The Climate-Governance-Conflict Nexus

by

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Department of Political Science
Duke University

Defense Date: March 24, 2025

Approved:

David Siegel, Thesis Advisor

Kyle Beardsley

Elizabeth Albright

Thesis submitted in partial fulfillment of the requirements for
the degree of Master of Arts in the Department of Political Science in
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ABSTRACT

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Abstract

What is climate change's effect, when interacted with government effectiveness, on armed conflict in Sub-Saharan Africa? This paper examines the interaction between climate stressors and governance capacity, and their compounding effects on conflict frequency and intensity, by theorizing climate change as a vulnerability amplifier. It expands upon current threat multiplier literature and disentangles the specific pathways through which climate change interacts with national characteristics and the mechanisms, such as government capacity, that mediate these interactions. This paper contends that climate disasters paralyze inefficient and inert systems that lack systematic, responsive institutions to shock events. Drawing from the ACLED and EM-DAT databases, the study aggregates climate disaster and conflict data at the country-year level through GIS-based location matching. This paper highlights that climate change's amplifying effects on conflict frequency and intensity are more pronounced at lower levels of state capacity and diminish as state capacity increases.

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1. Introduction

What is climate change's effect, when interacted with government effectiveness, on armed conflict in Sub-Saharan Africa? This question is significant not only because of its intrinsic relevance but also due to its broader implications for conflict dynamics in an increasingly climate-volatile world. Understanding this interaction is essential to developing effective conflict prevention strategies; improved governance in the face of climate change can lead to more cost-efficient and effective mitigation programs and create resilient societies, ultimately transforming the landscape of political stability and conflict resolution in an era marked by environmental uncertainty.

State capacity has long been associated with the onset and persistence of conflict (for instance, see Barbier & Hochard, 2018; Besley & Persson, 2010; Braithwaite, 2010; Hendrix, 2010; Jackson & Rosberg, 1982); the link between climate change and conflict, though, is more obscure. Current literature relates climate change and conflict through three pathways. First, it can have *direct* physical and psychological impacts on individuals, altering behavior in ways that increase violence. For example, studies found correlations between abnormal temperature or precipitation patterns and heightened belligerent tendencies (Buhaug, 2015; Hendrix & Salehyan, 2012a; Ide et al., 2014). The second, *indirect*, effect of climate change on violence pertains to its effects on intermediaries, such as economic output and mass migration. These intermediary effects can lead to higher crime rates or escalate intergroup tensions, creating fertile conditions for conflict. The third pathway sees environmental degradation as a *threat multiplier* that perpetuates current trends of inequality and marginalization, deepening fragmentation and fueling collective grievances. In other words, climate change does not create conflict on its own but instead exacerbates it in conflict-prone areas due to unaddressed, underlying grievances. This perpetuation of structural vulnerabilities can amplify group contempt and serve as a catalyst for violence (Baratti, 2023; Buhaug, 2015; Klomp & Bulte, 2013).

Despite established theoretical pathways, the wide variety of indicators selected to operationalize the multifaceted dimensions of climate change led to various and often diverging conclusions (Hendrix & Salehyan, 2012a; Ide et al., 2014; Klomp & Bulte, 2013; Koubi et al., 2018; Koubi, 2019). While the *threat multiplier* framework has gained widespread acceptance in the literature, it conceptualizes climate change primarily as an external force or imposition, overlooking critical state-level buffering capacities. This approach falls short of disentangling the specific pathways through which climate change interacts with national characteristics and the mechanisms, such as government capacity, that mediate these interactions.

This paper seeks to understand the climate-conflict relationship by framing it as a *vulnerability amplifier*. That is, in addition to increasing a region's susceptibility to external and immediate shocks, climate change worsens internal governance weakness and causes erosion in state capacity and public trust. Vulnerability, in this case, refers to a system unit's internal capability to cope with or cushion shock events (Alberini et al., 2006). Climate change exacerbates governance weaknesses by exposing existing insufficiencies in basic goods provisions and overwhelming the capacity of weak states to problem-solve and respond effectively to crises. In other words, climate disasters, both as acute weather events and chronic crises, are systemic stressors that amplify vulnerabilities across various sectors, compound their impacts, and undermine coping mechanisms, collapsing resilience under poor governance. It paralyzes systems that are already inert in crisis management or lack systematic, responsive institutions to shock events. To quell dissent, weaker states are more likely to resort to repressive violence as a cost-effective mechanism. External and internal actors can choose to further exploit exposed weaknesses; when countered with state violence, conflict ensues.

This paper contributes a theoretical extension to the current understanding of climate change as a threat multiplier on conflict dynamics by accounting for not only the *direct* impacts of climate change but also the diverse institutional and systemic *responses* it provokes. That is,

while climate change amplifies existing grievances, the effects would be less pronounced if they occurred in a system equipped to cushion them; this is not the case when climate change acts as a *vulnerability amplifier*. While climate change intensifies the immediate risks of conflict by increasing the frequency and severity of climate disasters, it also reveals and exacerbates underlying weaknesses within state governance. These vulnerabilities emerge as climate-induced stressors strain fragile institutions, exposing deficiencies in basic goods provision and eroding public trust in the state's capacity to manage crises. In states where governance is already weak, climate change compounds these challenges, amplifying societal stresses and diminishing the resilience of institutions to absorb shocks. Rather than simply triggering conflict through environmental pressures, climate change functions as a *vulnerability amplifier*, undermining existing coping mechanisms and creating openings for both internal and external actors to exploit governance gaps. When state responses rely on repression rather than resilience, the resulting social tensions are more likely to escalate into open conflict, revealing a complex interplay between environmental stress, governance capacity, and conflict dynamics.

In addition, this *vulnerability amplifier* framework advances existing scholarship on the interplay between climate change and governance capacity by introducing a *dynamic and reciprocal* relationship. Climate stressors exacerbate the vulnerabilities exposed by weak state capacity, thereby compounding the governance challenges and increasing the likelihood of instability and conflict. The reverse also holds, as robust governance capacity mitigates the adverse effects of climate change by effectively managing resources, addressing grievances, and fostering resilience. This bidirectional perspective moves beyond static analyses that treat governance capacity as either a fixed condition or a passive backdrop and instead as both a determinant and a product of climate interactions. It underscores the potential for strong institutions to serve as adaptive mechanisms that not only buffer against climate-induced stressors but also enhance long-term resilience.

To examine this proposed *vulnerability amplifier* theoretical extension, this paper examines the interaction between climate stressors and governance capacity, and their compounding effects on conflict frequency and intensity. The study obtains conflict event and casualty counts from the Armed Conflict Location and Event Dataset (ACLED) for Sub-Saharan African states between 2003 and 2018 (Raleigh et al., 2023). Climate disaster data is retrieved after a geospatial merge of the Emergency Events Database (EM-DAT) and the Geocoded Disasters (GDIS) Dataset (*EM-DAT*, n.d.; Rosvold & Buhaug, 2021b, 2021a). The study then aggregates climate disaster and conflict event data at the country-year level through GIS-based location matching, followed by a merge with state capacity data from the World Bank's Worldwide Governance Indicators (WGI)'s Government Effectiveness criteria (Kaufmann & Kraay, 2024a, 2024b). Through Logit and Poisson Model Regressions, this paper highlights climate change's amplifying effects on conflict frequency and intensity, which are more pronounced at lower levels of state capacity and diminish as state capacity increases.

This paper proceeds as follows. First, it defines the three key variables — armed conflict, government effectiveness, and climate change — and the mechanisms through which they are operationalized. Next, it outlines the theoretical pathways that motivate the central hypotheses of this paper. It then goes on to describe the research methodology for the state-level hypothesis and discusses the findings. Finally, I will identify the existing gaps in countering the amplifying effects of climate change and outline policy recommendations.

2. Definition and Scope

Armed conflicts, the main dependent variable, are violent interactions between two organized armed groups. Compared to other forms of collective action or targeted violence, particularly when a state is volatile and faces social unrest under climate disasters, battles capture governments' decisions in weighing various problem-solving mechanisms (Froese & Schilling, 2019). Rapidly resorting to armed conflict, or battles, as a solution to internal disputes indicates deficiencies in key areas of institutional strength. In other words, while the *outcomes* of battles are a direct testament to the state's capacity to maintain territorial control, deploy military resources, and provide security, the *decision* to engage in battles suggests that employing forceful measures is more cost-effective than peacefully absorbing internal dissent, such as through effectively delivering goods and resilience-building resources. This implies weakened capacity in these areas and a reactive governance structure. This definition of armed conflicts is in line with ACLED's "Battle" event type. There is no minimum fatality threshold for inclusion; instead, this paper emphasizes two specific elements of armed conflict: 1) collective, cohesively operating actors with an established purpose, and 2) an exchange, rather than single-sided, use of force between opposing groups.[1]

The explanatory variable of this paper is climate change, which is conceptualized as both a natural and anthropogenic phenomenon: though it is a consequence of temperature, hydrology, and land abnormalities, each administrative unit and individual experiences the same natural phenomenon differently due to varying vulnerability and resilience (Brooks et al., 2005). The

[1] Within the scope of this paper, armed conflicts do not encompass community-level violence (such as farmer-herder conflicts over land access and grazing availability), civil disobedience (such as peaceful and violent protests), or strategic developments of new weaponry and remote attacks. However, civilians can be harmed when caught in crossfires and listed as "collateral damage."

disproportionate impact of climate change determines that, though many nations contribute marginally to its root cause, those that are most vulnerable bear the brunt of the current environmental crisis and are unable to cushion the losses due to a lack of disposable capital (Kubik & Maurel, 2016; Lewis, 2017; Savari & Zhoolideh, 2021). To operationalize this complex phenomenon, this paper follows suit of existing conflict studies research and adopts climate disasters, notably droughts, floods, and extreme temperatures, as indicators of climate change (for instance, see Hendrix & Salehyan, 2012b; Hsiang et al., 2013; Ide et al., 2014; Mach et al., 2019; von Uexkull et al., 2016).

The use of climate disaster event data, or documentation on the occurrence of such disasters, is an attempt to prevent multicollinearity between capacity and climate. Though state capacity can significantly impact the management of, resilience against, and reconstruction after disasters, the *occurrence* of such climate disasters is difficult to mitigate through institutions and effective governance of a single state. The paper's focus is not on how states impact the onset of climate volatility but on how states respond to and manage disasters given current governance capacities, thereby affecting armed conflict (Milne, 2021). In other words, it assesses state adaptation to increasing climate variability through its impact on conflict frequency and intensity.

Climate disaster data used in this paper draws from EM-DAT, which is one of the most comprehensive databases on acute and chronic disasters coded from news coverage. Despite its relative thoroughness, there are notable weaknesses of such event data coding that must be acknowledged. First, for inclusion, these climate disasters must pass the severity threshold of incurring significant human and/or economic loss and satisfy one or more of the following components: 10 fatalities; 100 affected people; a declaration of state of emergency; and a call for international assistance (*EM-DAT*, n.d.; Rosvold & Buhaug, 2021b, 2021a). In addition, there are often reporting biases and regional omissions for smaller-scale, yet still impactful, climate stressors (Bohr, 2020; Reckova & Irsova, 2015). Areas with frequent weather events or that are

consistently impacted by chronic, pervasive crises can face underreporting, as varying expectations about the region's norm introduce callousness to media coverage (Brimicombe, 2022). This, in turn, could diminish the perceived severity of recurring crises. For the purpose of this study, though these weaknesses must be addressed, the emphasis on country-level units of analysis can circumvent issues brought about by the lack of high-definition data.

Finally, government effectiveness is a concept based on perceptions of the quality of bureaucratic institutions, their ability to deliver public services, and their independence from political pressures, as drawn from the World Bank's World Governance Indicators (WGI, 2023). The adoption of the WGI definition is a comprehensive view that encompasses various facets of state capacity and governance while effectively circumventing tautology. By defining governance capacity through institutional qualities rather than specific outcomes like conflict prevention, this approach maintains a conceptual separation between the characteristics of effective governance and its potential consequences, such as improved security, without presupposing those outcomes as part of the capacity itself (Braithwaite, 2010; Hendrix, 2010). Throughout this paper, "government effectiveness," "governance capacity," and "state capacity" are utilized interchangeably.

3. Climate and State Capacity: Pathways to Armed Conflict

The relationship between climate change, governance capacity, and conflict frequency is complex and multidimensional, raising fundamental questions about how environmental stressors intersect with state capacity to influence stability. Specifically, how does climate change act as a stressor that exacerbates weaknesses within governance structures, thereby increasing internal and external challenges to their power and authority? To what extent do these climate-induced challenges further prompt states to resort to violence and amplify the risk of conflict? Therefore, this section proceeds by briefly engaging with existing theories that assess the linkage between governance capacity and states' propensity for repressive violence. Then, it proposes a theoretical framework that views climate stressors as *vulnerability amplifiers* to existing state deficiencies, proposing that weak governance, combined with climate pressures, significantly heightens the likelihood and intensity of conflict.

3.1 Linking State Capacity and State Violence

Hendrix (2010), in measuring and operationalizing state capacity, emphasizes three complementary categories of definitions: military capacity, bureaucratic or administrative capacity, and institutional coherence and quality. In conflict onset, measures of brute military strength are often ineffective in capturing the fundamental motivation to rebel or the repressive capacity of a state during this initial rebellion. The monitoring and identification of, as well as targeted operations against, insurgencies are more direct determinants of the feasibility of rebellion and measures of relative capacity between the insurgent and the state (Fearon & Laitin, 2003). The state must demonstrate weakness in either or both latter criteria of state capacity — administrative capacity and institutional comprehensiveness — to present a feasible and lucrative breeding ground for rebellion and an effective power grab. Such a power gap in state capacity, though varying in degree and intensity, is present in both weak states (through the *Weak State*

Theory) and relatively strong, yet highly centralized and regionalized, states (through the *Relative Capacity Theory*). Both theoretical pathways are outlined below.

3.1.1 Weak States and Propensity for Violence

Defining *weak states* is an attempt to capture the extent of state power. This paper zooms into the literature that refers to the central government's inability to exercise its authority in its marked territory through three main fields: capacity, legitimacy, and authority (Lindell & Persson, 1986; Rotberg, 2003). Capacity manifests in the provision of basic services and public political goods, the construction and maintenance of infrastructure, and the implementation and effective enforcement of policies. Legitimacy, or the perceived capability to respond and answer to the concerns and demands of the population, complements governance in enhancing public trust; however, a decline in public opinion or widespread skepticism of the central authority's ability to serve the collective good results in diminished compliance among the population. Authority suggests the state's ability to buffer external forces and balance the dynamism of international constraints with domestic political realities (Hendrix, 2010; Herbst, 1990). This two-level engagement between domestic and international systems can inadvertently reveal gaps in the state's ability to provide essential political goods domestically, shape internal perceptions of legitimacy and capacity, and create opportunities for alternative actors to step in and fulfill roles held by the central government.

Failed states provide only limited quantities of other essential political goods. However, this absence of state control does not equate to an overall absence of power or authority. This decentralization of power initiates a power grab, with various actors, including local rebellions and external militia groups, competing for influence (Jackson & Rosberg, 1982). Rather, states tend to forfeit to regional organized actors their role as the preferred suppliers of political goods. The forfeit as the default supplier allows non-state actors to gain legitimacy by providing services or protection to local populations that the state fails to offer, establishing a form of parallel

governance. However, this power dynamic is inherently unstable, as it often leads to competition over resources and territory, escalating into conflict among non-state actors (Acemoglu, 2005; Herbst, 1990; Rotberg, 2003).

Typically, it is assumed that as states grow stronger, their capacity to provide public services increases, thereby reducing the likelihood of alternative governance structures emerging. However, the presence of organized actors, standing in and ensuring service deliveries as effective state parallels, is not exclusive to weak states. Within more powerful states, internal power differences can create pockets of weak governance where the state's presence is limited or inconsistent, offering the potential for pluralistic governance (Clapham, 1998). Though they maintain greater control and are more capable of delivering services in urban centers and politically significant regions, stronger states may struggle to exert influence in peripheral areas.

3.1.2 Relative State Capacity and Propensity for Violence

This uneven distribution of state control, or a differing *relational capacity*, can accumulate into insufficient basic goods provision, weak infrastructure, and political instability from the power grab. When state presence is minimal, but local groups are internally well-organized and interconnected, the state's absence allows for the development of alternative power structures that are more responsive to local needs or grievances than the central government. This is particularly prominent when local groups are bounded by shared heritage or community interlinkage (Müller-Crepon et al., 2021). Grievances play a critical role. When states fail to provide basic services or distribute resources equitably, marginalized groups accumulate frustration and resentment. These grievances are particularly acute in regions that have little interaction with the central government but are otherwise cohesive, allowing these frustrations to solidify into organized resistance. This disconnection between the central state and these regions contributes to social and political fragmentation, making conflict more likely (Arjona, 2014; Fukuyama, 2004; Staniland, 2012).

Under this context, how do the effects of climate change and factors of shock exacerbate governance tensions? The nature of unforeseen climate calamities overwhelms volatile institutions, damages subsistence plots, and amplifies impacts in the absence of state-provided safety nets (Rotberg, 2003). Climate change significantly impacts state capacity and cuts back on institutional strength to effectively provide basic services, enforce laws, maintain order, and, most importantly, uphold territorial integrity. The governance and management of resource scarcity and climate disasters are more crucial than the crises themselves: it is the state's *response*, rather than the scarcity of a resource or the occurrence of a disaster, that ultimately determines the trajectory of stability or conflict (Milne, 2021; Petersen-Perlman et al., 2017). Weak governance, though not directly impacting the onset or frequency of climate disasters, can intensify their *impacts*; these political institutions, in turn, act as mediators of climate shocks on conflict.

When faced with competition, this paper argues that states are more inclined to respond with repressive violence since it is the preferred, more cost-effective mechanism to reassert control and dampen dissent. This response is rooted in the state's lack of capacity for effective crisis management or constructive problem-solving: fundamentally, they lack the legitimacy, resources, or capacity to effectively negotiate or address the root causes of the rebellion. When they are struggling to maintain authority under forms of parallel governance (through internal or external challenges to their power), they often resort to coercive measures and violent suppression over addressing underlying issues since the creation of problem-solving institutions is unobtainable (given low state and administrative capacity) and more costly and resource-demanding (Acemoglu, 2005). The appeal of violent suppression lies in its ability to restore control quickly, a preference deeply rooted in the pragmatism of fragile states. Therefore, instead of following international norms or striving for long-term stability, they prefer to engage in short-term, violent solutions to brush off acute challenges to their authority (Humphreys, 2005). This is

the contextual premise upon which climate amplifies and perpetuates violence by proposing additional incentives to increase its appeal.

3.2 Theoretical Expectations: Climate as A Vulnerability Amplifier

This paper frames climate change as a *vulnerability amplifier* that exposes inherent weaknesses in state capacity, thereby increasing the likelihood of violence. This argument is based on several premises. First, there must be a power or capacity imbalance between the state and an organized non-state group in terms of service provision — as delineated through the weak state and relative capacity theories. Climate crises exacerbate these existing gaps, making them more visible and pronounced. Second, the state must have an interest in maintaining its hold on power; this paper contends that the mechanism through which weaker states are more likely to respond to these challenges is violence. This reaction stems from a calculated assessment that, in the absence of effective institutions to address public grievances, it is more cost-effective to rely on military force than to address underlying issues. Under the effects of climate change, violence increasingly becomes the preferred method to suppress dissent, driven by two key incentives. First, by framing the state as a defender against security threats, the government can bolster its legitimacy. Second, by using military action to justify disruptions in service delivery, states can obscure the underlying cause of governance failures — namely, an inherent weakness that is exacerbated by climate change. In this case, initiating and engaging in violence proves to be an effective *attention diverter*.

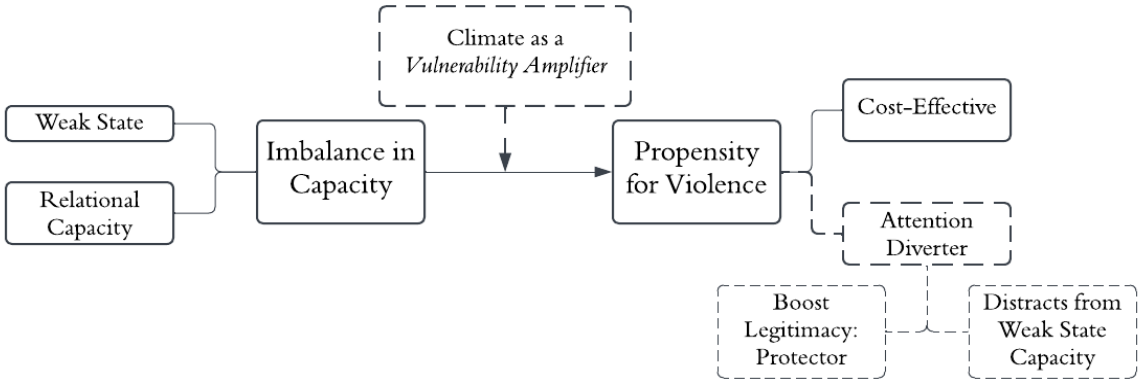

Figure 1 Theoretical Framework of Climate as a Vulnerability Amplifier

The dotted lines represent the motivations for state violence following the moderating effect of climate change.

In states where governance capacity is limited, the ability to prepare for and mitigate the impacts of climate change is severely compromised. The absence of robust disaster preparedness systems leaves vulnerable populations exposed to climate-induced events such as droughts, floods, and extreme weather. Likewise, in the aftermath of climate disasters, weak states lack the protocol for immediate and effective alleviation tactics in service delivery and reconstruction. Therefore, in climate disasters with similar magnitudes, weak states struggle to respond, but the lack of effective leadership and resources only deepens the crisis (Bäckstrand & Kuyper, 2017). In the context of climate disasters, existing imbalances in state capacity are exacerbated, making it increasingly costly for states to establish institutions that address underlying grievances. As a result, states are more incentivized to resort to violence, with its appeal as a cost-effective repressive mechanism increasing further.

A second incentive for the use of violence by the state is its function as a tool to divert public attention from critical governance shortcomings after climate shocks and shift blame; in other words, it creates an effective attention diverter to obscure the reality of their incompetence, especially under climate shocks. As climate disasters further expose the state's inability to provide aid or relief, public trust is eroded; to regain and bolster legitimacy, states may resort to conflict to reposition themselves as protectors and, by extension, as reliable providers of political

goods. This stems from states' attempts to conflate security and services (Hendrix, 2010). Therefore, this use of violence serves a dual purpose: It not only suppresses dissent but also helps the government maintain a facade of strength and control amid instability, particularly when exacerbated by climate-related stressors. It is an essential propaganda tool that bolsters states' perceived legitimacy (Boucek, 2009; Williams, 2003).

In weak states where governance failures are particularly evident, the strategic deployment of violence not only allows the state to shift the narrative away from its inadequacies but also allows it to alter the hierarchy of perceived services' importance. That is, the provision of security has been elevated to a critical priority and takes precedence over all others. This tactic not only serves to obscure immediate grievances but also attempts to reinforce the notion that security, rather than social or economic welfare, is the state's primary duty. By framing itself as a necessary defense against perceived threats, the state can shift attention away from its failures in service provision and reinforce its image as a stabilizing force. Over time, such strategies may foster a cycle of repression, where the state relies increasingly on force rather than governance reforms to maintain authority, further diminishing its capacity for crisis management and responsiveness to its population's needs. Consequently, the state's repeated use of violence ultimately weakens the very institutions necessary for long-term resilience, deepening the vulnerabilities that climate crises continue to expose (Jackson & Rosberg, 1982).

These unaddressed grievances continue to simmer, fostering resentment and further eroding public trust, ultimately escalating into conflict. Given this propensity for states with lower levels of governance capacity to default to violence under climate disasters, the interaction between higher levels of climate change and weak government effectiveness will increase the frequency and intensity of armed conflicts. In addition, it conceptualizes this interaction effect as more pronounced in extreme cases of state capacity. In other words, it believes that climate change is likely to amplify the frequency and intensity of armed conflict in contexts with severely

limited governance capacity, while this exacerbating effect would significantly attenuate as the robustness of state institutions and governance capabilities increase. Hence, this paper posits that:

Climate change will increase the frequency and intensity of armed conflict in areas with low governance capacity, but this effect will weaken as governance capacity strengthens.

Conversely, according to the Relational Capacity Theory, even stronger states can be susceptible to conflict if powerful peripheral regions challenge central authority. This suggests that the hypothesized diminishing effect of climate change on conflict in areas with higher governance capacity may not hold universally. Rejecting the hypothesis would result in this alternative explanation, which is that climate change will increase the frequency and intensity of armed conflict in areas. This effect is either homogenous across varying governance capacities, or there are no universal trends and each nation much be examined individually.

4. Research Design

I used time-series-cross-sectional panel data for the analysis, sourcing records from the ACLED Event Database, the EM-DAT Natural Disasters Database, and the WGI's Government Effectiveness Criteria (Beck et al., 1998)[2]. The EM-DAT dataset does not provide geolocations; to obtain Administrative Level 1 data (at the provincial level), it was spatially merged with the Geocoded Extension Dataset from NASA to provide the coordinates for each individual climate event for visualization (see Figure 2). Due to data validity and availability issues[3], I aggregated conflict and climate event data at the state-year level from 2003 to 2018 for 52 African countries to match the data resolution of WGI indicators.

The unit of analysis throughout this paper, therefore, is at the state-year level. My dependent variables, conflict frequency (count number within a given state/year) and intensity (count number of casualties within a given state/year), were respectively summed. Conflict occurrence was assigned a binary variable, with 0 being that there were no conflicts within a given state/year and 1 being that conflicts occurred, regardless of frequency and intensity, within the given state/year. My key independent variables, climate event occurrence and frequency, were also coded according to this schema. The capacity indicator, ranging from -2.5 (low levels of governance) to 2.5 (high levels of governance), was normalized based on Z-score standardization and lagged by a year. To investigate how government effectiveness mediates climate change's amplifying effect on armed conflict, my models interact climate event frequency with the capacity indicator.

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[2] See Appendix A for a detailed explanation of the coding scheme.

[3] According to EM-DAT documentation, pre-2000 data is subject to reporting biases due to selective coverage in extreme weather events. The WGI Indicators did not encompass data for Cabo Verde and Burundi; it also lacked data for 2001 for all nations.

Regarding control variables, I account for state-level factors impacting conflict characteristics. I control for economic and political variables, including Gross Domestic Product (GDP) and the level of democracy based on Polity IV scores.[4] States' economic prosperity may indicate resources available to independently mitigate climate stressors, while more democratic states may employ transparent and participatory approaches to conflict resolution, constraining state agency to leverage unconstrained violence and potentially affecting the severity and frequency of conflict. I also control for state geographic proxies with a binary variable, as equatorial nations are generally more susceptible to climate volatility (Collins et al., 2024).

To control for conflict relapse and persistent, chronic skirmishes with typically high tensions, I used the Political Corruption Index, a normalized interval variable ranging from 0 (not corrupt) to 1(corrupt), from the Varieties of Democracy (V-Dem) Database (Coppedge et al., 2024; Pemstein et al., 2024). This is a proxy variable that simulates conditions under which conflict relapse is more likely. Corruption, particularly how oligarchical politicians consolidate resources to benefit the few, instead of the "population at large," through selective deprivation policies, is widely cited as leading to recurrence and relapse in post-conflict settings (Hegre & Nygård, 2015; Szeftel, 1998). The choice of this variable, instead of a more direct estimation of conflict relapse, such as the number of days between two conflicts with the same actors, is constrained by the chosen level of analysis. As the data resolution is not granular enough to support or justify a potential time lag between disasters and conflict or between conflicts, the use of the corruption index to model conflict recurrence was chosen as an alternative out of necessity.

[4] For GDP, the World Bank data was missing for Eritrea from 2012 onward and for South Sudan from 2003-2007 and 2016-2018. They were replaced with the East Africa average. For Polity scores, data was absent for São Tomé and Principe, Seychelles, South Sudan and Sudan prior to 2011, and Somalia for 2011. They were replaced with the African average.

Potential multicollinearity issues between the governance capacity indicator and this corruption proxy were tested and prevented through a calculation of the variance inflation factors.

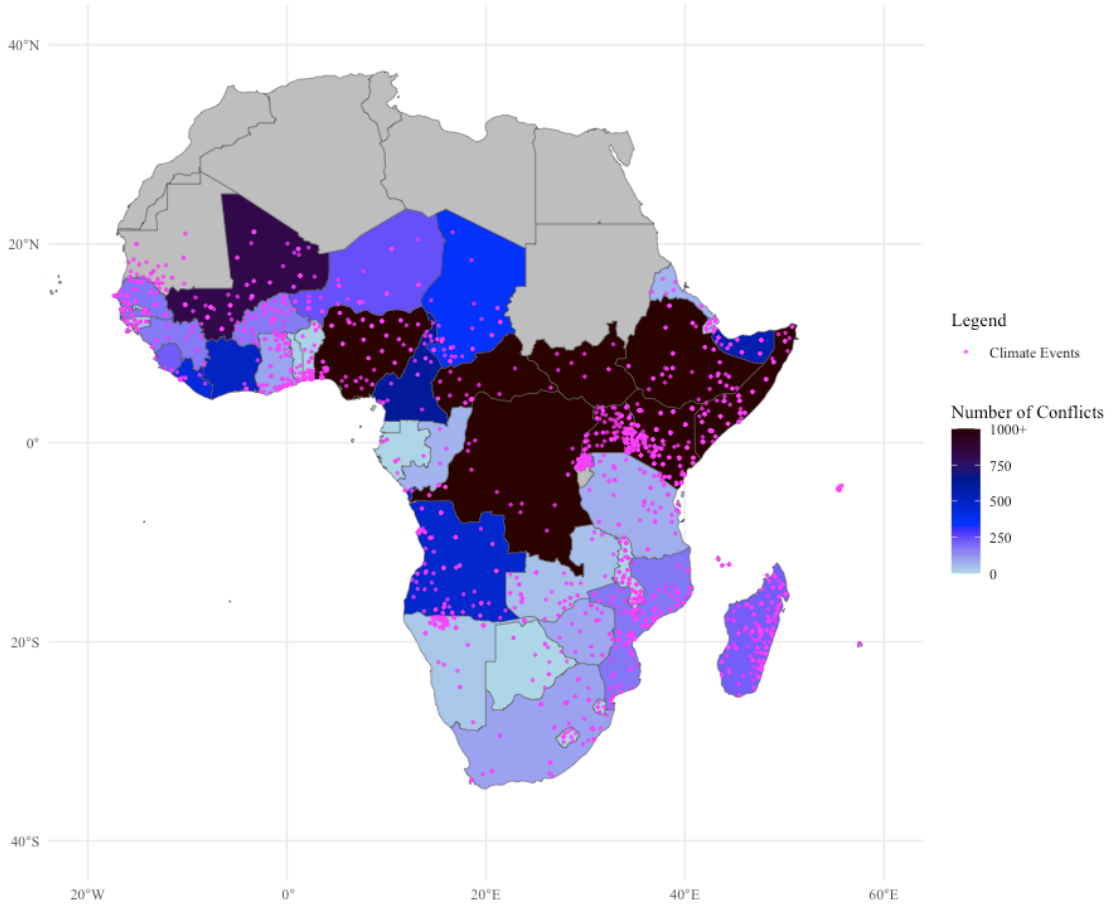

Figure 2 Distribution of Climate and Conflict Events in Sub-Saharan Africa, 2003-2018

Note: The choropleth map visualizes the aggregate of the number of conflict events within each nation-state from ACLED data. Magenta point data indicates the location of individual climate events, located by latitude-longitude coordinates after a geospatial merge of EM-DAT and NASA data.

Figure 2 provides an initial visualization of the geographic overlap in the distribution of climate and conflict events across Africa. Conflict events are heavily concentrated in specific regions, particularly the Sahel, East Africa (notably Somalia and Ethiopia), and parts of the Democratic Republic of Congo (DRC), while climate events are distributed widely across the continent. There is significant overlap between areas of high climate and conflict activity, especially in East Africa and the Sahel, which suggests that environmental stressors, compounded

by governance challenges, may play a role in driving conflict in vulnerable regions. This map serves as a foundation for further analysis into the interplay between climate change and conflict dynamics across Africa.

This paper does not employ fixed-effects models. The focus of this study is not on the internal evolution of governance structures within any one state but rather on the comparative dynamics between different countries. With its emphasis on within-entity variation, fixed effects would not be able to account for the cross-country differences in the trajectories of governance structures. Since governance evolves differently across countries, comparing these variations is essential to understanding how governance capacity influences the relationship between climate events and conflict dynamics across nations over a period of time, instead of solely examining its evolution within a particular nation. A model that ignores between-country differences would lead to a misleading interpretation of the role that governance plays across different national contexts.

5. Results and Discussion

This section presents the results table from three regression models as well as the associated marginal effects plot of climate on conflict frequency and intensity, ranging across various governance capacity values. Overall, the results from the models (depicted in Table 1) suggest strong support for the paper's main argument, which is that the interaction between higher levels of climate change and weak government effectiveness increases the frequency and intensity of armed conflicts. At the state level, it also tentatively supports that climate change will increase the frequency and intensity of armed conflict in areas with low governance capacity, but this effect will weaken as governance capacity strengthens.

The *Conflict Occurrence* model is a logit analysis that investigates whether the frequency of climate events impacts the presence of conflicts. The results indicate that the occurrence of climate events raises the likelihood of conflict. Other intrinsic state-level characteristics, such as GDP, level of democracy, and geographical proximity to the equator, all contribute to the occurrence of conflict. However, the interaction between capacity and climate event occurrence is not statistically significant, implying that governance capacity does not significantly modify the effect of a single climate event on the likelihood of conflict. In other words, climate event occurrence has a positive relationship with conflict occurrence, regardless of capacity levels.

The *Conflict Frequency* model interacts capacity with climate event frequency to estimate the frequency of conflict events. Capacity has a significant negative effect, indicating that higher levels of governance reduce the frequency of conflict events, when climate shocks are 0. Meanwhile, frequent climate events are associated with an increase in conflict frequency, as shown by a positive and significant coefficient. The interaction between capacity and climate event frequency is both negative and statistically significant, suggesting that as governance capacity increases, the frequency-boosting effect of climate events diminishes. This finding

implies that higher-capacity states are better able to buffer against the destabilizing effects of repeated climate stressors, reducing the likelihood of frequent conflict escalation.

Table 1 The influence of governance capacity and extreme weather event frequency on conflict occurrence, frequency, and intensity

	Conflict Occurrence	Conflict Frequency	Conflict Intensity
Capacity	1.820+	−92.614*	−413.739**
	(0.992)	(42.205)	(154.823)
Climate Event Frequency	0.308	120.100***	299.485***
	(0.288)	(10.435)	(38.278)
Capacity x Climate Event Frequency	0.962	−306.824***	−715.357***
	(0.777)	(28.593)	(104.888)
Polity Scores	0.079***	3.815***	7.727*
	(0.019)	(0.880)	(3.228)
GDP	0.000***	0.002	0.003
	(0.000)	(0.001)	(0.005)
Equatorial State	0.858**	64.602***	105.909**
	(0.279)	(11.124)	(40.806)
Corruption Index	3.361***	31.267*	183.390***
	(0.375)	(14.690)	(53.888)
Num.Obs.	832	832	832
RMSE	0.39	115.56	423.90

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

The *Conflict Intensity* model, which estimates the number of conflict casualties, mirrors this pattern, with capacity having a significant negative effect on the intensity of conflict, while frequent climate events significantly increase conflict intensity. The interaction between capacity and climate event frequency is again negative and highly significant, indicating that in states with

higher governance capacity, the intensifying effect of frequent climate events on conflict is substantially reduced. Overall, these findings support the hypothesis that governance capacity mitigates the adverse effects of climate stress on conflict dynamics. High-capacity states appear more resilient to the destabilizing impacts of frequent climate events, showing a lower propensity for both frequent and intense conflict in response to environmental stressors.

Figure 3 presents an analysis of the marginal effect of climate events on conflict frequency and intensity, moderated by state capacity. To account for heteroskedasticity and potential autocorrelations in the panel data as a result of the lack of independence within states over a period of time, this figure uses robust standard errors, or heteroskedasticity-consistent standard errors, to correct this issue. RSEs adjust the variance-covariance matrix of the error terms, making the standard errors valid even when heteroskedasticity is present. This allows for more reliable hypothesis tests and confidence intervals.

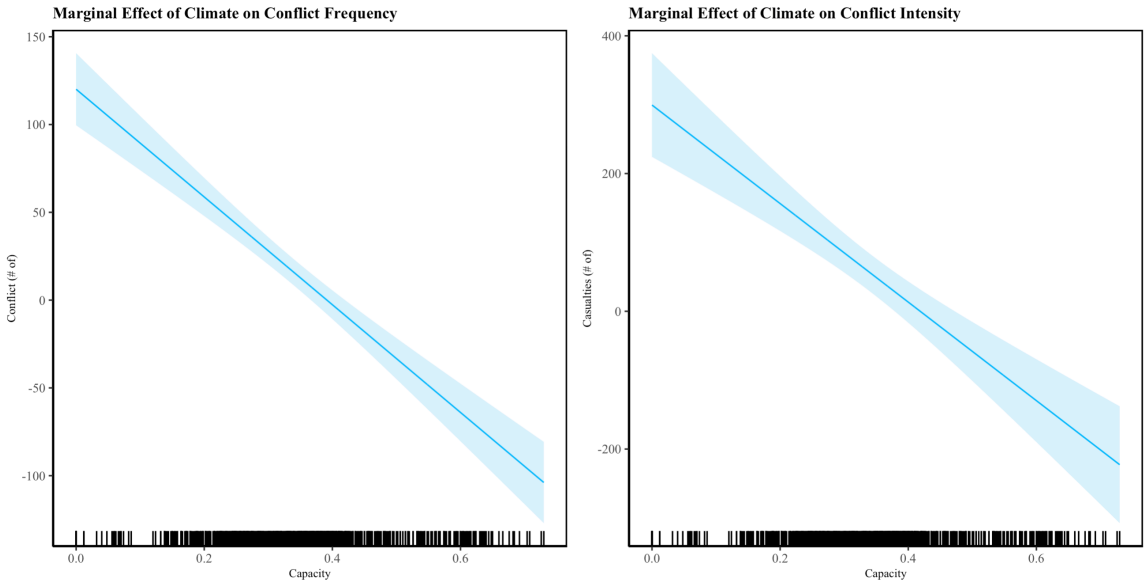

Figure 3 Marginal effects of climate disasters on conflict frequency (left) and intensity (right)

Note: Rug plot indicates the distribution of scaled Governance Capacity values in the SSA states within this study, ranging from 0 to 0.73. 95% confidence bounds included (calculated with robust standard errors).

It becomes evident that the impact of climate events on both conflict frequency and intensity is contingent upon the level of state capacity. At lower levels of state capacity — where governance structures are weak, resources are limited, and institutional resilience is minimal — climate events are associated with a substantial increase in the frequency and intensity of conflict. The positive values on the y-axis at the lower end of the capacity scale suggest that, in these contexts, climate-induced stressors heighten instability, leading to more frequent and deadly outbreaks of conflict.

As state capacity improves, however, the effect of climate events on conflict frequency appears to diminish. The downward slope of the line indicates a gradual reduction in the estimated number of conflict events and casualties as capacity increases. This suggests that, in more capable states, the systems and structures in place are better equipped to manage the pressures introduced by climate events, whether through more efficient distribution of resources, conflict prevention mechanisms, or more effective response strategies to mitigate resource scarcity and associated grievances. Eventually, at higher levels of state capacity, the marginal effect of climate events on conflict frequency turns negative, implying that states with strong governance not only withstand climate pressures but may even experience a stabilizing effect, where climate events no longer trigger conflict with the same intensity or frequency. This is possibly due to how effective mitigation and management of climate shocks decrease internal grievances over uneven distributions of resources.

Together, these two models underscore the critical role of state capacity in moderating the relationship between climate stressors and conflict dynamics. In states where capacity is low, the occurrence of climate events is associated with a greater likelihood and severity of conflict, suggesting that these states lack the resilience to manage the additional pressures posed by climate change. The governance weaknesses in such states appear to make them more susceptible

to climate-induced instability. Climate events, in this case, act as vulnerability amplifiers, exacerbating existing governance deficiencies and making conflict more likely.

In contrast, higher-capacity states demonstrate a buffering effect against climate-related conflict escalation. The decreasing marginal effect of climate on both conflict frequency and intensity as state capacity rises suggests that robust governance can mitigate, and in some cases even neutralize, the destabilizing impact of climate events. This finding aligns with theories that emphasize the role of institutional strength in conflict prevention and highlights the importance of investing in governance as a means of climate adaptation. Rather than merely reacting to climate events, high-capacity states can leverage their institutional resources to proactively address underlying vulnerabilities, thereby reducing the likelihood of climate-triggered conflicts. In essence, environmental stressors do not merely influence the likelihood of conflict in isolation but interact with state capacity to shape conflict outcomes in nuanced ways.

6. Policy Gaps and Implications

Building upon the analysis of the complex relationship between climate change, governance capacity, and conflict dynamics, it is essential to consider policy frameworks that can mitigate and reduce the risks of conflict relapse and enhance resilience in the face of climate-related challenges. As climate change continues to drive vulnerability, particularly in regions with weak governance, effective disaster risk management and community-based resilience programs become critical components of both conflict prevention and adaptation strategies. While states cannot completely circumvent climate events occurring within their borders, strengthening government capacity can mediate and attempt to diminish the impact of these environmental stressors (McBean & Rodgers, 2010; Tompkins & Neil Adger, 2005). By enhancing governance effectiveness, states can reduce the likelihood that climate events will escalate into conflict.

This section explores two key approaches: first, the effectiveness of prevention, resilience, and mitigation strategies as compared to post-disaster recovery efforts, and second, the importance of community-focused resilience programs that integrate structurally stable essential services through micro, localized initiatives. It concludes with policy recommendations, offering actionable interventions and strategies to enhance resilience to climate-induced risks under states with low governance capacity and reduce the likelihood of conflict relapse.

6.1 Disaster Risk Management: Prevention vs. Post-Disaster Recovery

Disaster risk management (DRM) is a comprehensive approach aimed at reducing the risks of a multitude of hazards “across a range of natural and human-induced disasters.” (Adelekan et al., 2015) The scope of this paper focuses particularly on the impacts of natural hazards and climate-related disasters on communities and societies. DRM typically takes on two approaches, depending on the stage at which they combat disasters: pre-disaster mitigation and prevention, and post-disaster recovery and reconstruction. The first approach emphasizes proactive measures that prevent and reduce the impact of disasters before they occur through

resilient infrastructure development and early warning system implementations. The second approach emphasizes reactive strategies and addresses the immediate aftermath of disasters by providing relief and humanitarian aid (Venton, 2010; Ziga-Abortta & Kruse, 2023).

Though both are necessary and target various stages of disaster occurrence, preventative mitigation is cited widely to be more cost-effective per dollar amount. They are typically more effective in avoiding the large-scale physical, economic, and psychological damage that requires expensive recovery efforts. The World Bank and U.S. Geological Survey calculate that a predicted $400 billion in economic losses from natural disasters could be reduced to $120 billion with a $40 billion investment in proactive prevention and mitigation strategies (Shreve & Kelman, 2014). Tangible examples could far exceed this dollar conversion; for instance, in Mozambique, the post-flood aid request for reconstruction and adaptation was 203 times the unfulfilled pre-disaster request to build resilient infrastructure and stable essential service delivery (Shreve & Kelman, 2014; Trobe, 2004). In addition, preventative measures are largely supportive of poverty reduction, increasing individual and community resilience, and decreasing reliance on state-provided aid, creating a virtuous cycle in combating disasters.

However, there is a notable lack in a preventative culture. There is often a bias toward reactive funding and disaster response rather than proactive prevention and resilience-building (Trobe, 2004; Ziga-Abortta & Kruse, 2023). This bias is myopic in nature and stems from a perception that disaster response is more urgent and visible, therefore neglecting resource allocation to prevention. As a result, funding is frequently directed to short-term relief efforts, though investing in prevention could reduce costs in the long run (Dupuis & Knoepfel, 2013).

Such reactive governance is notably more apparent in nations with lower governance capacity, which in turn triggers the “climate disaster-conflict” chain presented in the analyses above (McBean & Rodgers, 2010; Satterthwaite, 2011). The already-lacking infrastructure and weak administrative frameworks in these states are more constantly and likely to be overwhelmed

and preoccupied by acute, immediate crises. Low-capacity states lack the necessary funds to develop this infrastructure, and even when external aid or investment is available, insufficient internal capabilities fail to effectively manage resources and realize their full potential (Lightfoot, 2018). Without strong governance structures and effective coordination, external interventions often end up being disjointed or inefficient. This creates delayed or incomplete measures, resulting in a cycle of constant disaster relief efforts that only partially address underlying risks, occasionally backfiring to create over-reliance or fuel domestic corruption (Prys & Wojczewski, 2015; Snidal et al., 2024). When there is insufficient political prioritization of disaster prevention, it is much harder to gather the political will needed to enact the policies, allocate resources, or build the institutional frameworks required for effective mitigation.

6.2 Community-Driven Resilience: Micro-Level Engagement from the Bottom Up

In addition to state-level initiatives, in weaker states, subnational units play a significant role in community-driven collective action and in aligning initiatives with local needs and realities. It is crucial, at this point, to differentiate these solutions from the aforementioned forms of parallel governance. This section primarily focuses on individually grounded, micro-level initiatives that focus on localized issues, such as health systems, food, security, or resilience to climate change, without directly challenging central authority (Below et al., 2010; Kareem et al., 2020; Oloo & Omondi, 2017). They rely on individual agency and the capacity of smaller units, supported by financial or technical assistance from larger authorities, to leverage collective action to address immediate concerns.

These initiatives are adaptable to the unique challenges and circumstances of local communities, allowing them to respond quickly and effectively to emerging needs. Because these programs are smaller in scope and more targeted to specific concerns varying across different communities, they require fewer resources compared to large-scale, top-down programs and are

more effective than sweeping blanket initiatives, easing their implementation (Ashu & Niekerk, 2019; Baninla et al., 2022). Over time, micro-level initiatives reduce reliance on external actors by increasing local capacity, empowering communities to take ownership of their own development and adaptation efforts. This self-reliance creates a positive feedback loop, wherein the communities' abilities to address their challenges grow, reducing the need for outside interventions and fostering long-term resilience.

These micro-level initiatives successfully integrate central governance and local autonomy. By focusing on micro-programs that are centrally headed but allow for local adaptation, these initiatives can strengthen resilience without directly challenging central power structures (Ashu & Niekerk, 2019; Gaston et al., 2012). Essentially, these programs are complementary to the larger governance structures, enabling localized development without undermining the national government. Rather than competing with or undermining the existing national governance system, these initiatives work as complementary components that contribute to overall development goals.

The effectiveness of climate-related *policies* at the micro-level does not necessarily need to be confined solely to climate *goals*; while climate change remains a critical challenge, peripheral or structurally stable systems are equally essential for the overall resilience of communities (Chirambo, 2017). Rather than tackling individual problems in isolation, this approach emphasizes the interconnectedness of various sectors and creates integrated solutions to multifaceted problems (Muyambo et al., 2024; Nkoana et al., 2018).

Strengthening these intertwining systems fosters the overall community's capacity to handle climate-induced shocks, though they are significantly lacking. Community mobilization and empowerment are key to the success of micro-level programs, but in some regions, social and cultural barriers hinder widespread engagement. Gender inequality, traditional practices, and resistance to change can prevent communities from fully engaging with these programs

(Ezeruigbo & Ezeoha, 2023). Where social structures are rigid or local leadership is not supportive of the program's goals, it can be challenging to gain community buy-in or participation. There are also noticeable lacks in long-term commitment. Many micro-level programs are initiated as short-term pilot projects and are not sustained over time due to a lack of funding or commitment from national governments or donors (Below et al., 2010; Chirambo, 2017). Once the initial funding or support runs out, these programs may falter or end, leaving communities without continued support or follow-up. As a result, the gains made by these programs are not institutionalized and have not generated sufficient capacity for community self-sufficiency, in turn diminishing their overall impact.

6.3 Policy Recommendations

Bridging these two noticeable policy gaps could lower the overall costs of preventative action while increasing the life span of micro-level projects. These recommendations aim to place preventative action higher up along the priority spectrum, making it more appealing and ensuring the sustainability of these programs over time:

Establish long-term, flexible funding mechanisms for micro-level programs: Micro-level programs are more cost-effective when there is sustained financing. It is crucial to create dedicated, long-term funding pools specifically designed for community-based resilience programs that focus on preventative measures. These funding agencies should have community outreach branches, offer flexibility in how funds can be allocated to adjust to changing needs over time, and have enforcement mechanisms in place to oversee the allocation process and ensure that all funds are accounted for. This ensures that micro-level programs are no longer dependent on short-term project cycles and are less constrained by donor priorities, instead adjusting to the most outstanding localized needs. Additionally, long-term funding will allow local actors to build capacity, creating lasting impact and reducing the future need for costly emergency responses.

Integrate micro-level programs with broader national development plans: To ensure that localized solutions are not mutually exclusive or eventually be seen as confrontational to state authority, it is crucial to embed micro-level resilience programs into broader national development plans and climate policies and to ensure that these programs are supported by national institutions. By prioritizing preventative action within national frameworks, governments can reduce future costs by addressing risks before they become crises while also embedding these programs to eventually scale if effective.

7. Conclusion

This study aims to extend current climate-conflict theories and suggests climate change is a *vulnerability multiplier* to regions with weak governance capacity that makes them prone to conflict onsets. It hypothesizes an interactive, dynamic relationship between the onset of climate disasters and states' responses to such disasters. The empirical results indicate that the ability of states to cushion the effects of these natural hazards, or state capacity, is critical for whether they translate to armed conflicts of various frequencies and intensities. Overall, in low-capacity states, climate events are linked to higher likelihoods and greater severity of conflict, as these states lack the resilience to manage the pressures of climate change. Governance weaknesses in such states amplify vulnerabilities and increase susceptibility to conflict. In contrast, higher-capacity states show a buffering effect, with stronger governance mitigating the impact of climate events on conflict, suggesting that robust institutions can drop or circumvent climate-triggered conflict.

Notably, this study does warrant further research. The first is concerned with data disaggregation for 1) more granular temporal data on state capacities, and 2) distinguishing between state- or rebel-initiated violence in armed conflicts. More granular temporal data on state capacities at the monthly level, for instance, would allow a closer investigation of the potential lag between the onset of climate stressors and subsequent conflicts to ensure that they occurred chronologically. This more detailed, time-specific data could reveal these lags and provide deeper insights into how states with different governance capacities manage climate impacts over time, allowing for a more dynamic view of state responses. Another limitation of the current dataset is the lack of distinction between state-initiated and rebel-initiated conflicts. This distinction is crucial for understanding the motivations and dynamics of conflict in the context of climate change. Without this breakdown, it's difficult to assess whether armed groups are more likely to rebel due to climate-induced pressures or if state-perpetrated violence is a reactive measure to

quell dissent. Having a clearer picture of who initiates conflict, and under what circumstances, would enable more targeted policy interventions.

Finally, the current data, as depicted in the rug plot, is concentrated around the midpoint of state capacities, leaving a gap in data for both high- and low-capacity states. There are two concerns regarding this gap. First, working with the current dataset, sparse data on the extreme ends of observations creates a larger margin of error and may lead to incorrect estimations. It would be beneficial, then, to assess natural breaks in the original distribution of governance capacity, break the data into bins of low, regular, or high governance capacities, and separately model whether the degree of governance capacity impacts conflict dynamics. Second, under the possibility of including additional observations, this imbalance limits the ability to assess whether the observed trends are applicable across diverse political and governance contexts and regions. Expanding the dataset to include more countries with extremes in state capacity and to encompass more regions would provide a more comprehensive view of how climate change interacts with governance structures in different environments. This would allow for more generalizable conclusions and enable researchers to identify whether state capacity plays a consistent role in climate-induced conflict across varying contexts.

Nonetheless, these findings carry significant implications for policy and development, particularly in the context of climate adaptation and resilience-building in fragile states. Strengthening governance and institutional capacity appears to be not only a pathway to general stability but also a targeted strategy for climate resilience, reducing both the likelihood and intensity of conflicts that might otherwise be exacerbated by climate stressors. For policymakers, this underscores the value of investing in governance reforms, particularly in regions susceptible to climate-induced disruptions. Building up the mechanisms by which states can absorb and adapt to environmental shocks could, in turn, foster a more stable environment where the adverse effects of climate change are less likely to translate into armed conflict

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