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Forest Landscape Restoration governance: a case study from Espírito Santo, Brazil

Governança da restauração de paisagens florestais: um estudo de caso do Espírito Santo, Brasil

Luciana Gomes de ARAUJO[1*], Rosely Alvim SANCHES[1], Cristina ADAMS[2], Célia FUTEMMA[3], Jordano Roma BUZATI[1], Vitor Hirata SANCHES[1], Mariana OLIVEIRA[4], Luciana ALVES[4], Thiago BELOTE[5]

[1] Forest Governance Research Group, University of São Paulo (USP), São Paulo, SP, Brazil.

[2] University of São Paulo (USP), São Paulo, SP, Brazil.

[3] University of Campinas (UNICAMP), Campinas, SP, Brazil.

[4] World Resources Institute – Brasil (WRI Brasil), São Paulo, SP, Brazil.

[5] World Wide Fund For Nature – Brasil (WWF Brasil), Brasília, DF, Brazil.

[*] Contact e-mail: lgaraujo21@hotmail.com

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ABSTRACT: This study analyzes the governance of forest landscape restoration (FLR) in Espírito Santo, Brazil, based on its FLR initiatives and social actors. We discuss enabling conditions for the FLR governance system to upscale the total restored area and to involve farmers in FLR initiatives in Itaúnas and São Mateus watersheds. Data were collected through interviews and participatory workshops between 2018 and 2020. We identified 22 initiatives - programs, projects and actions - between 2001 and 2021, coordinated by public and private social actors. The initiatives refer to the FLR chain development, land use plans and assessments, the payment for environmental services programs, academic research, technical assistance and actions to raise awareness of rural producers. The FLR network is made up of different social actors engaged in multiple FLR initiatives and led mainly by public actors. Human and social capital, institutional arrangements and financial resources present in the initiatives point to a path for the advancement of forest restoration and the participation of farmers.

Keywords: environmental governance; watershed; Itaúnas river; São Mateus river; Atlantic Forest.

RESUMO: Este estudo analisa a governança da restauração de paisagens florestais (RPF) no norte do estado do Espírito Santo (ES), a partir de iniciativas e atores sociais da RPF. Pretende-se discutir as condições existentes para que o sistema de governança da RPF avance no ganho de área restaurada e no envolvimento de proprietários e usuários de terras em iniciativas de RPF, nas bacias hidrográficas dos rios Itaúnas e São Mateus. Os dados foram coletados por meio de entrevistas e oficinas participativas entre 2018 e 2020 e complementados com dados secundários. Foram identificadas 22 iniciativas – programas, projetos e ações pontuais – de RPF entre 2001 e 2021, que se referem a ações de desenvolvimento da cadeia da RPF, diagnósticos e planos de uso da terra, programas de pagamento por serviços ambientais, pesquisa acadêmica, assistência técnica e extensão rural, além de ações de sensibilização de produtores rurais. Lideradas principalmente por atores do setor público, as iniciativas contam com a participação de uma diversidade de atores sociais das esferas pública e privada, que atuam em rede. O capital humano e social, os instrumentos institucionais e os recursos financeiros presentes nas inciativas de RPF indicam que o sistema de governança da RPF do norte do estado pode avançar para obter ganho de escala na RPF e maior participação de proprietários e usuários de terra.

Palavras-chave: governança ambiental; bacia hidrográfica; rio Itaúnas; rio São Mateus; Mata Atlântica.

1. Introduction

Forest Landscape Restoration (FLR) has developed rapidly in Brazil through scientific research, public policies, and practical experiences implemented by social actors in the public and private sectors (Rodrigues *et al*., 2009; Calmon *et al*., 2011; Brancalion *et al*., 2016; Crouzeilles *et al*., 2019; Romijn *et al*., 2019; Adams *et al*., 2021; Siqueira *et al*., 2021). Integrating the ecological aspects of FLR with the social, economic, and political processes taking place in specific landscapes is a major challenge for FLR governance (Van Oosten, 2013a; Arts *et al*., 2017). This challenge includes the demand for public policies to support FLR (Schweizer *et al*., 2019a; Siqueira *et al*., 2021) and upscaling restored area to increase native vegetation cover (Romijn *et al*., 2019; Pinto & Voivodic, 2021). To achieve these results, the literature points to the need to attract financial resources in the long term (Ron Tonen *et al*., 2014; Schweizer *et al*., 2019a,b; Adams *et al*., 2021), develop technical capacity to design and implement projects (Chazdon *et al*., 2021; Mansourian *et al*., 2021), and involve farmers of private land, agrarian reform settlements, and indigenous, *quilombolas* (descendants of enslaved people from African-Brazilian communities known as quilombos), and traditional populations' territories (Reyes-Garcia *et al*., 2019; Adams *et al*., 2021; Elias *et al*., 2021; Sanches *et al*., 2021).

Forest Landscape Restoration (FLR) is a process that seeks to achieve the integrity of a landscape's ecological and productive functions while improving human well-being. This concept was formulated in 2000 and adopted by the United Nations Conventions on Biological Diversity and Climate Change. It transcends the disciplinary limits of ecological restoration to recover the ecological processes of native vegetation based on forest succession (Van Osten, 2021). The FLR governance concept refers to the set of interactions between multiple social actors aimed at influencing the management of FLR initiatives over time (Brancalion *et al*., 2016; Mansourian, 2017). The idea of governance comprises the different interests and power resources of social actors who connect to solve societal problems and create opportunities in the public interest (Kooiman *et al*., 2005). Specifically, environmental governance provides for changes in

legislation, agreements, knowledge, and the behavior of those who participate in decision-making regarding a given natural resource or environmental problem (Lemos & Agrawal, 2006).

This study adopted the concept of social actors in FLR as individuals, groups, or organizations from society in general, from the public and private sectors, who influence or are influenced by FLR initiatives. The landscape concept used here comprises the result of the marks that human society imprints on the earth's surface over time or as a phenomenon of continuous social construction, in which identity, knowledge, memory, and emotions overlap and associate with cultural collective organization processes (Verdum *et al*., 2016).

Brazil has a deficit of Permanent Preservation Areas (PPAs) and Legal Reserves (LR) of 2.3 and 12.8 million hectares, respectively, with large farm businesses accounting for 50% of the PPAs deficit and 65% of the LR deficit (Igari *et al*., 2021). These figures give an idea of the scale of the need to develop FLR governance models capable of up scaling forest restoration.

Currently, there are countless FLR initiatives in the Atlantic Forest, *Cerrado*, and Amazon ecosystems (Ball *et al*., 2014; Pinto *et al*., 2014; Richards *et al*., 2015; Benini *et al*., 2016; Sanches *et al*., 2021) characterized by different types of actions. These include the implementation of fencing and planting of seedlings, seed collection for native species nurseries, technical training, payment for environmental services (PES), and scientific research (Sanches *et al*., 2021; Siqueira *et al*., 2021; Buzati *et al*., in press; Oliveira *et al*., 2022). For example, in the early 2000s, indigenous communities, farmers, and other social actors began organizing to protect and restore the springs and forests at the headwaters of the Xingu River in the northeastern region of Mato Grosso State. They created the Xingu Seed Network, which includes around 568 seed collectors from villages and rural settlements in 16 municipalities in Mato Grosso, to exchange and sell native species seeds (Sanches *et al*., 2021). In the Paraíba do Sul River valley, in the state of São Paulo (SP), the Atlantic Forest Connection Project, implemented in 2018 by the São Paulo State Department of Infrastructure and Environment (SIMA), develops PES programs to increase carbon stocks, produce ecosystem services, and conserve biodiversity.

Since 2014, the north of the state of Espírito Santo (ES) has been experiencing increasingly dry seasons, which have directly impacted water supply to municipalities and agricultural activities (SEAMA, 2017). The drought context in this region, coupled with the deficit in native vegetation cover of around 28,000 hectares in the Itaúnas and São Mateus River basins (RBs), place them as priority areas for forest restoration in the state (SEAMA, 2017). Thus, this study aimed to analyze FLR governance in the Itaúnas and São Mateus RBs based on FLR initiatives and the social actors related to them. The analysis of the FLR governance in these two RBs will be deepened by exploring the types of FLR initiatives and the characteristics of the social actors involved in this landscape. Furthermore, this study will discuss how the current FLR governance in the two RBs can move forward to expand the areas undergoing restoration and deepen the involvement of farmers[1] in FLR initiatives.

[1] In this study, "farmers" include individuals; rural producers; family farmers; indigenous, quilombola, and traditional communities; and agrarian reform settlers.

2. Methodology

2.1. The Itaúnas and São Mateus River Basins in the north of the state of Espírito Santo (ES)

The Itaúnas and São Mateus River basins cover 16 municipalities[2] in an area equivalent to around a quarter of the state (Brandão *et al*., 2018; 2019). It is one of the least developed regions of ES, with an average HDI of 0.69. It is home to around 4 million inhabitants, which represents approximately 10% of the state's population (Brandão *et al*., 2018, 2019; Sossai, 2018; IBGE, 2019). The economy of the two RBs is represented by agricultural activities (coffee, sugar cane, papaya, coconut, rubber, cassava, beans, black pepper, and rice), dairy farming, and eucalyptus forestry (Sossai, 2018). The remaining native vegetation occupies between 90 and 100 thousand hectares (SEAMA, 2017; Sossai, 2018) and represents less than 8% of its total area (Sossai, 2018) (Figure 1, Table 1).

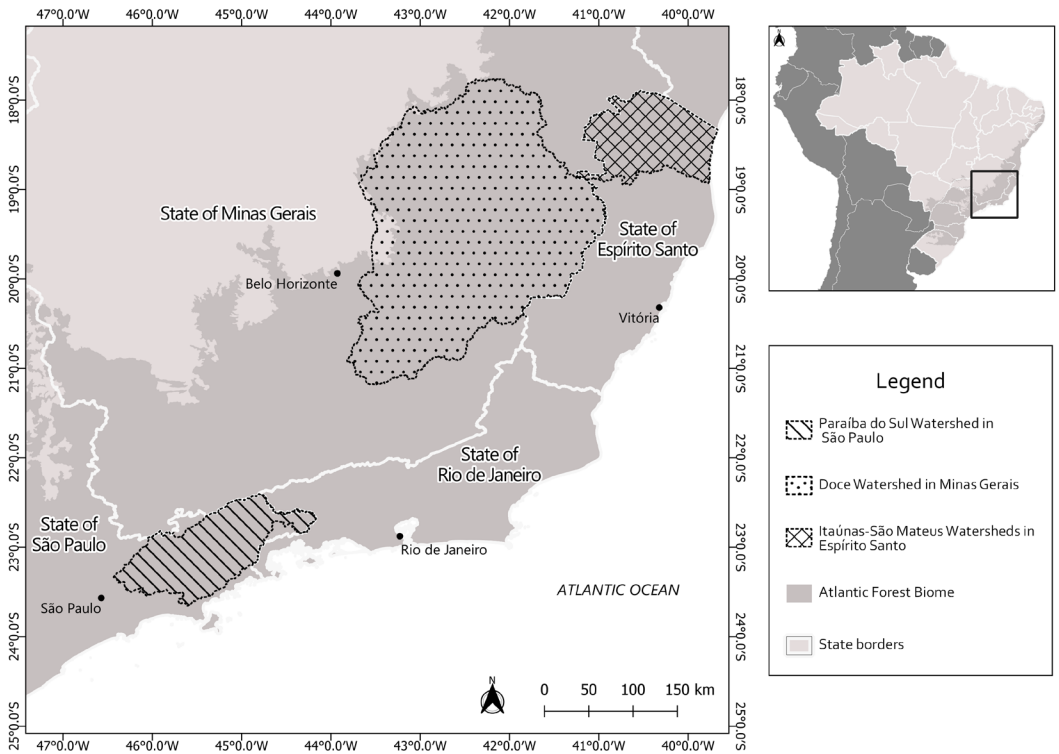

FIGURE 1 - Itaúnas and São Mateus River basins in northern Espírito Santo, Atlantic Forest Biome.

SOURCE: Prepared by Leonardo Barbosa - WRI Brasil.

[2] Água Doce do Norte, Águia Branca, Barra de São Francisco, Boa Esperança, Conceição da Barra, Ecoporanga, Jaguaré, Mantenópolis, Montanha, Mucurici, Nova Venécia, Pedro Canário, Pinheiros, Ponto Belo, São Mateus e Vila Pavão (Brandão *et al.*, 2018; 2019).

TABLE 1 - Areas of Espírito Santo and the Itaúnas and São Mateus River Basins with native vegetation and agricultural and forestry activities.

Occupation (in ha *, %)	State of Espírito Santo (in ha, %)	Itaúnas River Basin (in ha, %)	São Mateus River Basin (in ha, %)
Total area	4,608,663 (100%)	442,852.76 (100%)	826,886.32 (100%)
Native vegetation	732,777.41 (15.9%)	29,349.20 (6.6%)	68,417.95 (8.3%)
Native vegetation in the initial stage of regeneration	285,737.10 (6.2%)	15,948.04 (3.6%)	52,521.77 (6.4%)
Pasture	1.806,595.89 (39.2%)	208,384.09 (47.1%)	440,593.43 (53.3%)
Eucalyptus	313,389.08 (6.8%)	51,248.68 (11.6%)	63,332.60 (7.7%)
Sugar cane	78,347.27 (1.7%)	50,899.05 (11.5%)	4,176.15 (0.5 %)
Coffee	433,214.32 (9.4%)	13,795.17 (3.1%)	45,314.10 (5.5%)

CAPTION: *ha: hectares
SOURCE: Sossai (2018), data from 2012 to 2015.

This region has a history of deforesting large areas of the Atlantic Forest to open up colonization frontiers. Until 1888, only 15% of ES was occupied along the coast, where sugar cane and cassava were grown. In the 1920s, the state began to receive European immigrants, accelerating the clearing of the forest from the central region toward the south and north. The expansion of the frontiers to the north was contained until 1928, when the bridge over the Doce River was built in the city of Colatina, connecting the rest of the state to the northern region. Deforestation intensified in the region in the 1950s to make way for coffee plantations and extensive livestock farming on large estates. The native forest area decreased to 65% of the remaining areas in 1920, 29% in the late 1950s, and continued, reaching 20% and 10% in the mid-1970s and 1980s, respectively (Instituto de Pesquisas da Mata Atlântica, 2005; Sossai *et al*., 2018).

2.2. Data collection and analysis

Primary and secondary data on FLR initiatives and social actors in the Itaúnas and São Mateus River basins were collected between 2018 and 2020. The FLR initiatives developed by different social actors in the public and private spheres include programs, projects, and specific actions directly related to FLR or with an influence on it (e.g., scientific research, raising farmers' awareness of FLR, establishing networks). Primary data was obtained

between 2018 and 2019 through semi-structured interviews (Bernard, 2006) and two participatory workshops (Chambers, 2002) held with FLR social actors in the municipalities of Montanha and Boa Esperança (Figure 1).

The semi-structured interviews included 18 key players representing 18 organizations[3] that develop FLR initiatives in Espírito Santo. The interviewees were selected based on the two participatory workshops and secondary data. The interviews were held in person in the cities of Vitória, Nova Venécia, São Mateus, and Conceição da Barra, in ES, or online (*Skype*). The same protocol was followed to collect data on the interviewee's profile; description of forest restoration initiatives in the studied basins; financing of FLR initiatives; motivations for forest restoration; interactions between social actors in the initiatives; institutions (e.g., legislation, management instruments) related to the implementation of FLR initiatives; monitoring of FLR initiatives; and communication and access to FLR information.

The interview protocol was submitted to the Ethics Committee of the School of Arts, Sciences, and Humanities (EACH) of the University of São Paulo (USP) (CAAE: 22206619.2.0000.5390). The interviewees signed an Informed Consent Form (ICF) before each interview to inform them of its objectives, the expected results, the use of the data, and the interviewee's right to confidentiality of the information provided.

The two participatory workshops were based on the *Net-Map*[4] methodology for social landscape mapping (Buckingham *et al*., 2018). They generated data on the interactions between the different social actors in FLR initiatives. The two workshops were attended by 28 and 56 people, respectively, representing 13 and 29 public sector organizations, companies, non-governmental organizations (NGOs), universities, trade unions, farmers, and social movements. The workshops were documented, and their results were published in Buzati *et al.* (in press) and Oliveira *et al*. (2022). Secondary data was obtained from a database of FLR initiatives and social actors of the Itaúnas and São Mateus River basins and from academic publications, technical documents, and *websites*.

The primary data was transcribed and categorized according to the open coding method of Qualitative Research (Creswell, 2007) to interpret the different types of initiatives, the role of the social actors in the initiatives, and the aspects that emerged as potentialities and challenges for the evolution of the FLR governance in the Itaúnas and São Mateus River basins.

This study was carried out as part of the Governance Component of the Project "Maximizing Economic Opportunities for Forest Landscape

[3] Espírito Santo State Water Resources Agency – AGERH; José Bahia Sociocultural and Environmental Center; River Basin Committee (RBC) of the Itaúnas River; RBC of the São Mateus River; ProdNorte Consortium; Federation of Agriculture and Livestock of the State of Espírito Santo – FAES; Federation of Rural Workers, Farmers, and Family Farmers of the State of Espírito Santo – FETAES; Bioatlantic Institute – IBIO; Capixaba Institute for Research, Technical Assistance, and Rural Extension – INCAPER; Livestock and Forest Protection Institute of Espírito Santo – IDAF; National Institute for Colonization and Agrarian Reform – INCRA; State Park of Itaúnas; Espírito Santo State Department for the Environment and Water Resources – SEAMA; Municipal Environment Department of Conceição da Barra; Society Friends for Itaúnas – SAPI; Suzano; The Nature Conservancy – TNC; World Resources Institute Brasil – WRI Brasil.

[4] Net-Map is "a participatory method of social network analysis created by Eva Scheffer to map connections, influences, and interests in networks" (Buckingham et al., 2018: vi). This method was adapted by the World Resources Institute - WRI to map the social landscapes of the FLR by describing the flows that connect social actors in networks.

Restoration in Brazil" (Pro-Restaura), led by the World Resources Institute Brasil (WRI Brasil) in partnership with the International Institute for Sustainability (IIS). The project was carried out in the river basins of Doce river, in the state of Minas Gerais (MG) (Sanches *et al*., in preparation); Paraíba do Sul River, in the state of São Paulo (SP) (Buzati *et al*., in press); and Itaúnas and São Mateus Rivers, in ES.

3. Results

3.1. Forest Landscape Restoration initiatives in the Itaúnas and São Mateus River basins

This study identified 22 FLR initiatives established between 2001 and 2021, characterized by actions, projects, and programs developed by private for-profit organizations, non-profit civil society organizations, and public agencies (Table 2). This amount includes initiatives implemented in the state and in the Itaúnas and São Mateus river basins. In addition, this study considered two initiatives carried out in other RBs in ES that directly influenced the development of actions in the studied RBs. Of the total, 13 initiatives are ongoing or in progress, and nine initiatives have already been completed, as in the case of the Strategic Plan for the Forest Restoration Production Chain in the State of Espírito Santo (PERF-ES), the Assessment of FLR Opportunities for the State of Espírito Santo (ROAM-ES), and the Atlantic Forest Atlas of Espírito Santo. Most of the initiatives were implemented at the state and micro-regional level, with the latter involving more than one river basin and/or municipality (Table 2).

The twenty-two initiatives are grouped into six sets of actions, projects, or programs:

(i) development of the forest restoration chain (production and planting of seedlings and FLR monitoring);

(ii) conservation of standing forest and forest restoration based on payment for environmental services (PES);

(iii) development of teaching activities, academic research, technical assistance and rural extension;

(iv) land use assessments and plans;

(v) integrated water management and restoration of riparian vegetation; and

(vi) training, raising awareness, and mobilizing people for environmental conservation and FLR (Table 2).

Initiatives to develop the forest restoration chain include Suzano's[5] forest restoration program, the implementation of nurseries, the ecological monitoring project developed by The Nature Conservancy (TNC), the Environmental Extension Program, and the Sustainable Farming Project. Suzano's forest restoration program holds a central place in the FLR in the northern region of the state, both because of the size of the area restored (18,000 hectares in the process of restoration) and the technical knowledge and experience accumulated in the implementation and monitoring of its projects since 2010. In Conceição da Barra, where the São Mateus and Itaúnas rivers flow into the sea, the company

[5] During this study's data collection, the former Fibria, based in the north of Espírito Santo, was incorporated into Suzano.

TABLE 2 - Forest Landscape Restoration (FLR) initiatives from 2001 to 2021 impacting on the Itaúnas and São Mateus River basins (ES).

Initiatives	Goals	Types of initiative	Beginning	Progress	Areas of Coverage	Level of Implementation
1. FLR actions in the Itaúnas River Basin Committee (RBC)	Develop conditions to raise funds and implement FLR actions	Water and Forest Conservation and Management	2001	In progress	Itaúnas River Basin	Micro-regional
2. Production of native species seedlings and implementation of FLR projects (José Bahia Center)	Develop actions to recover native vegetation and produce native species seedlings	Development of the Restoration Chain	2003	In progress	Municipalities in the Itaúnas and São Mateus River basins	Municipal
3. Environmental adequacy of farm businesses	Provide guidance to famers on environmental and forestry legislation	Training, Raising Awareness, and Mobilization for FLR	2006	In progress	State of Espírito Santo	State
4. Water Producers Project	Implement PES for standing forests; double the state's forest cover through forest restoration	Payment for Environmental Services	2007	Completed	River basins of the Benebente, Guandu, and São José rivers	Micro-regional
5. Environmental Extension Program	Implement actions for the recovery of riparian forest and springs	Development of the Restoration Chain	2007	Completed	São Mateus, Brejetuba, and Jaguaré	Micro-regional
6. Capixaba Forest Forum/ Forest Dialogue	Strengthening dialogue between the forestry, agricultural, and environmental sectors	Training, Raising Awareness, and Mobilization for FLR	2008	In progress	State of Espírito Santo	State
7. Sustainable Farming Project	Promote the restoration of the vegetation of springs and riverbanks	Development of the Restoration Chain	2009	Completed	Lower Guandu River	Micro-regional
8. FLR actions in the São Mateus River Basin Committee (RBC)	Develop conditions to raise funds and implement FLR actions	Water and Forest Conservation and Management	2010	In progress	River Basin of the São Mateus River	Micro-regional

Initiatives	Goals	Types of initiative	Beginning	Progress	Areas of Coverage	Level of Implementation
9. Suzano's Forest Restoration Actions	Restore areas of environmental liabilities	Development of the Restoration Chain	2010	In progress	States of Espírito Santo, Minas Gerais, and Bahia	Subnational
10. Reflorestar Program	Conserve and restore the ES forest cover by PES	Payment for Environmental Services	2011	In progress	State of Espírito Santo	State
11. Strategic Plan for the Forest Restoration Production Chain in the State of Espírito Santo (PERF-ES)	Create strategies to integrate FLR and forest products market	Land Use Assessments and Plans	2014	Completed	State of Espírito Santo	State
12. Ecological Monitoring Project for the FLR	Develope ecological indicators for monitoring the FLR	Development of the Restoration Chain	2014	In progress	State of Espírito Santo	State
13. Atlantic Forest Biomes Project	Encourage the management of native and exotic tree species for economic purposes and PPAs and LRs restoration	Teaching, Academic Research, and Rural Extension	2015	Completed	Atlantic Forest in ES	State
14. Conceição da Barra's Municipal Plan for the Conservation and Recovery of the Atlantic Forest (PMMA)	Guide actions to conserve and restore native vegetation	Land Use Assessments and Plans	2016	In progress	Municipality of Conceição da Barra	Municipal
15. Assessment of FLR opportunities for the state of Espírito Santo (ROAM-ES)	Assess and define priority areas for the FLR	Diagnósticos e Planos de Uso da Terra	2017	Concluído	Estado do Espírito Santo	Estadual
16. Itaúnas Always Alive Campaign	Raise awareness among the population of the Itaúnas RB for actions to recover native vegetation	Training, Raising Awareness, and Mobilization for FLR	2017	Completed	River Basin of the Itaúnas River	Micro-regional

Initiatives	Goals	Types of initiative	Beginning	Progress	Areas of Coverage	Level of Implementation
17. Atlantic Forest Atlas of Espírito Santo	Define a baseline for monitoring native vegetation cover in ES	Land Use Assessments and Plans	2018	Completed	State of Espírito Santo	State
18. Training the RBs Committees in FLR	Introduce the FLR issue in the water management context	Training, Raising Awareness, and Mobilization for FLR	2018	Completed	State of Espírito Santo	Micro-regional
19. Forest Plans Project	Develop a municipal management tool for the conservation, restoration, and sustainable use of the Atlantic Forest	Land Use Assessments and Plans	2021	In progress	States of São Paulo, Minas Gerais, Espírito Santo, and Bahia	Municipal
20. Implementation of nurseries in the municipalities of Itaúnas and São Mateus River basins	Support FLR initiatives and implement native species nurseries in Environment and Agriculture Departments	Development of the Restoration Chain	n.d.	In progress	Municipalities in the Itaúnas and São Mateus RBs	Municipal
21. Environmental education for farmers	Develope a model for sustainable rural development based on cooperation and solidarity	Training, Raising Awareness, and Mobilization for FLR	n.d.	In progress	State of Espírito Santo	State
22. Education for environmental conservation	Provide training to students in conservation and environmental management	Teaching, Academic Research, and Rural Extension	n.d.	In progress	State of Espírito Santo	Municipal

SOURCE: Data collected by the authors between 2018 and 2020.

occupies around 50% of the municipality's land with its forestry businesses. The largest contribution to Permanent Preservation Areas (PPAs) with native vegetation cover in this municipality comes from Suzano's properties, connecting watercourses, slopes, and micro-basins.

The company reports that ensuring access to financial resources and technical knowledge is a requirement for implementing and improving its forest restoration projects and achieving good results. In addition to its own financial resources, Suzano obtained around 170 million BRL from the Brazilian Development Bank (BNDES) (Table 3) to restore 21,000 hectares between 2011 and 2019. Its adaptive restoration program comprises periodic evaluation and learning processes to improve its management. For example, seedling survival increased from 50% to 90-95% between 2014 and 2018. Monitoring the restored areas continuously is an essential step of the adaptive management to obtain successful outcomes.

In partnership with Suzano, the NGO TNC has been carrying out ecological monitoring of the company's restoration areas since 2014, after the 5th year of project implementation, based on the monitoring protocol of the Atlantic Forest Pact (Viani *et al*., 2013). By analyzing satellite images, TNC technicians choose areas to collect biodiversity data. This project is developing technologies through electronic applications that facilitate data collection in the field, the processing of this data, and its storage in an integrated system for monitoring the TNC's FLR. Based on this pilot project, TNC is building a protocol with ecological indicators for monitoring forest restoration that can be applied throughout the state. In this initiative, TNC is also collaborating with the production of information to support the drafting of norms that will regulate the Environmental Regularization Program (PRA)[6] in ES, under the responsibility of the Livestock and Forest Protection Institute of Espírito Santo (IDAF). The TNC is financing this project with funds from the Plant 1 billion Trees Campaign (until 2030) - Restaura Brasil, which receives donations from individuals and companies (Restaura Brasil, 2022) (Table 3).

Established in 2011, the *Reflorestar* Program (*Programa Reflorestar*) is the main initiative for conserving standing forests and forest restoration, based on Payment for Environmental Services (PES) in Espírito Santo. Its conception was based on criticism of the effectiveness of small-scale (e.g., river basin) forest restoration projects that preceded the program, such as the Water Producers Project (Table 2), implemented by the state through public tenders for the purchase of seedlings, fences, and inputs to be delivered to farm business owners.

Run by the State Department for the Environment and Water Resources (SEAMA), the *Reflorestar* Program offers agricultural producers a range of options for conserving and restoring forest cover. The program is based on the payment of a monetary value to the farmer, which is reverted into an environmental service through planting or another technique that conserves or restores native vegetation. There are two PES strategies: conservationist and profitable. The first includes conservation of the standing forest, recovery by planting seedlings,

[6] According to Federal Decree No. 7,830 of 10/17/2012, the Environmental Regularization Programs - PRAs provided for in the Federal Law for the Protection of Native Vegetation (Federal Law No. 12,651 of 05/25/2012) comprise the actions to be taken by farmers to carry out the environmental regularization of their lands, which aims to maintain and recover PPAs, LRs, and restricted use are-as.

TABLE 3 - Forest Landscape Restoration (FLR) initiatives in the Itaúnas and São Mateus RBs (ES) and funding sources between 2001 and 2021.

Initiatives	**Financial support**
1. FLR actions in the Itaúnas River Basin Committee (RBC)	State Water Resources Agency (AGERH) and WRI Brasil
2. Production of native species seedlings and implementation of FLR projects (José Bahia Center)	Environmental Petrobras
3. Environmental adequacy of farm businesses	Federation of Agriculture and Livestock of the State of Espírito Santo (FAES)
4. Water Producers Project	Global Environment Facility (GEF)/World Bank
5. Environmental Extension Program	Espírito Santo State Bank (BANESTES)
6. Capixaba Forest Forum/Forest Dialogue	National Forest Dialogue, Agribusiness Development Center - CEDAGRO (Executive Department)
7. Sustainable Farming Project	ES State Government
8. FLR actions in the São Mateus River Basin Committee (RBC)	AGERH and WRI Brasil
9. Suzano's Forest Restoration Actions	Suzano, BNDES
10. Reflorestar Program	Oil royalties/Fundágua and GEF/World Bank
11. Strategic Plan for the Forest Restoration Production Chain in the State of Espírito Santo (PERF-ES)	The Nature Conservancy (TNC), GEF/Brazilian Biodiversity Fund (FUNBIO)
s12. Ecological Monitoring Project for the FLR	Plant 1 billion trees campaign i
13. Atlantic Forest Biomes Project	BNDES, SEBRAE, John Deere, Vale, and Monsanto
14. Conceição da Barra's Municipal Plan for the Conservation and Recovery of the Atlantic Forest (PMMA)	Conceição da Barra City Hall and SOS Atlantic Forest
15. Assessment of FLR opportunities for the state of Espírito Santo (ROAM-ES)	United Kingdom Government and the Norwegian Government's International Climate and Forest Initiative

Initiatives	Financial support
16. Itaúnas Always Alive Campaign	Crowdfunding (Catarse Platform)
17. Atlantic Forest Atlas of Espírito Santo	National Project for Integrated Public-Private Actions (PROBIO-II), International Bank for Reconstruction and Development (IBRD), GEF, FUNBIO, Fundágua, and TNC
18. Training the RBs Committees in FLR	Pact for the Restoration of the Atlantic Forest (Pacto)
19. Forest Plans Project	SOS Atlantic Forest and Suzano
20. Implementation of nurseries in the municipalities of Itaúnas and São Mateus River basins	Municipal Departments of Environment and Agriculture
21. Environmental education for farmers	Federation of Rural Workers, Farmers, and Family Farmers of the State of Espírito Santo (FETAES)
22. Education for environmental conservation	Federal University of Espírito Santo (UFES) and Federal Institute of Espírito Santo (IFES): Ministry of Education/Federal Government; Agricultural Family School (EFA): State and municipal governments and donations from individuals and companies.

[i] Sponsors: Hyundai, Droga Raia, Drogasil, Cervejaria Ambev, DocuSign and Plantador Master, Premium and Pioneiro.
SOURCE: Data collected by the authors between 2018 and 2020.

and natural regeneration with fencing of the area. The profitable strategy includes agroforestry systems (AFSs) and managed forests for commercial exploitation. The *Reflorestar* Program was designed to serve the whole state, delegating responsibility for purchasing inputs and implementing the project to the farmer.

Since 2012, by means of a Technical and Financial Cooperation Agreement signed between SEAMA and the Espírito Santo Development Bank (BANDES), the *Reflorestar* Program has been carried out with the technical support of BANDES consultants to draw up the technical projects, compile the farm business owner's documentation, provide technical assistance, and annually monitor the contracts with SEAMA. Starting in 2015, the *Reflorestar* Program began to expand with funds from the *royalties* from ES oil and gas managed by the Espírito Santo State Fund for Water and Forest Resources (Fundágua), which, at the time, allocated 2.5% of the *royalties* collected to the program (R$30 million/year). These resources are attached to those of the Global Environment Facility (GEF) and are managed by the World Bank (Table 3). Since 2016, the amount of resources from oil *royalties* has varied and decreased due to the economic and financial crisis and changes in the country's oil exploration policies.

At the beginning of its implementation, the *Reflorestar* Program was publicized in several

municipalities, including Montanha, Pinheiros, and Boa Esperança, in the north of the state. Currently, the program's coordination depends on BANDES consultants, local leaders associated with the rural sector, or partner organizations, such as NGOs and River Basin Committees (RBCs), to attract farmers to the program. Once interested, the farmer registers for the Program through BANDES or directly on the *Reflorestar* Program[7] website. The area covered by the program reached 20,000 hectares in 2019, referring to 3,795 contracts. From 2015, the municipalities of the Itaúnas and São Mateus River basins were covered. By 2019, the contracts covered farm businesses in the 16 municipalities of the RBs, totaling 735 current contracts on 3,766 hectares (SEAMA, 2022).

The Atlantic Forest Biomes Project, which has developed field and laboratory experiments on planting and managing native and exotic tree species for conservation and production purposes, is among the teaching, academic research, technical assistance and rural extension initiatives. The experiments on private properties and experimental areas of the Capixaba Institute for Research, Technical Assistance, and Rural Extension (INCAPER) prioritized studies on soil and vegetation conservation, restoration of PPAs and legal reserves (LRs), management of tree species, and AFSs. Financed by the BNDES, the Brazilian Micro and Small Business Support Service (SEBRAE), and the companies John Deere and Vale, this project sought to contribute to the development of the production chain for native species. For example, it studied the management and certification of the *aroeira* tree, which produces pink pepper. Even though it was not carried out in the Itaúnas and São Mateus River basins, the project accumulated scientific knowledge to improve forest restoration techniques. The development of experiments on private properties allowed farmers to be involved in the research, creating an environment for exchanging information based on observations made by the farmers and making it possible to adjust the experiments. This practice materialized the experience of knowledge co-production in the field and farmers' adoption of new management techniques. Throughout the project, INCAPER extension agents have also benefited from the knowledge produced, which has been passed on to other farmers.

The other initiatives of teaching, academic research, technical assistance and rural extension refer to the training of young people. Four interviews revealed the importance of the Federal University of Espírito Santo (UFES) in the municipality of São Mateus, the Federal Institutes of Espírito Santo (IFES), and the Agricultural Family Schools (EFA)[8] as important centers for training people in environmental conservation and FLR. There are four IFES units and six EFA units[9] in the Itaúnas and São Mateus RBs.

This study identified four initiatives that resulted in land use assessments and plans: PERF-ES, ROAM-ES, Conceição da Barra's Municipal Plan

[7] https://seama.portalreflorestar.es.gov.br/login/?next=/ (accessed on 06/26/2022).

[8] Founded in 1968 by the Espirito Santo Promotional Education Movement (MEPES) for young students in the countryside, the Agricultural Family Schools (EFAs) adopt the Alternation Pedagogy, which seeks intellectual training for territorial development integrated with the farm setting of the young (Nosella, 2020).

[9] The Federal Institutes of Espírito Santo (IFES) are based in Barra de São Francisco, Montanha, Nova Venécia, and São Mateus. The Agricultural Family Schools are in Boa Esperança, Jaguaré, Montanha, Nova Venécia, Pinheiros, and São Mateus.

for the Conservation and Recovery of the Atlantic Forest (PMMA), and the Atlantic Forest Atlas of Espírito Santo. These documents indicate priority areas for the conservation and restoration of native vegetation and/or assessment of the forest restoration chain. All of them can be adopted at the state and municipal levels as management tools to guide fundraising and the preparation of FLR projects. In addition to these, the Forest Plans Project to draw up Municipal Atlantic Forest Plans (PMMA) started in five municipalities where Suzano operates in the north of the state in 2021. Actions to strengthen the Municipal Environmental Councils and train technicians from the Municipal Departments to monitor and evaluate the process of implementing the plans are being developed alongside the drafting of the plans. Started in 2016, Conceição da Barra's PMMA has been included in the Forest Plans for updating and implementation.

The RBs Committees (RBCs) of Itaúnas and São Mateus represent initiatives for integrated water management and restoration of riparian vegetation. In 2020, the two committees created their Forest Restoration Technical Chambers (CTRF) to establish strategies for planning and implementing forest restoration in the two basins. That year, the two RBCs carried out participatory processes to draw up their strategic plans for the FLR (Itaúnas RBC and São Mateus RBC in 2020). In 2021, they developed their FLR (SAPI, 2021) and communication plans.

Training, raising awareness, and mobilizing people for conservation and restoration of forests and landscapes are represented by: the Itaúnas Always Alive Campaign; environemntal training for family farmers by the Federation of Rural Workers, Farmers, and Family Farmers of the State of Espírito Santo (FETAES); environmental adequacy of farm businesses by the Federation of Agriculture and Livestock of Espírito Santo (FAES); the establishment of the Capixaba Forest Forum; and the training on forest restoration topics in the RBCs.

In 2017, the Itaúnas Always Alive Campaign was conceived and implemented by the NGO Society Friends for Itaúnas (SAPI), which is based in the municipality of Conceição da Barra. To raise awareness and mobilize the population living in the Itaúnas basin for the recovery of the river's whole ecosystem, SAPI produced a documentary called *Itaúnas Sempre Vivo* (Itaúnas Always Alive) and a traveling photographic exhibition along the river. This campaign had such a positive outcome that it was transformed into the Itaúnas Always Alive Movement, involving all the municipalities bordering the river. The Movement works to train and mobilize people, including students and teachers, to conserve the waters of the Itaúnas, restore its springs, and the involvement of farmers in the environmental adaptation of their properties towards sustainable models.

The training of family farmers carried out by FETAES seeks to build sustainable rural development models based on solidarity in the state of Espírito Santo. This training involves formalizing land ownership, raising awareness of environmental conservation, building food sovereignty, supporting agroecological production, holding fairs, and forming production cooperatives, industries, and associations. Forest restoration actions by farmers associated with FETAES are adopted when farmers have access to public financial resources to carry them out.

Since 2006, FAES has been working to provide information on environmental and forestry legislation to agricultural producers, raise their awareness

of the importance of environmental adequacy of their properties, and strengthen communication between agricultural producers, FAES, IDAF, and INCAPER. Finally, the Capixaba Forest Forum, created in 2008, articulates the pulp and paper industry, forestry, and biodiversity conservation sectors in the state. The Forum comprises representatives from the business, government, and civil society sectors. It is part of the Forest Dialogue, which facilitates the construction of common agendas between companies in the forestry sector, environmental organizations, and social movements.

3.2. Main social actors involved in the initiatives

Individuals from public and private organizations interact with each other, participate in FLR initiatives and in this way, develop a FLR network (Table 4, Oliveira *et al*., 2022). Most of the initiatives are coordinated by public actors, with state agencies standing out in the implementation of FLR actions. They are followed by the NGOs SAPI, Bioatlantic Institute (IBIO), WRI Brasil and, TNC that take part in seven initiatives (Table 4).

Within the main public authorities in ES, SEAMA is involved in seven of the 22 FLR initiatives. Other players participating in four or more initiatives include TNC, IBIO, WRI Brasil, SAPI, INCAPER, the State Agriculture, Supply, Aquaculture, and Fishing Department (SEAG), Municipal Environment Departments, and Suzano. Through partnerships, TNC and WRI Brasil carry out important actions to leverage the FLR, as in the case of support for the development of the *Reflorestar* Program management system by TNC and the strategic, action, and communication planning of the Itaúnas and São Mateus RBCs by WRI Brasil. Until 2011, when it changed its role from an environmental NGO to a River Basin Agency, IBIO made important contributions to the Water Producers Project, the training for the FLR in RBCs, and actions to raise awareness among farmers regarding water and forest conservation.

4. Discussion

In the Itaúnas and São Mateus River basins there is a wide range of FLR initiatives (e.g., PES, research, training) in which many social actors form a FLR network. This diversity of initiatives represents a system of governance for the FLR that includes:

(i) actions to develop the FLR chain, from the production of native species seedlings to monitoring;

(ii) a robust PES program designed for the whole state;

(iii) scientific research and land use assessments that contribute to FLR;

(iv) land use plans that can be used as management tools by the state, municipalities, and RBCs; and

(v) actions aimed at training and raising awareness among individuals regarding environmental conservation and FLR.

This abundance of initiatives reveals the favorable conditions for up scaling FLR and increasing the participation of farmers in FLR initiatives.

TABLE 4 - Forest Landscape Restoration (FLR) initiatives in the Itaúnas and São Mateus River basins (ES), leaders, and main social actors between 2001 and 2021.

Initiatives	Coordination/Leadership	Main actors
1. FLR actions in the Itaúnas River Basin Committee (RBC)	RBC	Advisors, WRI Brasil, IIS, SAPI
2. Production of native species seedlings and implementation of FLR projects (José Bahia Center)	José Bahia Sociocultural and Environmental Center	Farmers
3. Environmental adequacy of farm businesses	FAES	Rural unions, farmers, CNA Institute, SENAR, IDAF, INCAPER, SEAG, SEAMA
4. Water Producers Project	SEAMA	IBIO, farmers
5. Environmental Extension Program	INCAPER	State Institute for the Environment and Water Resources (IEMA), SEAMA, SEAG, Vale, farmers
6. Capixaba Forest Forum/Forest Dialogue	CEDAGRO (Executive Department)	FAES, IBIO, INCAPER, IDAF, SEAG, SEAMA, SENAR, Suzano, TNV, UFES, Vale, WWF Brasil
7. Sustainable Farming Project	SEAG	IBIO, farmers
8. FLR actions in the São Mateus Basin Committee (RBC)	RBC	Advisors, WRI Brasil, IIS, SAPI
9. Suzano's Forest Restoration Actions	Suzano	TNC, WWF Brasil
10. Reflorestar Program	SEAMA	TNC, Vale, BANDES, WRI Brasil, farmers
11. Strategic Plan for the Forest Restoration Production Chain in the State of Espírito Santo (PERF-ES)	TNC and SEAMA	IDAF, IBIO, WRI Brasil
12. Ecological Monitoring Project for the FLR	TNC	Suzano
13. Atlantic Forest Biomes Project	INCAPER	EMBRAPA Forests, Confederation of Brazilian Agriculture and Livestock Institute, farmers
14. Conceição da Barra's Municipal Plan for the Conservation and Recovery of the Atlantic Forest (PMMA)	Municipal Environment Department	SOS Atlantic Forest, Municipal Environment Council

Initiatives	Coordination/Leadership	Main actors
15. Assessment of FLR opportunities for the state of Espírito Santo (ROAM-ES)	WRI Brasil, SEAMA, UICN	IIS, TNC, IBIO
16. Itaúnas Always Alive Campaign	SAPI	SAPI, public school teachers and students
17. Atlantic Forest Atlas of Espírito Santo	SEAMA	Jones dos Santos Neves Institute, IDAF, IEMA, INCAPER, SEAG
18. Training the RBs Committees in FLR	TNC, IBIO	Pact for the Restoration of the Atlantic Forest, Capixaba Forum of RBCs, RBCs
19. Forest Plans Project	SOS Atlantic Forest, Suzano	Municipal Environment Departments, Municipal Environment Councils, SAPI
20. Implementation of nurseries in the municipalities of Itaúnas and São Mateus River basins	Municipal Environment and Agriculture Department	State employees, farmers
21. Environmental education for farmers	FETAES	Family Farmers
22. Education for environmental conservation	UFES, IFES, Agricultural Family Schools	Teachers and students

SOURCE: Data collected by the authors between 2018 and 2020.

The initiatives include those not necessarily planned for the RBs level, such as the PMMAs and the *Reflorestar* Program. This characteristic poses a scale challenge (Cash *et al*., 2006), which requires strong connections between the social actors who coordinate these initiatives and the actors who have bonds to the RBs landscape. This connections assist the process of spatializing governance by creating synergies between different social actors seeking to solve environmental problems collectively at the local level (Gorg, 2007; Van Oosten, 2013b; Van Oosten *et al*., 2018). For example, the implementation of the CTRFs and the preparation of the plans drawn up by the Itaúnas and São Mateus RBCs contribute at the local and RB levels to stimulating the implementation of actions based at higher levels initiatives (e.g., *Reflorestar* Program).

The actions developed by the Itaúnas and São Mateus RBCs and the *Reflorestar* Program represent the most important FLR governance arrangements in the studied area. Both can carry out actions across the landscape. They have legal and management tools that support their actions (e.g., the Water Law - Federal Law No. 9.433 of 1997, access to Fundágua, the institutionalization of the RBCs), and they can connect with other initiatives. The Itaúnas and São Mateus RBCs are participatory and deliberative management arenas. Governing

as a network, they host FLR plans and are able to manage environmental issues at the landscape level. The RBCs of Paraíba do Sul River (SP) (Marques *et al*., 2002; Buzati *et al*., in press) and Doce River (MG) (Oliveira *et al*., 2022) also stand out in FLR governance in their landscapes. In the RBC of Paraíba do Sul, its CTRF plays a central role in attracting financial resources for FLR projects carried out by local groups and organizations (Marques *et al*., 2020; Buzati *et al*., in press). In the Doce River basin, after the collapse of the Fundão dam in Mariana, the RBC became a central arena of the Conduct Adjustment Transaction Agreement (TTAC) signed by the Federal Government, the impacted states, and mining companies. It is in its CTRF that all the FLR actions carried out by the Renova Foundation are handled (Sanches *et al*., in preparation). These two cases provide a source of learning for the two younger committees on the Itaúnas and São Mateus Rivers.

The preparation of the FLR's strategic, action, and communication plans by the CTRFs of the Itaúnas and São Mateus RBCs clearly shows the progress made in their governance. The partnership with WRI Brasil to carry out these actions indicates that the leaders of the two committees have the agency to build the knowledge and social capital required to create the governance conditions to leverage the FLR in their basins.

The CTRFs of the Itaúnas and São Mateus RBCs comprise a network of social actors capable of building partnerships for forest restoration in the territory (Oliveira *et al*., 2022). The partnership between the two committees and WRI Brasil led to collaboration with SAPI to draw up the forest restoration action plan in the two basins (SAPI, 2021). In this case, WRI Brasil acted as a bridging organization, as it facilitated actions that strengthen landscape governance. As bridging organizations mobilize actors, financial resources, and knowledge, they create the environment for building trust (Berkes, 2009; Ros Tonen *et al*., 2014), social capital[10], and arenas for collective learning (Berkes, 2009; Anderson *et al*., 2019; Futemma *et al*., 2020). This is what has been under development in the Itaúnas and São Mateus landscapes.

The lack of continuous funding, legal uncertainty due to the complexity of environmental and forestry legislation, difficulties in accessing information and knowledge, and the lack of interest of farmers in FLR issues are pointed out as major challenges to FLR governance (Ros Tonen *et al*., 2014; Adams *et al*., 2021; Mansourian *et al*., 2021). These are the same challenges that top the agenda of the two committees. To overcome these challenges, the plans carried out by the CTRFs of the Itaúnas and São Mateus RBCs (strategic, action, and communication) include actions to train young people in the EFAs and, to increase the area served by *Reflorestar* Program in the two RBCs (SAPI, 2021).

The *Reflorestar* Program is based on a centralized governance arrangement coordinated by the State Environmental Agency - SEAMA. It covers the whole state including priorities areas for forest restoration in the north of ES (SEAMA, 2007). However, the program has difficulties to involve farmers. It lacks partnership strategies in the local

[10] The concept of social capital is related to the idea of social organization in which individuals and groups carry out collective purposes. To build social capital, individuals share common norms, values, trust and reciprocity, and cooperate and work in networks (Adger, 2003; Pretty & Ward, 2001).

level with NGOs, municipal departments, municipal and regional offices of state agencies (e.g., IDAF and INCAPER), and RBCs to develop communication, awareness-raising, and mobilization actions. As a consequence of this governance gap, Itaúnas and São Mateus River RBCs argue that the number of farmers involved is low. Nevertheless, according to data from 2015 to 2019, the municipalities of the two RBs account for around 19% of all the area covered by the program (SEMA, 2022).

The *Reflorestar* Program and the Itaúnas and São Mateus RBCs have human, social, and financial capital (Table 4, Oliveira *et al*., 2022) and a sufficiently developed management structure to make progress towards the integration of their activities. The *Reflorestar* Program lacks communication actions with farmers and other local actors. Currently, only BANDES consultants carry out the program's activities by assisting farmers. On the other side, the RBCs have human resources, the capacity to mobilize local actors (i.e., municipalities and the RB), and institutionalized arenas to develop FLR actions, but they lack financial resources for FLR.

Partnerships, bridging organizations, stakeholders' bodies (e.g., councils, committees, forums), and networks are attributes of governance that, by strengthening social capital (Berkes, 2002; Ros-Tonen *et al*., 2014; Buckingham *et al*., 2021; Buzati *et al*., in press), create favorable conditions for producing synergies between social actors and actions (e.g., Melo *et al*., 2013; van Oosten, 2013b; Pistorius & Freiberg, 2014; Holl, 2017). For example, in the north of ES, TNC's partnership strategy is to support groups and organizations with financial resources, knowledge, and technical training to leverage projects that contribute to up scaling FLR. In this sense, the ongoing FLR ecological monitoring project will contribute to the ES Environmental Regularization Program (PRA) norms to be drawn up by IDAF. As these regulations become institutionalized, they will create a clearer legal environment for farmers to adapt their land according to the environmental legislation.

In its partnership with the *Reflorestar* Program, TNC played a key role in developing the program's management system (*Reflorestar* Portal) by providing financial resources and institutional support. Through its partnership with the Rio Guandu Public Consortium, the Terra Institute, SEAG, and INCAPER in the Productive Forests project to implement AFSs, TNC has indirectly contributed to boosting farmer adhesion to the *Reflorestar* Program. At the beginning of the program, when the *Reflorestar* Program had not yet established the cooperation agreement with BANDES, TNC facilitated contacts and access to information for farmers participating in Productive Forests to join the *Reflorestar* Program.

The strategies to improve the management of FLR data throughout ES include integrating the information stored on the *Reflorestar* Portal into TNC's Integrated Forest Restoration System and making it available to other relevant organizations. From this perspective, PERF-ES, which was developed to assess the FLR chain, can leverage the integration of FLR actions between SEAMA, IDAF and INCAPER and guide the agenda of the Espírito Santo Forest Forum.

The development of the PERF-ES and ROAM-ES is also a networking example. These two documents were planned so that they converged with each other and could integrate the results of each of them (Table 4). The first had an economic focus and aimed at developing the FLR chain. The second was based on physical, ecological, and

economic criteria to define priority areas for FLR in ES. It is one of several actions the ES FLR actors' network carries out. In a social network analysis, Oliveira *et al*. (2022) identified 71 actors in the FLR network of Itaúnas and São Mateus River basins, with a predominance of public organizations. They interact with the largest number of social actors and play important roles as influencers, communicators, conflict mediators, and connectors of isolated groups. The public actors of the FLR are involved in attracting financial resources, formulating, and implementing public policies, and mediating actions at local and micro-regional levels in the two river basins. Public organizations operating at the municipal level are central to disseminating technical information to farmers (Oliveira *et al*., 2022). Represented by the Municipal Environment and Agriculture Departments and the municipal and regional offices of INCAPER and IDAF, these actors spread the actions defined by state agencies in the state capital.

The actors representing the companies include Suzano, which stands out in the Itaúnas and São Mateus River basins in two aspects. The first refers to the company's accumulation of technical knowledge in the implementation and monitoring of FLR projects in PPAs and LRs, which represents knowledge that can be made available in the region in other initiatives. The second relates to the contribution of native vegetation restored by Suzano in building vegetation corridors that connect micro-basins, as in Conceição da Barra, which is among the priority areas for FLR actions in the strategic planning of the Itaúnas RBC (CBH Itaúnas and CBH São Mateus, 2020). Suzano's land contains most of the Atlantic Forest vegetation in this municipality, which is associated with springs and other water bodies. This data, added to the eucalyptus plantation activity in large areas of the Itaúnas and São Mateus River basins (Table 1), shows the extent of the company's direct influence on the territory. This influence has also been marked by land conflicts since the 1970s, which extend to the present day between the company[11] and *quilombola* territories and settlements of family farmers (Porto *et al*., 2013; Ferreira, 2016; Barcellos *et al*., 2022). There are 11 *quilombola* territories and five rural settlements in Conceição da Barra living under the impact of eucalyptus cultivation. In the municipalities of São Mateus and Conceição da Barra, where the *quilombola* territory of Sapê do Norte used to be located, the communities live in fragments of this territory, claim their right to own the land, and demand more dignified living conditions amidst the "sea of eucalyptus" (Porto *et al*., 2013; Ferreira, 2016; Barcellos *et al*., 2022). Although Suzano carries out local development projects with the communities impacted by eucalyptus monoculture (see https://www.suzano.com.br/suzano-pg-e-wwf-firmam-alianca-em-projeto-de-planejamento-para-restauracao-da-mata-atlantica/), by 2019 only one of the community nurseries that supply Suzano's restoration projects was in the north of the state.

The challenges in FLR governance are also economic. Raising financial resources to implement long-term FLR initiatives is one of the main challenges to scale up FLR (Ros Tonen *et al*., 2014; Long *et al*., 2017; Adams *et al*., 2021). The flow of financial resources in FLR network of the Itaúnas

[11] Formerly Aracruz Celulose e Fibria.

and São Mateus RBs involves 51 organizations but, when compared to the equivalent networks of the Paraíba do Sul (SP) and Doce (MG) watersheds, it is not very dense (Oliveira *et al*., 2022). There are three loosely connected groupings: one around Fundágua, where the *Reflorestar* Program and the RBCs are connected; another bringing together academic research and teaching organizations; and the last connected to Suzano.

The statements given by interviewees of the State Water Resources Agency (AGERH), the RBCs, IDAF, INCAPER, SEAMA, the Conceição da Barra Municipal Environment Department, the José Bahia Sociocultural and Environmental Center, and SAPI point to the difficulty of ensuring financial resources as the main obstacle to FLR progress. Regarding the *Reflorestar* Program, the decrease in the value of oil and gas royalties directed to Fundágua forced the program to be limited to certain areas of the state. For the Itaúnas and São Mateus RBCs, fundraising still depends on the regulation of the mechanism for charging for water use and the establishment of their Water Agencies. Regarding INCAPER, the decline in financial and human resources over the years, the low salaries, and the deterioration of the material structures of the offices spread across the state affect not only the assistance to farmers but also the agency's ability to take on coordinating positions in large programs, such as *Reflorestar*. In particular, the Municipal Departments and SAPI lack the resources to carry out projects to train, raise awareness, and mobilize farmers in LFR initiatives.

The human and social capital, the accumulated knowledge, the institutional arrangements (e.g., Fundágua, RBCs, PMMA), and the financial resources associated with the FLR initiatives in the Itaúnas and São Mateus RBs indicate that the FLR governance system of the northern ES can be improved to increase the scale of FLR initiatives and deepen the involvement of farmers. In this scenario, the RBCs can help integrate local actors into the FLR governance and create opportunities for social participation through their Forest Restoration Chambers (CTRF). Local organizations (e.g., SAPI, Municipal Department) can strengthen governance arragements from the "bottom-up" (i.e., from the local level to the levels above). INCAPER, IFES, and EFAs can leverage actions to raise awareness among farmers, *quilombola* communities, and families in rural settlements to join the *Reflorestar* Program. The latter, in turn, can benefit from strengthening governance at the local level to increase the adherence of farmers to the program.

5. Conclusions

FLR initiatives in the Itaúnas and São Mateus RBs gather a wide range of programs, projects, and actions regarding the development of the FLR chain, assessment of land use, PES, teaching, academic research, technical assistance and rural extension, training, awareness, and integration between water management and FLR. These initiatives involve multiple social actors, are mainly led by actors in the public sector, and confirm the importance of bridging organizations and partnerships in efforts to integrate initiatives.

The *Reflorestar* Program and the Itaúnas and São Mateus RBs Committees (RBCs) are the most important FLR governance arrangements in the landscape. They have the human, social, financial, and institutional capital necessary to advance their

actions at the local level and to create opportunities to integrate other initiatives. On the one hand, the Itaúnas and São Mateus RBCs are organized through the CTRF to carry out their action plans (SAPI, 2021), focusing on the local level and in connection with organizations working in the watershed level. On the other hand, the *Reflorestar* Program, which has a consolidated management system capable of covering the north of the state, has access to the same network of social actors as the RBCs and can use it to expand its communication activities with farmers.

Thinking of governance as a process, challenges and opportunities will always be present. The FLR governance system in the Itaúnas and São Mateus RBs presents major challenges regarding raising financial resources, access and quality of technical assistance and rural extension, the legal insecurity of landowners, and the adherence of farmers to FLR projects. However, the landscape has accumulated technical knowledge in FLR. It has planned information, a diversity of initiatives, and the participation of multiple social actors who form a significant FLR network. These achievements create favorable conditions for breaking down the obstacles holding back FLR's gains in scale and the involvement of farmers. This case study provides an overview of the current state of FLR governance in northern ES. Future studies could provide more in-depth information on the structures and functioning of local governance in the Itaúnas and São Mateus River basins.

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