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Technical, financial, and political aspects of forest restoration projects and payments for environmental services in southern Minas Gerais, Brazil

Aspectos técnicos, financeiros e políticos de projetos de restauração florestal e Pagamento por Serviços Ambientais (PSA) no sul de Minas Gerais, Brasil

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ABSTRACT New frameworks driven by environmental concerns have emerged in the formulation of public policies for forest restoration, opening space for more participatory management of local natural resources. At the municipal level, budget constraints, limited technical capacity, and political interests can determine the success or failure of such policies. This study analyzed local public policies for forest restoration based on the payments for environmental services (PES) mechanism, following the model proposed by the *Plano Conservador da Mata Atlântica* (PCMA), and implemented in the cities of Extrema, Pouso Alegre, and Inconfidentes, in the state of Minas Gerais. We examined the institutional arrangements of these projects and the role of mediating actors who supported implementation strategies in the municipalities studied. The results identified sustainable development as the overarching reference and municipal public policies as the sectoral reference, expressed through the complementary roles of these actors, each advancing and reinforcing frameworks within their respective domains of action and interest. This study provides a theoretical-practical foundation to inform PES strategies in other regions of Brazil.

Keywords: PES; nature conservation; environmental planning; public policies; ecosystem services.

RESUMO Novos referenciais motivados pelas causas ambientais têm surgido no âmbito da formulação de políticas públicas para a restauração florestal, cuja forma de gestão tem dado espaço para uma configuração mais participativa da gestão local dos recursos naturais. Numa perspectiva municipal, a limitação orçamentária, a restrita capacidade técnica e interesses políticos podem configurar fatores críticos de sucesso ou insucesso de tais políticas. Nesse sentido, o principal objetivo deste estudo foi analisar políticas públicas locais de restauração florestal baseadas no mecanismo de pagamento por serviços ambientais (PSA) amparadas no modelo proposto pelo Plano Conservador da Mata Atlântica (PCMA) e implementados nos municípios de Extrema, Pouso Alegre e Inconfidentes, no estado de Minas Gerais. Foram analisados os arranjos institucionais de tais projetos e o papel dos atores mediadores, que atuaram em estratégias de apoio às ações de implementação dos projetos nos municípios em questão. Com base nos resultados obtidos, foi possível identificar como referencial global o desenvolvimento sustentável e as políticas públicas municipais como referencial setorial, traduzidos no caráter de complementaridade entre tais atores, uma vez que cada um deles atua e estimula referenciais dentro de seus campos de atuação e interesse. Este estudo pode auxiliar como fundamentação e arcabouço teórico-prático para outras estratégias de PSA em outras regiões do Brasil.

Palavras-chave: PSA; conservação da natureza; planejamento ambiental; políticas públicas; serviços ecossistêmicos.

1. Introduction

A global target to restore and conserve forests, prevent deforestation, and promote sustainable land-use practices was established in Germany in 2011 through the Bonn Challenge (Lewis *et al.*, 2019; Cartolano *et al.*, 2022). The Bonn Challenge initially aimed to restore 150 million hectares (Mha) worldwide by 2020; this target was expanded under the 2015 Paris Agreement to 350 Mha by 2030 (IUCN, 2017). At the 21st Conference of the Parties (COP-21) to the United Nations Framework Convention on Climate Change (UNFCCC), Brazil committed to reforest 12 million hectares by 2030 (Brasil, 2017), a pledge reaffirmed at COP-26 in Glasgow, Scotland, and COP-27 in Sharm el-Sheikh, Egypt.

The state of Minas Gerais has an environmental liability of 3.7 Mha that must be restored over the next 20 years. The areas with the highest rates of noncompliance are legal reserves (LRs, 2.2 Mha) and permanent preservation areas (PPAs) along watercourses (1.3 Mha) (Morais Júnior *et al.*, 2024). In the context of COP-27 (2022), Minas Gerais pledged to reforest 3.7 Mha in rural areas by 2030 (Minas Gerais, 2021). In 2023, the state became the first in Latin America to adopt a comprehensive package of public policies for green investment across its territory (Figure 1). The government launched the "Decarbonization Route" program (Minas Gerais, 2023), guided by a State Climate Action Plan (Minas Gerais, 2022), with strategies to strengthen and develop solutions and incentives for the recovery of degraded areas, productive restoration, and environmental compliance of rural properties in accordance with current legislation. Within the same plan, the state also committed to implementing the instruments needed to foster payment for environmental services (PES) arrangements, through

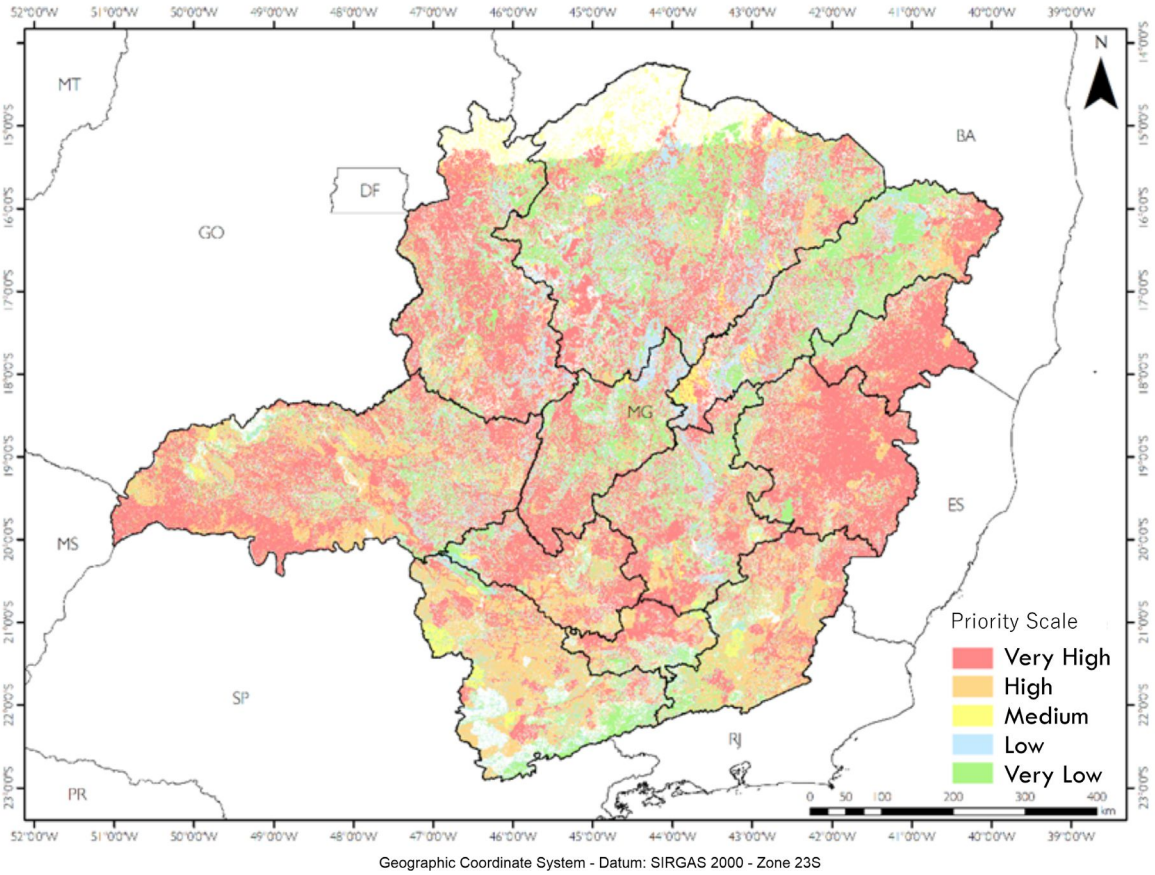

FIGURE 1 – Priority areas for environmental restoration, Minas Gerais.
SOURCE: The authors (2025).

an integrated state PES program and incentives for the development of private PES markets.

The advent of environmental public policies represents a symbolic contemporary advance in favor of sustainable development and an ecologically balanced environment. Political investment in biodiversity conservation and restoration strengthens the foundations for a renewed approach to social and economic development (Bustamante *et al.*, 2019; Metzger *et al.*, 2019). Nevertheless, the effectiveness of these policies has been considered insufficient in the face of ongoing ecological degradation and the systematic loss of biodiversity (Gudynas, 2020). This gap underscores the need for the engagement and participation of multiple actors in the design, formulation, and monitoring of public policies (Oliveira, 2020).

Recognizing environmental management as a process of mediating interests and conflicts among social actors (Quintas, 2006), this study adopts an analytical perspective focused on the implementation of environmental public policies for forest restoration and PES, supported by the model proposed by the *Plano Conservador da Mata Atlântica* (PCMA). The *Plano Conservador das Águas* (PCA), initiated by the city of Extrema, Minas Gerais, in 2005, has been considered one of the most prominent municipal public policies for rural property compliance based on the PES mechanism in Brazil (Richards, *et al.*, 2015; Mamedes *et al.*, 2023).

PES functions as an economic incentive and can be defined as a transfer of resources among social actors aimed at creating incentives that align individual or collective land-use decisions with the broader social interest in natural-resource management (Muradian *et al.*, 2010). The pioneering experience of the PCA inspired the creation of a broader territorial arrangement that brought together numerous public and private actors, both national and international, culminating in the launch of the PCMA in 2016. Originally called the *Plano Conservador da Mantiqueira*, the PCMA initially targeted 425 cities across the states of Minas Gerais, São Paulo, and Rio de Janeiro (Anjos *et al.*, 2022a). After a restructuring in 2022, the plan adopted the name PCMA and expanded its scope to the entire Brazilian Atlantic Forest domain, with the potential to positively impact more than 3,400 municipalities in 17 Brazilian states (Conservador da Mantiqueira, 2022). The initiative is led by Extrema's Municipal Secretariat for the Environment in partnership with non-governmental organizations such as SOS Mata Atlântica, The Nature Conservancy (TNC) Brazil, the International Union for Conservation of Nature (IUCN), the World Resources Institute (WRI) Brazil, and the World Wide Fund for Nature (WWF), with support from universities and research institutions in Minas Gerais, São Paulo, and Rio de Janeiro (Conservador da Mantiqueira, 2022).

Extrema's public policy, operationalized through the *Plano Conservador das Águas*, informed the model proposed by the PCMA, which in turn served as a reference for the creation of environmental public policies in the cities of Inconfidentes (2017) and Pouso Alegre (2018).

According to Chiodi *et al.* (2018), three dimensions are critical to the implementation of these policies: technical, financial, and political. To address them, cities rely on the engagement and coordination of multiple actors throughout the phases of awareness-raising, policy formulation, and implementation.

Theoretically, this reflection draws on Pierre Muller's (2003) notion of policy "reference frameworks", an analytical lens aimed at understanding how such frameworks shape the way actors perceive the world (and the public problem) and propose courses of action. Because of the complexity of public-policy analysis and the need to identify elements that motivate the creation – or non-creation – of specific policies by the actors involved, this study asks about the role and interests of mediating actors in the decision-making, formulation, and implementation pro-

cesses in the municipalities under study. This analysis can contribute to understanding the institutional arrangements built within an increasingly complex society composed of multiple actors capable of influencing decision-making arenas.

More specifically, using as an empirical lens the implementation of forest-restoration and PES public policies proposed under the PCMA, these reflections may help clarify the roles played by actors involved in constructing institutional arrangements within the municipalities examined and may serve as a reflective guide for other municipalities considering similar models.

This study is organized into three central components:

(i) the theoretical foundations that guide the discussion;

(ii) the methodological procedures; and

(iii) the results and discussion, based on documentary analysis and interviews with actors involved in the public policies of the projects examined.

2. Theoretical framework

Public policies lie at the core of State action. Understanding the motivations behind the design, implementation, and effects of a given policy is essential to grasp its sphere of action and the potential participation of other societal actors. These actors are not limited to those within the State; they also include external stakeholders who, through a complex web of relationships, influence how a policy problem is framed – thereby, to some extent, shaping the solutions pursued (Direito, 2021).

Actors engaged in public policy continually seek the most efficient territorial scope and management scale in relation to problems, targets, issues to be governed, and the available policy instruments (Faure *et al.*, 2007). New forms of public management – such as cooperation networks – promote new bonds and institutional arrangements, triggering novel political processes from policy formulation through implementation (Oliveira, 2020).

Because of the breadth and multiplicity of schools of thought guiding the public policy field, this study adopts an analytical lens based on the notion of a "reference framework" proposed by the French author Pierre Muller (2003) within the cognitive approach to public policy analysis.

2.1. The notion of a public-policy "reference framework"

Pierre Muller's (2003) notion of a public-policy reference framework rests on the cognitive idea that social actors organize their perceptions of a given problem, weigh solutions, and define proposals for action. The "reference framework" perspective conceives public policies as expressions of the representations that a society or social group holds about the reality it intends to change (Muller, 2003).

Within this perspective, two levels stand out: the global and the sectoral reference frameworks (Figure 2). The global reference framework is a broad representation around which different sec-

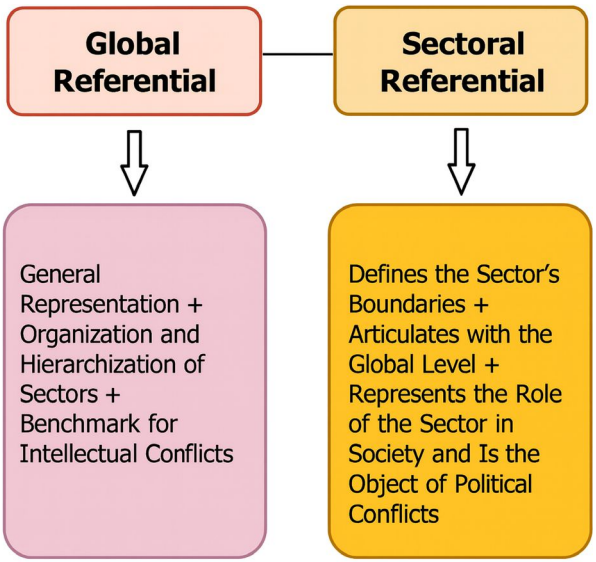

FIGURE 2 – Schematic of the interrelation and structuring of global and sectoral reference frameworks.

SOURCE: Prepared by the authors (2025).

toral representations are ordered and hierarchized. Although it does not constitute a consensus, it delineates the intellectual field within which social conflicts are organized. Muller emphasizes that this is not a perfectly coherent worldview – the values comprising it are themselves contested – but it nonetheless sets the bounds of the intellectual field in which social conflicts unfold (Muller, 2003).

The sectoral reference framework, in turn, represents the place and role of a given sector at a particular time and within a particular society, and it is articulated with the global reference framework. Muller (2003) underscores that the first effect of the sectoral framework is to demarcate the boundaries of the sector. The configuration of sectors such as agriculture, transport, or social policy depends intimately on how the roles of agriculture, transport, and solidarity are represented within society. Like the global framework, the sectoral framework is a social construction whose internal consistency is never perfect and remains subject to ongoing conflict, particularly in disputes over control of the policy agenda.

The link between these two spaces of action and meaning – global and sectoral – is forged by mediators. Mediators incorporate the complex relationship between global constraints and sectoral autonomy (Muller, 2003). As Muller further argues (2018), a new reference framework becomes established when an actor asserts leadership within a sector and simultaneously achieves hegemony as the framework gradually becomes the new rule. He also contends that it is impossible to study the construction of a reference framework without closely analyzing the characteristics of the group that carries out this operation – their strategies and their positioning within the field of power (Muller, 2008).

It falls to mediating actors to adapt the global framework to the sector and to redefine the new configuration through which social interests are expressed, thereby transforming an "incoherent socioeconomic reality into a coherent program of political action" (Muller & Jobert, 1987 *apud* Grisa, 2011, p. 71). Mediators participate in two meaning-production processes: decoding, by making the norms indicated by the global framework intelligible; and recoding, by translating those criteria into concrete application within public action in a given sector (Muller & Jobert, 1987 *apud* Grisa, 2011).

2.2. Sustainable development as the global reference framework and environmental public policies as the sectoral reference framework

Emerging in the 1980s, the term "sustainable development" articulates a concept that links planetary preservation with the fulfillment of human needs (IUCN, 1980). Since then – and especially after the publication of Our Common Future by the World Commission on Environment and Development (1987) – the concept has spread and taken hold as a global theme, even assuming the characteristics of an institution. Here, "institution" refers to the constraints societies create that underpin political, economic, and social interaction. According to North (1991), institutions can be informal (sanctions, taboos, customs, traditions, and codes of conduct) or formal (constitutions, laws, property rights). The practical outcomes of policies and their instruments are affected by the interplay of these distinct institutions (formal and informal), which are in constant interaction (Corbera *et al.*, 2008). Sustainable development therefore emerges as a global reference framework whose overarching representation orders and hierarchizes different sectoral representations (Gupta *et al.*, 2024).

What is termed a "sector" – or the sectoralization of public action – results from a process by which the State acquires competencies over a given problem and legitimacy to exercise authority, thereby contributing to its rationalization (Halpern & Jacquot, 2015). Consequently, environmental public policies may be understood as representations of sectoral reference frameworks. The actors who induce measures and actions that translate the formulation of such policies – based on their interests and institutional alignments – function as mediators between global and sectoral reference frameworks.

3. Methodology

This study employed case studies combining documentary analysis and semi-structured interviews with agents involved in forest-restoration projects and PES in the cities of Extrema, Inconfidentes, and Pouso Alegre, in southern Minas Gerais. To achieve the research objectives, we established criteria and methods to identify and investigate the actors involved and their motivations across the phases of awareness-raising, formulation, and implementation of municipal public policies.

The primary line of inquiry drew on documentary research concerning the projects PCMA, PCA (Extrema), *Conservador do Mogi* (Inconfidentes), and *Nossa Água, Nosso Futuro* (Pouso Alegre). The corpus included primers, informational materials, journalistic texts, and legal instruments (laws and decrees) (Supplementary Material). Screening of these documents enabled the identification of actors and the institutional arrangements associated with the design, conception, approval, and implementation of local public policies.

The secondary line of inquiry consisted of developing a semi-structured interview guide (Supplementary Document). We sought a broad and heterogeneous sample of respondents repre-

senting institutions directly and indirectly related to the projects under analysis. Participants were selected by purposive sampling, which, according to Lefèvre and Lefèvre (2003), is appropriate when the study universe is known.

Interviews were conducted in person and remotely between October 2021 and April 2022. The unit of analysis was individuals (Martínez-Salgado, 2012), focusing on key informants who participated in or were closely connected to each case study. Key-informant groups were:

i) at the municipal level, mayors; secretaries of the environment or equivalent officials with direct or indirect responsibilities for the projects; and municipal technical staff engaged directly or indirectly in the projects;

ii) within NGOs, consultants and/or project analysts who worked directly or indirectly on the projects;

iii) within technical public agencies, managers from *Agência Nacional de Águas e Saneamento Básico*, *Empresa de Assistência Técnica e Extensão Rural de Minas Gerais* (Emater-MG), and *Instituto Estadual de Florestas* (IEF); and

iv) within academic institutions, professors and researchers who contributed in some capacity to the projects.

In total, 27 interviews were conducted; one respondent chose to submit written answers.

Semi-structured interviews followed a guided protocol (Supplementary Document) covering:

i) main motivations;

ii) presence or absence of training and/or capacity-building in forest restoration and PES;

iii) resistance or opposition to the project;

iv) composition of funding sources; and

v) the perceived importance of partners.

Responses were recorded, transcribed, and analyzed using content analysis (Bardin, 2011).

3.1. Selection of study areas

We selected three cities (Figure 3) to develop this research on the basis of the following criteria:

i) a pioneer city in rural-property compliance and forest restoration whose environmental management model informed the creation of the PCMA – namely, Extrema, through the PCA;

ii) cities that joined the PCMA proposal within its first 2 years and received support from PCMA partner actors for the formulation and implementation of local public policies on forest restoration and PES;

iii) a small city, namely Inconfidentes; and

iv) a medium-sized city, namely Pouso Alegre.

The study was conducted with attention to the distinct socioeconomic contexts of the selected cities considering the technical capacity of municipal administrative staff as well as per capita GDP as strategic factors for implementing and managing public policies on forest restoration and PES.

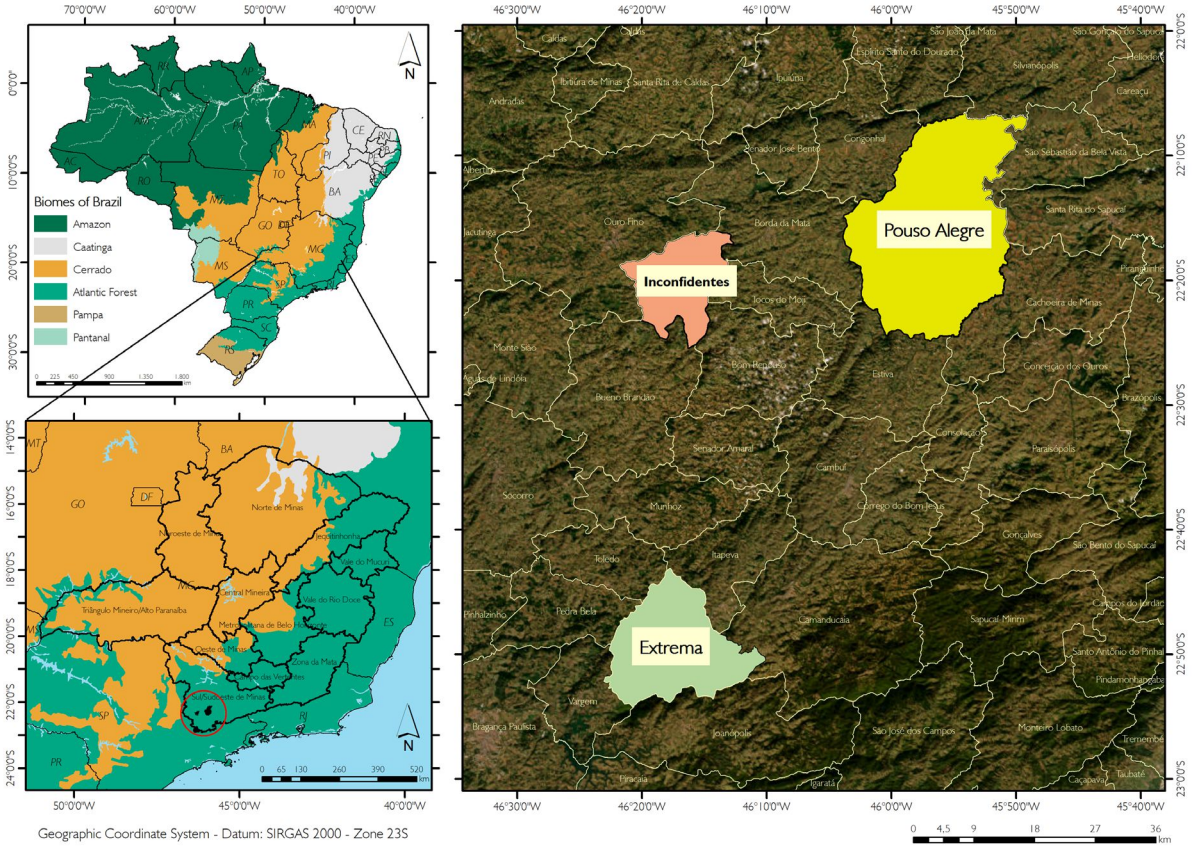

FIGURE 3 – Territorial distribution of the cities of Extrema, Pouso Alegre, and Inconfidentes.
SOURCE: Prepared by the authors (2023).

4. Results and Discussion

4.1. The reference-framework notion in the context of the PCMA

In conducting a case study, the researcher must clearly identify key actors, their strategic considerations, and the relevant technological, social, political, or economic constraints (Labra, 1999).

The formulation and implementation of public policies modeled on the PCMA mirror the municipal policy implemented by the Municipality of Extrema and are tied to forest restoration combined with the PES mechanism (Conservador da Mantiqueira, 2022). Although the initiative is led by Extrema's Secretariat of the Environment, a significant share of the PCMA's policy-design actors consists of international and national environmental NGOs which, together with staff from Extrema's Secretariat of the Environment, present a "package" of political-environmental

justifications and measures to actors in municipalities that choose to adhere to the PCMA's recommended model (Anjos *et al.*, 2022a).

Discussing the rationales of public policies, Massardier (2011) highlights multiple "reasons to act", including environmental issues. Regarding interactions among organizations and institutions in the environmental arena, Frey (2000) notes that environmental protection, as a sectoral policy, has led to significant transformations in institutional arrangements at all levels of state action; consequently, new political actors have entered the scene, transforming and restructuring the policy process.

First, it is important to underscore that the PCMA proposal brings "reasons to act" aligned with environmental agendas. The effects of climate change, shifts in rainfall regimes in Brazil's Southeast, wildfires and prolonged droughts, combined with intense regional anthropization, constitute the key elements of the problem as framed by the PCMA. The local management and environmental-governance model built since 2005 by the city of Extrema and its partners is highlighted as a solution pathway to this reality (Conservador da Mantiqueira, 2022). This narrative reinforces the notion that public policy serves not only to solve problems but also to express a "worldview" of the actors involved – i.e., a perception of reality and a projection of the future, "what the world should be" (Muller, 2000, free translation). Identifying this approach strengthens the public-policy reference-framework notion in which, as Muller (2003, p. 43, free translation) emphasizes, "to develop a public policy is to construct a representation, an image of the reality one intends to intervene in".

Tomazini (2018) stresses that grasping a reference framework requires examining the relationship between the global and sectoral frameworks. The global framework – composed of fundamental values – embodies how a society represents its relationship with the world at a given moment (Muller, 2003). As an argumentative basis favoring adherence to the PCMA, the evidence indicates alignment with a global framework of environmental protection and sustainable development, exemplified by the justification that

> the increased ambition (through the creation of the PCMA) is in tune with worldwide pressure from civil society and the scientific community for more effective actions – such as forest restoration – to combat climate change, warning of risks and ecosystem losses if the planet's average temperature rises more than 1.5 °C above pre-industrial levels. (Conservador da Mantiqueira, 2022, p. 2, free translation).

The sectoral framework – representing the place and role of a sector in a given society and time – materializes in the PCMA's proposal to implement environmental compensation policies through forest restoration and the PES mechanism.

The combination of the global and sectoral frameworks is constructed by "transaction operators", also called "mediators", i.e., actors who, by virtue of their social position and professional activities, construct meaning and, at the same time, facilitate its circulation across

the categorized and organizational spaces that make up a public-policy sector (Massardier, 2011). Within the PCMA, these mediators include representatives from Extrema's Secretariat of the Environment and partner institutions who present to interested local public actors – mayors, secretaries of the environment, councilmembers, and environmental and/or agriculture technicians – the PCA and the arguments favoring adherence to the PCMA's recommended model. In addition, the Municipality of Extrema maintains an administrative structure, the *Centro Internacional em Restauração da Paisagem Natural e Serviços Ambientais* (CIRPSA), as a support hub to provide technical assistance to cities needing training in forest restoration (Conservador da Mantiqueira, 2020).

The role of environmental NGOs is particularly salient not only because of the urgency they attribute to environmental issues but also due to the technical capacity they bring to training and knowledge-sharing with public actors aligned with the PCMA's proposal (Anjos *et al.*, 2022a). Labra's (1999) analogy – institutions as the rules of the game and organizations as the players and their strategies – fits well the operating context of actors involved in the PCMA.

External stimuli to create public policies based on the PCMA's model carry reference frameworks that foster new ways of thinking (and, consequently, acting) among local political agents who – in Pouso Alegre and Inconfidentes – were receptive to the proposal and incorporated forest-restoration and PES policies into local normative structures. For Marques (2000), interaction between the public and private spheres leads to the creation of specific public policies and evidences the State's permeability, indicating that State and society are not sealed, isolated entities; their boundaries in the interrelational field are often difficult to draw. The work of PCMA mediators also reflects Direito's (2021) observation that the sum of different viewpoints yields a shared understanding of how the State should act.

Interview findings indicate that bills modeled on the PCMA's recommendations originated with the local executive branch, and that voting in both cities' legislatures was unanimous in favor of approval. Moreover, the legal texts enacted in Pouso Alegre and Inconfidentes are notably similar to the one that established Extrema's *Conservador das Águas*. This conduct reinforces the role of PCMA mediators in transmitting the reference frameworks (Muller, 2003) they advocate and, consequently, in influencing political processes by "institutionalizing" patterns of action and negotiation procedures within organizational contexts (Frey, 2000).

In sum, theoretical analysis through the lens of the reference-framework notion helps elucidate the roles of actors, the institutional arrangements constructed, and the interests and motivations at play in policy-making processes (Figure 4).

From a systematic standpoint, the roles played by mediating actors in the projects analyzed were categorized according to three dimensions: financial, technical, and political.

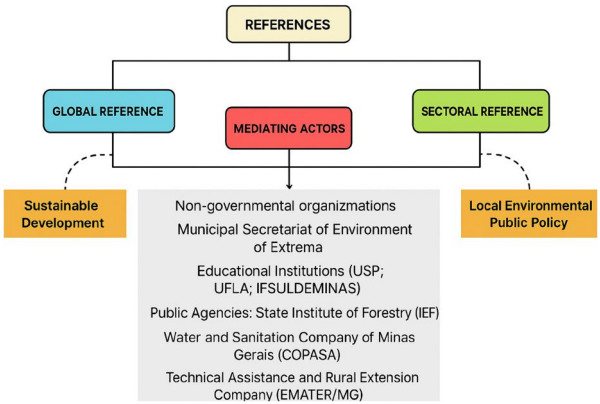

FIGURE 4 – Schematic arrangement of reference frameworks and mediating actors within the *Plano Conservador da Mata Atlântica*.
SOURCE: Prepared by the authors (2025).

4.2. Financial aspects

The formalization of PES projects through public policies legitimizes the State to assume direct responsibility for budgeting and, consequently, for the resources transferred to providers of environmental services. The effectiveness of such projects depends on transaction costs, which are the expenses required to initiate and operate a PES scheme – e.g., administration, monitoring, and enforcement (Wunder, 2007). However, particularly at the local scale, budget constraints and limited technical capacity can hinder the materialization of these schemes.

The fact that governments act as sole or principal funders of PES projects does not, in itself, guarantee project success (Guedes & Seehusen, 2012; Fiore *et al.*, 2020). According to the former mayor of Extrema, when the PCA was created in 2005, the participation of other entities was crucial because the municipality did not have to shoulder a large financial outlay to implement the project. Similarly, the Secretary of the Environment and project architect emphasized that support from partners such as IEF and TNC *significantly leveraged the initiative because it did not depend on municipal funds alone*. This perception aligns with Matzdorf *et al.* (2013), who highlight the fundamental role of intermediary actors in reducing transaction costs in PES schemes.

A similar point was made by technical operators (municipal public servants) in Pouso Alegre and Inconfidentes, who underscored strategic support from IEF in providing inputs – such as fence posts, wire, and seedlings – for fencing and forest-restoration measures on rural properties enrolled in the projects. These inputs were facilitated through PCMA-mediated coordination. As an interviewee from IEF noted, *the institution has been a long-standing partner of the Conservador since 2007; partners do not always have the resources to execute their projects, and one ends up complementing another, as IEF must meet the targets of the Multi-Year Government Action Plan* (PPAG, in Portuguese). This arrangement reinforces Marques's (2019) view that relational structures channel support and alliances by drawing on preexisting patterns of personal and institutional relationships.

Regarding payments per se, the PCA began disbursing environmental-service payments to rural landholders in 2005. The reference amount paid to enrolled producers was 100 Extrema's fiscal units, equivalent in 2005 to R$ 141.00 per hectare per year (Conservador das Águas, 2017).

For PES resource allocation specifically, the municipality of Inconfidentes earmarked R$ 30,000 for contractual commitments between the municipal government and rural producers. This budget allocation secured payments for six contracts with rural landowners, each with a 4-year term. Although Inconfidentes maintains a municipal sanitation fund, it does not have a fund dedicated specifically to PES.

In contrast to Inconfidentes, the legislation establishing the *Nossa Água, Nosso Futuro* project in Pouso Alegre stipulates that the water-supply utility must transfer to the project at least 0.5% of its total operating revenue derived from watershed operations within the municipality (Pouso Alegre, 2018). This measure provides, at least from a legal standpoint, an alternative source of financial security for project maintenance.

A comparative financial assessment among the municipalities highlights several points. As the reference value, we adopted "realized revenue", corresponding to resources actually received by the Public Administration – i.e., the total amount of taxes, fees, and contributions collected and incorporated (Tesouro Nacional, 2023). For proportionality and data availability, we used the realized revenue for each municipality corresponding to the first year of PES contract payments – except for Extrema, as data for the municipality's first year of PES payments (2005) were unavailable. To ensure comparability, we applied the same annual equivalence used for the other cases (Table 1). For Extrema, the budget line item is "maintain and expand activities related to the *Conservador das Águas*", a designation that underscores the project's consolidated and expanding status and reinforces Extrema's role as a strategic actor in disseminating the sectoral reference framework adopted by the city.

Both cities are also engaged in a parallel initiative related to forest restoration. The Pró-Mananciais program, created by *Companhia de Saneamento de Minas Gerais* (COPASA), aims to protect and restore micro-watersheds and aquifer recharge areas used for water abstraction in cities where the utility operates (COPASA, 2023).

TABLE 1 – Financial composition of forest-restoration and PES projects in the cities of Extrema, Inconfidentes, and Pouso Alegre.

(Where: Revenue (R$) = realized revenue; Amount (R$) = amount allocated to the project; % PES = share of revenue allocated to PES; PES (R$) = PES amount per hectare per year – 2021; Fundo PSA = dedicated PES fund or equivalent.)

City/Project	Revenue (R$)	Amount (R$)	% PES	PES (R$)	PES fund
Extrema / *Water Conservator / Plano Conservador da Mata Atlântica*	R$ 471,654,759.00 (2021)	R$ 1,360,000.00	0.34%	R$ 312.00	YES
Inconfidentes / *Conservador do Mogi*	R$ 29,048,888.96 (2021)[2]	R$ 30,000.00[1]	0.10%	R$ 489.00	NO
Pouso Alegre / *Nossa Água, Nosso Futuro*	R$ 726,982,750.00 (2021)[2]	R$ 207,000.00[1]	0.02%	R$ 565.00	YES

LEGEND: [1]Amount allocated exclusively to PES contracts; [2]Year corresponding to the first PES contract payments.

SOURCE: Prepared by the authors (2025).

Although not a PCMA partner, Pró-Mananciais works transversally on actions that can reduce implementation costs for forest restoration. In both Pouso Alegre and Inconfidentes, Pró-Mananciais carries out forest-restoration activities and rural-road management (COPASA, 2023).

Another measure with financial implications is the outreach to rural landowners, i.e., those who hold the ecosystem service on their properties. In Pouso Alegre, liaison with landowners is facilitated by Emater-MG. This dynamic does not occur in Inconfidentes, where Emater-MG is not a partner of the *Conservador do Mogi* project; there, liaison with landowners is handled by municipal staff supported by personnel from Instituto Federal de Educação, Ciência e Tecnologia do Sul de Minas Gerais (IFSULDEMINAS), a partner institution in that city.

The partnership arrangements that help reduce project costs in Extrema, Pouso Alegre, and Inconfidentes align with Mamedes *et al.* (2023) and Wunder *et al.* (2020) who emphasize that among the key conditions influencing the emergence of PES schemes are institutions that act as intermediaries between providers of environmental services and users of those services. PES schemes have been introduced worldwide as instruments to support multi-actor participation through organizational arrangements (Anjos *et al.*, 2022b).

In Extrema and in cities that adopted the PCMA proposal, PES is guaranteed to rural landowners by legal provisions enacted in each municipality. Payment criteria, terms, and reference values are established by municipal decrees and tied to each local government's budget allocation. This legal certainty is one of the conditions encouraged by PCMA partner-mediators to promote project continuity. While not an absolute prerequisite – as observed in another local PES project in Brumadinho, Minas Gerais (Anjos *et al.*, 2022b) – it can formalize commitments and bolster public-sector engagement in sustaining these initiatives.

4.3. Technical capacity

Although the primary objective of forest restoration is ecological, it cannot be sustained in practice without jointly addressing ecological, socioeconomic, and project-management dimensions (Costa *et al.*, 2020). From the outset, the strategy of the PCA, according to its architect, was to build datasets and knowledge so the project would be well grounded socio-environmentally. By partnering with technical and scientific institutions, the municipality of Extrema was able to bridge gaps in technical capacity, initially relying on support from the NGOs Valor Natural, TNC, and SOS Mata Atlântica. Additional support came from public bodies, such as IEF, and from universities – Universidade de São Paulo (USP) and Universidade Federal de Lavras (UFLA) (Brancalion *et al.*, 2013; Richards *et al.*, 2015).

Similarly, local operators in Inconfidentes and Pouso Alegre sought technical and scientific backing from organizations and academic institutions to substantiate strategies in their respective territories, with mediation by PCMA actors (Table 2). In the Mogi River basin, where

TABLE 2 – Type of technical support provided by mediating actors in the projects of Extrema, Inconfidentes, and Pouso Alegre. Abbreviations for project phases: Conception (C), Pilot Implementation (P), Refinement/Expansion (E).

City/project: Extrema/*Plano Conservador das Águas*

Type of technical support	Institution	Project phase	Details
PES project model	Agência Nacional de Águas e Saneamento Básico	C, P, E	Presentation of the PES methodology
Supply of materials	Instituto Estadual de Florestas	P, E	Agricultural inputs for fence construction
Preparation of executive project	Comitê das Bacias Hidrográficas dos Rios Piracicaba, Capivari e Jundiaí	C, P, E	Assistance in preparing the executive project
Supply of materials	SOS Mata Atlântica (NGO)	P, E	Donation of native-species seedlings
Forest-restoration techniques	The Nature Conservancy (NGO)	C, P, E	Operational team, vehicle, and executive project
Forest-restoration techniques	Valor Natural (NGO)	P, E	Forest-restoration techniques
Supply of materials	Indústria Dalka do Brasil	E	Environmental sanitation
Preparation of executive project	Universidade Federal de Lavras	P, E	Soil-mapping development
Preparation of executive project	Universidade de São Paulo	P, E	Environmental diagnostics

City/project: Inconfidentes/*Conservador do Mogi*

Type of technical support	Institution	Project phase	Details
Presentation of model legislation and decrees	Extrema's Secretariat of the Environment	C, P, E	Presentation of proposal, preliminary studies, and project planning
Training in forest restoration and PES	Instituto Federal de Educação, Ciência e Tecnologia do Sul de Minas Gerais	C, P, E	Environmental diagnosis, site visits to rural properties, and monitoring
Training and monitoring in forest restoration and PES	The Nature Conservancy (NGO)	C, P, E	Project planning, training in forest restoration, and implementation of a demonstration unit
Governance training	WWF (NGO)	P, E	Meetings promoting governance dialogue and pilot implementation in forest restoration
Supply of materials	COPASA	P, E	Donation of seedlings
Supply of materials	Instituto Estadual de Florestas	P, E	Donation of fence posts for spring and forest-fragment protection

City/project: Pouso Alegre/*Nossa Água, Nosso Futuro*

Type of technical support	Institution	Project phase	Details
Presentation of model legislation and decrees	Extrema's Secretariat of the Environment	C, P, E	Presentation of proposal
Training in forest restoration and PES	Instituto Federal de Educação, Ciência e Tecnologia do Sul de Minas Gerais	C, P, E	Environmental diagnosis
Training and monitoring in forest restoration and PES	The Nature Conservancy (ONG)	C, P, E	Project planning and training in forest restoration
Supply of materials	COPASA	P, E	Donation of seedlings
Supply of materials	Instituto Estadual de Florestas	P, E	Donation of fence posts for spring and forest-fragment protection
Farmer engagement	Emater-MG	P, E	Raising awareness among farmers about the project and promoting improved agricultural practices

SOURCE: Prepared by the authors (2025).

Inconfidentes is located, WWF – through the *Raízes do Mogi Guaçu* Program – convened periodic meetings to strengthen local governance and promote multisector dialogue among actors (NGOs, companies, municipalities, research institutes). The program covers cities in the Mogi Guaçu basin and seeks to stimulate restoration of at least 100 hectares of forests in a region with low forest cover and high water-scarcity risk (WWF, 2019; Anjos *et al.*, 2022a).

With support from TNC, IFSULDEMINAS designed and delivered a 2019 course on reforestation, financial returns, and water augmentation on rural properties. The initiative sought to provide technical training aligned with PCMA guidelines and capacitated municipal civil servants to diagnose rural properties, addressing environmental legislation, forest restoration, soil-conservation practices, sustainable agriculture, rural environmental sanitation, and the drafting of bills and decrees for PES (IFSULDEMINAS, 2019). Identified as a key factor, the TNC interviewee emphasized the need to train personnel and employ complementary tools and instruments to make restoration a practical reality. The course involved representatives from 12 PCMA cities and trained 26 local agents, including municipal staff and Emater-MG personnel (Anjos *et al.*, 2022a). The actions of these mediating actors and their interventions attest to the intent to translate the sustainable-development reference framework into local practice.

Interviews with environmental staff in both cities indicate that technical training provided by project partners – TNC, WWF, and IFSULDEMINAS – was crucial to building competencies in forest restoration and PES. At the same time, respondents underscored the need to replenish staff and hire additional personnel to achieve more effective results. As Fiore *et al.* (2020) note, maintaining at least a core technical team of public servants – dedicated to project design, terms of reference, draft contracts and calls for proposals, resource mobilization, fieldwork, project communication, and operational support – is essential for implementing PES projects.

The technical capacity provided by NGOs such as TNC and WWF encapsulates the translation of the global reference framework highlighted by Muller (2003) into training and deeper engagement with environmental and sustainable-development themes for local operators interested in the PCMA model. This view is reflected in the WWF representative's statement that the NGO's *actions connect smaller, local scales and coalitions such as the PCMA, seeking to drive conservation in the Atlantic Forest*.

This approach is also evident in the demonstration unit established on the Inconfidentes campus of IFSULDEMINAS, whose implementation was facilitated by TNC (IFSULDEMINAS, 2019). According to TNC's project manager, the demonstration unit can *help identify restoration techniques that are more efficient and suitable for the local biome, enabling scientific assessment of the most appropriate methods*. The combined support from TNC and IFSULDEMINAS – through training courses, the creation of a research unit, and ongoing assistance to municipal managers adopting the PCMA model – constitutes a central factor for strengthening local managerial capacity in environmental governance and promoting effective governance (Wang & Ke, 2024). As the PCMA's architect notes, this is the Plan's core role: *to foster public policies and execute the actions envisaged*.

4.4. Political interest

The municipal territory is where public policies can be implemented and provide direct benefits to the population. Policies can be tailored to local specifics at the municipal level to improve the overall quality of the environment (Rodrigues *et al.*, 2012).

It is important to recognize the PCA as a consolidated municipal public policy (Chiodi *et al.*, 2013) that even served as a model for the design of the PCMA (Anjos *et al.*, 2022a; Conservador da Mantiqueira, 2022). Originally, the PCA was not part of the municipal government's platform; it began in 2002 as an initiative of the Secretary of the Environment, who conceived a policy for environmental compliance on rural properties. From there, the municipality sought out technical partners to strengthen capacity, optimize results, and build partnerships. IEF and TNC, for example, have been PCA partners since its inception in 2005. Continuity in political-administrative leadership has been central to maintaining and sustaining the PCA – a factor highlighted in several studies as underpinning the

project's longevity (Chiodi *et al.*, 2013; Richards *et al.*, 2015).

Similarly, the *Conservador do Mogi* project in Inconfidentes was not part of the governing platform when its proposal was developed. The proposal arose from one of the first outreach efforts by the then *Plano Conservador da Mantiqueira* (now PCMA) in 2017, with mediation by the IFSULDEMINAS Inconfidentes campus. Liaison with the local Executive was conducted by TNC and Extrema's Secretariat of the Environment to draft the bill and decree and to define priority areas for forest restoration (Anjos *et al.*, 2022a).

At the end of 2020, a change in political leadership required renewed engagement by PCMA partners to reinforce the project's continuity – an approach also adopted by COPASA's Pró-Mananciais program. According to the program's technical lead, when mayors and environment and/or agriculture secretaries change, *the project is reintroduced*. Likewise, a PCMA coordinator emphasized the need to establish a *municipal environmental-management model to implement actions; securing backing from the municipal government remains a major challenge*. This scenario aligns with Muller's (2003) view of the challenges in absorbing a sectoral reference framework whose consistency is never perfect and is subject to continual conflict over agenda control.

As in Extrema, media visibility was cited as a political motivator for continuity in Inconfidentes. A feature on the television program Globo Rural showcased the municipality's role in making PES payments to rural producers. The political capital derived from such visibility reinforces the internalization of reference frameworks at the local level – a factor also highlighted by Extrema's Secretary of the Environment as politically motivating for the project's continuation.

In Pouso Alegre, the *Nossa Água, Nosso Futuro* project benefited from geographic proximity to Extrema and the personal interest of a staff member in learning more about the PCA in 2012. In 2014, a municipal law modeled on the PCA created the Ecocrédito program to encourage rural producers to designate on-farm environmental preservation areas for biodiversity conservation (Pouso Alegre, 2014). Due to political turnover, Ecocrédito did not take hold and was later repealed by the law that established *Nossa Água, Nosso Futuro* (Pouso Alegre, 2018). Unlike Extrema and Inconfidentes, Pouso Alegre's PES and forest-restoration initiative became part of the governing platform of the administration that implemented it – suggesting that, to some extent, environmental reference frameworks consolidated over time among political actors, who ultimately adopted them as policy proposals.

Nevertheless, forest-restoration and PES projects rarely consolidate quickly. Grima *et al.* (2016) indicate that the relevant time scale is medium to long term and depends on behavioral change among actors over a sufficiently long horizon to allow new attitudes to crystallize (Sattler *et al.*, 2013).

5. Conclusion

The proposal of a broad, comprehensive plan centered on stimulating the creation of environmental public policies at the municipal level grants the PCMA the status of a potentially inductive initiative for a new paradigm of local environmental public management. It is necessary to recognize that the PCA – created by the city of Extrema – anchors the PCMA's guidelines and stands as an institution whose core components rest on multi-actor partnerships, forest restoration, and PES, acting as a driver of socioenvironmental development.

Understanding the role of mediating actors is essential for grasping the scope of their actions and contributions to achieving project goals. The financial component emerges as an indirect factor in implementation, operating more as a political stimulus. Its versatility highlights the feasibility of working with larger or smaller budgets, depending on each locality's fiscal capacity and on collaborative arrangements with mediating actors. Likewise, the technical support provided by partner institutions constitutes a central mechanism for building capacity among local staff. Moreover, we identified a complementary dynamic among actors, as each advances and reinforces reference frameworks within their own domains of action and interest. By contrast, political aspects appear as the most subjective and sensitive elements. Even when project design aligns with the interests of public agents, variables such as political interests and ideological orientations may undermine continuity. The PCA's reference model bears specific particularities linked to Extrema's political, social, and economic dynamics.

The case studies analyzed here illuminate the role played by mediating actors in implementing public policies grounded in the PCMA model. Nevertheless, the limited number of cases necessarily constrains our ability to fully capture these actors' performance and their effectiveness in translating reference frameworks into practice.

Shifts in social values, interests, and action objectives can generate the prominence of certain actors – particularly in times of social and political rupture – who strive to modify patterns of political behavior and may even succeed in "institutionalizing" new styles through novel procedures and arrangements (Frey, 2000). The translation of environmental reference frameworks into municipal public policies makes this dynamic evident in the municipalities studied.

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