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RESEARCH ARTICLE

Smallholders' perspectives, motivations, and incentives for restoring the Brazilian Atlantic Forest

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Ecosystem restoration, recognized as a critical strategy for climate change adaptation and mitigation, faces significant challenges in achieving widespread implementation. A particular facet of this challenge lies in the active involvement of rural landowners. Our study aimed to understand rural landowners' perspectives, motivations, and characteristics that influence their participation in restoration projects in the Atlantic Forest of southeastern Brazil. Qualitative content analysis was conducted on 68 semi-structured interviews with two groups of landowners: 36 who received support and 32 who did not receive project support from a local non-governmental organization to restore native forests on their landholdings. Approximately three-quarters of the sample are classified as smallholders (<80 ha). The main difference between the two groups is the dependence on agricultural production as the main source of income, with 22% of *farmers* in the supported group and 72% in the unsupported group. This socio-economic characteristic appeared to influence the decision to restore native forest. *Farmers'* focus tends to be linked to rural production, and the main obstacle to restoration was the loss of productive land. They usually allow natural forest regeneration to establish on slopes. The other type of landowner (lifestylers) mainly restored land through planting of seedlings, with the main barrier being the cost of restoration. Both groups had water conservation as their main motivation for restoration. Our study shows that understanding the perspectives and motivations of the diversity of rural landowners is crucial to effectively engage them and address the socio-economic feasibility of different restoration approaches.

Key words: conservation policies, ecosystem restoration, incentives, smallholders, socio-ecological approach

Implications for Practice

- Understanding the socio-economic characteristics and perspectives of landowners is essential to promoting their effective engagement in native forest restoration.
- Non-governmental organizations-led restoration projects in the Atlantic Forest tend to attract landowners categorized as lifestylers, whose primary income source is not dependent on rural production.
- Landowner's socio-economic characteristics and the restoration technique used were major drivers of engagement in the restoration initiative.
- Landowners' primary motivation for restoring native forests is to obtain water-based services.

Introduction

In the face of climate change and biodiversity loss, ecosystem restoration is recognized as key to the well-being of both the planet and its inhabitants (Chazdon & Brancalion, 2019). Because of this importance and urgency, it has been developed as a central theme for the United Nations Decade 2021–2030 and is considered a critical element in achieving the Sustainable Development Goals (SDGs) by 2030. Many countries around the world have committed to ambitious restoration targets, such as those outlined in the Paris Agreement and the Bonn Challenge (Fagan et al., 2020). However, several challenges remain to achieve these goals, and the slow progress reported raises questions about the feasibility of these commitments (Fagan et al., 2020; World Conservation Union, 2020). Successfully addressing the environmental crisis and achieving the goals of the Decade of Restoration will require the integration of the social dimension into restoration efforts, projects, and research (Ceccon, 2020). According to Tedesco et al. (2023b), shifting the focus from a project-oriented perspective to embedding restoration as a transformative process within broader social-ecological systems is critical to achieving lasting change.

Brazil, as a megadiverse country that is home to 13% of the planet's biodiversity, has a great responsibility to restore native ecosystems in regions with intensive past land use change (Lewinsohn & Prado, 2005). In 2015, the country made a major commitment to the Paris Agreement to restore 12 million ha of natural areas for multiple purposes by 2030 (MMA, 2019). However, achieving such ambitious restoration goals requires the active participation and collaboration of key stakeholders, especially those who can or need to implement restoration actions on the ground. In Brazil, approximately 53% of the land area with native vegetation is located on private land, making rural landowners the main actors responsible for implementing restoration (Soares-Filho et al., 2014). To protect native vegetation on private land, Brazil has enacted the Native Vegetation Protection Law (NVPL) n° 12651/2012 (Brazil, 2012). In addition to protecting existing native vegetation, this law requires the restoration of ecologically important areas, such as buffer strips along waterways, springs, and steep slopes, known as Areas of Permanent Protection. Despite the existence of the NVPL, which was originally enacted in 1934, effective implementation has yet to be achieved (Guidotti et al., 2017; Santiago et al., 2018). Currently, there remains a deficit of approximately 19 million ha of native vegetation that needs to be restored in areas protected by the law (Guidotti et al., 2017). Forest ecosystem restoration is particularly important in the Atlantic Forest region of Brazil. This biome is a biodiversity hotspot of global importance and the most densely populated region in Brazil (Laurance, 2009; Brancalion et al., 2019a, 2019b), where native forests provide important ecosystem services to the people of this region.

One of the challenges hindering native forest restoration is the lack of participation of rural landowners in restoration activities (Lima & Bastos, 2020; Gardon & dos Santos, 2024). Recognizing this, there is a lack of studies that examine landowners' perspectives and motivations for native forest restoration, particularly with respect to their socio-economic characteristics (Aronson et al., 2010; César et al., 2021; Tedesco et al., 2023b). To improve our understanding of landowners' decision-making processes regarding their land management strategies, including conservation, it is necessary to characterize and identify their motivations (Greiner & Gregg, 2011). Considering restoration as a process in complex social-ecological systems recognizes stakeholders as important actors with diverse motivations. This perspective may help prevent conflicts and design restoration projects with broader and more successful outcomes (Fielding & Hornsey, 2016; Hagger et al., 2017). In addition, establishing local governance that fosters trust among actors and enhance restoration actions, particularly with landowners, is critical to scale up restoration efforts (Schweizer et al., 2019).

In Brazil, non-governmental organizations (NGOs) play an important role in ecosystem restoration by organizing and facilitating landowners' access to funding sources for native vegetation restoration. In addition, several specialized institutions provide direct support to landowners for the implementation of ecosystem restoration, ranging from donating seedlings and providing technical assistance to full support for the establishment of native vegetation (Gutierrez & Keijzer, 2015). Understanding the socio-economic characteristics of landowners supported by restoration projects is essential for gaining insight into the specific types of landowners that are attracted to receive restoration support. Also, this understanding is crucial to identify types of landowners who have not participated in restoration projects and to develop alternative mobilization strategies to address them.

This study aims to explore the socio-economic characteristics of landowners and their perspectives and motivations in relation to native forest restoration to identify incentives and implementation barriers. For this purpose, we interviewed two groups of landowners: those who received support and those who did not receive project support from in native forest restoration projects in the Atlantic Forest region of Brazil. We hypothesized that the extent and type of restoration carried out by landowners depends largely on the degree to which rural production is their primary source of income. The research focuses primarily on the experience of the Associação Ambientalista Copaíba (Copaíba), an NGO that has been involved in Atlantic Forest restoration and conservation in two watersheds in southeastern Brazil since 1999.

Methods

Theoretical Framework

For the purpose of our study, we used an analytical framework with two interacting scales, the larger regional/watershed scale and the smaller farm scale (Fig. 1). For the latter, we adapted the restoration motivation framework developed by Greiner and Gregg (2011), focusing on aspects specific to the context of our study and native forest restoration practices. The macroscale, based on the framework of Liu et al. (2018), includes regional characteristics that are assumed to be consistent across respondents, such as legislation, climate, landscape characteristics, ecosystem restoration incentives, socio-cultural norms, and the market. Policymakers and information providers are responsible for providing regulations, public policies, restoration project recommendations, and financial resources at the regional/watershed scale, taking into account socio-economic and biophysical conditions. In this study, NGOs (Copaíba) and other actors such as extension agents, universities, and public officials are some of the actors responsible for transferring the information provided to landowners in the case of restoration, monitoring regulations, and financial support for restoration projects from the macroscale (watershed, state, and regional levels) to the microscale (farm) (Liu et al. 2018).

In this study, the macroscale was used mainly to provide context and potential factors that influence landowners at the microscale. The latter was at the focus of the analysis and formed the basis of our data collection and analysis. In-depth analysis of qualitative data collected from landowner interviews was used to shed light on the relationships between factors at the macroscale and microscale. The analysis at the microscale focused on the individual farm setting, specifically the landowner's decisions regarding support for restoration projects, their perspectives, and the extent and type of restoration efforts. In a first step (part 1 of the framework at the microscale), we further
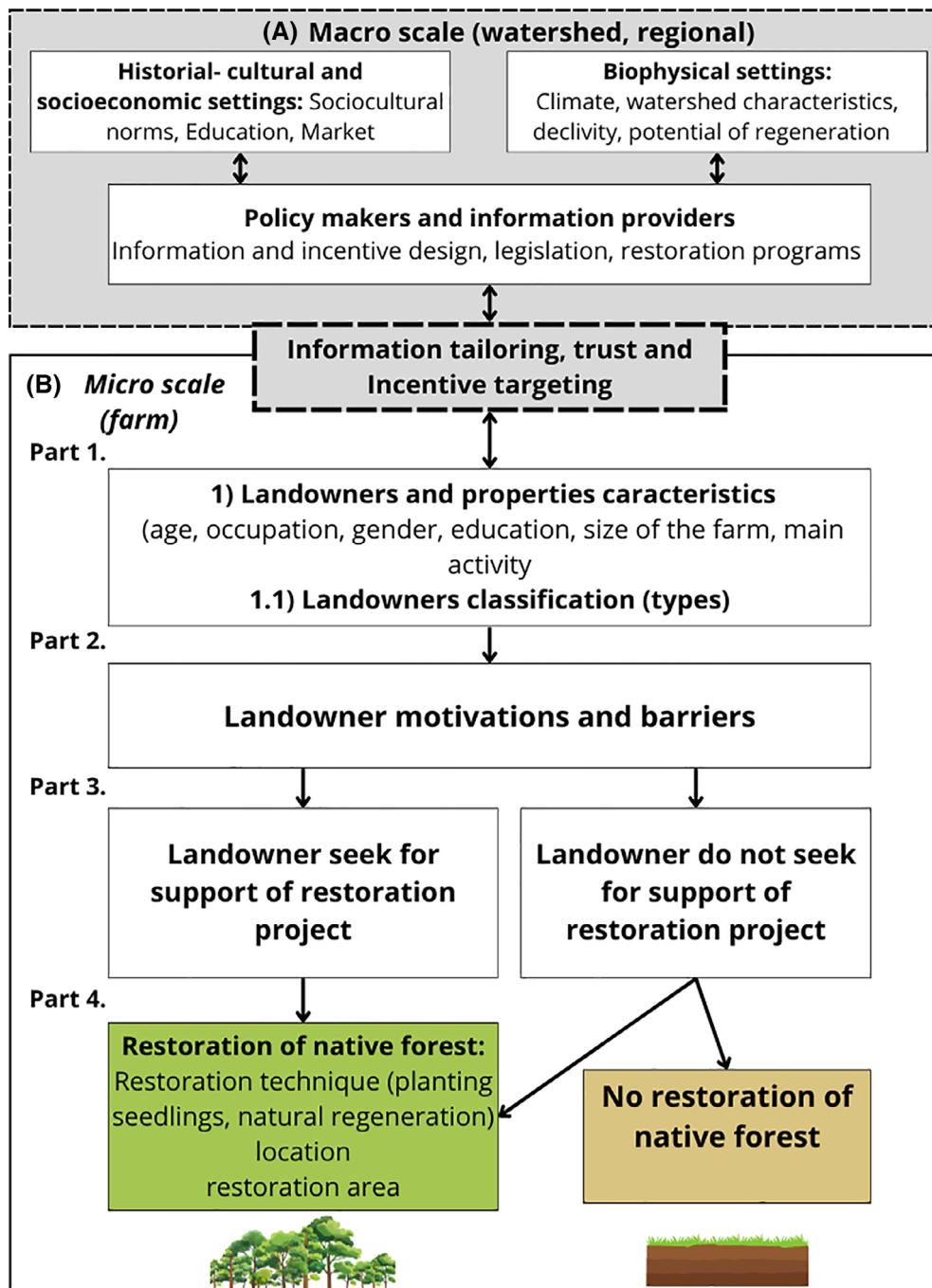
Figure 1. Restoration motivation framework adapted from Greiner and Gregg (2011) and Liu et al.(2018). The gray frame A represents the context of the macroscale (watershed and regional), and the white frame B represents the microscale (farm). The white boxes and arrows represent the information, influences, and relations between them. The gray dashed box is an element that may or may not be present. Finally, the green box represents the decision of the landowner to restore the native forest, and the brown box the decision of the landowner not to restore the forest.

characterized landowners across the two groups (supported and unsupported for restoration) using factors such as age, occupation, gender, education, total income, share of income based on rural production, risk preference, inheritance, and farm size. Based on these factors, we could identify in a preliminary analysis

two main types of landowners: (a) *farmers* and (b) "lifestylers" based on self-declaration and primary income related to rural production (Baldwin et al., 2017). *Farmers* were landowners whose main source of income came from agricultural/livestock activities on their rural property and who identified their occupation as a

farmer. Lifestylers were landowners who have alternative occupations and do not rely on rural production as their primary source of income. They do not identify themselves as farmers or rural producers but are typically retired professionals, absentee or hobby farmers, and others who seek a different style and quality of life away from urban centers and who were previously environmentally sensitive (Greiner et al., 2009; Emtage & Herbohn, 2012; Sorice et al., 2014). These different types of landowners formed the basis of our hypothesis.

In a second step (part 2 of framework at the microscale), we captured landowners' motivation, perspectives, and barriers. Motivation was categorized into five groups according to Clewell and Aronson (2006): biotic (improving aspects related to biodiversity), technocratic (complying with legislation), pragmatic (seeking to restore ecosystem services), idealistic (reconnecting with nature, concerned about environmental degradation, striving to be part of change, concerned about the future), and none (no motivation). This classification was chosen because of its specific focus on ecosystem restoration and because it has been used in other recent studies on the same topic and thus could serve as a reference (Hagger et al., 2017; Jellinek et al., 2019; Löfqvist et al., 2023). Barriers were identified through participant responses and represent perceived difficulties or obstacles to native vegetation restoration (e.g. cost, implementation, and loss of productive land) (Schweizer et al., 2019).

All of these characteristics and motivations play a significant role in shaping the decision-making process of landowners as they pursue and engage in restoration projects, which in turn influences the determination of restoration techniques, site selection, and the extent of restoration efforts (part 3). Rural landowners who receive support from restoration initiatives actively seek out and participate in such efforts, often encouraged by institutions, government agencies, and businesses. This support can take a variety of forms, including technical advice, provision of materials, distribution of seedlings, and labor support throughout the restoration effort. Conversely, the other group of landowners does not actively seek assistance in restoring their native forests. However, it is critical to recognize that the lack of assistance-seeking behavior among the latter group does not necessarily imply a lack of effort to restore native forests. Finally, the decisions landowners make regarding restoration, whether they choose to participate or not, are represented by part 4 of this framework.

Study Area

The study focused on the watersheds of the Peixe and Camanducaia rivers in southeastern Brazil, in the states of São Paulo and Minas Gerais (Fig. 2). This area includes 19 municipalities with a total area of 281,000 ha as part of the Mantiqueira mountain range, a critical area for biodiversity conservation and provision of ecosystem services (Associação Ambientalista Copaíba, 2019). The dominant local vegetation is a seasonal semi-deciduous forest, a vegetation type of the Atlantic Forest (Balderi, 2020). The climate is tropical (Cwa in the Köppen classification), with 1401 mm of rainfall per year, concentrated in the summer, and an average temperature of 18°C (CEPAGRI, 2021). The relief is mountainous,

with altitudes ranging from 600 to 1600 m.a.s.l. (Instituto Brasileiro de Geografia e Estástística (IBGE), 2022). According to the land use classification defined by MapBiomas in 2019, 75% of the land is devoted to agriculture, including livestock. The remnants of the original native forest cover between 5 and 17% of the initial land area of the two watersheds (Fundação SOS Mata Atlântica & INPE, 2018; Balderi, 2020; Projeto Mapbiomas, 2023). Forests in the area have been significantly degraded, with more than 90% of the remaining fragments smaller than 10 ha (Associação Ambientalista Copaíba, 2019). Livestock production, mainly through extensive grazing, is present throughout the region. Agricultural crops vary with local topographic characteristics. Specifically, regions characterized by a flatter relief have a prevalence of larger land holdings, mainly oriented to the cultivation of sugarcane and orange plantations. In contrast, areas with more pronounced topographical relief are commonly used for coffee cultivation (Censo Agropecuário do Estado de São Paulo, 2021).

In addition to agriculture, tourism plays an important role in the rural context of selected municipalities such as Socorro, Águas de Lindóia, Lindóia, Serra Negra, and Monte Sião. In 2020, there were 12,167 properties within the government registry. The calculated average property size is 19.2 ha, a dimension that qualifies as small farming in the regional context. More than 60% of the agricultural units are considered family farms (Balderi, 2020; Censo Agropecuário do Estado de São Paulo, 2021).

The Case Study Area of the NGO Associação Ambientalista Copaíba

Among the initiatives supporting native forest restoration in the region, the Associação Ambientalista Copaíba (Copaíba) deserves special mention as a local non-profit civil society organization. For more than two decades, it has worked to conserve and restore the Atlantic Forest in the two focal watersheds of this study (Fig. 2). Since 1999, the organization has supported over 320 landowners in 658 ha through its initiatives (Associação Ambientalista Copaíba, 2023a).

The restoration projects involve different types of assistance to rural landowners. During this research period, most of the respondents within the supported group participated in the Verde Novo project (Associação Ambientalista Copaíba, 2023b). In this project, assistance included the provision of seedlings, selected application of agrochemicals, and technical support. The supported landowners are responsible for planting and maintaining the areas undergoing native forest restoration. The organization also undertakes projects that provide full support for native forest restoration. In this case, Copaíba carries out the planting and maintenance of the areas in the restoration process, with the landowner assuming the maintenance once the native forest has been successfully established.

Interviews and Data Analysis

Semi-structured interviews were used for data collection. This method has the advantage of being guided by questions that help address the research question while being flexible enough to
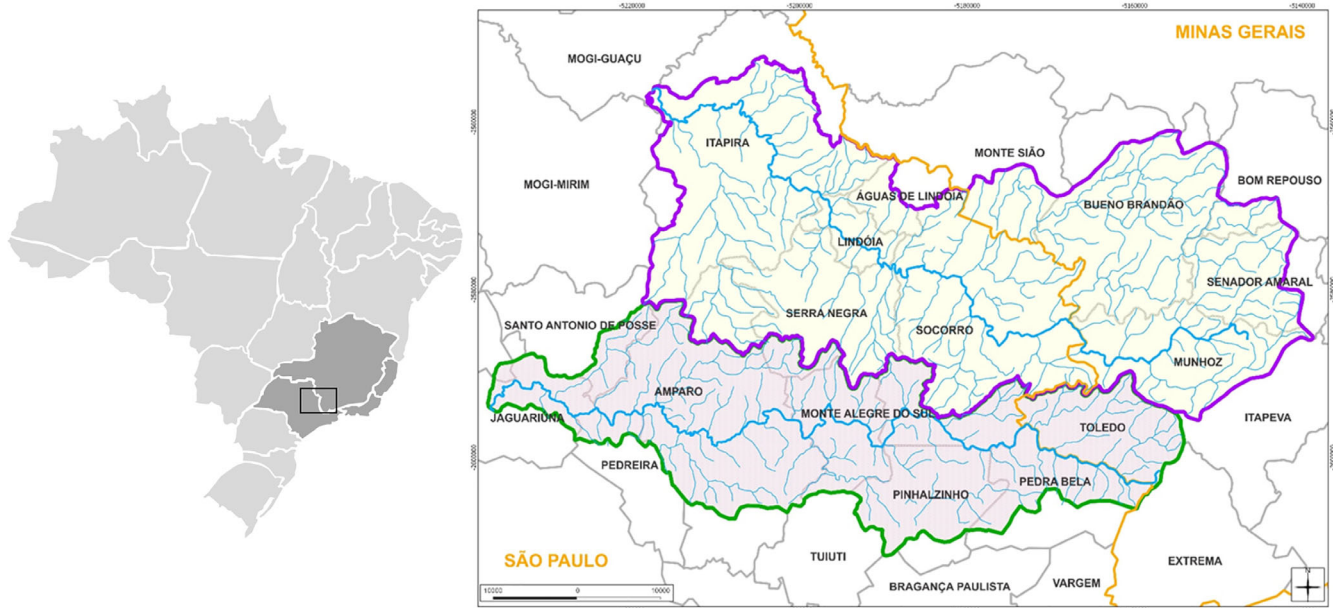
Figure 2. Location of the two watersheds Peixe (purple) and Camanducaia (green): area of operation of the Associação Ambientalista Copaíba at latitude 22°39′16″S and longitude 46°38′27″W (*Source*: Associação Ambientalista Copaíba, 2019; Balderi, 2020).

allow respondents to express different perspectives. This flexibility allows for more effective elaboration of challenging questions, leading to richer insights (Galletta, 2013). Respondents were intentionally kept unaware of the theoretical ideas that underpinned the structure and content of the interviews. This approach aimed to minimize any bias or preconceived notions that interviewees may have had, allowing for more authentic and unbiased responses.

We conducted interviews that included both open-ended and closed-ended questions. Due to the constraints of the coronavirus disease 2019 (COVID-19) pandemic, all interviews were conducted by telephone. The questionnaire contained a total of 62 questions, divided into three main sections: (1) perceptions of ecosystem restoration; (2) incentives, motivations, and barriers to ecosystem restoration; and (3) socio-economic information about landowners and their property (Annex 1). The reliability of this research was ensured through several measures, including the provision of references used, a description of the stakeholders interviewed, and an explanation of the research design and methodology. The questionnaire underwent several iterations during its development. An initial version was created and submitted for expert review. A revised version was then tested, and, based on further feedback, the questionnaire was revised again to produce the final version.

Interviews were conducted between March 2021 and April 2022, focusing on two different groups of landowners: (1) rural landowners who received support from ecosystem restoration projects (supported), and (2) rural landowners who did not receive support from ecosystem restoration projects (unsupported). The majority of the supported group was selected from a list of smallholders who were partners of the NGO Copaíba. This NGO provided a list of 235 landowners who had engaged in reforestation, and 34 of them were randomly selected to participate in the study. In the case of the unsupported group, it was more difficult to obtain contacts. The initial sample was derived from a list of landowners who participated in an extension project initiated by the state government, known as the "Microbacias Program." This project was implemented in one of the cities located in the study area, specifically Amparo. From this list, 13 landowners agreed to participate in the study. In addition, a snowball sampling technique was used, where interviewees recommended other potential participants. In total, 34 people from the unsupported group were interviewed. It is worth noting that two participants from this group reported receiving support for ecosystem restoration from companies and the government and were therefore reassigned to the supported group. Thus, the final sample consisted of 68 respondents, with 36 in the supported group and 32 in the unsupported group. All interviews were recorded with interviewee consent, and personal information, including names and telephone numbers, was kept confidential. Each landowner was identified by code.

Content analysis was used to analyze the data, with the goal of identifying concepts, key issues, themes, and patterns within the transcribed interviews and providing interpretive and quantitative summaries of the qualitative information (Patton, 2014). This research followed the guidelines of qualitative content analysis suggested by Flick and Schreier (2014). First, the interviews were transcribed using MaxQDA Plus 2022 software, which facilitated a thorough analysis of the data and allowed for the identification of 41 codes with similar response patterns. These codes were then organized into nine categories, which were further grouped into four overarching themes: motivations, perceptions, incentives, and barriers (Fig. 3).

The informal language and original messages have been retained in the translation, along with the use of quotations for illustrative purposes (Annex 2). It should be noted that other words such as "bush" and "weed" are used by some landowners to refer to native forests. To complement the content analysis, the percentage of rural landowners referring to the different responses associated with each code was calculated. It is important to note that each landowner's response could include multiple codes, and this was also taken into account in the frequency calculation. The supported and unsupported groups were analyzed separately to identify similarities and differences inherent in each group.

Results

Socio-Economic Characteristics of Landowners

The sample consisted mainly of men (71%) over 51 years of age, including smallholders (76%) (Fig. 4).

In the supported group, the majority of participants (78%) could be classified as "lifestylers," all of whom have alternative occupations and do not depend on rural production as their main source of income. This characteristic is also reflected in the degree of rural production on the farm, where almost half (53%) declared that they do not pursue this activity on their farm, preferring to focus on recreation or housing. This group also includes many people with a university degree (70%). Most do not live on the property (56%) and have a high gross annual income (more than $30,700). Regarding native forest restoration, almost all respondents in the supported group (97%) employ planting of native seedlings as a restoration technique, focusing on areas near water sources associated with the NVPL.

In contrast to the first group, only 28% of the unsupported group consisted of "lifestyle" landowners, while 72% were *farmers*. In this unsupported group, about 80% reported to carry out agricultural or livestock-related production on the property.

In this group, most have lived on the land since birth (88% inherited the farm) and still live there (72%). In contrast to the former group, only 41% have a university degree. Although the unsupported landowners did not receive project support, over 90% restored at least a small portion of their property. However, the majority (75%) used natural regeneration to restore land. They focused restoration efforts on areas not suitable for farming or ranching (hillsides and less agriculturally suitable areas).

In order to better understand the implementation of the NVPL and the need for ecosystem restoration, landowners were also asked about the restoration of native forest on the hydrological Areas of Permanent Protection. Of the total sample, 63% of landowners reported that they were required to restore some of the Areas of Permanent Protection. Of those landowners in the unsupported group, who were still required to restore native forest, 40% said they did not want to restore more areas on their property because they already had enough vegetation or because the property was too small. In the assisted group, only 14% of those with restoration requirements said they did not want to do it for the same reasons as the other group.

Motivation and Barriers for Restoring the Atlantic Forest

The motivations (pragmatic, idealistic, biotic, technocratic, and none), as well as the primary barriers, were distinctly different between supported and unsupported landowners but also showed some commonalities (Fig. 5).

The pragmatic motivation for native forest restoration was most common in both groups (76%), in particular for the purpose of water regulation. This may be related to concerns about the decline or degradation of water resources on the property, as almost 100% of owners reported the drying up of springs and the decline of stream flow.

Idealistic motivation was the second most mentioned by the supported group (almost 70%). This motivation was characterized by

Figure 3. Classification of the content analysis in themes, categories, and codes.
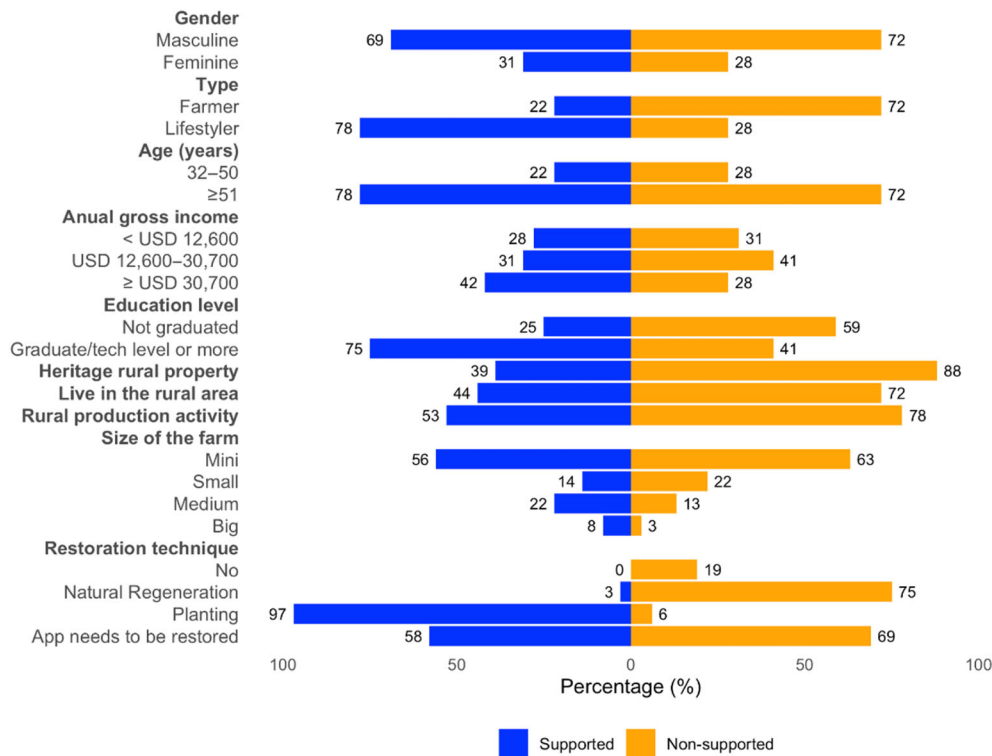
Figure 4. Characteristics of the landowners and their properties. The size of the property was classified according to the Law No. 8629 of February 1993 (small property: less than 80 ha, medium property: 81–300 ha, big property: over 300 ha), which categorizes Brazilian rural properties according to the fiscal module of the municipalities. USD dollar quoted on 09 August 2023 (dollar at 0.20 cents of BRL).

statements about reasons aimed at "contributing to the planet or the environment," "thinking about future generations," and "doing one's part" on one's property. This category also included statements expressing admiration for nature as a primary reason for restoring native forests. This was followed by biotic motivation. This motivation was described as being concerned with increasing biodiversity, attracting wildlife, and creating ecological corridors. Many cite the attraction of birds as a benefit of native forest restoration.

Compared to the unsupported group, the second most common motivation was technocratic (38%). Technocratic motivation was associated with two factors: voluntary compliance with the law or compliance after being fined or required to obtain a license. For half of the unsupported group who reported this motivation, the remediation was related to environmental licenses needed to improve water supply for rural production. Idealistic motivation was reported by 28% of landowners in this group. The category "lack of motivation" to restore native forests appeared only within this group (22% of respondents).

In terms of barriers, the cost of restoration was the most frequently cited barrier in the supported group. High costs were also related to the other major categories: labor and difficulty in implementing and maintaining native forest restoration. In terms of implementation and maintenance, grass and ant control were cited as the main challenges. Regarding the perception of the negative effects of native forest restoration on the farm, most of the respondents in this group (60%) indicated that they could not identify any negative aspect of restoration. The rest of this group said that native forest restoration could affect productive areas in an economically harmful way for those who depend on the property, while pointing out that this would not be the case for them.

Regarding the unsupported group, "lack of space" was cited as a significant barrier to implementing native forest restoration. Many reported having enough native forest in relation to small properties and feared the potential loss of productive land and, consequently, income. This barrier was also the main negative impact identified for this group. About 70% of the unsupported respondents reported that they perceived the negative impacts of native forest restoration. Some even used expressions such as "kills the farm" and "ruins the property" by allowing the forest to regrow in productive areas. Interestingly, about 25% of the unsupported group reported no difficulties with restoration. Finally, the need for environmental awareness was the third most common barrier cited by this group.

Incentives for Restoring the Atlantic Forest

In the interviews, we identified five main categories of incentives that could make the practice of restoration more attractive to landowners: payments for ecosystem services (PES), basic support for restoration projects (donation of seedlings, technical support, and some specific inputs), labor support (in addition to the benefits of project support, it includes support with labor for planting or maintenance), environmental
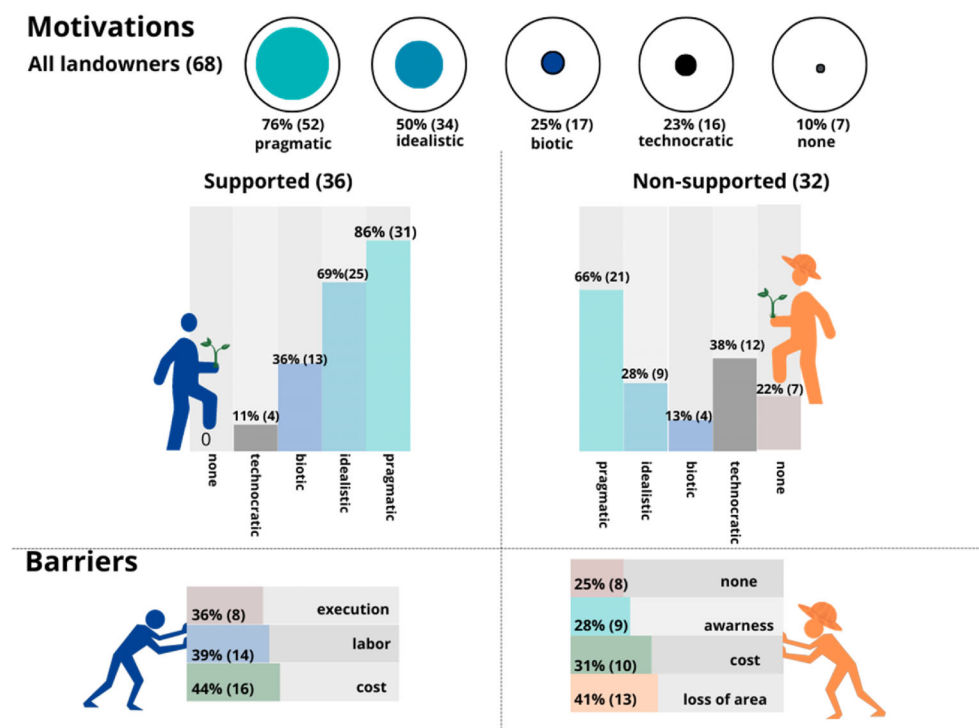
Figure 5. Summary of landowners' motivations and barriers to restore native forest.

education (raising awareness about the importance of native forest restoration), and income from native forest (receiving products from the forest or using the forest for tourism).

A PES scheme was the most frequently mentioned incentive by both the supported group (64%) and the unsupported group (69%). Financial support was reported to be particularly attractive in the unsupported group. This incentive may also be linked to one of the difficulties faced by this group, namely the potential loss of productive land or income. However, some respondents reported that the amount paid for the provision of ecosystem services to society was very low and that the owner should be better rewarded for this.

Both groups ranked support for restoration projects as the second most important incentive. The supported group (61%) indicated that receiving assistance with labor in addition to the benefits already received from the project would be an incentive. The unsupported group (44%) named the donation of seedlings and technical assistance ("basic" support for the restoration project) as the most important incentive.

Environmental education (named by about 30% of respondents in each group) included complaints about the lack of action and awareness of neighbors regarding native forest restoration. They gave examples of springs being trampled by cattle and Eucalyptus plantations damaging the water supply.

Discussion

The analysis of characteristics, typologies, and perspectives of landowners played a pivotal role in elucidating the socio-economic differences between rural landowners seeking assistance and those who may demand a different approach to restoration projects. Our findings indicate a divergence of perspectives and motivations regarding native forest restoration that appears to influence the needs and actions of different types of landowners. This understanding is essential to develop effective support for restoration projects that take into account the full diversity of landowners in a given regional context.

Socio-Economic Characteristics, Perceived Barriers, and Selection of Native Forest Restoration Techniques

A key finding of the landowner characterization was that the supported group consisted mainly of landowners who were not dependent on agricultural activities (*lifestylers*). The lifestylers tend to value conservation practices more than economic factors (Liu et al. 2018). This type of landowner tends to lack land management skills and land management knowledge (Koontz, 2001; Farmer et al., 2015; Borda-Nino et al., 2021). In this case, as shown in our results, the supported group, composed primarily of *lifestylers*, had a greater interest in conservation and the need for technical assistance, seeking out experts and project support for restoration. Consequently, based on the technical project assistance, the primary restoration technique was seedling planting of various native tree species. This type of planting requires higher costs and more labor compared to natural regeneration (Durigan et al., 2013; Molin et al., 2018). This may also be related to the most frequently cited barrier to restoration for the supported group, which is related to cost, labor, and implementation difficulties.

Concerning the unsupported group, it consisted mainly of *farmers*. Our results suggest that *farmers* tended to prioritize rural production over restoration efforts. Similar results have been reported from other studies, where traditional *farmers* were more focused and dependent on rural production (Hagger et al., 2017; Borda-Nino et al., 2021). This may be related to the main barrier to restoration identified by our respondents, which is the loss of productive agricultural areas. Because native forest land does currently not provide a financial return to landowners in the region, many *farmers*, especially smallholders, perceived native forest land as having little value. In our interviews, they refer to native forests as "lost areas," "abandoned areas," or "places of no value." This is consistent with previous research on rural landowners in the Atlantic Forest biome who struggle to recognize the economic benefits of native forest restoration and perceive it as an unproductive land use (Schweizer et al., 2019). Despite recognizing the ecosystem services provided by the forest, as evidenced by the primary motivation for native forest restoration to protect and increase water resources, the need to rely on the land as a primary source of income often leads to negative perceptions of restoration efforts. This result indicates that the perceived benefits resulted from restored forests are not enough to compensate the loss of agricultural production for land use conversion, which is a critical issue in the context of small landowners with a high dependence on agricultural income (Silva et al., 2018; Schweizer et al., 2019).

However, although the landowners from the unsupported group were not involved in specific projects, and most still had to restore the areas protected by the NVPL, the majority reported that they had restored or allowed natural regeneration to grow on a portion of their land that was not used for agricultural production (e.g. steep areas), using natural regeneration as a restoration technique. However, the potentially restored areas may not be enough to reach the level of native vegetation cover demanded for legal compliance. This tendency is evident in the fact that they refer to the native vegetation with words like "bush" or "weed," which shows that they see this vegetation as something to be "controlled or cut down." *Farmers*, the majority of the unsupported group, have more local knowledge of natural resources, skills in land management, and extensive knowledge related to the dynamics of native vegetation (Silva et al., 2018). Furthermore, according to some, restoration is easy; "you just have to want it." The potential for restoration from natural regeneration is supported by the findings of Borda-Nino et al. (2021), who combined socio-economic data with time series analysis of multi-temporal satellite imagery and found that natural regeneration is favored in areas with lower agricultural suitability, greater slope, and proximity to fragments. In this sense, it would be interesting to relate our interview data to geospatial data of the region to better understand if and how areas of low agricultural suitability could be combined with strategies for creating ecological corridors, protecting fragments, and complying with the NVPL. In addition, the historical, social, and cultural context can influence the dynamics of natural regeneration as well as the land use decisions of landowners. Aspects such as the lack of labor in rural areas, the aging of the population, or the exodus of young people from farming families can also influence the increasing natural regeneration of native forests, as it favors the abandonment of marginal, non-mechanized lands requiring the manual clearing of regenerating trees to maintain the agropastoral land use over time (Fantini et al., 2019; Chazdon et al., 2020; Borda-Nino et al., 2021).

The characterization provides evidence of which types of landowners are attracted to restoration projects in the region and which ones are resistant to seeking assistance. Besides that, the characterization of types of landowners lies in the choice of restoration technique and perception of barriers. The results regarding the perception of barriers and the use of restoration techniques demonstrate how crucial this understanding of landowners is and how it is reflected in their perspective on choosing to restore native forests, the technique, and the location of restoration.

Motivation and Incentives for Restoration of Native Forest

The primary motivation for native forest restoration for both groups (supported and unsupported) is to protect and enhance water resources. The perception of a positive relationship between native forest restoration and water resources has also emerged in other studies examining landowner perspectives in Brazil (e.g. Durigan et al., 2013; Gonçalves & das Chagas, 2017; Schweizer et al., 2019). The role of native forests in the water cycle is widely recognized, as they influence precipitation through evapotranspiration and protect, infiltrate, and store water in the soil (Ferraz et al., 2021; Lara et al., 2021; Jones et al., 2022). However, increasing water availability depends on several additional factors beyond native forest restoration that can influence hydrologic processes, such as land use history, climate, soil type, and geography (de Mello et al., 2018; Lopes et al., 2022). Honda and Durigan (2017) emphasize that proper soil management throughout the watershed is essential to facilitate water infiltration and conservation of water resources. The necessity of these actions for water management demonstrates the need to integrate soil conservation practices into forest restoration projects when the motivation is to increase water resources. The motivation of landowners to protect water resources also points to an issue that can be used to make landowners interested in native forest restoration.

In terms of motivation, ideological or intrinsic values drive motivation for most landowners in the supported group, mostly represented by the *lifestylers*. Similar results were obtained in a study of water resource conservation in western Oregon watersheds, where 46% of rural landowners who did not derive their primary income from rural production reported being motivated by the need to maintain and improve the environment for future generations (Rosenberg & Margerum, 2008). *Lifestylers* tend to have more pro-environmental attitudes and greater financial capacity to invest in these practices (Moon & Cocklin, 2011; Farmer et al., 2015; Borda-Nino et al., 2021).

The statements on incentives of PES emerged as the most relevant for both groups. Tax reductions, PES schemes, and other economic benefits of restored areas could be possible ways to reduce economic disadvantages. In addition, if the main motivation is conservation of water resources, other measures such as soil conservation and water treatment could be included in

PES schemes, as can be found in other restoration projects in the Atlantic Forest (e.g. Conservador da Águas-Extrema-MG) (Richards et al., 2015; Holl, 2017; Young & de Castro, 2021). Consistent with studies on policies for PES schemes in the Atlantic Forest (Richards et al., 2020), small landowners who rely on agricultural income expressed that they would be unlikely to engage in restoration activities without financial compensation or reward. They also indicated a need for higher PES than was currently offered.

One potential incentive could be the use of tree species for restoration that increase agricultural productivity (Richards et al., 2020), for example, in agroforestry systems that allow the restoration of protected areas on small plots of land (Shennan-Farpón et al., 2022). None of the landowners from the unsupported group interviewed mentioned this type of management as an option for restoring legally protected areas. This may be attributable to the high labor demand to establish and maintain agroforestry systems when compared to using natural regeneration for restoration purposes. Therefore, before introducing agroforestry systems as a solution, it would be necessary to consider their feasibility in the socio-economic context and interests of landowners (Shennan-Farpón et al., 2022).

Both groups of landowners expressed the need for more support for restoration projects. In particular, the assisted group perceived the support they received as very helpful to reduce their restoration costs. In Brazil, NGOs play an essential role in the native forest restoration sector because they organize and facilitate landowners' access to funding sources for native vegetation restoration (Gutierrez & Keijzer, 2015). Given the characteristics of the region, where most landowners have small farms, the commitment and actions that make restoration attractive are more labor-intensive and costly for the local NGO. Projects in such regions tend to have more smallholders, which consequently require increased mobilization efforts and logistical efforts. In addition, performance measures for environmental benefits, such as the number of hectares restored, tend to be lower owing to the larger number of landowners and smaller restoration projects that are distributed over many properties (Shennan-Farpón et al., 2022).

Incentives need to be tailored to the heterogeneity of landowners and their preferences that influence land use (Richards et al., 2020). Strengthening social assets such as inclusive governance, participation in decision-making, and smallholders' perceptions and interests will determine the success of an incentive mechanism. The integration of social and economic aspects and a participatory process involving local multi-stakeholders in the design and implementation of restoration strategies is crucial to maximize the chances of successful projects in terms of time and benefits for nature and the community (Tedesco et al., 2023a).

Social Aspects and Restoration Strategies

The importance of the social aspects and the understanding derived from qualitative analysis are highlighted in various studies as crucial for planning and monitoring restoration projects to ensure sustainable long-term commitments and engagement (Hagger et al., 2017; Löfqvist et al., 2023). In Brazil, restoration projects are financially maintained for only 2–3 years (Brancalion et al., 2019a, 2019b), which contrasts with the several years or decades required to safeguard an adequate ecological trajectory in restored ecosystems. In the lack of a continuous financial support, it is critical to find ways to maintain the engagement of local actors in the restoration projects, which relies on the understanding of the context and characteristics of the actors involved. To achieve truly meaningful change, we must recognize that restoration is not a one-time ecological event but an ongoing social-ecological process relying on effective stakeholder engagement (Tedesco et al., 2023b).

International restoration goals and compliance with the NVPL are achieved through the actions of local stakeholders who understand and respect the diversity and uniqueness of the region at multiple scales. Our findings underscore the importance of considering the social issues associated with the diverse characteristics of the target audience, including perspectives on motivations and barriers to native forest restoration, and highlight potential avenues for increased landowner engagement and effectiveness in restoration efforts. In this particular case, it demonstrates that decisions about restoration, methods of restoration, and location of native forest establishment are influenced by these factors. In addition, it provides insights into potential incentives for successful engagement and long-term outcomes in restoration projects. Considering their context and interests facilitates the collaborative construction of empirical and scientific knowledge to address practical challenges. Landscape-scale restoration requires stakeholder collaboration and recognition of social diversity and its multiple perspectives. It is imperative to make restoration attractive and beneficial to different types of rural landowners through programs and projects that incorporate their viewpoints and facilitate their representative involvement in project design and decision-making processes, thus enabling them to become active participants in restoration efforts.

Ultimately, it is important to acknowledge a limitation of this research in that it reflects the configuration at a particular point in time. Motivations and typologies are not static but depend on the preferences of rural landowners, which fluctuate over time and are influenced by market forces, public policies, and intrinsic factors, among others (Darnhofer & Walder, 2014).

Conflict of Interest Statement

P.H.S.B. is a partner at Re.green, a forest restoration company.

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Supporting Information

The following information may be found in the online version of this article:

Supplement S1. Questionnaire—rural landowners.