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Collective management for the conservation of mountain environments: lessons from tourism in the Marins-Itaguaré crossing, Serra da Mantiqueira, Brazil

Gestão coletiva para a conservação de ambientes de montanha: lições do turismo na travessia Marins-Itaguaré, Serra da Mantiqueira, Brasil

Camila Espezio OLIVEIRA[1*], Maria João CANADAS[2], Alexandre IGARI[1]

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

[2] Forest Research Centre and Associate Laboratory TERRA, School of Agriculture, University of Lisbon, Lisbon, Portugal.

[*] Contact email: camila.espezio.oliveira@alumni.usp.br

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ABSTRACT: Collective action involves collaboration among various actors to achieve shared benefits. Identifying community attributes that promote collective action for environmental conservation is a challenge in sustainability research. This article employs methodological triangulation among participant observation, documentary analysis and semi-structured interviews to characterize the development of collective action and institutional arrangements that foster the conservation of mountain environments in Serra da Mantiqueira, Brazil. The results indicate that collective action arising from mountaineering activities draws the attention to the need for conservation, relying on formal elements of the arena and on the skilled actors' efforts, contributing to a bottom-up management approach. The study also highlights the weakness of established governance, which collapses in the absence of skilled actors or when formal structures disintegrate, emphasizing the role of these key elements to strengthen the collective action process.

Keywords: community attributes; collective action; action arena; governance; mountaineering activities.

RESUMO: A ação coletiva envolve a colaboração entre diversos atores para alcançar benefícios compartilhados. Identificar os atributos que promovem a ação coletiva para a conservação ambiental é um desafio na pesquisa de sustentabilidade. Este artigo utiliza uma triangulação metodológica entre observação participante, análise documental e entrevistas semiestruturadas para caracterizar o desenvolvimento da

ação coletiva e dos arranjos institucionais que promovem a conservação em ambientes de montanha na Serra da Mantiqueira/Brasil. Os resultados indicam que a ação coletiva derivada de atividades de montanhismo chama à atenção para a necessidade de conservação, apoiando-se em elementos formais da arena e na atuação de atores hábeis, contribuindo para uma gestão *bottom-up*. O estudo também revela a fragilidade da governança, que se desfaz na ausência de atores hábeis ou quando a estrutura formal se desarticula, destacando o papel desses elementos-chave para fortalecer o processo de ação coletiva.

Palavras-chave: atributos da comunidade; ação coletiva; arena de ação; governança; atividades de montanhismo.

1. Introduction

Undertaken by a group pursuing a common interest, collective action is a collaborative game involving multiple actors, each contributing efforts or resources in exchange for collective benefits. This type of action offers advantages over uncoordinated individual initiatives or State/private control, such as reduced management costs, enhanced knowledge sharing and greater effectiveness in addressing local issues (Ostrom, 1990; OECD, 2013).

However, barriers such as lack of information or shared understanding of the benefits offered by collective action, as well as selfish users' behaviours, can hinder collaboration, leading to free-riding, where individuals benefit from the outcomes without contributing to the necessary efforts (Olson, 1965; OECD, 2013; Dardot & Laval, 2017; Villamayor-Tomas *et al.*, 2019). Political uncertainties represent another significant obstacle, potentially undermining continuity of the initiatives, generating insecurity and easing free-riding (OECD, 2013; Villamayor-Tomas *et al.*, 2019).

Collective action applies to various contexts. In tourism, it is associated with promoting conservation and sustainability in destinations (Chamberlin, 2010; Bramwell, 2011; Schmidt *et al.*, 2016; Goldberg *et al.*, 2017; Hofman *et al.*, 2020; Partelow & Nelson, 2020; Oliveira *et al.*, 2024), while also socially strengthening communities (Mbaiwa & Stronza, 2011; Hwang & Stewart, 2016). Notable examples include conservation of the Great Barrier Reef in Australia (Goldberg *et al.*, 2017; Hofman *et al.*, 2020), the Niagara Falls in Canada (Healy, 2006) and Mount Everest in Nepal (Oliveira *et al.*, 2021).

In tourism, collective action oftentimes emerges from self-management principles at destinations organized by tour operators, landowners, local populations or frequent visitor groups (Chamberlin, 2010; Bramwell, 2011; Mbaiwa & Stronza, 2011). Mbaiwa and Stronza (2011) demonstrate that self-management enhances social capital (the set of social resources enabling individuals or groups to act and influence others), by fostering autonomy in rulemaking, conservation control and resource-use decisions, thereby stimulating local belonging and positive attitudes toward tourism and conservation. Hwang and Stewart (2016) emphasize that high social capital levels explain collective action in tourism, turning key actors with agency capacity – those possessing intellectual, cultural or persuasive social capital – into essential figures in structuring collective action.

A study from the OECD (2013) identifies critical factors for collective action, primarily aiming at understanding the characteristics of each resource to

be managed, the nature of the groups dependent on that resource, the particularities of the institutional relationships that govern the resources and the nature of the links between the group and external forces or authorities. Ostrom (2005) developed the Institutional Analysis and Development (IAD) framework, which resembles the OECD's description of critical factors for collective action.

Ostrom (2005; 2008) argues that collective dynamics depend on external variables such as biophysical conditions, community attributes and usage rules. These variables influence the action arena, where action situations are structured through disputes and interactions among agents and coalitions. The outcomes of these action arenas are reassessed, feeding back into and adjusting the parameters of external variables and modifying the action situation (Pavanelli *et al.*, 2022). The IAD model provides promising theoretical grounds for studying how coalitions and institutions are formed and organized – sets of rules and shared meanings that influence the dynamics of social interactions – focused on collective action regarding common goods and environmental conservation (Figure 1), including mountain tourism.

Mountaineering activities rely on trails and campsites, which are considered common-pool resources due to their rivalry (use by one individual prevents use by another) and non-excludability (free access). Unregulated appropriation and inefficient control can lead to a situation analogous to the tragedy of the commons, where predominance of free-rider behaviours results in overexploitation and degradation of shared resources, as currently observed on the trails to Mount Everest (Oliveira *et al.*, 2021).

While mountaineering activities generate negative environmental impacts, they also foster shared meanings that encourage conservation, oftentimes consolidated through formal or informal rules (Oliveira *et al.*, 2024). Communities in mountainous regions such as the Sherpas in the Himalayas

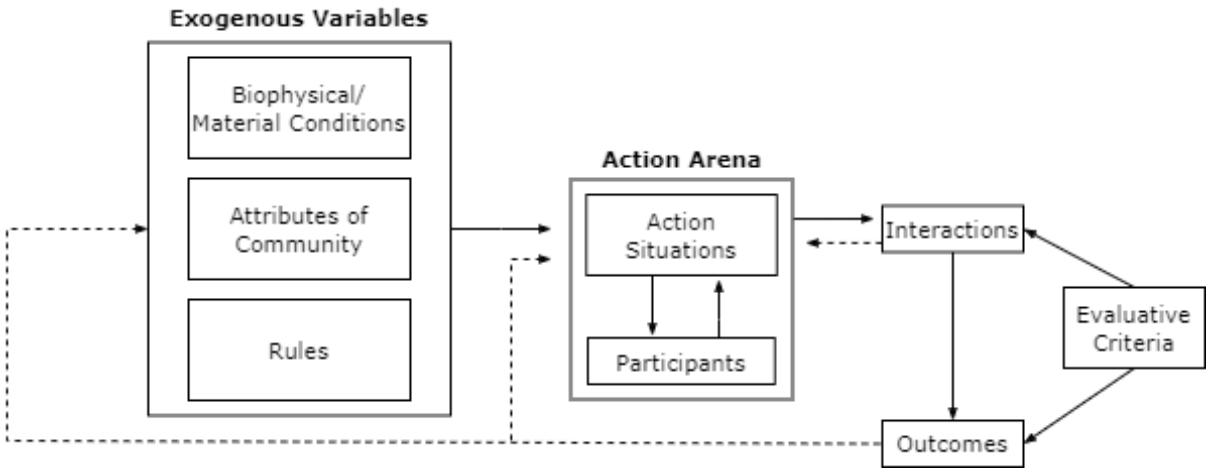

FIGURE 1 – Institutional Analysis and Development (IAD) framework.
SOURCE: Ostrom (2005; 2008).

develop strong ties to their environment. On the one hand, interaction between these communities and mountaineers promotes strengthening of the social capital and conservation efforts but, on the other hand, it also increases commercial exploitation of the environment, highlighting the contrasting perspectives within the mountaineering conservation dilemma (Oliveira *et al.*, 2021).

Understood as institutional arrangements, establishing formal and informal rules is essential for voluntary conservation actions, providing complementary instruments to State and private organization. Based on a systematic literature review, Oliveira *et al.* (2024) identified the main actors involved in mountaineering activities and their interrelations with conservation efforts (Figure 2).

The framework presented by the authors (Figure 2) illustrates the various interactions between mountaineering activities and the formal and informal rules that guide conservation in mountainous areas. Through this framework, the authors highlight the environmental and socioeconomic impacts exerted by mountaineering on conservation of mountain environments. Mountaineering activities and improvements in tourism infrastructure (represented by the squares on the left) generate direct socioecological impacts (indicated by the solid arrows), including environmental, social and economic effects, as well as changes in the key actors' behaviours and attitudes (represented by the circles). These impacts can be either positive or negative on natural mountain environments (repre-

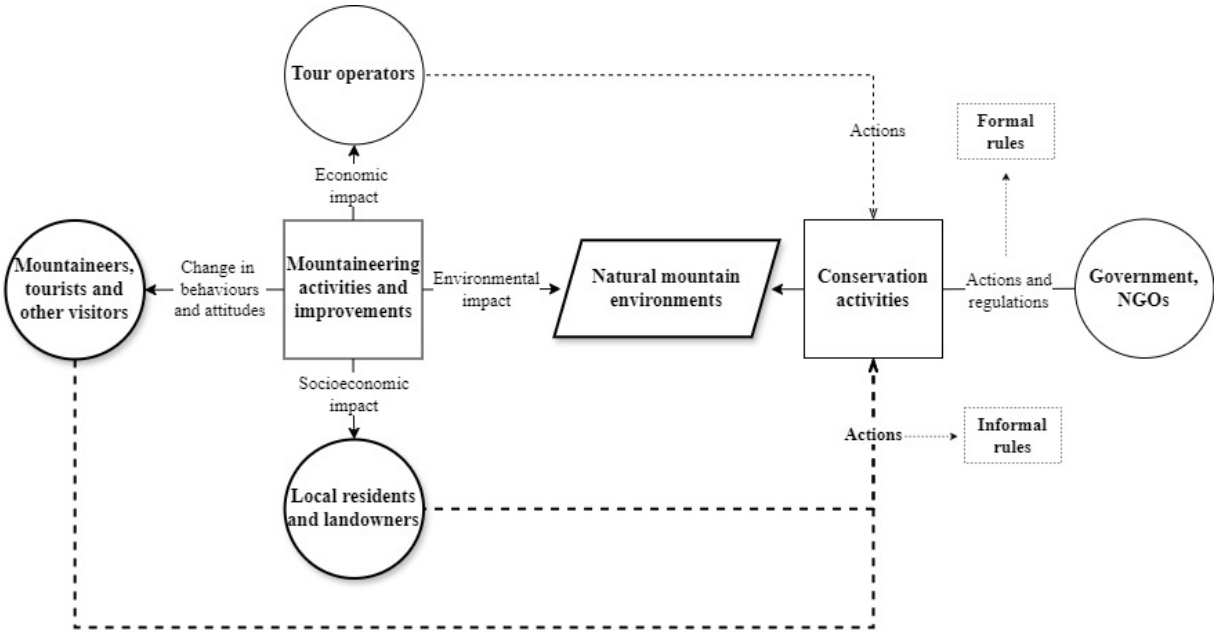

FIGURE 2 – Conceptual framework corresponding to the relationships between mountaineering activities and formal and informal rules that guide conservation.

SOURCE: adapted from Oliveira *et al.* (2024).

sented by the solid arrow pointing toward the central parallelogram).

Conversely, conservation activities such as the development of rules or programs that promote environmental stewardship can generate direct positive environmental impacts on natural mountain environments (squares on the right). These activities are driven by actions (dashed lines) taken by tour operators, mountaineers, tourists, visitors, landowners and local residents, who are in fact directly influenced by mountaineering activities and improvements in tourism infrastructure. Certain conservation efforts depend on structures related to trail maintenance and access control. Ultimately, conservation activities are regulated, funded and directly implemented (solid arrows) by governmental agencies and some environmental NGOs.

Located in south-eastern Brazil, Serra da Mantiqueira is a popular mountaineering destination in the country, featuring traditional trails such as the crossing between the Marins and Itaguaré peaks. Territorial management of the Marins-Itaguaré massif is complex, involving public conservation units (Environmental Protection Area and Natural Monument) managed by the State, and private reserves (Private Natural Heritage Reserves) managed by individual or collective landowners. Therefore, its use and conservation depend on coordination among social actors wiht oftentimes contrasting roles, perspectives and interests.

Despite the formal division between the public and private spheres, informal rules largely govern use and conservation of the trails as common-pool resources (characterized by usage rivalry but non-excludability of access). Among other things, the region is the focus of collective action aimed at fire prevention, trail maintenance, cleaning and conservation of trails and watercourses, carried out through collaboration among various groups of social actors. Thus, the Marins-Itaguaré crossing trail represents a challenging case regarding the dilemmas, conflicts and underlying motivations to shape collective action and rules for the use and conservation of mountain environments.

This study aims at identifying and characterizing the formation of collective action and institutional arrangements that promote environmental conservation in the mountainous areas of the Marins-Itaguaré crossing trail, located in a section of Serra da Mantiqueira between the states of Minas Gerais (MG) and São Paulo (SP), south-eastern Brazil. To achieve this objective, the article adopts the framework presented by Oliveira *et al.* (2024) as a general structure and applies it to the specific context of collective action for conservation (square on the right – Figure 2).

The framework also serves as a starting point for characterizing social actors, potential coalitions and interrelations. Accordingly, the following points will be addressed:

1) Application, adaptation and refinement of the conceptual framework regarding the actors and coalitions involved in organising collective action and institutional arrangements.

2) Identification of formal and informal action arenas in which collective action and rules for the use and conservation of mountain environments emerge in the Marins-Itaguaré crossing trail.

3) Characterization of the motivating factors and structuring elements inherent to collective action and institutional arrangements.

2. Methodology

2.1. Study area

Established by Federal Decree No. 91,304/85, the Serra da Mantiqueira Environmental Protection Area (Área *de Proteção Ambiental da Serra da Mantiqueira*, APASM) encompasses 437,192 hectares of public and private lands across 27 municipalities in the states of Minas Gerais (MG), São Paulo (SP) and Rio de Janeiro (RJ) (ICMBio, 2018). Holding significant socioeconomic and environmental relevance, this area includes one of the largest mountain ranges in south-eastern Brazil, featuring endemic flora, high-altitude grasslands and important native vegetation remnants. It also shelters endangered animal species. These characteristics justified creation of the APA and restriction of activities harmful to the conservation of natural resources (ICMBio, 2018). Environmental Protection Areas (EPAs) are federal Conservation Units (CUs) that reconcile nature conservation with sustainable use of natural resources (Brazil, 2000). The APASM management plan highlights areas for nature-based tourism, particularly adventure tourism, including traditional Brazilian mountaineering trails such as the crossing between the Marins and Itaguaré peaks and their respective camping areas, which are the focus of this study.

Beyond the APASM, the Serra da Mantiqueira territory includes various public and private conservation units. In this context, a 2006 ordinance issued by the then Ministry of the Environment (*Ministério do Meio Ambiente*, MMA) established the Mantiqueira Mosaic, which brings together public and private Conservation Units in the Serra da Mantiqueira region across all three governmental levels. Its objective is to integrate and expand the various conservation efforts aimed at preserving the region's natural and cultural heritage (MMA, 2006).

2.2. The Marins-Itaguaré massif

The Marins-Itaguaré massif stretches for 18 kilometres across the municipalities of Piquete (SP), Cruzeiro (SP), Marmelópolis (MG) and Passa Quatro (MG). The trail can be completed in one or multiple days, with camping permitted at designated sites (Figure 3).

Unlike other trails in the region that are under private management, there is currently no regulation governing public use of the trails in the Marins-Itaguaré area. However, in 2021, the *Mantiqueira Paulista* Natural Monument (*MONA Mantiqueira Paulista*) was established through Decree No. 65.457/2021 by the Secretariat of Infrastructure and Environment from the state of São Paulo. Natural monuments allow for indirect use of natural resources and may include private lands, provided they are compatible with conservation objectives (Brazil, 2000). *MONA Mantiqueira Paulista* encompasses over 10,000 hectares between the municipalities of Cruzeiro and Piquete in the state of São Paulo, though it does not cover the entire massif.

2.3. Methodological triangulation

Methodological triangulation (Denzin, 1978) was employed to achieve the objective proposed, combining participant observation, documentary analysis and semi-structured interviews.

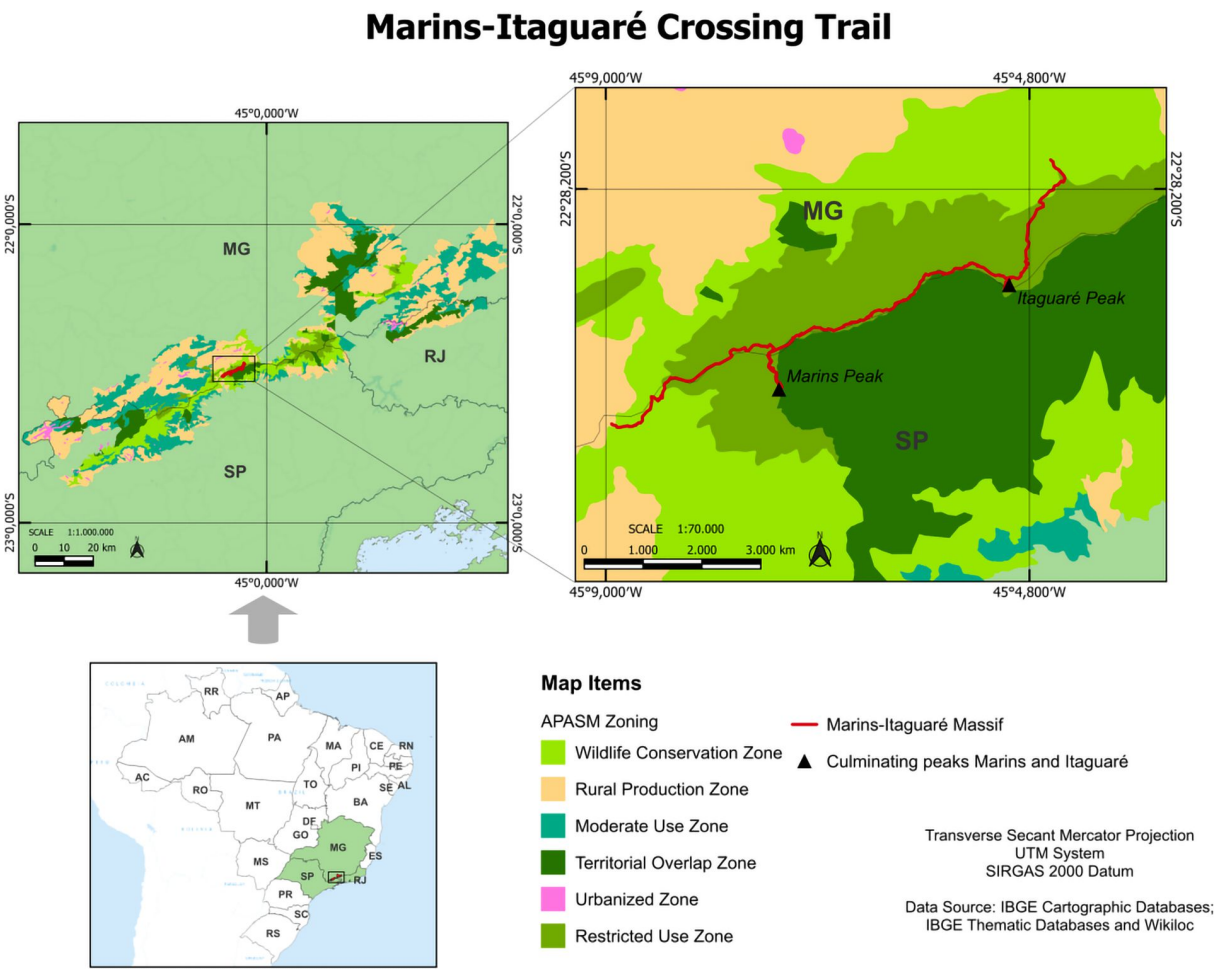

FIGURE 3 – Location of the Marins-Itaguaré crossing trail.
SOURCE: developed by the authors based on Wikiloc (2014) and ICMBio (2018) data.

2.3.1. Participant observation

Participant observation seeks to study individuals in their daily routines without intervention, providing detailed impressions of their actions and speech in specific situations (Gil, 2008; Puri, 2011). It can be natural, when the observer belongs to the group under research, or artificial, when the observer integrates into the group for research purposes (Gil, 2008).

The objective of participant observation was to identify the social actors responsible for establishing the institutional arrangement that promotes conservation actions on mountain trails and campsites

along the Marins-Itaguaré crossing, as well as to identify the formal and informal institutions that encourage or restrict such actions. In this study, participant observation was natural and unstructured, as one of the authors is a mountaineering practitioner with prior knowledge of the study area.

Data collection included participation in meetings of the APASM and Mantiqueira Mosaic councils (at least five regular meetings and two training courses during 2021) and in livestreams hosted by volunteer groups and owners of Private Natural Heritage Reserves (*Reservas Particulares do Patrimônio Natural*, RPPNs) (two livestreams in 2021), where topics such as territory management, organization, maintenance and conservation were discussed. Additionally, the trails were traversed in July 2021 during an extended State holiday, a peak period for mountaineering activities in the area. Informal, unstructured conversations were recorded in field notes and incorporated as evidence, along with other observations made during subsequent interactions to clarify key points of the research.

2.3.2. Documentary analysis

In addition to participant observation, a documentary analysis was performed to gather information sources that would empirically support the research (Veal, 2011). The documents consulted included those relevant to understanding local management, such as the APASM management plan, the decree establishing *MONA Mantiqueira Paulista*, visitation reports for the Marins-Itaguaré massif (prepared by the MONA team), minutes from advisory council meetings and other pertinent materials.

2.3.3. Semi-structured interviews

Semi-structured interviews with key actors from various social groups constituted the third method used in the triangulation process. According to Triviños (1987), semi-structured interviews begin with basic questions grounded on theory and research hypotheses, while remaining open to new questions arising from the interviewees' initial answers, contributing recursively to the information gathered.

This method was employed to capture, analyse and compare the testimonies of representatives from social groups involved in the appropriation and use of common-pool resources (trails and campsites), aiming to understand the institutional arrangement formation process in the Marins-Itaguaré massif region from Serra da Mantiqueira. An interview guide and records (e.g., authorized recordings, notes) were used, resulting in detailed transcripts for subsequent analysis.

The sampling units were the individuals engaged in mountaineering and environmental conservation activities in the study area. Data collection followed a targeted non-probability sampling approach, selecting key actors identified during the literature review, documentary analysis and participant observation (Creswell, 2007; Newing, 2011; Trochim, 2022). Sample size was determined by the saturation principle, continuing until new data no longer added relevant insights (Newing, 2011). Ten interviews lasting approximately 60 minutes each were conducted with public officials, tour guides, volunteers, tourism agencies, trail users, NGO presidents, mountaineering club members, advisory council participants and local residents (Table 1).

TABLE 1 – Descriptive table corresponding to the respondents.

Respondent	Job/Characterisation	Relevant information
R1	Public servant, advisory council	Biologist, MSc, CU Manager
R2	Public servant, advisory council	International Relations, MSc, Environmental Analyst
R3	Tour guide, trail user, travel agency employee	Environmental Monitor, Outdoor Activities Guide
R4	Public servant	Forest Engineer, Forest Management Specialist, Environmental Analyst
R5	NGO, council, local resident	Social Communicator, MSc, NGO Director
R6	Tour guide, trail user, NGO, travel agency owner	Biologist, Consultant, Guide and Adventure Sports Instructor
R7	Trail user	Environmental Engineer, Consultant, Social and Environmental Responsibility Coordinator
R8	Advisory council, volunteer	Architect and Urban Planner, MSc, Project Leader
R9	Tour guide, trail user, volunteer, travel agency founding partner	Tourism professional, Tourism Consultant
R10	Mountaineering club, frequenter of trails	Social Scientist, MSc, Organizational Development Consultant

SOURCE: developed by the authors.

2.4. Data analysis

During data collection (literature and document review, participant observation and interviews), a preliminary analysis was performed through daily field notes and transcription of interviews. For a more in-depth examination, the Content Analysis technique was employed, which describes the content of messages and infers relationships between discourse and external aspects (Bardin, 2011; Khirfan *et al.*, 2020).

The Content Analysis enabled data interpretation and association with the analytical categories set forth in Ostrom's Institutional Analysis and Development (IAD) framework, allowing for a comparison of information regarding the social groups and actors involved in the use and conservation of common-pool resources. This approach eased constructing discourse matrices concerning the interactions among different groups, thereby enhancing understanding of the institutional arrangement formation process in the region under study.

3. Results

The results present the identification and characterization regarding how collective action and institutional arrangements are formed in Serra da Mantiqueira, specifically within the Marins-Itaguaré massif. The findings are organized into four categories:

1) Adaptation and refinement of the conceptual framework.

2) Identification and description of formal and informal action arenas where collective action and rules for use and conservation emerge.

3) Identification of conservation activities developed.

4) Characterization of interest groups, their motivating factors and their roles in collective action and in developing institutional arrangements.

3.1. Adaptation and refinement of the conceptual framework

Based on the data collection and analysis processes, adaptations and refinements were made to the framework proposed by Oliveira *et al.* (2024), aiming to characterize actors and coalitions, as well as their roles and interrelations in the process to structure collective action in the Marins-Itaguaré crossing region (Figure 4).

The first result observed through the conceptual framework proposed highlights the crucial role of mountaineering activities (square on the left in Figure 4). Despite the negative environmental impacts widely reported in the literature, such as improper waste disposal, trampling, vegetation suppression and water pollution (e.g., Bridle & Kirkpatrick, 2003; Pickering & Barros, 2015; Dynowski *et al.*, 2019), and observed during the participant observation and documentary analysis phases, mountaineering also generates positive socioeconomic

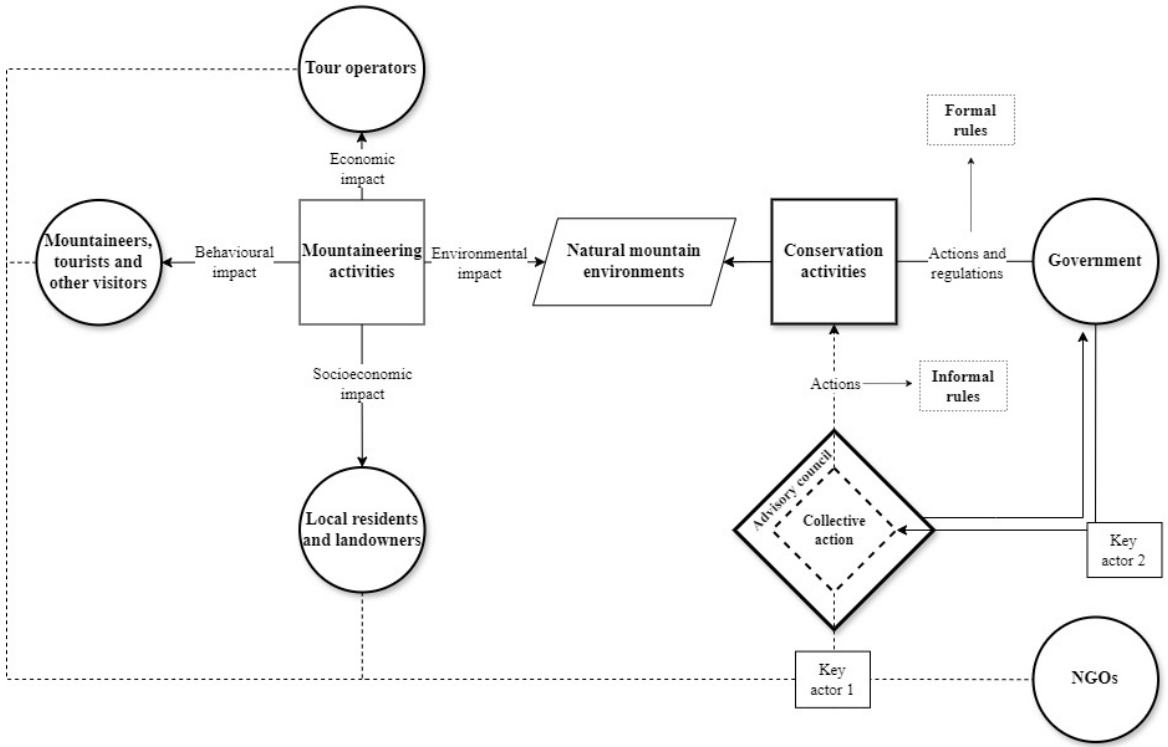

FIGURE 4 – Conceptual framework, adapted and refined.
SOURCE: developed by the authors.

and behavioural impacts. These include income generation (e.g., parking fees, local commerce, tourism packages), improved relationships with nature and appeal to individuals interested in preserving natural environments, as also noted in the literature, even if indirectly (e.g., Sacareau, 2009; Hoyem, 2020; Latip *et al.*, 2020), and confirmed through fieldwork and document review. These positive impacts encourage actors to engage in conservation efforts, while the negative ones mobilize them toward damage mitigation, such as organizing clean-up campaigns along trails and campsites (participant observation and documentary analysis).

However, social mobilization is not spontaneous. Some key actors (1 and 2 in Figure 4) were instrumental in structuring the action arenas (nested diamonds in Figure 4) and enabling these arenas to conceive collective conservation efforts. In turn, the collective action arena originated from the structure and composition of *Câmara Temática de Montanha* (Mountain Thematic Chamber), a formal consultative arena within the advisory councils active in the region (solid diamond in Figure 4). From this formal arena, an informal deliberative arena emerged for decision-making within the collective action scope (dotted diamond in Figure 4). The key actors with agency capacity (key actors 1 and 2 in Figure 4) permeated, mobilized and organized groups of social actors within the arena. Thus, two fundamental elements for collective action in the region are emphasized:

1) Defining a decision-making arena for conservation-oriented collective action.

2) The role of key actors 1 and 2 in mobilizing interest groups to implement the action.

3.2. Decision-making arena for collective action

As sustainable-use conservation units, EPAs establish governance rules that guide public and private land use, defining boundaries, responsibilities and formal rights for local populations and other social actors within the territory. The Conservation Units National System (*Sistema Nacional de Unidades de Conservação*, SNUC) defines the role of EPAs and mandates the creation of councils chaired by the managing authority and comprised by representatives from public agencies, civil society organizations and local communities (Art. 15 § 5, Law No. 9,985 dated July 18th, 2000). The Advisory Councils of the Serra da Mantiqueira EPA (*Conselho Consultivo da APA da Serra da Mantiqueira*, CONAPAM) and the Mantiqueira Mosaic follow this formal structure.

CONAPAM works as an advisory council without deliberative power, but it reflects the State's willingness to engage with local organizations to establish or revise land-use rules, serving as a listening space for local governance. Together with the Mantiqueira Mosaic advisory council, CONAPAM created *CT Montanha* among other initiatives. This chamber served as the starting point to structure an informal decision-making arena for collective action in the Marins-Itaguaré massif (dotted diamond in Figure 4).

Within the advisory council, *CT Montanha* operates as an action arena providing a space for discussing rules and decisions driven by the social actors' interest in participating in the decision-making process (solid diamond in Figure 4). Thus, *CT Montanha* can be viewed both as a consultative arena for structuring new formal institutions and

as a deliberative arena for collective action and for establishing informal norms within the territory. The importance of these structures in formal institutional processes and collective action was evidenced by examples provided during the interviews, such as mobilization of users and landowners for trail conservation, regulation of large-scale events held in the area (e.g., mountain races), development of guidelines and best practice manuals and wildfire monitoring, among other initiatives.

Social actors associate according to their interests, whether in economic exploitation of trails and landscapes for tourism or in environmental conservation, assembling interest groups (circles in Figure 4) that engage in disputes within the arena. These groups are generally comprised by previously organized actors, as outlined in the conceptual framework, including tour operators, visitors, local populations, NGOs and governmental bodies, all involved in conservation efforts (Figure 4). The revised conceptual framework distinguishes NGOs from governmental actors, recognizing that the former have a distinctive local role that should be represented separately.

3.3. Conservation activities undertaken

The conservation activities within the collective action scope include maintenance and clean-up campaigns for trails and campsites, signage installation, summit log data systematization, implementation of access logs, trail management courses, environmental education, distribution of waste tubes, and wildfire prevention and response initiatives (CONAPAM, 2019a; 2019b; 2019c). The organization of trail and campsite maintenance and clean-up campaigns stands out among these activities.

These campaigns are primarily coordinated by *CT Montanha*, involving tour operators, visitors, NGOs, local residents and governmental agencies. Each group contributes technical and scientific knowledge, as well as logistical support such as food and water for volunteers. The organization of these actions is evidenced by invitations and reports published since 2018 on the CONAPAM blog, created to disseminate information and activities from different bodies participating in the council, as well as records in council meeting minutes[1]. One excerpt highlights: "An unprecedented collaboration effort among environmental public managers, landowners, mountaineers and environmentalists has been carrying out visitation monitoring and trail maintenance actions in the Serra da Mantiqueira EPA" (CONAPAM, 2019b[2]).

This excerpt underscores the coordination among various social actors in trail conservation efforts within the APASM territory. Another excerpt points to growing interest among landowners near the Marins peak in supporting conservation activities: "Neighbouring landowners have shown strong interest in supporting the activities, as they feel more

[1] Available at: https://www.gov.br/icmbio/pt-br/assuntos/biodiversidade/unidade-de-conservacao/unidades-de-biomas/mata-atlantica/lista-de-ucs/apa-da-serra-da-mantiqueira/conselho-consultivo-da-apa-da-serra-da-mantiqueira-conapam

[2] CONAPAM blog – *Monitoramento e Manutenção de Trilhas da APA da Serra da Mantiqueira*. Available at: http://blogconapam.blogspot.com/2019/08/texto-de-mantiqueira-bem-e-analistas-da.html

engaged with the issue alongside APASM, helping to prevent future problems" (CONAPAM, 2019a[3]).

Additional excerpts also reveal calls for voluntary participation in clean-up campaigns and the implementation of environmental education initiatives along the trails, characterized as informal collective action within *CT Montanha*:

> A call for volunteers was issued for a new clean-up campaign scheduled by the Passa Quatro Guides Association, which is part of the Serra da Mantiqueira EPA volunteer group. The campaign will take place at the Itaguaré peak on Friday, December 14th, with the meeting set at 7:00 a.m. in the Passa Quatro bus station. (CONAPAM, 2019c[4])

> Mantiqueira Mosaic's awareness campaign for waste tubes (Shit Tubes) is underway, with the first awareness and distribution event held at Marins on August 2nd and organized by the Serra da Mantiqueira EPA Volunteer Program. (CONAPAM, 2020, p. 17)

At least one event was held under CONAPAM auspices between 2019 and 2020, gathering volunteers from various groups to replace summit logbooks, maintain the containers in which the books are stored, systematize data and schedule periodic maintenance. Additionally, at least three trail management campaigns were conducted along the Marins-Itaguaré crossing, involving groups of 10 to 20 individuals, including mountaineers, tour operators, fire brigaders, teams from the Itatiaia National Park and local residents. The activities included construction of stone crossings, maintenance of wooden bridges and trail rerouting to prevent trampling over watercourses. Clean-up efforts were also organized at the end of the mountain season (September/October) and after extended holidays, aiming to collect waste left by visitors along trails and campsites. All this information was gathered through participant observation and public communications via the CONAPAM blog and social media platforms.

Implementing these campaigns is crucial for biophysical and aesthetic maintenance of the trails, helping to prevent issues such as soil erosion, trampling of watercourses and increased rodent populations due to waste accumulation. However, some actors emphasize that these actions alone are not sufficient to ensure the conservation of natural mountain environments. They stress the need for effective institutional arrangements for access control and environmental education targeted at visitors (as cited in the interviews and in the participant observation phase).

Within the *CT Montanha* scope, in collaboration with the Mantiqueira Mosaic council and CONAPAM, the "Guidelines for Best Practices in Tourism Use of the Mantiqueira Ridges" manual was developed. Consisting of informal rules established through agreements among actors involved in the action arena, this document aims at regulating and sustainably managing visitation and tourism activities along the Mantiqueira ridge trails. Its objectives include reducing negative impacts, supporting the local tourism supply chain and strengthening voluntary participation in trail and campsite management

[3] CONAPAM blog – *Relato de Ações do Grupo de Voluntariado da APASM no Âmbito da Câmara Temática de Montanha (CT-Montanha) do CONAPAM*. Available at: http://blogconapam.blogspot.com/2019/08/relato-de-acoes-do-grupo-de.html

[4] CONAPAM blog – *Ações de Voluntariado no Manejo de Trilhas no Pico do Itaguaré*. Available at: http://blogconapam.blogspot.com/2019/12/acoes-de-voluntariado-no-manejo-de.html

efforts. However, the guidelines manual is not available through official channels, with only references to its development found in council meeting minutes and in the 12th Mantiqueira Ridges newsletter, published on the CONAPAM blog in September 2021.

Creation of this manual – non-binding due to its informal nature – highlights the importance of bottom-up contributions in addressing gaps left by formal legislation. Management bodies acknowledge ambiguities in existing laws and formal rules and recognize that the uncertainties they generate must be discussed and mitigated through the councils, whose local decision-making processes for collective action are the focus of this study. This topic is explored in greater detail in the following section.

3.4. Interest groups, collective action and institutional arrangements

The government participates in the action arena through two main institutional layers. The first, at the federal level, is represented by the APASM, managed by the Chico Mendes Institute for Biodiversity Conservation (*Instituto Chico Mendes de Conservação da Biodiversidade*, ICMBio). APASM's management contributes to developing collective action primarily by transferring the *CT Montanha* formal structure (under CONAPAM) to an informal decision-making arena for collective action. Diverse evidence gathered from interviews highlights the importance of this transfer in structuring collective action, emphasizing the need for participatory management and volunteer work to foster local community autonomy and regulate trail use (R2 and R4).

At the State level, the second layer refers to *MONA Mantiqueira Paulista*, whose primary goal is to preserve biodiversity within the São Paulo corridor of Serra da Mantiqueira. Managed by the Forest Foundation linked to the São Paulo State Secretariat for Environment, Infrastructure and Logistics, *MONA Mantiqueira Paulista* encompasses two of the highest peaks in the state of São Paulo: Marins (2,427 m) and Itaguaré (2,308 m). This unit overlaps with other federal (APASM), municipal (*MONA Municipal Pico do Itaguaré*) and private conservation units (RPPNs) (SEMIL, 2024).

The area is also part of the Mantiqueira Mosaic and actively participates in its advisory council. The MONA leads conservation efforts along the Marins-Itaguaré crossing trail, as evidenced by events such as "A Day in the Park" in 2023 and 2024, which included waste tube distribution and environmental education activities[5], and its collaboration with CONAPAM and *CT Montanha*, as documented in the 66th and 69th CONAPAM meeting minutes.

In the framework, two solid arrows connect the government representation (circle in the upper right corner from Figure 4) and the action arena (solid diamond in Figure 4). The arrow from the arena to the government represents the advisory council outcomes, which legitimize governmental policies and provide human capital for formal conservation actions. The arrow from the government to the arena indicates support for collective action within the informal arena.

NGOs in the action arena (Figure 4) aim at supporting the conservation of local protected areas. In the Marins-Itaguaré massif region, these NGOs are locally based and focused on preserving natural

[5] Shared via MONA's social media: https://www.instagram.com/p/CvFxkqkuHDp/?igsh=MTJ6NTJtaWQ4Zmx0Mg==

mountain environments. They actively participate in advisory councils and contribute to management plans, guidelines manuals, conservation projects and proposals for new protected areas, such as the initiative to create the "*Altos da Mantiqueira* National Park", led by an NGO and supported by other organized social actors under the "Mantiqueira Task Force".

Tourism operators such as mountaineering guides, local agencies and independent providers have economic interests in mountain exploration, but they also actively engage in conservation efforts within the EPA. They frequently volunteer in trail maintenance campaigns to ensure a minimally viable infrastructure that supports local conservation. Additionally, guides and agencies promote environmental awareness among their clients, as evidenced in the interviews (R3 and R6).

Mountaineers, tourists and other visitors engage in mountaineering activities in the region as a hobby, sport or leisure pursuit, valuing the well-being and satisfaction inherent to exploring natural environments. Generally, they are interested in preserving the area to continue their activities and, thus, they participate in collective conservation efforts. These groups are oftentimes organized through social media, where they schedule hikes and outings with or without guides and discuss relevant topics such as equipment, weather conditions and environmental conservation.

In addition to these groups, mountaineering clubs offer hiking and climbing courses and excursions. The semi-structured interviews and participant observation revealed groups focused on raising awareness among new mountaineers and educating them, with comments highlighting concern for promoting low-impact practices and setting examples for first-time visitors to mountain environments.

Conversely, some other groups hold more exclusionary views, believing that only well-prepared individuals should access mountain environments and advocating for regulations that restrict inexperienced users from entering mountain trails. There are also individual actors who oppose certain conservation measures, such as mandatory use of waste tubes on Mantiqueira trails.

Affected by mountaineering activities and economically dependent on tourism, local populations are generally dispersed among other groups, particularly those created by tourism operators and mountaineers. However, some landowners have begun organizing themselves into associations upon recognizing the importance of preserving their lands. A notable example is the Serra Fina crossing trail, where access became regulated by a landowners' association following a major wildfire in 2020.

Prior organization of these actors eases assembling nucleations, that is, the combination of two or more organizations to achieve a common goal, such as maintaining mountaineering activities in alignment with mountain environment conservation (dotted line in Figure 4). However, these nucleations rarely emerge spontaneously and typically require the involvement of a key actor with agency capacity who, due to their intellectual, cultural or social capital persuasive skills, can structure a coalition around collective action (key actors 1 and 2 in Figure 4).

The participant observation phase during the council meetings and semi-structured interviews identified at least two key actors with these characteristics. Key Actor 1 (R6) emerges from the

informal arena and engages across all the groups described (tourism operators, mountaineers, local residents and NGOs). This actor was nominated as a potential respondent in at least four of the ten interviews conducted. Statements such as the following ones further illustrate their involvement in the action arenas:

> So these parameters [guidelines manual] were predefined together with the entire CONAPAM body, there are several people that I didn't mention, but I know that there was a, let's say, teaching staff there and a good part of them are specialists; for example, [Key Actor 1] is a biologist. (R3)

> I've worked with a very competent technician who knows a lot about these mountains. I'd like to mention two, actually. One is more in the mountaineering and biology fields, and you might have heard of him: he's [Key Actor 1]. (R5)

> [Key Actor 1] has a long history in mountaineering, one of the Association for Mountaineering and Protection of the Serra da Mantiqueira [AMPM] founders, he invited us when the association was positioning itself alongside the EPA. (R9)

A Biology graduate, Key Actor 1 has been involved in mountaineering-related activities since the 1980s, including wildfire response, trail management, environmental education, protected area administration and participation in conservation-focused NGOs. His background demonstrates intellectual, cultural and social capital that grants him legitimacy and agency capacity as a Key Actor, making him essential for aligning diverse interests within the action arena and assembling nucleations (Key Actor 1 in the dotted line connecting groups from Figure 4).

Key Actor 2 plays a fundamental role in structuring the formal arena (*CT Montanha*) and transferring it to the informal collective action arena, representing the government. She was central to establishing dialogue, maintaining the arena and mediating conflicts, thanks to strong relationships with other stakeholders. Statements such as the following highlight her importance both in the formal and informal arenas:

> [Key Actor 2] was always our main focus point in managing public use of the EPA. (R2)

> [Key Actor 2] is the most important figure in this process, she carried everything on her shoulders and should definitely share her testimony. (R4)

> [Key Actor 2] was an environmental analyst at the EPA and coordinated the volunteer program for a long time, we used to joke that she was everyone's mother there, she coordinated all that work, and it was very well done. (R8)

A Forestry graduate, Key Actor 2 worked for over a decade in managing the APASM, leading various mountain conservation initiatives, including the creation of *CT Montanha*. Her intellectual, cultural, social and political capital supports her role as a key actor. The coordinated efforts by both key actors created a favourable environment for developing collective action.

When these key actors left the arena whether due to personal reasons, internal conflicts or changes in management, collective action became demobilized, primarily due to lack of incentives for collaboration. This is evidenced by statements such as the following ones:

> [Key Actor 2] was transferred to another conservation unit, and that really set us back, because [Key Actor 2] was our main focus point for managing public use of the EPA, especially the Mountain Thematic Chamber and the volunteer program, which have been the anchors of tourism management and trail use in Serra Fina over the past five years (R2)
>
> With [Key Actor 2] leaving, there was major demobilization, because she really made things happen. (R2)
>
> [Key Actor 1] is very militant, with a strong environmentalist discourse, but I have my criticisms, we clashed a bit because he's not very pragmatic, he was very resistant to the Transmantiqueira movement, and I think the AMPM ended up strained, there was a rupture. (R9)

In a second phase, the arena's structure was dissolved. After the COVID-19 pandemic, renewal of CONAPAM's membership and creation of the Mantiqueira Integrated Management Centre (*Núcleo de Gestión Integrada*, NGI), which merged the APASM with another two conservation units, eliminated the local specificity of the formal arena. This space where social actors gathered to consult with the State and deliberate on collective action was dismantled. Evidence includes absence of blog and social media posts after 2022, missing meeting minutes from that year, lack of public calls for council meetings and statements such as the following ones:

> No contact has been made so far [three months after the management change] to strengthen ties [with the volunteer program] and the NGI (CONAPAM, 2021, p. 42).
>
> CT Montanha is currently demotivated, and just as volunteers are expected to support the management team, the team must also support the CT, which doesn't feel adequately backed (CONAPAM, 2023, pp. 1–2).
>
> Creation of the NGI was a deeply traumatic process, particularly for the APASM team, I don't know how the process affected the teams of the other two conservation units, it was largely carried out without any involvement of conservation units […], we had a very different stance at the ICMBio than what the management had been doing, so the new management did everything behind closed doors (R2).
>
> With the establishment of the NGI Mantiqueira, the original focus began to dissipate, today the emphasis is no longer on zoning and regulation of these vast territories, which include the Mantiqueira range prominent peaks, the process came to a halt, the analyst [Key Actor 2] that was most involved in this process was removed, she requested to be removed from Mantiqueira, this part was lost because the current managers don't pay due attention to this planning process (R4).
>
> In the last few years, since the pandemic, there's certainly been some demobilization because of that, due to lack of continuity, it coincides with that, with those years that I told you about until 2018, when there was great mobilization, and then there was no continuity (R9).

After the creation of the *Mantiqueira Paulista* Natural Monument in 2021, conservation efforts in the Marins-Itaguaré massif came under management of the State of São Paulo Forest Foundation. Several initiatives have been implemented since then, including environmental awareness campaigns, distribution of waste tubes, trail and campsite signage in partnership with the fire department and seed dispersal in collaboration with the *Gigante do Itaguaré* Private Natural Heritage Reserve (RPPN). However, there is still no consolidated informal

arena for collective action comparable to the one previously established under CONAPAM.

Another critical issue is the presence of free-riders. Despite the existence of key actors, a structured arena and ongoing collective action, certain groups (typically from outside the region) benefit from the local actors' efforts without participating in collective initiatives or taking responsibility for the socio-environmental damage they cause. These impacts are documented in mountaineering-related social media posts, where guides, tourism agents and mountaineers report negative consequences such as improper waste disposal, human excrement, vegetation suppression and trampling of watercourses.

It is essential to recognize that local collective action requires a *locus*, a space for dialogue where relevant issues can be discussed. Such a space would contribute to developing institutional arrangements and serve as a deliberative body for voluntary collective action.

4. Discussion

The main findings from the methodological triangulation align with the objectives of this article. Initially, the key institutions and actors within the action arenas were identified, revealing a pre-existing organization level within their respective groups, which eases assembling nucleations in contested environments. The conceptual framework restructuring highlights the influence of a formal action arena, under CONAPAM, which also works as an informal deliberative space where collective action and discussions about new institutional arrangements take place. Among the key findings, it is noteworthy that, although motivational and interest-based elements related to mountain activities contribute to collective action, such mobilization is not spontaneous. In this case, other elements enabled the realization of collective action, such as the transposition of structural and agency-related components from the government and the key actors' social skills.

The results indicate that, due to the absence of specific formal rules for the conservation of mountain environments, informal groups mobilize collectively to establish informal conservation norms. This mobilization fosters interest and motivation for a deeper understanding of the environment, promoting voluntary conservation actions that transcend State organization and landowners' individual interests. Such actions generate collective engagement, aligning with the alternative governance models proposed by Ostrom (1990).

Ostrom *et al.* (1990; 1999) propose an alternative to State-based management, initiated at the collective level, where common resource appropriators seek to understand the biophysical structure of the resources and develop usage rules adapted to the temporal and local contexts, as well as to community norms, rather than following pre-established instructions. They also emphasize that one of the initial challenges inherent to this "self-organized governance" is to fairly and feasibly convince sceptical actors that resources are limited and that cooperation will yield benefits, thus requiring restrictions on resource use.

The findings also suggest that mountaineering activities can be instrumental in helping the participants understand the importance of the resources they use and the benefits of their conservation, thereby encouraging participation in collective action.

These insights are supported by Chamberlin (2010), Bramwell (2011), Mbaiwa and Stronza (2011), Hwang and Stewart (2016), Schmidt *et al.* (2016), Goldberg *et al.* (2017), Hofman *et al.* (2020), Partelow and Nelson (2020), Oliveira *et al.* (2021) and Oliveira *et al.* (2024). The structure and agency transposition from a formal arena to informal group discussions interested in collective action is particularly significant, as is the presence of key actors with social skills capable of articulating various disputing groups, easing persuasion and catalysing actors toward collective action.

Ostrom (2005) argues that the arena levels influence one another, with the constitutional level delimiting the possibilities for collective action situations. This article identified that, beyond the institutional framing provided by the constitutional level (government), establishing a formal local action situation was crucial for collective action, serving as a replication of the formal structure. Transposition of the formal structure, characterized by *CT Montanha* within the region's advisory councils, and the agency capacity of Key Actor 2 within the government, were essential for mobilizing symbolic, political and economic capital in the development of collective action (Pavanelli *et al.*, 2022; 2023).

As Fligstein (2001) stated, the findings demonstrate that the key actors' social skills are fundamental to group functioning, as they induce cooperation among actors by defining collective interests and identities, resulting in the creation of institutions (i.e., shared rules) and meanings that shape social relations. The role of these key actors, endowed with strong social skills, is crucial to the success of collective action aimed at preserving trails and campsites in the Marins-Itaguaré massif region. These actors not only legitimately represent group interests but also mobilize other actors to participate in the arena by leveraging their social endowments.

Unlike the empirical cases presented by Ostrom (1990), the arrangements discussed in this article are more vulnerable to actions by free-riders due to the limitations of the agreements, which do not encompass all actors involved with the mountain environments in the region. Only some visitors and users commit to the collective action objectives. The presence of actors external to the action arena, disconnected from the agreed-upon institutions yet operating in the same natural mountain environments, gives rise to opportunistic behaviours (free-riders), who benefit from the collective action outcomes while oftentimes contributing to negative impacts without bearing the conservation costs (Olson, 1965).

The presence of free-riders highlights the social capital limits, where the collective action reach is constrained by the strength of the commitments among social actors (Ostrom, 2005). Within the arena, as groups assume mutual commitments there is informal pressure to uphold agreements, based on maintenance of the social capital (trust, reciprocity, solidarity). Thus, collective action tends to be weakened when more actors in the arena fail to align their behaviours with social capital preservation.

This destabilization also takes place when skilled actors and the action arena structure are removed. These findings corroborate the arena levels proposed by Ostrom (2005), showing the influence of the constitutional level on collective action, as observed in several empirical cases

presented by Ostrom (1990), where the creation of institutional arrangements for collective action is shaped by structures and arrangements at the constitutional level of action arenas. In her various papers and empirical case studies, Ostrom addresses community attributes and discusses the role of social capital but provides limited details on how these factors concretely articulate in formulating and implementing collective action, focusing instead on elucidating the structures of the problems faced and why the rules adopted appear to work (Ostrom, 1990).

This article identified that the interests and meanings social groups attribute to mountain environments were the starting point for collective mobilization toward conservation. Furthermore, community attributes such as the role of actors with social cooperation skills and the establishment of common agendas, as well as the transposition of structures from formal arenas to informal collective action ones, were essential to the collective conservation efforts in the mountain environments studied.

5. Conclusions

The empirical evidence presented in this article reveals several essential factors for promoting collective action aimed at preserving natural mountain environments. One such factor, structural in nature, is transposition of the *CT Montanha* as a model for the informal action arena. Another factor, functional in nature, is the key actors' agency capacity. This agency is primarily exercised by a governmental actor that transfers their formal agency to a more informal environment, where their social skills in maintaining cohesion, organization and dialogue are crucial. Another key actor, whose legitimacy and agency stems from symbolic capital, operates transversally across social groups, representing diverse interests and exploring convergence points among tourism operators, visitors, local populations and NGOs.

It is concluded that collective action for the conservation of natural mountain environments in the Marins-Itaguaré massif region is primarily driven by informal nucleations of groups such as tourism operators, mountaineers, tourists and local residents, in collaboration with NGOs and governmental bodies. This characterizes a bottom-up management approach, with significant participation from governmental agents who are essential for structuring and sustaining collective action. A critical point of concern is the weakness represented by dependence on skilled actors and the formal structure of the arena for developing collective action. Removal of these elements tends to destabilize collective action and, consequently, conservation efforts.

Greater attention must be paid to the role of these actors in decision-making processes, as seemingly minor changes in governance such as the departure of key actors can dismantle informal arenas and demobilize communities. It is recommended that future studies investigate, through multiple case studies, how collective action unfolds in other key mountain activity sites within *Serra da Mantiqueira*, including areas under private and governmental management, in order to establish a more comprehensive panorama of collective governance in the region.

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