the VPP identified that approximately 175,000 hectares occupied by pasture would be economically suitable to receive restoration projects with an economic goal ([ibid.](#)). However, despite this window of opportunity, local and regional organisations' articulation capacity and chain preparation to carry out this transformation in the landscape were fragile.

A group of people then moved on to identify and integrate the organisations and individuals involved with the restoration of the VPP and thus better understand the dynamics of forest restoration in the region, its opportunities, and limitations, and outline a strategy for collective action. In 2017, the VPP Restoration Actors Group (ARVP) comprised 141 organisations ([Andrade et al., 2019](#)).

The group was formed by mobilising a local leadership, which identified individuals and organisations with common demands and interests around forest restoration actions in the VPP. As discussion and collective actions advanced, other social actors joined. Three annual meetings were held so members could recognise each other personally, present their work, and share their ideas. The interactions provided by the two communication channels (email list and face-to-face meetings), together with the

FDP preparation activities, contributed to creating a vision of the future and common objectives, strengthening the bonds of trust among stakeholders. There were no well-defined governance mechanisms, and those discussed priorities with more time and willingness to participate in the mobilisations.

The departure of the main leader led to the demobilisation of part of the group. Later, the ARVP was invited to constitute the Technical Chamber of Forest Restoration (CT-RF) under the Paraíba do Sul Watershed Committee. This movement was intended to reconcile the demands of the ARVP with the demands of the CT-RF in an institutionalised space, with agendas defined in periodic meetings, and make them feasible through the State Water Fund. However, despite the advances in financing some initiatives, the discussions' institutionalisation reduced the spectrum of ARVP's agendas. Currently, only part of the original group remains active in the CT-RF.

Another demobilising factor was the power centralisation by large NGOs, also ARVP members. Although they have greatly contributed to the mobilisation of actors and the elaboration of analyses and documents, which are important for creating the ARVP's vision of the future, these organisations have occupied the niche of mediators for accessing international funding. In this sense, while they have been important in building bridges, they also occupy decision-making spaces in local socio-economic development.

The ARVP network has provided mutual recognition and integration of various social actors involved in the VPP forest restoration chain. Among its results was creating and strengthening the network's identity in the landscape and with external actors, who began to identify the group as a social capital for developing projects and public policies. Furthermore, strengthening this capacity for mobilisation and collective action facilitated interaction between NGOs, municipalities, companies, rural producers, and others. One of the products of these interactions was the knowledge and resource dissemination that made possible the execution of several forest restoration experiences, training in project management, development of payments for ecosystem services instruments, and participation in public policies such as the Atlantic Forest Connection Project (Buzati et al., no prelo).

5.5 DISCUSSION

Social Innovation (SI) is a collective action in search of solutions where knowledge exchange, networks of relationships and social organisations improve the capacity of collaboration between people, increasing consecutively the local social capital (Bourdieu, 1986; Mulgan et al., 2007). When this SI also brings benefits to nature, we have an SEI. In this section, we will deepen the discussion on some peculiar aspects captured in the description of the three case studies from the perspective of SI-FLR (Table 5).

The cases studied highlighted the SI-FLR's transformative potential. In the first case, family farmers organised themselves into Agroecology Nuclei to exchange knowledge and plan collective practices and, as a result, recovered native vegetation, modified their production systems, and influenced other farmers to do the same. In the second case, a social learning process influenced social values and mobilised local agents for the repopulation and sustainable use of the Juçara palm tree. In the third

case, a group of organisations elaborated a common vision for the future, initiated cooperation to recuperate a degraded landscape, and collaborated in public policy-making about land use.

The landscape context is influenced by extrinsic and intrinsic factors and, mainly, by the agents' perception of the cause-effect relationships of these factors, such as cascading consequences and feedback processes (Fedele et al., 2017; Zasada et al., 2017; Castro-Arce & Vanclay, 2019). In the three case studies, we explored, dissatisfaction with the perceived context and reflexive understanding about the opportunity to design and experiment through structured and participatory projects resulted in new values, new attitudes, new ways of producing food and managing native species, generating income, and increasing nature's contribution to people. Regardless of the context, landscape stewards mobilise only when they understand that their attitude could change the unwanted context and realised that there was a window of opportunity to do so (Biggs et al., 2010; F. R. Westley et al., 2013).

The SI-FLR only happens when the quest for a better local quality of life is articulated with the interests of institutions and organisations operating within and outside the landscape (Castro-Arce & Vanclay, 2019). The presented SEI emerged when the needs of local agents and regional interests converged to build knowledge, share experiences, and plan activities to make a new food production system feasible, generate income by managing native species, or minimise the unwanted scenario of a new prolonged water crisis. When this meeting of interests (local and regional) is legitimate and leaders emerge to facilitate communication and lead the development steps, landscape stewards become involved voluntarily, initiating the SEI building process SEI (Biggs et al., 2010; McCarthy et al., 2014; Sarkki et al., 2019).

Processes of SIs can be initiated by different governance configurations within the triangle of power whose vertices are represented by: governments, businesses, and civil society (Nicholls & Murdock, 2012; Arts, 2014). When this governance conformation succeeds in promoting the protagonism of landscape stewards in the cyclical stages of design, implementation and adaptive management of landscapes and forests, a favourable environment is created for SEI to emerge (Dias & Partidário, 2019; Moraes et al., 2021).

The recognition of the socio-innovative role of landscape stewards is fundamental to ensure their permanence throughout SI-FLR development and the continuous mobilisation of these agents is indispensable for the expected impacts to be achieved (Moore & Tjornbo, 2012; Cockburn et al., 2019). The case studies demonstrated that diverse social actors could act as landscape stewards. By being recognised as such and empowered by the analysed initiatives, family farmers, women, youth, landowners, and organisations in the forest restoration chain have voluntarily assumed the FLR protagonism. Bridging organisations (social movements, local or regional governmental and non-governmental organisations) can assist the empowerment of these agents by facilitating social learning, promoting reflexive moments, and connecting these groups with other agents within and outside the landscape.

Table 5. Cases of Social Innovative – Forest and Landscape Restoration (SI-FLR).

SI-FLR cases	Context	Why “Reason”	Who “Agents”	How? “Process”	Impacts
seven Agroecology Nuclei (AN) emerge in agrarian reform settlements to implement agroforestry systems in response to the "Sowing Agroforests" stimulus	In line with the agroecological production policy guidelines established by the MST's Agrarian Programme, a project to restore degraded areas has started in rural settlements in Vale do Rio Doce, Minas Gerais.	The local need to build knowledge in agroecology, share experiences and plan collective activities leveraged the AN constitution. The AN organisation was not organised by MST but was facilitated by its organisational structure.	Family farmers from agrarian reform settlements convinced and motivated to produce in agroecological systems. The project's multidisciplinary team facilitated the groups' organizational process.	The "Peasant to Peasant" methodology was essential for the organisation of collective action. It encouraged reflexive moments, promoted dialogue and the exchange of knowledge. This dialectic favoured the self-recognition of the settlers as agents of their own reality.	The AN continued even after the project ended, expanding their actions and influence on other settlements. On a voluntary basis, they have recovered degraded areas and riparian forests, built structures to contain erosion and implemented agroecological backyards. They have promoted environmental education actions, strengthening social cohesion between the settlers' communities.
The social learning promoted by the project "Sowing sustainability" has changed values, social relations, and the local agricultural production system.	Faced with the pressure caused by deforestation and illegal extraction of Juçara, the recovery of 160 hectares starts in the surroundings protected area (NSV/ PESM), in São Paulo.	The local community recognised the opportunity to generate income through Juçara palm and other native species sustainable use.	Women, youth, and landowners recognized the benefits of local biodiversity. The project team demonstrated a strong ability to build relationships of trust with diverse sectors of society.	Social learning processes on the use and sustainable management of the Juçara palm, based on agroecology principles, with joint efforts to build nurseries, sow seeds and plant Juçara seedlings.	After the conclusion of the project, another 100 hectares were restored and 200ha were enriched with Juçara; young people were employed in socio-environmental activities and products from local socio-biodiversity began to be sold in regional fairs and public procurement programmes.
A group of individuals and organisations drew up a regional Forest Development Plan and initiated a restorative co-operation network.	Following the worst water crisis in history, a collective construction plan started to restore the landscape connecting the two largest cities in Brazil.	Low production capacity, coupled with the 2013-2014 water crisis, moved organisations to seek solutions for landscape restoration.	Seed collectors, seedling producers, governmental and non-governmental organisations that plan, execute and foster forest restoration projects in the region.	A local leadership, supported by several local and regional organisations, mobilises restoration actors in the Paraíba Paulista Valley to identify common demands and interests to drive landscape restoration.	Knowledge and resource dissemination, enabling the funding of several forest restoration experiences; capacity building actions for project management; development of instruments for payment for ecosystem services; and network members' participation in public policy.

In the cases analysed, it was observed that multidisciplinary teams and social participation were essential for the four governance capacities (trust-building, practical skills and self-organisation, flexibility and adaptation, and "bottom-up connection"), which are essential to put into practice a socio-innovative vision of the future (Padovezi et al., 2022). In the Minas Gerais case, the use of the "Peasant to Peasant" methodology by a multidisciplinary team was key for the rural settlers to recognise themselves as agents of transformation of their own reality. In the São Paulo cases, professionals trained in the application of participatory approaches and methodologies, such as *mutirões*, identification of common demands and interests and participatory planning, catalysed social learning processes and concrete actions that contributed to the empowerment of the social innovators' group, paving the way for SI-FLR progress.

Although bridge organisations are important actors in the consolidation of SEI as they facilitate the access of landscape stewards to multiple resources and capitals, when focusing on their own institutional goals, they can - voluntarily or involuntarily - contribute to the dismantling of SEI processes. This dark side of SI (Fougère & Meriläinen, 2019) can be exacerbated when there is a local leadership change, as observed in the case of VPP Restoration Actors.

5.6 CONCLUSION

The cases studied highlighted that SEI happens and can be stimulated by FLR initiatives. The guiding questions of the SI-FLR theoretical framework helped to systematise and understand five determinant factors for the emergence of the experiences presented: 1) Context; 2) Motive; 3) Agents; 4) Process, and 5) Impacts.

The three case studies' in-depth analysis pointed to five main determinant of an SI-FLR: 1) Local agents perceive the current context as undesirable; 2) Multidisciplinary teams, trained in participatory methodologies, facilitate reflexive processes, favour social learning, assist future vision construction and the collective action planning; 3) Landscape stewards assume the protagonism of experimenting and proposing solutions when; 4) They perceive the window of opportunity capable of moving the necessary capitals to change the undesired scenario; 5) Empowered local leaderships and bridging institutions aware of their facilitating role.

The innovative character of this research consists in exploring in a systematic manner some determining factors that promote a more inclusive landscape restoration, where landscape stewards assume the protagonism of the transformation of the social-ecological system they belong to. Although this research brings essential elements to understand this process, several questions need to be deepened for FLR initiatives to promote SEI such as: What are the profiles of landscape stewardship that best align with SI-FLR objectives? What are the key individual and social network capacities to promote an SI-FLR? Are there more conducive governance models for SI-FLR? How can FLR projects create institutional environments more supportive to SI-FLR emergence?

CHAPTER 6. NETWORKS OF NATIVE SEED COLLECTORS: SOWING SOCIAL INNOVATION IN BRAZIL

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In addition to presenting five more SI-FLR cases, this chapter applies network theory to examine the bottom-up perspective (see chapter 3) through the relationships and exchange flows between organisations involved in native seed collector networks in Brazil. It is a scientific paper written by me in collaboration with my supervisors, a professor at the Federal University of Viçosa (Brazil) and other researchers, activists and seed collectors directly involved in the networks analysed. The paper was submitted to *People and Nature* journal on January 23rd, 2023.

Author Contributions: A.P., L.S., C.A., R.C., E.M.; conceived the ideas and designed methodology; A.P.; E.M.; E.D., N.A., F.S., E.M.C. collected the data; A.P., C.A., E.M. analysed the data; A.P. led the writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

ABSTRACT:

- I. We are currently in a time where global society is coming together to restore social-ecological landscapes by mobilising capital and creating networks. Social innovations (SI) can help make Forest and Landscape Restoration (FLR) initiatives more inclusive, benefitting local communities by reconfiguring social structures.
- II. We argue that traditional groups such as Indigenous, Kalunga, and Geraizeiros, as well as rural and peri-urban communities and other social actors, are implementing Socially Innovative Forest and Landscape Restoration (SIFLR) in Brazil. We used mixed methods and social network analysis on data from nine Brazilian Networks of Native Seed Collectors (NNSCs) to investigate this.
- III. Our findings show that from 2018 to 2021, these NNSCs received US\$ 12 million in investment, producing 180 tons of native seeds and generating US\$ 1.01 million for 997 seed collectors, with 55% of them being women. Additionally, 46% of the collectors are from traditional groups, and 23% relied solely on seed collection as income. Government, non-governmental, and universities are the most common organisations involved in these NNSCs. Connected mainly by partnerships, these networks facilitate knowledge exchange and political action cooperation.
- IV. The thorough examination of five cases through the SIFLR framework revealed that local experimentation, familiarity with administrative procedures and active participation in decision-making processes influence the agency power of social-ecological innovators.

KEYWORDS: Forest and Landscape Restoration; Social-Ecological Innovation; Social Network Analyses, Agency Power; Environmental Governance.

6.1 INTRODUCTION

We live in a historical moment in which global society is beginning to mobilise capital and articulate actions to restore complex, multiverse social-ecological landscapes in an attempt to secure human well-being and mitigate the effects of climate change (Fischer et al., 2020). This moment is supported by human values on nature that advocate for the need to carve pathways towards a more just and sustainable future (IPBES, 2022). Future visions and goals crafted from these values promote new purposes and building directions that can lead to transformative social change¹⁸. The core values forming the basis of this transformative governance focus on partnerships, social learning, and co-creation for innovation and have characteristics such as interactivity, reflexivity, support of democratic institutions, and paying attention to principles of respect, equity and social inclusion (*ibid*).

Aiming to foster public-private collaboration, increase the sharing of knowledge and practices, and improve the financing and monitoring mechanisms needed to scale up ecosystem restoration, the United Nations Decade of Ecosystem Restoration represents a global effort towards this transformation (FAO, 2021). In terrestrial environments, the Restoration Decade supports and is supported by Forest and Landscape Restoration (FLR). FLR initiatives aim to restore the ecological functionality of degraded landscapes while improving human well-being (Lamb et al., 2012).

Empowered by an ecological modernisation discourse (i.e., ecosystem services plus green jobs provision), FLR has pursued its dual objective by dialoguing with stakeholders interested in land use and strengthening a landscape governance approach. In doing so, FLR has gained a foothold on the international environmental policy agenda (Reinecke & Blum, 2018).

Although democratic and promising, FLR is not a trivial pathway. It requires a collaborative approach involving the co-creation and co-management of supportive and cooperative environments that promote innovative solutions tailored to a wide range of contexts and specific interests (Chazdon et al., 2020). This is a task that governments and markets have struggled to accomplish (Fagan et al., 2020). The rationale behind this may lie in the FLR's purpose of proactively transforming social-ecological systems to another desirable state, which implies substantial changes in social organisation, institutional and productive arrangements, and the governance ruling them. Such transformation calls for systemic changes, which may threaten the inertia of relationships forged through the dominant political and economic powers, thus restricting the space for innovation and new agendas (Chaffin et al., 2016).

In Brazil, where there is a legal demand to restore ca. 21 million hectares, FLR programmes still have weak governance and implementation structures, low funding capacity, uncoordinated policy instruments, and disorganised supply chains (Bustamante et al., 2019; Urzedo et al., 2019; Padovezi 2023, in review). All this contributes to making the domestic native seed market seasonal and peripheral (Schmidt et al., 2019). Unlike crop seeds, which production is linked to a well-consolidated market, the domestic demand for native seeds is highly dependent on environmental enforcement, which has been weakened in Brazil over the last decade (Dockendorff et al., 2022; Vale et al., 2021). Native seeds are essential for ecological restoration (Jalonen et al., 2018). When natural regeneration

¹⁸ Transformative change is defined by the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES) as “a fundamental, system-wide reorganisation across technological, economic and social factors, including paradigms, goals and values, needed for the conservation and sustainable use of biodiversity, good quality of life and sustainable development.” (IPBES, 2019; p. 14)

is not an option, terrestrial ecological restoration depends on people's efforts to collect, store, transport and sow native seeds, either by direct planting or seedling production and planting (Gann et al., 2019). Therefore, regardless of the strategies and methods adopted, collectors of native seeds are fundamental to any FLR initiative (Hancock et al., 2020; Schmidt et al., 2019).

From 2000 to 2006, the Brazilian Ministry of Environment invested about US\$ 4 million to form eight public and private networks to structure and enhance technical and scientific knowledge, promoting the institutional environment to leverage native seed production in the country. Rural communities were then trained to structure local seed supply systems (Ribeiro-Oliveira & Ranal, 2014). After the end of this brief and limited public funding, a new generation of native seed-collecting groups emerged, this time, focused on providing native seeds for restoration projects while generating benefits for rural communities (e.g., Xingu Seed Network) (Piña-Rodrigues et al., 2020; Durigan et al., 2013). This second generation has inspired environmental compensation programs, philanthropic investors, bilateral cooperation, governmental agencies and other communities, expanding seed-collecting groups across Brazil (Piña-Rodrigues et al., 2020; Sampaio et al., 2020). So far, more than 1,000 collectors have sold almost 420 tons of native seeds, generating a family income increase of about US\$ 260 per year. Moreover, there is room for additional seed production, as supply still falls short of the forecasted demand of 3.6 to 15.6 thousand tons from mandatory restoration initiatives in Brazil (Urzedo et al., 2020).

By increasing exchange flows between local ecological knowledge and practices (e.g., species distribution in the landscape, local phenology of flowers and fruits, and seed management) with other knowledge systems and practices, Networks of Native Seed Collectors (NNSCs) have improved the connections between local social needs (e.g., income generation, recognition of knowledge, improved well-being) while improving FLR supply chain. Thus, NNSC have contributed to the Brazilian FLR efficiency.

This paper argues that NNSCs have also been protagonists of social-ecological innovations from the Socially Innovative Forest and Landscape Restoration (SIFLR) perspective. SIFLR is an analytical framework that highlights the role of landscape stewardship groups in promoting social innovations that increase the efficiency and social participation on FLR initiatives, generating tangible benefits for local livelihoods (Padovezi et al., 2022). We shed light on NNSCs and their cultural, social, economic and environmental relevance for the global effort to restore degraded forests and ecosystems, collaborating with the "Land Stewardship and Biocultural Conservation" pathway towards a just and sustainable future (IPBES, 2022).

We develop our argument by presenting data on the number of seed collectors, investments received, income generated, and tons of seeds produced by 9 Brazilian NNSCs. In addition, we delved into the history, context, and social network analysis of four Brazilian NNSCs, in which five study cases were described through SIFLR and actor-oriented approach to rural development.

6.2 CONCEPTUAL GROUNDING

6.2.1 Socially Innovative Forest and Landscape Restoration (SIFLR)

SIFLR stands for social innovation (SI) in Forest and Landscape Restoration (FLR). It emphasises the role of SI in developing context-specific solutions to address local social needs while improving the effectiveness of social participation in FLR initiatives (Padovezi et al., 2022). SIFLR takes the political

stance to empower local livelihoods in designing and implementing solutions to leverage landscape restoration.

Social innovation refers to *“the reconfiguration of social practices in response to societal challenges, which seeks to enhance outcomes on societal well-being and necessarily includes the engagement of civil society actors”* (Polman et al., 2017: p. 1). SI emergence and development are dependent on the time-space context and four core components: agency power, social learning, social capital, and collective action (Moulaert, 2013; Moore et al., 2018; Secco et al., 2020; Brondizio et al., 2021).

Agency power represents an intentional action to change a social situation, e.g., indigenous communities influencing landowners upstream of their territory to restore riparian areas. Social learning refers to how these individuals acquire new knowledge, skills and values to solve a problem; for example, seed collectors share discoveries on how best to collect and store seeds through informal conversations. Social capital represents the network of social relationships promoting cooperation and collaboration, increasing access to resources and opportunities. For example, by working together and sharing knowledge and resources, native seed collectors can strengthen social ties in their community and with other stakeholders. Finally, collective action¹⁹ represents the coordinated effort to achieve a specific goal, for example, a collective effort among groups of seed collectors to pressure the government for regulations. In an appropriate context, a coordination between these four elements may lead to social innovation.

Once triggered, SI can develop and scale in (i.e. changing the attitudes and values of its participants and beneficiaries), scale up (i.e. inspiring others to replicate or adapt the innovative social solutions in different time-space contexts), and scale out (i.e. influencing new public policies or novel regional governance arrangements) (Moore et al., 2015).

6.2.2 Actor-oriented approach to Rural Development

The actor-oriented approach to rural development (Long, 2003) is a conceptual framework that places actors' agency at the centre of rural development processes. This approach recognises that actors hold varying levels of influential power and that their interests, values, and worldviews can significantly shape rural development outcomes. It also stresses the significance of local knowledge and social networks in promoting sustainable and equitable development outcomes. Hence, the actor-oriented approach highlights the importance of building social capital and trust between actors to leverage collective action to support the implementation of rural development initiatives.

6.2.3 Social Network Analyses (SNA)

SNA has been used to explain the processes and outcomes of collective action (Paletto et al., 2016) and allows the exploration of its internal drivers and dynamics. For instance, Pisani et al. (2014) applied SNA to evaluate transnational cooperation projects and demonstrated that the network structures and dynamics of local action groups facilitated knowledge and information sharing, stimulating social learning. Recently, SNA has been applied to map the social landscape of an FLR initiative (Buckingham et al., 2020).

¹⁹ While social innovation and collective action are closely related, they represent distinct but complementary mechanisms. Social innovation focuses on the process and outcomes of generating new ideas, while collective action focuses on mobilizing resources and the needed support to implement them.

6.3 MATERIALS AND METHODS

6.3.1 Case studies selection and data collection

Brazil was chosen as the *locus* of this research because it has a robust institutional framework in the environmental policy domain, policy instruments to promote FLR and presents a multitude of actor-oriented to rural development initiatives (Chazdon et al., 2022; Dockendorff et al., 2022). Brazil is a large and megadiverse country, with over 214 million people³. Despite being one of the world's largest economies (GDP = US\$ 1.61 trillion, 2021²⁰), Brazil is marked by deep social inequality (Gini Index = 52.9, 2021³), rural poverty, and uneven distribution of land (Kato et al., 2020). In addition, the country recorded one of the highest murder rates in the world of land and environmental activists (Global Witness, 2020).

We collected data in three phases: i) an exploratory round of semi-structured interviews, ii) desk-based research with a second round of interviews; and iii) a field visit with workshops and a third round of interviews.

Phase i - Based on available literature and the author's knowledge, we mapped key FLR actors in Brazil. From January to February 2021, we interviewed 15 of them online, each for ~90 minutes, aiming to identify FLR initiatives meeting the following criteria: 1) were relatively recent (formalised not before 2015); 2) met a clear local social demand; 3) promoted voluntary engagement of civil society; 4) enabled new partnerships (expanding network); 5) promoted social learning, and; 6) generated benefits for local communities and nature. These six criteria represent key characteristics of SIFLR, as identified by Padovezi et al., 2022b.

Phase ii - From February to September 2021, we conducted: a) desk research on 9 Brazilian NNSCs identified in phase i; and b) remote semi-structured interviews (~60 minutes each) with 27 individuals from 18 organisations in these networks. In addition to delving into the six SIFLR characteristics, we explored their organisational structures, seed production and commercialisation systems. These interviews were also helpful for defining and planning field visits for data collection in *phase iii*. The "Instituto Socioambiental" (socioambiental.org) and "Agroicone" (agroicone.com.br) assisted in identifying and contacting the interviewees in this phase.

Phase iii – Consisted of field visits conducted from October 2021 to January 2022. Although nine NNSCs were initially envisioned, Sars-Covid-19 imposed health restrictions and four NNSCs were selected for in-depth analysis. These included: Sao Francisco River Integration Project Seed Network (case study 1: SFSN); Arboretum Programme (case study 2: ARBORETUM); "Nascentes Geraizeiras" seed collectors (case study 3: GERAIZEIROS), and; the partnership between the *Cerrado de Pé* Association and the *Cerrado* Seed Network (case study 4: ACP+RSC). These NNSCs are distributed in three Brazilian biomes (Figure 7). During field visits, we followed the native seed collection, processing, storage, commercialisation, and related administrative procedures. In addition, we conducted 24 face-to-face semi-structured interviews with local leaders, technicians, and seed collectors (6 in each NNSC visited); and 7 "Future Search Conference" workshops (Hurworth, 2007) (1 in SFSN, 2 in ARBORETUM, 3 in GERAIZEIROS, and 1 in ACP+RSC)²¹. A total of 41 people (6 in SFSN, 15

²⁰ DataBank | The World Bank. (n.d.). Retrieved 15 May 2023, from <https://databank.worldbank.org/home.aspx>

²¹ The number of workshops and respective participants was given according to the logistics and agenda availability of seed collectors and local partners.

in ARBORETUM, 18 in GERAIZEIROS, and 12 in ACP+RSC)²² attended these seminars. While the interviews were directed at NNSCs leaders and senior collectors, the seminars were open to all partners and collectors. The guest list for each activity was determined by the NNSC leaders considering the objectives of this research.

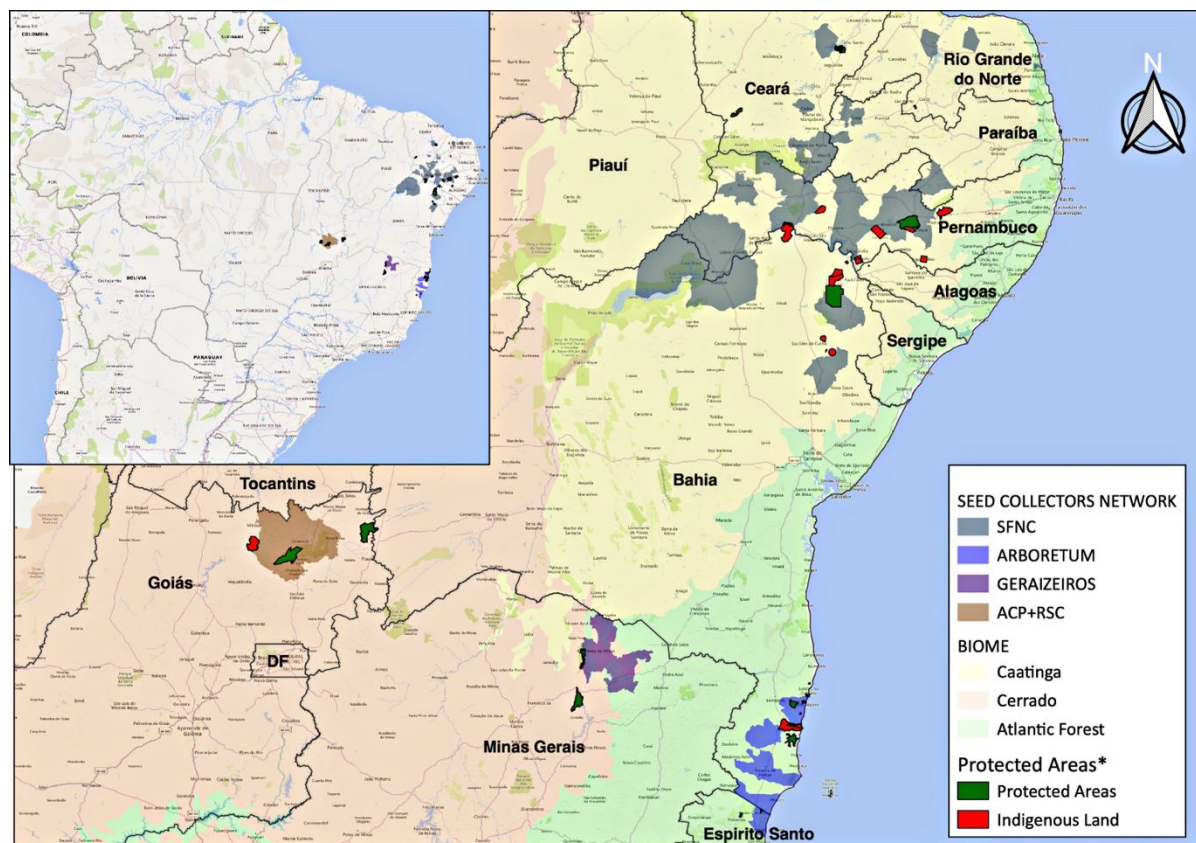


Figure 7. Location of seed collection areas of the four networks of native seed collectors analysed.

SFSN = Sao Francisco Seed Network; ARBORETUM = Arboretum programme; GERAIZEIROS = Nascentes Geraizeiras seed collectors; ACP+RSC = Cerrado em Pé Association (ACP) And Cerrado Seeds Network Partnership (RSC).

6.3.2 Data Analyses

Mixed methods and multiple sources were applied and combined through data triangulation. *Phase I* and *II* interviews were recorded through Zoom, and *Phase III* interviews and workshops were taped with a digital audio recorder. Visual outcomes from the workshops were captured through digital photos, and participant observations were registered in field notebooks. The results section concisely presents the history, context, organisational structures, and main achievements of the nine NNSCs.

²² As the data collection method involves traditional people and communities, the research was protocolled and followed the Brazilian context-fitting parameters required by the Ethics Committee at the School of Arts, Sciences and Humanities at the University São Paulo (USP) (CAAE: 47115520.2.0000.5390).

Social Network Analyses

SNA was applied in the four study cases (Figure 7). In this analysis, nodes represent organisations, while connections (edges) symbolise links between organisations through which information is exchanged, either material (e.g., native seed trade) or non-material (e.g., knowledge, political actions, project activities, and culture) (Garton et al., 1997). All data collection methods contributed to identifying organisations, their connections, and information exchange flows. Subsequent email exchanges and online meetings were fundamental to analysing and designing the networks, which were validated by their representatives.

Node classification was crafted through workshops and interviews, resulting in a comprehensive categorisation of 17 types and six roles. Connections were conceived as bidirectional, are represented by five types where six types of exchange flow can co-occur and can be formal or informal. Figure 8 presents a hypothetical example and the description of all possible types and role of organisations, connection types and exchange flows used to design the networks.

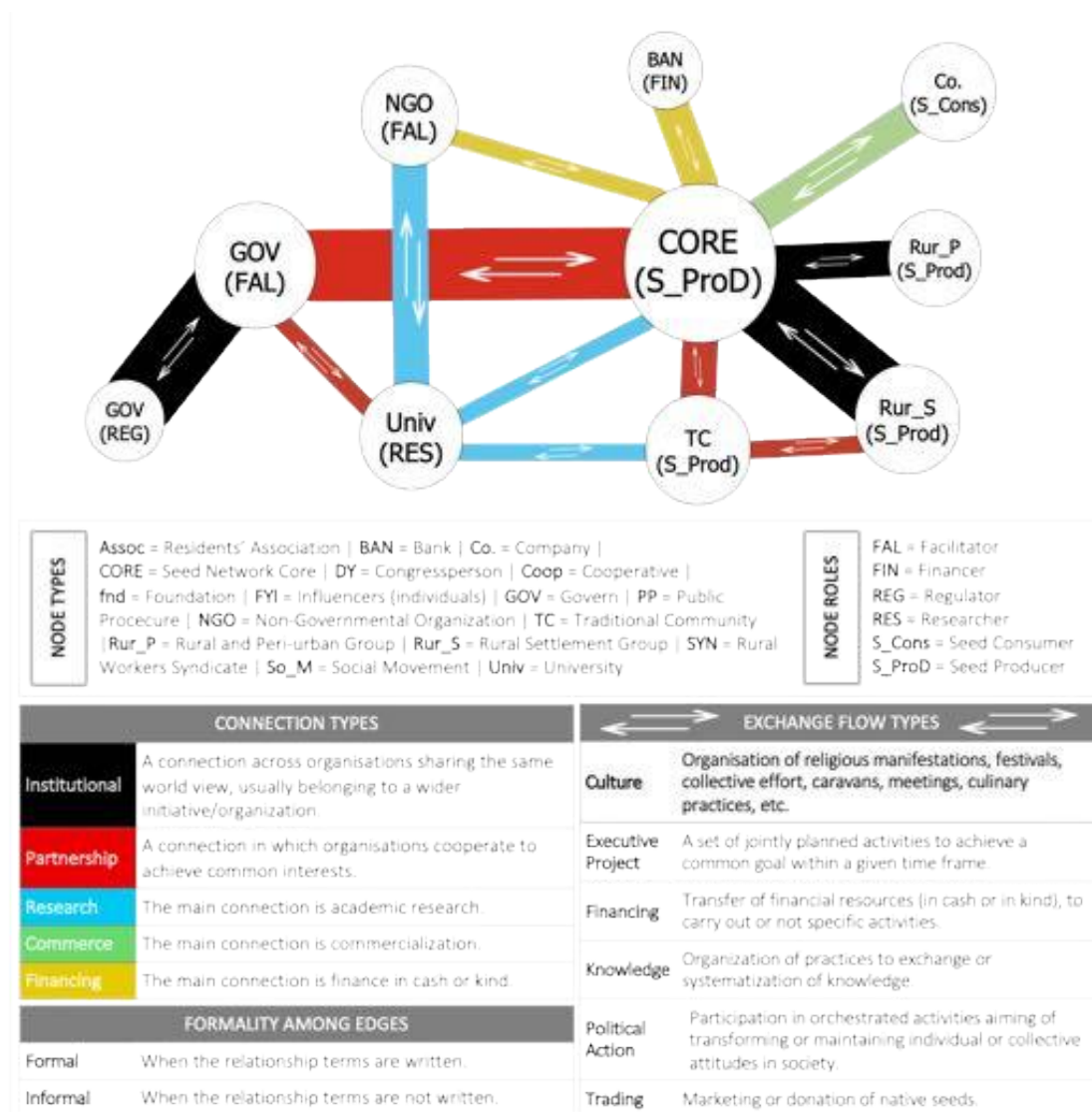


Figure 8. A hypothetical example of a Network of Native Seed Collectors. Node types and roles, connection types, formality, and exchange flow types.

The four NNSCs were drawn and analysed with Gephi and MS Excel software support. Betweenness centrality distribution (Brandes, 2001) is represented by the size of the nodes while colours characterise the network's modularity (Lambiotte et al., 2014).

Connection types are represented by different colours, while their thicknesses represent the exchange intensity, from 0 (no line, no flow) to 4 (thickest, intense exchange flow). The thickness was determined by assuming integer values resulting from the weighted average between the values of each exchange flow present in each connection. For the flows of 'culture', ('knowledge', and 'political action', the interviewees of phase iii assigned scores from 0 to 4 according to the frequency with which these exchanges occurred from 2018 to 2021 (0 = did not happen; 1 = once a year; 2 = once a semester; 3 = once every four months; 4 = at least once a quarter). As the data about the 'executive project' flow were collected in a binary form (exists or does not exist), and they are directly related to the flows ('culture', 'knowledge', and 'political action'), we used the weighted average between these flows to calculate the 'executive project' value. The flows 'financing' and 'commerce' were defined by median quartiles (0 = zero; Q1 = 1; Q2 = 2; Q3 = 3; Q4 = 4), according to the investment value (in cash or cash on hand) and to the kilos of seeds trading (purchase and sale or donation), respectively (values in Table 6).

6.4 RESULTS

6.4.1 Networks of Seed Collectors in Brazil

In the first phase of the research, 25 Brazilian FLR initiatives linked to the characteristics of the SIFLR theoretical framework were identified, nine of which were Networks of Native Seed Collectors (NNSCs). These NNSCs received investments of US\$ 12 million between 2018 and 2021. In this period, they collectively produced 180 tons of native seeds, generating US\$ 1.01 million for 997 seed collectors (US\$265 per capita per year, on average²³). Of this total, 80% are rural workers, 46% are traditional people (indigenous, *Kalunga*, and *Geraizeiros*) and 55% are women. Although 23% of the collectors depend exclusively on seed collection for their income, the majority (76%) have another economic activity, providing an income of up to US\$ 300 per month. In addition to native seed collection, these NNSCs also undertake other economic activities: recovery of native vegetation, agroecological food production, seedling production and handicrafts. In Table 6, the main characteristics of the nine NNSCs are synthesised and listed in order from the most (in the upper part) to the least productive in terms of tons of seeds produced between 2018-2021.

²³ This figure does not consider SFSN data. Since the seed collectors in this NNSC are employees receiving an average annual salary of US\$ 4,644.

Table 6. Information on nine Brazilian Network of Native Seed Collectors. In bold, the four NNSCs analysed in depth in this chapter.

Name	Starting Year	Formation Year	Organizational Formalization	other activities	Nº of seed collectors (women)	% of collectors who are rural workers	Average monthly income of seed collectors not counting seed collection activity	% of collectors with exclusive income from native seeds	tons of seeds produced from 2018 to 2021	investments received from 2018 to 2021*	value of sales from 2018 to 2021
Xingu Seed Network Association	2007	2014	ASSOCIATION	Agroecological food production	568 (370)	90% (more than 60% are traditional community)	not informed	20%	97,70	\$ 2.808.989	\$ 639.287
Cerrado de Pé association and Cerrado Seed Network (ACP+RSC)	2001	2017	PARTNERSHIP established between an agreement between a non-governmental organisation (RSC) and a seed collectors' association (ACP) made up of quilombolas, rural settlers, urban and periurban dwellers.	Native Vegetation Recovery	61 (31)	57% (over half are traditional community)	60% = \$ 101 to \$ 200	51%	28,50	\$ 2.324.680	\$ 176.288
Seed Network of the São Francisco Integration Project (SNSF)	2015	2015	PROGRAMME administered by a public university, aiming of assist the environmental compensation efforts of the São Francisco river trasposition. All seed collectors are formally hired by the program.	Native Vegetation Recovery, Seedling Production	41 (2)	46%	-	100%	19,10	\$ 4.261.914	**
Amazonia Portal Seed Network	2010	2016	COOPERATIVE	Native Vegetation Recovery, Agroecological food production, Handicrafts	70 (32)	100% (rural communities and settlements)	70% ≈ \$ 101 to \$ 200 30% ≈ \$ 201 to \$ 300	10%	15,33	\$ 774.893	\$ 71.840
Arboretum Program Seed Network (ARBORETUM)	2013	2018	PROGRAM administrated by a private non-profit organisation. The seed collectors nucleis are institutionalised by cooperation agreement between the Arboretum program and organized seed collectors groups.	Native Vegetation Recovery, Seedling Production, Agroecological food production, Forest management of timber and non-timber products, Tourism, Handicrafts	53 (15)	100% (half are traditional community)	80% ≈ \$ 101 to \$ 200 20% ≈ \$ 201 to \$ 300	0%	7,60	\$ 1.162.340	\$ 16.195
"Nascentes Gerazeiras" seed collectors (GERAIZEIROS)	2017	2021	COOPERATIVE made up of local groups of seed collectors and restorationists, mostly Gerazeiros people.	Native Vegetation Recovery, Agroecological food production, Forest management of non-timber products, Tourism, Handicrafts	29 (17)	(100%) over 80% are traditional community	17% up to \$ 100 60% ≈ \$ 101 to \$ 200 23% ≈ \$ 201 to \$ 300	7%	3,90	\$ 23.247	\$ 29.833
Vale do Ribeira Seed Network	2017	not formalized	seed sales has been carried out by a single microentrepreneur	Seedling production, Food production	32 (22)	(100%) over 80% are traditional community	not informed	40%	2,48	\$ 193.723	\$ 42.813
Seed Collectors of the Paraíba Valley	2020	not formalized	seed sales has been carried out by a cooperative	Agroecological food production	21 (12)	(100%) over 80% of agrarian reform settlers	40% ≈ \$ 101 to \$ 200 20% ≈ \$ 201 to \$ 200 20% ≈ \$ 201 to \$ 300	70%	2,28	\$ 154.979	\$ 28.090
Rio Doce Seeds and Seedlings Network	2018	not formalized	seed sales has been carried out by an association	not informed	102 (47)	not informed	not informed	not informed	1,50	\$ 11.914	\$ 12.205

* Commercialisation of native seeds is not considered | ** SFSN does not commercialise native seeds

For currency conversion, we consider the exchange rate of (US\$ 1 = R\$ 5,162) (01/04/21).

<http://www.ipeadata.gov.br/ExibeSerie.aspx?serid=38590&module=M>

6.4.2 Networks of seed collector and related SIFLR cases

São Francisco seed network (SFSN): Sowing Pankararu nursery

This network was set up in 2015 to strengthen the productive chain of regional native seeds and seedlings, driven as a compensation measure for the environmental impact of the *São Francisco* River Integration Project (PISF) (Damasceno et al., 2021). The SFSN is initiative managed by the Centre for Ecology and Environmental Monitoring of the Federal University of *São Francisco* Valley (NEMA/UNIVASF) with financial support from the Brazilian Ministry of Regional Development (NEMA/UNIVASF, 2022).

SNSF has a well-organised structure encompassing strategic planning, executive management, and research coordinations. Additionally, an administrative support team is responsible for contracts, bookkeeping, and accounting. SNSF counts on 41 employees (2 women) working in two seed collectors' teams, receiving a salary of US\$ 387/month. Most of them (64%) came from urban and peri-urban areas.

The primary use of collected native seeds are research and implementation of restoration models in areas impacted by the PISF infrastructure work (56%). A small percentage of seeds (2%) is destined for external research institutes, 0.3% for seedling production in nurseries managed by NEMA/UNIVASF and (4.9%) for 116 partner nurseries. Including the *Pankararu* nursery, located in the indigenous community *Bem Querer de Cima*.

Among the native species produced in the *Pankararu* nursery, the *croá* (*Neoglaziovia variegata*) stands out for being the main raw material used to make the '*praiá*', a costume used in sacred rituals of enormous significance for the *Pankararu* people cultural identity and social organisation (TVP, 2017). Since 2019, this nursery is also fulfilling demands for regional restoration projects. However, since the council of *Pankararu* chiefs strongly influences its planning, the priority of the nursery has been the production of *croá*, *umbu* (*Spondias tuberosa*) and other native plants used in rituals, to restore the *Pankararu* territory itself.

The decision of the council of caciques to increase the production of seedlings of these species is the result of a process of revaluing the *Pankararu* culture, which is also manifested in musical and cultural events for the non-indigenous people. The funds raised from seedling sales, regional restoration projects, and musical and cultural exhibitions are largely invested in the *Pankararu* communities. All the labour (intellectual, artistic, or physical) involved in these activities comes from the *Pankararu* people. Thus, cultural practices that used to be voluntary are now remunerated, starting a circular economy that prioritises applying financial capital in the local human, social and cultural capital.

According to the *Pankararu* people, SFSN has strengthened their community by providing access to native seeds and exchanging information through courses and technical visits. Producing native species used in sacred rituals, the nursery has gained recognition within and outside the *Pankararu* people, becoming a space for socio-environmental practices and integration between indigenous and non-indigenous communities.

Arboretum programme (ARBORETUM): sowing knowledge, highlighting invisible local communities

The ARBORETUM programme locates in Bahian *hileia* (*Atlantic Forest*), a landscape with one of the highest levels of plant diversity on the planet (Thomas et al., 1998). It was conceived by the Brazilian Forest Service (SFB) with the support of the federal environmental agency and began in 2013 through a conduct adjustment, in which the public prosecutor demanded pulp and paper companies to support the environmental compliance of rural properties in the landscape.

SFB, Botanical Garden of Rio de Janeiro, State Secretary for the Environment and Water Resources of Bahia and the State University of Bahia form the ARBORETUM management council. *Fundação José Silveira*, a nongovernmental organisation, oversees the administrative and financial coordination, while *Embrapa Tabuleiros Costeiros*, a public scientific agricultural enterprise, oversees the scientific coordination.

There are 53 seed collectors (15 women) distributed in 7 groups or nuclei and organized in associations or cooperatives partners of with Arboretum. Most of them are family farmers (75%), many living in traditional communities (50%) and agrarian reform settlers. The seed production is destined to the Arboretum programme, which has commercialised part of it. Below we present the history of two nuclei, *Juçara* and *Jatobá*.

Juçara Nucleus

Back in 2002, residents of *Córrego do Artur* (*Conceição da Barra* municipality, *Espírito Santo* state, Brazil) were worried because they had no access to basic public services like school transportation, medical assistance, and roads. They had weak social network and felt neglected by the local government to be far from the city centre.

In 2013, they formed the *Córrego do Artur* Family Farmers' Association (AAFCA) and collaborated with *Rio Preto* National Forest in identifying native species, collecting seeds, producing seedlings, and restoring degraded areas. During this time, they also partnered with Arboretum, becoming the programmes' first group of seed collectors, named *Juçara* nucleus. Between 2013 and 2014, the group underwent technical and administrative training. According to its members, although training helped, practical experimentation and collaboration with nearby agents (facilitators) were crucial to overcoming the challenges of legalising, processing, storing, and marketing native seeds. Reflecting on this period, one of the collectors emphasised the change in the connection between knowledge and the use of forest resources:

"In the past, knowledge about species was for wood extraction; for this reason, we knew only a few species and characteristics of the adult plant. Now, to collect seeds, it is necessary to know much more about the characteristics of the species, fruit, seeds, resins, seedlings, ... this knowledge has changed our relationship with the forest".

From 2018 to 2021, the *Juçara* nucleus collected nearly 1 ton of native seeds, considering it of little monetary importance. However, they witnessed increased cohesion within their group and network, resulting in tangible benefits such as a public transportation line attending the community, a tractor from the city hall, and their inclusion in federal programmes for food acquisition and family farming funding.

Jatobá Nucleus

In 2015, the *Pedra Bonita* Association formalised a partnership with Arboretum, becoming the *Jequitibá* nucleus of native seed collectors. The association is formed by residents of the *Pedra Bonita* rural settlement, located in *Itamaraju*, southern Bahia, a landscape marked by declining cocoa production, expansion of eucalyptus cultivation and land conflicts.

The social organization and network of *Pedra Bonita* settlement were built over decades of struggle for the right to occupy and produce on large unproductive farms, which connects them to the Landless Workers' Movement (MST) in Brazil. Agroecological food production, biodiversity conservation and forest and landscape restoration are MST's guidelines, which facilitated the *Pedra Bonita* partnership with Arboretum. Moreover, food production in the *Pedra Bonita* settlement is limited by difficult road access and by the protected forest area that occupies more than 80% of its area. For these reasons, the production of native seeds and seedlings quickly became the settlement's main monetary activity, which has been motivated by a continuous learning process that reconciles local income generation with the preservation of the local natural heritage.

During the last four years, *Jequitibá* nucleus has produced more than 2 tons of seeds of approximately 70 forest species, generating an extra income of about US\$ 195 per year for each collector. However, in 2020 the seed production dropped by ~90%, and they lost one seed collector due to Sars-Covid-19.

Nascentes Geraizeiras Seed Collectors: Sowing Future For Young Geraizeiros

This network was formed in 2017 through a provocation of *Bem Diverso*, a project coordinated by *Embrapa Cenargen* in partnership with the United Nations Development Programme and financed by the Global Environment Facility to promote conservation, restoration, and management of agro-extractivism in *Cerrado* biome. The project had a local committee made up of representatives from *Embrapa Cenargen*, *Chico Mendes* Institute for Biodiversity Conservation (ICMBio), the public institute managing protected areas in Brazil, *Rio Pardo de Minas* Rural Workers' Union, *Água Boa II* Agro-extractivism Family Farmers' Cooperative, Centre for Alternative Agriculture in the North of *Minas Gerais*, Technical Assistance and Rural Extension Company of *Minas Gerais*, *Cerrado* Seed Network (RSC) and *Nova Esperança* Agricultural Family School.

Working with multiple approaches, *Bem Diverso* encouraged residents to reflect on the relationship between land use and water scarcity in the landscape, one of the main local issues. Understanding the origins of this problem meant looking at the historical invisibility of traditional communities to the state and the ignorance about the culture, ecological knowledge, and sustainable ways of life of the traditional Brazilian peoples. *Geraizeiros* are traditional people that were constituted during the sociohistorical, cultural, and political occupation process of the *Alto do Rio Pardo* region. Unlike *quilombolas*, who live on collective land, *Geraizeiros* are family farmers with private land that raise cattle and collect fruits on common-use land. These communities cover more than 45,000 people (IBGE, 2016).

During the 1970s, the Brazilian military dictatorship government offered land to private companies to develop a forest district in *Alto Rio Pardo*, ignoring the *Geraizeiros'* ownership of that land (Brito, 2013). However, concessions of public lands to private companies were restricted by the 1988

Constitution and the National Policy for the Sustainable Development of Traditional Peoples and Communities (decree No. 6,040, 2007). Both supported the legal recognition of the *Geraizeiros* people, who began to claim their land back. After a long and conflictive process of territorial reappropriation, the *Nascentes Geraizeiras* Sustainable Development Reserve was created in 2014.

This historical context helps to understand the willingness of *Geraizeiros* people to recover the local native vegetation devastated by eucalyptus plantations. More than 300 people participated in the training courses promoted by the *Bem Diverso* project. In 2019, *Geraizeiros* seed collectors visited the *Xingu* Seed Network and exchanged experiences with *Cerrado de Pé* Association and *Cerrado* Seed Network. In addition, local young people created the *Geraizeiros* Instagram webpage ([@coletores_restauradoresrds](#)) and got time on the local radio cultural programme to communicate the group's actions. In the words of these communicators, the learning process allowed them to "*rediscover the Cerrado*" since working with native seeds requires profound observation and knowledge about the local landscape ecology.

Nascentes Geraizeiras seed collectors represent a movement of traditional people taking the lead in restoring their heritage land. Also, they sell native seeds to companies and landowners locally and in other Brazilian states. Today, there are 29 *Geraizeiros* (17 women) seed collectors organized in a cooperative. This activity is the only income source for 7% of them (mostly young); 17% have up to US\$ 100 as monthly income; 60% of 101 to 200, and only 23% receive between 201 and 400. On average, they are generating an income increment of 257 per year per person, which is significant in the regional context. Besides seeds, *Nascentes Geraizeiras* collectors are also involved in restoration, non-timber products management, tourism, and handicraft activities.

The impact of native seed production on *Geraizeiros* people goes beyond additional income. It encompasses Brazilian cultural heritage valorisation and encourages local youth to continue struggling for a better life in marginalised rural landscapes.

***Cerrado Em Pé* Association and *Cerrado* Seeds Network (ACP+RSC): Sowing fruitful Partnerships**

In 2009, residents were hired to fight a fire that devastated half of the Chapada dos Veadeiros National Park (Alves, 2010). In 2010 ICMBio²⁴ appointed a specialist officer to explore new methods to accelerate the fire scar restoration. Taking inspiration from the successful "*muvuca*" technique (direct native seed plantation), develop by the *Xingu* Seed Network (Campos-Filho et al., 2013), ICMBio began experimenting with direct seeding of *Cerrado* herbaceous and grass species, developing the "*Cerrado muvuca*" technique. Members of the fire brigade actively participated in the design, implementation and evaluation of these experiments.

In 2016 ICMBio directed an environmental compensation fine to restore 94 hectares within the Park. However, the company responsible for the restoration project had no experience with the technique being experimented in the Park. So, the ICMBio team shared their knowledge and actively assisted in implementing the first large-scale restoration project by using the *Cerrado muvuca* technique. To meet the seed needs of this project, approximately 60 families were trained and actively involved in

²⁴ ICMBio = Chico Mendes Institute for Biodiversity Conservation

seed collection efforts. After the completion of the project, there was a surplus of 12 tonnes of native seeds.

At this moment, a renowned Brazilian artist visited the shed where the seeds were stored. He was touched by the initiative and prompted the local government to assist the seed collectors, leading to the establishment of the *Cerrado de Pé* Association (ACP) in 2017. In 2022, ACP was made up of 66 members (33 women), its board is composed of 4 seed collectors (2 women) and has two mentors, one from ICMBio and another from the University of Brasilia, both members of the RSC (*Cerrado* Seeds Network) board. Decisions about the seed's price and the associates' exclusion are made in assembly. Decisions about including new collectors in the network, new partnerships, and changes in the statute are made by ACP directors. A secret vote chooses directors among ACP members.

Once operating, ACP realised it needed a larger network to offer its production. ACP also needed *Renasem*, a registry to market seeds in Brazil. The innovative social solution of this case was their partnership between ACP and RSC. The partnership consisted of a formal agreement in which ACP is the seed collector. RSC has the dual role of technical manager (responsible for overseeing production, processing, packaging, and seed analysis) and marketer the seeds collected by ACP. RSC also prospects new customers, provides technical assistance to customers, and follows up after sales. Furthermore, the agreement between these organisations establishes mutual exclusivity, i.e., ACP only markets seeds through RSC, while RSC only markets the seeds collected by ACP. In the first year (2017), this partnership enabled the commercialisation of the stored seeds, generating US\$ 20.730 in revenue for the ACP collectors.

Also, in 2021, the Bank of Brazil Foundation recognised the ACP+RSC initiative as a social technology and it continues expanding its network of strategic partners, starting to market seeds to other SNCs. As the volume of seeds, financial resources and the network has grown, so have the challenges and needs to improve the efficiency, administrative management, and governance of seed production. Today, these are the main challenges facing the ACP+RSC partnership.

6.5 SOCIAL NETWORK ANALYSIS OF THE NETWORK OF NATIVE SEED COLLECTORS

The main types of organisations in the NNSCs analysed are 'governments', followed by 'companies', 'nongovernmental organisations' and 'universities'. The role of 'facilitator' is played primarily by 'governments', followed by 'NGOs' and 'local associations'. 'Financing' is carried out mainly by 'NGOs', followed by 'companies' and 'governments', while 'governments' centralise the role of 'regulator' and 'universities' that of 'researcher'; 'companies' are the main consumers of seeds, followed by 'governments' and 'NGOs'. The main 'seed producers' are 'traditional communities', 'rural and peri-urban groups' and 'rural settlements' (Figures 9).

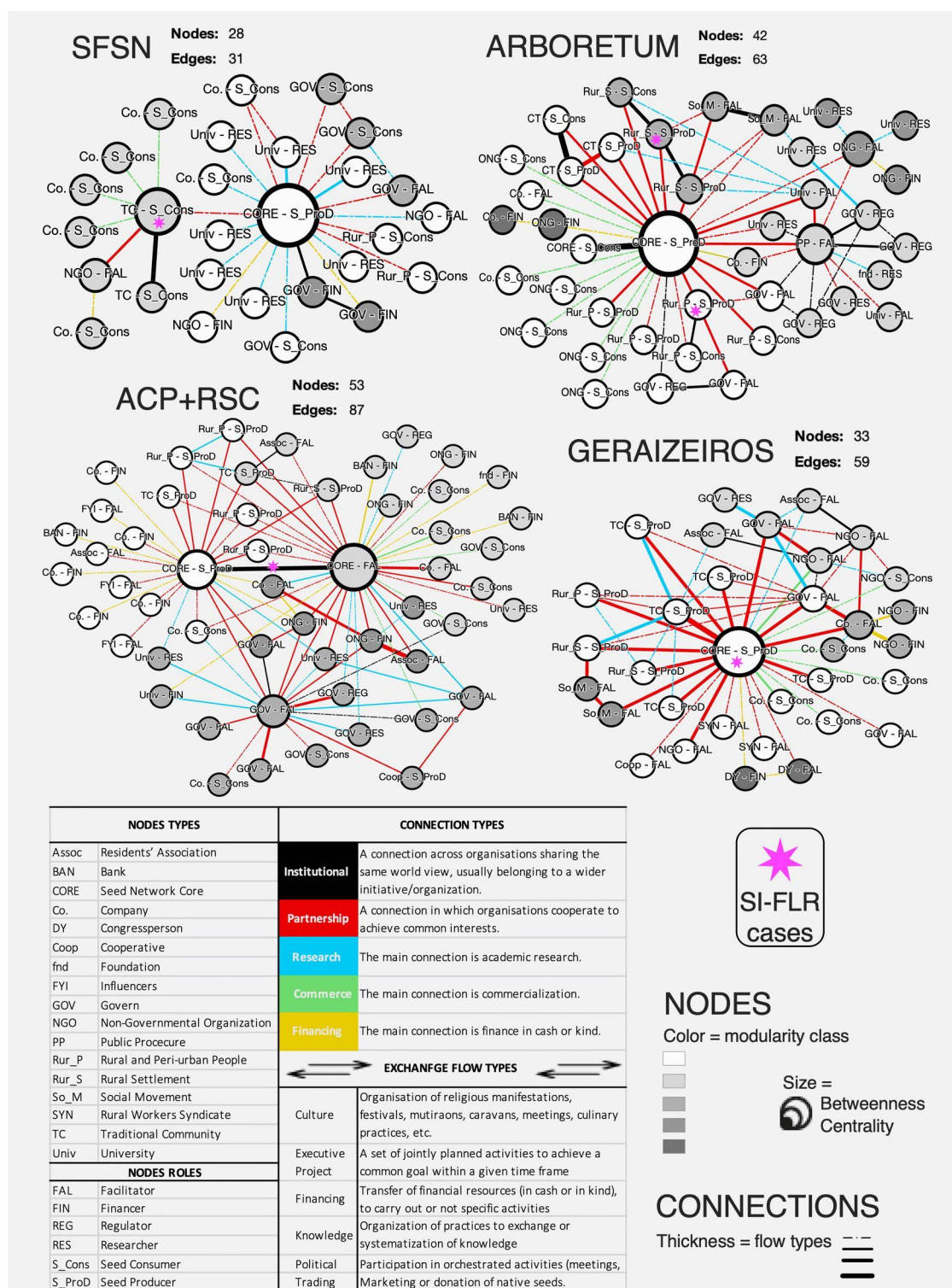


Figure 9. Network map of the Networks of Native Seed Collectors analysed.

SFSN = São Francisco Seed Network; ARBORETUM = Arboretum programme; GERAIZEIROS = *Nascentes Geraizeiras* seed collectors; ACP+RSC = *Cerrado em Pé* Association (ACP) And *Cerrado* Seeds Network Partnership (RSC). SI-FLR = Socially Innovative Forest and Landscape Restoration.

* Nodes size and connections thickness are not comparable between NNSCs.

Figure 9 shows level 2 actor-centred (or ego-net) networks (Crossley et al., 2015). In this type of network, the main actors connect to other actors, who in turn may connect to actors connected to other actors. The core actors in NNCSs are the organisations managing the 4 NNCS and the 5 cases of SIFLR. In the Geraizeiros network, these two core actors are the same, a cooperative managed by the seed collectors themselves. This same logic applies to the ACP+RSC network. However, the network management is divided into two organisations, which characterise this SIFLR case. In the Arboretum and SFSN networks, this rationale is different since although the NNCS are closely related to the SIFLR cases, they have separate organisational management. Arboretum is managed by a council of government agencies, a university and the public prosecutor and is run by an NGO, while the two SIFLR cases described in this network are managed by local associations. SFSN is managed by a university in response to government demand, while the *Pankararu* nursery is managed by a local association.

The main connection types in the four NNCSs analysed are ‘partnership’, followed by ‘research’ in SFSN, and ‘institutional’ in ACP+RSC and ARBORETUM. Through these connections, the most active exchange flows were about ‘knowledge’, ‘political action’ and ‘executive project’. Table 7 below compares the total exchange flows by connection type for each NNCSs with the respective case studies described through the lens of SIFLR. As the initiatives representing the study cases are central to the ACP+RSC and GERAIZEIROS networks, their organisations also present a greater number of connections and, consecutively, more intense exchange flows than in the *Pankararu*, *Juçara* and *Jequitibá* cases.

Table 7. Percentage of connection types, formality level and exchange flow types in the Seed Collector Networks and Social Innovative - Forest and Landscape Restoration analysed.

Conection types	SFSN network	SI-FLR Pankararu	ARBORETUM network	SI-FLR Juçara	SI-FLR Jequitibá	GERAIZEIROS network	SI-FLR Geraizeiros	ACP+RSC network	SI-FLR ACP+RSC
Institutional	22%	11%	33%	3%	4%	14%	-	9%	3%
Partnership	33%	8%	48%	5%	5%	61%	39%	58%	39%
Research	31%	-	9%	-	-	9%	-	17%	6%
Commerce	5%	3%	5%	-	-	7%	7%	3%	3%
Financing	9%	-	5%	-	-	9%	1%	13%	11%
TOTAL	100%	21%	100%	8%	9%	100%	48%	100%	62%
FORMAL	52%	67%	81%	25%	25%	34%	42%	67%	78%
INFORMAL	48%	33%	19%	75%	75%	66%	58%	33%	22%
Exchange Flow types									
Knowledge	32%	7%	31%	3%	3%	37%	15%	40%	26%
Political Action	8%	4%	22%	2%	3%	28%	12%	21%	8%
Executive Project	19%	6%	17%	2%	2%	18%	7%	19%	11%
Financing	9%	1%	12%	1%	1%	4%	1%	9%	8%
Trading	28%	-	12%	1%	1%	10%	9%	9%	9%
Culture	4%	4%	6%	1%	1%	3%	2%	1%	-
TOTAL	100%	21%	100%	8%	9%	100%	48%	100%	62%

SFSN = São Francisco Seed Network; ARBORETUM = Arboretum programme; GERAIZEIROS = *Nascentes Geraizeiras* seed collectors; ACP+RSC = *Cerrado em Pé* Association (ACP) and *Cerrado* Seeds Network partnership; SIFLR = Socially Innovative Forest and Landscape Restoration.

Notes:

* In the PISF network, we consider the donation of NEMA/UNIVASF seeds for research and nursery supply as an edge type;

** Besides being used to restore their landscape, *Pankararu* nursery seedlings are traded only through executive restoration projects, elaborated under partnerships or institutional cooperation.

6.6 DISCUSSION

6.6.1 General Observations

Although marginalised and invisible, site-based initiatives involving traditional people and local rural communities have been protagonists in landscape care, conservation, and restoration (Brondizio et al., 2021). In the 9 NNSCs investigated, 180 tons of native seeds were produced from 2018-2021, with 80% of the collectors being rural workers and 46% traditional communities (indigenous, *Kalunga* and *Geraizeiros*). Organised and connected with other actors, these people saw the window of opportunity in native seed production and supported by some socio-environmental government policies and actions, developed socio-ecological innovations that, besides improving FLR's efficiency, transformed their own socio-economic reality, strengthening values of living *from*, *in*, *with* and *as* nature (IPBES, 2022).

Agency power generates and depends on a network of actors who share, at least partially, the same purpose (Long, 2003). Figure 9 shows that SIFLR cases can emerge at many positions in a network. Some NNSCs (ACP+RSC, GERAIZEIROS) originated from socio-innovative cases captured by the SIFLR framework, while others (SFSN, ARBORETUM) were born from centralized governance arrangements, but also favoured the emergence of socio-ecological innovations.

Betweenness centrality indicates the influence of the organisation in the network. The partnership between ACP and RSC plays a central and complementary role in the ACP+SC network, which gives them the highest sum value of betweenness centrality (1.013, supplementary material). Looking at each type of connection, we observe that ACP and RSC share participation in 100% (9% of 9%) of business connections, 89% of connections with financial agents, 68% of partnerships and 33% of research connections in their network (Table 7). The main organisation of the NNSC GERAIZEIROS is a cooperative involved in 100% of its commercial connections in the network (Table 7). However, although the *Geraizeiros* cooperative is involved in 64% of the partnerships in its network, their human capital to manage financial and research relationships needs to be improved (Table 7).

For social innovation to have a broad and lasting impact, it must cross multiple social boundaries and involve different social actors nested at different scales of cooperation (local to regional, national to global) linked in social networks (Westley & Antadze, 2010). When a social-ecological innovation does not have the necessary agency or capital to influence the larger network, a sub-network can be formed. This was observed in the SFSN, where, although it participates in 50% of institutional connections, 60% of business connections and 24% of partnerships, the *Pankararu* nursery is present in only 21% of the total SFSN connections (Table 7). The connection between the *Pankararu* nursery and NEMA/UNIVASF is the only link between the two sub-networks of the SFSN (Figure 9). This may be a future threat to the *Pankararu* nursery, as it has no connections to the financial and research organisations in this network.

NNSCs centralised by centralized governance arrangements and limited agency power, local associations rarely assume a leading role, even when representing socio-ecological innovation cases. In the Arboretum programme, we observed that the associations forming *Juçara* and *Jequitibá* nuclei showed lower social capital in their networks, represented by participation of only 8 and 9% of the connections, respectively (Table 7). The participation of the *Pankararu* nursery in the SFSN is also low (21%).

Knowledge sharing can increase social participation in FLR-related efforts, as it strengthens local human and social capital, helps to resolve legal issues and increases the chances of accessing incentives and resources (Chazdon et al., 2020). 'Knowledge' was the main exchange flow in all NNSCs analysed (Table 2), tending to express itself more intensively through 'partnership' type connections (supplementary material). Networking and knowledge sharing are common in social innovations and have the potential to accelerate and amplify FLR efforts (Padovezi et al., 2022).

To regain agency power in landscape governance, traditional and local rural communities in Latin America have designed future visions and bottom-up decision-making processes to advocate for their needs and maintain autonomy in the development of their livelihood strategies (Castro et al., 2016). The second most important type of exchange flow in the NNSCs analysed was 'political action', tending to be more expressive in NNSCs with greater participation of social movements and traditional communities (Table 7). The third type of exchange flow was 'executive project', which did not present expressive differences among NNSCs analysed (Table 7). It is also interesting to note that in all these networks, the exchange flow 'trading' occurs mainly through 'partnerships' and 'research', not on 'commerce' connection type (supplementary material). This highlights the crucial role of partnerships and knowledge exchange in NNSCs.

6.6.2 Lessons to learn from specific cases

The "path dependency" risk and the agency potential to disrupt it

Some networks encourage nodes to seek innovative solutions; others adopt self-reinforcing feedback mechanisms that reproduce strategies already adopted (Ostrom et al., 1994). This last is case is called "path dependency," when the initial direction of a social movement is maintained to guarantee the benefits being achieved; however, it can immobilise social innovation (Moulaert, 2009). In the SFSN, path dependence expresses itself through the administrative procedures adopted to manage public funding that, while guaranteeing monthly salaries and labour benefits to seed collectors, limits the formalisation of partnerships with associations and cooperatives and vetoes seed commercialisation, imposing constraints on its future. Probably for this reason, the SIFLR case identified in this network is marginal to its core. In addition to carrying out restoration actions in the areas impacted by *Sao Francisco* River Integration Project (PISF), NEMA/UNIVASF articulates, trains, and allocates 4.9% of the seeds produced to 116 local nurseries, which explains the high number of seed consumers in this network (Figure 9, SFSN). Among these consumers is the *Pankararu* nursery. The emergence of this SIFLR in an unfavourable environment reinforces the role of agency in managing domination structural forces such as norms and administrative procedures (McCarthy et al., 2014).

The (still significant) role of public bodies in promoting conditions

Public organisations (government agencies and public prosecution) mediating conflicts between external economic agents and local social actors can favour the conciliation of local social needs and sectoral demands, strengthening network efforts in the search for innovative social solutions (Castro-Arce et al., 2019). For example, the Arboretum programme was born from the mediation of the public prosecutor in a landscape context of conflict between pulp and paper companies and social movements over land use. The programme's goal of promoting landscape conservation and restoration through research, regulation, and rural extension, and social actors representing landscape conflicts have contributed to shaping the Arboretum network, composed of universities, government agencies, social movements, organisations representing indigenous peoples and forest sector companies (Figure 7, ARBORETUM).

Often, government FLR programmes marginalise people with low incomes, ethnic minorities, and local communities (Chazdon et al., 2020). The Arboretum governance model is centred on public agencies (Figure 9, ARBORETUM), favouring the participation of regulatory agents but marginalising seed collectors in decision-making processes. On the other hand, organisations can support the development of social innovation by creating a niche (Moore et al., 2015). The administrative model embraced by the Arboretum strongly promotes seed commercialisation and facilitates collaboration between the Arboretum and local associations for seed production. This innovative approach was fundamental to connect the program to the communities of *Jatobá* and *Jequitibá* nuclei. In line with Padovezi et al. (2022) perspective, the occurrence of a SIFLR case can be triggered when a social innovation addresses actions related to FLR or when an FLR initiative creates a conducive environment for social innovation to flourish.

The (transformative) role of socially innovative forest and landscape restoration cases

Bottom-up approaches emerging from social learning and reflexive processes are less common in the FLR context (Chazdon et al., 2020). The Geraizeiros cooperative is an exception since its main objective was to re-assume the design of the Geraizeiros' ancestral landscape and restore the socio-cultural and ecological relations that historically shaped the local socio-ecological system. Nongovernmental organisations (mainly related to social movements), local associations; companies; government agencies, social movements, rural unions, cooperatives, and congressmen are the main node types that comprise NNSC Geraizeiros (Figure 9, GERAIZEIROS). The *Geraizeiros* seed collectors assumed the protagonism of their development by organising themselves administratively into a cooperative. The ability of local agents to reflect on the role and impact of established institutions is an essential result of capacity building and a determinant factor for social innovation to spark (Moore et al., 2018). In addition, a minimum of social, political and financial capital is required to drive this process. Although the *Geraizeiros*' cooperative has marketed 3.9 tons of seeds in the last four years (most buyers are companies), only a few investments have contributed to this initiative (Table 7). The SIFLR framework assumes that the path of landscape transformative change is directly related to the reconfiguration of local economies, network formation and power redistribution mechanisms (Padovezi et al., 2022).

The (always vital) role of experimentation and multi-sector partnerships

In complex social-ecological systems, ongoing experimentation coupled with flexible management systems and participation is decisive in overcoming barriers through social innovative solutions (Nicholls & Murdock, 2012). The ACP+RSC network was formed during the development and adaptation of the *Cerrado* species direct seed planting restoration technique (the *Cerrado muvuca*), aiming to improve the effectiveness of restoration in a protected area and generate tangible benefits for surrounding communities. The articulations required to develop and expand this technological innovation, as well as the participation of local dwellers in seed collection and strategic partnerships formed to overcome crisis moments, can explain why this network presented the greatest diversity of organisations (13 node types) of different types (government bodies; companies, traditional and rural communities and three banks (Figure 9, ACP+RSC). The great diversity of financial agents and facilitators in this network provides the third largest budget among the nine networks in Table 6. Engaging private companies in the FLR value chain tends to increase economic benefits to local communities (Sayer & Boedhihartono, 2018). Multistakeholder networks and public-private partnerships reinforce these benefits (Chazdon et al., 2020).

6.7 CONCLUSION

Networks of Brazilian native seed collectors are mostly formed by governmental agencies, companies and social organisations and can leverage socially innovative cases of forest and landscape restoration (SIFLR). These initiatives can emerge before or after the formation of these networks, with actors assuming various roles and connections to support restoration efforts in different contexts.

The cases examined have revealed several factors that act as drivers for SIFLR, including the demand for restoration, the management of funding resources through administrative procedures, the imperative for innovation, the strong ties between local communities and the landscape, and the strategic partnerships forged during times of crisis.

Networks of native seed collectors can stimulate or suppress the emergence and development of innovative social restoration of forests and landscapes. However, even in unfavourable environments (e.g., networks centralised by governmental arrangements with strict administrative procedures), cases of SIFLRs can emerge through agency power. The power of this agency, together with the history of the network and the local context, will determine the SIFLR's role in the network. In this sense, landscape restoration programmes can encourage the inclusion and participation of marginalised low-income people, ethnic minorities and local communities, promoting governance conducive to the emergence and development of SIFLR cases.

Knowledge was the main exchange flow observed, mainly through partnership connections, followed by political actions, more expressive in networks with social movements and traditional communities. In this sense, SIFLR cases holds the potential to empower marginalized populations, enabling them to assume a more autonomous role in the landscape's environmental governance.

We believe that identifying and acknowledging the critical role of NNSCs in leveraging SIFLR cases can contribute to broadening their scope and recognition in the FLR chain while favouring their inclusion in the rural development agenda by expanding their range of potential partnerships and funding sources. More broadly, we expect that a better understanding of their experience can inspire and motivate other groups engaged in FLR initiatives to strengthen their networks and capacities in this global effort.

CHAPTER 7. EXPLORING COMPLEXITY: BRAZILIAN POLICY INSTRUMENTS FOR SOCIALLY INNOVATIVE FOREST AND LANDSCAPE RESTORATION

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This chapter examines the top-down perspective (see chapter 3) through a policy gap analysis of 12 Brazilian policies. It is a scientific paper written by me in collaboration with my supervisors, a researcher from University of Padova, and two professors at University of Natural Resources and Life Sciences (BOKU, Vienna). The paper was submitted to Land Use and Policy Journal on August 1st, 2022.

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HIGHLIGHTS:

- Existing policy instruments can support Socially Innovative Forest and Landscape Restoration.
- However, they are dispersed in a wide, complex, uncoordinated governance structure.
- Governance effectiveness could be improved by tailoring decision-making closer to local needs.

ABSTRACT: Governments and markets have faced challenges mobilising stakeholders and resources to restore degraded landscapes and improve sustainable livelihoods. However, organised landscape stewardship groups, including local communities, rural workers, women, and youth, can drive social innovations that improve Forest and Landscape Restoration (FLR) efforts. Socially Innovative Forest and Landscape Restoration (SIFLR) can enhance the resilience of livelihoods and nature's contributions to people, benefiting government, markets, and society. A content analysis of Brazilian policy documents identified 102 policy instruments that could support SIFLR. However, these were dispersed in a complex organisational structure with weakened governance and limited experimentation by local actors. A policy gap analysis suggests three ways to broaden Brazilian government support for SIFLR: 1) Reconnect politics to existing environmental policies and laws; 2) Bring decision-making closer to local needs through landscape governance; and 3) Establish a legal framework to enable innovation and science structures to support local civil society in developing social-ecological innovations.

KEYWORDS: Land Use Policy; Environmental Governance; Forest and Landscape Restoration; Social-Ecological Innovation; Qualitative Content Analysis; Brazil politics

7.1 INTRODUCTION

Nature is a common good that provides public and private goods and services for people and well-being through non-tangible connections (such as culture) (Russell et al., 2013). Yet, humanity has already modified three-quarters of Earth's land cover (UNEP, 2021) and threatens to convert another 500 million hectares to agricultural land by 2050 (Searchinger, 2018). Continuous ecological degradation points to a critical threshold that, once crossed, can severely impair Earth's life support systems (Steffen et al., 2018). Reversing this course is one of the most significant contemporary humanitarian challenges.

By advocating a win-win discourse (creating jobs, fostering economic development and well-being through on-the-ground environmental conservation and restoration actions), Forest and Landscape Restoration (FLR) has gained momentum on the international political agenda (Mansourian et al., 2021). FLR is one of many nature-based solutions (Cohen-Shacham et al., 2019) operating at the landscape level to create a negotiation arena among land use stakeholders to restore degraded lands and improve the well-being and economic benefits of local and indigenous communities.

Each landscape has its history, culture, political disputes, and ecological and socioeconomic characteristics, presenting challenges for governments and markets to identify and nurture innovative solutions connecting local social demands to FLR (Fagan et al., 2020; Ota et al., 2020). Linking social, private, and state actors around social innovation has contributed to unravelling complex human-landscape adaptive processes (Baker & Mehmood, 2015). Social innovation (SI) can be seen as a collective action that responds to social challenges that modify social practices to improve local well-being through knowledge exchange, networking, and civil society engagement (Polman et al., 2017; Secco et al., 2019; Živojinović et al., 2023). When connected to a regional development process, SI can promote bottom-up social inclusion, transform power relations, remodel governance structures, and encourage political participation, transcending but also affecting economic relations (Castro-Arce & Vanclay, 2019; Ludvig et al., 2020; Moulaert & Mehmood, 2020). Thus, linking social innovations can drive more inclusive and effective FLR programmes.

Socially Innovative Forest and Landscape Restoration (SIFLR) points to a new and distinct approach in which organised dwellers lead or actively participate in the design, execution and evaluation of innovative practices and processes to leverage landscape restoration (Padovezi et al., 2022). Policy instruments can be powerful tools to trigger bottom-up FLR efforts (Weiss et al., 2021) and induce SIFLR.

Brazil is the world's largest freshwater and terrestrial biodiversity reservoir and has been ranked #1 in tropical deforestation rates (Weisse & Goldman, 2019). Internal and external political pressure drove Brazilian lawmakers to improve environmental legislation and policies (Drummond & Barros-Platau, 2006; Chaves et al., 2015), which succeeded in reducing deforestation rates from 2004 to 2012 without negatively impacting its economy (Boucher et al., 2013). Notwithstanding, deforestation rates have recently accelerated due to new political directions (Thomaz et al., 2020).

One of Brazil's main drivers of deforestation is the expansion of the agricultural frontier pushed by the agribusiness sector, which has significant political and economic power and influences the policy-making and governance structure at the federal, state, and municipality administration levels (Kröger, 2017; Pendrill et al., 2022). An example of such power was the lobby to replace the 1965 Brazilian

Forest Code with the 2012 Native Vegetation Protection Law (*LPVN*, acronym in Portuguese²⁵). *LPVN* reduced the obligation to protect native vegetation in private lands by almost 60% and introduced new instruments to support landowners in restoring an estimated deficit of 20 million hectares of degraded forests (Brancalion et al., 2016).

Two of the essential instruments of *LPVN* were I. the Rural Environmental Registry (*CAR*²⁶), a public self-declaratory electronic platform that georeferences native vegetation at the rural property level, and II. the Environmental Compliance Programmes (*PRAs*²⁷) implemented by subnational governments to help rural landowners comply with *NPVN*. However, implementing these instruments and the increased flexibility in compliance enabled by the new law brought negative consequences, affecting the Brazilian forest restoration service chain due to a reduction in restoration demand (Durigan et al., 2013; Vidal & Rodrigues, 2019). Consequently, many restoration organisations, private companies, and initiatives stop operating after 2012. The remaining ones had to adjust their discourses, experiment with new processes, generate new knowledge and networks, and adapt to the new FLR policy environment.

The restoration service chain crisis created new opportunities for SIFLR initiatives at the landscape level (for example, the native seed collector networks (Padovezi et al., 2023, in review), which have not yet been probed in terms of the policies and governance structures that enabled them and that could be improved to leverage FLR in Brazil. Therefore, in this paper, we address the following question: What are the policy gaps at the Brazilian federal level to foster SIFLR in the country?

To answer this question, we applied qualitative inductive content analysis to identify potentially SIFLR-friendly Policy Instruments and mapped the governance structures ruling them. Based on that, we discuss gaps and elaborate recommendations to foster SIFLR.

In the next section, we present the concepts of policy domains and instruments and their relevance for SIFLR. In this section, we present the methodology used for the policy analysis. Section four presents the identified instruments structured according to the analysed policy domains and describes the identified governance structures. In section five, we discuss the most evident gaps stemming from governance structures and provide recommendations for leveraging the full potential of supportive policy instruments. Finally, we highlight some research limitations in section six and draw conclusions and points to future needs in the research in section seven.

7.2 FUNDAMENTAL CONCEPTS

7.2.1 Policy Domains and Instruments

Policies constitute collective agreements between stakeholders in a particular social context about the general direction they should follow and are usually formulated within a particular political domain (Sabatier, 1999). Policies are both the goal and a tool of politics, defined and implemented within a governance structure to regulate the behaviour of plebes (the people, individuals or organised in communities or organisations). Politics means a bargaining process in which interests and worldviews compete for power to regulate who gets what, when, and how (Lasswell, 1936). Ultimately, politics means making agreements between people, enabling them to live in social groups (Krott, 2005).

Environmental politics and policies are complex because they deal with multiple feedback mechanisms and processes between manifold social and environmental domains in a negotiation arena where

²⁵ We have kept the Portuguese version of all acronyms of public policies, laws, boards, programmes, organs, funds and banks, as this is how they are usually recognised in Brazil.

²⁶ By April 2022, only 0.44% SICAR records had its environmental regularity analysed (SFB, 2022).

²⁷ By 2021, only 15 of the 27 Brazilian federative units had its *PRA* in action (Chiavari et al., 2021).

multiple actors represent diverse interests and expertise. This way, policy, social and environmental fields create a complex, intricate, dynamic social, economic, and political network (Fahey & Pralle, 2016). The resulting governance structure is a particular area of public policy, which is characterised by a distinct set of issues, actors, and institutions that are involved in the formulation, implementation, and evaluation of policy (Sabatier, 1999). When linked to FLR, governance refers to the collaborative space shared by stakeholders where rules and actions are designed and put into practice to restore a landscape (Mansourian & Sgard, 2021; Chazdon et al., 2021).

Policy decisions emerge from the political system to guide the actions of governments (and other stakeholders' actions) to meet social needs. The liberal democratic rule of law concept emphasises the need to limit state power through a governance balance between its three powers (executive, legislative, and judiciary) and stakeholder participation through boards formed by representatives from different policy domains, ideologies, and backgrounds where policies and their respective instruments are designed, contested and continually adjusted (Krott, 2005). Thus, policy documents usually represent the agreements reached among political actors and other stakeholders to express decisions, principles, and guidelines for their implementation (e.g., laws and strategies). Based on these documents, the executors of public policies (e.g., ministries, agencies, institutes, and public companies) design operational plans, programmes, and projects, which are carried out with or without civil society and private sector participation. They typically target one or more interest groups, guiding their rights, duties, and actions through policy instruments. Government administration bodies implement public policies through policy instruments and support for government agencies and institutions.

Government administration bodies implement public policies through policy instruments. Thus, they determine power relationships between political actors (policymakers and implementers) and other stakeholders (civil society and business), who may welcome and follow or deviate and renounce these instruments. Regarding forest and land use policies, governments and their allies may promote or hinder landscape management proposals through a combination of four types (3+1) of policy instruments (Krott, 2005).

- a) Regulatory instruments: policy interventions that affect social and economic action by restricting or encouraging the behaviour of actors or sectors of society;
- b) Informational instruments: policy interventions that shape social and economic activity through the production, systematisation, and provision of information;
- c) Economic instruments: policy interventions that influence social or economic action through economic or financial means, collection (taxes), and distribution of resources (financing) according to political priorities;

Land use planning: policy interventions that involve designing and implementing a future vision for the use of space aimed at a region's economic and social development. As land use planning is crucial for FLR, we highlighted its importance by adding to Krott's tripartite typology of policy instruments.

In rural landscapes, local actors guided by multiple policy instruments shape the management of private (e.g., food and timber) and public goods (e.g., water quality, biodiversity). Nevertheless, the State is central in developing solutions to complex social-ecological issues, and policy instruments are the main mechanism for addressing them (Sabatier & Mazmanian, 1980). Maintaining public environmental goods to ensure the provision of environmental and other ecosystem services requires the coordination of multiple policy instruments from different policy domains among multiple actors (Blackstock et al., 2021).

Coordination involves establishing shared priorities and working together across organisations and policy domains to make the implementation process smoother and more efficient. It affects many natural and economic goods (*ibid*). Ideally, it should lead to synergies among policies and prevent conflicts among them. However, a lack of coordination can lead to contradictions, gaps, redundancies or spill over effects. One of the main mechanisms used to improve policy coordination is central agencies, which are autarchies that oversee and support public and private organisations in a sector (Candel & Biesbroek, 2016; Peters, 2018). This paper refers to "governance subsystems" when agencies and other governance structures (boards, administration, programmes and financial agents) work in coordination to implement one or more policies.

7.2.2 Socially Innovative Forest and Landscape Restoration (SIFLR)

SIFLR represents a phenomenon in which social innovation is directed to leverage forest and landscape restoration within a social-ecological system (Ostrom, 2009), aiming to improve livelihood resilience (Scoones, 2009) and enhance nature's contributions to people (IPBES, 2019).

As with any other social innovation, SIFLR represents the proactivity of civil society to address social needs. Therefore, it is a product of the socioeconomic and political context in which it emerges. The connection between SI and public policy is easier to unfold when democratic and participatory structures facilitate connections between the State, markets and civil society. By strengthening and connecting the social capital resulting from civic engagement with governmental structures, SI can generate or improve public policies through the gradual incorporation of the needs of civil society into the political system (Habermas, 1996).

Scholars have highlighted landscape governance as an approach to foster the connection between social actors, public policies and respective governance structures, facilitating the development of FLR initiatives (van Osten et al., 2021; Mansourian & Sgard, 2021; Chazdon et al., 2021; Sayer et al., 2021). Landscape governance can be understood as a concept that deals with the interconnections between socially constructed spaces and the 'natural' conditions of places. It is concerned with the complex reconfiguration of politics, multilevel decision-making and the transformation of the State, as well as with environmental problems in concrete regions and specific places (Görg, 2007).

7.3 METHODOLOGY

This paper applied an inductive approach and a qualitative analysis to identify federal-level policy instruments that could support SIFLR in Brazil and map the complex governance structures governing them. For this, we assumed that policy documents express policy decisions.

Therefore, at this level of analysis, the focus on policy formulation, implementation, and reformulation is limited, giving space to discuss the governance structure, strategies, and instruments adopted to implement policy objectives (Sabatier, 1986).

We selected policies related to SI in rural areas following the policy domains identified by Ludvig et al. (2018)²⁸ adapted to the Brazilian context: Environment, Agriculture, Regional Development, Science and Innovation. Within these domains, we focused on the policies related to the protection, restoration, and sustainable management of native vegetation coupled with the socioeconomic development of rural landscapes²⁹.

²⁸ Environment; Forest; Regional Development; Rural Development; Innovation; and Social policies.

²⁹ Environment, Forest, Biodiversity, Water resources, Climate Change, Agriculture, Science and Innovation policies.

We searched for governmental public documents representing current policies, regulations, governance structures, and instruments that could support SIFLR in any of its phases (see [Padovezi et al., 2022](#)). To this end, we focus on official documents available on the websites of the Brazilian Ministries of: Environment (MMA³⁰); Agriculture, Livestock and Supply (MAPA³¹); Regional Development (MDR³²), and Science, Technology & Innovation (MCTI)³³. Desk research was carried out from February to June 2022.

The creation and modification of institutional acts (legal documents) and recent activity records (official documents such as meeting minutes, reports, official websites, or newspaper articles) were checked to extract information on current governance structures and policy instruments. To map the current governance structure in 2022, we included only those boards, programmes, and administrative bodies with at least one activity record within the last two years (after February 2020).

We identified the latest version of laws, decrees, official strategies, plans, and reports for each policy domain, totalling 64 policy documents. In this procedure, policy documents mean solely primary references ([Siegnier et al., 2018](#)) and express documented dealing arrangements ([Ludvig et al., 2017](#)). **Table 8** presents the policy domains, respective policies, and the number of documents analysed³⁴.

Table 8. Policy domains, policies and number of policy documents analysed.

POLICY DOMAIN	POLICY	NUMBER OF DOCUMENTS
Environment	Environment (PNMA)	6
	Biodiversity (Pbbio)	7
	Payment Environmental Services (PNPSA)	1
	Native vegetation recovery (Proveg)	7
	Climate Change (PNMC) and Green Growth program (PNCV)	15
Agriculture	Forest (PNF/PNAFP)	5
	Agriculture (Pagro)	6
	Technical Assistance and Rural Extension (Pnater)	1
	Cooperativism (PNCoop)	2
Regional Development	Water Resources (PNRH)	2
	Regional Development (PNDR)	2
Science and Innovation	National Policy on Innovation (PNI)	7
General Govern structure		3
TOTAL		64

Each identified document was systematically scrutinised in a search for policy instruments potentially related to SIFLR processes and their respective governance structures. During this review, we identified and grouped policy instruments into four categories (regulation, information, economics, and land use planning, see section 2.1). Simultaneously, we identified and graphically represented the most evident relationships between the governance structure elements ruling the design and

³⁰ <https://www.gov.br/mma/pt-br>;

³¹ <https://www.gov.br/agricultura/pt-br>

³² (<https://www.gov.br/mdr/pt-br>)

³³ <https://www.gov.br/mcti/pt-br>

³⁴ The name and reference of all 64 documents analysed are available in the supplementary material - [Appendix I](#).

implementation of the analysed policies. Nonetheless, the evaluation of the policies and implementation of the respective instruments analysed is beyond the scope of this study.

7.4 RESULTS

This section is divided into two subsections. The first presents an overview of each policy domain investigated and its governance structure. The second summarises the 102 policy instruments identified.

7.4.1 Policy domains investigated and their governance structure

The whole picture of governance structures is presented in [Figure 10](#), which expresses a simplified framework of Brazilian policy complexity in the governance of natural resources and land use. The acronyms in [Figure 10](#) appear in italics throughout this document, and their definitions can be found in [Table 9](#).

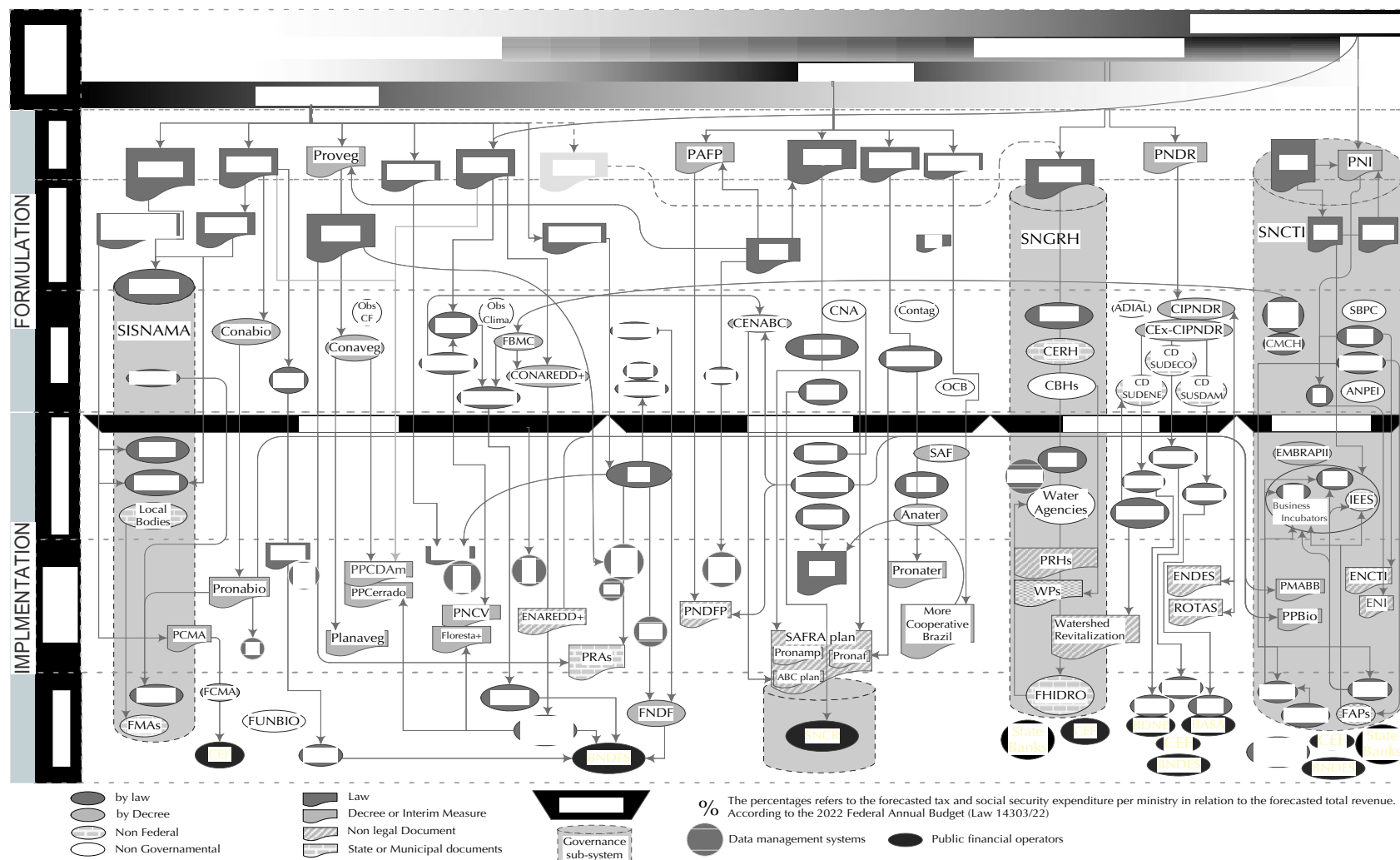


Figure 10. Brazilian policy governance map likely supportive to Social Innovative – Forest and Landscape Restoration initiatives: Policy domains, policies, regulations, boards, executors, programs, plans and financing structures.

Table 9. Acronyms meanings of Figure 10.

acronym	Name	acronym	Name
ABC plan	Low Carbon Agriculture Plan	ICT	Scientific and Technological Institute
ADIAL	Brazilian Association for Sustainable Regional Development	IEES	State Institute of Higher Education
Amazon Fund	Amazon Fund	IFES	Federal Institute of Higher Education
ANA	National Water Agency	Incra	National Institute for Agrarian Reform
Anater	National Agency for Technical Assistance and Rural Extension	LAP	Research Support Law
ANPEI	National Association for Research and Development of Innovative Companies	LGFPSS	Sustainable Public Forest Management Law
BASA	Amazon Development Bank	LIIPC	Innovation and Scientific Research Incentive Law
BDNE	Northeast Development Bank	Local Bodies	Sub-national executive bodies of SISNAMA
BNDES	National Economic and Social Development Bank	LPVN	Native Vegetation Protection Law
CBHs	Watershed Committees	LSC	Social Cooperative Law
CCT	National Council for Science and Technology	LSM	Seeds and Seedlings Law
CD-FNMA	National Environmental Fund Deliberative Council	MAPA	Ministry of Agriculture, Livestock and Supply
CD-SUDAM	Deliberative Council of SUSAM	MCTI	Ministry of Science, Technology & Innovation
CD-SUDECO	Deliberative Council of SUDECO	MDR	Ministry of Regional Development
CD-SUDENE	Deliberative Council of SUDENE	MMA	Ministry of Environment
CEF	Caixa Econômica Federal (the federal bank)	More Cooperative	More Cooperative Brazil
CENABC	National Executive Commission of the ABC Plan	ObsCF	LPVN observatory
CERH	State Councils of Water Resources	ObsClima	PNMC observatory
CG-FNDF	National Forest Development Fund Managing Council	OCB	Organization of Brazilian Cooperatives
Cgen	Genetic Heritage Management Council	PAB	Federal Government's food acquisition programme
CGFLOP	Public Forest Management Commission	PAFP	National Agricultural Policy on Planted Forests
CI	Innovation Chamber	Pagro	Brazilian Agricultural Policy
CIMV	Interministerial Council on Climate Change and Green Growth	PB	Biodiversity Portal
CIPNDR	Technical Committee of the CIMV	PBBIO	Brazilian Biodiversity Policy
CMCH	Meteorology, Climatology and Hydrology Coordination Commission	PCMA	National Fines Conversion Program
CMN	National Monetary Council	PFPSA	Payment for Ecosystem Services Federal Program
CNA	National Confederation of Agriculture and Livestock	Planaveg	National Plan for Native Vegetation Recovery
CND	National Defence Council	PMABB	Programme for Environmental Monitoring of Brazilian Biomes
CNPA	Agricultural Policy Council	Pnater	National Policy of Technical Assistance and Rural Extension
CNPq	National Council for Scientific and Technological Development	PNCoop	National Cooperativism Policy
CNPISA	National Payment for Environmental Service Registry	PNDFFP	National Plan for Planted Forests
CNRH	National Council of Water Resources	PNDR	National Regional Development Policy
Codevasf	São Francisco Valley Development Company	PNI	National Policy on Innovation
Conabio	National Biodiversity Council	PNMA	National Environmental Policy
Conama	National Environmental Council	PNMC	National Policy on Climate Change
CONAREDD+	National REDD+ Council	PNPSA	National Policy of Payment for Ecosystem Services
Conaveg	National Council of the Native Vegetation Policy	PNRB	National Benefit-Sharing Programme
CONDRAF	National Council for the Development of Family Agriculture	PNRH	National Water Resources Policy
Condraf	National Council for the Smallholders Development	PPBio	Biodiversity Research Program
Confap	National Council of State Research Support Foundations	PPCDAm	Action Plan for the Prevention and Control of Deforestation in the Amazon
Contag	Confederation of Rural Workers and Smallholders	PPCerrado	Action Plan for Prevention and Control of Deforestation in the Cerrado
CRA	Environmental Reserve Quota	PRAs	Environmental Regularization Programmes

acronym	Name	acronym	Name
CSMs	Seeds and Seedlings Committees	PRHs	Water Resource Plans
CTCIMV	Technical Committee of the CIMV	Pronabio	National Biodiversity Program
Embrapa	Brazilian Agricultural Research Company	Pronaf	National Family Farming Program
Embrapii	Company for Industrial Research and Innovation	Pronamp	National Programme to Support Medium-sized Rural Producers
ENAREDD+	National REDD+ Strategy	Pronater	National Program of Technical Assistance and Rural Extension
ENCTI	National Strategy on Science, Technology & Innovation	Proveg	National Native Vegetation Policy
ENDES	National Strategy for Economic and Social Development	Rede-Clima	Brazilian Research Network on Global Climate Change
ENI	National Strategy for Innovation	Renasem	National Seeds and Seedlings Register
Environmental Crimes	Environmental Crimes Law	ROTAS	National Integration Routes
		SAF	Secretaria de Agricultura Familiar
FAPs	Research Support Foundations	SAFRA plan	Agricultural Financing Plan
FBMC	Brazilian Forum on Climate Change	SBPC	Brazilian Society for the Progress of Science
FBRB	National Fund for Benefit Sharing	Senar	National Rural Learning Service
FCMA	Fines Conversion Fund	SFB	Brazilian Forest Service
FDA	Amazon Development Fund	SiCAR	Rural Environmental Registry System
FDCO	Midwest Development Fund	Sinare	National System for Reducing Greenhouse Gas Emissions
FDNE	Northeast Development Fund	SisGen	National Management System of Genetic Heritage and Associated Traditional Knowledge
FHIDRO	Water Funds	SISNAMA	National Environmental System
FINEP	Financier of Studies and Projects	SNCR	National Rural Credit System
FMAAs	Sub-national environmental funds	SNCTI	National System of Science, Technology & Innovation
FNDCT	National Fund for Scientific and Technological Development	SNGRH	National Water Resources Management System
FNDF	National Forest Development Fund	SNIRH	National Water Resources Information System
FNMA	National Environmental Fund	SNUC	National System of Protected Areas
FNMC	National Climate Change Fund	State Banks	State Banks
Foresta+	National Program of Payment for Environmental Services	SUDECO	Midwestern Development Superintendency
FUNBIO	Brazilian Biodiversity Fund	SUDENE	Northeast Development Superintendence
GC-FNMC	National Climate Change Fund Management Council	SUSAM	Development Superintendence of the Amazon
Ibama	Brazilian Institute of Environment	Water Agencies	Water Agencies
IC85	Constitutional Amendment #85	Watershed Revitalization	Watershed Revitalization Plan
ICMBio	Chico Mendes Biodiversity Institute	WPs	Watershed Plans

A brief description of the governance structures pictured in [Figure 10](#) is present below. [Annex 6](#) presents it more detailed.

Environmental Domain

In 2022, the Ministry of Environment (*MMA*) managed the lowest budget among its assessed peers. The National Environmental System (*SISNAMA*) coordinates federal, state, and municipal environmental boards and agencies. *Ibama* and *ICMBio* are institutes responsible for monitoring and managing environmental policies related to deforestation, environmental licensing, protected areas, and biodiversity. The Genetic Heritage Management Council (*Cgen*) and the National Biodiversity Commission (*Conabio*) manage the National Biodiversity Policy (*PBbio*) and its associated programs. *Planaveg*, *PPCDAm*, and *PPCerrado* are programs addressing illegal deforestation and compulsory restoration. The National Climate Change Policy (*PNMC*) involves multiple governance structures and, through the National Climate Change Fund (*FNMC*), supports projects to reduce emissions and adapt to climate change. Civil society organisations like the Climate Observatory (*ObsClima*) and the Forest Code Observatory (*ObsFC*) participate in this environmental governance.

Agriculture Domain

In 2022, the Ministry of Agriculture, Livestock, and Supply (MAPA) had the highest budget among the evaluated ministries. Its main executive organisations include *Embrapa* for research and innovation, *Senar* for capacity building, and *Conab* for stock and food supply. The Brazilian Forest Service (SFB) oversees the management of the National Forest Information System (*Snif*) and the Rural Environmental Registry System (*SiCAR*). In addition, it provides guidance on the Federal Policy of Payment for Environmental Services (*PFPSA*) and Environmental Compliance Programs (*PRA*) and manages federal public forests and the National Forest Development Fund (*FNDF*). The *SAFRA* plan operates as the primary economic instrument for Brazilian agriculture. Civil society sectors are represented by the National Confederation of Agriculture and Livestock (*CNA*), the National Confederation of Rural Workers and Smallholders (*Contag*), and the Brazilian Cooperatives Organisation (*OCB*).

Regional Development Domain

In 2022, the Ministry of Regional Development (*MDR*) had the second-highest budget among the ministries evaluated to manage two policies implementation: regional development (*PNDR*) and water resources (*PNRH*). The *PNDR* promotes productive inclusion and cooperativism in regions with low socioeconomic indicators, while the *PNRH* ensures the provision of quality water. The national water agency (*ANA*) regulates the subnational *Water Agencies* responsible for executing watershed plans (*WPs*). Resources for *PNRH* come from treasuries, water use fees³⁵, and water resources funds are managed by state entities and executed by public banks. The *PNRH* operates through a system (*SNGRH*) involving government, private sector, and civil society participation at different levels. The *MDR* also controls *Codevasf*, a large public company that implements agricultural irrigation systems and water security programs.

Science and Innovation Domain

The Ministry of Science, Technology and Innovation (*MCTI*) manages the science, technology and innovation system (*SNCTI*) to support innovation through entities like *Embrapii* and financial agencies such as *FINEP*, *CNPq*, and *FAPs*. The term "innovation" was introduced in 2015 through a constitutional amendment to allow and stimulate partnerships between government entities, educational institutions, and private companies to foster innovation. The National Innovation Policy (*PNI*) guides and coordinates efforts to enhance productivity and competitiveness in the private sector. [Table 10](#) provides an overview of the objectives, governance structures and the number of potentially SIFLR-friendly policy instruments associated with each policy domain described above.

³⁵ Foreseen by the National Water Resources Policy (*PNRH*), the water use ree is charged from water users to finance the management, monitoring and recovery of water resources in the watershed where it was collected.

Table 10. Policy domains, goals, number of boards, percentage of government revenue forecasted for 2022, main administrative bodies, financial agents, and number of potentially SIFLR-friendly policy instruments.

POLICY DOMAIN	POLICY GOALS	Nº of BOARDS	REVENUE *	MAIN ADMINISTRATIVE BODIES **	MAIN FINANCIAL AGENTS ***	Nº of INSTRUMENTS
Environment	Protection of biodiversity and natural habitats, ensuring the participation of civil society in the formulation and implementation of environmental policies, and recognizing the traditional knowledge associated with biodiversity	12	0.07%	MMA, Ibama, ICMBio	BNDES, CEF, FUNBIO	(10) Regulatory (08) Informational (15) Economic (07) Land use Planning
Agriculture	Regulate the production, commercialisation and distribution of food, fibres, bioenergy, and support rural social organisation.	6	0.32%	MAPA, Embrapa, Conab, Senar, Incra, SFB	SNCR	(06) Regulatory (09) Informational (08) Economic (05) Land use Planning
Regional Development	Address regional socio-economic inequalities	9	0.28%	MDR, ANA, Codevasf, SUDECO, SUDENE, SUDAM	BNDES, BASA, BNDE, CEF, State Banks	(03) Regulatory (05) Informational (05) Economic (03) Land use Planning
Science and Innovation	Strengthen, expand and integrate the national science, technology & innovation system (SNCTI) for promoting the country's economic and social development.	7	0.21%	MCTI, Embrapii, IFES, IEES, ICT	BNDES, CEF, State Banks	(08) Regulatory (03) Informational (11) Economic (00) Land use Planning

* The percentages refer to the forecasted tax and social security expenditure per ministry in relation to the forecasted total revenue. According to the 2022 Federal Annual Budget (Law 14303/22).

** MMA (Ministry of Environment), Ibama (Brazilian Institute of Environment and Renewable Natural Resources), Chico Mendes Biodiversity Institute (ICMBio); MAPA (Ministry of Agriculture, Livestock and Supply); Embrapa (Brazilian Agricultural Research Corporation); Senar (National Rural Apprenticeship Service); Conab (National Supply Company); Anater (National Technical Assistance and Rural Extension Service Agency); Incra (National Institute for Agrarian Reform); SFB (Brazilian Forest Service); MDR (Ministry of Regional Development); ANA (National Water Agency); São Francisco Valley Development Company (Codevasf); development superintendencies (SUDAM - Amazon; SUDECO - Centre-West; SUDENE - Northeast); Ministry of Science Technology and Innovation (MCTI); Embrapii (Brazilian Company for Industrial Research and Innovation); IFES (Federal Institute for Higher Education); State Institute of Higher Education (IEES); ICT (science and technology institutes).

*** BNDES (National Development Bank); FUNBIO (Brazilian Fund for Biodiversity); CEF (Federal Savings Bank); SNCR (National Rural Credit System); State Banks (State and Federal District Banks); BNDE (National Northeast Development Bank); BASA (National Amazon Development Bank).

It was observed that, in 2022, while the *environment* domain manages regulatory instruments (e.g., licencing and inspection), the *agriculture* domain controls instruments to leverage FLR implementation (e.g., *PRAs*, *SiCAR* and *CRA*). The largest current public executor of watershed revitalisation in the country (*Codevasf*), and the most structured landscape governance (*SNGRH*), are under the *regional development* domain, while instruments to promote social-ecological innovations are under the *science and innovation* domain.

7.4.2 Potentially SIFLR-friendly Policy Instruments

The exploration of SIFLR as a social and land use transformation process conducive to sustainable local livelihoods and the overall resilience of social-ecological systems is recent ([Padovezi et al., 2022](#)). Thus, as expected, no specific policy has been designed to support social-ecological innovators linked to the FLR efforts in Brazil. However, we identified 102 policy instruments ([Table 11](#)) created for other purposes that – with appropriate adaptations and adjustments – could also favour SIFLR or inspire the creation of specific policy instruments.

Regulatory Instruments

At least 22 regulatory instruments potentially supportive of SIFLR can be classified into three groups.

- a) regulating land use to maintain or enhance natural capital (e.g., Native Vegetation Protection Law (*LPVN*), National System of Protected Areas (*SNUC*), *Environmental Crimes Law*, National Water Resources Policy (*PNRH*), Public Forest Management for Sustainable Production Law (*LGFPSP*);
- b) organising multi-governance systems, facilitating coordination among government agencies, civil society, and the private sector at different levels (e.g., National Environment System (*SISNAMA*), National Technical Assistance and Rural Extension Service Agency (*Anater*)),
- c) defining guidelines and promoting institutional environments favourable to experimentation and innovation (e.g., National Technical Assistance and Rural Extension Service programme (*Pronater*), National Science, Technology & Innovation System (*SNCTI*)).

The *LPVN*³⁶ and *SNUC*³⁷ are regulatory instruments and the main driving force of the Brazilian restoration chains. They are complemented by the *Environmental Crimes law*, which criminalises noncompliance with environmental norms.

The National Seed and Seedling Law (*LSM*) establishes standards to ensure the identity and quality of propagating material for agricultural, forestry, and native species, consecutively influencing the National Agriculture Policy (*Pagro*), the Agricultural Policy for Planted Forests (*PAFP*), and the National Policy for Native Vegetation Recovery (*Proveg*). This is a crucial regulation for SIFLR since we have identified social-ecological innovative cases in community-based native seed collectors' networks ([previous chapter](#)).

³⁶ *LPVN* establishes the general rules for protecting, recover and promote the sustainable use of Permanent Protection Areas (PPA) and Legal Reserves (LR), besides creating instruments to support the environmental compliance of rural properties. Together, PPA and LR require 21 ± 1 Mha of native vegetation recovery ([Soares-Filho et al., 2014](#)).

³⁷ The restoration demand estimative in Federal Protected Areas is 5 million hectares ([Planaveg, 2017](#)).

Table 11. Potentially supportive Brazilian policy instruments for Socially Innovative Forest and Landscape Restoration (SIFLR).

POLICY DOMAIN	INSTRUMENTS			
	REGULATORY	INFORMATIONAL	ECONOMIC	LAND USE PLANNING
Environment	1 - Protection of native vegetation on private land (LPVN); 2 - Protection of native vegetation in public areas (SNUC); 3 - Environmental Crimes Law 4 - Conversion Program for Environmental Fines (PCMA); 5 - Surveillance (Ibama); 6 - Surveillance (ICMBio); 7 - National Program for Benefits Sharing (PNRB); 8 - National Policy of Payments for Environmental Services (PNPSA); 9 - Targets for national restoration, forestry and agriculture plans (NDC); 10 - Policy instruments coordination (SISNAMA).	23 - Dissemination of environmental management technologies, environmental data and information (e.g., Biodiversity Platform - PB); 24 - Environmental Education; 25 - Research on Biodiversity (ICMBio); 26 - The 8 high level strategies of Planaveg; 27 - The National Adaptation Plan; 28 - National Benefit Sharing System (SisGen); 29 - The National Emissions Reduction System (Sinare); 30 - The REDD+ National Strategy (ENAREDD+).	48 - Environmental Licensing; 49 - Environmental Fines Fund (FCMA); 50 - National Environmental Fund (FNMA); 51 - Sub-National Environmental Funds (FMAs); 52 - National Fund for Benefit Sharing (FNRB); 53 - FUNBIO; 54 - Climate Change National Fund (FNMC); 55 - ABC plan; 56 - Reducing Emissions from Deforestation and Forest Degradation (REDD+) (Amazon Fund); 57 - Payment for Environmental Services; 58 - Green bonds; 59 - Legal Reserve sustainable forest management plan; 60 - Incentives to innovate and accelerate the restoration and sustainable use of native vegetation; 61 - Tax exemption for inputs and equipment, to PPA and RL restoration; 62 - Brazilian Emission Reduction Market (MBRE).	87 - Ecological-Economic Zoning (ZEE); 88 - Protected Areas (PA); 89 - Ecological Corridors (EC); 90 - Permanent Protected Areas (PPA); 91 - Legal Reserves (LR); 92 - Management Plans of (PA, EC, PPA and RL); 93 - Plan for prevent and control of deforestation in Amazon (PPCDam) and Cerrado (PPCerrado).
Agriculture	11 - Public forests management rules (LGFPPS); 12 - CAR as a requirement for granting agricultural credit; 13 - National Seed and Seedlings Law; 14 - National Programme for Technical Assistance and Rural Extension (Pronater); 15 - National Agency for Technical Assistance and Rural Extension (Anater); 16 - Regulation for Cooperative Societies (PNCoop and Social Cooperative Law - LSC).	31 - Annual Forest Grant Plan (PAOF); 32 - National Forest Information System (snif); 33- National Rural Environmental Registry System (SiCAR); 34 - Seeds and Seedlings National Register (Renaseam); 35 - SAFRA plan (ABC plan; Pronaf; Pronamp) 36 - Technical assistance and training in planting, forest management, restoration and agroforestry systems (SFB); 37 - Training, education and research (Rural education; SENAR; Embrapa); 38 - Technical Assistance and Rural Extension (Anater; Incra). 39 - Support farmers organization in associations and cooperatives (More Cooperative Brasil).	63 - Public Forest Consecration; 64 - National Forest Development Fund (FNDF); 65 - SAFRA plan (Pronaf, Pronap, ABC Plan); 66 - Rural tax exemption for PPA and LR; 67 - Environmental Compliance Programs (PRAs) 68 - Environmental Reserve Quota (CRA); 69 - State's purchasing power (CONAB); 70 - Cooperative Contribution (foreseen in the PNCoop).	94 - Agro-environmental Zoning; 95 - Agricultural Zoning of Climate Risk (Zarc); 96 - Public Forest Management; 97 - National Rural Environmental Registry System (SiCAR); 98 - Environmental Compliance Programs (PRAs); 99 - Forest Inventory (sniff).

continued next page...

POLICY DOMAIN	INSTRUMENTS			
	REGULATORY	INFORMATIONAL	ECONOMIC	LAND USE PLANNING
Regional Development	17 - Water Resources Policy (PNRH); 18 - National Water Agency (ANA); 19 - Policy instruments coordination (SNGRH).	40 - ANA (National Water Agency); 41 - Water Resources plans (PRHs); 42 - Watershed plans (WPs); 43 - Water Resources Information System (SIRH); 44 - Regional Observatory Plan (ODR).	71 - Water fund (FHIDRO); 72 - Water fee (foresee in the PNRH); 73 - São Francisco Watershed Revitalization plan (2020-30); 74 - Development fund for Nortest, Amazon and Central-wester (FNDE, FDA, FDCO); 75 - Codevasf;	100 - Water Resources plans (PRHs); 101 - Watershed plans (WPs). 102 - Regional Development planas (PNDR)
Science and Innovation	20 - Innovation incentive law (LAP); 21 -Puclic Incentives for Innovation in the productive environment law (LIIPC); 22 - Policy instruments coordination (SNCTI).	45 - Innovation ecosystems (ENCTI, ENI; UFES, IEES, ICT, EMBRAPII) 46 - Biome monitoring program (PMABB); 47 - Biodiversity Research Program (PPBio).	76 - Incubation of innovative companies; 77 - Promotion of innovation ecosystems; 78 - Economic subsidy; 79 - Technological order; 80 - Tax incentives; 81 - Granting of scholarships; 82- State's purchasing power; 83 - Equity participation; 84 - FINEP-FNDCT; 85 - CNPq; 86 - FAPs.	

Informational Instruments

We identified 25 informational instruments consisting of the production, organisation, and dissemination of data and information to:

- a) Assist in the management of administrative procedures (e.g., National System of Genetic Heritage and Associated Traditional Knowledge (SisGen), the Rural Environmental Registry System (*SiCAR*); National Seed and Seedlings Register (*Renase*));
- b) Foster a decision-making process (e.g., *Planaveg*, *SNIRH*, the Programme for Environmental Monitoring of Brazilian Biomes (*PMABB*), and the National System for Reducing Greenhouse Gas Emissions (*Sinare*), which is a key instrument for the Brazilian Emissions Reduction Market (MBRE).
- c) Develop human capital (e.g., environmental and rural education service (*Senar*), federal and state institutes of higher education (*IFES*, *IEES*), and;
- d) Strengthen social capital (e.g., Biodiversity Portal - *PB*³⁸), Watershed Plans (*WPs*) and *Biodiversity Research Programme (PPBio)*).

Economic Instruments

We also identified (39) economic instruments that could support SIFLR, such as:

- a) Incentives and taxes mechanisms (e.g., national environmental fund (*FNMA*), climate change fund (*FNMC*), national forest development fund (*FNDF*), the agricultural financing plan (*SAFRA plan*), and the water use fee managed by the *Water Agencies*;
- b) Compensatory payments (e.g., licencing, payment for environmental services in Permanent Protected Areas and Legal Reserves, and;
- c) New market incentives (e.g., REDD+, MBRE, Environmental Reserve Quota (*CRA*³⁹), public forest concession, and state purchasing power).

Regardless of the strategy adopted by a SIFLR and socioeconomic, political, or geographic contexts, the larger volume of FLR investments is destined for the service and supply chain associated with the physical transformation of the landscape (e.g., seeds and seedling production, ecological restoration, and implementation of agroecological systems). Thus, a wide range of existing economic and financial instruments to this end was detected. For instance, the carbon market and the water use fees determine the value of products (e.g., water quality) or services (e.g., carbon stored) to collect resources and finance watershed plans and programmes to reduce deforestation, such as the Action Plan for the Prevention and Control of Deforestation in the Amazon (*PPCDAm*) and its version to the savanna biome (*PPCerrado*), or to support strategic restoration efforts.

In addition to penalties (sticks) and information (sermons), economic instruments have been used as an incentive (carrots) to encourage landowners to protect and restore native vegetation ([Bogdzevič & Kalinauskas, 2021](#)). In this sense, the national policy for the payment of environmental services (*PNPSA*) allows landowners to receive financial contributions to protect and restore native vegetation. In 2022, the *FLORESTA+* programme, anchored in the national green growth programme (*PNCV*), uses *Amazon Fund* resources to execute payments for environmental services in northern Brazil.

Other examples of economic instruments include the deduction of Permanent Protected Areas (PPA) and Legal Reserves (LR) from the rural property tax accounting; rural credits for volunteering finance PPAs and LRs restoration; and agricultural credits designed for rural properties that comply with environmental legislation, such as the low carbon agriculture plan (*ABC plan*).

A single policy instrument can operate through multiple approaches. For example, the environmental conversion programme (*PCMA*) is a regulatory and economical instrument that offers a discount to the environmental violator on the deferred fine, accelerating the infraction's enforcement process. This

³⁸ (<https://portaldabiodiversidade.icmbio.gov.br/portal/>)

³⁹ Foreseen by the Native Vegetation Protection Law (*LPVN*), CRA is a nominative title representing a native vegetation area, existing, or recovering, which can be used for Legal Reserve compensation.

mechanism collects resources to finance large restoration projects in priority landscapes. The protected area system (*SNUC*) also has a similar instrument, which requires a contribution fee of 0.5% of the total cost of any enterprise located near protected areas. These resources have supported restoration in protected areas and their surroundings. Established by the national environmental policy (*PNMA*), forest replacement is another regulatory-economic instrument that imposes a mandatory contribution on timber consumers.

Land-Use Planning Instruments

Finally, we observed 16 land-use planning instruments that could be organised into:

- a) Functional mapping and other informational tools that assist public administration in enforcing sanctions and providing investments (e.g., economic, ecological zoning and agricultural climate risk zoning);
- b) The structural planning formulated to generate recommendations and action plans (e.g., environmental regularisation programmes *PRAs*), *programmes* to tackle deforestation (*PPCDAm* and *PPCerrado*), Watershed Plans (*WPs*) and the national integration programme (*ROTAS*)).

7.5 DISCUSSION

Through a systematic analysis of 12 Brazilian public policies, we have uncovered a complex governance structure (Figure 10) that oversees 102 policy instruments (Table 11) capable of promoting the emergence and development of SIFLR. Nevertheless, a thorough evaluation of these elements has brought to light four significant gaps that hinder their capacity to leverage SIFLR initiatives in Brazil effectively: 1) policy and politics disconnection; 2) uncoordinated policy instruments; 3) weak landscape governance approach; 4) repressed local experimentation.

7.5.1 Policy and Politics Disconnection

The main driving force for SIFLR in Brazil is the legal demand for native vegetation recovery, generated by policy instruments designed and implemented under the *environment domain*. However, weakened over the past decade⁴⁰, this domain began to be systematically dismantled in 2019. Without being able to extinguish the Environment Ministry (*MMA*), Bolsonaro's government transferred some of its competencies to the Agriculture (*MAPA*) and Regional Development (*MDA*) ministries, reduced the budget and autonomy of environmental inspection and monitoring bodies, bureaucratised and relaxed environmental standards, and removed representatives of organised civil society from the composition of environmental boards. As a result, the federal government became an accomplice in deforestation, particularly in the Amazon region, and neglected legal commitments to promote the recovery of native vegetation (Abessa et al., 2019; Garrett et al., 2021; Moutinho & Escobar, 2022). Furthermore, the prevalence of congress members not committed to environmental issues⁴¹ encouraged the executive power drive to dismantle Brazil's environmental policy (Ferrante & Fearnside, 2021).

The recent history of the Brazilian deforestation reduction policy highlights the relevance of aligning written policy with its respective implementation of politics. For example, the first phases Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (*PPCDAm* 2004-2011) were marked by the articulation between dozens of ministries coordinated directly by the presidency's civil house, resulting in the alignment of policy instruments that led to ~80% reduction in deforestation in the region (West & Fearnside, 2021).

Although a democratic and participatory political atmosphere tends to reduce conflict between actors' interests and increase understanding and compliance with the rules of the game, the predominant

⁴⁰ Between 2014 and 2018, MMA's settled discretionary expenses were reduced by 72.1%, as noticed by Allegation of Noncompliance with a Fundamental Precept 760 submitted by political parties to the Federal Court of Justice, demanding that the Brazilian State effectively implements the Action Plan for the Prevention and Control of Deforestation in the Amazon - *PPCDAm* (STF, 2022);

⁴¹ Agriculture Parliamentary Front (44% of the Deputies and 48% of the Senators); Regional Development Parliamentary Front (54% of the Deputies and 20% of the Senators); Science, Technology & Innovation Parliamentary Front (38% of the Deputies and 52% of the Senators); Environment Parliamentary Front (with 38% of the Deputies and 7% of the Senators).

*A congressman may participate in more than one thematic parliamentary front.

(source: <https://www.camara.leg.br/internet/deputado/frentes.asp>)

approach to land use policy in Brazil is top-down, privileging allies of the State with few adequate mechanisms to engage the stakeholders and actors most affected by the regulations (Rametsteiner, 2009; Bennett et al., 2018). Thus, political will is a determining factor in enabling the public structure required for the execution of instruments, and effective implementation of environmental policies since degradation is supported by illegal practices and restoration demands public investments (Vadell et al., 2016; Ferrante et al., 2021).

Political will was key in driving South Korea to reverse the forest degradation left by tree wars from 1910 to 1953. Using a patriotic discourse followed by a significant media effort, President Park Chung-hee (1963–1979) prioritised forest restoration for his administration and his successors (Lee, 2012). Through Forest Development Plans for Rehabilitation and Restoration, the South Korean government articulates energy, agriculture, water, and restoration policies to implement activities on national, provincial, and municipal scales. Setting clear goals and promoting financing and technical assistance, these three million-hectare plans were restored from the mid-1950s to 2007, generating income for rural communities. (Bae et al., 2012).

7.5.2 Uncoordinated Policy instruments

The complexity of issues addressed by the policies analysed (e.g., water and food security, regional development and climate change) calls for the participation and coordination of many stakeholders, multilevel governance, and policy instruments for local context-based solutions (as SIFLR) to emerge (Chazdon et al., 2021; Osborne et al., 2021). The 102 policy instruments we identified are distributed in a top-down governance structure and respond to poorly integrated policies, represented by the prevalence of vertical connectors (Figure 10). As discussed in the previous subsection, most horizontal lines departing from the *environmental* domain represent its organisational dismantling.

Uncoordinated policy instruments and their negative impacts on FLR governance have also been reported in other countries, such as Indonesia (Sayer et al., 2021), Madagascar, and Paraguay (Mansourian et al., 2014; 2016). Although lack of policy coordination is often associated with a technical-administrative issue (Weitz et al., 2017), conflicts of interest and power disputes are undeniable limiting factors for policy coordination (Cejudo & Michel, 2017). For this reason, coordinated policy instruments are often observed within rather than between policy domains. This can be confirmed by observing the water policy (PNRH) execution, where the National Water Agency (ANA) coordinates the policy instruments implementation in harmony with governance subsystems (SNRH) (Figure 10).

Costa Rica is a well-known example of policy coordination toward forest transition, having increased forest cover by 48% between 1986 and 2005 while promoting green jobs (Buckingham & Hanson, 2015). It began in the 1980s when the International Monetary Fund forced the country to implement austerity policies that reduced social investments and agricultural subsidies. This measure resulted in the abandonment of agricultural areas, mainly low-productivity pastures. With international tutelage and funding, the country coordinated the implementation of policy instruments to reduce deforestation, promote natural regeneration and develop ecotourism, biodiversity protection, and water and energy security (Roebeling & Hendrix, 2010). However, although the transformation driven by this policy change has sparked social-ecological innovation (Castro-Arce et al., 2019), the long-term sustainability of local livelihoods is questionable (Allen et al., 2017).

7.5.3 Fragile Landscape Governance Approach

Weak landscape governance refers to a situation where there is a lack of effective management or regulation of the interconnections between socially constructed spaces and the 'natural' conditions of places (Görg, 2007). Multiscale coordination between the interests of actors and sectors in the management of landscape resources is essential to negotiate trade-offs and maximise synergies that lead to an inclusive FLR (Chazdon et al., 2021), eventually supporting SIFLR to spark. Participatory land use planning is an important tool to create a shared vision of the future, set the rules of the game and priorities local interventions. The land use planning instruments we have identified are designed to collect, organise and make information available to the general public. However, they do little to engage local stakeholder networks in developing plans for landscape restoration, which contributes to FLR initiatives poorly connected to the local context. Landscape governance seems to need more space as a policy instrument in Brazil. In 2022, participatory landscape planning was relegated to project activities carried out in priority

geographical areas, funded mainly by philanthropies. However, these projects are generally one-off and short-lived, limiting the employment of a long-term landscape approach.

The landscape approach can improve governance effectiveness by tailoring decision-making closer to local needs, increasing buy-in from local communities and stakeholders, and ultimately increasing the chances of FLR to succeed (Mansourian & Sgard, 2021; van Oosten et al., 2021) and; eventually, supporting by social-ecological innovations. For example, the Fandriana-Marolambo FLR programme in Madagascar evolved when landscape governance was centred on local communities to restore thousands of hectares of forest (Mansourian et al. 2016). Lessons learnt from this initiative encouraged the national government to commit to restoring 4 million hectares by 2030 with community involvement in landscape governance to ensure their local demands are met (Rakotoarisoa et al., 2020).

According to Sapkota et al. (2021), decentralising decision-making through supporting legal structures and transversal multilevel (i.e., landscape to national) and multi-sectoral (e.g., forestry, agriculture, infrastructure, and finance) platforms can contribute to more effective FLR governance. Through instruments such as the Peat Restoration Agency, Forest Management Units and Ecosystem Restoration Concessions, the Indonesian government has decentralised its FLR efforts (Sayer et al., 2021). However, disorganised multilevel governance and uncoordinated policy instruments have given rise to a proliferation of fragmented subnational initiatives, escalating competition for the already limited resources needed to implement FLR (Sari et al., 2019). Moreover, this can also hinder the emergence of legitimate and capable local initiatives, which can impact the country's forest restoration progress since, in Indonesia, smaller-scale restoration programs have been more successful than large-scale initiatives (Sayer et al., 2021).

Landscape governance involves multilevel articulation of competing land use demands within a defined area, improving its ability to withstand natural, socioeconomic or political changes or shocks (Reed et al., 2017). The forest transition through SIFLR requires landscape governance that is both; effective in actively listening to local social needs and responsive in designing and implementing policy instruments that stimulate the innovative capacity of local communities, especially economically marginalised ones.

7.5.4 Repressed Local Experimentation

The Brazilian innovation policy encourages the productive sector (mainly through economic instruments) to develop new solutions (primarily technological) to increase the country's labour productivity. This vision prioritises investments and public-private partnerships to foster research and development (R&D) through a classic model in which researchers respond to the demands of political and economic agents (Leydesdorff, 2012). The Brazilian Association for Industrial Research and Innovation (*Embrapii*) is a symbol of this model; its mission is to enable innovative solutions by fostering partnerships between the industrial sector and the governmental structure to support science and innovation. Once the scope of the partnership is defined, federal and state research centres (*IFES* and *IEES*) take action, having as main public financing instruments the Financier of Studies and Projects (*FINEP*), the National Council for Scientific and Technological Development (*CNPq*) and the Research Support Foundations (*FAPs*). Groups of landscape stewards could be supported to develop socio-ecological innovations by a similar arrangement.

Currently, supporting socio-environmental innovators is marginal in the Brazilian innovation system, leaving them dependent on specific activities within research projects, mainly with a socio-environmental approach. However, public technical assistance and rural extension services can act as articulators between scientific and local empirical knowledge in some cases, depending on local and individual characteristics, facilitating SIFLR germination.

Since 2011, bill PL#111/11 has been pending in the Brazilian Congress to institutionalise the National Social Technology Policy. Using a broader concept of technology, this bill aims to regulate the production and systematisation of knowledge and innovative social practices developed by or in partnership with local communities, contributing to local social development (Dagnino, 2014). This bill holds the promise of regulatory and economic instruments to bring the governmental science and innovation structure closer to local social-ecological innovators, expanding the possibilities of SIFLR.

7.5.5 Recommendations

Drawing upon the aforementioned prominent policy gaps, we present three key recommendations aimed at enhancing SIFLR in Brazil:

- 1) Re-establish the connection between politics and environmental policy and laws already in force, reinstating social participation in formulating, evaluating, and adapting environmental public policy instruments. This entails aligning policies with established environmental regulations and actively involving stakeholders in decision-making.
- 2) Foster localised decision-making processes that prioritise sustainable livelihoods, bringing decision-making closer to the specific needs of local communities. Taking inspiration from SNGRH, institutions can consider establishing a national governance system, such as a National Landscape Restoration Agency or a National Landscape Restoration Management System. These entities would facilitate decentralised decision-making on priority landscape-scale actions, empower socio-ecological innovators, promote innovative solutions, and ensure the well-being of the landscape and its inhabitants.
- 3) Enact a legal framework that enables the National System of Science, Technology, and Innovation (*SNCTI*) to support civil society organisations interested in developing socio-ecological innovations, particularly those related to the restoration and sustainable utilisation of native vegetation. The proposed bill (PL#111/11) on the National Policy for Social Technology aligns with this objective. Additionally, establishing a national registry and implementing a communication strategy for SIFLR initiatives would serve as essential tools to promote innovative solutions and effectively address the needs of Brazil's landscapes and communities.

7.6 RESEARCH LIMITATIONS

To portray the governance structure in force in 2022, we made the methodological option of considering only the governance elements (regulations, councils, executors, programmes and plans, funds and financial institutions) with at least one publicly disclosed activity in the previous two years, i.e., after February 2020. We made this option to better portray the governance structure in 2022, given that, unable to be extinguished, some of these governance elements were frozen in Bolsonaro's administration. In making this choice, we are aware that some elements of the governance structure in place in 2022 have been excluded from [Figure 10](#) (e.g., the National Forest Programme – PNF and the National Forestry Commission – Conaflor), as they did not publicise any activity from 2020 to 2022.

The analytical option to focus on federal public policies is justified by the exploratory nature of this research and the complexity of analysing 26 more states, one federal district, 5,568 municipalities and philanthropic investments in Brazil. However, as some of the identified gaps (e.g., landscape governance and local experimentation) may be filled by subnational policies or supported by philanthropic investments, this option also brings another constraint to this research.

7.7 CONCLUSION and INSIGHTS

By revealing 102 potentially SIFLR-friendly policy instruments in Brazil and mapping their respective governance structure, this paper represents a first step towards a better understanding of the role of public policy in promoting SIFLR. Furthermore, our analysis of Brazilian policy documents identified a complex organisational structure with weakened governance and limited experimentation by local actors. We suggest three ways to broaden the Brazilian government's support for SIFLR: I. Reconnecting politics to existing environmental policies and laws, II. Bringing decision-making closer to local needs through landscape governance, and III. Establishing a legal framework to enable innovation and science frameworks to support local civil society in developing social-ecological innovations.

Finally, we recognise the need for further analysis, not only to explore the effectiveness of each identified instrument and governance structure but also to understand the profile of those who have accessed these instruments and are representing SIFLR on policy councils and their impacts on socio-ecological innovators and landscape restoration.

CHAPTER 8. FINAL REMARKS, LAST INSIGHTS and CONCLUSION

Here I present a compilation of the main findings and reflections developed throughout this thesis, answering the research questions initially established (chapter 1.1). I have also taken this closing section to share last insights and final remarks of this investigative journey.

8.1 RESEARCH COMPILATION and LAST INSIGHTS

8.1.1 Specific Objective 1: To establish the bridges of understanding between Social Innovation (SI) and Forest and Landscape Restoration (FLR).

Research question 1.a: What conceptual bridges link Social Innovation and Forest and Landscape Restoration?

Research question 1.b: Could a merged conceptual framework explain the phenomenon of "Social Innovative - Forest and Landscape Restoration" (SI-FLR)?

According to this thesis results, SI-FLR can be described as a socioeconomic and land-use transformation process conducive to sustainable local livelihoods and overall resilience of social-ecological systems. As proved by the applications proposed in this thesis, SI-FLR is also a framework that allows conceptual generalizations and simplifications to explain how SI can lead to more inclusive and transformative FLR initiatives. By describing how this phenomenon can theoretically occur, the innovative bridging framework developed in this thesis, which brings together the previously separate concepts of SI and FLR, i.e., SI-FLR, provides analytical tools that help to understand the potential determinants of its emergence, development, and structuration.

A deeper answer on what SI-FLR requires a better understanding of its main components, FLR and SI. While FLR is about dialoguing with stakeholders to identify, plan and implement more effective landscape mosaics, SI focuses on reconfiguring the social landscape (social relations and structures) to include marginalised people, adjusting, or transforming social attitudes and demands, which eventually will influence the landscape mosaic design.

Conceived through conceptual bridges between SI and FLR, the SI-FLR framework assumes a unique nature, which can be seen through two perspectives. The socio-economic, pictured as a SI process supporting efforts towards landscape restoration; and socio-ecological, which recognises FLR actions arising from or reinforced by SI processes. Both perspectives share the understanding that multiple local needs should be addressed by the landscape mosaic design. By embracing both, SI-FLR reinforces the policy choice of prioritizing local sustainable livelihood needs to ensure socio-ecological systems resilience.

As such, SI-FLR specifies a distinct and innovative approach to FLR, as it brings social innovation as a core element to enable inclusive solutions to restore the elements and relationships of complex social-ecological systems. Thus, SI-FLR argues that answers to the questions for whom, how, where and who will carry out restoration efforts in the landscape should be crafted through reflexive processes that involve marginalised local dwellers together with other actors in the landscape, who should participate in both the design and execution of the solutions designed at this level. From a SI-FLR perspective, it is imperative that FLR initiatives reduce the vulnerability of sustainable local livelihoods.

The main conceptual bridges that link SI and FLR are presented below (chapter 4). These bridges were guiding questions to describe the SI-FLR phenomenon and analyse its determinant factors.

- *Guiding question 1 - Bridge 1 - is "Where can SI-FLR occur?"* SI-FLR is a place-specific process triggered and shaped by a multi-scalar context, local possibilities, and interests. Place (the landscape) is where the resources, local livelihoods, direct beneficiaries, risks, and opportunities are. Although it can be influenced by external factors such as policy instruments and external trade relations, SI-FLR depends on local agency power to emerge.
- *Guiding question 2 - Bridge 2 - "Why does SI-FLR happen?"* SI-FLR happens when socially organized

local dwellers realize, through a reflective process about the intrinsic and extrinsic factors that affect where they live, that landscape restoration activities can meet some of their social needs. When nature becomes a social-environmental need, local dwellers are one step closer to becoming SI-FLR agents.

- *Guiding Question 3 - Bridge 3 – “Who does this transformation?”* Transformation is led by Landscape Stewardship Groups (LSG) that act - with agency power - to (re)shape the landscape according to their wishes and possibilities. Agency power is the capacity of a social actor to deal with structural forces of domination, e.g., formal institutions and norms. It only occurs in a favourable context, by a qualified LSG, willing and enabled to make a change happen. Intermediary organisations can support LSGs by covering short-term weaknesses and promoting relationships of trust with different scales and sectors, acting as brokers of connections, resources, and knowledge.
- *Guiding Question 4 - Bridge 4 - “How does SI-FLR develop?”* The SI-FLR development process depends on many intrinsic and extrinsic dynamics. Appropriate governance conditions are fundamental for stakeholders to negotiate and implement an action plan capable of (re)designing land use in a transparent and democratic way, connected to the local social needs. In this sense, it was highlighting the following governance capabilities:
- **Trust-building:** It is the capacity to increase and maintain the level of trust and integrity among stakeholders;
 - **Self-organisation:** It is the capacity of self-organised networks to develop and maintain governance mechanisms favourable to the inclusion of marginalised social actors in the decision-making process and participation equity among the social groups involved;
 - **Adaptability-flexibility:** It is the capacity, through participatory and reflective processes, to facilitate the understanding of the feedback mechanisms between environmental flows and socio-economic changes, resulting in actions that allow rapid course adjustments;
 - **Bottom-up-linked:** It means the ability to keep local actors connected to the SI-FLR's development and structuration phases. As an SI-FLR develops, other social actors may embed into the network and governance structure. These new voices may act to shift power relations, pushing local actors out of the decision-making process.
- *Guiding Question 5 - Bridge 5 - “What is the expected impact of SI-FLR?”* When successful, SI-FLR improves local wellbeing, inspiring more resilient ways of living. The path of landscape transformation through SI-FLR pervades the reconfiguration of local economy, social relations, and power distribution to increase the stock of natural and social capital, strengthening political-economic and ecological resilience. This way, the SI-FLR approach contradicts the economic models that lead to socio-ecological degradation.

Last Insight 1: Since SI-FLR takes place at the local level, it is fundamental that - however, broad FLR programmes and projects may be - they should promote local spaces to encourage reflexive processes (exploring ‘glocal’ interlinked context and potential windows of opportunity), experimentation on solutions addressing local realities and values, as well as engaging local actors, especially the marginalised ones, in decision making (especially in the design and planning of activities, development of proposals and liaison with funders, prioritisation and analysis of activities locally executed).

Last Insight 2: The local-landscape approach referred above can be facilitated by local bridging organisations or facilitators. Organizations with this profile can fill local gaps (e.g., administrative skills, technical knowledge, networking), enhancing the actions of local agents. However, social learning and the continuous empowerment of local agents are fundamental for them to become autonomous in conducting their own ideas and protagonists of their own choices. By occupying the legitimate spaces of local governance, bridge organisations can alienate local actors from these spaces (see chapter 5, SI-FLR, ARVP).

Last Insight 3: The SI-FLR framework strength is to diagnose the situation and describe the process where SI is occurring/occurred, aiming to restore the multiple functions and possibilities of the landscape. However, although it favours the understanding and analyses of this phenomenon, the SI-FLR framework is not very prescriptive. That is, it is limited in inferring about the determinants and potential events or actions that can lever the emergence, development, and structuration of SI-FLR. With the aim of starting to address this gap, below (item 8.1.4) I present 10 determining factors, as well as events and actions that can leverage them and, eventually, the emergence, development, and structuration of SI-FLR cases.

8.1.2 Specific Objective 2: To identify and describe SI-FLR cases in Brazil.

Research question 2.a: Are there SI-FLR cases happening in Brazil?

Research question 2.b: What kind of Brazilian initiatives can be considered cases of SI-FLR?

Yes, there are SI-FLR processes occurring in Brazil at least since 2007, when the Xingu Seed Network emerged. Now this is happening in at least 3 biomes and 6 Brazilian states, where seven SI-FLR cases have been described along this document. These cases are linked to several FLR Brazilian initiatives, as demonstrated in the [Table 12](#) below.

Table 12. Brazilian initiatives categories identified and described as cases of SI-FLR.

CATEGORIES OF BRAZILIAN INITIATIVES	Nº of SI- FLR cases	REFERENCE of CASES DESCRIBED IN THIS DOCUMENT
Native Seed Production	4	ACP-RSC, Geraizeiros, Jequitibá and Juçara (chapter 6)
Native Vegetation Recovery	4	Sowing Sustainability (chapter 5) ACP-RSC, Geraizeiros, Pankararu, (chapter 6);
Social Movements for Territory Reappropriation	4	Agroecology Nuclei (chapter 5) (Geraizeiros, Jequitibá and Pankararu (chapter 6)
Agroecology	3	Agroecology Nuclei (chapter 5) Jequitibá and Juçara, (chapter 6);
Sustainable Use of Local Biodiversity	3	Sowing Sustainability (chapter 5) (Geraizeiros, Pankararu (chapter 6)
Landscape Planning and Advocacy	2	Restoration Actors Network of the Paraíba Valley (chapter 5) Geraizeiros (chapter 6)
Native Seedling Production	2	Jequitibá, Pankararu (chapter 6)

* The topics above relate to the SI-FLR cases identified and described along this document; however, we recognise that SI-FLR may emerge within other Brazilian initiatives as well.

Last Insight 4: Based on the original fieldwork and data, this thesis revealed that social innovations are occurring in Brazilian FLR initiatives. This research indicates that by privileging the design of local solutions, the social-innovative approach to landscape restoration (SI-FLR), can broaden social participation, especially of marginalised communities, strengthening sustainable livelihoods and driving restoration actions in landscapes. The categories presented in [Table 12](#) demonstrate that SI-FLR can arise in any link of the restoration services chain, from seedling production to the sustainable use of biodiversity, through forms of food production (Agroecology), to territorial re-appropriation and landscape use planning. In this perspective, the great challenge of governments and markets may not be to assume the direct implementation of FLR activities, but rather to create instruments and mechanisms that favour partnerships and networks capable to stimulate and strengthen local social-ecological innovations.

8.1.3 Specific Objective 3: To explore and analyse the intrinsic and extrinsic factors shaping and propelling SI-FLR in the Brazilian context.

Research question 3.a: Have Networks of Native Seed Collectors been protagonists of SI-FLR in Brazil?

Network of Native Seed Collector (NNSC) stood out as protagonists of SI-FLR in the country. Of the 25 potential cases of SI-FLR mentioned by 15 Brazilian FLR experts, 9 were NNSC, representing 36% of the total. The remaining 64% are scattered among other SI-FLR protagonists related to the six additional categories identified in Table 5 (e.g., seedling producers, restorationists, dwellers, grassroots organisations, and restoration brokers).

Native seeds are primary resources for FLR. When natural regeneration is not an option, terrestrial ecological restoration depends on seed collectors. In the Brazilian context, traditional (indigenous, Kalunga, Geraizeiros), rural and peri-urban communities, in collaboration with other social actors, are transforming the national seed market by articulating themselves into networks to collect and produce native seeds.

These NNSCs have developed innovations that improve seed supply for FLR actions while addressing local social needs (e.g., income generation, local ecological knowledge recognition, and improvement of local well-being).

Despite the lack of specific public policies to empower community-based native seed production, it was identified that, from 2018 to 2021, 180 tons of native seeds were produced by nine Brazilian NNSCs, generating US\$ 1.01 million for 997 (55% women) seed collectors (chapter 6). Of this total, 46% are people from traditional communities. Although significant, this volume is still very low, at least 20 times less than the minimum foreseen to meet the legal demand of national native vegetation restoration of about 20 million hectares.

Last Insight 5: Besides technological solutions (e.g., mixed seed planting - 'muvuca'), Brazilian SNCs have created new models of governance, partnerships, values, practices, and exchanges, namely SI-FLR that can inspire FLR programmes to improve their governance structures, financing capacity, coordination of policy instruments and the organisation of supply chains. Based on the original fieldwork and data, the present thesis has shed new light on NNSCs, and their relative cultural, social, economic, and environmental relevance within global efforts to restore degraded forests and ecosystems.

Last Insight 6: Recognising the critical role of NNSCs in SI-FLR processes can contribute to broadening their influence in the FLR chain and favouring their inclusion in the rural development agenda by expanding their range of partnerships and funding sources. However, NNSC must also improve their visibility and create larger networks (network of networks) to create a critical mass that can gain legitimacy in national and federal (or lobbying) negotiations. In this sense, this PhD highlights the role of SNCs and people from traditional communities, which are currently undervalued and under-supported in the country.

Research question 3. b: Are there policy instruments supporting SI-FLR in Brazil?

Policy instruments are powerful as they can trigger bottom-up movements driving SI-FLR emergence and development. However, SI-FLR is a new concept, and there are still no policies to support it in Brazil. Thus, identifying the existence of policies supporting the SI-FLR (chapter 7) was focused on the Brazilian policy domains of environment, agriculture, regional development and science and innovation.

Within the environmental domain, five policies, 12 councils and 38 instruments encourage the protection of biodiversity, aiming to ensure the participation of civil society in formulating and implementing environmental policies and recognise traditional knowledge associated with biodiversity. In the agricultural domain, four policies, nine councils and 25 instruments can influence SI-FLR by regulating the production,

commercialisation, and distribution of food, fibers, and bioenergy and by supporting rural social organisations in cooperatives and associations. In the regional development domain, two policies, nine councils, and 16 instruments address regional socio-economic inequalities. Finally, in the science and innovation policy domain, one policy, seven councils and 17 instruments were identified aiming to strengthen, expand and integrate the national science, technology and innovation system to promote the country's economic and social development (Figure 10 represents, in simplified form, the governance of these instruments both within and across these policy domains).

Thus, in 2022 there are at least 102 policy instruments (22 regulatory, 25 informational, 39 economic and 16 land-use planning, see Table 11) potentially supportive of SI-FLR in Brazil, responding to 4 policy domains and 12 policies. However, these policy instruments have been organised in a top-down manner and respond to fragile policies in a dispersed governance structure with a weak landscape approach, which disfavours local actors' experimentation of innovative solutions.

Last Insight 7: The main driving force for FLR in Brazil is the legal demand for the recovery of native vegetation, generated by policy instruments designed and implemented mainly under the political domain of the environment. The predominant land use policy approach in Brazil is top-down, privileging allies of the State, which partly explains the weakening of the environmental domain in the past decades. Thus, social participation in public policy governance is a premise to create the structure for effective social-environmental policy implementation. In addition, Rule of Law Mechanisms must act to guarantee the prevalence of environmental policy over the political strategies of governments. The main recommendations here are to align politics with existing policies and laws and maintain social participation in the preparation, evaluation, and adaptation of environmental public policy instruments. A path which the Brazilian government elected in 2023 seems to be resuming.

Last Insight 7: Policy instruments potentially conducive to SI-FLR are dispersed in the government governance structure, mostly top-down organised and responding to poorly integrated policies. Thus, while the environmental domain maintains control over regulatory instruments, most land use incentive instruments are under the control of the agricultural domain. Moreover, the main instruments to promote enabling environments for FLR innovations are under the science and innovation domain. In this sense, governance structures empowered to coordinate policy instruments implementation across policy domains could drive FLR actions that are more inclusive and attuned to local social demands.

Last Insight 8: Brazilian innovation policy encourages the productive sector (mainly through economic instruments) to develop new solutions (mainly technological) to increase labour productivity in the country. Since 2011, bill PL#111/11 has been pending in the Brazilian Congress to institutionalise the National Social Technology Policy. This bill holds the promise of institutionalising regulatory and economic instruments to bring the governmental science and innovation structure closer to local social-ecological innovators, expanding the possibilities of SI-FLR.

8.1.4 Specific Objective 4: Support FLR stakeholders and decision-makers in leveraging SI-FLR.

Research question 2. a: What are the determinant factors for the emergence, development, and structuration of the SI-FLR in the Brazilian context?

Research question 2. b: What are the events or actions that might lever these determinant factors?

The determinant factors (DF) for SI-FLR emergence, development and structuration are interwoven and influence each other through complex feedback mechanisms occurring at different scales over time and space. The infinite possibilities represented by the range of DFs and the possibilities of combinations between them can favour or inhibit SI-FLR, shaping its innovative socio-ecological character and goals. Determinant factors interfere with the development pace, pathways, functioning mode (e.g., organisational structure, governance, collective actions, and internal processes), and external relations established by SI-FLR.

Using a knowledge systematisation (chapters 2 and 4), observation, description, and analysis of seven SI-FLR cases (chapters 5 and 6) and a gap analysis of 12 policies potentially influencing SI-FLR in Brazil (chapter 7), Ten (10) DFs were identified for the emerging, development and structuration of SI-FLR, as well as events and actions likely to leverage them (Table 12). Awareness of DFs and their respective levers can assist decision-makers and other stakeholders involved in FLR initiatives in leveraging the SI-FLR approach.

Table 13. The three transformational scales of SI-FLR, the determinant factors for each, and the respective transformational scales and potential levers.

transformational SCALE	DETERMINANT FACTORS	DETEMINANT FACTOR LEVERS
Local Scale (EMERGENCE)	context changes	natural disasters, natural resources or nature benefits to people availability, shifts in political, economic or market trends
	social-ecological needs	reflexive processes, local livelihood interests, inspiring experiences, exchange of experiences, local ecological knowledge, local experimentation, belonging to local, technical and managerial skills, decision-making involvement
	innovative solutions	shared purpose, social inclusion, social organization, collective actions, knowledge
	local empowerment	sharing, strategic partnerships, local facilitators, bridging organizations
	social cohesion	regulations, grant funding, marketing, branding, ambassador
Landscape Scale (DEVELOPMENT)	social networks	trust-building, self-organization, adaptability-flexibility, landscape planning
	windows of opportunity	bottom-up-link, advocacy, cross sector coordination
	governance	social participation, policy instruments, politics alignment, policy coordination, landscape approach
	civil society power	
Game changing (STRUCTURATION)	State power	

The SI-FLR represents a bottom-up phenomenon sparked by local perceptions and reflections on socio-ecological issues and develops through social and economic relations. Although I have not identified cases of SI-FLR structuration over the dominant society, for example, it would be possible through adaptation or new policy instruments based on Gibbens' structuration theory. On the other hand, it was observed that SI-FLR could be strongly influenced by top-down institutions (e.g., policy instruments) and structural contexts (e.g., social relationships, economic positions, unequal access to financial resources and central network actors). Thus, while all DFs listed exert influence on the SI-FLR process, there are differences depending on the transformational scale/phase of the process (local-emergent; landscape-development; game-changing-structuration - Table 13).

Based on empirical data from the case studies and policy gaps discussed earlier, I present the 10 DFs, the events and actions that can leverage them along the transformational scale in the following paragraphs.

Context changes. Unexpected events or slow contextual changes that cause or threaten the well-being of individuals can mobilise people to (re)act, interrupting the local state of social inertia and triggering the

onset of an SI-FLR. Some examples are natural disasters, decreasing availability of natural resources or nature's benefits to people, and abrupt changes in political, economic or market trends.

- Context changes can occur slowly, like the 40+ year process of Geraizeiros territorial re-appropriation (SI-FLR Geraizeiros, chapter 6), or abruptly like the wildfire that consumed half of the Chapada dos Veadeiros National Park in 2010 (SI-FLR ACP+RSC, chapter 6) or the water crisis in the Paraíba Paulista Valley in 2014-15 (SI-FLR ARVP, chapter 5);
- They can also be triggered by institutional changes such as changes of direction in Brazilian environmental policy (chapter 7), by organisational adjustments due to large regional projects (SI-FLR Pankararu, chapter 6), by local initiatives (Agroecology Nuclei, chapter 5), or social-ecological needs (Geraizeiros, chapter 6).

Innovative solutions: By representing a possible way to address local social needs, innovative solutions (managerial, technological) can be determinant in leveraging SI-FLR. Different types of inspiring SI-FLR innovations were identified and described in this thesis. For instance, the innovative policy instrument which subsidised the creation of eight research networks on native seed production, the technological innovation "muva de sementes" (direct sowing of forest seeds), and the socio-innovative managerial model developed by the Xingu Seed Network, inspired the SI-FLR cases presented in chapter 6. The organisational and managerial innovations that enabled the establishment of the Arboretum programme and the elaboration of the Forest Development Plan for Vale do Paraíba Paulista were fundamental for the emergence of the SI-FLR Juçara, Jequitibá (chapter 6) and SI-FLR ARVP (chapter 5). Agroecology as an innovative approach to food production inspired the SI-FLR Agroecology Nuclei (chapter 5). It was possible to observe that visits to inspiring experiences, experience exchange gatherings, valorisation of local ecological knowledge, local experimentation, technical and managerial training, and involvement in decision-making were all actions that leveraged FD's innovative solutions:

- Visits to the Xingu Seed Network inspired the emergence of the SI-FLR ACP+RSC and Geraizeiros (chapter 6);
- Exchanging experience between both seed collector groups and networks is mentioned by SI-FLR ACP+RSC and Geraizeiros members (chapter 6), as well as Sowing Sustainability and the Agroecological Nucleus participants (chapter 5);
- Training, both technical and managerial, and experimentation with local or adapted proposals from other groups or geographies are present in the 7 SI-FLRs identified;
- Local ecological knowledge represented, for example, by local wisdom on the identification, distribution, and behaviours of native species, as well as the management of their seeds, was an added value of the communities involved in the SI-FLR Juçara, Jequitibá, Geraizeiros and ACP+RSC (chapter, 6).

Local empowerment: Discoveries resulting from the connection between local ecological knowledge, inspiring experiences, and new content (from visits, training, and experimentation) tend to increase the confidence of marginalised communities in taking up the role of agents of transformation of their own reality. By assuming this role, local communities can join in the game-changing stimulated by the FLR. In addition, the sense of belonging, technical and managerial skills, and involvement in the decision-making process can leverage local empowerment.

- In addition to being pivotal in reconquering their territory, the Geraizeiros people's sense of belonging to the Alto Rio Pardo territory stimulated youth's engagement with SI-FLR Geraizeiros (chapter 6) and the same feeling was observed among women and youth groups in São Luiz do Paraitinga (SI-FLR Sowing Sustainability) and among restoration actors (SI-FLR ARVP, chapter 5).
- The training in seedling production and business management provided by the São Francisco Seed Network (SFSN) favoured the emergence of the SI-FLR Pankararu (chapter 6);

- The self-management of the cooperative COOCREARP (SI-FLR Geraizeiros) and the association ACP (SI-FLR ACP+RSC) favoured the participation of seed collectors in important decisions, such as the definition of criteria for valuing the seeds of the marketed species.

Social Cohesion. Empowerment can provoke a re-balancing of power forces, destabilising the local social order. In this sense, it is strategic that the emerging SI-FLR represents a shared purpose, strengthening social interaction in the local community. In addition to the shared purpose, inclusion, social organisation, and knowledge sharing are levers of the social cohesion necessary for the emergence of SI-FLR.

- The shared purpose of producing healthier food in both settlements and rural schools fostered the social cohesion that underpinned the emergence of SI-FLR Agroecology Nuclei and Sowing Diversity (chapter 5);
- The social inclusion and organisation promoted by the landless movement (MST) positively influenced the structuring of the SI-FLR Agroecology Nuclei (chapter 5), Geraizeiros and Jequitibá (chapter 6);
- The social network analysis (chapter 6) indicated that "knowledge" is the main information flow exchanged between the seed networks hosting SI-FLRs.

Social Networks. The social network (or social landscape) represents the expansion of the social cohesion initially established around the SI-FLR or the aggregation of the SI-FLR network into a larger dominant network. The social relations of the social landscape can mobilise capital (human, financial and political) to foster and develop the SI-FLR. Collective actions, strategic partnerships, local facilitators, and bridging (or intermediary) institutions can act as levers of the social landscape.

- Collective actions for territorial re-appropriation and restoring degraded landscapes were vital to building the social landscape supportive of the SI-FLR Geraizeiros (chapter 6). Similarly, collective actions were fundamental to the diagnoses and elaboration of the landscape restoration plan, as well as to the meeting supportive of the SI-FLR ARVP's development (chapter 5);
- In its very first year, the strategic partnership between ACP and RSC enabled the commercialisation of stoked seeds, generating US\$20,730 in revenue for seed collectors;
- The social network analysis (chapter 6) revealed that the number of relationships involving seed commercialisation is higher in partnership relationships than among those that are purely commercial;
- The collaboration of local facilitators was crucial to overcoming the challenges of legalisation, processing, storage, and commercialisation of native seeds faced by the SI-FLRs Juçara, Jequitibá and Geraizeiros;
- Bridging organisations acted as knowledge, financial and relationship brokers, facilitating the SI-FLR's connection with other sectors and scales. It could temporarily overcome the technical and managerial limitations of SI-FLR agents (chapters 5 and 6).

Windows of Opportunity. The connections established across social landscapes increase the possibilities of identifying and accessing windows of opportunity, i.e., available resources (e.g., financial, human) and power connections (political, visibility), which can enhance the action and thus the development of SI-FLR in the landscape. Regulatory instruments, grants, marketing, branding, and ambassadors can facilitate access to windows of opportunity.

- Two regulatory instruments that provide windows of opportunity for SI-FLR in Brazil are the Native Vegetation Protection Law and the Forest Seed Law. While the former creates the legal demand for native vegetation restoration, the latter regulates the management and marketing of native seeds (chapter 7);
- Although the estimate of services and products needed to meet the legal demand for the recovery of native vegetation is sufficient to move a chain of supplies and services, its timid enforcement,

weak governance, and insufficient financial inventory result in a vulnerable and seasonal restoration economy. Within this context, all 7 SI-FLRs have accessed grants (public and private) to move their projects forward;

- Most SI-FLR cases provide services and products to a consumer market; however, none of these cases would be able to finance their projects by this means;
- Some SI-FLRs, such as ARVP (chapter 5), Geraizeiros and ACP+RSC (chapter 6), have personalised their purpose through communicative identity (branding). The ARVP (chapter 5) created a website to communicate the initiative⁴² and another one⁴³ to make available the methodology and results of the Paraíba Valley Forest Development Plan; in turn, SI-FLR ACP+RSC has a website aimed at marketing native seeds⁴⁴;
- Another window of opportunity lever is ambassadors, i.e., an influential person who advocates for the initiative. For instance, an artist, sensitised by the initiative of the seed collectors around the Chapada dos Veadeiros National Park, mobilised the local municipality to help them to create the Cerrado de Pé Association (ACP) (chapter 6).

Governance. When the SI-FLR accesses a window of opportunity and begins to put its ideas into practice, it may need to access data and share information, delegate tasks, and coordinate actions to expand its influence eventually. Opposing interests over who should participate, how to execute and what will be the priority of each envisaged activity might trigger explicit or veiled conflicts, hampering the SI-FLR development. Agreements (e.g., rules, assignments, responsibilities, and punishments) are established to help manage these conflicts, and governance represents these agreements and the negotiation space to define and enforce them. The greater the SI-FLR's power to act, the larger the network of actors and interests involved, and the more complex its governance. The capacities to build trust, self-organisation, adaptability-flexibility to adjust to the challenges of its own expansion and landscape planning are four levers for governance.

- Multidisciplinary teams applying participatory methodologies were efficient in establishing relationships of trust between partners and building applied knowledge for self-organisation and adaptive planning to new contexts, adjusting their goals when required. In the case of SI-FLR Agroecology Nuclei, a multidisciplinary team's "peasant-to-peasant" methodology was crucial for rural settlers to recognise themselves as agents of transformation of their own reality. In the case of SI-FLR Sowing Sustainability, professionals trained in applying participatory methodologies catalysed social learning processes and concrete actions that contributed to the social innovator's group empowerment, paving the way for SI-FLR development (chapter 5).

Civil Society Power. We understand that the development of an SI-FLR can scale its influence in three dimensions: inward, outward, and upward. It scales when it firms up as a belief and practice, changing the social and physical landscapes from which it emerged. Scaling out means influencing groups in other landscapes to engage in similar collective action. To scale up is to provoke institutional change at the policy level by creating or adjusting policy instruments. Civil society power represents the articulated action between SI-FLRs, supporters and beneficiaries to influence institutional changes favourable to the engagement of other groups in similar collective actions, extending the SI-FLR's power to act.

⁴² <https://restauracaovp.wixsite.com/atoresdarestauracao>

⁴³ <https://restauracaovaleadoparaiba.org.br>

⁴⁴ <https://www.rsc.org.br/vendas/sementes-nativas>
<https://www.rsc.org.br/vendas/sementes-nativas>

The DF Civil Society Power represents the entry of the SI-FLR into its third transformational scale (game-changing-structuring). Unfortunately, this stage of maturity was not observed in the SI-FLRs analysed, limiting the discussion on the SI-FLR structuring process in this thesis. However, along the research path, a recent movement of articulated action between the SI-FLRs ACP+RSC, Geraizeiros and several other Brazilian seed collector networks was identified. This movement is called "Redário" ([Annex 7](#)), which is a neologism in Portuguese that means a network of networks). Redário represents the power of civil society to create social relationships and (re)form a social organisation through generating and distributing knowledge about community-based native seed production in Brazil. Based on the literature review (chapter 2, specifically item 2.3), chapter 4, social network analysis (chapter 6), political gap analysis (chapter 7) and empirical observations on the emergence of Redário, it is believed that its bottom-up-link, advocacy, and cross-sector coordination are levers of this FD.

- Bottom-up-linking means keeping local socio-ecological innovators involved in SI-FLR decision-making at all scales of its transformational development. The social network analysis (chapter 6) showed that the second most important information flow exchanged in seed networks is "political action," demonstrating the dedication of these networks to participate in the transformation process where they are embedded;
- The Network of Seed Networks (Redário) has representatives in the Technical Chamber of Forest Seeds (attached to the Ministry of Agriculture, Livestock and Supply - MAPA) advocating for adjustments in the forest seed law to favour the interests of seed collectors (see chapters 7 and 8). In addition, the Redário promotes intersectoral assignments to organise the demand and supply of native seeds in Brazil (see [Annex 7](#)).

State power is the ability of a State to regulate the rights, duties and behaviours of individuals and organisations within its territory. Mobilising this power is a key milestone in structuring an SI-FLR. The policy gap analysis identified five approaches leveraging this determinant factor of SI-FLR: social participation, policy alignment, policy coordination and landscape approach.

- Creating and ensuring democratic spaces for civil society participation in the elaboration, evaluation, and proposition of adjustments of policy instruments favouring SI-FLR structuration;
- Interested policy domains need to be aligned (politics) so that governance and administrative structures can be established to coordinate the implementation of policy instruments relevant to SI-FLR;
- Policies that consider the landscape governance approach, i.e., that have a decentralised governance structure and executive bodies approaching the landscape scale (for example, watershed committees), favour the emergence and development of the SI-FLR.

8.2 CONCLUSION

The major outcome of this research was to evidence that social innovations have leveraged more inclusive and transformative Landscape and Forest Restoration initiatives in Brazil. More inclusive because they design local solutions effectively connecting local social needs with the curation of nature's benefits for people through the FLR service chain. Transformative because they aim to modify both the physical mosaic of the landscape (increasing the supply of nature's benefits to people) and the socioeconomic and political relations that have sustained the social marginalisation and environmental degradation processes.

To reveal this major outcome, the analytical framework SI-FLR was created and applied to the situational diagnosis of eight Social Innovative - Forest and Landscape Restoration cases. The bottom-up perspective was captured through social network analysis of four seed collector networks. The top-down perspective was analysed through a policy gap analysis of four Brazilian policy domains, identifying 102 policy instruments that could potentially leverage SI-FLR initiatives. The analytical instrumental articulated through sequence mixed methods is another important contribution of this thesis since it can be used both to deepen the knowledge of the described SI-FLRs and to investigate this phenomenon in other geographical, temporal, and contextual situations.

Finally, to present pathways for decision-makers and other stakeholders interested in promoting the SI-FLR approach, I reorganised the main findings, empirical evidence and reflections generated along the investigative pathway into eight final insights; 10 determinants for the evolution of SI-FLR at three transformational scales; as well as events and actions with the potential to leverage such determinants (see previous sub-section 8.1.4).

Although SI-FLR is based on a rigorous framework of theoretical references and relies on empirical cases to build its arguments, this research has limitations. Among them, it is worth noting: 1) its innovative character in bringing together two broad, dynamic, and relatively recent concepts (social innovation and landscape and forest restoration); 2) the low number of case studies (8); 3) the lack of evidence on physical landscape transformation (e.g., landscape land-use change) and institutional/structural change (e.g., policy instruments shift).

The innovative character of this research consists in exploring, in a systematic manner, levers to overcome determinant factors to promote a more inclusive landscape restoration, where landscape stewardship groups assume the protagonism of the social-ecological system transformation they belong to.

CHAPTER 9. REFERENCES

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Desvendando a Inovação Social das iniciativas brasileiras de Restauração de Paisagens e Florestas



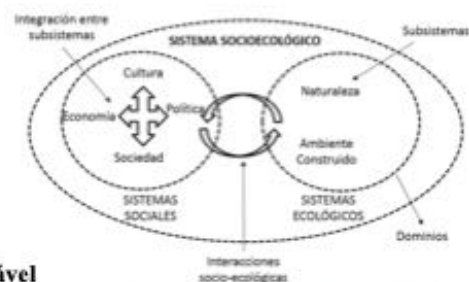
Doutorando:
Aurélio Padovezi

Supervisor:
Dr. Laura Secco

Co-Supervisores:
Dr. Cristina Adams (USP-BRA)
Dr. Robin L. Chazdon (USC-AUS)

Restauração de Paisagens e Florestas

- **RESTAURAÇÃO** de Sistema Sócio-Ecológico
 - Ganho de **cobertura florestal**
 - Ganho de **qualidade de vida**
 - Foco nos **modos de vida sustentáveis**
- **Foco na PAISAGEM**
 - Compromisso em torno de um **mosaico sustentável viável**
 - **Decisão no território** e gestão **adaptada** à mudança de contexto
- **FLORESTAS** multifuncionais
 - Visão holística e integrada: **conservação, manejo, agrofloresta**
 - **Abrange outros ecossistemas** respeitando suas especificidades
 - **Resposta a múltiplos problemas**



Inovação SócioEcológica

• INOVAÇÃO

- Algo novo para a paisagem ou para as pessoas
- Uma prática
- Processo, Produto, Serviço, Atitudes e Valores

• SÓCIO

- Construída pelas pessoas para as pessoas
- Reconfigura uma estrutura social
- Aumenta o capital social e humano

• ECOLÓGICA

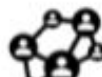
- Aumenta os ativos e serviços da paisagem
- Cria habitats para a biodiversidade
- Beneficia modos de vida resiliente



uma nova
solução



satisfaz uma
necessidade social



muda uma
estrutura social



Aumenta a capacidade
da sociedade em agir

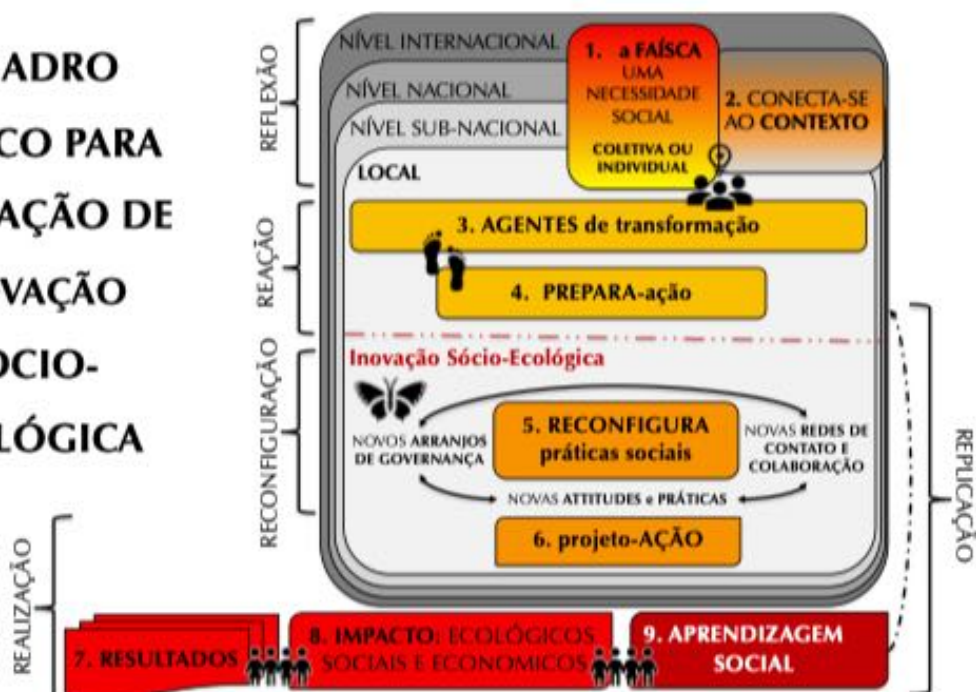


benefícios da
natureza às
pessoas

3

Mulgan et al. 2007; Adams and Hess 2010; Nicholls and Murdoch 2012; Olsson and Galaz 2012; Dennis, Armitage, and James 2016; Polates L., 2019; Melnykovych et al. 2018

QUADRO LÓGICO PARA AVALIAÇÃO DE INOVAÇÃO SOCIO- ECOLÓGICA



4

Severo et al. 2000



EXPLORANDO Inovação SocioEcológica?

1. Um grupo de agricultores treina seus vizinhos sobre técnicas inovadora de conservação de solo;
2. Uma plataforma compartilhada para comercializar sementes nativas e crioulas;
3. Uma cooperativa adota um novo método de cultivo, mais barato e ecológico;
4. Uma nova regulamentação atende a demanda local de produzir agrofloresta em Área de Preservação Permanente;
5. Uma prefeitura inicia um programa de Pagamento por Serviços Ambientais;
6. Uma parceria publico-privada inicia um Programa de Silvicultura de Espécies Nativas;
7. Um grupo de empreendedores locais se organiza para para atender demandas de um programa de restauração florestal.



Posso gravar a entrevista?

Pergunta e objetivos específicos da pesquisa

QUAL É o papel da Inovação Social no contexto de projetos de Restauração de Paisagens e Florestas?



1. Estabelecer as **pontes de conhecimento** entre SI e RPF
2. Identificar e descrever **exemplos de IS** nas iniciativas de RPF do Brasil
3. Identificar, descrever e analisar os **fatores exógenos** e que influenciam a emergência de IS em iniciativas de RPF
4. Identificar, descrever e analisar os **fatores endógenos** e que influenciam a emergência de IS em iniciativas de RPF

Elaborar um **guia** sobre como viabilizar a Inovação Social em iniciativas de Restauração de Paisagens e Florestas

Informações importantes sobre a entrevista

- **Sua contribuição será ajudar a identificar a Inovação Social em Projetos de Restauração no Brasil**
- **QUANTO TEMPO?** Aproximadamente 1 hora e 20 minutos.
- **QUEM?** Esta pesquisa é conduzida pelo doutorando **Aurélio Padovezi**,
– Laura Secco (TeSAF-Unipd-ITA), Cristina Adams (IEE-USP-BRA) e Robin L. Chazdon (UCS-AUS).
- **As respostas a esta pesquisa são totalmente anônimas.** Seu nome, função ou qualquer outro dado pessoal não será divulgado. Todos os dados registrados estarão sujeitos às políticas de uso de dados da União Europeia.
- **Aspas de trechos de sua fala podem ser utilizadas em publicações científicas.** Mesmo nesses casos, seus dados pessoais não serão divulgados.

Termo de Concordância

Concordo em participar do projeto de pesquisa "DESCOBRINDO A INOVAÇÃO SOCIAL DAS INICIATIVAS DE RESTAURAÇÃO DA FLORESTA E PAISAGEM BRASILEIRA" liderado por Aurelio Padovezi.

1. Recebi informações suficientes sobre este projeto de pesquisa e minhas perguntas foram respondidas de forma satisfatória. **O objetivo da minha participação foi explicado e é claro para mim.**
2. **Minha participação é voluntária.** Não há coerção explícita ou implícita para participar.
3. **Tenho mais de 18 anos de idade.**
4. **Tenho o direito de não responder a nenhuma das perguntas.** Se me sentir desconfortável de alguma forma ao responder ao questionário, tenho o direito de desistir do estudo.
5. Recebi a garantia explícita de que **o pesquisador não me identificará por nome ou função em nenhum relatório baseado neste estudo, e que minha confidencialidade como participante deste estudo permanecerá segura.** Estou ciente que o uso subsequente de registros e dados estarão sujeitos às políticas de uso de dados padrão União Europeia.

I agree to participate in the research project "UNCOVERING SOCIAL INNOVATION OF BRAZILIAN FOREST AND LANDSCAPE RESTORATION INITIATIVES" led by Aurelio Padovezi.

1. I have been given sufficient information about this research project and my questions have been answered to my satisfaction. The purpose of my participation has been explained to me and is clear.
2. My participation is voluntary. There is no explicit or implicit coercion whatsoever to participate.
3. I am at least 18 years of age.
4. I have the right not to answer any of the questions. If I feel uncomfortable in any way when answering the questionnaire, I have the right to withdraw from the study.
5. I have been given the explicit guarantee that the researcher will not identify me by name or function in any reports based on this study, and that my confidentiality as a participant in this study will remain secure. In all cases, subsequent uses of records and data will be subject to standard data use policies at the EU (Data Protection Policy).

1) Qual a INOVAÇÃO?

1. Qual é a sua relação com essa [IS-RPF]?
 1. Informante
 2. Inovador
 3. Seguidor / transformador
 4. Beneficiário
 5. Parceiro | Comprador | Contratante
 6. Doador, apoio técnico ou político



uma nova solução

- Nome
- Breve descrição
- Onde aconteceu?
- Quando começou?
- Qual foi a faísca que a despertou?
- Em que paisagem ela ocorre?

2) PORQUE é INOVADORA?

- **PORQUE** é inovador?
 - **Para QUEM** foi inovadora?
 - **Que TIPO** de mudança trouxe?
 - **Qual o NÍVEL** dessa mudança?
- (trazer um exemplo)



3) PORQUE é SOCIOECOLÓGICA?

- Qual sua **ORIGEM**?
- Qual era o **OBJETIVO** inicial?
- Como o **PROCESSO** foi desenvolvido?



benefícios da
natureza às
pessoas

4) Quais os **AGENTES** envolvidos?

- Quem foram os **INOVADORES**?
 - Existem **Seguidores**? Quem são?
 - Existem **Transformadores**? Quem são?
- Quem são os **BENEFICIÁRIOS** diretos?
- Quem são os principais **APOIADORES**?

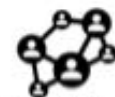


5) Quais os **RESULTADOS** até agora?

- Quais os **RESULTADOS** (outputs e impactos ambientais, institucionais sociais e econômicos)?
- Existe um sistema de **monitoramento dos IMPACTOS**?
- Quais **PRATICAS SOCIAIS** foram reconfiguradas?
Novas redes; procedimentos de iteração (público ou privados); atitudes
- Houve **impactos regionais**? Quais?



satisfaz uma
necessidade social



muda uma
estrutura social



Aumenta a capacidade
da sociedade em agir

6) Quais foram os FATORES que mais influenciaram?

- 3 fatores **do grupo inovador** que mais influenciam?
(positivos ou negativos?)
- 3 fatores **contexto** que mais influenciam?
(positivos ou negativos?)



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7) DIVERGENCIAS

- Qual o **nível de aceitação**?
- Quem foi (tem sido) **contra**?
- Quais foram os **efeitos negativos** para não envolvidos?
- Quais foram as **reações** dos não envolvidos?
 - Quais foram os **encaminhamentos** para essas reações?



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ANNEX 2 - Terms of free and clear consent

TÍTULO: DESVENDANDO A INOVAÇÃO SOCIAL EM INICIATIVAS BRASILEIRAS DE RESTAURAÇÃO DE PAISAGENS E FLORESTAS

Instituição de ensino: O doutorado é uma cotutela entre os programas:

Land Environment Resources and Health (LERH) - Università degli Studi di Padova, Itália.

e

Programa de Pós-Graduação em Ciências Ambientais (PROCAM) - Universidade de São Paulo

Doutorando: Aurélio Padovezi

Orientadoras: Laura Secco, Cristina Adams e Robin L. Chazdon

RESUMO DO PROJETO DE PESQUISA

Embora a importância de manter e recuperar a vegetação nativa seja cada vez mais reconhecida, a pressão para a degradação dessas áreas é permanente. Assim, cada vez mais, as pessoas precisarão adotar múltiplas maneiras para conservar, gerenciar e restaurar remanescentes florestais. A busca de soluções para aliviar esse cenário é um dos desafios mais urgentes da atualidade e só será bem-sucedida se muitos atores sociais concordarem em atuar na Restauração de Paisagens e Florestas, garantindo o duplo objetivo de: restaurar a integridade ecológica, e; melhorar o bem-estar humano. Embora os recursos financeiros estejam começando a fluir para essa agenda em todo o Mundo, as experiências acumuladas parecem ser incapazes de superar os desafios contemporâneos de governança, reduzindo a escala e a velocidade das transformações desejadas. Problemas de longa data e amplamente reconhecidos cujas instituições atuais não conseguiram resolver, como paisagens em processo de degradação socioambiental a longa data, são um terreno fértil para a Inovação Social. IS é o processo e o resultado da interação entre vários atores na construção de soluções para atender necessidades e problemas sociais. O presente projeto de pesquisa visa investigar se, e como a IS pode ajudar a impulsionar os desafios de implementação da RPF. Após um levantamento de iniciativas socio-inovadoras relacionadas à programas de recuperação da vegetação nativa no Brasil, identificamos dois temas que se destacam nesse tópico: a agroecologia e as Redes de Sementes Nativas do Brasil. Especificamente sobre o segundo tema, queremos aprofundar o conhecimento sobre as relações estabelecidas entre os atores sociais que se relacionam com as REDES. Nesse sentido, faremos entrevistas e aplicaremos questionário e revisão de literatura cinza para colher as informações necessárias para: a) identificar os nós (os atores sociais), e; b) os laços (tipos de conexões entre os nós). O desenho do mapa das relações socioecológica objetiva registrar e avaliar as relações construídas entre os atores que podem influenciar o desenvolvimento de Inovações Socioecológicas.

Palavras-chave: Restauração de Paisagens e Florestas, Inovação Socioambiental, Sistemas Socioecológicos

OBJETIVOS DESTA ETAPA DE PESQUISA

- 1) Mapear os laços de relação entre as redes de coletores de semente, instituições ponte, governamentais e demais nós (atores) que se articulam em rede para alavancar na agenda de recuperação da vegetação nativa;
- 2) Identificar e descrever inovações socioecológicas inseridas no contexto das redes de semente do Brasil;

O QUE É UMA ANÁLISE DE REDES SOCIOECOLÓGICA?

Análise de Redes Sociais busca compreender as relações sociais em termos da Teoria de Redes. Permite estudar, através da identificação dos atores e suas ligações, as relações entre os mesmos de forma a poder identificar as formas de interação entre si, contribuindo para o conhecimento sobre a rede social e o seu desenvolvimento. A Análise de Redes Sociais permite representar as redes sociais através da representação dos nós e das ligações entre eles. Os nós da rede social representam os atores dessa rede (indivíduos ou organizações). As ligações representam as relações entre os atores componentes da rede representada.

As relações entre os atores podem ser relações do tipo: parceria, troca de conhecimento, recursos financeiros, capital natural etc. As redes sociais podem ser representadas através de diagramas onde os nós são representados por pontos e as ligações são representadas por linhas. A Análise das Redes Sociais centra o seu interesse nas relações entre os diversos atores e não nas suas características.

DOCUMENTOS DE AUTORIZAÇÃO ÉTICA. (entrevistados devem assinar esse termo)

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

(Gestores e lideranças de programas e projetos de restauração Florestal no Brasil; inovadores, parceiros, beneficiários diretos das inovações sociais em iniciativas de restauração de floresta e paisagem identificadas)

Você consente ser entrevistado para contribuir com a pesquisa:

“DESVENDANDO A INOVAÇÃO SOCIAL EM INICIATIVAS BRASILEIRAS DE RESTAURAÇÃO DE PAISAGENS E FLORESTAS”.

Realizada pelo doutorando Aurelio Padovezi pela Universidade de Padova (Itália) em cotutela com a Universidade de São Paulo (Brasil).

Seu objetivo é identificar e compreender como processos de inovação social acontecem em projetos de restauração de paisagens e florestas. Bem como, avaliar a influência desses processos na dinâmica do uso do solo e qualidade de vida de comunidades rurais.

Para tanto, gestores e lideranças de projetos de restauração florestal serão entrevistados a fim de identificar onde se localizam e como experiências inovadoras que, através de mudanças nas relações sociais, se desenvolveram e foram capazes de mobilizar ações coletivas para melhorar a qualidade de vida dos moradores locais e, ao mesmo tempo, aumentar a cobertura florestal da paisagem.

Os inovadores – principais referências dos exemplos identificados – também serão entrevistados, assim como os parceiros e beneficiários diretos dessas iniciativas.

As informações levantadas serão trianguladas com dados sobre a dinâmica socioeconômica e do uso do solo para analisar e discutir sobre como essas inovações sociais emergiram e quais foram os fatores que mais contribuíram com isso.

A investigação resultará em uma tese de doutorado e outras publicações, que ficarão disponíveis na Universidade de Padova, Universidade de São Paulo ou em jornais científicos especializados. Portanto, muitas pessoas do Brasil e do mundo poderão ter acesso aos resultados dessa pesquisa.

Com a sua permissão, as entrevistas serão gravadas e você poderá ser fotografado. O pesquisador se compromete a apresentar e discutir os resultados com os entrevistados antes de sua divulgação. Além de garantir esclarecimentos sobre o projeto e seu andamento, a qualquer momento você poderá interromper a entrevista, pedir para retirar alguma informação específica, ou mesmo deixar de participar da pesquisa. Seus dados pessoais não serão divulgados.

Para registro desse compromisso, você receberá uma cópia deste termo.

_____, _____ de _____ de 202____.

Aurélio Padovezi*

Programa de Doutorado: Paisagem, Meio-Ambiente, Recursos e Saúde – Universidade de Padova
Programa de Pós-Graduação em Ciência Ambiental - Universidade de São Paulo

Entrevistado / Instituição

* Contato Pesquisador: (+55) 11 998 989 871 (+39) 320 267 3002 / email: aurelio.padovezi@gmail.com aurelio.padovezi@gmail.com

* Contato Comitê de Ética em Pesquisa Envolvendo Seres Humanos (EACH-USP): (11) 3091-1046 cep-each@usp.br each@usp.br

ANNEX 3 – Questionnaire used in the interviews

Olá,

Segue abaixo o questionário de coleta de dados para elaboração do **Mapa de relações Socioecológicas** das iniciativas “Caminhos da Semente” e “Redário de Redes de Sementes”.

As informações coletadas contribuirão para a pesquisa “Desvendando a Inovação Social da Restauração de Paisagens e Florestas”, conduzida pelo doutorando **Aurélio Padovezi**, pela *Universidade de Padova (Itália)* e *Universidade de São Paulo (Brasil)*, em parceria com a *Universidade de Viçosa (Brasil)*. O objetivo da pesquisa é compreender os ambientes organizacionais e institucionais favoráveis à emergência e desenvolvimento de Inovação SocioAmbiental nos contextos de Restauração de Paisagens e Florestas.

Assumimos o compromisso de comunicar os dados coletados respeitando a privacidade e os direitos individuais dos sujeitos participantes da pesquisa. Assim, as respostas são totalmente anonimizadas. Seu nome, função ou qualquer outro dado pessoal não será divulgado. Todos os dados registrados estarão sujeitos às políticas de uso de dados da União Europeia.

Esperamos que os resultados contribuam para melhorar a compreensão sobre as relações socioecológica e organizacionais que favorecem, ou reprimem, as Inovações SocioAmbientais no contexto de Restauração de Paisagens e Florestas no Brasil. Para tanto, ao final da pesquisa um relatório sintético e analítico sobre os dados coletados será disponibilizado, apresentado e discutido, via online. Todos aqueles que contribuíram com a coleta de dados serão convidados.

A. INFORMAÇÕES BÁSICAS DA REDE DE SEMENTES

A1. Nome da Rede de Sementes: _____ A.1.a Que ano a Rede foi criada? _____

A.2 Nome do Principal contato: _____ A.3. Há quanto tempo participa dessa Rede?: _____

A.4 e-mail: _____ A.5. telefone: _____

A.6. A rede de sementes é uma organização formal?

() Não () Sim, é uma associação () Sim, é uma cooperativa () Sim, é uma empresa

() Sim, outro tipo: por favor especifique: _____

() Caso seja uma organização formal, em que ano foi instituída legalmente? _____

A.7. Qual a escala de atuação da rede de sementes?

ESCALA DE ATUAÇÃO		A.7.1 NOME da REGIÃO, BACIA HIDROGRÁFICA, MUNICÍPIOS e LOCALIDADES	A.7.2.a N.º DE COLETORES DE SEMENTE (unidade)		A.7.3.b N.º DE NÚCLEOS DE COLETORES DE SEMENTE	A.7.4.a ÁREA DE COLETA DE SEMENTE	A.7.5.b Nº DE ÁREAS DE COLETA DE SEMENTE
	QTDE		mulheres	homens	unidade	hectares	unidade
A.7.1.a REGIÃO / TERITÓRIO							
A.7.1.b BACIA HIDROGRÁFICAS							
A.7.1.c MUNICÍPIOS							
A.7.1.d BAIRROS ou LOCALIDADES							

A.8. Qual o perfil dos *coletores de semente*? Na primeira parte da tabela abaixo, é esperado que a soma de “I.a” e “I.b” seja = 100%. Na segunda parte da pergunta as porcentagens podem se sobrepor, excedendo 100%.

PERFIL	PORCENTAGEM ESTIMADA (%)
I.a. Moradores rurais	0% 25% 50% 75% 100%
I.b. Moradores da cidade (periurbano ou urbano)	0% 25% 50% 75% 100%
II.a. Trabalhadores rurais	0% 25% 50% 75% 100%
II.b. Proprietários rurais	0% 25% 50% 75% 100%
II.c. Agricultor familiar	0% 25% 50% 75% 100%
II.d. Comunidades tradicionais ou indígenas	0% 25% 50% 75% 100%
II.e. Assentados rurais	0% 25% 50% 75% 100%
II.f. Outros: por favor, especifique: _____	8% 25% 50% 75% 100%

A.9 Qual o *volume de sementes* e *recurso financeiro* movimentado pela **rede de semenetes** nos últimos 3 anos?

	2018	2019	2020
A.9.a Número de espécies			
A.9.b Quantidade total de Sementes (em toneladas)			
A.9.c Recurso financeiro (em R\$)			

B. INFORMAÇÕES SOBRE A REDE DE CONTATOS DA ORGANIZAÇÃO ENTREVISTADA

Por favor, liste as principais organizações, as iniciativa(s) por onde se relaciona com a rede de semenetes e preencha as demais colunas com as informações sobre essa relação organizacional

Nº	B.1. NOME DA ORGANIZAÇÃO QUE MAIS SE RELACIONOU sobre o tema restauração de paisagens e florestas nos últimos 3 anos	B.2. Qual o nome da INICIATIVA (programas, projetos e/ou movimentos sociais) pela qual a relação com essa organização tem se dado? <i>Caso a relação seja apenas comercial indique “Comercial”;</i> <i>Caso a relação seja apenas doação de sementes “Doação”;</i> <i>e assim por diante.</i>	B.3. PARCERIA (COM ou SEM acordo formal) <i>Caso não haja parceria, deixe a resposta em branco)</i> informal? formal?	B.4. TROCA DE CONHECIMENTO (técnicas, práticas ou organizacionais) (assinale com um X)	B.5. Quantidade média de SEMENTES NATIVAS TRANSACIONADAS (por ano nos últimos 3 anos)	B.6. Compra ou Venda de SEMENTES NATIVAS nos últimos 3 anos (Indicar D = DOAÇÃO , V = VENDA ou C = COMPRA) (assinale com um X)						B.7. Valor estimado de SUPORTE FINANCEIRO nos últimos 3 anos (à parte da comercialização de sementes) <i>Em R\$ 1.000</i>	
						D	C ou V	< 50 mil	> 50 < 250 mil	> 250 < 500 mil	> 500 mil	Recebido	Entregue
0	Exemplo: Instituto EXEMPLO	Programa EXEMPLO		X	2		V			X		10	
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

C. INFORMAÇÕES SOBRE POTENCIAIS INOVAÇÃO SOCIOECOLÓGICAS

C.1 Das INICIATIVAS listadas acima (B.2), quais as 3 que apresentam maior número das características (A-G):

Nº*	Assinale com um X nas características que a INICIATIVA possui.							Por favor, caso exista, nos indique referências (ex. websites, artigos de jornal ou revista etc.) que decoram sobre alguma dessas característica assinaladas
	A	B	C	D	E	F	G	
0	X	X		X	X	X	X	www.exemplo.exemplo.ex

* indique o número da iniciativa (de acordo com a planilha questão "B", acima)

Essa INICIATIVA:

A = é NOVA no local (até 7 anos), para o grupo de pessoas envolvidas, ou no contexto atual;

B = ATENDE uma demanda social local (uma necessidade reconhecida pela comunidade local);

C = PROMOVE o engajamento voluntário da sociedade local;

D = VIABILIZA novas parceiras, colaborações ou redes de trabalho, ou; formou novas organizações, ou; alterou formas de planejar, tomar de decisão, ou; monitorar resultados.

E = Promove APRENDISAGEM social (cursos, treinamentos, visitas técnicas, organização social etc.);

F = GERA benefícios para a comunidade local;

G = GERA benefícios para a fauna e flora local;

D. INFORMAÇÕES ADICIONAIS SOBRE A REDE DE CONTATOS DA REDE DE SEMENTES

D.1. Por favor, indique abaixo o nome das 3 principais ORGANIZAÇÕES listada acima (B.1) com as quais se envolveu em atividades:

-> EDUCACIONAIS: cursos, aulas abertas, seminários, oficinas, intercâmbios, visitas, excursões, sistematização de conhecimentos e práticas etc.

-> CULTURAIS: manifestações religiosas, festas, mutirões, caravanas, encontros, práticas culinárias etc.

-> POLÍTICAS*: reuniões, manifestações, participação em eventos político etc.

*Obs: as atividades políticas envolvem um conjunto de ações planejadas e desenvolvidas de forma orquestrada com o objetivo de transformar ou manter instituições, valores, comportamento e atitudes individuais ou coletivas em sociedade.

NOME ORGANIZAÇÃO PARCEIRA (de acordo com B.1)	TIPO (especifique o tipo da atividade que organizam conjuntamente)	FREQUENCIA (número de eventos por ano) (assinale com um X)			
		2	4	6	6
EDUCACIONAL					
Exemplo: Instituto EXEMPLO	Exemplo: Treinamento em identificação botânica				
CULTURAL					
Exemplo: Instituto EXEMPLO	Exemplo: Festa da semente	X			
PROJETOS POLITICOS					
Exemplo: Instituto EXEMPLO	Exemplo: Normativa para comercialização de sementes				X

E. POLITICAS PÚBLICAS

Por favor, indique abaixo as 3 POLÍTICAS PÚBLICAS que mais impactam a rede de sementes que participa.

E.1. NOME DA POLÍTICA PÚBLICA	E.2. ESFERA			E.3. IMPACTO	
	Federal	Estadual	Municipal	POSITIVO	NEGATIVO

A.10 A **rede de sementes** desenvolve, coletivamente, alguma outra atividade relacionada à:

**Mais de uma opção pode ser escolhida.*

- () Recuperação da Vegetação Nativa
- () Produção de mudas
- () Agroecologia
- () Sistemas Agroflorestais
- () Manejo Florestal de Produtos Madeireiros
- () Manejo Florestal de Produtos Não Madeireiros
- () Turismo
- () Artesanato
- () Outros: Por favor, especifique qual:

A.5. Indique a porcentagem estimada da faixa de **renda média mensal** das famílias dos *coletores de semente* da **rede de sementes** em que participa.

até R\$ 500	0%	10%	20%	30%	40%	50%	60%	70%	90%	100%
de R\$ 500 a R\$ 1.000	0%	10%	20%	30%	40%	50%	60%	70%	90%	100%
de R\$ 1.000 a R\$ 2.000	0%	10%	20%	30%	40%	50%	60%	70%	90%	100%
de R\$ 2.000 a R\$ 3.000	0%	10%	20%	30%	40%	50%	60%	70%	90%	100%
de R\$ 3.000 a R\$ 4.000	0%	10%	20%	30%	40%	50%	60%	70%	90%	100%
de R\$ 4.000 a R\$ 5.000	0%	10%	20%	30%	40%	50%	60%	70%	90%	100%
de R\$ 5.000 a R\$ 6.000	0%	10%	20%	30%	40%	50%	60%	70%	90%	100%
mais que R\$ 6.000	0%	10%	20%	30%	40%	50%	60%	70%	90%	100%
A semente é a única fonte de renda para ___% dos coletores	0%	10%	20%	30%	40%	50%	60%	70%	90%	100%

FIM. **MUITO OBRIGADO PELA SUA PARTICIPAÇÃO** ❤️

ANNEX 4 – FUTURE SEARCH CONFERENCE GUIDELINE

OFICINA DO FUTURO e GRUPO FOCAL

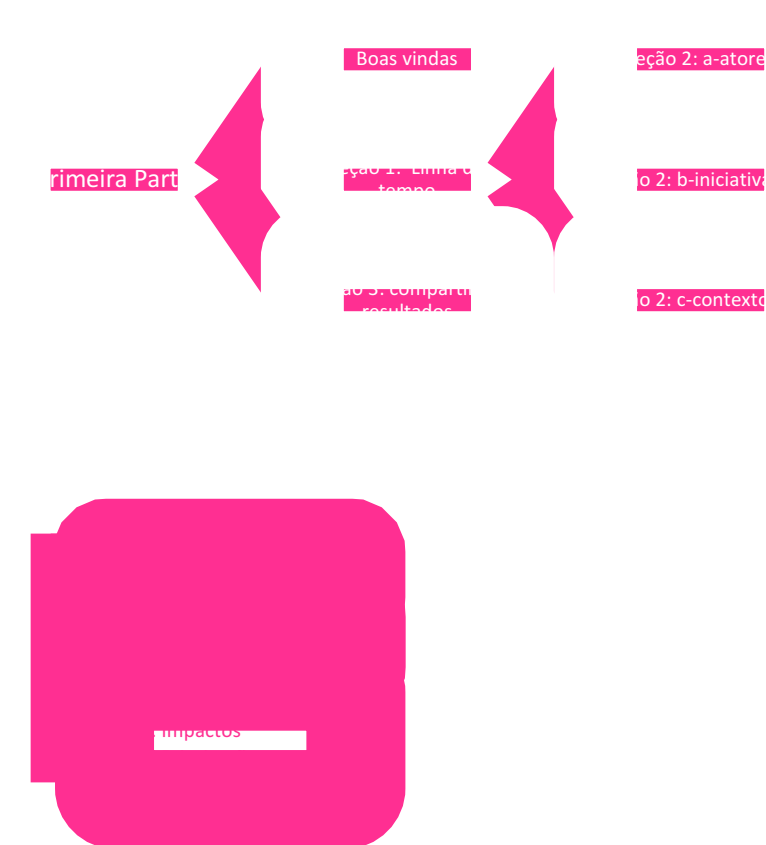
PARTICIPANTES: TODOS os atores relacionados com a [SI-FLR] que queiram participar voluntariamente

(1. Informante | 2. Inovador, Seguidor | 3. Transformador | 4. Beneficiário | 5. Parceiro, Comprador, Contratante | 6. Doador, apoio técnico, ou político)

Organizadores:

- 1* Moderador: Recepciona os convidados; conduz as dinâmicas de grupo;
 - 1* Assistente: Faz a recepção e registro dos convidados; ajuda a organizar os materiais para as dinâmicas; realiza os registros audiovisuais;
 - 1* Relator: Toma nota das discussões em grupo e registra os resultados das discussões;
 - 1* Observador: Toma nota dos comportamentos dos participantes, quem fica próximo a quem, que sai, quem chega, bastidores... etc.
- * esses números podem variar em função do número de participantes.

As atividades de grupo serão baseadas nas técnicas “Future Search Conference” e “Grupo Focal”, e serão divididas em duas partes e cinco seções.



A. Observações técnicas

A primeira parte pode ser conduzida em um grupo grande (máximo 100 pessoas), havendo meios para facilitar as atividades previstas por meio de subgrupos.

Na primeira parte, enquanto a boas-vindas e a ‘Seção I’ poderão abrigar um grande número de participantes, as seções subsequentes deverão ser conduzidas em subgrupos menores. Se o número de participantes for pequeno (até 12 pessoas) todas as seções poderão ser realizadas conjuntamente.

PRIMEIRA PARTE - Boas-vindas

Objetivo: Apresentar os participantes das “regras do jogo” da oficina. Apresentar o framework de avaliação do SIMRA (Social Innovation in Marginalized Rural Areas).



Figura 01. Framework do SIMRA. Arcabouço metodológico de Avaliação de Inovação Social em Áreas Rurais Marginalizadas.

PRIMEIRA PARTE – Seção 1: Linha do tempo

Objetivo: Identificar a linha do tempo da [IS-RPF] em três níveis: Os Atores; A Iniciativa, e O Contexto da [paisagem]

Uma linha do tempo é desenhada em papel Kraft afixado na parede. Os participantes são convidados a reconstruir a história da [IS-RPF] registrando as datas e eventos importantes que marcaram sua história. A Seção 1 pode durar de 1 a 2 horas.

a-atores

Após eventos e datas serem adicionados à linha do tempo, o moderador instiga os convidados a identificarem os atores que participaram de cada etapa da história registrada na linha do tempo. As perguntas chave aqui são: *Quem foi envolvido nas diferentes fases e eventos da [IS-RPF]? Quando você começou a se envolver nessa [IS-RPF]? O que você tem feito por essa [IS-RPF]?*

b-iniciativa

Na fase subsequente será explorado o processo de desenvolvimento da [IS-RPF], datas e acontecimentos importantes relativos ao seu desenvolvimento na [paisagem]. As perguntas chave aqui são: *Queremos saber quais foram os acontecimentos importantes seu desenvolvimento e quando aconteceram. Quais os eventos foram mais significativos? Qual foi a reação dos envolvidos diretamente, da comunidade e do poder público? Quais eram os fatores limitantes? Quais eram as condições favoráveis?*

c-contexto

Essa seção finaliza-se com a inserção da descrição dos contextos da [paisagem] ao longo da linha do tempo da [IS-RPF]. As perguntas de estímulo nesse momento são: *Qual o contexto do entorno quando do início da [IS-RPF]? Esse contexto foi modificado? Quando, como, e por quê? Qual foram*

as reações da comunidade e das instituições públicas a esse contexto inicial? Quais eram os fatores limitantes a serem superados?

PRIMEIRA PARTE – Seção 2: Detalhamento da linha do tempo

(pode ser realizada paralelamente à seção 1 com um conjunto específico de atores caso sejam muitos participantes)

a. Envolvimento dos atores da [IS-RPF] (aproximadamente 30 minutos)

Objetivo: Confirmar os atores mais importantes e identificar suas características em cada fase da linha de tempo do [IS-RPF].

O moderador coloca a linha do tempo construída na (ou adaptada da) seção anterior no centro e pede aos participantes para identificarem os atores mais relevantes no processo.

As **perguntas-chave** aqui são: *Quais atores foram mobilizados pela faísca inicial da [IS-RPF]? Quais as comunidades que mais se envolveram com a [IS-RPF]? Quem foi envolvido em cada etapa? Quem foram os inovadores? Quais foram as pessoas que se apaixonaram pela ideia? Quem foram os seguidores? Quais foram as primeiras pessoas que reconheceram o valor da ideia e começaram a colaborar com ela? Quem foi envolvido durante o processo de desenvolvimento da ideia? Quem fez mudanças ou ajustes importantes para viabilizar a implementação da ideia (transformadores)? Quem adotou a ideia rapidamente e começou a comunicá-la a outros grupos, aumentando a rede de contatos? Quem são os parceiros da [IS-RPF]? Quais atores externos foram envolvidos? Quem são os usuários finais do resultado da [IS-RPF]? Quem são os beneficiários diretos? Quem são os beneficiários indiretos?*

b. Fases e características inovadoras da [IS-RPF] (aproximadamente 30 minutos)

Objetivo: Especificar as fases da [IS-RPF] de acordo com o framework SIMRA.

O moderador coloca a linha do tempo no centro e pede aos participantes para identificarem e enquadrarem os eventos ali descritos no framework SIMRA.

As **perguntas-chave para identificar as fases de desenvolvimento** são: *Gostaríamos de saber quando as coisas aconteceram e como elas poderiam ser encaixadas no 'framework SIMRA'. Como poderíamos arranjar os eventos descritos nessa linha do tempo nesse sentido? Você se lembra de alguma fase-chave para a [IS-RPF]? Você poderia ajudar a conectar os eventos a datas específicas? Quando a [IS-RPF] começou? Quando foram obtidos os primeiros resultados? Quais foram os momentos de crise e como foram superados?*

As **perguntas-chave sobre o caráter inovativo** são: *Por que vocês acham que essa iniciativa é inovadora? Essa foi uma ideia totalmente nova? Os inovadores se inspiraram em alguma outra experiência? Qual? Foram realizados ajustes, adaptações a esse exemplo inspiração? Quais? Quais foram as mudanças na rede de relacionamentos, estrutura de governança (acordos, monitoramento), atitudes provocadas por essa [IS-RPF] no grupo de pessoas que se envolveu?*

c. O contexto da [paisagem] onde a [IS-RPF] acontece (aproximadamente 30 minutos)

Objetivo: Compreender o contexto da paisagem onde [IS-RPF] emergiu.

O moderador coloca a linha do tempo construída no centro e pede aos participantes para identificarem e enquadrarem os contextos descritos (ou outros) em relação a :a) características geográficas limitadoras; b) infraestrutura limitante; c) questões sociais e econômicas problemáticas; d) perda de benefícios providos pela natureza; com foco em 2 aspectos: 1) oportunidades, e; 2) limitações.

As **perguntas-chave** aqui são: *Quais os limites geográficos da [paisagem] onde a [IS-RPF] emergiu? Quais os elementos da [paisagem] que contribuíram para a emergência da [IS-RPF]? Quais os elementos da [paisagem] que ameaçaram o desenvolvimento da [IS-RPF]? Qual o contexto da [paisagem] onde a [IS-RPF] emergiu? Quais os eventos mais significantes relacionados a esse contexto? Quais foram as reações das comunidades e agentes públicos em resposta a esse contexto? No início da [IS-RPF] quais eram os principais aspectos/elementos relacionados a: a) características geográficas limitadoras (e.g., montanha, localização); b) infraestrutura limitante (e.g., acesso a internet, estradas); c) questões sociais e econômicas problemáticas (e.g., baixa renda, mão de obra escassa); d) perda de benefícios providos pela natureza (e.g., desastres naturais, disponibilidade de recursos e habitats naturais);*

PRIMEIRA PARTE – Seção 3: Compartilhamento conclusivo de resultados

Objetivo: compartilhar os resultados obtidos pelos subgrupos e promover a oportunidade de hibridizá-los por meio de um debate coletivo.

Todos os materiais produzidos pelos grupos são afixados na vertical (na parede). Pelo menos uma pessoa de cada grupo, auxiliada por um assistente, permanece frente a esse material para apresentá-los aos demais grupos. Enquanto os demais participantes são convidados a visitar e comentar os materiais elaborados pelos outros grupos. As observações inseridas pelos observadores deverão ser anotadas com uma cor diferente no material produzido.

Após essa atividade segue o encerramento da reunião.

SEGUNDA PARTE – GRUPO FOCAL

Grupo focal é uma entrevista profunda com um grupo pequeno de indivíduos (entre 6 e 12) que compartilham interesses e características em comum. Nesse sentido, os participantes selecionados para essa atividade devem possuir uma experiência similar sobre a [IS-RPF] investigada. A técnica de grupo focal permite que os participantes expressem livremente opiniões, conhecimentos e experiências, entretanto o resultado final deve ser baseado na opinião do grupo como um todo.

O moderador facilita a condução dessa atividade e observadores registram as discussões e o comportamento dos participantes. Essa seção necessita ser gravado para posterior análise. A duração dessa seção não deve ultrapassar 90 minutos.

Os participantes devem possuir uma profunda compreensão e vivência dos processos pelos quais a [IS-RPF] passou. Eles podem, portanto, ser representados pelos próprios *inovadores, gestores de projeto, doadores, agentes técnicos, políticos ou pesquisadores* com profundo envolvimento com a iniciativa.

SEGUNDA PARTE – Boas-vindas (aproximadamente 15 minutos)

Objetivo: Introduzir e explicar as ‘regras do jogo’ ao Grupo Focal e compartilhar os resultados obtidos na primeira parte àqueles que porventura não participaram (alinhamento).

Recepção, boas-vindas, rodada de apresentação, introdução dos participantes. Explicação do objetivo das seções posteriores. **Perguntas orientadores** para quebrar o gelo: *Quais foram as principais atividades da [IS-RPF] nos últimos anos? Quais são os principais serviços e produtos oferecidos pela [IS-RPF]? Quais foram os impactos que a [IS-RPF] gerou até agora?*

SEGUNDA PARTE – Seção IV: Contexto – Impactos e elementos problemáticos da [paisagem]. (de 15 a 30 min)

Objetivo: Identificar e priorizar (ranquear) os elementos da [paisagem] considerados problemáticos. Compreender se, e como esses elementos podem ter sido alterados em função da [IS-RPF].

O moderador estende um pôster pré-preparado na parede com os resultados da Seção 2-C (primeira parte). Esse pôster está dividido em quatro colunas respectivamente intituladas: a) “características geográficas limitadoras”; b) “infraestrutura limitante”; c) “questões sociais e econômicas problemáticas”; d) “perda de benefícios providos pela natureza”.

O moderador lê os elementos problemáticos descritos no pôster aos participantes e inicia-se a discussão sobre a concordância, discordância ou mesmo se existem outros elementos não considerados no pôster.

A seguintes **pergunta orientadora** podem ser utilizadas: *No início da [IS-RPF], quais foram os principais aspectos/elementos que indicavam problemas relativos a: a) características geográficas limitadoras (e.g., montanha, localização); b) infraestrutura limitante (e.g., acesso a internet, estradas); c) questões sociais e econômicas problemáticas (e.g., baixa renda, mão de obra escassa); d) perda de benefícios providos pela natureza (e.g., desastres naturais, disponibilidade de recursos e habitats naturais);*

O moderador completa a seção perguntando aos participantes se a [IS-RPF] lidou com os elementos/aspectos identificados de alguma forma. E se foi observado algum impacto positivo em relação a esses aspectos depois que a [IS-RPF] começou a operar.

Tabela 1. Elementos problemáticos e aspectos gerais da [paisagem] que influenciaram a [IS-RPF]

Categorias	Elementos problemáticos e aspectos da [paisagem]	Elementos/aspectos que a [IS-RPF] lidou		Melhorias observadas nos últimos anos	
		Lida com?	Obs.:	Melhorou?	Obs.:
<i>Características geográficas</i>					
<i>Infraestrutura limitante</i>					
<i>Questões socioeconômicas problemáticas</i>					

Perda de benefícios providos pela natureza					

* essa tabela será utilizada para sistematizar os resultados, (??) *entretanto sua apresentação ao grupo focal não é recomendada (??)*

SEGUNDA PARTE – Seção V: – Ranqueamento dos Impactos da [IS-RPF]. (de 30 a 60 min)

Objetivo: Listar e ranquear os impactos da [IS-RPF].

O moderador e o assistente criar um ambiente de trabalho. Removem as cadeiras e solicitam aos participantes que se aproximem ao redor de uma mesa. Essa seção é dividida em duas partes. Na segunda, os participantes serão convidados a se sentar novamente em um semicírculo.

Essa seção requer diferentes **materiais**, a saber:

- papeis recortados* reportando os elementos que a [IS-RPF] pode ter tido (ou ainda está tendo) impactos positivos ou negativos (esses pontos vêm do primeiro exercício dessa seção). Cada papel recortado reporta um elemento e são representados por cores diferentes, de acordo com as categorias (“características geográficas limitadoras”; “infraestrutura limitante”; “questões sociais e econômicas problemáticas”; “perda de benefícios providos pela natureza”).
- Um *pôster* pré-desenhado com 5 colunas intitulados: “muito negativo”, “negativo”, “sem impacto”, “positivo”, “muito positivo”;



- Um *pôster* pré-desenhado (tamanho A2) reportando a tabela da segunda tarefa (**tabela 2**). Tabela de pontuação e ranqueamento e uma tabela com a definição dos aspectos de significância dos valores atribuídos (**tabela 3**).

De posse dos materiais o moderador apresenta aos participantes as duas questões chave dessa seção, a saber:

- A **primeira questão** lida com os impactos. Ao entorno da mesa os participantes são desafiados a organizar os papeis recortados em 3 grupos. Um grupo com itens na qual a [IS-RPF] teve ou tem tido **impacto negativo**, outro grupo de **impacto positivo** e,

finalmente, aqueles que não tiveram impactos relacionados (**sem impacto**). O moderador conclui a atividade dessa primeira questão mostrando aos participantes o grupo de elementos com impactos negativos e pedindo que selecionem no máximo 4 elementos sobre os quais eles acham que a [IS-RPF] teve (ou está tendo) mais impacto negativo. Os 4 elementos podem pertencer à mesma categoria (por exemplo, todos sociais) ou a categorias diferentes (por exemplo, 2 econômicos e 2 ambientais). Todos os outros elementos são considerados aqueles sobre os quais a iniciativa de [IS-RPF] teve (ou está tendo) impactos ligeiramente negativos. O mesmo é feito com o grupo de elementos (máximo 4) com os impactos muito e ligeiramente positivos. Na prática, o resultado desta atividade é a criação de 5 grupos de elementos conforme relatado no “Diagrama da primeira questão” (apresentado no item b de **materiais**). **Perguntas orientadoras:** *Com relação às condições iniciais da [paisagem], quais são as questões ambientais, econômicas, sociais e institucionais / de governança que a iniciativa de Inovação Social impactou, ou ainda impactam? Pense nos impactos negativos e positivos. Dentre os elementos que você acabou de identificar como negativamente / positivamente impactados pela [IS-RPF], quais são os 4 com maior impacto negativo e os 4 com maior impacto positivo?*

- II) A **segunda questão** é contígua à primeira, uma vez que é baseada em seus resultados. O moderador convida os participantes a sentarem-se em frente à parede onde os resultados da primeira questão são expostos. Então, solicita aos participantes que escolham os 8 elementos de maior importância (4 positivos e 4 negativos) e, com base nos critérios mostrados na tabela 3, os avaliem. **Perguntas orientadoras:** *Pense nas atividades realizadas na sua iniciativa de Inovação Social e nos impactos no meio ambiente / economia / sociedade-comunidade / instituições que estão vinculadas a essas atividades. Em uma escala de 0 (nulo) a 4 (muito alto), qual foi o nível de controle que a iniciativa de Inovação Social teve sobre os 8 maiores impactos? Qual foi a sensibilidade do contexto local em relação ao impacto? Qual foi a frequência com que as atividades da [IS-RPF], determinaram os impactos? Qual foi a significância do impacto?”*

Tabela 2. Pôster para ser utilizado na segunda questão. Tabela de pontuação e ranqueamento.

CRITÉRIO*	PERGUNTAS NORTEADORAS	0	1	2	3	4
1. Capacidade da [IS-RPF] em manter o impacto sob controle direto	1. Até que ponto seria possível mudar os impactos alterando as práticas ou comportamentos das pessoas envolvidas na [IS-RPF]?	0 de modo nenhum	1 Um pouco	2 De alguma forma	3 Muito	4 Total//
2. Frequência das atividades que influenciam os impactos	2. Com que frequência sua [IS-RPF] realiza essas atividades?	0 nuca	1 Rara//	2 De vez em quando	3 Frequente/ /	4 Continua//
3. Magnitude (intensidade) do impacto	3. 1 Qual é a extensão da [paisagem] afetada pelos impactos da [IS-RPF]?	0 Pontual	1 Mais de um lugar	2 Grande	3 A maior parte da paisagem	4 Toda a paisagem

	3.2 Quanto tempo duram os impactos?	0 Imediata//	1 Temporário	2 por algum tempo	3 por um longo tempo	4 Para sempre
4. Sensibilidade da comunidade local ao impacto	4.1 Quanto a comunidade local depende dos recursos naturais impactados pela [IS-RPF]?	0 nada	1 Um pouco	2 de alguma forma	3 muito	4 Total//
	4.2 Quão bem a comunidade local aceitou a [IS-RPF] e os impactos que ela determina? Existem conflitos relacionados a isso?	0 Sem conflito (totalment e aceito)	1 Aceito pela maioria da comunidade e	2 Ainda não completamente e aceito pela maioria	3 Conflito latente	4 Conflito Visível (não aceito pela comunidade e

* essa coluna pode ser omitida do pôster

Tabela 3. Critérios de pontuação para definir aspectos significativos nos estudos de caso SIMRA.

CRITÉRIO	PONTUAÇÃO				
	NULO (= 0)	BAIXO (= 1)	MODERADO (= 2)	ALTO (= 3)	MUITO ALTO (= 4)
1. Capacidade de manter o impacto sob controle direto	A [IS-RPF] não tem controle direto do impacto.	A [IS-RPF] tem limitado controle direto sobre o impacto.	A [IS-RPF] tem moderado controle direto sobre o impacto.	A [IS-RPF] tem bom controle direto sobre o impacto.	A [IS-RPF] tem total controle direto sobre o impacto.
2. Frequência das atividades e impactos relacionados	As atividades não são promovidas pela [IS-RPF].	As atividades não são frequentemente e promovidas pela [IS-RPF].	As atividades não são frequentes, mas não regularmente promovidas pela [IS-RPF].	As atividades são regularmente promovidas pela [IS-RPF].	As atividades são promovidas continuamente pela [IS-RPF].
3. Magnitude (intensidade) do impacto	A [IS-RPF] não tem qualquer impacto*	A [IS-RPF] tem baixa intensidade (por exemplo, os impactos são pontuais, duram	A [IS-RPF] tem intensidade moderada (por exemplo, afetam mais de um local, os impactos	A [IS-RPF] tem alta intensidade (por exemplo, eles afetam uma grande parte da paisagem, um grande número	The [IS-RPF] tem uma intensidade extremamente alta (por exemplo, afetam uma grande parte da paisagem e / ou toda

		pouco tempo e seus efeitos são reversíveis no curto prazo) **	duram um tempo e seus efeitos são reversíveis, mas apenas a médio prazo)	de pessoas e seus efeitos são reversíveis apenas a longo prazo)	a comunidade, e seus efeitos são irreversíveis a longo prazo).
4. Sensibilidade do contexto local	O contexto local não é favorável à [IS-RPF] (por exemplo, a comunidade local aceita plenamente e os recursos naturais / patrimônio cultural não são afetados).	O contexto local é pouco favorável à [IS-RPF] (por exemplo, apenas alguns recursos naturais / patrimônio cultural são afetados e a maioria da comunidade aceita isso).	O contexto local é moderadamente favorável à [IS-RPF] (por exemplo, um ou mais recursos naturais ou um recurso natural / patrimônio cultural chave são afetados, mas a comunidade ainda não aceitou totalmente o [IS-RPF]).	O contexto local é altamente favorável ao [IS-RPF] (por exemplo, habitats importantes são restaurados, patrimônios culturais são afetados pela [IS-RPF]; existe um conflito latente entre a [IS-RPF] e o resto da comunidade).	O contexto local é extremamente favorável à [IS-RPF] (por exemplo, a comunidade depende totalmente do recurso-chave afetado pela [IS-RPF], o patrimônio cultural está em risco; existe um conflito permanente e visível em relação à [IS-RPF])

Notas * e **: não se aplicam ao exercício de pontuação, pois os elementos foram identificados anteriormente como os de maior impacto (positivo ou negativo). No entanto, os critérios são relatados para compreensão completa pelo moderador / avaliador.

ANNEX 5 – POLICY DOCUMENTS ANALIZED IN CHAPTER 7

POLICY DOMAIN	POLICY	document type	number/ YEAR	POLICY DOCUMENTS ANALYSED
Environment (36)	Environment (6) PNMA	law	6938/81	National Environmental Policy
		law	7797/89	Establish the National Environment Fund
		law	9605/98	Environmental Crimes
		decree	99274/90	Establish the National Environment System (SISNAMA) and National Environment Council (CONAMA)
		decree	9806/19	Review the composition and functioning of the Conama.
		decree	10455/20	Regimental Structure of the Ministry of the Environment and relocates and transforms positions into commission and trust functions.
	Biodiversity (7) PBbio	law	9985/00	Establish the National System of Protected Areas (SNUC)
		law	13123/15	National Biodiversity Policy (PBBIO)
		decree	8974/17	Regimental Structure of Chico Mendes Biological Conservation Institute (ICMBio)
		decree	4339/02	Establishes principles and guidelines for the implementation of the National Biodiversity Policy
		decree	4703/03	National Biological Diversity Program (Pronabio)
		decree	10235/20	on the National Biological Diversity Program - PRONABIO and the National Biodiversity Commission
		document	2017	National Strategy and Action Plan for Biodiversity (EPANB)
	Environmental Services (1) (PNPSA)	law	14119/21	National Policy for Payments for Environmental Services
	Native vegetation recovery (7) (Proveg)	law	12651/12	Protection of Native Vegetation (LPVN)
		decree	8972/17	National Policy for Native Vegetation Recovery (Proveg)
		decree	9640/18	Regulates the Environmental Reserve Quota (CRA)
		decree	10142/19	Establishes the Executive Commission for the Control of Illegal Deforestation and Recovery of Native Vegetation (Conaveg)
		decree	10142/19	Establishes the Executive Commission for the Control of Illegal Deforestation and Native Vegetation Recovery (Conaveg2)
		document	2010	National Plan for Native Vegetation Recovery (Planaveg)
		document	2020	National Plan to Control Illegal Deforestation and for Native Vegetation Recovery (2020 – 2023) (Planaveg_2)
	Climate Change (9) (PNMC) and Green Growth program (6) (PNCV) (15) total	law	12141/09	Establishes the National Fund on Climate Change (FNMC)
		law	12187/09	Establishes the National Policy on Climate Change (PNMC)
		decree	9578/18	Establishes the National Climate Change Fund (FNMC)
		decree	10144/19	REED+ National Commission - (CONAREDD+)
		decree	10846/21	Establishes the National Green Growth Program (PNCV)
		decree	10845/21	on the Interministerial Committee on Climate Change and Green Growth (CIMV)
		decree	11075/22	Establishes the Brazilian Emission Reduction Market (MBRE)
		document	2016	Establishes the National Strategy for REDD+ ((ENREDD+)
		document	2020	Report on Climate Change Policy implementation (Programa2050)
		document	2020	National Program for Payment for Environmental Services (Floresta+)
		document	2020	Floresta+ Program – Carbon

		document	2020	Floresta+ Program – Bioeconomy
		document	2020	Floresta+ Program – Entrepreneur
		document	2021	Monitoring and Evaluation Report on Climate Change Adaptation Strategy
		document	2021	Brazil’s Nationally Determined Contribution (NDC)
Agriculture (14)	Forest (5) (PNF/PNAFP)	law	11284/06	Public forest management for sustainable production law (LGFPSP)
		decree	3420/00	National Forest Program (PNF)
		decree	8375/14	Agricultural Policy for Planted Forests (PAFP)
		decree	10062/19	National Forest Development Fund (FNDF)
		document	2018	National Plan for the Develop of Planted Forests (PNFP)
	Agriculture (6) (Pagro)	law	8171/91	National Agriculture Policy
		law	10711/03	Seed and Seedling System (LSM)
		decree	10431/20	Establishes the National Executive Commission of the Sector Plan for Consolidation of a Low Carbon Economy in Agriculture (CENABC)
		Ordinance	121/21	Brazil Bioeconomy Program (BBP)
		document	2012	Low Carbon Agricultural Plan (ABC plan)
document		2021	SAFRA plan 2021/2022	
Technical Assistance and Rural Extension (1) (Pnater)	law	12188/10	National Policy and Program of Technical Assistance and Rural Extension for Family Farms and Agrarian Reform (PNATER)	
Cooperativism (2) (PNCoop)	law	5764/71	National Cooperativism Policy (PNCoop)	
	law	9867/99	Social Cooperativism Law (SCL)	
Regional Development (4)	Water Resources (2) (PNRH)	law	9433/97	National Water Resources Policy (PNRH)
		document	2021	National Plan for Water Resources (2016-2021)
	Regional Development (2) (PNDR)	decree	9810/19	National Policy of Regional Development (PNDR)
Ordinance		80/2018	Regional Development and Productive Integration Strategy (ROTAS)	
Science, Technology & Innovation (7)	National Policy on Innovation (7) (PNI)	Constitutional Amendment	85/14	insert the term “innovation” in the Federal Constitution
		law	8958/94	on the relationship between federal institutions of higher education and scientific and technological research and supporting foundations (LAP)
		law	10973/04	public incentives for innovation in the productive environment (LIIPC)
		decree	9283/18	Incentives for innovation
		decree	10463/20	Regimental Structure of the Ministry of Science, Technology and Innovations
		decree	10534/20	National Innovation Policy
		document	2016	National Strategy for Science, Technology, and Innovation
General Govern structure (3)	law	13844/19	Establishes the basic organization of the bodies of the Presidency of the Republic and the Ministries (Provisional Measure #870/19)	
	decree	9759/19	Extinguishes and establishes guidelines, rules, and limitations for collegiate bodies of the federal public administration	
	law	14303/22	Federal Annual Budget	

ANNEX 6 – The four policy domains investigated and their respective governance structures.

Environment policy domain

Within the *environmental* policy domain, we identified five policies (*PNMA*, *PBbio*, *Proveg*, *PNPSA*, *PNMC*), 12 boards and 38 instruments, aiming to encourage the protection of biodiversity of natural habitats, ensure the participation of civil society in the formulation and implementation of environmental policies, and recognise traditional knowledge associated with biodiversity. This domain has relied on conservation biology and socio-environmental sciences to build the Brazilian environmental agenda. Through the Ministry of Environment (MMA), this domain manages 0.07% of the total revenue forecast by the Brazilian Federal Government for 2022⁴⁵.

The National Environmental System (*SISNAMA*) articulates boards and executor bodies from all environmental public administration spheres (Federal, State, and Municipal) to govern the National Environmental Policy (*PNMA*). The National Environmental Council (*CONAMA*) is the highest-deliberative instance. The Brazilian Institute of Environment and Renewable Natural Resources (*Ibama*) monitors *PNMA* (e.g., combating deforestation and environmental licencing). Meanwhile, *ICMBio* (Chico Mendes Biodiversity Institute) is the main executor of the National Biodiversity Policy (*PBbio*), managing the federal Protected Areas (PA) and coordinating conservation and research programmes. Finally, the National Environmental Fund (*FNMA*) is governed by the *CD-FNMA board*, and sub-national environmental funds (*FMA*s) are managed by local bodies, which form the *SISNAMA*.

Two bodies manage *PBbio*'s governance: a) the Genetic Heritage Management Council (*Cgen*), managing the National Benefit Sharing Programme (*PNRB*) and the National Fund for Benefit Sharing (*FNRB*), and; b) the National Biodiversity Commission (*Conabio*), responsible for the National Biodiversity Programme (*Pronabio*), an informational instrument used to establish partnerships with civil society and public agencies to produce and disseminate knowledge on biodiversity and its sustainable use. *FUNBIO* is a non-governmental organisation and fund that has supported the biodiversity policy's implementation.

The Executive Commission on Illegal Deforestation Control and Recovery of Native Vegetation (*Conaveg*) is responsible for *Planaveg*, *PPCDAm*, and *PPCerrado*. *Planaveg* is an informational instrument that organises a set of strategies to help rural landowners recover the areas protected by the native vegetation protection law, *LPVN*. In turn, *PPCDAm* and *PPCerrado* combine land-use planning, economic, and regulatory instruments for curbing deforestation rates in the Amazon and Cerrado biomes, respectively. Both plans have been financed by the *Amazon Fund*⁴⁶ and the National Treasury government.

The National Climate Change Policy (*PNMC*) has a multi-governance structure. The Inter-ministerial Committee on Climate Change and Green Growth (*CIMV*) is responsible for guiding, articulating and coordinating the *PNMC*, and the Technical Committee of the Inter-ministerial Committee on Climate Change and Green Growth (*CTCIMV*) technically supports its implementation. The Brazilian Forum on Climate Change (*FBMC*) is a scientific body that analyses the implications of global warming for the country, assists in creating standards, and disseminates relevant information to the public. *FBMC* is supported by the *Rede-Clima* network of researchers, which, in turn, is subsidised by the Meteorology, Climatology, and Hydrology Activities Coordination Commission (*CMCH*). *FMCM* and *CMCH* report to the Ministry of Science, Technology and Innovation (*MCTI*). The *FBMC* has the prerogative to nominate one representative for the National Climate Change Fund Steering Group (*GG-FNMC*), and the *CIMV*

⁴⁵ The percentages refer to the forecasted tax and social security expenditure per ministry about the forecasted total revenue. According to the 2022 Federal Annual Budget (Law 14303/22).

⁴⁶ With no activity since 2019, the House of Representatives has sought to institutionalise *Amazon Fund* through Bill 415/20.

appoints all others (10). The National Climate Change Fund (*FNMC*) supports projects and studies that aim to reduce greenhouse gas emissions and adapt to the effects of climate change. The *FBMC* also appoints a member to *CONARRED+* (National Commission for Reducing Greenhouse Gas Emissions from Deforestation and Forest Degradation, Conservation of Forest Carbon Stocks, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks - REDD+), responsible for the REDD+ National Strategy (*ENAREDD+*) and for elaborating the requirements for accessing the REDD+ pay-for-results in Brazil, which is the main fund source of the Amazon Fund.

The execution of *Proveg* and *PNMC* has been carried out by the executive structure of the *MMA* and agencies of other ministries linked to these agendas. In 2022, there are two networks of organised civil society members actively participating in the environmental governance structure. The Climate Observatory (*ObsClima*) follows and influences the climate policy agenda, and the Forest Code Observatory (*ObsFC*) watches over the *LPFN* implementation.

The Sustainable Public Forest Management Law (*LGFPMS*) regulates and forms the organisational structure that administers Brazilian forests and their management. Although created in the environmental domain, in 2019, this structure was relocated to the Ministry of Agriculture, Livestock and Supply (*MAPA*). The same happened with the National Water Resources Policy (*PNRH*) structure that was transferred to the Ministry of Regional Development (*MDR*).

Agriculture policy domain

Within the *agriculture* domain, we identified four policies (*PAFP*, *Pagro*, *Pnater* and *PNCoop*), 9⁴⁷ boards and 25 instruments, which influence the SI-FLR by regulating the production, commercialisation and distribution of food, fibres, and bioenergy, as well as by supporting rural social organisation in cooperatives and associations. This domain is anchored mainly in the Agricultural Sciences to help define federal priorities on agriculture, livestock, food supply, agroindustry, planted forests and fishing activities.

While *Pagro*, *Pnater*, and *PNCoop* are focused on agriculture and livestock production, the Agricultural Policy for Planted Forests (*PAFP*) represents the forestry sector's effort to be connected to the *agriculture* domain. The *PAFP* goal is expressed in the National Plan for Planted Forests (*PNDFF*), which is expanding commercial planted forests from 10 to 12 million hectares by 2030.

The strategic decisions for the Agricultural Policy (*Pagro*) are made by the National Council for Agricultural Policy (*CNPA*), and the National Council for Smallholder Development (*Condraf*) deliberates on the objectives and goals of the Family Agriculture Strengthening Programme (*Pronaf*) and the *Pnater* instruments. The ABC Plan National Executive Committee (*CENABC*) manages the execution of the Low Carbon Agriculture Plan (*ABC plan*).

Three boards represent civil society sectors in this domain: a) the national confederation of Agriculture and livestock (*CNA*), which represents Brazilian landowners, agribusiness leaders and manages *Senar*⁴⁸; b) the national confederation of rural workers and smallholders (*Contag*), and; c) the Brazilian cooperatives organisation (*OCB*), which fosters and defends the cooperative system in all political and governance instances.

To run these four policies, *MAPA* relies on six executive bodies: Brazilian Agricultural Research Corporation (*Embrapa*), the research and innovation developer; *Senar*, the capacity builder; and the National Supply Company (*Conab*), the stock and food supply manager. The Federal Government's Technical Assistance and Rural Extension Service (*ATER*) is coordinated by the Secretariat for Family

⁴⁷ CDN (National Defence Council) and CMN (National Monetary Council) appear in figure 1, but were not counted because, although their approval is required for, respectively, design of public forest and agricultural credit, these councils were not created by the policies analysed.

⁴⁸ National Rural Apprenticeship Service (*Senar*) offers over 100 courses with and without tutoring.

Agriculture and Cooperatives (*SAF*) and implemented and monitored by the National ATER Agency (*Anater*). The National Institute for Agrarian Reform (Incra) handles agrarian reform, manages the Union's land registries, and provides ATER for federal rural settlements. The *SENAR* and public ATER services are free for farmers.

Moved from *MMA* in 2019, the Brazilian Forest Service (*SFB*), its Public Forest Management Commission (*CGFLOP*), the National Forest Development Fund (FNDF), and its board (*CC-FNDF*), are part of the *MAPA* structure. The *SFB* manages the National Forest Information System (*Snif*), a database that brings together policy documents, information, and data on the national forests inventory, the economy and markets, and higher education related to Brazilian forest management. *Snif* is, therefore, an important SI-FLR informational instrument.

In 2022, the *SFB* will be the main federal executive body responsible for the implementation of *Proveg* and *LPVN*, managing the Rural Environmental Registry System (*SiCAR*) and being the federal government's technical advisor for the Federal Payment for Environmental Services (*PFPSA*) and Environmental Compliance Programmes (*PRA*). It is also responsible for creating and managing capacity-building trainings, research and technical assistance, and promoting forest planting and sustainable management, agroforestry systems, native vegetation recovery, forest product processing, and ecosystem services exploitation. In addition, the *SFB* manages the federal public forests and the *FNDF*.

The main economic instrument of *Pagro* is the *SAFRA plan*⁴⁹, implemented through the National Rural Credit System (*SNCR*). The *SAFRA plan* works together with a set of public policies covering ATER, production insurance, price guarantees, marketing and economic and social organisation of family farmers. The National ATER programme (*Pronater*) sets the guidelines and goals for public ATER services throughout the country, and the 'More Cooperative' programme promotes corporativism and associativism, strengthening farmers' organisation and working close to the Federal Government's food acquisition programme (*PAB*).

Regional Development Policy Domain

Within the regional development domain, we identified two policies (*PNDR* and *PNRH*⁵⁰), 9 boards, and 16 instruments aiming to address regional socio-economic inequalities. This domain anchors in Regional Science and exerts its executive power through the Regional Development Ministry (*MDR*), which manages 0.28% of the Brazilian Federal Government's total revenue forecast for 2022.

The National Policy of Regional Development (*PNDR*) is supported by well-equipped financial instruments to promote productive inclusion through cooperativism and integration of local networks into regional production chains in regions characterised by low socioeconomic indicators. The National Policy on Water Resources (*PNRH*) is managed by the National Water Resources Management System (*SNGRH*), aiming to ensure the provision of quality water to the Brazilian population, which is influenced by the land use and socioeconomic conditions of the watersheds. Therefore, both objectives of the policies are intrinsically related to SI-FLR.

The National Strategy for Economic and Social Development (*ENDES*) for 2020-2031 is a guideline for the implementation of *PNDR*. This informative instrument is a long-term plan for the country's social and economic development and thereby influences the discussions on the country's most important planning instruments (the multiannual plan, the budget guidelines law, and the annual budget law).

⁴⁹ *SAFRA plan* foresees investments in the 2021/2022 planting period of 49.3*10¹² €, of which 7.7*10¹² € for family agriculture (*Pronaf*), 6.7*10¹² € for medium-sized rural producers (*Pronamp*), and 1.06*10¹² € for ABC plan.

⁵⁰ *PNRH* were recently (2020) moved from *MMA* to *MDR* structure.

The Chamber of National Integration and Regional Development Policies (*CPINDR*) centralises the decisions of the *PNDR*, which does not include any civil society representative but is influenced by the Brazilian Association for Sustainable Regional Development (*ADIAL*). The *PNDR* actions are prioritised in the less developed regions of Brazil, are coordinated by an executive secretariat (*CEx-CPINDR*) and are executed by development superintendencies (*SUDAM* - Amazon; *SUDECO* - Centre-West; *SUDENE* - Northeast). Each superintendency has its board (*CD-SUDAM*; *CD-SUDENE*; *CD-SUDECO*), which manages development funds (*FDA*, *FDCO* and *FDNE*) operationalised by public banks (e.g., *BASA* in Amazon and *BNDE* in Northeast regions).

The *MDR* also controls the So Francisco Valley Development Company (*Codevasf*), a Brazilian public company that implements agricultural irrigation systems, structures food production chains, revitalises watersheds, and water security programmes. Initially created to operate in the Sao Francisco basin, since 2020, the operation area of the company has reached one-third of the country based on political, not technical, decisions.

The *PNRH* was conceived as a system (the *SNGRH*), establishing a board and executive bodies to design, implement priorities and evaluate actions on water and watershed management (Water Resource Plans and Watershed Plans (*PHRs* & *WPs*)). The *SNGRH* articulates the participation of the government, private sector and civil society at different levels, connecting the local scale level (watershed committees, *CBHs*) with the jurisdiction at the state (State Water Resources Councils, *CERH*) and the federal scale level (National Water Resources Council, *CNRH*). The goal of its decision-making process is to implement water resources management priorities through a coordinated planning mechanism involving these three governance levels.

On a local scale, the watershed plans are executed by the *Water Agencies*, which provide technical and administrative support to *CBHs*. The *Water Agencies* are regulated by the National Water Agency (*ANA*), which is the federal agency responsible for promoting the decentralised and participative management of water resources and implementing the *PNRH* instruments.

The resources to execute *PNRH* come from the federal and state treasuries, together with the water use fee, an economic instrument exclusively developed to support the administrative cost of the Water Agencies and finance the implementation of the watershed plans through the water resources funds (*FHIDRO*), which are managed by state entities and executed by public banks.

Science and Innovation Policy Domain

Within the *science and innovation* policy domain, we identified one policy (the National Innovation Policy - *PNI*), seven boards, and 17 instruments aimed at strengthening, expanding, and integrating the national science, technology & innovation system (*SNCTI*) to promote the country's economic and social development.

The term "innovation" was introduced in 2015 through a constitutional amendment (IC85), institutionalising partnerships between government entities and companies to generate technological novelties or improvements resulting in gains in quality or productive performance. Supported by this constitutional amendment, we identified two laws and one policy potentially influencing SI-FLR processes: the Research Support Law (*LAP*), the Innovation and Scientific Research Incentive Law (*LIIPC*), and the *PNI*. While *LAP* allows agreements between higher education institutions (*IFES*, *IEES*), science and technology institutes (*ICT*), and research funding agencies (*FAPs*, *CNPq*, and *FINEP*) with private companies to promote innovation, the *LIIPC* encourages such partnerships by promoting *IFES*, *IEES*, and *ICT* as incubators for innovative companies using the State's purchasing power to leverage them. The *PNI* builds on the *LIPC* and is designed to guide and coordinate the enhancement of productivity and competitiveness in the domestic private sector.

Regarding the seven boards identified, *Rede-Clima* and *CMCH* generate and systematise information to support decision-making on the climate change policy agenda. The National Council

for Science and Technology (CTT) and the National Council of State Research (*Confapi*) are the main government instances for taking decisions on public investments in science and technology, while the *CI* (Innovation Chamber) rules the *PNI* (National Innovation Policy). The National Association for Research and Development of Innovative Companies (*ANPEI*) and the Brazilian Society for the Progress Advancement of Science (*SBPC*) are two nongovernmental bodies that actively participate in the construction of the National Strategy for Science, Technology & Innovation (*ENCTI*).

ENCTI lists 11 themes as the main goals for 2016-2022, among them, “social sciences and technologies” is the closest to social innovation, with the aim of seeking regional solutions by fostering traditional knowledge and promoting social inclusion. The National Strategy for Innovation (*ENI*) also sets a four-year horizon (2020-2024) but takes a more activity-orientated approach, establishing action plans for five topics to stimulate a favourable atmosphere for innovation.

The Programme for Environmental Monitoring of Brazilian Biomes (*PMABB*) is an informational instrument aimed at mapping and monitoring the vegetation of all Brazilian biomes, including deforestation, land use, fires, ecological restoration, and extraction of natural resources. *PMABB* attended the *ENAREDD+* demand and has *Embrapa*'s technical support.

The Ministry of Science, Technology and Innovation (*MCTI*) manages 0.21% of the total revenue forecast by the Brazilian Federal Government for 2022, being the federal entity responsible for coordinating the *SNCTI*. To implement *PNI*, *MCTI* has under his umbrella *IFES*, *IEES*, and *ICTs* as the main business incubators in the country. Created in 2013, the Brazilian Company for Industrial Research and Innovation (*Embrapii*) aims to improve the articulation between government institutions and the business sector. Thus, the Brazilian government identifies innovation opportunities and, through public-private partnerships, makes the *SNCTI* structure available to reduce the private risks of developing the innovation precompetitive phase. The main *SNCTI* financial agencies are: *FINEP*, in charge of the National Fund for Scientific and Technological Development (FNDCT); the National Council for Scientific and Technological Development (CNPq), and the research support foundations (FAPs), at the subnational level.

ANNEX 7 - Supplementary material - social network analyses

Conection types	exchange flow types						% of CONNECTIONS	connection formality	
	Knowledge	Political Action	Executive Project	Financing	Trading	Culture		FORMAL	INFORMAL
Seed Network Sao Francisco (SNSF)									
Institutional	4,8%	6,9%	4,8%	2,8%	-	2,8%	22%	100%	-
Partnership	9,7%	1,4%	8,3%	-	12,4%	1,4%	33%	40%	60%
Research	14,5%	-	3,4%	-	13,1%	-	31%	55%	45%
Commerce	1,4%	-	0,7%	0,7%	2,1%	-	5%	-	100%
Financing	1,4%	-	2,1%	5,5%	-	-	9%	100%	-
TOTAL	32%	8%	19%	9%	28%	4%	100%	52%	48%
Arboretum Programme (ARBORETUM)									
Institutional	9,5%	11,9%	7,0%	1,5%	1,0%	1,8%	33%	100%	-
Partnership	15,5%	9,3%	8,0%	4,4%	7,5%	4,4%	48%	75%	25%
Research	4,9%	-	1,8%	2,6%	-	-	9%	100%	-
Commerce	0,3%	-	-	0,5%	3,1%	-	5%	100%	-
Financing	1,0%	0,5%	0,5%	3,1%	-	-	5%	69%	31%
TOTAL	31%	22%	17%	12%	12%	6%	100%	81%	19%
"NASCENTES GERAIZEIRAS" seed collectors (GERAIZEIROS)									
Institutional	6,3%	4,1%	3,6%	-	-	0,2%	14%	0%	0,22
Partnership	24,1%	16,9%	10,6%	1,4%	5,3%	2,7%	61%	10%	44%
Research	3,6%	3,1%	1,9%	-	0,0%	0,5%	9%	7%	0%
Commerce	1,4%	0,5%	0,7%	0,2%	3,6%	-	7%	0,10	0%
Financing	1,7%	3,4%	1,0%	2,4%	0,7%	-	9%	7%	-
TOTAL	37%	28%	18%	4%	10%	3%	100%	34%	66%
"CERRADO EM PÉ" ASSOCIATION (ACP) AND CERRADO SEEDS NETWORK partnership (ACP+RSC)									
Institutional	2,3%	3,3%	1,2%	0,7%	0,7%	0,8%	9%	83%	17%
Partnership	25,3%	12,6%	11,1%	0,04	5,3%	0,2%	58%	72%	28%
Research	9,0%	4,5%	3,8%	-	-	-	17%	24%	76%
Commerce	0,5%	-	0,2%	-	2,0%	-	3%	80%	20%
Financing	3,0%	1,0%	2,3%	5,0%	1,5%	-	13%	92%	8%
TOTAL	40%	21%	19%	9%	9%	1%	100%	67%	33%

Conection types	exchange flow types						% of CONNECTIONS	connection formality	
	Knowledge	Political Action	Executive Project	Financing	Trading	Culture		FORMAL	INFORMAL
SI-FLR Pankararu									
Institutional	2,8%	2,8%	2,8%	-	-	2,8%	11%	100%	-
Partnership	2,8%	1,4%	2%	-	-	1,4%	8%	100%	-
Research	-	-	-	-	-	-	-	-	-
Commerce	1,4%	-	0,7%	0,7%	-	-	3%	-	100%
Financing	-	-	-	-	-	-	-	-	-
TOTAL	7%	4%	6%	1%	-	4%	3%	67%	33%
SI-FLR Juçara									
Institutional	1,0%	-	0,8%	0,3%	-	-	3%	33%	67%
Partnership	1,8%	0,8%	1,0%	0,3%	0,8%	0,5%	5%	-	100%
Research	-	-	-	-	-	-	-	-	-
Commerce	-	-	-	-	-	-	-	-	-
Financing	-	-	-	-	-	-	-	-	-
SI-FLR Jequitiba									
Institutional	1,5%	-	1,3%	0,3%	-	0,3%	4%	-	100%
Partnership	1,0%	1,0%	0,3%	0,3%	1,0%	0,3%	5%	50%	50%
Research	-	-	-	-	-	-	-	-	-
Commerce	-	-	-	-	-	-	-	-	-
Financing	-	-	-	-	-	-	-	-	-
TOTAL	3%	3%	2%	1%	1%	1%	9%	25%	75%
TOTAL	3%	2%	2%	1%	1%	1%	8%	81%	19%
Collectors and Restores Network of the "Nascentes Geraizeiras" Sustainable Development Reserve (GERAIZEIROS)									
Institutional	-	-	-	-	-	-	-	-	-
Partnership	13,5%	10,8%	6,5%	0,7%	0,05	2,4%	39,3%	22%	78%
Research	0,2%	-	0,2%	-	-	-	0,5%	-	100%
Commerce	1,4%	0,5%	0,7%	0,2%	3,6%	-	6,5%	100%	-
Financing	-	1,0%	-	0,5%	-	-	1,4%	100%	-
TOTAL	15,2%	12,3%	7,5%	1,4%	8,9%	2,4%	48%	42%	58%
Partnership between the Cerrado de Pé Association and the Cerrado Seed Network (ACP+RSC)									
Institutional	0,7%	0,7%	0,5%	0,7%	0,7%	0,2%	3%	100%	0%
Partnership	18,3%	6,7%	7,0%	2,2%	5,3%	-	39%	82%	18%
Research	3,7%	0,8%	1,2%	-	-	-	6%	29%	71%
Commerce	0,5%	-	0,2%	-	2,0%	-	3%	92%	8%
Financing	2,5%	0,3%	2,0%	5,0%	1,5%	-	11%	92%	8%
TOTAL	26%	8%	11%	8%	9%	0,2%	62%	78%	22%

Redário” a network of seed collectors’ networks

“Redário” is a neologism, a word that does not exist in the Portuguese vocabulary. However, to the lusophones (those having Portuguese as a mother tongue), the word refers to the idea of a network of networks. And it is with this perspective that the socio-ecological innovation "Redário of seed collectors" materialises in 2019, when started to act to strengthen Networks of Native Seed Collectors (NNSCs).

Most NNSCs in Brazil began their activities stimulated by the demand for native seeds created by the legal demand to recover and protect native vegetation. This demand can be passive when a third organisation buys them; or active when the NNSC seeks a use or market for the seeds it has already produced. Although a seed buyer is fundamental to the start of an NNSCs’ activities, when this dependence is prolonged for too long, it tends to become detrimental to social-ecological innovation since the buyer could develop the power to influence the NNSCs’ decisions and direct its governance and action plans.

In general, the main bottleneck for NNSCs is to make feasible the commercialisation of the seeds produced. The market for native seeds in Brazil is incipient, fluctuating and strongly dependent on the legal demand for revegetation. In addition, many native seed species are recalcitrant; that is, they quickly lose their twinning power. Therefore, mobilising capital to collect seeds without a signed purchase contract is a high-risk economic activity. Without a purchase guarantee, the risk of this activity is transferred to the financial value of the seed, which impacts its supply and, consequently, breaks the development of this market, impacting the entire value chain associated with terrestrial ecological restoration.

In this sense, the main purpose of the "Redário" is to identify seed buyers and stimulate them to sign longer contracts with the NNSC, based on orders made in advance. In addition, Redário proposes to organise and divide the seed orders among the NNSCs involved, considering the ecological similarity (Krebs, 1999) between seed collection areas and the areas to be restored, thus increasing the probability of success of the ecological restoration. As a strategy to ensure the maintenance of the productive activities of the NNSCs involved, Redário also considers the socioeconomic criteria for choosing the NNSCs that will participate in the delivery of each request.

Redário also organises knowledge exchanges between the NNSCs involved, mainly in relation to innovations developed both in the production, storage and quality control of seeds and in managing flows (financial and seeds) and people. This exchange occurs mainly through cross-training, where a technician or seed collector visits another NNSC to learn or teach specific content. This practice has proven more effective than hiring a specialist because the communication between collectors is more effective, less expensive, empowers collectors, and promotes integration between the NNSCs. With this philosophy, the Redário evolves as the NNSC involved develops and strengthens.

Redário is inspired by the governance model of the Xingu Seed Networks Association, the largest and most structured NNSC in Brazil (Schmidt et al., 2019) - presented in more detail below - and

driven by the socio-technical innovation "muvuca de sementes"⁵¹ (Silva & Oliveira, 2015), also developed as a forest restoration strategy for the Xingu basin. These two innovations have encouraged the organization of at least more 5 NNSCs in the country⁵².

Some of these NNSCs have begun to articulate themselves to better serve the seed market for the recovery of native vegetation generated by Law No. 12.651, 2012 that establishes rules on the protection of vegetation (Permanent Preservation Areas and Legal Reserves), exploitation and supply of forest raw material.

The challenge of supplying 5 tons of native seeds in just 3 months for a large restoration project located in the Doce River basin (Minas Gerais and Espírito Santo) was the window of opportunity to materialize the Redário in 2019. As the order was impossible to be served by a single NNSC, several NNSCs in the region have worked together. The strength of this collective action and its positive result further encourage the NNSCs to format Redário. This initiative, however, is not yet formally constituted and is operated through its member organizations.

The Redário governance model is under construction, but there is already a conviction that it should be participative and polycentric (decentralized). The members understand that it is a strategy to maintain the transparency of transactions (financial and seed flows) and thus trust among its operators.

In this sense, one of the first actions of Redário is to organize the seed stocks and production potential of each NNSC in an online database ("redario.org.br" under construction). With this tool, while the NNSCs improve their inventory controls, Redário can plan the allocation of orders in the different geographies where NNSCs operate.

Each NNSC has a representative, called liaisons ("elo" in Portuguese), who present their demands to Redário (e.g., price and offer of seeds, working conditions of the collectors, technological innovations). Local meetings (meetings of NNSC itself) and regional meetings discuss proposals that are validated in an annual assembly. This way, innovations recognized as important for the improvement of NNSCs are implemented by the Redário community, such as, for example, the remuneration of the liaisons people.

The liaisons' role is to identify the local demands of the collectors, organize the seed production, and resolve conflicts that may arise in the NNSC. They are the ones that render accounts and guarantee the transparency of the material flows (seeds and finance).

Redário also has its own administrative structure, composed of a board of directors, a curator, and a fiscal council. In the beginning, these positions were occupied only by NNSCs' technicians; today, half of these positions are already occupied by seed collectors. Twelve NNSCs co-host the Redário today; 5 more NNSCs are planned to join Redário in 2023. Currently, Redário covers the Amazon,

⁵¹ A mixture of native seeds, green manure and sand that forms a homogenous input conducive to the formation of the forest structure, "muvuca" can plant twice or even ten times as many trees per hectare and at half the cost of planting with seedlings.

⁵² Rede Tupyguá - Tupinikim e Guarani; Rede de Sementes Vale do Ribeira; Associação Cerrado de Pé; Rede Sementes do Portal da Amazônia; Rede de Sementes do Vale do Paraíba.

Cerrado and Atlantic Forest biomes, and with the new groups planned for the next year, it will also work in Pampa and Caatinga.

Redário dream is to help to develop the internal governance of communities where there is an NNSCs. Thus, they can identify and create solutions to their own problems, defend their rights, and produce saleable products, starting with native seeds and collaborating towards more resilient social-ecological systems and communities that are more autonomous in solving their problems and conflicts.

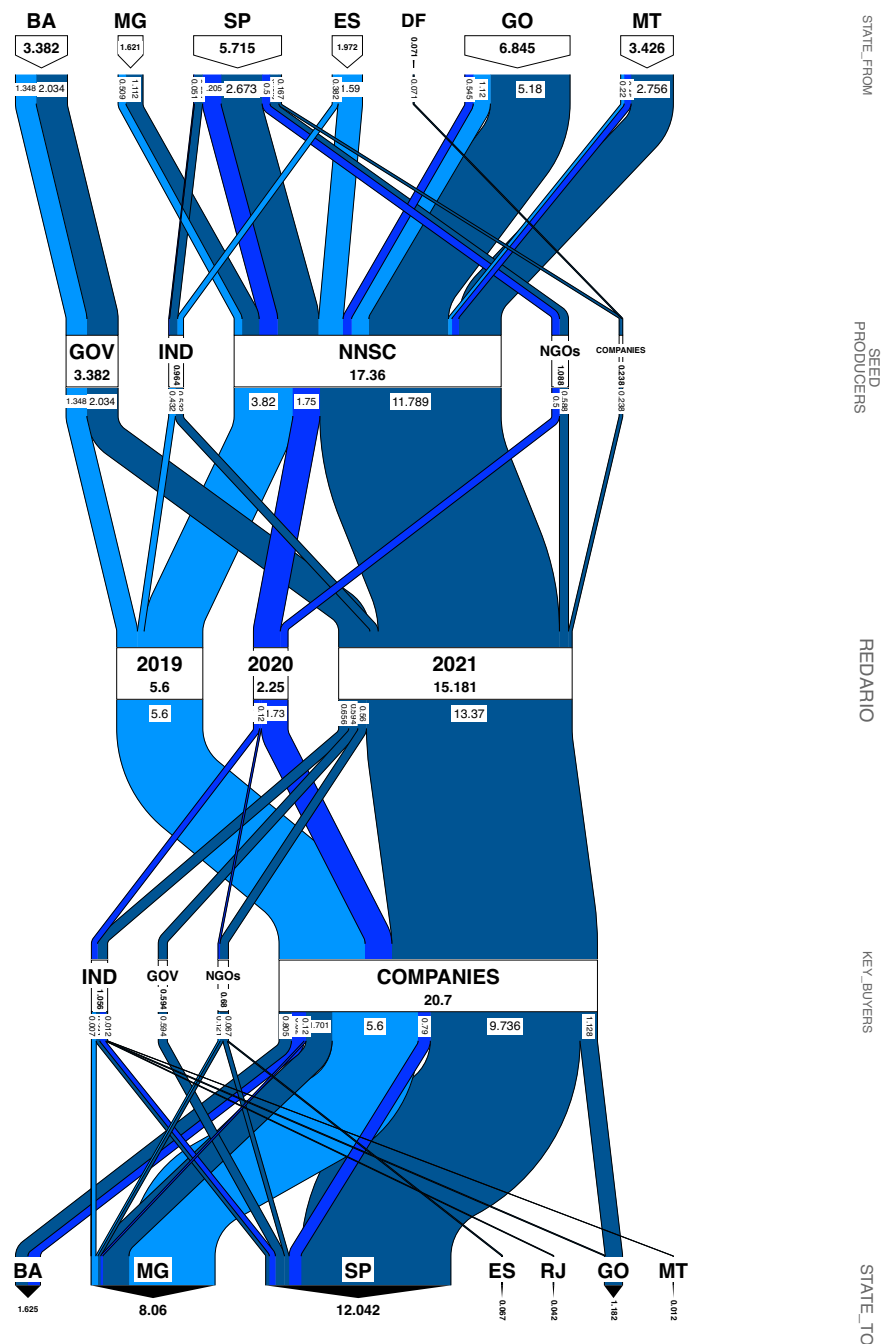


Figure 11. Flow of native seeds traded by Redário from 2019 to 2021 (in tons of seeds)

BA = Bahia; MG = Minas Gerais; SP = São Paulo; ES = Espírito Santo; RJ = Rio de Janeiro; GO = Goiás; MT = Mato Grosso.

Gov = Governments; IND = Individuals; NGOs = Non-Governmental Organisations; NNSC = Networks of Native Seed Collectors.

the end.