

Culturally Embedded Governance for Fire Management: A Case Study of Social Innovation in Andohahela National Park, Madagascar

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ABSTRACT

In the semi-arid agropastoral systems of southern Madagascar, fire has historically been a functional and culturally embedded tool for pasture management. However, demographic pressure, climate change, and the erosion of customary institutions have led to uncontrolled bushfires, threatening both biodiversity in protected areas and the livelihoods of local communities. Conventional top-down fire management policies have proven largely ineffective due to their disconnect from local socio-cultural realities.

This study employs a qualitative case study design to analyse an innovative community-based fire management initiative in the buffer zone of Andohahela National Park. The initiative is focused on a community social pact (locally framed as a “fady”), sanctioned by traditional authorities and operationalized through village vigilance committees. Data were derived from an in-depth analysis of an unpublished 2025 mission report from Madagascar National Parks and relevant academic literature, using qualitative content analysis to identify key themes related to governance, social learning, and institutional innovation.

The findings reveal that the integration of customary governance structures and ritual practices generated a socially legitimate and effective fire management system. The ritualized social pact embedded rules within moral and spiritual frameworks, shifting enforcement from external policing to internalized social control. Village vigilance committees translated this commitment into practical action through prevention, surveillance, and rapid response. Customary authorities played a central role in legitimizing and enforcing the pact, creating a bridge of trust between communities and conservation institutions. The initiative was associated with observable shifts in behavior and discourse among community members.

The Andohahela case demonstrates that culturally embedded governance mechanisms can significantly enhance fire management outcomes. The study contributes to Agricultural Knowledge and Innovation Systems (AKIS) and agroecological transition theories by highlighting the transformative role of cultural and institutional innovation. It offers practical implications for conservation practitioners and policymakers, emphasizing the need for cultural diagnostics, support for local governance structures, and the formal recognition of customary institutions in protected area co-management.

Introduction

Agropastoral systems in the semi-arid south of Madagascar are historically structured around the use of fire for pasture regeneration and land preparation. Known locally as “tavy”, burning is not only an agronomic technique but also a culturally embedded practice linked to customary land tenure, rituals, and social regulation [1]. Under conditions of low population density and strong customary control, fire use was historically regulated and spatially contained through informal norms, seasonal

calendars, and collective sanctions. Fire thus played a functional role in maintaining pasture productivity and controlling woody encroachment while remaining socially governed [2].

However, recent decades have witnessed a significant transformation in these dynamics. Demographic growth, climate variability, market integration, and the progressive weakening of customary institutions have led to the intensification and uncontrolled spread of fires [3]. Increasing competition over

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land, reduced fallow periods, and prolonged dry seasons have altered both the frequency and spatial extent of burning. Today, bushfires constitute one of the most significant anthropogenic pressures on Madagascar's ecosystems, contributing to habitat fragmentation, biodiversity loss, soil erosion, and reduced carbon sequestration [4]. These ecological impacts are accompanied by social consequences, including declining pasture quality, reduced agricultural productivity, and increased vulnerability of rural livelihoods [5].



Figure 1: Communities living around the park

Caption: View of the agropastoral landscape in the buffer zone of Andohahela National Park, showing the proximity of villages to the protected forest areas. The image illustrates the overlapping land uses, grazing, shifting cultivation, and settlement expansion, that characterize the park's periphery and create tensions between conservation objectives and local livelihood strategies.

Source: Madagascar National Parks (2025)

These dynamics are particularly acute in the buffer zone of Andohahela National Park, a UNESCO World Heritage Site characterized by exceptional ecological gradients ranging from humid forests to arid spiny ecosystems [6]. The park's periphery concentrates overlapping land uses, including grazing, shifting cultivation, fuelwood collection, and settlement expansion. In this context, repeated fires threaten globally important conservation values while simultaneously undermining the natural resource base that sustains surrounding agropastoral communities. This situation generates a persistent tension between conservation objectives and local livelihood strategies, often expressed through mistrust, conflict, or non-compliance with formal regulations [7].

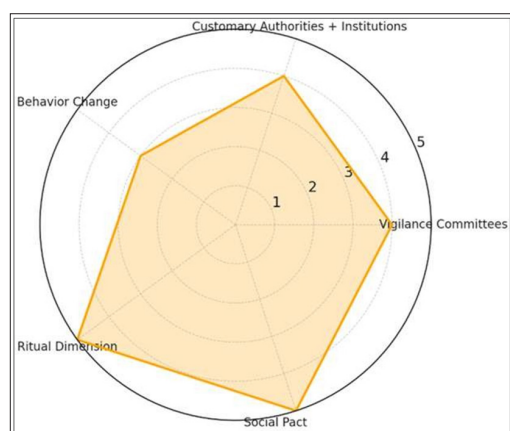


Figure 2: Conceptual framework for community fire management, integrating customary governance and ritual practice

Caption: Conceptual framework illustrating the integration of customary governance, ritual practice (*fady*), and community-

based structures (vigilance committees) for fire management in the Andohahela buffer zone. The framework shows how these elements interact synergistically: (1) the ritualized social pact embeds rules within moral and spiritual registers, shifting enforcement from external policing to internalized social control, (2) vigilance committees translate symbolic commitment into practical action through prevention, surveillance, and rapid response, and (3) customary authorities (chiefs, elders, ritual specialists) act as custodians of the agreement, creating a bridge of trust between communities and conservation institutions. Together, these interconnected outcomes produce social innovation and contribute to agroecological transition processes. **Source:** Author's elaboration based on Madagascar National Parks (2025)

Conventional fire management policies in Madagascar have largely relied on top-down regulatory and enforcement-based approaches promoted by state institutions and conservation agencies [3]. In Andohahela, as in many other protected areas, such approaches have shown limited effectiveness. Their failure is largely explained by a disconnect between formal regulations and local socio-cultural realities. By neglecting local ecological knowledge, customary authority, and existing community capacities, externally imposed rules often lack legitimacy, provoke resistance, and fail to produce durable behavioural change [8]. In some cases, strict prohibition has even reinforced clandestine burning practices, further weakening governance outcomes [9].

In response to the shortcomings of top-down approaches, an innovative community-based initiative emerged in the village of Beroanga (Commune of Tranomaro, Anosy Region). Facilitated by Madagascar National Parks with support from UNESCO, this process culminated in the establishment of a binding community social pact, locally framed as a "*fady*" (ritual prohibition or curse), involving seven neighbouring villages. Sanctioned through customary rituals and endorsed by traditional authorities, the pact commits agropastoralists to restrict uncontrolled burning. It is operationalized through locally established vigilance committees responsible for prevention, surveillance, and rapid response to fires [10]. This initiative reflects a deliberate effort to reconcile conservation imperatives with cultural continuity and community autonomy.

Theoretically, this experience resonates with Agricultural Knowledge and Innovation Systems (AKIS) approaches, which emphasize knowledge co-production, social learning, and multi-actor governance rather than linear technology transfer [11,12]. It also aligns with agroecological transition frameworks that conceptualize sustainability transitions as socio-technical, institutional, and cultural transformations rather than purely technical changes [13]. The Andohahela case thus provides an empirically grounded example of social innovation rooted in cultural embeddedness, where customary institutions and ritual practices are recombined with contemporary conservation objectives to address complex socio-ecological challenges.

This paper aims to analyse how the integration of local knowledge, customary practices, and community capacity building can enhance the legitimacy and effectiveness of fire management while contributing to agroecological transition

processes in the buffer zone of Andohahela National Park. The study is based on the premise that fire management challenges at the conservation-agriculture interface are fundamentally governance and social innovation issues.

Materials and Methods

Research Design and Context

This research adopts a qualitative case study design focused on the community fire management initiative implemented in the periphery of Andohahela National Park. This approach allows for an in-depth and contextualized analysis of interactions between cultural practices, governance arrangements, and environmental management outcomes [14]. The case study is bounded by the geographical area of the seven participating villages in the Beroanga area and the period from the initiative's inception to the present, with the primary data capturing the process up to 2025.



(3)



(4)

Figures 3 and 4: A two-phased approach to community sensitisation

Caption: Figure 3 captures the initial phase of community mobilisation, characterised by a large, informal assembly held beneath a mature tree, serving as the village's natural "palabre tree". This setting was deliberately chosen to maximise accessibility and inclusivity, allowing a broad cross-section of the community, predominantly men and youths in this instance, to gather without logistical constraints. This informal environment fostered an open dialogue, enabling the project facilitators to gauge the community's existing knowledge, address initial concerns, and secure broad-based buy-in for the upcoming interventions.

Subsequently, Figure 4 illustrates the transition to a more structured, formal phase of knowledge dissemination. The setting shifts to a dedicated covered marquee, equipped with microphones and official branding, indicating the arrival of external partners and subject-matter experts. Notably, this session is characterised by a predominantly female audience, with mothers and caregivers seated attentively in rows. This

segmentation demonstrates a targeted approach, suggesting that the specific topics addressed (likely pertaining to maternal health, nutrition, or household welfare) were tailored to the direct priorities and responsibilities of women within the household.

Collectively, these figures demonstrate a dual-pronged methodology: Figure 3 utilises grassroots, informal approach to establish trust and mobilise the general population, while Figure 4 employs a formal, gender-specific pedagogical strategy to deliver precise, actionable information. This adaptive framework ensures that the sensitisation campaign is not only culturally resonant but also technically effective in achieving sustainable behavioural change within the target community.

Source: Author (2025)

Andohahela National Park, located in the Anosy Region of southeastern Madagascar, is a unique conservation area due to its exceptional ecological gradients, ranging from humid forests on the eastern slopes to dry spiny forests in the west [6]. The park's periphery is a complex landscape where various land uses, including agriculture, pastoralism, and resource extraction, intersect. The local population is predominantly comprised of agropastoralists from the Antandroy and Mahafaly ethnic groups, who have a long history of interaction with the park's ecosystems. The community fire management initiative in Beroanga arose from a recognized need to address the escalating problem of uncontrolled bushfires in this sensitive interface area.



Figure 5: Cultural diagnostics

Caption: The initial phase of community engagement is grounded in participatory cultural diagnostics. As depicted in Figure 5, the intervention deliberately integrates itself into significant communal activities, such as the traditional preparation of livestock. This immersive approach serves a critical strategic purpose: it enables the team to map existing authority structures and belief systems prior to introducing external frameworks. Rather than imposing interventions externally, the project seeks to align its objectives with prevailing local norms and practices. By demonstrating respect for these customs and engaging directly within the community's cultural sphere, the facilitators establish essential trust and ensure that subsequent initiatives will be organically adopted rather than resisted.

Source: Author (2025)

Data Sources and Collection

The primary data source for this analysis is an unpublished 2025 mission report produced by Madagascar National Parks [10]. This document provides detailed accounts of community consultations, awareness-raising activities, negotiation processes, the ritual ceremony establishing the pact, and the structure and functioning of vigilance committees. The report is a rich source of qualitative data, containing observations, transcripts of community meetings, and descriptions of the ritual proceedings.

Secondary sources included academic literature on fire management in Madagascar, community-based conservation policies, and theoretical works on agroecology, AKIS, and social innovation. These sources were used to contextualize the findings and to develop the theoretical framework for the analysis.

Data Analysis

Data were analysed using qualitative content analysis, a method for systematically categorizing and interpreting textual data to identify patterns and themes [14]. The analysis combined deductive coding, based on AKIS and agroecological transition concepts (e.g., multi-actor governance, social learning, institutional hybridity), with inductive themes emerging from the case material (e.g., ritual sanction, customary enforcement, peer monitoring). The coding process involved several iterative steps: familiarization with the data, generation of initial codes, searching for themes,

reviewing themes, and defining and naming themes. The analysis emphasizes understanding processes and mechanisms rather than measuring biophysical impacts, focusing on the social and governance dynamics of the initiative.

Results

The analysis of the Andohahela experience reveals several interconnected outcomes that illustrate both social innovation and the strengthening of community governance for fire management. Together, the findings highlight how cultural practices, local governance structures, and institutional support can be combined to address environmental challenges.



Figure 6: Targeted Support

Caption: Following the establishment of cultural alignment and trust, the project transitions to the provision of targeted,

practical support. Figure 6 illustrates a collaborative meeting with the broader community, featuring a distinct focus on the local vigilance committee. The informal, seated nature of this gathering reflects a continued commitment to accessible dialogue. The strategic objective of this phase is to furnish these local committees with low-cost support, comprising specific training in safe fire control, the distribution of basic protective equipment, and the provision of essential logistical resources. By empowering community members with sustainable, affordable tools and skills, this approach ensures long-term operational resilience and promotes a sense of active local ownership over the safety and development of the village.

Source: Author (2025)

The Ritualized Social Pact: A Major Institutional Innovation

The formalization of a community social pact (*"fady"*) represented a major institutional innovation. Ritualized through a collective ceremony involving the sacrifice of an ox and oath-taking, the pact embedded fire management rules within moral and spiritual registers. Rule violation was framed not only as a regulatory offense but as a transgression against collective values, social cohesion, and ancestral authority. This moral framing significantly increased the perceived seriousness of compliance and shifted enforcement from external policing to internalized social control. By linking the rules to the sacred, the pact transcended the limitations of state-imposed regulations, which often lack local legitimacy. The involvement of seven neighbouring villages in the pact created a broader landscape-level agreement, fostering a sense of shared responsibility and collective identity.

Village Vigilance Committees: Translating Commitment into Action

Vigilance committees established in each village translated symbolic commitment into practical action. Their responsibilities covered three main areas:

- **Prevention:** Construction of firebreaks, community awareness-raising, and provision of advice on safe burning periods.
- **Surveillance:** Regular patrols during the dry season to monitor compliance and detect fires early.
- **Rapid Response:** Coordinated action to suppress fires before they could spread widely.

Their recognized authority and proximity to the landscape increased deterrence and reduced reliance on distant or understaffed formal enforcement agencies. Committee members also acted as mediators, resolving tensions over land and fire use before they escalated into open conflict. This local ownership and accountability were crucial for the system's effectiveness and sustainability.

The Central Role of Customary Authorities

Customary authorities played a central role in legitimizing and enforcing the pact. Chiefs, elders, and ritual specialists acted as custodians of the agreement, publicly reminding community members of their commitments and invoking cultural sanctions when necessary. Their involvement created a bridge of trust between communities and conservation institutions, enabling

a functional multi-level governance arrangement in which customary norms and formal conservation objectives reinforced one another rather than competing. Their authority ensured that the pact was not merely a written document but a living social contract, continuously reaffirmed through community discourse and customary practice.

Observable Shifts in Behaviour and Discourse

The initiative was associated with observable shifts in behaviour and discourse. Individuals previously identified as frequent users of fire publicly committed to limiting burning practices, participated in collective prevention activities, and increasingly framed fire management as a shared responsibility linked to community identity and long-term wellbeing. The discourse shifted from a focus on individual

rights to a concern for the common good, indicating a process of norm internalization. While long-term ecological impacts remain to be assessed, these early social and behavioural changes suggest the emergence of a more sustainable governance trajectory.

Discussion

Theoretical Implications

The Andohahela experience provides significant theoretical contributions to the fields of environmental governance and sustainability transitions.

Contributions to AKIS Theory

The study contributes to Agricultural Knowledge and Innovation Systems (AKIS) theory by demonstrating that customary authorities and ritual practices function as active actors within knowledge and innovation systems, facilitating knowledge co-production, legitimacy, and behavioural change [11]. In the Andohahela case, the innovation was not a new technology but a socio-institutional arrangement. The AKIS framework often focuses on formal institutions and scientific knowledge. This case expands the notion of innovation to include symbolic and institutional recombination, showing how traditional knowledge and governance can be integrated with conservation objectives to create novel and effective solutions. The ritual ceremony served as a powerful mechanism for social learning and knowledge transfer, embedding new rules and expectations within the community's cultural fabric.

Contributions to Agroecological Transition Theory

For agroecological transition theory, the findings challenge techno-centric perspectives that prioritize technological solutions like improved agricultural techniques or fire suppression technologies [13]. Instead, the Andohahela case highlights the transformative role of cultural and institutional innovation. The transition toward more sustainable fire management was not driven primarily by new technology but by a change in the social contract and governance norms. This illustrates that fundamental changes in norms, authority, and social contracts are foundational to sustainability transitions, particularly in contexts where agroecological systems are deeply embedded in cultural and social life. The “*fady*” pact acted as a social innovation that redefined the relationship between the community and its environment, creating the conditions for more sustainable practices to emerge.

Integration of Ritual and Moral Economy

More broadly, the study argues for integrating ritual, moral economy, and cultural embeddedness into sustainability and social innovation theories, particularly in non-Western contexts where the sacred and social are inseparable from environmental governance. The case shows that “*fady*” is not just a set of prohibitions but a living institution that shapes behaviour through moral and spiritual sanctions. Ignoring such institutions in conservation planning is not only a missed opportunity but can be actively counterproductive, as top-down regulations often clash with these deeply held values. This case demonstrates that conservation success can be enhanced by recognizing and working with these existing social and cultural logics.

Practical Implications

The Andohahela experience offers several practical lessons for conservation practitioners, development actors, and policymakers.

The Value of Cultural Diagnostics

The findings highlight the importance of conducting cultural diagnostics at an early stage of project design. Mapping local authority structures, belief systems, and socially legitimate rituals allows interventions to align with existing norms rather than undermine them. This understanding is crucial for designing interventions that are not only effective but also durable, as they are rooted in the community's own social and cultural fabric. A “one-size-fits-all” approach to fire management is unlikely to succeed, context-specific strategies that respect local institutions are essential. In Andohahela, the successful establishment of the “*fady*” pact was predicated on a deep understanding of the local Antandroy social organization and the importance of ritual sanctions.

Supporting and Sustaining Local Governance

The vigilance committee model offers a low-cost and locally owned approach to decentralized fire management. Its effectiveness lies in its proximity to the landscape, social accountability, and rapid mobilization capacity. To sustain these committees over time, targeted support is required, including training in safe fire control techniques, basic equipment, and modest logistical resources. Such support should strengthen autonomy rather than create dependency on external actors. Building the capacity of these committees is not just about technical skills but also about strengthening their legitimacy and their ability to mediate conflicts and enforce rules. This approach empowers communities to take ownership of their resource management challenges.

Formal Recognition of Customary Institutions

For policymakers, the case underscores the value of formally recognizing customary institutions within co-management and protected area governance frameworks. Aligning statutory conservation rules with culturally legitimate systems can improve policy effectiveness, reduce conflict, and strengthen trust between communities and state institutions. In Madagascar, the legal framework for protected areas has increasingly recognized the role of local communities, but there is often a gap between policy and practice [4]. The Andohahela case demonstrates a successful model of how such recognition can be

operationalized. However, caution is required when transferring this approach. Ritual potency, authority structures, and socio-ecological pressures vary across regions, and mechanical replication without deep contextual understanding may be ineffective or counterproductive. The success of the “*fady*” depended on the specific cultural context and the existing social cohesion in the Beroanga area [15,16].

Limitations and Future Research

This study has some limitations. It relies on a single case study, which limits the generalizability of its findings. The primary data source was a single, albeit detailed, report. While this provided rich qualitative data, future research could be strengthened by conducting independent interviews with community members, customary authorities, and conservation officials to triangulate the findings. Additionally, the study focuses on the social and governance aspects of the initiative, but a comprehensive assessment would also need to include an analysis of the biophysical impacts on fire frequency, area burned, and ecological restoration. Longitudinal research is also needed to assess the long-term sustainability of the behavioural changes and the institutional arrangements. Finally, comparative studies across different socio-ecological contexts in Madagascar would be valuable to identify the conditions that favour or hinder the success of similar initiatives.

Conclusion

The study of the community fire management initiative in the Andohahela National Park buffer zone demonstrates that integrating local knowledge, customary practices, and community capacity building can generate a socially legitimate and effective system for managing fire in agropastoral landscapes. The experience shows that conservation and development challenges are often fundamentally governance challenges. By leveraging the power of ritual and customary authority, the initiative successfully addressed the limitations of top-down enforcement approaches. The “*fady*” pact and the vigilance committees represent a form of social innovation that is culturally embedded and locally owned.

The findings contribute to AKIS and agroecological transition theories by showing the critical role of cultural and institutional innovation in sustainability transformations. They also offer practical guidance for practitioners and policymakers, emphasizing the importance of cultural diagnostics, support for local governance structures, and the formal recognition of customary institutions. While further research is needed to assess long-term ecological outcomes and the transferability of the approach, the Andohahela case provides compelling evidence that working with, rather than against, local cultures and institutions can lead to more effective and more equitable environmental governance.

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