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Adapting to climate change under threats of violence: A comparative institutional analysis of incentives for conflict and collaboration

Leonardo Medina [a,b,c], Grazia Pacillo [a], Peter Läderach [a], Stefan Sieber [b,c], Michelle Bonatti [b,c,*]

[a] International Center for Tropical Agriculture (CIAT), Colombia
[b] Leibniz Centre for Agricultural Landscape Research, Germany
[c] Thaer-Institute of Agricultural and Horticultural Sciences, Humboldt-Universität zu Berlin, Germany

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ABSTRACT

Research on climate and conflict often emphasizes violence and its drivers, overlooking the prevalence of collaboration in shaping social relations. Addressing this gap, this study undertakes a comparative institutional analysis of community-level responses to climate threats in violence-prone settings. The research explores conditions that incentivize either cooperation or conflict, refraining from presuming one outcome as dominant. Using a structured analytical framework applied through a thematic analysis, it systematically examines environmental, relational, institutional, and systemic patterns across three case studies of localized collective adaptation to climate change under varying forms of violence. These case studies are located in Guatemala, Philippines and Kenya. The study identifies 18 factors that drive conflict or foster collaboration, revealing that while these factors are broadly consistent across contexts, their effects are highly context-dependent. In some cases, the same factor contributes to both conflict and collaboration within shared adaptation arenas, underscoring the complex interplay of drivers. These findings highlight the importance of analysing interactions among drivers when designing collective climate adaptation efforts, emphasizing opportunities to mitigate violence and foster collaboration. The study concludes that enhancing adaptive capacities and climate-resilient peace requires expanding adaptation strategies to address often-overlooked dynamics. These include the historical processes underpinning institutional multiplicity, the legitimacy of local security forces, and the cohesion among neighbouring communities. By realigning incentives toward collaboration, such interventions can simultaneously build resilience and advance peaceful relations, providing actionable insights for policymakers and practitioners working in violence-prone regions.

1. Introduction

Research on climate security highlights that the effects of climate change may interact with, and potentially exacerbate, pre-existing factors contributing to violent conflict (Mach et al., 2019) or undermine peacebuilding capacities (Matthew and Hammil, 2012). Climate-conflict interactions occur through various causal pathways (Scheffran et al., 2012). For instance, illegitimate resource management regimes may fuel grievances fuelling violent conflict, as climate change reduces resource availability (Abrahams, 2021). Climate-induced disruptions to livelihoods can lower the opportunity cost of violence (Villani, 2020). Climate-related disasters can create opportunities or barriers for the operation of security forces and non-state armed groups (Ide, 2023). Additionally, climate effects may force people to change migration patterns and move across borders (Devlin and Hendrix, 2014), or even displace the location of borders (Lee and Tanaka, 2016), hence increasing the risk of violence.

Many studies have sought to empirically determine the contextual and institutional factors that increase the risk of conflict under climate threats (Augsten et al., 2022; Koubi, 2019). However, there has been less focus on identifying the factors that promote collaboration in climate adaptation within conflict-affected settings. Barnett (2019) attributes this research gap to "dystopian imaginaries" and negative assumptions of social relations, which result in research that prioritizes violence over cooperation. Yet, responses to climate threats often involve collaboration rather than conflict (Shields and Soeters, 2017). To broaden this

* Corresponding author at: Leibniz Centre for Agricultural Landscape Research, Germany.
E-mail addresses: l.medina@cgiar.org (L. Medina), g.pacillo@cgiar.org (G. Pacillo), p.laderach@cgiar.org (P. Läderach), stefan.sieber@zalf.de (S. Sieber), michelle.bonatti@zalf.de (M. Bonatti).

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focus, it is necessary to explore the "relational conditions that are always already producing peace" (Bregazzi and Jackson, 2018) in the context of societal responses to climate change.

This shift in focus would examine how climate change can create opportunities for cooperative governance and enhance resilience through shared adaptation efforts (Morales-Muñoz et al., 2022). It would also assess how governance structures and institutions can maintain peaceful relations even in the face of climate change, or foster a "climate-resilient peace" (Barnett, 2019). Numerous studies have highlighted the crucial role of governance in creating conditions that support and reinforce peaceful relations through adaptation strategies (Agrawal, 2008; Boas and Rothe, 2016; Hellin et al., 2018). In fact, research aiming to uncover linkages between climate and conflict have often clarified the institutional settings in which climate-affected populations maintain, and sometimes strengthen, peaceful relations (Bernauer et al., 2012; Bond, 2014; Theisen, 2012). This literature suggests that the influence of climate change on conflict is contingent upon institutional and social factors shaping people's adaptive capacity and political agency (Adger, 2003; Zografos et al., 2014).

To better understand the dual potential for both conflict and collaboration emerging from responses to climate effects, research must assess the conditions that foster either outcome without presuming one to be more likely than the other. This study contributes to this understanding by conducting a comparative institutional analysis, based on participatory appraisal methods, of climate adaptation efforts in three communities in Guatemala, the Philippines, and Kenya. These case studies represent settings where local populations are confronting a range of climate and violence-related threats. The inquiry seeks to deepen understanding of how climate impacts influence, and are shaped by, processes of collective action—whether collaborative or conflictual. Thus, the study aims to identify the drivers and conditions that incentivize either cooperation or conflict within community-level responses to climate threats in contexts of violence risk. Furthermore, this article bridges research on collective action for climate adaptation as a contributor to peace, addressing a key question in the field of environmental peacebuilding (Medina et al., 2023; Sändig et al., 2024).

1. Conceptual framework

This study applies the conceptual framework developed by Ratner et al. (2013) to examine the conditions that drive conflict and collaboration in community responses to climate threats (Fig. 1). The framework combines Ostrom's (2005) Institutional Analysis and Development framework, with insights from political ecology and environmental conflict management. It facilitates the analysis of resource management and collective action institutions in conflict-sensitive settings, considering four key elements: social-ecological context, collective action institutions, action arenas, and outcomes. A summary of the framework as applied in the study is presented here; for a more detailed account consult Ratner et al. (2013).

The context encompasses the characteristics of climate threats as experienced by local populations, the resources affected, and the attributes of resource users. It also includes the governance structures that regulate access to these resources. Together, these factors shape adaptive capacities and play a critical role in determining whether responses to climate threats are collaborative or conflictive. Collective action institutions refer to the mechanisms through which different social groups organize and mobilize in response to climate and violence threats.

The action arena is conceptualized as the space where social bargaining occurs, allowing actors to either cooperate or engage in conflict (Ratner et al., 2013). In this study, action arenas are analysed at the community level—though these are also embedded within broader governance structures—with a specific focus on responses to climate threats. These responses encompass the collective behaviours, whether cooperative or conflictive, that local populations identify as being influenced by climate change trends, which in turn influence adaptive capacities—the ability to adjust to climate impacts, mitigate damages, seize opportunities, and manage consequences (Tompkins and Adger, 2004). The research employed community-led dialogues through which participants first identified locally experienced climate changes, and then defined their community's responses to these changes. Through this process, the community's response strategies were articulated by participants themselves, based on their lived experiences, and relate to areas such as natural resource management, rural livelihood maintenance and diversification, disaster risk reduction, policy advocacy, and cultural preservation.

Action arenas consist of the specific actors involved, the action resources derived from their assets to pursue objectives, and the current rules that restrict strategic use of these action resources by those actors. The interplay between these three elements, influenced by the social-ecological context in which the arena is situated, gives rise to diverse patterns of collaboration or conflict. Here, conflict is understood as any

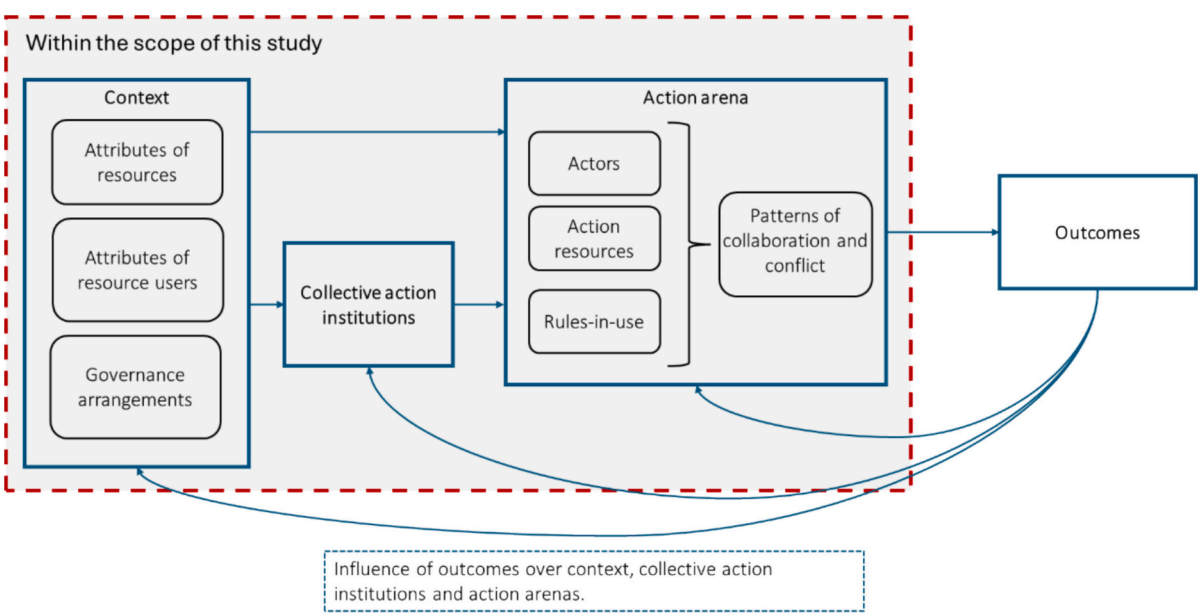

Fig. 1. Conceptual framework adopted in this study (Ratner et al., 2013).

relational pattern or interaction among groups or institutions that poses a threat of escalating violence or undermining peace in the context of societal responses to climate threats (Scheffran et al., 2023). This definition recognizes conflict as more than just open hostilities or physical confrontations; it includes underlying tensions, competition over resources, political disagreements, social grievances, and power struggles that may manifest in various forms, such as protests, legal disputes, or even passive resistance. These conflicts are often driven by divergent interests, values, or perceptions within and between groups, and at multiple levels of governance.

Cooperation refers to processes of concerted group effort to achieve higher adaptive capacities which facilitate non-violent conflict management and resolution (Schmeidl et al., 2023). Cooperation encompasses activities where actors—ranging from local communities to governments and international organizations—work together to build resilience, share resources, develop shared strategies, and implement joint efforts aimed at reducing vulnerabilities and coping with climate change while coping with and addressing threats of violence. This definition highlights the potential for collective action to mitigate the risks of conflict by fostering social cohesion, equitable resource distribution, and inclusive governance.

These definitions recognize that conflict and cooperation exist along a continuum of responses that can be shaped by multiple intersecting drivers (Pacillo, 2024). Within action situations, the same actors can simultaneously engage in cooperation and conflict depending on context, incentives, and situational dynamics (Ratner et al., 2017). In turn, patterns of collaboration and conflict engender outcomes that influence the social-ecological context, and the institutional framework defining the contours of the action arena and the interactions within. For example, in the context of social mobilisations in demand of political representation, Temper et al. (2018), propose three dimensions of democracy that can be used to interpret outcomes from action arenas—direct and delegated democracy, economic democracy, and knowledge democracy—that collectively uphold equity, plurality and inclusivity.

In this article, our focus lies in conflict and collaboration patterns, meaning outcomes are not integrated in the analysis. This study addressed the questions: 1) what patterns of collaboration and conflict emerge in community-level responses to climate threats in violence-affected settings?; and 2) how can adaptation strategies leverage drivers of collaboration and mitigate drivers of conflict in seeking to contribute to violence prevention? Drivers of conflict and collaboration are categorized as 1) attributes of resources, 2) attributes of resource-users, 3) institutional practices in the action arena, and 4) systemic factors (Table 1).

Table 1
Classification of drivers of conflict and collaboration.

Category	Description
Attributes of resources	Drivers related to ecological traits of natural resources being affected by climate impacts or involved in climate adaptation efforts (Ratner et al., 2013).
Attributes of resource-users	Refers to the patterns of communication, perceptions, and interactions in relationships, shaped by socio-economic traits, intergroup relations, past engagements, and self-other perceptions (Bar-Tal, 2013).
Institutional practices in the action arena	Pertains to how social structures, organizations, and institutions shape, and are shaped by, conflict and collaboration in climate adaptation, including resource tenure, adaptation resource distribution, and decision-making processes (Zografos et al., 2014).
Systemic factors	Historical, political, socio-economic, and cultural drivers, such as colonial legacies, globalization, political legitimacy, and the lasting impacts of armed conflict, which influence institutional arrangements and intergroup relations beyond climate adaptation (Selby and Hoffmann, 2014).

2. Methodology

Conventional participatory appraisal tools for assessing climate vulnerability (Ulrichs et al., 2015) and conflict analysis techniques (Ruettinger et al., 2014) were merged into a method to evaluate climate- and violence-related threats as experienced by community members. Data collection was led by the main author in all case studies. It included direct observation, unstructured interviews, and focus group discussions (FGDs). The analysis of each case study was structured into three phases: (1) understanding climate trends, adaptive capacities, and conflict risks; (2) assessing climate change impacts on livelihoods and community responses; and (3) exploring the links between climate impacts, conflict and cooperation, and developing collective adaptation solutions.

FGDs in the first two phases were held separately for women and men, while the third phase involved mixed-gender working groups. Additionally, unstructured interviews with community leaders and local government representatives were conducted to gather data on institutional structures and their relationship with local governance. A total of 73 community members (36 men, 37 women) were each engaged in 5 FGDs, plus 9 local leaders (representatives of local government and civil society organizations) were consulted. Data was gathered between September 2022 and July 2023. FGDs in each location were completed within four days. See Fig. 2 for a description of the appraisal method, and refer to Medina et al. (2024) for a more exhaustive discussion of its application.

Extensive notes and quotes from FGDs and interviews were analysed using inductive thematic analysis, a qualitative research method that identifies patterns or themes in data without relying on predetermined theories or hypotheses. In this approach, themes emerge naturally from the data through an iterative process of coding and categorization, ensuring that the findings are grounded in participants' perspectives and the diverse contexts of data collection. Guided by our conceptual framework, this method involved examining and comparing factors—systemic, institutional practices, attributes of resource users, and attributes of resources—that influence collective action for conflict or collaboration within the identified action arenas. Case studies were coded to identify recurring patterns, which were then defined as themes.

2.1. Case studies

Countries were selected for their diverse geographical and cultural settings and their varied experiences with organized violence, including ongoing and past insurgencies, organized crime, and loosely organized inter-community and political violence. This diversity is intended to enhance the generalizability and theoretical relevance of the findings. Case studies were chosen in collaboration with civil society organizations active in each country. Priority was given to villages currently facing climate-related threats, such as increased seasonal variability, drought, floods, heavy rains, landslides, or a combination of these issues. Additionally, locations were selected based on the presence of different violence risks, including inter-community conflicts, high levels of organized and petty crime, violent political repression, and insurgency threats from non-state armed groups. All selected locations predominantly rely on agricultural-based livelihoods, primarily farming and pastoralism. See Table 2 for a summary of each case study. For more detailed case study descriptions, see Supplementary Materials 1 (Laikipia, Kenya), 2 (Chiquimula, Guatemala) and 3 (Lanao del Sur, BARMM, Philippines).

3. Results

This section summarizes the framework's application in the three case studies. The findings highlight the complex interplay of factors that drive both conflict and collaboration within community-level climate adaptation efforts in violence-affected settings. Through thematic analysis, 18 key drivers influencing incentives for conflict and

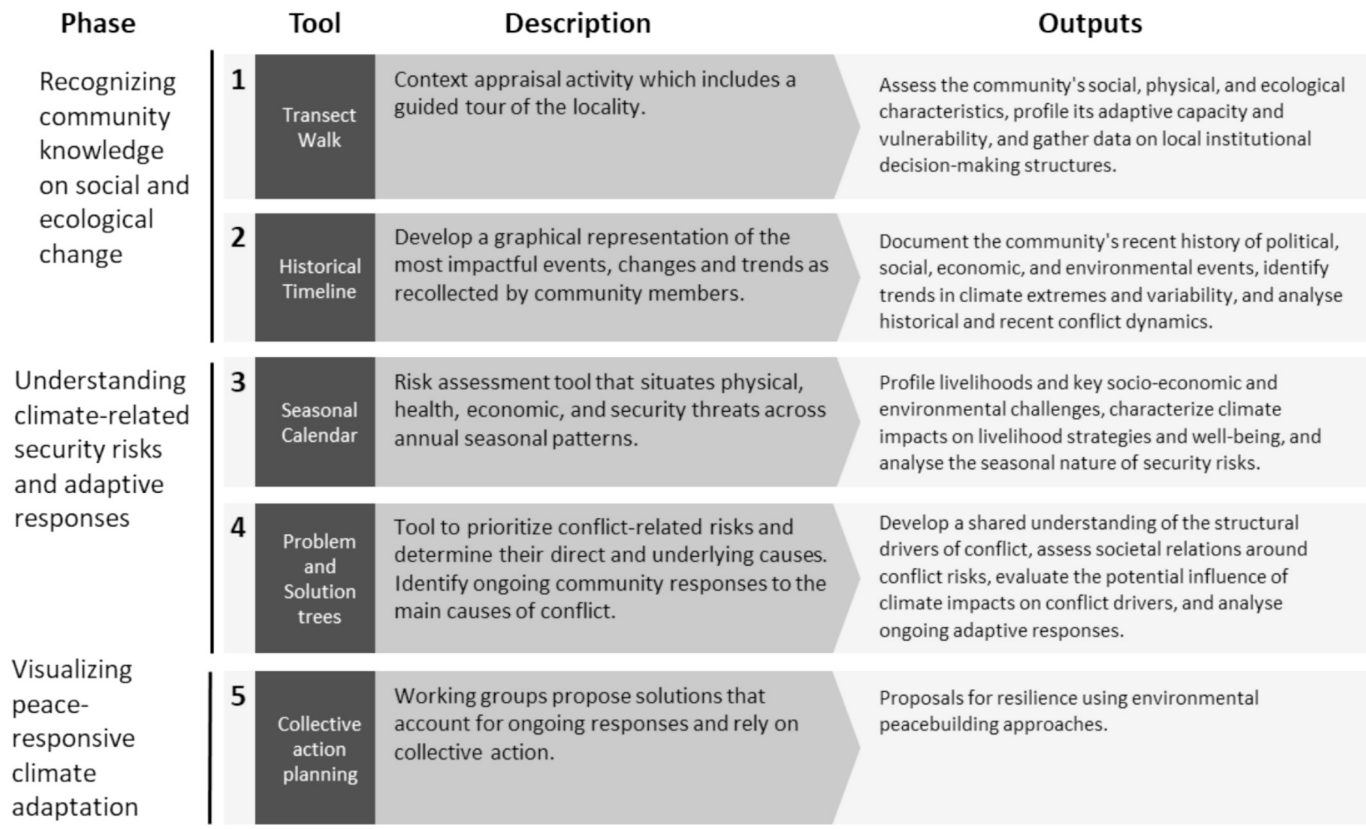

Fig. 2. Appraisal method. Adjusted from (Medina et al., 2024).

Table 2
Summary of case studies.

Case study	Community	Action arenas for adaptation	Threats of violence
Laikipia, Kenya	Yiaku Indigenous Peoples	- Management of Mukogodo forest reserve to diversify livelihoods - Secure tenure of forest resources - Cultural preservation and policy advocacy for Indigenous recognition	- Inter-ethnic cattle rustling and village raiding - Political instigation of violence - Forced displacement
Chiquimula, Guatemala	Maya Ch'orti' Indigenous Peoples	- Strengthen livelihoods through agricultural and non-agricultural strategies - Sustainable management of community forest - Secure access to agricultural land and water	- Inter-community conflict over access to forest. - Destruction of water infrastructure - Presence of organized and petty crime
Lanao del Sur, BARMM, Philippines	Maranao Muslim populations	- Maintenance and repair of irrigation infrastructure - Collective action for better market access and agricultural production - Demands for political representation and reductions in corruption	- Presence of extremist non-State armed groups - Inter-clan conflict - Political violence driven by local elites

collaboration were identified (Fig. 3). While several drivers were categorized within individual framework categories, many were found to operate across multiple categories. Table 3 presents a systematisation of the thematic analysis results, classifying the 18 identified drivers in *italics*. See the supplementary materials for more detailed version of the table describing patterns of collaboration and conflict, and the application of the framework in each case study.

Laikipia, Kenya. The Yiaku Indigenous People, originally from Ethiopia, are a minority group who migrated to the Mukogodo area of Kenya over a century ago and assimilated into the Maasai culture, adopting a Maa-speaking pastoralist lifestyle. Today, only a few individuals still speak Yiakunte. Mukogodo Forest, located in Laikipia County, is a critical biodiversity hotspot and wildlife corridor and remains the only forest in Kenya managed exclusively by Indigenous Peoples. Variability in seasonal precipitation patterns has always been a major agricultural risk across Laikipia county; and the Mukogodo region has historically been among the most affected by recurrent dry-spells. Climate change is most clearly experienced as unpredictable seasonal patterns, with recent years showing steep changes in historical rainfall trends. As a dry forest, Mukogodo is a fragile ecosystem that is highly susceptible to increasing precipitation variability.

Pastoralists within the Yiaku Indigenous Peoples community report to be currently experiencing a reduction in pasture productivity within the forest. Longer dry-spells lead to reduced flower blooms, significantly impacting bee populations and herb species. The most frequented water points in Mukogodo now dry up during longer periods of the year, hence forcing people to buy water by walking far distances into larger settlements. There was a general agreement among participants that one of the most pressing challenges faced today by members of their communities is the realisation that they cannot rely on livestock herding as a main source of livelihood for the future. This has pushed the community to seek for alternative sources of income, which for the most part rely in the sustainable management of Mukogodo Forest and in cultural preservation as strategies to foster tourism.

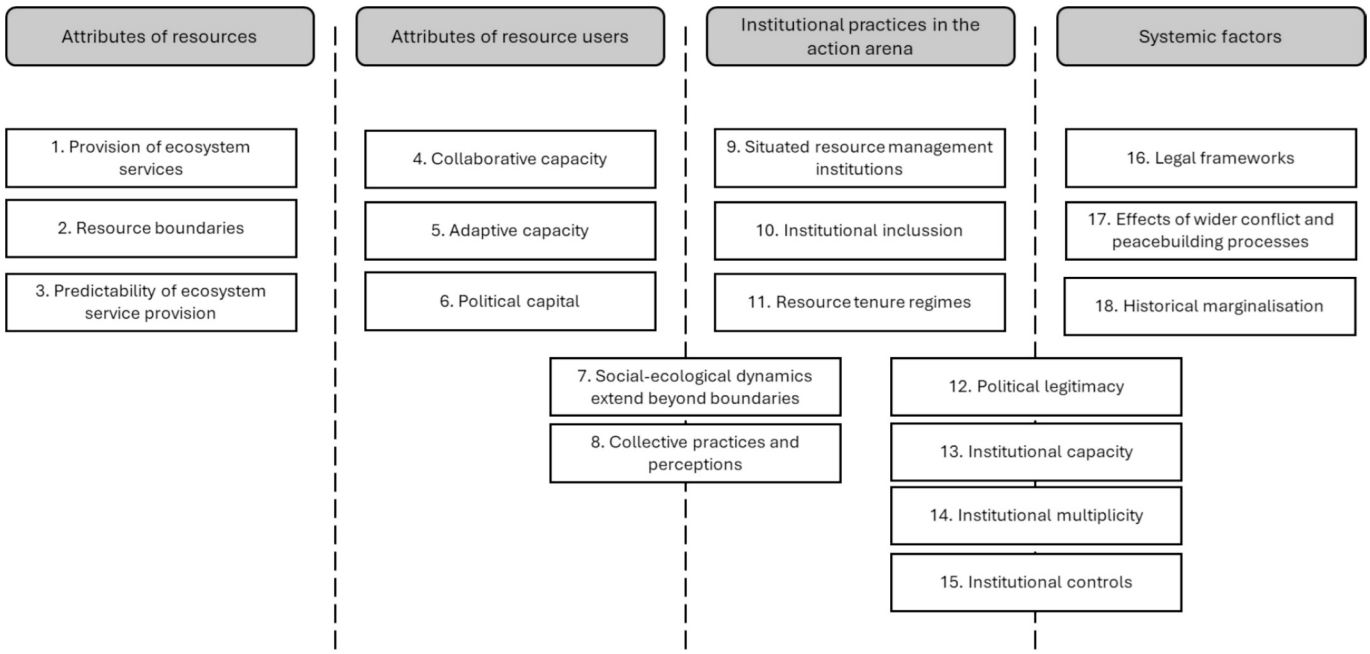

Fig. 3. 18 drivers incentivising conflict and collaboration were identified.

A community-based forest association, comprising members from multiple ethnic groups residing around Mukogodo, collaborates with the Kenya Forest Service to promote sustainable forest management, balancing conservation efforts with traditional livelihoods such as livestock grazing, ecotourism, and honey harvesting. However, climate change impacts, including unpredictable seasonal patterns and prolonged droughts, have reduced pasture productivity, water availability, and bee populations, threatening these practices. Additionally, the Yiaku community frequently experiences inter-ethnic conflict over access to natural resources and political violence driven by territorial and electoral ambitions.

Robust local institutions managing the Mukogodo Forest have strengthened community capacities to prevent illegal activities, mitigate deforestation, and promote inter-ethnic harmony in a region prone to cattle rustling and village raids. These institutions have evolved from traditional values and practices, supported by the cultural attachment of user communities to the forest. Ethnic integration, social capital development, and openness to alternative livelihoods have further enhanced collaboration. However, these institutional arrangements also drive conflict in response to climate threats. Limited resources, unclear zoning, and perceived illegitimacy of the community forest association enforcement measures contribute to tensions. The association's actions, seen as more accountable to the Kenyan government than local communities, worsen conflicts over conservation and livelihoods. Additional deforestation is driven by charcoal burning as an alternative income to pastoralism, and by external pressures like agricultural expansion and logging.

Although local communities, including the Yiaku Indigenous Peoples, are entitled to forest stewardship under Kenya's Forest Conservation and Management Act (2016), the legal status of the forest as a government-owned protected area restricts their rights and livelihoods, increasing fears of eviction and resentment by local populations toward the government. Outsider communities often do not recognize the Yiaku's resource claims, leading to violent conflicts exacerbated by drought, resource scarcity, and extended migratory routes. Traditional conflict management mechanisms have weakened, and ethnic-based political patronage fuels violence, further straining community relations and trust in government institutions.

Chiquimula, Guatemala. The Maya Ch'orti' Indigenous Peoples in La Lima village, Chiquimula department of Guatemala, still use their traditional language, although with considerable influence from Spanish. The community's traditional milpa agricultural system, cantered on maize and bean cultivation, faces increasing threats from climate variability, soil erosion, deforestation, and the overuse of agricultural inputs. Situated in Central America's Dry Corridor, the region is highly susceptible to extreme weather events, such as prolonged droughts and heavy rains that exacerbate soil erosion, further undermining the viability of traditional agriculture. Additionally, coffee production, which relies predominantly on daily labour, is widespread in the region and serves as a primary source of income. The crop is highly exposed to coffee rust across the region. The effects of the civil war in Guatemala, inter-community conflict over resource access, and the presence of organized crime threaten the security of local populations.

Participants demonstrated a collective awareness of the climate-related threats they jointly face and recognized the imperative to address them. This includes promoting soil conservation practices, enhancing market access through cash crops, ensuring access to potable water, and instituting more effective forest management arrangements as a strategy to develop alternative livelihoods. Notably, the community, with support from international development initiatives and government programs, has initiated efforts to adopt agricultural conservation practices aimed at mitigating soil erosion and fertility loss. Shared Indigenous identity, community belonging, and mutual respect for property rights encourage collaboration for fairer land-leasing agreements and sustainable practices.

Seasonal migration to coffee plantations has become a key livelihood strategy, despite people on the move being exposed to risks of violence. The loss of agricultural livelihoods with limited alternative employment has also driven some youth toward illicit activities, including illegal crop cultivation and petty crime. Systemic drivers, such as the presence of criminal groups, weak state-society relations, and ongoing effects of Guatemala's post-conflict setting, perpetuate violence and undermine adaptive and collaborative capacities. Community trust is further eroded by fear, surveillance, and peer judgment, limiting cooperation in managing shared socio-ecological threats.

Informal and insecure land leasing significantly affects adaptive capacities and social dynamics between landowners and lessees. Most small-scale farmers lease land seasonally for 3 to 4 months, with few

Table 3
Patters of conflict and collaboration across case studies. Drivers incentivising conflict or collaboration are classified in italics.

Action arena	Attributes of resources	Attributes of resource users	Institutional practices in action arena	Systemic factors
Laikipia, Kenya				
Sustainable management of Mukogodo forest reserve and diversification of livelihoods	**Collaboration** - *Provision of ecosystem services:* alternative livelihoods from Mukogodo forest **Conflict** - *Predictability of ecosystem service provision*: high levels of precipitation variability	**Collaboration** - *Collaborative capacity:* high social capital from past and ongoing collective action - *Collective practices and perceptions*: willingness to explore alternative livelihood strategies **Conflict** - *Collective practices and perceptions*: conflicting interests on conservation and resource extraction - *Adaptive capacity*: low capacities for livelihood diversification	**Collaboration** - *Political legitimacy*: legitimate leadership in community-based organizations - *Locally-situated collective action institutions*: locally led and pluralistic resource access rules **Conflict** - *Political legitimacy*: low accountability of community-based organizations to local resource-users - *Institutional capacity*: low institutional capacities for resource management	**Collaboration** - *Institutional capacity*: inter-community sharing of public service infrastructure **Conflict** - *Institutional controls*: clientelism and nepotism constrain access to livelihood opportunities
Secure tenure of forest resources	**Collaboration** - *Resource boundaries*: well-defined protected area **Conflict** - *Predictability of ecosystem service provision*: seasonal variability in pastureland cover	**Collaboration** - *Collective practices and perceptions*: shared identity tied to Mukogodo forest **Conflict** - *Complex social-ecological dynamics*: transhumance as a main livelihood - *Political capital*: minority status of Indigenous Peoples limits capacities for policy advocacy	**Collaboration** - *Institutional inclusion*: formally recognized community-led institutions for common-pool resource management **Conflict** - *Resource tenure*: unclear and illegitimate resource tenure and access rights - *Institutional inclusion*: exclusion of outsider pastoralist groups from resource management - *Institutional capacity*: lack of response from security forces to violent conflict	**Collaboration** - *Legal frameworks*: legal frameworks for resource access provide a clear guide for collective action **Conflict** - *Institutional multiplicity*: territorialization of ethnic identities as colonial legacy - *Institutional multiplicity*: instigation of inter-ethnic grievances by elites fosters violence - *Political legitimacy*: low political legitimacy in local government and security forces
Cultural preservation and policy advocacy for indigenous recognition	**Collaboration** - *Predictability of ecosystem service provision*: erosion of traditional livelihoods **Conflict**	**Collaboration** - *Collective practices and perceptions*: shared responsibility for cultural preservation - *Collective practices and perceptions*: inter-ethnic integration and a shared understanding of traditional practices **Conflict** - *Collective practices and perceptions*: warrior culture acts as an incentive for violence - *Political capital*: Indigenous identity only partly recognized by national government	**Collaboration** - *Institutional multiplicity*: effective traditional conflict management mechanisms - *Collaborative capacity*: civil society organizations focused on cultural preservation and livelihood development **Conflict** - *Collective practices and perceptions*: punitive and retaliative practices reinforce cycles of violence - *Institutional multiplicity*: Changing sources of traditional authority	**Collaboration** - *Legal frameworks*: devolution trends in Kenya facilitate sub-national representation **Conflict** - *Political legitimacy*: ethnic-based patronage constraints the political agency of local constituents
Chiquimula, Guatemala				
Strengthen livelihoods through agricultural and non-agricultural strategies	**Collaboration** - *Provision of ecosystem services*: high-value cash crop cultivation and diversified food production systems **Conflict** - *Predictability of ecosystem service provision*: extreme weather events reduce productivity	**Collaboration** - *Collective practices and perceptions*: shared understanding of social-ecological threats and strategies to address them - *Complex social-ecological dynamics*: reliance on international migration as a livelihood diversification strategy **Conflict** - *Collective practices and perceptions*: sense of relative deprivation as Indigenous Peoples - *Collective practices and perceptions*: use of remittances at household level increases inequality and individualism	**Collaboration** - *Adaptive capacity*: remittances facilitate livelihood diversification **Conflict** - *Collaborative capacity*: lack of civil society or cooperative organizations - *Adaptive capacity*: reliance on intermediaries for market access - *Complex social-ecological dynamics*: reliance on seasonal mobility as a livelihood strategy	**Collaboration** - *Institutional capacity*: availability of international support and resources for capacity building **Conflict** - *Effects of wider conflict and peacebuilding processes*: effects of past armed conflict and human rights abuses undermine present adaptive capacities - *Collaborative capacity*: societal exposure to chronic violence affects social capital - *Institutional capacity*: lack of spaces and opportunities for social life - *Institutional capacity*: poor road connectivity, public service provision, social protection and access to finance
Sustainable management of community forest	**Collaboration** - *Provision of ecosystem services*: cultural ecosystem services foster shared identity **Conflict** - *Resource boundaries*: unclear	**Collaboration** - *Collective practices and perceptions*: collective identities strongly connected to community forest - *Collective practices and perceptions*: homogeneity of Indigenous identity	**Collaboration** - *Locally-situated collective action institutions*: matched restrictions of harvest to regeneration of forest resources - *Political legitimacy*: legitimate regulations for resource use and	**Collaboration** - *Political legitimacy*: legitimate leadership of local community development council **Conflict**

(*continued on next page*)

Table 3 (*continued*)

Action arena	Attributes of resources	Attributes of resource users	Institutional practices in action arena	Systemic factors
	boundary definition of community forest	**Conflict** - *Collaborative capacity*: low capacity for collective action due to mistrust within and between communities	extraction **Conflict** - *Institutional inclusion*: low community representation in forest management - *Institutional capacity*: lack of community-led organisation for forest management - *Institutional controls*: land grabbing attempts by local political elites - *Institutional capacity*: low capacity to enforce administrative boundaries in forest	- *Political legitimacy:* low legitimacy of local government due to corruption
Secure access to agricultural land and water	**Collaboration** **Conflict** - *Resource boundaries*: water sources located outside municipal boundaries - *Predictability of ecosystem service provision*: unpredictable precipitation	**Collaboration** - *Collective practices and perceptions*: legitimate land management based on shared liberal values and respect of private property **Conflict** - *Adaptive capacity*: land concentration under increasing inequality and illegal livelihoods	**Collaboration** - *Locally-situated collective action institutions*: inter-municipal agreement for water sharing **Conflict** - *Resource tenure*: reliance on neighbouring community for drinking water - *Resource tenure*: informal land leasing	**Collaboration** **Conflict** - *Institutional controls*: influence of organized crime over local governance
Lanao del Sur, BARMM, Philippines				
Maintenance and repair of irrigation infrastructure	**Collaboration** - *Resource boundaries*: common-pool irrigation channels operated by local community **Conflict** - *Predictability of ecosystem service provision*: extreme events lead disrupt irrigation channels	**Collaboration** - *Collaborative capacity*: well-established collective management of irrigation channels **Conflict**	**Collaboration** - *Locally-situated collective action institutions*: locally devised management rules dictate access to water and irrigation infrastructure **Conflict** - *Institutional capacity*: limited support from government for post-disaster recovery and risk reduction - *Resource tenure*: insecure land tenure and informal leasing - *Institutional controls*: selective distribution of resilience and development support	**Collaboration** **Conflict** - *Political legitimacy*: influence of political allegiances over public opportunities and support
Collective action for better market access and agricultural productivity	**Collaboration** **Conflict** - *Provision of ecosystem services:* limited alternative livelihood opportunities - *Resource boundaries*: upstream extractive activities affect local ecosystems	**Collaboration** - *Collaborative capacity*: high social capital as former insurgents **Conflict** - *Adaptive capacity*: low capacities for collective action in a post-conflict context - *Relative deprivation*: perception of historical relative marginalization as Muslim Maranaos	**Collaboration** - *Locally-situated collective action institutions*: farming land managed through communal and cooperative means **Conflict** - *Collaborative capacity*: lack of collective action and cooperative organizations - *Institutional inclusion*: low representation in basin-wide resource management - *Complex social-ecological dynamics:* extractive industries upstream increase climate threats	**Collaboration** **Conflict** - *Resource tenure*: unclear and overlapping resource-tenure mechanisms - *Relative deprivation*: exclusion and discrimination of former combatants
Increase political representation and accountability in access and use of resilience funds		**Collaboration** - *Collective practices and perceptions*: homogeneity of identity as Muslim Maranaos **Conflict** - *Collective practices and perceptions*: shared sense of collective pride facilitates conflict escalation - *Collective practices and perceptions*: Common use of retaliation facilitates conflict escalation	**Collaboration** - *Institutional multiplicity*: multiple customary and statutory conflict management mechanism **Conflict** - *Institutional inclusion*: low representation in sub-national government - *Institutional controls*: unequal distribution of resources due to corruption, clientelism and nepotism	**Collaboration** - *Legal frameworks*: peace agreement providing a clear framework for action - *Political legitimacy*: highly legitimate political actors supporting the peacebuilding process **Conflict** - *Institutional multiplicity*: local elites use institutional multiplicity for political repression - *Effects of wider conflict and peacebuilding processes*: active

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Table 3 (*continued*)

Action arena	Attributes of resources	Attributes of resource users	Institutional practices in action arena	Systemic factors
				recruitment by extremist non-state armed groups

owning land outright. These short-term, informal arrangements, exacerbated by increased land concentration from remittances, create constant eviction risks for lessees. This instability, coupled with climate change-induced reductions in agricultural productivity, threatens food security and heightens tensions between landowners and lessees. Insecure land tenure hampers broader implementation of soil conservation measures, limiting efforts to small plots, such as women-managed vegetable gardens.

Conflicts over territorial boundaries and road maintenance have persisted for decades. Since the 2000s, disputes over a communal forest led to violent confrontations, while unresolved road maintenance responsibilities have resulted in destroyed water infrastructure, exacerbating tensions. The conflicts are partly driven by institutional weaknesses, such as the lack of community-based organizations for local representation, unclear boundaries, and La Lima's dependence on a neighbouring community for drinking water.

Lanao del Sur, BARMM, Philippines. The municipality of Butig, located in the Lanao del Sur province within the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM), Philippines, is characterized by high levels of poverty and low human development indicators compared to national averages. The Maranao Muslim community predominantly depends on small-scale rice cultivation, supported by rain-fed irrigation channels. Women's engagement in vegetable gardening serves as a supplementary source of food and income for households. Populations across Mindanao experience a constant threat of climate shocks, mainly in the form of typhoons, intense rainfall, flooding, landslides and drought (Giles et al., 2019). During recent years, populations in Butig have observed increasingly erratic climatic patterns. Participants cited a higher number of extremely warm days as the most perceptible shift in the weather, followed by unpredictable precipitation patterns and concentrated rainy events. Study participants in Butig have observed extended periods of increased temperatures and prolonged droughts, hampering the planting of staples like rice and corn. This shift not only disrupts food supply but also forces communities to seek alternative sources of income. Furthermore, the irrigation infrastructure is highly vulnerable to landslides triggered by extreme rainfall events, which reduce rice production to less than one-third of its potential yield. These disruptions to livelihoods intensify existing threats of politically-driven conflict between clans and increase the risk of recruitment by insurgent armed groups, a persistent concern in Mindanao's post-conflict setting.

Since the ratification of the Bangsamoro Organic Law (BOL) in 2019, the peacebuilding process in the Bangsamoro Autonomous Region of Muslim Mindanao (BARMM) has made substantial progress. Key achievements include the implementation of governance structures, development initiatives, cultural preservation, and capacity-building efforts. Ongoing collaboration between the Bangsamoro Transitional Authority (BTA), the Philippine government, and international partners remains vital for sustained progress. However, the peace process faces challenges, such as the need for comprehensive disarmament, demobilization, and reintegration (DDR) of former combatants, addressing marginalized communities' grievances, and managing the influence of local elites. In Butig, local elites manipulate networks combining traditional, insurgent, and formal political structures for personal gain, undermining community adaptive capacities and equitable resource distribution. These dynamics contribute to ongoing vulnerabilities and limit adaptation efforts.

In 2023, a landslide caused by intense rainfall damaged a critical irrigation channel in the case study community in Lanao del Sur, which name shall remain anonymous due to ongoing threats of insecurity. The delayed government response to the damage exacerbated tensions between communities affected by unequal water access. Despite this, local communities maintain a tradition of cooperation, such as sharing agricultural labour, regulating water access, and rebuilding homes, guided by the cultural principle of maratabat, which emphasizes honour, dignity, and mutual respect. However, maratabat can also justify violent retaliation, leading to conflicts like rido, which have eroded local authorities' legitimacy and have led to the unequal distribution of resilience opportunities and public investments across the municipality. As a result, residents of Butig have conveyed that formal institutional processes related to decision-making at the local level, the distribution of employment opportunities, the management of natural resources, and the allocation of funds for development and resilience-building are markedly influenced by clan-based relationships linked to this enduring conflict.

In this post-conflict setting, the lack of political legitimacy, exclusive political systems, and threats to rural livelihoods increase the risk of recruitment into extremist groups. Some individuals may turn to these groups for social support and protection against political violence. Additionally, limited capacities for collective action hinder local farmers' ability to access markets, engage in cooperative production, and manage resources collaboratively, which are crucial for adaptation efforts. Continuing challenges in reconstruction, exclusion, and discrimination of former combatants contribute to a persistent sense of marginalization among Maranao Muslims in Butig.

The primary distinction observed among the three analysed cases lies in the specific array of drivers acting over each context. We argue that climate adaptation strategies aimed at fostering climate-resilient peace must comprehensively address all categories of drivers. The subsequent sections examine how adaptation strategies can incorporate these drivers to realign incentives toward fostering cooperative relationships while mitigating the potential for conflict and reducing the risk of violence. Although all 18 drivers are discussed, some have been grouped to facilitate a more practical and programmatically relevant analysis.

3.1. Systemic factors

Institutional multiplicity. Drivers of conflict and collaboration in responses to climate threats are shaped by institutional multiplicity—the coexistence of overlapping, hierarchical, and often competing sources of authority. Across case studies, these sources are strategically leveraged by political actors to consolidate or expand influence. This complexity, common in post-colonial and conflict-affected settings, fosters overlapping governance systems whereby central state authorities, local elites, former combatants, and customary authorities interact, creating conflicting claims over resources and entitlements (Hilhorst, 2013; Meinzen-Dick and Pradhan, 2002).

Despite this, findings suggest institutional multiplicity can also facilitate transitions toward inclusive legal pluralism. Legal pluralism formally recognizes and integrates multiple sources of authority, enabling more equitable and effective governance (Benda-Beckmann & Benda-Beckmann von Benda-Beckmann and von Benda-Beckmann, 1997). Recent theoretical frameworks like hybrid peace infrastructures (Mac Ginty, 2010) and locally-led adaptation (Rahman et al., 2023), offer opportunities to harness institutional multiplicity toward collaboration. These two approaches integrate both formal and informal governance mechanisms, allowing for more flexible and context-sensitive approaches. Hybrid arrangements in climate adaptation better address diverse actors and authorities, fostering inclusive dialogue,

power-sharing, and collaborative governance that is locally legitimate and effective in managing conflict and supporting peace (de Coning, 2018; Krampe et al., 2024).

Legacies of historical marginalization. In settings characterized by protracted conflict, like Lanao del Sur, or chronic exposure to violence, like Chiquimula, adaptation relies upon fostering equitable and inclusive practices that are mindful of the historical contexts of marginalization experienced by local populations (Young and Goldman, 2013). In Lanao del Sur, unchecked and unaccountable elite control over public resources has led to an uneven distribution of support for resilience-building and disaster recovery. This intensifies long-standing grievances and socio-political tensions. The implications of such unequal distribution extend well beyond immediate concerns related to adaptive capacities, contributing to weakened trust and cohesion, increased risks of local conflicts, and the sustained dominance of political elites, perpetuating cycles of conflict (Soriano, 2006).

Climate adaptation can act as preventive peacebuilding tool (Saraiva and Erfe, 2023) by addressing underlying drivers of conflict, including political, social, and economic challenges faced by vulnerable communities. Achieving this requires adapting policies to reflect the complexities of historical grievances and power asymmetries, which significantly influence intervention effectiveness. In contexts where perceptions of historical marginalization continue to fuel conflict, climate adaptation efforts should incorporate strategies aimed at developing clear, legally anchored, and multi-level frameworks to establish new institutional structures that enhance representation and power-sharing (Leonardsson et al., 2021).

Post-conflict settings and broader peacebuilding processes. Our findings suggest that climate adaptation in violence-affected regions should not be viewed solely as an environmental or technical policy issue. Instead, it must be integrated into broader peacebuilding strategies, particularly in contexts that, while not experiencing active armed conflict, continue to face significant social and political challenges (Bruch et al., 2016). The peacebuilding process in the BARMM region establishes a legal and institutional framework for power-sharing, disarmament, reintegration, and reconciliation (Trajano, 2020). However, in areas like Lanao del Sur these drivers persist, undermining collective climate adaptation efforts and incentivising recruitment by insurgent organizations, which provide relief to climate impacts. This underscores the need for alignment between adaptation strategies and broader peacebuilding processes (Brady et al., 2015; Ishiwatari, 2021).

Likewise, In Chiquimula, organized crime disrupts governance and adaptation efforts. Without institutional strategies to reduce criminal influence, adaptation's potential to foster peace remains uncertain (Villani, 2020). Under threats of violence, the peacebuilding potential of adaptation strategies is challenged by the absence of broader peacebuilding frameworks. These findings are consistent with the broader literature on environmental peacebuilding, which posits that environmental cooperation can more effectively support sustainable peace in post-conflict contexts (Ojha et al., 2019).

3.2. Institutional practices in the action arena

Institutional inclusion and local demands for representation. In all three case studies, local populations demand stronger rural democratization, seen as crucial for enhancing adaptive capacities to climate and violence threats. However, institutional frameworks for expressing grievances and demanding action remain limited and inaccessible. In Laikipia, resource-users call for greater accountability from institutions managing common-pool resources, emphasizing responsiveness to local needs over higher governance priorities. Chiquimula farmers stress strengthening local capacities for cooperative market access and representation within agrarian production systems. In Lanao del Sur, communities seek institutional reforms to reduce corruption and political violence.

This comparative analysis highlights the importance of acknowledging and supporting diverse forms of representative democracy as a crucial element of climate adaptation in violence-affected settings. However, as perceived by study participants, democratization processes often fail to account for the complexities of local contexts and priorities. In conflict-prone regions, this oversight can lead to new conflicts (Björkdahl et al., 2018), or limit adaptive capacities (Krampe et al., 2021). Adaptation strategies should thus prioritize flexible institutions that respond to grassroots demands for representation.

Political legitimacy and institutional controls. This research highlights low political legitimacy as a critical barrier to achieving a climate-resilient peace. Adaptation efforts must challenge existing political obstacles to building adaptive capacities, such as political exclusion, nepotism, and corruption (Nicoson, 2021). To overcome these barriers, interventions will likely require the engagement of formal policy processes and government actors committed to supporting necessary reforms. However, in contexts characterized by low political legitimacy, the involvement of government actors can exacerbate existing power asymmetries, hindering collaboration and undermining local ownership of adaptation initiatives (Simangan et al., 2023).

Conversely, legitimate community-based organizations (CBOs) were found to enhance collaborative capacities in responding to climate-related threats. As found in Laikipia, these organizations foster cooperation especially when their leadership bridges connections with legitimate local governments while staying accountable to communities. To improve adaptation in contexts of low legitimacy, interventions should identify legitimate political actors capable of navigating illegitimate networks and link them to active CBOs. This approach mitigates risks tied to state involvement, bolsters local ownership, and strengthens climate resilience and peacebuilding outcomes.

Locally-situated collective action institutions. Incentives for both conflict and collaboration in the context of climate responses across the case studies were most pronounced at the local level, where they are shaped by political-economic factors, the distribution of authority across actors at multiple levels of governance, and the effectiveness of local response mechanisms. Effective adaptation thus requires locally relevant systems aligned with community practices, knowledge, and priorities of the populations experiencing the direct impacts of climate and conflict threats (Leonardsson et al., 2021). However, power dynamics often compromise these systems. In Lanao del Sur, for instance, local institutions are frequently co-opted by elites or private interests, weakening legitimacy and exacerbating exclusion (Agrawal, 2008; Sultana et al., 2019). In these cases, adaptation processes may deepen social divisions and reduce trust in local governance structures.

Similarly, Laikipia's devolution has shifted adaptation burdens onto communities without adequate institutional investment, leaving them ill-equipped to manage long-term climate impacts under threats of violence. This underscores the need to promote conflict management strategies within collective action institutions, focusing on strengthening the resilience of local populations to prevent, cope with, and recover from conflict (De Coning, 2016). Local governance systems must not only manage the immediate effects of climate change, but also foster collaborative and equitable decision-making processes that distribute resources legitimately and mitigate the risks of elite capture.

Complex social-ecological dynamics. Climate and violence threats unfold through non-linear social-ecological dynamics, often marked by feedback loops and emergent challenges (Beaumont and de Coning, 2022). Interventions neglecting these complexities—focusing on technical fixes or top-down governance—risk exacerbating grievances by neglecting the socio-political and cultural dimensions of conflict (Barnett et al., 2015). In Laikipia, for instance, despite the establishment of devolved institutional arrangements for resource management, high human mobility has driven conflict as collective action institutions exclude external resource-user groups, undermining legitimacy and fuelling disputes. This illustrates the broader need for adaptation strategies to foster flexible collective action institutions capable of navigating the multi-scalar dynamics in violence-affected regions, and the diversity of groups usually involved (Walch, 2018). Recognizing

interdependencies across communities and ecosystems, these institutions should transcend political borders to navigate socio-ecological complexities (Darwish et al., 2023).

Resource tenure. Uncertain resource tenure was identified as a pivotal factor influencing community-level responses, often leading to intra-group collective action aimed at securing legally recognized resource access. In Laikipia, Yiaku communities mobilize to preserve communal ownership, as tenure ambiguity from state actions or elite appropriation generates resentment toward state authorities and undermines collaboration. An inability to develop sustainable livelihoods from common-pool resources, compounded by their legal status and climate effects, undermines the legitimacy of collective management institutions and increases conflict among users. In Chiquimula, where insecure tenure results from the increasing privatization of land, the same pattern of mobilization was not observed. Here, informal land leasing exacerbated tensions between small-scale farmers and landowners. The resulting instability underscores how informal practices can undermine resource tenure and act as a driver of conflict at the community level.

These findings highlight a key lesson in designing institutional arrangements that promote collaboration: effective adaptation and climate-resilient peace are unlikely to emerge without secure resource tenure and livelihood benefits from resource stewardship (Ratner, 2015; J. Unruh and Williams, 2013). However, adaptation efforts should consider and draw upon past and ongoing instances of collective action in accounting for present state-society relations (Begeny et al., 2022). In contexts with well-established yet illegitimate tenure mechanisms, like in Laikipia, political reform and peaceful negotiation may clarify tenure. In areas with limited capacities for collective action, as in Chiquimula, efforts should focus on building local facilitation capacities to manage tenure-related conflict peacefully. Where systemic conflict drivers obstruct resource tenure improvements, as seen in Lanao del Sur, integrating land and resource management reforms into peacebuilding frameworks could be a crucial first step toward sustainable peacebuilding. Nonetheless, caution is warranted, as land reform in post-conflict settings may inadvertently create new conflicts by altering tenure claims (Grajales, 2021; Van Leeuwen et al., 2023).

3.3. Resource user characteristics

Intra- and inter-group identities and collective perceptions. Shared identities—rooted in indigeneity, cultural values, territorial belonging, and historical experiences—influence conflict and collaboration in communities facing climate and violence threats. These identities often enhance intra-group cohesion and collective purpose, fostering adaptive capacities. For instance, shared identities in Laikipia motivate communities to secure access to land and cultural practices. However, they can also justify the exclusion of outsiders, fuelling inter-group conflict. This is evident when identities become sources of exclusivity or delegitimize others. In some cases, extreme behaviours to protect group pride, as seen among Muslim Maranao populations in Lanao del Sur, can escalate conflicts.

These dynamics suggest that climate adaptation strategies must consider the interaction between regional conflict systems and identity-based incentives. While social identity theory posits that ingroup identities foster positive perceptions and collaboration among members (Green, 2015), intergroup antagonistic relations are more deeply shaped by structural, environmental, and historical factors (Bar-Tal, 2013; Gibson, 2006). In Laikipia, politicians exacerbate tensions through identity-based narratives, while in Chiquimula, shared liberal values mitigate disputes over unfair land leases. These narratives are used by social groups to organize and make sense of grievances and approvals, motivating collective action for conflict or collaboration (Jost et al., 2017; Van Zomeren, 2019). Effective adaptation strategies must account for collective identities, leveraging these to build capacities for dialogue that address barriers and opportunities for sustainable peace emerging from community values (Tarusarira, 2022).

Adaptive capacities. Adaptive capacities, the "set of resources available for adaptation, as well as the ability…to use those resources effectively" (Brooks and Adger, 2005, 168), strongly influence collaborative capacities under threats of violence. Even when social relations support cooperation, a lack of resources can severely restrict collective action. In Lanao del Sur, despite strong within-group social bonds, resource scarcity hampers mobilization against climate threats. In Chiquimula, resource scarcity drives hoarding behaviours that weaken cooperation. In conflict-affected regions, livelihoods dependent on natural resources are especially vulnerable, as armed conflict degrades resources, disrupts productive systems, and weakens governance (Jaspars and O'Callaghan, 2010; Vesco et al., 2025). This fragility exacerbates income loss, increasing the likelihood of illegal livelihoods or insurgent sentiments, as observed in both Chiquimula and Lanao del Sur. Adaptation strategies to foster a climate-resilient peace must enable collective action to strengthen rural livelihoods. Collective action institutions that are perceived as effective for resilience building help prevent the escalation of conflicts and aid in the recovery process in post-conflict environments (Saraiva and Erfe, 2023). Building capacities for livelihood diversification, public service access, legal safeguards, and support from civil society and government entities is critical (Young and Goldman, 2013).

Collaborative capacities. Adaptation that contributes to a climate-resilient peace depends on sufficient trust among community members to sustain long-term collaboration (Adger, 2003). Hence, in contexts like Lanao del Sur and Chiquimula, where protracted conflict and violence have fragmented social cohesion (C. McAllister, 2009; Vellema et al., 2011), adaption processes should be leveraged toward increasing trust among resource-users. However, traditional mediating and diplomatic approaches often prove ineffective, hence demanding alternative means of negotiation and reconciliation between social groups, governments and societies, or between community members (Huda, 2021; Song et al., 2024). Cooperation for climate adaptation offers a neutral platform for dialogue, circumventing the cultural, historical, and political factors that traditionally divide conflictive parties (G. McAllister and Wright, 2019; Taher et al., 2012).

Adaptation efforts should promote collective action that includes social groups whose trust over one another has been eroded. Literature highlights the importance of institutionalized cooperation in ensuring sustained support and commitment from involved parties (Ojha et al., 2019). However, institutionalization can also present challenges, especially when political and economic elites act as peace spoilers (Medina et al., 2024). Divergent interests in adaptation processes may further widen disparities. Consequently, collaborative processes must incorporate robust conflict management mechanisms that prevent disputes from escalating into violence. A common recommendation involves the inclusion of an arbitration body as a special element of collaboration. Legitimate structures for conflict mediation in resilience building processes have proven effective for reconciliation and trust-building (Hellin et al., 2018). Facilitation processes within adaptation efforts must encourage negotiation and reflection on collective identities and their relationship to negative perceptions between and within groups (Aiken, 2014).

3.4. Resource characteristics

Three factors emerged as distinct resource characteristics that shape local responses to climate threats: 1) the delineation of resource boundaries, 2) the degree of provision of ecosystem services that enable livelihood diversification, and 3) the predictability in the availability of these services under a changing climate. Well-defined resource boundaries of in Laikipia and Lanao del Sur reduce ambiguities regarding rights and responsibilities, thereby minimizing disputes and fostering cooperative behaviour. Similarly, the high provision of ecosystem services from Mukogodo Forest in Laikipia incentivised multi-ethnic collaboration for the diversification of livelihoods beyond pastoralism.

In all case studies, decreasing predictability of ecosystem service provision was related to increasing competition over access to resources, whether natural or financial.

However, the presence of these resource traits does not automatically translate into collaborative nor conflictive patterns. Instead, the influence of these characteristics is contingent upon their interaction with broader social, political, and institutional contexts. For example, increasing variability in resource availability in Laikipia has increased both conflict and collaboration across resource-user groups. These patterns are primarily shaped by the political legitimacy attributed to resource management institutions and tenure mechanisms, as perceived by various user groups. Resource-user groups inhabiting within Mukogodo Forest perceive local management regimes as inclusive, and engage in collaboration, while those outside feel excluded, and engage in conflict.

These results can be interpreted in line with those of Sultana et al. (2019). The authors used the same theoretical framework adopted in this study to understand drivers of conflict and collaboration in the management of climate-affected natural resources in Bangladesh and Nepal, and concluded that climate-induced variability and declines in resource productivity "directly exacerbated conflicts over natural resource use" in close to half the assessed cases (ibid, 100). Although at first glance this contradicts the results from this study, Sultana et al. (2019) also recognize that collective action approaches to resource management in response to climate threats contributed to developing greater collaboration in 80 % of these conflicts. Issues of power distribution, unintended effects of policy and institutional barriers prevented collaboration in the remaining cases. Hence, broader political and social factors were evidenced as more influential in incentivising collaboration over conflict under climate effects.

4. Conclusion

This study explored the conditions that incentivize either cooperation or conflict in community-level responses to climate threats, without presuming one outcome to dominate. Its primary objective was to deepen understanding of how climate impacts influence and are shaped by collective action in violence-prone settings. Using a structured analytical framework, the study systematically compared localized collective responses to climate change across contexts marked by different forms of violence. By analysing environmental, relational, institutional, and systemic patterns, the research identified 18 key factors that either drive conflict or foster collaboration.

The findings showed that while most factors were present across the three case studies, individual factors often contributed to both conflict and collaboration within the same adaptation arenas. This underscores the need to carefully examine how these drivers interact when planning and supporting collective climate adaptation, as their impact is context-dependent. Recognizing these complexities is crucial for identifying opportunities for adaptation efforts to mitigate drivers of violence.

The results emphasize that understanding the full spectrum of drivers shaping community responses can enhance collective action's potential to advance both adaptive capacities and climate-resilient peace. However, to fully capitalize on these opportunities, adaptation strategies must expand beyond traditional approaches to address often-overlooked elements. These include historical processes leading to institutional multiplicity, the legitimacy of local security forces, and the cohesion among neighbouring communities outside the immediate intervention area. By integrating these broader dynamics, policymakers and practitioners can design interventions that realign incentives toward collaboration, supporting both resilience and peaceful relations in violence-prone regions.

The study developed a set of propositions intended to inform the design and implementation of adaptation strategies in violence-prone settings. The broad nature of these propositions is a reflection of the study's comparative approach, which assessed collective responses within action arenas but did not include outcomes from these arenas within its analytical scope. To develop actionable recommendations that address specific combinations of the identified factors and promote collaborative action, future research should employ longitudinal approaches. Such approaches would evaluate the outcomes of collective action in response to climate threats, focusing on the extent to which these actions engender peace or violence, justice or repression, and resilience or vulnerability.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT in order to edit a few selected paragraphs within the manuscript for a clearer use of the English language. No reflections or ideas contained within were generated through AI or AI-assisted technologies. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

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Appendix A. Supplementary data

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