



## Full Length Article

# Floods, communal conflict and the role of local state institutions in Sub-Saharan Africa

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## ABSTRACT

Does the occurrence of flood disaster increase the risk of communal conflict and if so, does trust in state political institutions mitigate the adverse effect? This study addresses these questions by studying the intervening effect of trust in local governmental institutions at a sub-national level. The effect of flood disasters on the risk of communal violence is expected to be contingent on peoples' trust that local political structures are able to address potential disputes between groups. Violent conflicts, in that sense, are neither inevitable nor directly determined by the occurrence of disasters. They largely depend on the context of a given society and political response to these external shocks. To test this expectation, the study uses survey data on trust in local state institutions in Sub-Saharan Africa from the Afrobarometer (2005–2018), combined with geo-referenced communal conflict and flood data. In line with theoretical expectations, results suggest that flood disasters are associated with communal violence only for administrative districts that are governed by distrusted local state institutions. Conversely, flood disasters tend to be negatively associated with the risk of communal clashes in the presence of highly trusted local government councils and (especially) trusted judicial courts. Changing model specifications and estimation techniques produces similar results. An out-of-sample cross-validation also shows that accounting for political variables, in addition to flood disasters, improves the predictive performance of the model.

## 1. Introduction

Academic, policy and popular discussions surrounding the issue of climate variability and extreme weather events have received increasing attention in recent years (IPCC, 2018). Shifting weather patterns are predicted to increase the frequency and intensity of hot extremes, including heatwaves (very likely), and heavy precipitation (high confidence) (IPCC, 2021). These hazard events, as natural phenomena, have the potential to become disasters when causing substantial death and damage (Slettebak, 2012). Hazard-related disasters, in turn, are predicted to increasingly become a significant threat to social stability (e.g. Bergholt & Lujala, 2012). Alongside these debates on the security implications of climate variability, an emerging literature considers the impact of disasters on the risk of violent conflicts (Bergholt & Lujala, 2012; Nel and Righarts, 2008). Most academic literature agrees on the absence of the direct effects between natural hazards and disasters and conflict. Exploration of the indirect and conditional pathways, however, is a rapidly growing field. Scholars have studied intervening

mechanisms such as agricultural production and living conditions (e.g. Koren, 2018; Vesco et al., 2021; Vestby, 2019), food price changes (e.g. Maystadt & Ecker, 2014), economic growth (e.g. Cavallo et al., 2013; Koubi et al., 2012) and migration (Koubi et al., 2016; Linke et al., 2018b).

There is a wide agreement in the literature that causes and dynamics of conflicts are related to political factors. In that sense, the impact of natural hazards on violent outcomes depends on how societies prepare and respond to extreme weather events. Destabilising effects of disaster occurrence are not only related to nature, but also to human response such as coping strategies and governance approaches. Previous studies have considered this crucial element through e.g. looking at the role of exclusionary political institutions on the state level (von Uexkull et al., 2016). Advancing this line of inquiry would include exploring the local political setting where conflict and disaster collides. Rather than affecting an entire country, disasters and conflict cluster in smaller geographical regions. Relatedly, there is great variation in the type and strength of state institutions that govern these sub-national regions.

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Addressing the identified gap by considering the local nature of these phenomena, this study aims to explore the role of local state institutions in mitigating the risk of conflict in the aftermath of a disaster.

This study specifically focuses on the relationship between flood events and communal conflict. According to recent figures, floods constitute the most frequent disaster type (UNISDR, 2018). Between 1998 and 2017, floods comprised 43.4% of all recorded events, and impacted 45% of all individuals affected by weather-related disasters (2018, 8). Flood events are also projected to increase everywhere under all considered Representative Concentration Pathway (RCP) warming scenarios (Alfieri et al., 2017). In terms of social outcome, literature suggests that following extreme weather events, the type of conflicts that are more likely to occur include communal violence and land-use disputes, rather than large-scale civil conflicts (Buhaug & Seter, 2014; Eck, 2014; Fjelde & von Uexkull, 2012). Communal conflicts are understood here as fighting between non-state groups with shared communal identity (e.g. ethnicity, language, livelihood and/or religion) without the direct involvement of the state (Sundberg, Eck, & Kreutz, 2012). These types of conflicts are not only broader indicators of social instability but tend to revolve around renewable natural resources that are particularly vulnerable to disasters.

The theoretical argument in this paper suggests that areas experiencing flood disaster while governed by distrusted local state institutions, such as judicial courts, police and local councils, are more likely to experience communal violence. Flood disasters are expected to adversely affect livelihoods. One scenario is that groups may adapt to shortages by attempting to forcefully redistribute access to resources through attacks on other groups. Other more viable coping strategies, such as livelihood diversification and relocation, could also indirectly heighten communal conflict risk by raising the stakes of common resource control and putting pressure on existing conflict resolution arrangements. Both of these pathways to conflict could be mitigated by trusted institutions that incentivize groups to resolve their conflicts peacefully.

Since the effects of floods and communal conflicts are highly localised and take place within a narrow geographical region, the paper tests its expectation at the sub-national level. Data extend from 2005 to 2019, and include about 16,000 district-year (2nd order administrative unit) observations from 25 countries in Sub-Saharan Africa. I use georeferenced data on flood disasters, derived from the Dartmouth Flood Observatory (DFO) and communal conflicts, available from the Uppsala Conflict Data Program Georeferenced Event Data. To model the effect of political institutions, I use five waves of Afrobarometer survey data on trust in different types of local state institutions.

In line with the theoretical argument, the results suggest that at the local level previous-year flood disasters are associated with higher risk of communal conflict. I also find that trust in local state institutions moderate the relationship. The effect of a flood disaster on the probability of communal violence is amplified in regions that are governed by distrusted governmental councils and (especially) judicial courts. Findings remain robust to alternative operationalization, model specifications and estimation techniques, and out-of-sample evaluation exercises suggest that they are also substantively meaningful.

## 2. Existing literature

Some studies analysing the impact of disasters on the risk of armed conflict show that rapid-onset disasters may significantly increase the risk of civil conflicts (Ide et al., 2020; Nel and Righarts, 2008). This effect is particularly pronounced in low- and middle-income countries with medium to high levels of inequality, low level of human development and mixed political regimes (Ide et al., 2020; Nel and Righarts, 2008). Schuessner et al. (2016) also find higher conflict risk in ethnically fractionalised countries in the aftermath of disasters. Omelicheva (2011) reports that disasters might trigger instability only in countries already facing considerable conflict risk. Other studies find that disasters

may have the opposite effect and in certain contexts decrease the likelihood of conflict. In a qualitative study of rebel groups in the Philippines, Walch (2018) finds that disasters may reduce the intensity of the conflict by obstructing the organisational structure and supply lines of rebel movements. Alternatively, in the aftermath of a disaster, well-distributed aid flows may make a conflict ripe for resolution and foster peace (Egorova & Hendrix, 2014).

These earlier studies predominantly examine larger scale violence such as armed conflict between a government and armed groups or non-state conflicts between multiple rebel groups. Some studies specify that following environmental or climatic changes, if violent outcomes occur, they are expected to take place at a smaller-scale and be in the form of land disputes or communal conflicts that involve renewable natural resources, vulnerable to environmental changes and natural hazard events (e.g. Buhaug & Seter, 2014). In Sub-Saharan Africa more specifically, the majority of communal conflicts take place between farmers, herders and pastoralists and revolve around access to renewable resources such as land and water. These resources are valuable goods that are essential to the exercise of power and wealth throughout the region (Eck, 2014).

As a result, studies increasingly center around communal conflicts in their theoretical arguments and analyses (e.g. Fjelde & von Uexkull, 2012; van Weezel, 2019; Döring, 2020). For example, Raleigh and Kniveton (2012) find that, in East Africa, higher rates of communal conflict are expected to follow increasingly anomalous wet conditions. Similarly, Detges (2014) analysis indicates that the location of pastoralist violence in northern Kenya is closely related to the spatial distribution of opportunities for livestock raiding, including violence being conducted in the vicinity of well sites and far from main roads. Finally, Raleigh (2010) argues that small, politically marginalised ethnic groups tend to experience most communal conflicts related to environmental pressures.

Among this research on disasters and resource availability regarding communal conflict, there is consensus that political factors have a conditioning effect on the dynamics and causes of communal clashes. Thus, scholars stress that vulnerability assessments should include non-climatic drivers such as socio-political and technological factors that shape the sensitivity or resilience of a community to extreme weather events (Mach et al., 2019). Coping measures are in that sense often embedded in a politicised environment (Birkmann, 2011). Eck (2014) argues that weak legal systems at a state-level that fail to address social groups' grievances are an important condition for explaining higher motivation for collective mobilisation for land conflicts in the presence of environmental scarcity. Along those lines, Detges (2017) finds that fragile state-citizen relations with ethnic discrimination or a low trust in the head of state play an important role in the processes linking drought exposure and support for political violence. In a study of the Mopti region of Mali, Benjaminsen et al. (2012) find that in the aftermath of a drought, land legislation and policies largely favouring farmers over herders combined with weak state presence in the area increased the risk of land-use conflicts.

In addition to national-level structures, important institutions can also be found at the local level. Strong local institutions of governance can provide public services and act as efficient administrative apparatuses to manage resources, act as conflict resolution bodies and potentially prevent conflict between local communities from turning violent (Meierding, 2013). In the aftermath of a drought, local institutions engaged in communal dialogue in rural Kenya (e.g. Linke et al., 2015) and Somali region of Ethiopia (Bogale and Korf, 2007) have been found to decrease the support for violence. In addition, findings suggest that drought in the absence of traditional rules are associated with more violent events, but that this effect disappears where unofficial regulations are present and can take the dispute to court (Adano et al., 2012; Linke et al., 2018a).

In sum, there is increasing acknowledgement of the importance of political factors and local institutions in the risk of violence communal

conflicts. This focus on non-violent coping mechanisms helps account for the wide range of possible human responses to climatic changes. Our understanding of which institutions in particular may have pacifying conditional influence on conflict after disasters remains quite limited. What are the effects of not only national, but also sub-national state institutions within the disaster–conflict relationship? This paper addresses these questions by theoretically elaborating and empirically testing the relationship between flooding, communal conflict and the role of local state institutions.

### 3. Theoretical framework

#### 3.1. Floods and communal violence

Flooding can lead to potentially large income loss, particularly for groups that depend on renewable natural resources for their livelihoods (Betts et al., 2018). For example, in Mozambique between February and April 2000, widespread flooding damaged 10% of the country's cultivated land and 100,000 ha of subsistence and commercial crops, causing a \$700 million loss, 20% of the country's gross national product at the time (Wisner et al., 2003). Floods may result in soil contamination and food spoilage, making plant material unfit for consumption (Mora et al., 2018). The hazard event may also disrupt harvest cycles, impact nutritional content and thus crop quality, and destroy livestock due to disease outbreak (Mora et al., 2018). Adverse consequences of flooding also include destruction of fresh water sources and fish stocks (IPCC, 2018, p. 232). For example, floods pose increasing challenges for the fishing communities in coastal zones of Nigeria, where fishing significantly contributes to the economic activities of the rural population (Adelekan & Fregene, 2015). In times of flooding, freshwater fish stocks are destroyed by the high salinity of seawater and fishers cannot easily transport fish stock to markets, resulting in high economic losses for the coastal community (Adelekan & Fregene, 2015). Flood disasters may also force people to sell land and livestock at a lower price due to a critical situation (Wisner et al., 2003), depressing local market prices due to low-quality assets (Maystadt & Ecker, 2014). Overall, flood-related damage affects crop production and distribution of water and grazing resources, which, despite the resilience of agriculturalists and pastoralists to environmental uncertainty, adversely impacts their livelihoods.

How do these adverse effects on local livelihoods influence the risk of communal conflict?<sup>1</sup> Existing literature has shown that households develop various risk coping strategies in times of shock, including resorting to purchases and sales of assets, diversification of land use, creating community networks, relying on transfers from informal mutual support (Ellis, 1998; Justino, 2011; Ostrom, 1990). Given the high personal risks associated with fighting, participation is not usually regarded as a welfare coping strategy. However, participants may be able to take advantage of potential opportunities offered by violence. Economic downturns that follow in the wake of floods' destructive impact might lower opportunity costs for participating in violence because alternative modes of securing a livelihood are more restricted. Literature on abundance of resources has shown that attacking other groups in activities such as cattle-raiding might be a direct way of regulating access to resources that are critical to acquiring wealth and that may help sustain livelihoods during uncertain environmental conditions (e.g. Raleigh, 2010; Witsenburg and Adano, 2009). In fact,

<sup>1</sup> The following steps that link compromised livelihoods to communal conflict are non-deterministic and apply in the context of local livelihoods-dependency on environmental conditions (i.e. in rural Sub-Saharan Africa). In addition, economic shock related to flood disasters will not act as proximate cause for conflict outbreak, but rather contributing factors that can increase or decrease probabilities of violence in specific sub-national areas. The following sections outline two possible causal mechanisms.

studies show that communal conflicts often revolve around local access to water, pasture, cropland, and weak leadership within the region (Turner, 2004; von Uexkull & Pettersson, 2018). In that sense, these conflicts also reflect a broader struggle to not only secure but also maintain or defend access to and control of already fluctuating resources (Turner, 2004).

Although such direct attacks to appropriate resources are but a small subset of coping strategies, other measures that groups may use to adapt to shifting environmental conditions may also indirectly increase the risk of conflict. Faced with adverse effects on local livelihoods, both agriculturalists and pastoralists can try to diversify their livelihoods over time: farmers invest in cattle while pastoralists shift movements in search of new grazing opportunities or markets, or may even settle to cultivate (Bassett & Turner, 2007). These diversification strategies can lead pastoralism and crop agriculture to overlap across large territories, increasing the risk of local conflict as each group raises its demands for the same land and water resources (Brottem, 2020). Agricultural encroachment due to increased land cultivation may limit pastoral herders' access to areas that historically served as grazing land, water sources for livestock, or passage corridors (Turner, 2004). Crops damaged by herders' livestock without compensation may create grievances among farmers (Majekodunmi et al., 2014); as may farmers putting their livestock in established corridors for herders (Benjaminsen & Ba, 2009).

Shifting migration patterns may also disrupt existing arrangements for shared resource access. Communities living together over time are more likely to develop institutions for sharing resources and for dispute settlement, whereas in-migration could challenge existing conflict resolution mechanisms (De Juan, 2015). As a result, shared practices and laws may differ, leaving communities more vulnerable to violence (Adano et al., 2012; Linke et al., 2015). For instance, in the Masai region of Kenya, mobility of pastoralists, as a consequence of changing environmental circumstances, had been considered a rising problem for herders. To address potential issues, the state authorities introduced a common pool resources system, which led to a legislation over common rangelands and accommodated the mobility of pastoralists (Penu & Paalo, 2021).

To sum up, flood occurrence contributes to livelihood reduction, to which groups adapt differently in times of crisis. One strategy is to seek a forceful redistribution of access to resources through cattle-raiding and looting. Other practices include livelihood diversification and relocation that, due to convergence of communal groups' livelihoods, raise the stakes of common resource control and in turn increases the likelihood of communal conflict. This leads me to the following expected association:

**H1.** *Areas that experience flood disaster occurrence are also more likely to experience violent communal conflicts.*

#### 3.2. The role of local state institutions as a conditioning effect

Violent escalation of communal conflict, however, remains a comparatively rare event; peace prevails in most areas where land and water resources are compromised (Boone, 2017). In light of this, scholars postulate that violent resource-related conflicts are inseparable from political dynamics that range at scales from inter-group and community relations to national and international dynamics (e.g. Dimelu, Salifu, & Igbokwe, 2016; Seter, Theisen, & Schilling, 2018).

Eck (2014) argues that before disputes turn violent, they usually involve long-term peaceful interactions between groups. Farmers, herders and pastoralists have historically lived in the same community and interacted with each other on a daily basis, developing social ties through monetary transactions for animal products and economic dependencies in positions such as seller and trader (Turner et al., 2011). However, slow erosion of livelihood interdependencies have led to pastoralism and crop agriculture overlap across large territories

(Brottem, 2020). These overall changes in adaptive strategies such as relocation and diversification of livelihoods increase the importance of arrangements for regulating shared resource access to avoid competing claims potentially leading to conflicts.

In the case of disagreements, first steps to resolve issues often include mediation by a council of elders or judicial proceedings (Eck, 2014). Land near villages is usually managed through annual local agreements that determine which areas are to be set aside for grazing and which are to be used for farming. Permission for land use and access to water holes tends to be obtained from the village chief or district officials, depending on the type of land regime in place.<sup>2</sup> Land management at the village level aims to create formal local institutions and so-called customary institutions (Black and Sessay, 1998). In some regions of sub-Saharan Africa a clear division of labour between those two types of institutions might be difficult to distinguish as they constitute a hybrid governmental arrangement (Cleaver et al., 2013).

These local level state and customary institutions that arbitrate competing demands tend to play a crucial role for social outcomes. Since it is difficult to distinguish between formal and customary institutional set up, in this study I particularly focus on the role of state institutions, including judicial courts, police and governmental councils. Local courts handle land disputes and have the power to uphold insurances or land-use contracts (Meierding, 2013). Incidents involving damage or stray livestock, framed as property damage, could also be dealt with by criminal law where the judiciary attempts to negotiate a resolution. The police have the power to enforce the law and sanction property theft, with the local government council often being part of the delegation determining corresponding fines and assessing damages (Beeler, 2006). However, these local institutions may be distrusted by a group if another group hold a privileged status among decision-makers, therefore biasing local policies to protect that privileged group. For example in Tanzania from early 2000s onward, the government has intensified agriculture, aiming for economic growth and sustainable natural resource management (Sokoni, 2008), which eventually resulted in policies prioritizing farmers. However, other groups such as pastoralists and fisherfolks did not necessarily fit easily in the government's efforts to stimulate economic growth and therefore have limited representation in the formal and informal social institutional set-up (Lange, 2011).

As such, distrust of police, local governments or courts may lead to the disputant's refusal to take final judgement on the issue seriously. It may also be harder for these distrusted institutions to help disputing parties reach an agreement. If one group expects a biased judgement in favour of the other, regardless of the crime, communities may be less likely to seek institutional help (Turner et al., 2012). That might also be the case if groups do not expect the case to be handled within a reasonable time frame due to inefficiency of judicial courts (Eck, 2014). Not only are distrusted institutions less likely to be used for addressing disagreements, but if groups perceive a verdict to be an unjust decision, the community may use violent strategies. For example, in a land dispute between two pastoral communities in the Maasina region of Central Mali, after the local officials ruled in favour of one community, the other group perceived this decision to be unjust and challenged it by provoking a violent exchange (Turner, 2004).

Inequitable governance of shared resources and ambiguous court decisions can contribute to anger and frustration among the disputants. Such perceptions of injustice and collective identities often overlap and facilitate mobilisation for collective action (Fjelde & Østby, 2014). Higazi and Lar (2009) further find that levels of violence between demographically similar states in northeast Nigeria significantly differ depending on how inclusive their institutions are and whether they foster a sense of belonging. As such, the argument put forward here is in

<sup>2</sup> Land tenure regimes in Sub-Saharan Africa could be neo-customary ones governed by state-backed communal leaders and 'statist' land regime where land allocation is conducted directly by the state ruler (Boone, 2014, pp. 1-16).

line with previous theories expecting that conflicts are not an inevitable outcome as less costly alternative responses to violence exist. Arising disputes could be adjudicated by local institutions, and higher trust in them is likely to reduce communal conflict risk as communities will seek their help or respect their verdict. This leads to the following hypothesis:

**H2.** *In the aftermath of a flood disaster, the presence of highly trusted local state institutions that govern sub-national districts is likely to decrease the risk of communal violence.*

#### 4. Research design

This article investigates how trust in local state institutions conditions the effect of flood disasters on violent communal conflict. Data extend from 2005 to 2019, and include about 16,000 second order district-year observations as a unit of analysis from 25 countries in Sub-Saharan Africa. Appendix 1 shows all included countries and years in the analysis. The temporal scope is determined by data availability for the measure of trust in local institutions. Boundaries of second order administrative areas for Sub-Saharan Africa are made available through Database of Global Administrative Areas version 3.6 (GADM, 2018). Administrative regions have an advantage for this analysis over alternative units as local state institutions vary across sub-regions within countries. The second sub-national level districts represent the political boundaries that are appropriate for identifying these variations (Boone, 2017).

##### 4.1. Dependent variable: communal conflict

For the dependent variable *communal conflict incidence*, I rely on Uppsala Conflict Data Program Georeferenced Event Data (UCDP GED) version 20.1, which includes detailed information on the location and date of all communal conflict incidents in Sub-Saharan Africa for the period of study (Croicu & Sundberg, 2017; Sundberg and Melander, 2013). The data set is first merged with the UCDP Non-State Conflict Dataset in order to filter out the georeferenced communal violence from the other forms of non-state conflicts (Pettersson & Eck, 2018; Sundberg et al., 2012). Communal conflict is defined as the use of armed force by an informally organised group (without an announced name) where a clear pattern of violent incidents can be identified. The groups tend to share communal identities along religious, ethnic, livelihood and/or language lines (Sundberg et al., 2012). By definition, the conflict does not involve the government of the state and it has resulted in at least one battle-related death (Sundberg et al., 2012). The analysis excludes other forms of non-state violence such as conflict between rebel groups during a civil war or other groups that are permanently organised for combat. The conflict enters the data set as a binary variable, where the occurrence of communal conflict per district-year is coded as 1 if at least one event occurred and as 0 if otherwise. Communal violence incidents are spatially overlaid with the relevant administrative division by intersecting geo-referenced UCDP GED point data with the district polygons in Q-GIS software. Descriptive tendencies in the dataset show that the phenomenon appears to be a rare event with 163 cases in total, most of which take place in Ghana, Kenya, Mali, Nigeria and Sudan.

##### 4.2. Main independent variable: flood disaster occurrence

This study focuses on floods as hydrological disasters, defined as hazards yielding significant damage such as livelihood disruption, a high number of affected people and casualties.<sup>3</sup> Flood disaster events are

<sup>3</sup> Moderate flood events that have a positive impact on agriculture (e.g. by contributing to regeneration of crops and plants by replenishing agricultural soils with nutrients), and therefore beneficial for social groups' livelihood are not included in this study (Wisner, 2003, p. 175).

drawn from the Dartmouth Flood Observatory (DFO). An event enters the data if it is defined as a hydrological hazard event with 'significant damage to structures or agriculture ... and/or fatalities' (Brakenridge, 2018). According to geo-referenced location, the flood is coded as a binary variable assuming the value 1 for administrative districts exposed to flooding in a given year and 0 - otherwise. Countries such as Ghana, Kenya, Malawi, Mozambique, Namibia, Nigeria, Sudan and Tanzania appear to be those most affected by multiple flooding annually, whereas Sierra Leone and Gabon show no record of flood disasters. The flood event is lagged with one year to allow for the theorised consequences of flooding to materialise and affect communities. Although in robustness check the analysis allows for a longer time frame and lags the disaster with two years, it still remains challenging to move beyond short-term fluctuations and capture the theorised cumulative consequences of flooding and change of adaptation practices. Alternative operationalization of the disaster are also included in robustness checks in order to make greater use of the data available. For example, DFO also reports area size affected by each flood event. Based on this information, the variable *flood affected area (km<sup>2</sup>)* is calculated by taking the mean of the affected area by multiple flood events for a given district-year and dividing the average affected area by the area size of the administrative district, measured as a continuous variable between 0 and 1. The severity,<sup>4</sup> taking the value between 0 and 2, and duration of flooding (measured in days), available from the DFO, are also used in robustness checks.

As seen in the definition above, disasters are defined by their impact and consequences. Differentiating flood hazard events from flood disasters has important implications for the study, as risk of flood disasters are known to be a function not only of the occurrence of flood hazards, but also of exposure and vulnerability level (Collins et al., 2013, chap. 12). In that sense, flood disasters are measured endogenously, where the degree of damage is, to a certain extent, shaped by economic conditions and human agency, ranging from infrastructural set-up to disaster management (Brzoska, 2018). It is therefore important not to equate disasters with extreme weather events since disaster risks can be reduced or amplified, depending on certain socio-economic and political factors. These same factors can also potentially affect the likelihood of communal violence. Fifty eight percent of all communal conflicts in the dataset occurred in districts exposed to flood disasters in the previous year, offering some preliminary supportive evidence for H1. In an attempt to account for spurious relationships, the statistical analysis accounts for several potentially confounding variables.

#### 4.3. Conditioning variable: local state institutions

Local state institutions are defined as a legally established set of formal institutions that deliver particular services to small geographic jurisdictions (Bratton, 2012, p. 517). To measure trust in these, I rely on survey data from the Afrobarometer survey project available for round 3 (2005), round 4 (2008), round 5 (2011–2013), round 6 (2014–2015) and round 7 (2016–2018) (BenYishay et al., 2017). Inspired by Wig and Tollefsen (2016) I select different questions that measure trust in local judicial courts, police forces and local government councils. Each trust variable is based on one question, which has the exact same wording in all 5 survey waves, as shown in Appendix 2. The georeferenced individual-level data are located to the second order districts by intersecting with the administrative polygons of GADM (2018), using Q-GIS software. Once geo-located, data are aggregated to the administrative area as a unit of analysis. This results in district-year level measurement

<sup>4</sup> Flood severity falls within four categories: 0 for no flooding; 1 for large floods with significant damage to structures or agriculture, fatalities and/or 1–2 decade interval since the last similar event; 1.5 for very large events with 20–100 year recurrence interval; and 2 for extreme events with an estimated recurrence interval greater than 100 years (Brakenridge, 2018).

of institutional trust, ranging from 0 to 3, with higher values indicating higher trust.<sup>5</sup> Since trust in local institutions remains stable for all rounds and appears to be drawn from similar distribution as shown in figure A.3.1 in Appendix 3, I interpolate missing values for in-between years (from 2005 to 2008 and from 2008 to 2011), which results in a panel dataset for the period 2005–2018. Following Brambor, Clark, and Golder (2012), for easier interpretation of the interaction term between flood occurrence and trust in institutions, the variables are further dichotomised using the mean as a cut-off point given their normal distribution, where 0 signifies low trust and 1 high trust.

The data include information on respondents' location at the district level and covers a high number of African countries. However, there are a few limitations with the data as the Afrobarometer survey project does not cover all Sub Saharan African states and administrative areas. The states or districts included can potentially be the ones with higher institutional quality that are more accessible for implementing survey projects, which entails a certain level of sampling bias in the analysis. Afrobarometer's method for selecting respondents also includes random sampling of respondents and regional stratification to ensure representation (BenYishay et al., 2017).

#### 4.4. Control variables

More densely populated areas may give rise to more property-related disputes and run a higher risk of conflict (Theisen, 2012). As flood occurrence may lead to more casualties in cases of larger population size or larger areas and turn into a disaster, *population and area size (km<sup>2</sup>)* appear to also be related to the independent variable and therefore a confounder for the examined relationship. These variables are derived from the Gridded Population of the World dataset version 4 with data available for every 5 years between 1990 and 2020 (CIESIN, 2016). The variables have been log-transformed per district and interpolated between data points to fill in missing values.

Another standard control for political violence is *economic development* (Hegre et al., 2001). Populations with higher economic development may have more opportunities or means to avoid locations with high physical exposure to flooding or be better prepared to respond to the flood hazard effect, which could prevent the extreme event turning into a disaster. The gross cell product, measured in USD using purchasing power parity (Nordhaus, 2006) is used here as a proxy for measuring economic development on a local level. Data are based on the G-Econ dataset version 4 and are derived from the PRIO-GRID data framework version 2 (Tollefsen, Strand, & Buhaug, 2012). Following a similar logic, economic development, measured as GDP per capita (constant 2010 US\$), on a national level is made available from the World Bank (2019) and is included as a confounding variable in the analysis.

Share of the district area covered by grassland, cropland and water bodies also account for the presence of renewable resources, which might be affected by flood hazards. The degree of access and availability are also common issues around which communal conflicts revolve. Data are provided by ESA Land Cover version 2.0.7 (ESA Land Cover CCI project team and Defourny, 2019) and made available at the district level by GeoQuery platform (Goodman et al., 2019).

Following Wig and Tollefsen (2016), I include a country-level additive index measuring *good governance* mapped by the World Governance Indicators (World Bank, 2019). The index includes four different dimensions for measuring the strength of the state-level governance: corruption, effectiveness, regulatory quality and rule of law. Here the intention is to capture the quality of national institutions. Strong

<sup>5</sup> The survey item codes levels of trust in the following way: 0 = Not at all, 1 = Just a little, 2 = Somewhat, 3 = A lot; The other three categories - 9 = Don't Know/Haven't Heard Enough, 98 = Refused to Answer, and -1 = Missing Data, are excluded from the analysis.

**Table 1**

Mixed effects logistic regression with random intercepts at year-level: Estimated log odds of communal violence, Sub-Saharan Africa 2005–2019; standard errors in parentheses.

	Dependent variable:						
	Communal conflict						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Flood (t-1)	1.427*** (0.170)	1.415*** (0.196)	1.385*** (0.197)	1.426*** (0.197)	1.458*** (0.197)	1.421*** (0.197)	1.417*** (0.196)
Communal conflict decay		3.269*** (0.366)	3.244*** (0.364)	3.255*** (0.367)	3.321*** (0.365)	3.270*** (0.366)	3.269*** (0.366)
Communal conflict spatlag (t-1)		2.731*** (0.228)	2.687*** (0.227)	2.689*** (0.228)	2.724*** (0.227)	2.707*** (0.229)	2.730*** (0.228)
Log(district GDP PPP) (t-1)		-0.262 (0.208)	-0.266 (0.200)	-0.289 (0.212)	-0.352* (0.207)	-0.267 (0.208)	-0.256 (0.208)
Log(area size) (t-1)		0.066 (0.069)	0.008 (0.070)	0.086 (0.072)	-0.014 (0.070)	0.067 (0.069)	0.066 (0.069)
Log(population size) (t-1)		0.055 (0.124)	0.062 (0.122)	0.042 (0.126)	0.118 (0.123)	0.063 (0.124)	0.054 (0.124)
Share of grassland (t-1)			1.595*** (0.498)				
Share of mosaic cropland (t-1)				1.451** (0.692)			
Share of rain-fed cropland (t-1)					-1.156 (0.349)		
Share of irrigated cropland (t-1)						-1.331 (1.632)	
Share of water bodies (t-1)							-0.571 (2.095)
Strength national institutions (t-1)		-1.454*** (0.277)	-1.588*** (0.280)	-1.406*** (0.280)	-1.565*** (0.281)	-1.466*** (0.277)	-1.448*** (0.277)
Log(national GDP pc) (t-1)		0.3280** (0.158)	0.358** (0.152)	0.314* (0.161)	0.376** (0.157)	0.320** (0.159)	0.325** (0.159)
Constant	-5.344*** (0.232)	-10.449*** (1.841)	-10.536*** (1.822)	-10.494*** (1.852)	-10.655*** (1.845)	-10.489*** (1.838)	-10.408*** (1.844)
Observations	15,734	15,734	15,734	15,734	15,734	15,734	15,734
Year RE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-832.223	-606.505	-601.875	-604.429	-600.698	-606.083	-606.464
Akaike Inf. Crit.	1670.447	1233.009	1225.749	1230.858	1223.396	1234.166	1234.929
Bayesian Inf. Crit.	1670.447	1309.645	1310.049	1315.157	1307.695	1318.465	1319.228

Note: \*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01.

national-level political institutions are more capable of responding to and preventing the risk of flooding turning into a disaster (De Mesquita et al., 1999), but are also known to reduce the risk of violent conflict by enabling credible commitments by the government to pose limits on its authority (Hegre, 2014). Recent research also finds that such national institutional arrangements that serve to support the rule of law are especially associated with civil peace (Fjelde, Knutsen, & Nygård, 2021).

Administrative units experiencing conflict in the vicinity of a district under study or with a violent conflict history may run a higher risk of experiencing renewed conflict. To account for these dependencies, a *spatial lag* (t-1) of communal conflict in the neighbouring districts is included as a control for spatial dependence in conflict occurrence. Robustness checks further include spatial lags for communal and armed conflicts, measured from one to five years prior. The time component is addressed by using a decay function of the number of years since previous communal conflict occurred in a given administrative area, where after 2 years the effect of previous communal conflict is reduced in half. Full list of descriptive statistics for all above-mentioned variables are presented in Table A.3.1 in Appendix 3.

## 5. Results

### 5.1. Analysis

#### 5.1.1. Flood disasters and communal conflict

The theoretical argument suggests that the occurrence of flood disaster is associated with the risk of communal conflict, and that the probability is higher in districts with low trust in local state institutions. The following section presents results from the statistical analysis of this relationship.

Table 1 reports results from mixed-effect logistic regressions of panel data with a random intercept for year. The random year effects are proxies of group level characteristics (Bell, Fairbrother, and Jones, 2019) that aim at alleviating some concern that the correlation between flooding and communal conflict is due to some unmeasured

year-specific factors. Models in the main analysis do not include country or district random effects, but both of these are added in additional tests to account for potential clustering. Model 1, in Table 1 shows estimated results for occurrence of flooding at (t-1), which is positive and statistically significant at 1%. This yields preliminary support for Hypothesis 1: the probability of communal violence increases in administrative districts that experienced a flood disaster in the previous year. Model 2 further includes district-level control variables such as log-transformed population, area size, GDP purchasing power parity, spatial and temporal lag for communal conflict. It also adds national level strength of institutions and GDP per capita as confounders. The relationship between flooding and communal conflict remains substantially unchanged. In Model 3–7, I estimate more extensive models, adding different types of cover area per district such as the share of grassland (accounting for pastoralist livelihoods being affected by flooding), three types of cropland (considering effects on agricultural production) and water bodies (accounting for possible effect on fishing activities). Considering other confounders, the percentage of districts covered in grassland (Model 3) seems to be positively associated with communal violence. Share of mosaic cropland (a mixture of pasture, cropland, forest) in Model 4 exhibits a similar effect, whereas rain-fed cropland share appears to have the opposite effect on the probability of communal conflict. Further robustness checks looking at the interaction between flooding and land cover in Table A.5.1, Appendix 5, show that in the aftermath of flooding, the likelihood of communal conflict is positively associated with larger grassland ratio at 10%. These results provide supportive evidence for the presence of pastoralist cattle raiding activities as a livelihood strategy or possible disputes related to location of livestock corridors.

In that sense, flooding may damage or destroy grasslands and negatively affect groups' well-being that rely on this for livelihoods. This causal mechanism is additionally tested in Table A.5.9, Appendix 5, showing that flooding is negatively associated with how groups rate their present living condition and how they compare themselves to other groups (at 10%). When asked about the most important issue that

**Table 2**

Mixed effects logistic regression with random intercepts at year-level and an inter-action term for trust in local state institutions: Estimated log odds of communal violence, Sub-Saharan Africa 2005–2019; standard error in parentheses.

Dependent variable:						
Communal conflict						
	(8)	(9)	(10)	(11)	(12)	(13)
Flood (t-1)	1.324*** (0.198)	1.568*** (0.230)	1.402*** (0.201)	1.804*** (0.256)	1.352*** (0.198)	1.405*** (0.229)
Trust Gov Council (t-1)	-1.246*** (0.232)	-0.817*** (0.296)				
Trust Courts (t-1)			-1.361*** (0.199)	-0.853*** (0.274)		
Trust Police (t-1)					-1.120*** (0.223)	-1.019*** (0.306)
Communal conflict decay	3.569*** (0.373)	3.534*** (0.369)	3.505*** (0.371)	3.434*** (0.368)	3.319*** (0.362)	3.313*** (0.361)
Communal conflict spatlag (t-1)	2.563*** (0.229)	2.586*** (0.230)	2.481*** (0.231)	2.486*** (0.233)	2.551*** (0.227)	2.554*** (0.227)
Log(district GDP ppp) (t-1)	-0.374* (0.209)	-0.367* (0.208)	-0.400* (0.217)	-0.389* (0.217)	-0.393* (0.213)	-0.393* (0.213)
Log(area size) (t-1)	0.022 (0.071)	0.020 (0.072)	0.053 (0.075)	0.053 (0.075)	0.047 (0.074)	0.046 (0.074)
Log(population size) (t-1)	0.053 (0.122)	0.047 (0.122)	0.047 (0.122)	0.045 (0.123)	0.052 (0.122)	0.052 (0.122)
Share of grassland (t-1)	1.655*** (0.514)	1.623*** (0.516)	1.534*** (0.511)	1.505*** (0.511)	1.755*** (0.508)	1.752*** (0.507)
Strength national institutions (t-1)	-1.230*** (0.290)	-1.239*** (0.290)	-1.241*** (0.301)	-1.290*** (0.303)	-1.366*** (0.293)	-1.373*** (0.294)
Log(national GDP pc) (t-1)	0.070 (0.165)	0.078 (0.165)	0.263* (0.158)	0.270* (0.158)	0.206 (0.161)	0.208 (0.161)
Flood (t-1)*Trust Gov Council (t-1)		-0.952* (0.441)				
Flood (t-1)*Trust Courts (t-1)				-1.003*** (0.387)		
Flood (t-1)*Trust Police (t-1)						-0.196 (0.416)
Constant	-7.660*** (1.871)	-7.769*** (1.880)	-8.969*** (1.891)	-9.248*** (1.911)	-8.954*** (1.839)	-8.993*** (1.843)
Observations	15,734	15,734	15,734	15,734	15,734	15,734
Year RE	Yes	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-586.219	-583.782	-577.290	-573.855	-588.234	-588.123
Akaike Inf. Crit.	1196.439	1193.565	1178.581	1173.711	1200.468	1202.246
Bayesian Inf. Crit.	1288.402	1293.191	1270.544	1273.337	1292.431	1301.873

Note: \*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01.

governments should address, concerns of food insecurity appear to be prominent in the data, which also tends to be positively correlated with the occurrence of flooding at 10%. Variables related to issues of income, food security and living conditions are also based on questions in the Afrobarometer survey project and are fully listed in Appendix 2. Although estimated results do not guarantee a causal relationship between flooding, reduced livelihood conditions and communal conflict, it nevertheless provides supportive evidence for the first part of the theoretical argument related to adverse economic impacts of flood

disasters. It also speaks to previous findings that deteriorating economic conditions as a result of exposure to climate-related events increase groups’ support for violence (Vestby, 2019). However, the cumulative effects of flooding on long-term fluctuation of resources, socio-economic well-being and communal conflict risk still remain untested.

5.1.2. The role of local state institutions

The second hypothesis examines whether there is significant difference between the effect of flood occurrence on communal conflict risk in

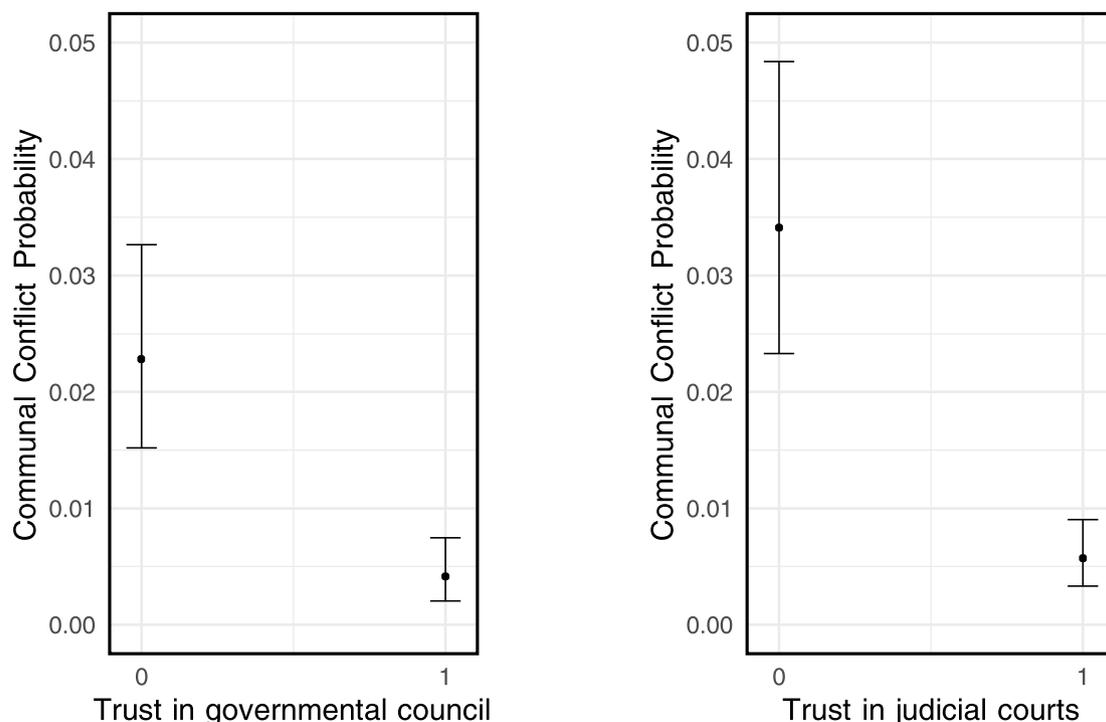


Fig. 1. Simulated expected probability of communal conflict (N = 1000) where flood disaster equals 1, all controls are set to their mean, and trust in local governmental council and local judicial courts (from left to right) vary across its range, with 95% bootstrapped confidence intervals.

administrative units with different degrees of trust in local state institutions. Model 8, 10 and 12 in Table 2 first include the constituent terms of flooding and trust in local state institutions separately. Model 9 then shows that high trust in local government councils seems to mitigate the adverse effect of flood from the previous year and decrease the risk of communal conflict at 5%. Districts governed by highly trusted local courts tend to have even more certain pacifying effects on the likelihood of communal violence, as shown in Model 11. The interaction term is statistically significant at 1%, where the estimated effect provides further supportive evidence for the second hypothesis. The relationship between higher trust in local police and communal conflict in the aftermath of a flood is also negative, but does not exhibit a conventional level of certainty. Collinearity checks, shown in a correlation matrix in Appendix A.4, indicate that these three types of institutions are in fact not highly correlated, also possibly pointing to their different role in the causal mechanism.

Further, expected probability of communal conflict are calculated. Here flood disaster is set to 1 and all other independent variables are set to their mean except trust in institutions, which is allowed to vary across its observed range to show the isolated effect on the dependent variable. In the aftermath of flooding, the likelihood of communal conflict increases with 2 percentage points in areas governed by a low-trusted local governmental council, as shown on the left-hand side of Fig. 1. In the case of local courts, the increase in effect of communal conflict is slightly higher, by 3 percentage points, shown in the middle of Fig. 1. That is, in the aftermath of flooding, conflict risk seems to be substantially moderated by the presence of highly-trusted institutions, entailing that the adverse effects of flooding could be offset by certain political contexts.

To assess the out-of-sample predictive power of the models, Ward, Greenhill, and Bakke (2010) propose a measure called area under the curve (AUC) for Receiver Operating Characteristic (ROC) and Precision-Recall (PR) curves. The technique calculates changes in the area under the curve when a variable is omitted from the model and provides information about the contribution of individual variables to the predictive performance of the model.<sup>6</sup> To guard against overfitting, the cross-validation keeps the data used to evaluate the model separate from the data used to develop it. This routine is usually conducted multiple times; in this case for a model that 1) includes only flood disaster and control variables, 2) adds trust in local courts as a control variable, and 3) finally includes an interaction term between the disaster and judicial court variables. After partitioning the data into train (75%) and test (25%) samples and taking the mean for all 100 iterations, the average out of sample AUC-ROC for the first model is 0.936, while the one for the full model is 0.944, as shown on the left side of Fig. 3. In that sense, the full model improves the out of sample AUC-ROC with 0.08, indicating a higher out-of-sample predictive power in comparison to the other models. After calculating the average out of sample AUC-PR for all models, we can see that the area under the PR curve of the plot improves from 0.245 to 0.291, shown on the right side of Fig. 3, indicating that the model including the interaction term shows the highest precision level.

### 5.1.3. Robustness checks

To evaluate the robustness of the results, I employ alternative estimation techniques and measurements so as to account for possible omitted biases and sensitivity to model specifications.

First, I re-estimate the main models including country and year fixed effects, clustered by districts, to account for time-invariant, unobserved heterogeneity between different countries and years in terms of communal conflict risk. The inclusion of fixed effects, however, may create the incidental parameters problem. The inclusion of many additional parameters can distort the likelihood function, leading to biased and inconsistent parameter estimates (Deleuw & Meijer, 2008). In a

second robustness check, I estimate a model adding country, district and year random intercepts instead. The mixed effect logistic regression estimates a Bayesian multilevel model, accounting for cluster-confounding issue by modelling the two levels in the data - countries and years as the higher grouping structure and districts, nested in the level 2 variables as the lower units (Gelman & Hill, 2007, p. 301–322). The random intercepts account for unobserved historical, political or socio-economic characteristics that districts within the same country share, which could make them more likely to be similar to each other than to districts in other countries (Hox, 2010, pp. 112–139). Overall, this multilevel approach allows for modelling the variation of district-level regression coefficients across groups and therefore a range of unmeasured social processes, which might include the omitted variables themselves (Bell, Fairbrother, and Jones, 2019). I also estimate a mixed effects cloglog model for highly skewed outcomes, appropriate for the analysis of communal conflict incidence. These results are shown in Table A.5.2 -A.5.4, Appendix 5 and remain substantially similar to the original ones.

Next, I evaluate the robustness of the results by using alternative operationalizations of floods. The Dartmouth Flood Observatory (DFO) data not only include information on occurrence of flooding, but also on duration and severity. An alternative robustness check tests whether the pacifying effect of local state institutions in the aftermath of flooding also holds for the most severe disasters (only those taking the value of 2, measured on a scale from 0 to 2) or the most durable ones (lasting more than 30 days). In case these disaster events take longer to materialise than initially theorised, I also relax the operationalization and include an alternative dichotomous measure for whether flood occurred in the last two years. Estimated results in Table A.5.5 show that only the effect of judicial courts remains substantially unchanged even in the case of most durable floods or even when flooding occurred two years prior. Trusted state institutions, however, do not seem to have the estimated mitigating effect for the most severe floods. To account for the degree to which districts are affected by flooding, I also include a share of the affected area, calculated by the size of flood-spread, derived from the DFO project, divided by the area size of the administrative unit. Final results in Table A.5.6 suggest that earlier estimated results hold even when the entire district is registered as affected by the flooding.

Another source of concern could be that areas with highly trusted institutions are actually the ones favoured by the state. Research shows that communal conflicts are often initiated by governments favouring one group over others (Fjelde & Østby, 2014), selecting to manage conflicts strategically and intervening on the behalf of supporting groups (Elfversson, 2015). In that sense, areas with trusted state institutions might be largely favoured by central governments and therefore less likely to be involved in communal conflicts. To account for this

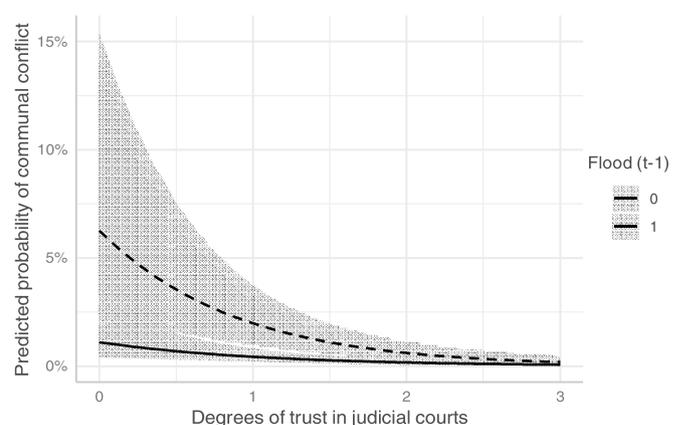
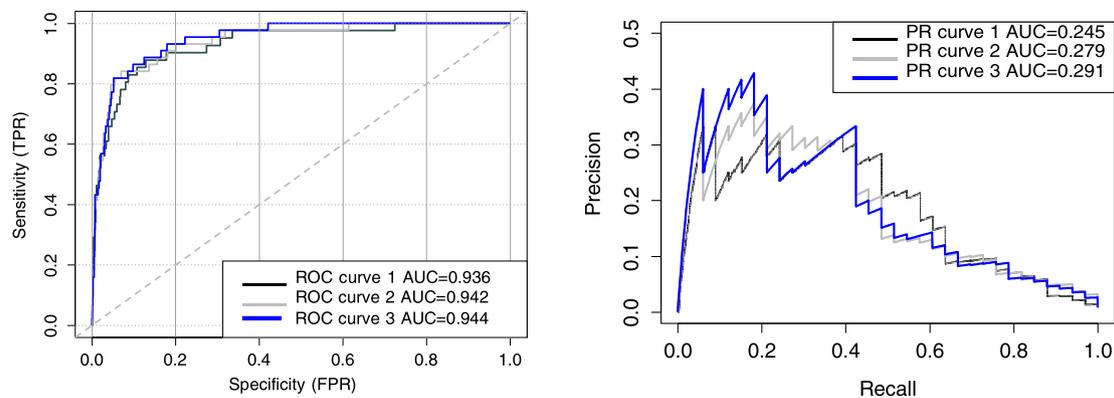


Fig. 2. Simulated effect (N = 1000) of flood occurrence on the expected probability of communal conflict for different degrees of trust in local courts, with 95% bootstrapped confidence level.

<sup>6</sup> For a detailed description of the procedure and its benefits, see Appendix 6.



**Fig. 3.** Cross validated ROC and PR curves calculated for a model that 1) includes only flood disaster and control variables (Model 3 in Table 1) and 2) adds trust in local courts as a control variable (Model 10 in Table 2), and 3) includes an interaction term between the disaster and judicial court variables (Model 11 in Table 2).

possibility, I use another question from the Afrobarometer survey project, asking how often respondents perceive their ethnic group to have been treated unfairly by the government. The variable, which ranges between 0 (Never) to 3 (Always) is fully described in Appendix 2 and included as a possible confounding variable.

Perception of ethnic exclusion by the state tends to increase the likelihood of communal conflict, as shown in Table A.5.7, but key results related to judicial courts in the aftermath of flooding remain robust at the 10% level. Alternative model specifications are also shown when accounting for the spillover effect of armed and communal conflict in neighbouring districts in the last year or in the last five years. Armed conflict may destroy infrastructure rendering flood hazards more likely to turn into disaster, but may also affect the likelihood of communal conflict by an increase in availability of weaponry. Key results shown in Table A.5.8 remain substantially unchanged. As the model including trust in judicial courts emerges as the most robust, I also plot simulated probability of communal conflict in the presence and absence of flood disaster for all possible degrees of trust from 0 to 3, keeping controls at their mean. Fig. 2 shows how the likelihood of conflict gradually decreases as trust in local courts increases at the 95% confidence level.

## 6. Discussion and conclusion

This study empirically evaluates the relationship between flood disasters, trust in local state institutions and incidences of violent communal conflict. Taken together, the evidence suggests that local government councils and (especially) judicial courts tend to mitigate the adverse effect of flood disasters and decrease the risk of violent communal clashes between groups in sub-Saharan Africa. The results remain robust to the inclusion of other model specifications, use of alternative estimation techniques and out-of-sample evaluation exercises.

Adverse impacts of flood occurrence and consequent diversification of adaptation strategies may cause friction and play a role in communal conflict, but understanding how disputes turn violent requires more careful attention to political forces at different scales. In line with previous literature, although communal conflicts revolve around renewable resources, they rather reflect underlying national and local issues of property and governance, which relate to the use of and access to specific resources (Boone, 2014; Eck, 2014; Seter et al., 2018). Court systems and official authorities, which constitute a subset of conflict resolution mechanisms, are the ones responsible for formally allocating resources and enforcing property rights. Although courts, government councils and police were expected to play a similar role during group disputes, judicial courts exhibit the most robust conflict-attenuating effect. In certain regions, government councils could predominantly deal with providing public services instead of adjudicating disputes. They might for example be responsible for distributing disaster relief

aid, and therefore redress (or generate) the population's grievances as a result. Police, on the other hand, might mainly be concerned with enforcing the rule of law by e.g. sanctioning property theft or damage. Judicial courts then could be the main bodies dealing with resolving conflicts and providing a platform for adjudication of disputes, which groups may turn to with trust of a just verdict as an alternative to violent means. As such, policy circles should uplift the political aspect of institutional set-ups, including addressing the colonial legacy of unjust distribution of access to and control over natural resources.

In addition, while there is an increased knowledge on the state-led social protection coverage, much more research is required for understanding conditions for developing effective social protection systems that may not rely on national institutions. Currently traditional or customary institutions are not included in the analysis, but some of them may in fact be more influential in creating community-based security as they are at times more relevant to the local and traditional governance structure (Menkhaus, 2007).

Although linking floods to climate change requires further research, it warrants emphasis that climate change is not a local phenomenon, even though national and local political structures do play an important role in mitigating adverse effects. The focus of mitigating climate risks should still rest with countries in the Global North, which are, to a large extent, responsible for causing climatic changes due to overconsumption of energy resources. In that sense, a focus on the interactive role between international governance, national regimes and local level leadership is another relevant way of examining the relationship of interest in the future.

### Declaration of competing interest

None.

### Declaration of competing interest

I have no conflict of interest to disclose.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.polgeo.2021.102511>.

## Replication data

Replication and supplementary data for the empirical analysis can be found at: link. The analysis was conducted using R version 3.6.3.

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