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Mechanisms of 'Climate Conflict'

The Relevance of Local Contexts For Understanding the Relationship Between Climate Change and Communal Conflict in Chad

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List of Abbreviations

ACLED	Armed Conflict Location and Event Data Project
AFP	Agence France-Presse
ANT	Chadian National Army
BRACED	Building Resilience and Adaptation to Climate Extremes and Disasters
CAR	Central African Republic
CIA	Central Intelligence Agency
DRC	Democratic Republic of Congo
ECC	Environment, Conflict and Cooperation
EROS	Earth Resources Observation and Science Center
FAO	Food and Agriculture Organization
FEWS	Famine Early Warning Systems Network
FSI	Fragile States Index
HRW	Human Rights Watch
ICG	International Crisis Group
IDP	Internally Displaced Person
IPCC	Intergovernmental Panel on Climate Change
LTDH	Chadian Human Rights League
OCHA	Office for the Coordination of Humanitarian Affairs
SCAD	Social Conflict Analysis Database
UCDP	Uppsala Conflict Data Program
UN	United Nations
UNEP	United Nations Environment Programme
USGS	United States Geological Survey
WMO	World Meteorological Organization

1. Introduction

It has been observed that the number of violent conflicts in the world has decreased since the end of the Cold War (Scheffran et al. 2012: p. 870). However, there is a concern that climate change will pose a threat to the stability of many nations in coming decades (Theisen, Gleditsch & Buhaug 2013: p. 614). Fears that a changing climate will lead or already led to armed conflict in vulnerable regions are expressed by institutions such as the Norwegian Nobel Committee and the UN Security Council, as well as by prominent political figures including US President Barack Obama (*ibid.*). Scholars, on the other hand, are highly divided on the question whether climate change and conflict are related. Salehyan notes that linking climate and conflict "allows decision-makers to shift blame for civil wars and grave human right violations" (2008: p. 317). Hence, one should be careful with terming civil war the result of a climate crisis. A frequently cited IPCC report suggests caution as well, noting that "many other intervening and contributing causes of inter- and intra-group conflict need to be taken into account" (2007: p. 365). These mediating conditions of conflict include economic productivity, social and economic inequality and migration and urbanization, among others (Hsiang, Burke & Miguel 2013: p. 11).

Africa has been identified as the continent most vulnerable to climate change (IPCC 2007: p. 435). The Sahel, in particular, is believed to become a climate change 'hotspot' (OCHA 2016: p. 2). The region is facing extreme climate conditions and variability, which greatly affects Sahelian populations, as they mainly depend on rainfed agriculture for their livelihoods. Other stresses such as chronic poverty, rapid population growth and ongoing civil unrest contribute to the region's vulnerability as well (Hagenlocher 2013: p. 95). Chad, located in the central Sahel (see Figure 1), ranks amongst countries with a high climate risk level (OCHA 2016: p. 2). Rising temperatures and erratic rainfall, resulting in droughts in the north and floods in the south, are major concerns for Chadian populations. Environmental degradation has increased competition over resources between farmers and pastoralists (UNEP 2011: p. 59). As a result, low intensity conflict over water and pasture has become a common phenomenon. This is especially true for Chad's east, where the inflow of refugees from neighboring Darfur (in Sudan) has exacerbated resource scarcity and aggravated tension with host populations (USGS 2012).

This research focuses on the relation between climate change and civil conflict in the central Sahel and in Chad in particular. It aims to explore *how rainfall variability contributes to the outbreak of communal conflict in Chad.* While no academic consensus exists that climate and conflict are linked, the potential consequences of a changing climate for the stability of African nations are too serious to ignore. Aggravated climate conditions "might overwhelm adaptive capacities and response mechanisms of both social and natural systems … and thus lead to “tipping points” toward societal instability” (Scheffran et al. 2012: p. 871). The Sahel has been dubbed ‘ground zero’ for climate change because of “its extreme climatic conditions and highly vulnerable population” (UNEP 2011: p. 7). Therefore, the region seems highly suited to study the impact of climate on conflict. However, several Sahelian countries, including Chad, remain critically understudied. It has been observed that research on climate-conflict links is mainly guided by reasons of convenience and data availability (Hendrix 2018: p. 190-191). This has created a sampling bias towards politically stable English-speaking countries, that are relatively save, easy to reach, and do not pose a language barrier. As a result, some very relevant countries are almost entirely ignored. Chad, a former French colony suffering high instability, has a long history of violence and faces significant exposure to the effects of climate change. It may score low on matters of convenience, but compensates with regard to relevance.

With this case study of Chad, I hope to contribute to our currently limited understanding of the climate-conflict nexus. I aim to do so by studying conflict first on the national level, which should allow for a broad understanding of how rainfall variability and conflict are associated. Next, the analysis descends to the local level to examine factors that potentially influence the link between climate change and conflict. Theisen et al. note that “extant studies provide mostly inconclusive insights, with contradictory or weak demonstrated effects of climate variability and chance on armed conflict” (2013: p. 613). Examining indirect links that tie climate change to conflict is considered a research priority (*ibid*.: p. 621). Furthermore, scholars have paid too little attention to the local contexts in which potential ‘climate conflicts’ play out (Von Uexkull 2014: p. 16). This study aims to explore such contexts by focusing on the *mediating mechanisms* through which climate change contributes to communal conflict in Chad. The mechanisms that are explored are resource scarcity, elite exploitation, and migration. Each increase the chance of conflict differently: resource scarcity leads to worsened livelihood conditions; political elites tend to exploit local resource conflicts; and migration heightens tension between migrant and host populations (Van Baalen & Möbjork 2016: p. 20, 25, 29). These mechanisms are mainly found in studies on pastoral conflict and livestock raiding, which are common in the Sahel (Van Baalen & Möbjork 2016: p. 16). Hence, studying these mechanisms of ‘climate conflict’ should allow for a more accurate mapping of climate-conflict pathways in the case of Chad.

Fig. 1. *Location of Chad in Africa*

Source: Wikimedia (2011).

1.1. Organization of the thesis

This research is presented in five chapters. In Chapter 2, main concepts are defined and relevant environmental security literature is reviewed. The chapter first discusses academic debates on climate-conflict links. It then provides a few hypotheses with regard to mediating mechanisms, followed by a summary of empirical studies. Next, I introduce first the Sahel and then Chad as a way of setting the scene. In Chapter 3, variables are conceptualized and operationalized and the chosen research design is explained, a combination of quantitative and qualitative analysis. Results are presented in Chapter 4 in two separate sections. First, the results of the quantitative analysis are presented. Subsequently, I summarize several communal conflicts, which are the focus of the qualitative analysis, and describe mediating mechanisms. Finally, in Chapter 5, I discuss main findings and limitations, and suggest possible avenues for future research.

2. Literature review

2.1. Conceptual definitions

The main concepts of this study are *rainfall variability* and *communal conflict*. The former is used as a proxy for climate change. Effects of climate change are difficult to observe due to the long timespan associated with it. This problem has been recognized by Scheffran et al. (2012: p. 869). To circumvent this, they suggest the use of short-term data on weather and extreme weather events (*ibid.*). Rainfall variability has been defined as the "annual standardized *rainfall deviation* from the long-term panel mean of rainfall" (Hendrix & Salehyan 2012: p. 40). To clarify any confusion that may exist with regard to the difference between *climate change* and *climate variability*, those concepts should be defined here as well. Climate variability refers to climate fluctuations above or below a long-term average value, while the term climate change is used to indicate a long-term continuous change to average weather conditions.[1]

As the second main concept, *communal conflict* is used to study the impact of climate on human systems. It refers to conflict which stands along lines of communal identity and involves groups that are only informally organized (Sundberg et al. 2012: p. 4). It is one of several types of small-scale conflict that, by definition, is restricted to a relatively small part of one region of a country. Riots, strikes and violent and nonviolent protests, for example, are other instances of small-scale conflict. I only focus on communal conflict, as it is expected to be the most relevant conflict type within the context of this research. In Chad, significant variations in rainfall often cause droughts, diminishing the availability of natural resources such as water and pasture. This has serious consequences for communities that heavily depend on these resources. Agricultural activities are the primary source of food security for Sahelian populations; hence, a disturbance in agricultural productivity can directly result in food insecurity and malnutrition. Drought leads to a situation in which different land users are forced to compete over scarce resources. Conflict, then, seems a logical outcome, especially so in African societies where livelihood is generally closely linked to ethnicity; climate events may exacerbate pre-existing grievances and awake old rivalries between farmers and pastoralists belonging to different ethnic groups.

2.2. Body of knowledge

2.2.1. Academic debates on climate-conflict links

There exists a rich body of research that examines whether climate change has an impact on the

[1] These definitions have been derived from a Michigan Sea Grant publication which can be accessed here: http://www.miseagrant.umich.edu/downloads/climate/11-703-Climate-Variability-and-Climate-Change.pdf

onset of conflict. This section limits the discussion of existing literature to research focused on the African continent. The reason to do so is that the impact of climate variability on conflict is expected to be different in Africa than elsewhere. Africa is particularly vulnerable to the effects of climate change. The consequences of variations in rainfall are more pronounced as a majority of the population relies on rainfed agriculture and pastures for their livelihoods (Raleigh & Kniveton 2012: p. 54). In fact, only 6% of Africa's cropland is irrigated. As a result, there exists a more immediate and direct association between resource availability and conflict (*ibid*.: p. 51). Additional factors that exacerbate the continent's vulnerability are widespread poverty and low institutional coping capacity (IPCC 2007: p. 48). Due to these conditions, findings from research oriented toward other continents do not necessarily apply to Africa.

Whether climate change is a driver of conflict is contested by scholars. Burke et al. find that higher temperatures see an increase in conflict in Sub-Saharan Africa (2009: p. 20670). This is disputed by Buhaug, who finds that no direct relationship exists between climate and civil war risk (2010: p. 481). Couttenier & Soubeyran also find little evidence for impacts of drought on civil war (2014: p. 202). Devlin & Hendrix (2014) focus on the relationship between rainfall and interstate conflict, distinguishing between trends (long-term processes) and triggers (acute scarcity/abundance). They find that low rainfall has a pacifying effect on the short-term, but over a longer time period, rainfall scarcity and variability increase the risk of interstate conflict (2014: p. 35). Thus, there seems to be little agreement on the climate-conflict relationship. It is argued that this is because of a focus on large-scale conflict (Raleigh & Kniveton 2012: p. 60). Salehyan criticizes the notion that climate change directly gives rise to civil war, stating that this "ignores human agency, ingenuity, the potential for technological innovation, and the vital role of political institutions in managing conflict" (2008: p. 317). It has been noted that "scarce recourses should be more relevant in generating smaller, more local conflicts than civil or intra-state wars" (Theisen 2012: p. 83). Finally, Hendrix & Salehyan expect that conflict involving the state is an unlikely outcome of climate change, as "communities most vulnerable to climate change are also the least equipped to challenge the government" (2012: p. 37).

An analytical shift can be observed in the academic literature. Country-level studies are said to overlook "local variations in weather extremes and civil conflict violence", phenomena that affect limited areas rather than a whole country; hence, a subnational level of analysis is found better suited to study climate conditions and conflict (Von Uexkull 2014: p. 17). The *Journal of Peace Research* dedicated its January 2012 issue to the subject of conflict and climate change. A large number of studies included in this issue have moved away from large-scale conflict and focus on, for instance, communal conflict (Adano et al. 2012), or consider a range of conflict types which includes protests and riots (Hendrix & Salehyan 2012). These studies are aimed at finding intricate pathways between conflict and climate factors, rather than direct links, further setting them apart from the preceding research. Raleigh & Kniveton maintain that the "climate's influence is mediated via other drivers of conflict" (2012: p. 52). Those drivers which are most relevant to the onset of communal conflict are discussed in the section below.

2.2.2. Mediating mechanisms

From here on, the so-called 'drivers of conflict' will be referred to as *mediating conditions* or *mechanisms*. The term denotes that climate does not affect the onset of conflict in isolation from other factors. It has been argued that "different types of conflicts have alternate sets of instability determinants, and, hence, will have distinct relationships (if any) with climate change" (Raleigh & Kniveton 2012: p. 52). 'Instability determinant' is simply a different denominator for driver of conflict. Communal conflict is associated with a number of mediating mechanisms. These are, among others, resource scarcity, elite exploitation, and, lastly, migration.

Resource scarcity is thought to be caused by (interactions of) three factors, i.e., population growth, resource degradation, and the distribution of resources between individuals and groups (Homer-Dixon 1999: p. 48). This produces varying types of resource scarcity, resp. demand-induced, supply-induced and structural scarcity (*ibid.*). *Resource capture* is the outcome of an interaction of resource degradation and population growth. In this scenario, powerful groups take control over scarce resources on the expense of weaker groups (Raleigh & Urdal 2007: p. 678). It should be noted here that resource scarcity in itself does not trigger conflict – the manner in which resources are distributed does (Hendrix & Salehyan 2012: p. 37). It is not difficult to comprehend how decreased availability of resources may lead to conflict in Sahelian societies. Farmers and pastoralists both require water and land for their livelihoods. When drought or flood events diminish the availability of these resources, resource distribution becomes a zero-sum game. Resource sharing now yields less benefits and, as a consequence, resorting to violent resource capture becomes less costly (Schilling et al. 2012: p. 5-6, referenced in Van Baalen & Mobjörk 2016: p. 22). Based on this theory, I formulate the following hypothesis:

H1**:** *Rainfall variability leads to conflict when resources are scarce.*

Elite exploitation is another mediating mechanism discussed in studies on climate-conflict links. Raleigh & Kniveton note that "conflicts do not occur in a political vacuum" (2012: p. 62). Nevertheless, a political interpretation of conflict is frequently absent in explanations of pastoral violence (Hagmann & Mulugeta 2008: p. 165). This is a serious flaw, since political factors may contribute significantly to conflict. It has been observed that "people living in [Arid and Semi-Arid Land] are frequently victims of … political maneuvering including elites who encourage groups to 'ethnicize' land claims" (Raleigh & Kniveton 2012: p. 62). Fueling inter-group conflict may serve different purposes. Political elites use it as a means to crush their adversaries, divert the attention of the public or support groups whose survival would otherwise be threatened, e.g., their own tribe (Kahl 1998: p. 84-93, referenced in Van Baalen & Mobjörk 2016: p. 29). Resource conflicts often pose an invitation to elite manipulation, as they provide tensions and grievances to exploit (Kahl 1998: p. 88, in Van Baalen & Mobjörk 2016: p. 30). Based on the above, I arrive at the following hypothesis on conflict and elite exploitation:

H2: *Rainfall variability leads to conflict when elites exploit local grievances.*

Finally, climate change might contribute to the onset of communal conflict via its effect on migration. Migration is a potential outcome of environmental degradation. When climate events threaten livelihoods by increasing resource scarcity, populations will likely move to areas where resources are more available (Hendrix & Salehyan 2012: p. 38). In the Sahel, environmental change has led pastoralists to push south into agricultural lands (UNEP 2011: p. 59). Migration often leads to intensified competition between migrants and residents over resources, housing and jobs. Reuveny lists various channels through which migration can lead to conflict: besides increased resource competition and ethnic tension, conflict might arise over distrust between migrants and natives, or simply by following existing socioeconomic fault lines (2007: p. 659). It is further noted that groups from different areas, of different ethnicities, often lack common institutions to resolve conflict (Van Baalen & Mobjörk 2016: p. 24). Non-climate change related migration could also increase the struggle for resources and as such drive violent conflict (*ibid.*). The third and last hypothesis is based on the theory laid out above and goes as follows:

H3: *Rainfall variability leads to conflict when migration increases the interaction between different groups.*

Fig. 2. *Mediating mechanisms*

2.2.3. Empirical literature

A few empirical studies on climate-conflict links will be discussed to gain some insight into the recent Africa-oriented body of research. Attention to local conditions is a recurring trait of the works under review below. A summary of findings can be found in Annex 1. To begin, Adano et al. (2012) studied resource availability and violent conflict, looking at the conditions under which conflict arises in northern Kenya. They found that wetter periods saw more violence than periods of drought, contrasting mainstream thinking that resource scarcity exacerbates conflict risk (2012: p. 69). Theisen (2012), also studying Kenya, found similar results, stating that "years following wetter years [are] less safe than drier years" (p. 93). These findings can be explained by considering livestock raiding and the accompanied use of violence which is "common and part of the group-specific accepted codes of conduct and cultural institutions" among Kenyan pastoralists (Adano et al. 2012: p. 68-69). During drought periods, pastoralists tend to cooperate and seek reconciliation to survive, rather than fight over scarce resources. Moreover, raiding livestock is an easier and more fruitful endeavor during the wet season for a variety of reasons: the animals are stronger, thus more valuable; the environment provides more foliage for hiding; and a labor surplus drives young men to participate in the raiding (*ibid*.: p. 71).

In a study on rainfall variability and subnational conflict in East Africa, Raleigh & Kniveton (2012) looked at various types of conflict, distinguishing between rebel and communal conflict. They list four hypothetical relationships between rainfall variability and political conflict. First, the standard 'zero-sum' narrative, which implies that drier periods are more violent because of competition over scarce resources; second, it could be that drier periods are less violent, as the little available resources are deemed not worth fighting over; third, periods with above average rainfall see an increase of violence, because an abundance of resources triggers wealth-seeking behavior; lastly, these wetter periods could be more peaceful as well, since there is less of an economic need to engage in violent conflict (2012: p. 54). Raleigh & Kniveton find that extreme dry and wet conditions lead to an increase of conflict, thus lending credibility to both the first and third narrative (*ibid*.: p. 62). In addition, rebel conflict was found to be more likely to occur under dry conditions, whereas wetter periods saw more communal violence (*ibid*.).

Hendrix & Salehyan (2012) further widen the scope of conflict, taking into account riots, demonstrations, strikes, communal conflict and anti-government violence. Contrary to Adano et al. (2012), they studied effects of rainfall variability on conflict nationwide, expecting them to have an impact beyond a single area and noting that "causal pathways may be long and far-reaching" (2012: p. 38). While their research, which takes into account all African countries with a population of at least 1 million, has a far greater scope, they arrive at similar conclusions as Raleigh & Kniveton. Very wet and dry years saw more conflict; violent events were most common in years with extremely high rainfall, whereas above average dry years saw more non-violent events (*ibid.*: p. 45-46). Some evidence was found that civil war and insurgency were more likely during rainfall abundance. This is attributed to tactical considerations, not unlike the case of the pastoralists in northern Kenya: waging war is more difficult when water is scarce and the environment is bereft of foliage necessary to successfully escape (*ibid.*: p. 45).

Lastly, Von Uexkull (2014) studied drought and conflict in Sub-Saharan Africa. She found that there is an increased risk of conflict following drought periods in areas where populations depend on rainfed agriculture (2014: p. 24); some evidence was found that drought is correlated as well with conflict risk beyond agricultural areas (*ibid.*). Drought-induced economic hardship can add to pre-existing grievances and may drive those struck hardest into the arms of rebel groups (*ibid.*: p. 17). The drought-conflict link was mainly found in areas with rainfed croplands where civil unrest was recurring or ongoing (*ibid.*: p. 24). Here, "the "fixed costs" of initiating war have already been paid" (*ibid.*). Hendrix & Salehyan deem civil war as an outcome of water scarcity unlikely due to "significant start-up costs, planning and organizational capacity" (2012: p. 36). Yet, Von Uexkull suggests that drought can exacerbate pre-existing conflicts.

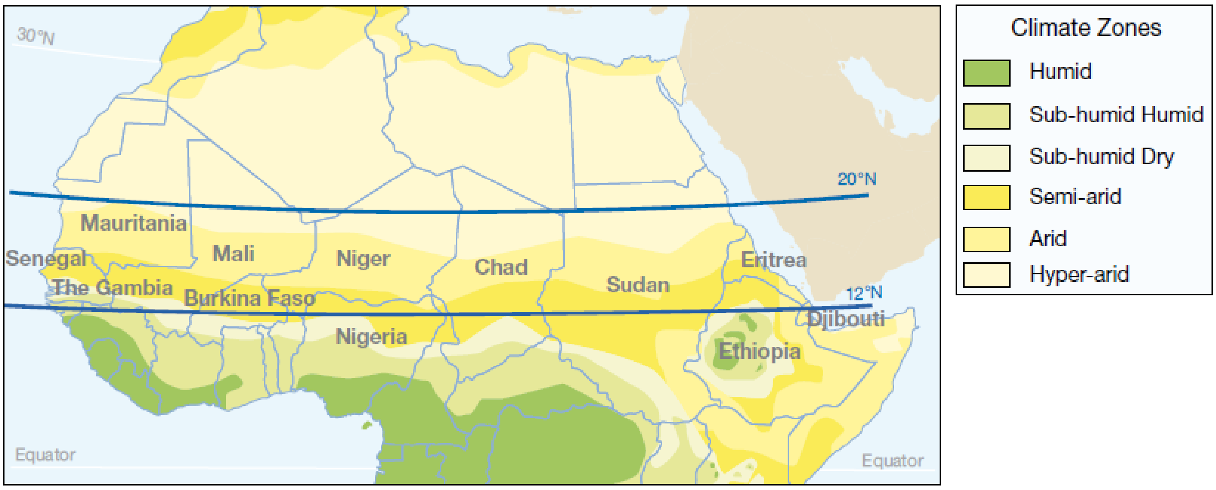
In short, findings of recent research on climate-conflict links are mixed. Different scenarios are observed: an increase of conflict is seen following both wetter and drier periods. It could be concluded that deviations from the average rainfall in general drive conflict, whether they be positive or negative. Resource competition is often treated as a mediating mechanism of climate effects. Scholars pay attention to two contrasting hypotheses: either resource scarcity creates a zero-sum situation, or, in the other case, an abundance of resources provokes wealth-seeking behavior. In addition, different climate events see different types of civil conflict. Based on the reviewed literature, this research examines whether drier periods precede a rise of conflict in Chad. The focus on drought as a driver of conflict is explained in the methodology.

2.3. Setting the scene

2.3.1. The Sahel

In this section, the Sahel is introduced to provide some relevant background information. The Sahel is a semi-arid and arid region in Africa, stretching from the Atlantic coast to the Red Sea. Many African countries lie partly or entirely in this region, including Mauritania, Senegal, Mali, Burkina Faso, Niger, Chad and Sudan (Heinrigs 2010: p. 5). The name "Sahel" finds its origin in the Arabic word for “shore”, a shore overseeing the vast Saharan sands to the north (*ibid.*).

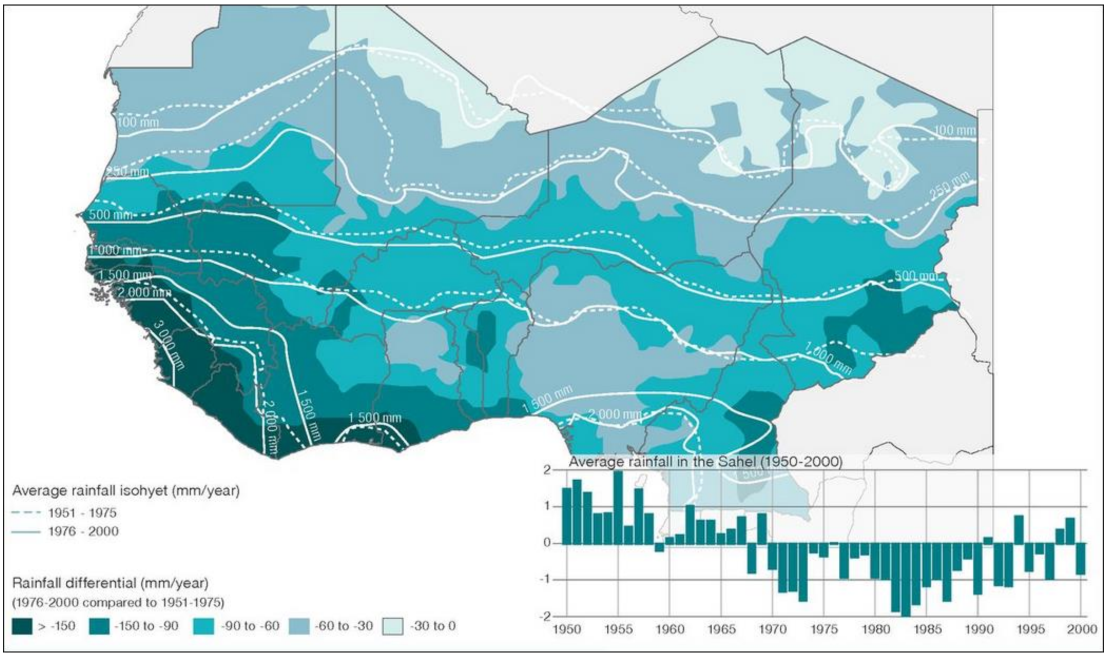
Fig. 3. *The Sahel*



Source: WMO (2001) in Heinrigs (2010).

While not as inhospitable as the desert it borders on, living conditions in the Sahel are far from easy. The rain season is short, lasting three to four months, with most of the rain falling in August (Heinrigs 2010: p. 5; Nyong et al. 2007: p. 789). In the north, annual rainfall amounts to 150 mm, whereas the south is wetter with 600 mm (Nyong et al. 2007: p. 789). Due to high temperatures in the wet period, much of the rain directly evaporates (Mortimore 1998: p. 9). Under such conditions, only grassland and savanna are able to thrive. Rainfall is not only sparse, but also highly variable (see Figure 4). The 1950s and ‘60s of the twentieth century saw a slight increase in rainfall, but were followed by two decades of drought with disastrous consequences for food and livelihood security of many African populations (Heinrigs 2010: p. 12). Since the 1990s, the climate has partially improved (Lebel & Ali 2009: p. 63). Still, for Sahelian farmers and livestock breeders, relying on rainfall *averages* is risky (Mortimore 1998: p. 15). In Africa’s drylands, rainfall not only varies greatly between years, but within seasons as well. Most of the seasonal rain falls in a small number of short intense showers. Thus, “a reduction of one or two rain events can make the difference between a bumper crop and a catastrophe” (*ibid.*: p. 14). What causes the Sahelian rainfall variability is poorly understood. However, there is agreement that “sea surface temperatures have a major role in determining interannual-to-decadal variability of the West African monsoon” (Lebel & Ali 2009: p. 53).

Fig. 4. *Rainfall variation 1951-75 – 1976-2000*

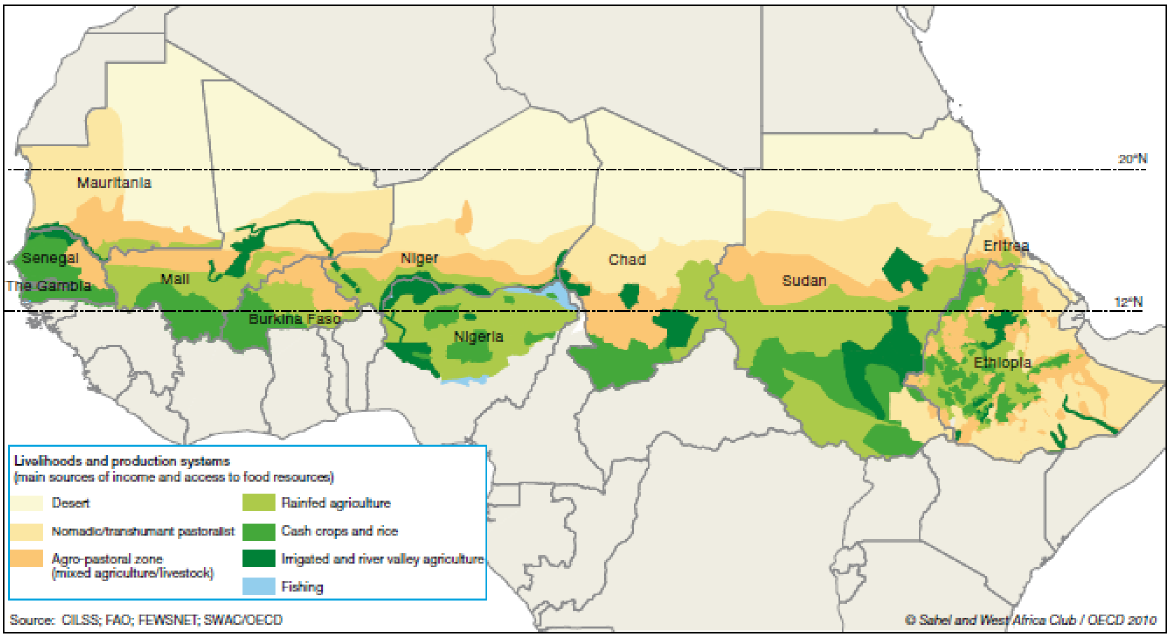


Source: Global International Waters Assessment 2004; SDRN/FAO; SWAC/OECD 2007 in Tremolieres (2013).
The decrease in rainfall measured over the 1976-2000 period in comparison to 1951-1975 is most substantial in West Africa along the Atlantic coast (Gambia, Guinee, Sierra Leone, Liberia).

The majority of Sahelian populations depend on agriculture for their livelihoods (Sissoko et al. 2011: p. 119). More than half of the region's working-age population consists of subsistence farmers, who contribute between 35 and 60% to their country's GDP (*ibid*.: p. 120). Livelihood systems vary from north to south. Pastoralism is most common among northerly cultures, while southern populations rely more on sedentary rainfed farming (see Figure 5) (Nyong et al. 2007: p. 790). Besides unfavorable climate conditions, multiple other factors threaten the region's food security. A mere 8% of all land in the Sahel is suitable for agriculture (*ibid*.). Soils are described as "fragile and infertile, with very low levels of organic matter, particularly in the semi-arid zones" (Sissoko et al. 2011: p. 120). Land degradation, a result of resource depletion in dry years, is a major issue (*ibid*.). Meanwhile, Sahelian populations are growing rapidly with approximately 3% and will have been doubled to 300 million by the century's midpoint (OCHA 2016: p. 2).[2] Consequently, far greater levels of food production will be required, imposing even more stress on the little amount of land available for agricultural activities.

[2] In the report by the UN Office for the Coordination of Humanitarian Affairs (OCHA), the Sahel comprises of Burkina Faso, Chad, The Gambia, Mali, Mauritania, Niger, northern Cameroon and Nigeria, and Senegal.

Fig. 5. *Livelihood systems in the Sahel*



Source: CILSS; FAO; FEWSNET; SWAC/OECD in Heinrigs (2010).

2.3.2. Chad

The focus of this case study is Chad, a typical Sahelian state in the center of the region. With a total area of 1,284 million square kilometers, the country ranks among the largest on the African continent. It is also Africa's largest landlocked country, bordering Libya to the north, Sudan to the east, the CAR to the south and Cameroon, Nigeria and Niger to the west. Since 2012, Chad is divided into 23 administrative regions. Later chapters will mention several of these regions. A map of Chad is included in Annex 2 which can be used to locate individual regions. The name "Chad" is derived from *tsade* meaning "large body of water" or "lake" in local native languages, which refers to Lake Chad (CIA 2017). From north to south, different climatic regions can be found, i.e., desert, a semi-arid and savanna zone. Most Chadians, about 70%, rely on agriculture for their livelihoods (Maharana, Abdel-Lathif & Pattnayak 2018: p. 255). Traditional rainfed farming is most common in Chad, with "cotton, sorghum, millet, peanuts, cattle, sheep, goats [and] camels" being the country's most important agricultural products (CIA 2017).

Chad has a population of about 14.5 million that is rapidly growing with 3.1% per year (The World Bank 2017). The country is heavily fragmented in both ethnic and religious terms. More than two hundred ethnic groups can be found here, many of which were brought into Chad as slaves (historically, the region acted as a hub in the slave trade between Sub-Saharan Africa and the Middle East) (Maceachern 2001: p. 138). The Sara, based in the south, are Chad's largest ethnic group, making up more than a quarter of the population; Arabs represent 10% of the population and mostly live in the desert and arid Sahelian zone (CIA 2017). Inter-group conflict in Chad is often characterized by ethnic dimensions. Religion (Christianity, Islam and animistic African religions) coincides with and intensifies ethnic differences (Collelo 1990: p. 35).

Why study Chad?

Previously, it was asserted that Chad is a highly relevant country for research on climate-conflict links. Sub-Saharan Africa represents "a most likely" case to find an association between rainfall variability and conflict. This is because of a high dependence on rainfed agriculture, widespread poverty, weak states, discriminatory, neopatrimonial regimes, high frequency of armed conflict and, finally, high exposure to the negative effects of climate change and variability (Theisen, Holtermann & Buhaug 2011: p. 104). All of these features are found in Chad. Only 300 km² of land here is irrigated, the remainder of agricultural land being rainfed (CIA 2017). Chad ranks third to last in the Multidimensional Poverty Index, with a staggering 87.1% of the population in multidimensional poverty (Alkire & Kanagaratnam 2018). The Fragile State Index ranks the country 8th, which places it high up in the "high alert" category, the second worst category (FSI 2017). Influential positions in Chad are mostly occupied by members of the clan of President Déby, which could be perceived as evidence for the discriminatory nature of the regime (HRW 2007: p. 16). And lastly, the country has a long history of internal armed conflict.

All of this would be irrelevant if Chad were not highly vulnerable to the effects of climate change. Vulnerability is generally perceived as a function of exposure (the chance that an event may occur) and capacity (the impact of an event on humans) (Pandve et al. 2011: p. 142). In Chad, climate variability often causes droughts and floods; the factors listed above amplify the impact of these events. Because of this dynamic, climate change effects can be highly disruptive to Chadian communities, causing a "vicious circle of underdevelopment, poverty and resource depletion" (Sissoko et al. 2011: p. 120). The GeoRisQ Climate Change Vulnerability Monitor places Chad in the second highest vulnerability category (out of five) among other African states such as Mali, Zimbabwe and Senegal.[3] In 2016, Verisk Maplecroft ranked Chad as the single worst performing country out of a total 186 countries worldwide – although, in its 2017 Index, it dropped out of the extreme risk category, now ranking outside the top five.

Chad's east can be identified as a particularly vulnerable region. Since 2003, the conflict in Darfur has been spilling over into Chad. A Darfuri population of over a quarter million remains

[3] This Climate Change Vulnerability Index "shows the relative standing of various countries with respect to three major impacts of climate change: weather-related disasters; sea level rise; and loss of agricultural productivity."

in refugee camps and more than hundred thousand Chadians have become internally displaced (Reeves 2012: p. 8). This places intense pressure on the region, forcing host populations to compete with refugees and IDP's over resources and employment (USGS 2012). Risk of climate hazards is also greater in the east than elsewhere. Between 1970 and 2016, the mean seasonal temperature has risen with 1°C to 1.5°C as opposed to a rise of 0.5°C to 1°C in the west (UNEP 2011: p. 30-31).[4] This warming coincides with rainfall declines ranging from -150 to -50 mm, increasing food insecurity for a population already in peril (USGS 2012).[5] Due to these climate trends, eastern Chad has been identified as one of roughly 20 hotspots of climate change impact, "where climatic changes have been most severe" (Hagenlocher 2013: p. 93).

Temperature and rainfall variations

With an estimated rate of 0.15°C per decade, mean annual temperature in Chad has increased by more than 1°C since 1950 (Maharana et al. 2018: p. 260). In the far eastern strip bordering Sudan, temperatures have even risen with 1.25°C (see Figure 6). Temperatures increased the most during the wet months of July till September at a rate of 0.36°C per decade (The World Bank 2017). It has also been stated that the increase in temperatures in Chad has become more prominent since 1990 (Maharana et al. 2018: p. 259). Due to the limitations of this study, the impact of temperature on conflict onset is not examined. However, it should be noted that higher temperatures contribute to drought and, therefore, could be a driver of conflict.

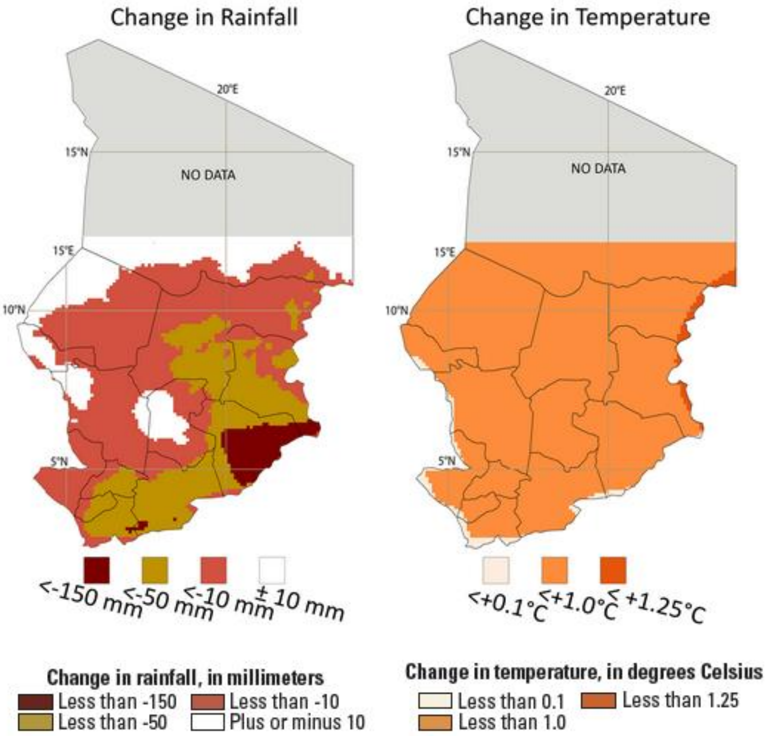
Rainfall over Chad has been highly variable between years and decades, making it difficult to observe any specific trend. Yet, rainfall analyses show that the country entered a drier period by the mid-1960s which lasted throughout the entire 1970s and '80s. The current period, starting in the early 1990s, is characterized by a slight recovery in rainfall (0.1 mm/year) (Maharana et al. 2018: p. 261). Rainfall has decreased most during the wet period which lasts from June till August, the decrease rate being the highest in August (0.74 mm/year) (*ibid.*: p. 260). This is problematic for rainfed agriculture since annual rainfall is concentrated in the wet period. The decrease in rainfall is most pronounced in the southeast (Figure 6). With current trends expected to continue in next decades, a substantial share of Chad's crop production areas will receive less than 500 mm during the rainy season (USGS 2012). This will likely lead to a contraction

[4] Measured from May to October, as this period "includes the rainy and cropping season months of July to September, as well as "buffer" moths to capture natural variance" (UNEP 2011: 31).

[5] The rainfall decline is an "observed and projected change in June-September rainfall for 1960–2039"; the mean rainfall is based on the 1920-1969 time period (USGS 2012). It should be noted that seasonal rainfall (May–October) during the 1970-2006 time period has actually increased or remained constant for most of the Sahel, although the mean seasonal rainfall is still below the long-term historical average (1900-2009) (UNEP 2011: 35).

of crop production areas, with major consequences for livelihood systems (*ibid*.). In the studied period (1997-2014), precipitation received during the wet period was on average 2.6 % higher than normal.[6] This supports Maharana et al.'s characterization of the post-1990 period as one of recovery. Rainfall during the studied period is described in more detail in Chapter 4.

Fig. 6. *Observed and projected changes in rainfall and temperature (1960-2039)*



The decrease in rainfall (left) is most substantial in the southwest (the dark red area). The increase in temperature (right) is highest near the Sudanese border (the dark orange area). Source: USGS (2012).

Communal conflict in Chad

This study focuses on the occurrence of communal conflict in Chad. A general development in the Sahel is that environmental change intensifies competition over resources between farmers and pastoralists (UNEP 2011: p. 59). Because of this, farmer-herder conflicts are often seen in places where agriculture and pastoralism intersect. In Chad, the decrease in rainfall since the 1970s has driven pastoralists south into lands traditionally inhabited by farmers (Serge & Hesse 2008: p. 10). Herders from the Sahel zone now move as far south as Mayo Kebbi region near Cameroon; those originally from the Soudanian zone have begun penetrating into the CAR and beyond into the DRC (*ibid*.). An increasing number of pastoralists is even settling in the south and no longer travel back northwards when the rainy season arrives (*ibid*.). This has increased

[6] 'Normal' refers here to the climatological standard normal calculated over the 1961-1990 period.

competition over renewable natural resources such as water and land and exacerbated tensions between natives and newcomers. Some areas, particularly in the southwest, have become unable to absorb more livestock (*ibid*.: p. 11). Increased interaction between different land users has led to cattle damaging crops and farmland blocking migratory routes used by pastoralists, often with conflict as a result (BRACED 2018). Water is another source of conflict, frequently making water points sites of intercommunal tension (*ibid*.).

3. Research methodology

3.1. Conceptualization and operationalization of variables

Independent variable

Rainfall variability is measured as the monthly rainfall deviation from the long-term mean of rainfall. Monthly and seasonal mean values are retrieved from the University of Delaware Air Temperature & Precipitation dataset (V4.01). The long-term mean of rainfall, or *climatological standard normal*, is calculated over a thirty year period. It is assumed that "for periods of 30 plus years normality can be accepted" (Agnew & Chappell 1999: p. 302). To demonstrate a change in climate, climate values from a studied period are compared to an earlier period. The period 1961 to 1990 is used to calculate climatological standard normals. This is the standard reference period for long-term climate change assessments (WMO 2017). Rainfall is measured from May to October, which includes the rainy and cropping season (June-September) as well as a few "buffer" months to account for natural variance. This period has been considered "the most critical time period for agriculture-based livelihoods" (UNEP 2011: p. 30).

There is significant rainfall variability when seasonal rainfall (May-Oct) deviates 25% or more from the climatological standard normal. A deviation of ≤-25% indicates drought. The 'percent of normal' precipitation is "a meteorological drought index that describes the drought as the precipitation deviation from the normal (average)" (Zargar et al. 2011: p. 336). In order to accurately estimate rainfall situations, rainfall is measured for the year seeing the onset of conflict as well as the preceding year. The effects of drought on, for instance, food security may not be directly visible, hence the inclusion of multiple years. Admittedly, the ≤-25% deviation as a threshold of drought is somewhat arbitrary, yet not uncommon (Agnew & Chappell 1999: p. 301). It could be reasoned that such levels of rainfall have a profound effect on vulnerable populations in the Sahel and are thus appropriate to denote drought in the context of this study. For instance, it has been stated that a deviation of -13% is sufficient to increase the number of poor harvests (USGS 2012: p. 3). Yet, it cannot be said with full certainty that significant rainfall deviation indeed indicates a drought event. "In addition to delayed effects, droughts vary by multiple dynamic dimensions including severity and duration, which in addition to causing a pervasive and subjective network of impacts makes them difficult to characterize" (Zargar et al. 2011: p. 333). The main advantage of the percent of normal index is that it is simple and transparent. Disadvantages are that there is no statistical transformation used for the distribution of the precipitation record, potentially diminishing its accuracy; and that it cannot be used to compare drought across seasons and regions (*ibid.*: p. 336). Regarding accuracy, it is checked for each conflict whether drought was mentioned as a contributing factor in media coverage or reports. A comparison of drought across seasons and regions would be problematic only in case there was a wide dissimilarity between those. However, this study analyzes conflict within a single country and only slightly differing climate zones. Furthermore, it only considers the wet season, thereby omitting the dry period which lasts from November to April.

Lastly, it should be noted that significant rainfall abundance (≥25%) does not per se indicate flood events. The occurrence of flood not only depends on rainfall levels, but on the intensity of rainfall and quality of soils as well. Because subnational data on these variables is limited, the impact of flood on civil conflict is only limitedly included in the scope of this research.

Dependent variable

The definition of communal conflict is derived from the Non-State Conflict Dataset (Version 17.2) of the Uppsala Conflict Data Program (UCDP). It is a category of conflict which stands along lines of communal identity, between informally organized armed groups, resulting in a minimum of 25 battle-related deaths yearly. Unlike rebel groups, "these are not groups that are permanently organized for combat, but who at times organize themselves along [identity lines] to engage in fighting" (Sundberg et al. 2012: p. 4). Based on academic literature, expectations are that environmental stress, caused by climate variability, will most often trigger communal conflict. It is stated that "groups competing for resources may fight directly rather than engage the government" (Hendrix & Salehyan 2012: p. 37). This is due to their weak organizational capacity, making it difficult to challenge the government; also, governments may be unwilling to redistribute resources or simply absent in the area and thus unable to do so (*ibid*.). In the context of the Sahel, conflict is expected between different land users and ethnic groups.

Data on communal conflict is retrieved from various datasets. These are the Social Conflict Analysis Database (SCAD); the Armed Conflict Location and Event Data Project (ACLED); and the Non-State Conflict Dataset by UCDP, all of which list conflict events of varying types for African countries and other continents.[7] For the qualitative analysis, I avoided relying on a single dataset to make sure that all recorded instances of high-intensity communal conflict are included. While communal conflict is a common phenomenon in most of the Sahel, which has even been termed "cyclical", it has also been stated that "these conflicts, and the migrants they create, are often invisible to governments and conflict researchers" (Raleigh & Kniveton 2012:

[7] All datasets are available online: https://www.strausscenter.org/scad.html (SCAD 1990-2016); https://www.acleddata.com/data/ (ACLED Version 7 1997-2016); http://ucdp.uu.se/downloads/ (UCDP Version 17.2).

p. 53). Indeed, communal conflict events are far outnumbered by other types of conflict in the datasets listed above. The limited number of casualties and, perhaps as a consequence, lack of media coverage, often make them slip under the radar. Yet, there are a number of high-intensity communal conflicts in Chad that did generate a substantial degree of attention from both media and NGO's. These are the instances of civil conflict considered for this study. To capture recent effects of climate change, conflict events are selected within the 1997-2014 period.

Table 1. *Operationalization scheme I*

Concepts	Definition	Indicators	Data sources
Rainfall variability	Monthly and seasonal fluctuations of precipitation above or below the climatological standard normal.	Rainfall deviation in a given area in a given year.	• U of Delaware Air Temperature & Precipitation Dataset
Communal conflict	Conflict which stands along lines of communal identity, involves informally organized armed groups, resulting in a minimum of 25 battle-related deaths per year.	Occurrence of communal conflict in a given area.	• Multiple datasets on social conflict (SCAD, ACLED & UCDP)

Intervening variables

Expectations are that the effects of rainfall variability on the onset of conflict are mediated via several other drivers of conflict. To gain a better comprehension of climate-conflict pathways, these factors should be carefully analyzed. Within the context of this research, the most relevant mediating mechanisms are resource scarcity, elite exploitation, and migration.

The first mechanism refers to supply-induced scarcity of renewable natural resources such as water and land. Such scarcity occurs when there is a decline in quantity or quality of a certain resource, usually as a result of environmental change (Homer-Dixon 1999: p. 48). Another term, resource competition, is used as well. To avoid confusion, this term refers to a situation in which "two or more groups try to limit each other's access to scarce resources or positions" (Hoetink 1975: p. 9). Resource competition is a potential outcome of resource scarcity. In the context of the Sahel, competing groups are often rival communities of farmers and herders, though conflict may also arise between communities with the same livelihood. Resource scarcity as a concept is operationalized by assessing the quality or quantity of natural resources. In case of significant rainfall variation, the dynamics of conflict may give an indication of these matters. Relevant questions are: did a group attempt to secure its access to resources, for instance by asserting its control over a water hole or gaining land at the expense of the other group? Did livestock raiding take place or spark the conflict in the first place? Had there been tensions before over resource access or availability? If these questions can be answered with 'yes', this could be seen as an indication that resources were scarce and that scarcity had an impact on conflict onset. The data to answer the above questions is found in news articles, academic papers and NGO reports that report on communal conflicts and describe their development and context.

Elite exploitation could be defined as the politicization and manipulation of local grievances by political elites for selfish reasons (Van Baalen & Mobjörk 2016: p. 29). Exploitation by local or national elites may manifest itself in various ways. Elites may be the instigators of conflict by means of stirring up ethnic tension. They may also be the facilitators of violence, for instance by diminishing the presence of military and police forces within a conflict stricken region. Elite exploitation is operationalized by examining (alleged) actions by (agents of) the state that have the intent of provoking hostilities, and ultimately, violence between rival groups. NGO's such as Human Rights Watch have closely observed escalations of violence between rivaling ethnic groups in Chad. Their reports include a discussion of the political context of these conflicts and the role of state actors. For this reason, they are very useful for assessments of elite exploitation. Other information sources are news articles and academic papers on civil war in Chad.

Lastly, it has been observed that migration plays a role in many scenarios of climate conflict (Reuveny 2007: p. 656). Climate change-induced migration refers to a process in which people are "forced to leave their traditional habitat, temporarily or permanently, because of a marked environmental disruption … that jeopardizes their existence and/or seriously affects the quality of their life" (El-Hinnawi 1985, cited in Cardy 1994: p. 2). In Chad, severe drought may cause degradation of pasture, forcing pastoralists to move to other areas; subsequently, the arrival of these migrants might lead to ethnic tension and spark violence. The concept is operationalized by looking at settlement patterns of ethnic groups, although a lack of data makes this difficult. The last and only population census in Chad dates from 1993. Since recent subnational data on ethnic composition is nonexistent, no statistical observations can be made that may indicate a change of residence of ethnic groups. However, information on the mobility of ethnic groups can be gained from other sources, such as NGO reports and the ECC Factbook, which explores the environmental dimension of more than 120 conflicts around the world. Indicators of climate change-induced migration are sudden movements of groups or alterations of migratory routes; and increased interactions between different ethnic groups and/or different land users.

Table 2. *Operationalization scheme II*

Concepts	Definition	Indicators	Data sources
Resource scarcity	Supply-induced scarcity of renewable natural resources such as water and land.	Quality and quantity of natural resources such as fresh water, pasture and farmland.	• News articles • Academic papers • NGO reports
Elite exploitation	Politicization and manipulation of local grievances by political elites for selfish reasons.	Actions by (agents of) the state with the intent of provoking hostilities, and ultimately, violence between rival groups.	• News articles • Academic papers • NGO reports
Migration	Forced mobility involving a change of residence between geographic and administrative areas as a result of a marked environmental disruption.	Sudden movements of groups or alterations of migratory routes; and increased interactions between groups.	• ECC Factbook • NGO reports

3.2. Research design: Single Case Study

To answer the main research question, a single case study design is chosen. A combination of qualitative and quantitative methods are used. The latter takes the shape of a correlation analysis that considers a range of conflict types, whereas the former focuses on communal conflict. Such an approach should lead to a better understanding of climate-conflict links. First, it contributes to general insights regarding civil conflict and its association with rainfall on a national scale. Second, it allows to zoom in on individual conflicts of a specific type and to assess them in their local contexts. It has been noted that there are significant empirical gaps in our understanding of how climate change and conflict are linked (Von Uexkull 2014: p. 17). Until recently, studies in this field focused on large-scale conflict, producing mixed and even contradicting findings. These studies did not account for the variability of climate change effects across time and space, which may be considerable even within a single country, and overlooked local circumstances. Therefore, there is a need to study climate-conflict links on a subnational level as well.

3.2.1. Quantitative analysis

The correlation analysis is based on the ACLED dataset. This is the most extensive dataset on conflict in Chad, listing 666 events between 1997 and 2016. Other datasets are not considered as this would require filtering out a large number of conflict events included in more than one dataset. Since each dataset uses different conflict ID's, this would be very time consuming. The ACLED dataset, moreover, is comprehensive enough for generating valid results. Some conflict events were left out from the analysis. This includes ‘strategic developments’, e.g., arrests of political figures, peace talks, and recruitment drives (ACLED 2017: p. 12). These type of events are closely linked to conflict, but I do not consider them to be instances of conflict themselves. The reason for their inclusion in the ACLED dataset is to “capture contextually important events that are not political violence” (*ibid*.). Nevertheless, they are excluded from the analysis here, as they would likely obscure any meaningful findings. Also, all instances of interstate conflict between Chad and its neighbors are omitted, as this study focuses on civil conflict. Events that took place in the country’s northern regions, i.e., Tibesti, Borkou and both Ennedi’s, are left out from the analysis as well. Since these regions receive virtually no rain, rainfall variability can be excluded as a driver of conflict here. Lastly, events dated between Oct. 2015 and Dec. 2016 could not be analyzed, because precipitation data is only available up to and including 2014. Due to the chosen method of calculating rainfall deviation, conflict events taking place between Jan. and Sep. 2015 could be included for certain parts of the analysis.[8] However, all graphs that compare annual precipitation and conflict trends exclude 2015 altogether.

This leaves us with a total of 462 conflict events. They are divided in a number of categories, slightly different to the categorization used in the ACLED dataset. This new categorization was necessary, because some of the ACLED categories refer more to the dynamics of conflict (e.g., whether there was a change of territory) than to a certain conflict type. Based on the information on conflict actors, the new categories are called: anti-government conflict, extra-governmental conflict, intra-governmental conflict, repression, protest, riot, and, strike. The latter three are rather self-explanatory, whereas the others require some explanation. Anti-government conflict entails conflict between Chad’s military (or its allies) and a non-state actor. Intra-governmental conflict is fought between state agents (e.g., coups or factional fighting within the military). Extra-governmental conflict indicates conflict between a non-state group and individuals or rival communal groups. As such, communal conflict is included within this category. Finally, repression applies to violence of Chad’s military and police forces against civilians.

A number of methods are used to test whether precipitation and conflict or specific conflict types are associated. One of these methods makes use of the percentage of rainfall deviation, which is calculated by dividing the rainfall increase or decrease by the average precipitation of the preceding wet period (May-Oct.) and multiplying by 100. Or, when put into a formula:

$$Rainfall\ deviation = \frac{Increase\ or\ decrease}{Precipitation\ old} \times 100$$

[8] The specifics of calculating rainfall deviation are explained further in this section.

For conflicts taking place between January and September of year 1, the preceding wet period is that of year 0. For conflicts occurring between October of year 1 and September of year 2, the preceding wet period is that of year 1, etc. Technically, November should be the start of this cycle, since October falls within the wet period as a buffer month. However, October is chosen as it directly follows on the wet summer months and conflict occurring in this month is more likely associated with rainfall variability during these preceding months than with conditions of more than a year prior. This method is, admittedly, somewhat arbitrary and may be inaccurate to a degree. For instance, it is possible that a conflict event in September is linked to a drought in June and July of the same year. The current method would overlook this, as it would consider rainfall values of the previous rain season instead of the ongoing one. However, by graphing precipitation and conflict trends, potential inaccuracies should become visible.

Finally, the methods used to explore the hypothesized association between rainfall and civil conflict are explained. First, precipitation and conflict trends are compared for the 1997-2014 period on both a national and regional level and tested for correlation. A regional level analysis excludes the possibility that results are inaccurate due to regional differences in rainfall trends (which the national level analysis does not account for). Second, conflict trends are analyzed within the calendar year. In this way, I explore whether conflict is more associated with the wet or dry period. I also examine how the distribution of conflict changes in high and low rainfall years. These are not years with significantly more or less rainfall, but rather with a rainfall level that either resembles a peak or trough.[9] The final method involves the rainfall deviation. It is based on more precise precipitation data, as it uses data for the conflict location and month of conflict onset instead of national averages and/or proxies. The aim is to chart the distribution of conflict with rainfall deviation on the x-axis to explore whether conflict is associated with anomalous rainfall. Lastly, it should be noted that conflict frequency may not always be a proper indicator of the intensity of conflict and therefore, fatalities are analyzed as well.

3.2.2. Qualitative analysis

The qualitative method that is used is in-case process tracing. This method should be helpful for assessing the local contexts in which communal conflicts take place in Chad. Process tracing has been defined as "the analysis of evidence on processes, sequences, and conjunctures of events within a case for the purposes of either developing or testing hypotheses about causal

[9] By this standard, 1999, 2001, 2003, 2006, 2008 and 2010-2013 classify as high rainfall years. All remaining years within the studied period are deemed low rainfall years.

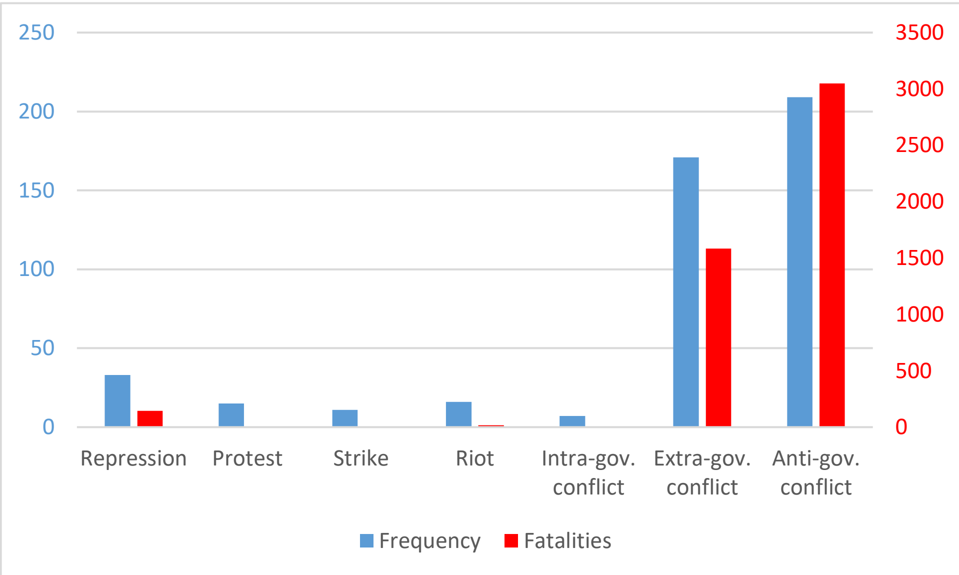
mechanisms that might causally explain the case" (Bennett & Checkel 2015: p. 7). Due to the previously established importance of mechanisms for understanding the relationship between climate change and conflict, process tracing seems an apt method to study this relationship. A characteristic of good process tracing is to ground inferences on a diversity of evidence (Bennett 2011: p. 2137). For that reason, several types of sources are reviewed, e.g., official documents, academic papers, NGO reports and news articles. This should generate specific knowledge on local conditions such as ethnic composition, conflict history, livelihood systems, rebel activity, and state capacity. Naturally, process tracing also has its share of limitations. It has been stated that this method "requires a great deal of information and research" (*ibid*.). This has proven challenging, as information is sometimes very limited, making it difficult to find 'mechanistic evidence' to test hypotheses. In addition, results may not be generalizable beyond the case of Chad. These limitations, among others, are discussed more elaborately in Chapter 6.

4. Results

4.1. Quantitative analysis

The following section discusses the relationship between rainfall and conflict predominantly on the national level. This analysis includes 462 violent and nonviolent conflict events which took place in Chad between Jan. 1997 and Sep. 2015. I divided these events in a number of categories (Figure 7). This makes clear in what shapes civil conflict occurred in Chad. Anti-government conflict was most frequent, followed by extra-governmental conflict. Anti-government conflict also claimed most casualties, about twice as many as extra-governmental conflict. A myriad of political and regional factions active in Chad can be held responsible for the high frequency of these types of conflict. Their efforts to oust President Déby caused many fatalities, both on the rebel and government side. When these factions target civilians or rival rebel groups, an event is labeled as extra-governmental. Janjaweed militias are most often involved in such conflicts. Repression includes one-sided violence by the state against journalists, protesters, foreign aid workers, opposition figures, and civilians thought to be rebels, but those instances are limited, as are protests, riots and strikes. Intra-governmental conflict is the least frequent. Examples are the coup attempts against Déby by some high ranking army officers.

Fig. 7. *Distribution of conflict types*

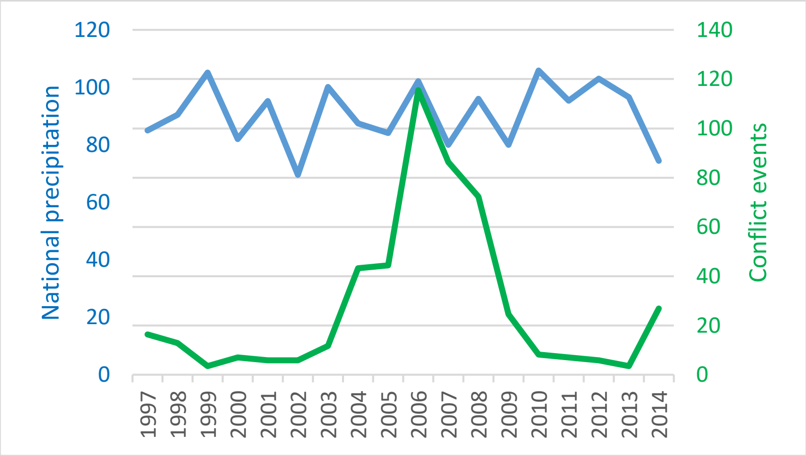


4.1.1. Trends by year

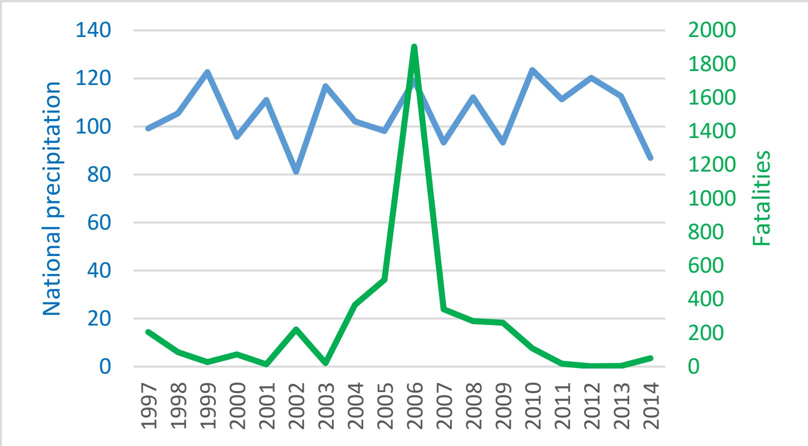
Figure 8 demonstrates conflict and precipitation trends in Chad for the 1997-2014 period. It shows the national average of monthly wet period precipitation (later on referred to as national precipitation).[10] This makes visible the high inter-annual rainfall variability in Chad. Years with high and low rainfall alternate in short cycles. It should be noted that, at the start of the 2010s, rainfall was slightly higher than in the previous decade. However, 2014 saw a sharp decrease in rainfall. 2002 marks the driest year with an average wet period precipitation of 81.1 mm per month. In contrast, 2010 was the wettest year with a monthly average of 123.5 mm.

Conflict trends take a very different shape. Up until 2003, the amount of conflict events was low and individual events caused few fatalities. Civil conflict started to increase in 2004. 2006 saw a steep rise in both conflict events and fatalities. After that, the number of conflict events and fatalities decreased. By 2010, conflict events and fatalities were back to pre-2004 levels. In 2014, the number of events increased again, although the level of fatalities remained fairly low. The biggest peak in conflict takes place between 2004 and 2007. This roughly overlaps with the first stages of the civil war of 2005-2010. During this time period, the Chadian government fought a myriad of rebel groups, some of them supported by the Sudanese government. In 2004, violence from Sudan's Darfur region started to spill into the country. Arab militias referred to as 'Janjaweed' became active in the east, attacking and looting villages. Violence peaks in 2006 as Arab militias penetrate deeper into the country and kill hundreds of civilians. In the same year, rebels confront government forces near the capital, resulting in an estimated 400 fatalities. In the east, conflict between different ethnic communities escalates, claiming the lives of more than a hundred. After this violent year, the number of conflict events decreases. Already in 2007, the number of fatalities drops dramatically. Improved ties between Chad and Sudan help to end the civil war early in 2010. Since then, the number of fatalities remains low, though an increase of conflict events, mostly nonviolent protests and strikes, can be observed in 2014.

Fig. 8a, b. *Conflict and precipitation trends in Chad*



[10] National precipitation values were obtained by taking the mean wet period precipitation for each region and calculating the average. The desert regions Tibesti, Borkou and Ennedi were not included.



When comparing conflict and precipitation trends, a few observations can be made. The 2006 peaks in fatalities and conflict events coincide with a peak in rainfall. This is the clearest instance where conflict and rainfall follow the same direction. However, it is also a misleading one. Initially, it appears that most fatalities are caused in years with high rainfall (2369 deaths as opposed to 2121 in low rainfall years). Yet, when 2006 is considered an outlier and minimum and maximum values of the distribution of fatalities are discarded, a different conclusion can be drawn. Drier years now appear to be nearly three times as violent than wetter years (1555 deaths opposed to 463, or a yearly average of 222 deaths opposed to 66). Moreover, the top five most violent years is almost completely occupied by low rainfall years (if 2006 is excluded). In contrast, the top five least violent years were all relatively wetter years. When looking at conflict events, it seems that low rainfall years saw slightly more instances of conflict than high rainfall years (229:200). Again, when outliers are excluded, the difference is more profound (150:98, or a yearly average of 21.4 events opposed to only 14). These findings raise the assumption that rainfall and conflict are somehow linked. Correlation analysis, however, fails to generate any significant results (Table 3). Specific types of conflict were tested as well, i.e., anti-government and extra-governmental conflict, but none showed significant correlation with rainfall (Table 4). No other types were tested, as those contain too few events to produce valid results.

Table 3. *Pearson correlations among national precipitation and conflict*

	1	2	3
1. National precipitation	--		
2. Conflict events	-,031	--	
3. Fatalities	,089	,813**	--

**. Correlation is significant at the 0.01 level (2-tailed).

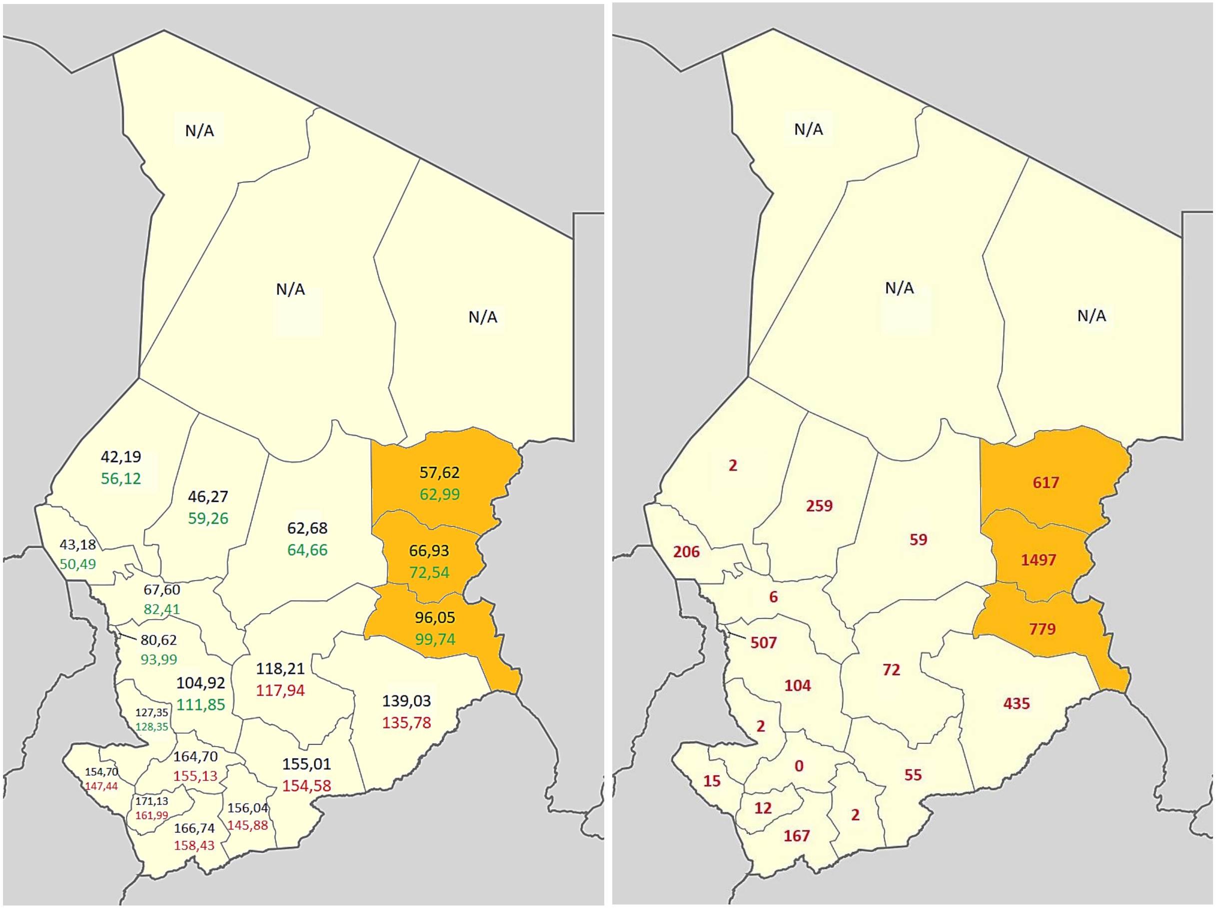
Table 4. *Pearson correlations among national precipitation and conflict types*

	1	2	3	4	5
1. National precipitation	--				
2. Anti-gov. conflict events	,102	--			
3. Anti-gov. fatalities	,058	,749**	--		
4. Extra-gov. conflict events	-,084	,776**	,808**	--	
5. Extra-gov. fatalities	,111	,672**	,935**	,848**	--

**. Correlation is significant at the 0.01 level (2-tailed).

Thus, no correlation could be found for rainfall and conflict nationwide. However, this may be different for individual regions within Chad. Sufficient conflict data is only available for the east, the region with the most fatalities and highest frequency of conflict.[11] Figure 9 shows the region's fatality values in comparison with the rest of the country, along with rainfall values

Fig. 9. *Average precipitation and fatalities per administrative region*

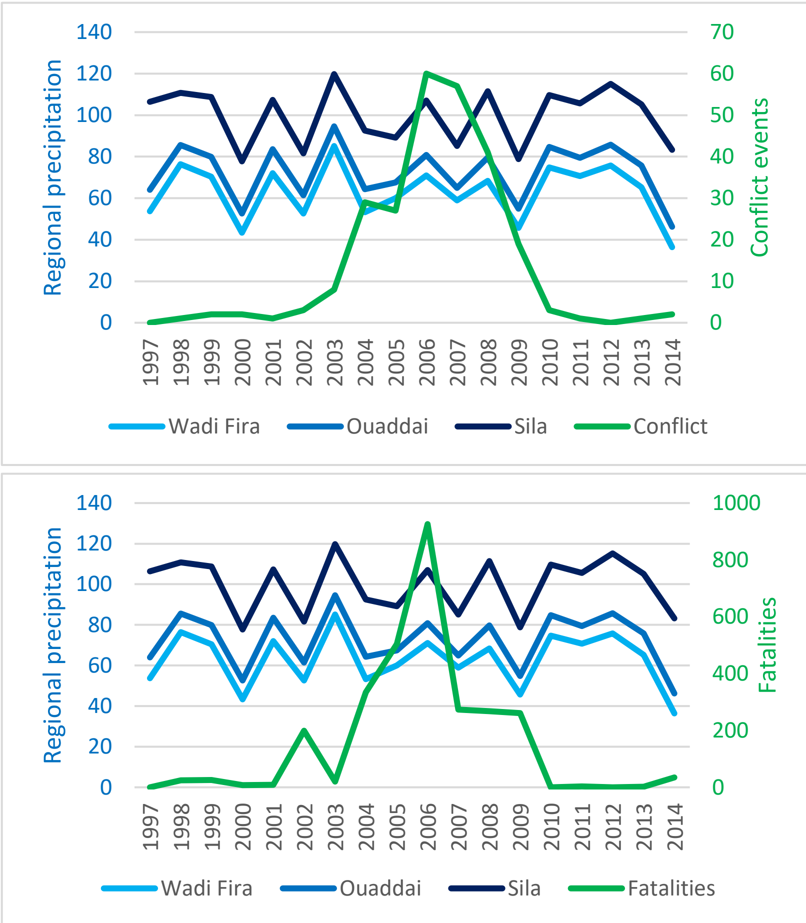


Left*: A comparison of the climatological standard normal (in black) and the average wet period precipitation for 1997-2014 (in green or red, indicating an increase or decrease). It can be observed that Chad's Soudanian climate zone is becoming slightly drier, whereas the semi-arid Sahel zone is becoming wetter.* ***Right****: Number of fatalities caused by civil conflict. Fatalities are highest in the east, in the southern region Logone-Oriental, the capital N'Djamena, and Lac region and Bahr-el Gazel in the west.* ***Left/Right****: Regions that are becoming wetter generally do not see less lethal violence than regions that are receiving less precipitation during the rainy season.*

[11] The 'east' refers here to the administrative regions of Ouaddaï, Sila and Wadi Fira.

that indicate that the region has received more rain than normal. This recovery of rainfall, which is not seen throughout the whole country, may have had some sort of effect on conflict in eastern Chad. However, the conflict trends for this region look highly similar to the national trends (see Figure 10). Possibly due to this similarity, correlation analysis continues to show no significant correlation between the key variables rainfall and civil conflict (Table 5).

Fig. 10. *Conflict and precipitation trends in Eastern Chad*



Note: Regional precipitation is actually the precipitation in the region's capital which is used as a proxy for the whole region (Biltine for Wadi Fira, Abéché for Ouaddaï and Goz Beïda for Sila).

Table 5. *Pearson correlations among regional precipitation (East Chad) and conflict*

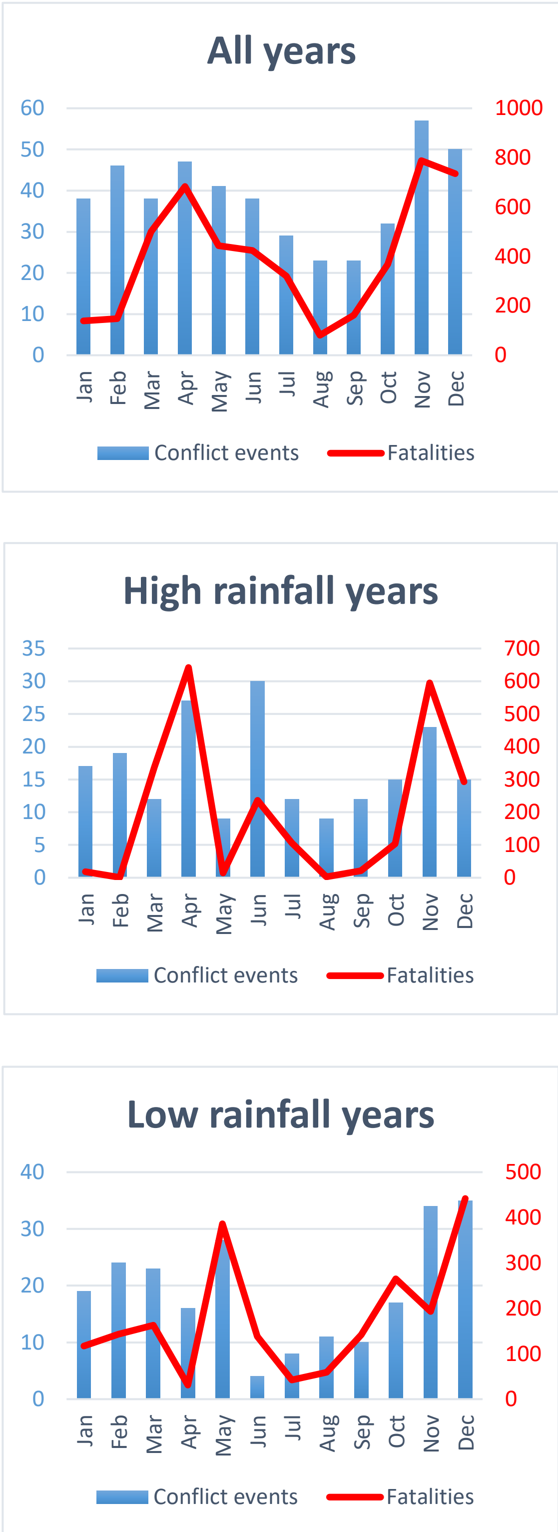
	1	2	3
1. Regional precipitation	--		
2. Regional conflict events	-,074	--	
3. Regional fatalities	-,115	,837**	--

**. Correlation is significant at the 0.01 level (2-tailed).

4.1.2. Trends by month

Another method to explore a potential association between rainfall and conflict is to look at the distribution of conflict events and fatalities throughout the calendar year. Below, this is done for all years of the studied period and for all high and low rainfall years (Figure 11). In this way, it might be possible to assess whether conflict is associated with dry or wet conditions. In Chad, the dry period lasts from November to March, during which there is virtually no rain. The length of the rainy season depends on latitude, the south having a longer wet period (May-Oct.) than the center (Jun.-Sep.) (The World Bank 2017). In Figure 11a, it can be observed that the number of fatalities starts to rise near the end of the dry period, peaks in April, and then decreases during the wet period. The least fatalities are found in August, the month with the highest precipitation. Fatalities are still relatively low in September; yet, with the dry period approaching in October, the level of fatalities starts to climb again. Finally, another drop in fatalities can be observed in the midst of the dry period. The level of conflict varies less than fatalities, but shows the same dip mid-wet period and peaks at the beginning and end of the dry period.

Fig. 11a, b, c. *Conflict trends by month*



For high and low rainfall years, these trends look slightly different. During high rainfall years, wet periods see remarkably few fatalities, with only 1 out of 5 fatalities caused in the wet period; during low rainfall years, this is almost 1 out 2 (see Table 6). Low rainfall years may see more violent wet periods, but the number of conflict events during the wet period is relatively lower compared to high rainfall years. Thus, whereas less conflict events take place in the wet period during low rainfall years, those events claim relatively more fatalities. Wet period fatalities for those years are concentrated near the beginning and end of the wet period (Figure 11c). In short conflict seems more associated with dry conditions, which is clearest in low rainfall years. High rainfall years, on the other hand, see a stronger association between dryness and fatalities.

Table 6. *Distribution of conflict in the calendar year*

	All years ***(%)***	**High rainfall years** ***(%)***	**Low rainfall years** ***(%)***
Conflict wet	40,26	43,50	34,06
Conflict dry	59,74	56,50	65,94
Fatalities wet	37,55	20,39	48,66
Fatalities dry	62,45	79,61	51,34

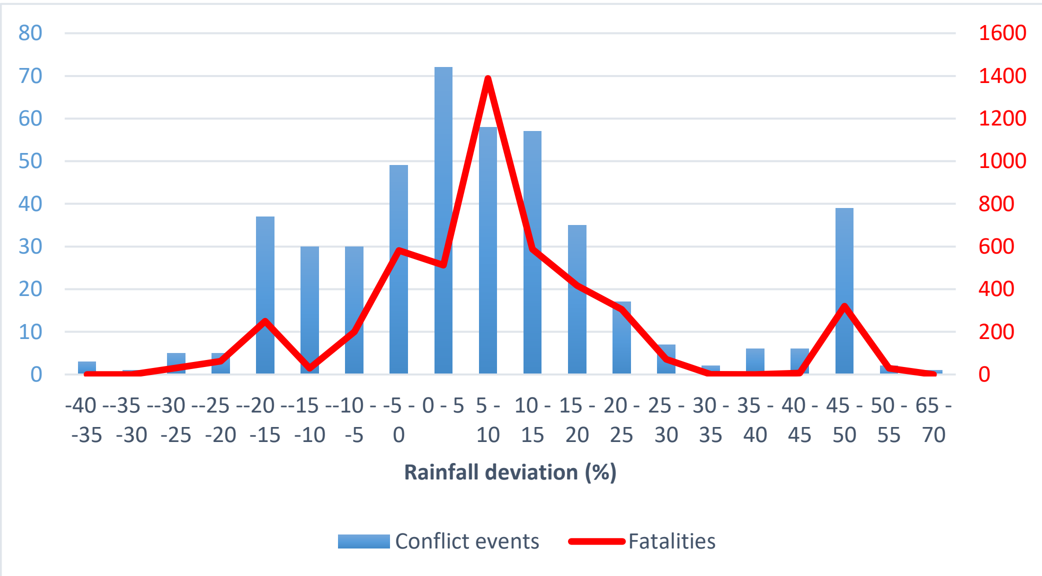
4.1.3. Rainfall deviation

A final method to explore association between rainfall and civil conflict involves the rainfall deviation. It could be that correlation analysis did not yield any significant results, because the used precipitation data consisted of national averages or proxies rather than the actual rainfall per conflict location. Thus, an approach to increase the accuracy of the data would be to check precipitation for each conflict event in the month of conflict onset and with the coordinates of the conflict location and then to calculate the rainfall deviation. In this manner, an association between rainfall anomalies and conflict onset may be observed. Figure 12 shows the frequency of conflict and number of fatalities with the level of rainfall deviation on the x-axis. The mean rainfall deviation at which conflict occurred is 7.18% with a standard deviation of 18.56%. This indicates that most conflicts occur when precipitation during the previous wet period deviated between -11,4% and 25,7% from the climatological standard normal. These are normal rainfall conditions. Such a distribution of conflict is to be expected, since extremely wet or dry years are less common than normal rainfall years.[12] Therefore, conflict is less frequent, in an absolute sense at least, in anomalous rainfall years than under normal conditions.

[12] The mean rainfall deviation of national precipitation in Chad is 2.59% with a standard deviation of 12.32%.

However, from this it cannot be concluded that conflict is less *likely* in significantly wetter or drier years. In a relative sense, these years may see an increase in the probability of conflict onset, or not. The limitations of this research prevents me from making such claims. Yet, some useful observations can be made. Extra-governmental conflict is more common at high (≥25%) and more violent at negative deviation levels than anti-government conflict (Table 7). Less than 1 out 10 fatalities was caused following anomalous rainfall and about 1 out of 4 following wet periods with negative deviation. Of all conflict events, 1 out 3 occurred after wet periods with negative rainfall deviation. Thus, it appears that conflict and fatalities are much rarer when rainfall deviated negatively. This might indicate that such conditions simply occur less frequent than positive rainfall deviations. It could also imply that conflict is more responsive to positive deviations than negative ones. Yet, this cannot be proven using the current method.

Fig. 12. *Rainfall deviation, conflict onset and fatalities*



Note: the peak in conflict and fatalities at +45-50% deviation is considered an outlier. All events occurring at this deviation level took place in either 2003 or 2006, predominantly in Ouaddaï, Wadi Fira and N'Djamena.

Table 7. *Rainfall deviation, conflict onset and fatalities*

Deviation	**Total conflict events *(%)***	**Anti-gov. events *(%)***	**Extra-gov. events *(%)***	**Total fatalities *(%)***	**Anti-gov. fatalities *(%)***	**Extra-gov. fatalities *(%)***
≥25%	15,58	9,57	16,96	9,61	8,96	11,29
≤25%	84,42	90,43	83,04	90,39	91,04	88,71
Positive	65,37	67,46	67,25	75,92	78,77	69,09
Negative	34,63	32,54	32,75	24,08	21,23	30,91

4.2. Qualitative analysis

4.2.1. Communal conflict

This section aims to explore how rainfall variability and the largely overlooked occurrence of communal conflict are associated. It specifically examines local conditions and how these shape potential 'climate conflicts'. Three instances of high-intensity communal conflict were found within the studied period (see Table 8). Below, each intercommunal clash is first summarized to shed light on their context. Afterwards, I discuss which mediating mechanisms were found for which conflicts and how these factors contributed to the onset of conflict.

Table 8. *High-intensity communal conflicts*

Actor 1	***Actor 2***	***Start date***	***End date***	***Fatalities est.*** [1]	***Location***
Khouzam	Walat Rachid	21-11-2000	28-11-2000	72	Batha region
Tama	Zaghawa	4-7-2006*,**	15-10-2007**	200	Wadi Fira region
Arab	Kibet	31-10-2006**	7-11-2006**	140	Salamat region

* This conflict is believed to have started on 13-3-2006, but the given episode of conflict activity only reached 25 battle-related deaths on the date showed in the table.
** Day is assigned; month and year are precisely coded.
[1] This is the best estimation for fatalities.
Source: UCDP; Agence France-Presse (AFP); Reuters.

Communal conflict: Khouzam herders and Walat Rachid herders (2000)

The conflict between Khouzam and Walat Rachid herders took place on 21 November 2000 in Djédaa, a relatively small town in Batha region in central Chad, about 350 km northeast of the capital N'Djamena. The Khouzam and Walat Rachid ethnic groups are both Arabs; the members involved in the conflict belonged to the same livestock-rearing community. The clash resulted in 50 deaths and left an additional number of people injured.[13] It is estimated that, ultimately, 63 people died (Sundberg et al. 2012). Reportedly, fighting broke out during a period of drought over land containing a well. On 29 November, another eruption of violence was reported. Again, the well was the source of conflict. During this second event, nine people were stabbed to death, bringing the total estimated death count to 72. The clashes followed on months of tension over ownership of the well. Authorities had repeatedly attempted to resolve the dispute, but did not

[13] IRIN reports that, in addition to the 50 people who died, "many more" were injured, whereas the Africa Research Bulletin, based on an AFP news report, only speaks of "several people" being injured. Source: https://reliefweb.int/report/benin/irin-wa-weekly-roundup-47-covering-period-18-24-nov-2000; *Africa Research Bulletin: Political, Social and Cultural Series*, 21 December 2000, Vol 37 (11): 14192-14193.

succeed. Troops were sent to Batha region to prevent further outbreaks of violence.

Communal conflict: Tama and Zaghawa civilians (2006-07)

In 2006, violence erupted between Tama and Zaghawa ethnic groups in Dar Tama, the heartland of the Tama in eastern Chad. Between June '06 and October '07, an estimated 200 people were killed and thousands displaced (HRW 2007: p. 25; Sundberg et al. 2012). The violence seems to be linked to the wider civil conflict in eastern Chad and Sudan's neighboring Darfur region. At the time, an internal armed conflict raged between numerous rebel factions and the Chadian government. In addition, the violence from Darfur began leaking into Chad, as the Chadian and Sudanese governments, each supporting and arming rebel groups, became engaged in a proxy war. In December 2005, Chadian rebels led by Mahamat Nour, a Chadian from the Tama ethnic group, attacked the town of Adré. In reaction, Chadian authorities allegedly distributed weapons and ammunition to Zaghawa civilians, traditional adversaries of the Tama belonging to the same ethnic group as President Déby (HRW 2007: p. 34). A climate of impunity materialized when the government withdrew the military from the region. By mid-2006, ethnic tensions reached a climax, resulting in widespread communal violence which would last over a year.

Prior to the violent episode of 2006-07, there had occasionally been conflict between Tama and Zaghawa over pasture and cattle (ECC Platform). The Zaghawa, people of semi-sedentary and nomadic cultures, originally lived further north (Collelo 1990: p. 49). In the 1980s, drought drove them southwards into Tama populated Guéréda region. The first incidents took place in the early 1990s when "Zaghawa leaders … began to behave like a dominant group, encouraged by the fact that one of their own, Idriss Déby, was now head of state" (ICG 2009: p. 5). Protected by local authorities, the Zaghawa grew increasingly aggressive towards other groups, Tama in particular. Livestock raiding and humiliating acts of violence, including the rape of young girls, remained unpunished (ICG 2009: p. 5-6). These hostilities ultimately forced many Tama to flee into Darfur. Mahamat Nour later exploited their grievances to gather support for his insurgency against a government that the Tama perceived as highly sectarian (Marchal 2006: p. 482).

Incidents between Tama and Zaghawa populations were first reported in March and seem to have been triggered by Nour's failed attack on Adré. By mid-June, Zaghawa attacks in Guéréda region had become widespread and livestock raiding commonplace. Gun battles with village-based Tama self-defense forces led to an unknown number of casualties. A particularly violent incident took place in Obé village, some 10 kilometers southeast of Guéréda. A few days before, two Zaghawa men were killed by a Tama after they had robbed a Tama man. On July 4, "a large force of Zaghawa armed with automatic weapons" encircled Obé. The attackers then opened fire indiscriminately, shooting at fleeing people and into houses. The violence left 20 dead and 9 seriously injured and prompted 300 Tama families to seek refuge across the Sudanese border. Whereas previously, conflict between Tama and Zaghawa usually arose because of stolen cattle, the perpetrators of the attack on Obé village were not interested in livestock raiding. "They only came to kill", a displaced Tama individual stated, "not to steal" (HRW 2007: p. 30). Zaghawa attackers have been reported to accuse their victims of being rebels or rebel sympathizers, which may indicate political motivations (Sudan Tribune 2006a; HRW 2007: p. 25).

The situation in villages around Guéréda had deteriorated even more by September. A Tama *chef de canton* said that "things started to get especially bad … when the [Chadian] rebels went to Aram Kollé", a mountainous area close to the Sudanese border where skirmishes took place between insurgents and the Chadian army (HRW 2007: p. 25). In reaction to this increased rebel activity, Zaghawa gunmen began to use more lethal violence against the Tama population, Tama men in particular. Tama authorities claimed that 44 men had been killed since 16 September. The second half of 2006 also saw a dramatic increase of people admitted to Guéréda hospital with gunshot wounds (*ibid*.). A Tama farmer stated that "if [the Zaghawa] leave us alone, they think we will all join the rebels, so now they want us dead" (HRW 2007: p. 27). Ironically, the violence seems to have driven Tama people seeking safety into the arms of rebel groups (HRW 2007: p. 27-28). Many fled to refugee camps as well, leaving villages in a 10-kilometer band north of Kounoungo camp completely abandoned by Tama men (HRW 2007: p. 26).

Tama-Zaghawa violence reached the threshold of high-intensity conflict in 2006, but at that time, the greatest eruptions of violence had yet to take place. By December 2006, the political tide finally turned for the Tama population, signifying a reversal of power dynamics. Tama rebel leader Mahamat Nour, after suffering some stinging military defeats, rejoined the government side, becoming President Déby's defense minister a few months later. With the Tama regaining control over their lands, they began to exact revenge (Sudan Tribune 2007). Seventy Zaghawa and dozens of Tama died in tit-for-tat killings. Some of the victims on the Zaghawa side were reportedly mutilated by having their eyes gouged out (*ibid*.). Subsequent violent incidents were reported on 23 August and again on 15 October (Reuters 2007a; 2007b). In August, 11 Tama and one Zaghawa were killed close to Guéréda town before security forces intervened. Violence resurged once again in October when former rebels loyal to Nour deserted, abandoning Guéréda and migrating to the Sudanese border. Armed Zaghawa clansmen, wanting to settle scores with Tama individuals, then took advantage of the security vacuum. Twenty people were reported to have been killed in the ethnic clashes that followed (Reuters 2007b).

The deployment of an EU force in February 2008 has contributed to a decrease of communal violence in Dar Tama, although violence did not cede entirely (ECC Platform). The situation in Chad's east remains perilous, partly due to the high number of displaced persons in the region. Also, grievances of the Tama and Zaghawa populations have been mostly neglected.

Communal conflict: Arab herders and Kibet farmers (2006)

The conflict between Arab and Kibet tribes was yet another instance of communal conflict that should be regarded in the context of the wider political situation in eastern Chad. The violence took place between 31 October and 7 November in and around Am Timan, the main town of Salamat region in southeastern Chad. The week prior, rebels had clashed with the Chadian army in the same area, leaving about 100 rebels and over 200 soldiers dead. National Administration Minister Bachir stated that the eruption of violence was preceded by a smaller clash, which left three dead on each side (Mail & Guardian 2006). Subsequently, Arabs in neighboring districts started to attack Kibet populated villages. This violence resulted in over 140 deaths; 38 people were gravely wounded and a dozen villages were burnt to the ground. In 2003, tensions between the two groups already led to violent clashes over access to water and pastureland.

Although it is not known what sparked the initial clash between Arabs and Kibets, it seems that the same dynamics of conflict are in place here as in the Tama-Zaghawa case. These entail civilians attacking a rebel groups' ethnic base, as an act of retaliation or to prevent individuals from joining the rebels. According to the Chadian Human Rights League (LTDH), rebel attacks regularly lead to reprisals against the attackers' communities (Mail & Guardian 2006). President Déby has accused Sudan of "stirring up ethnic and tribal hatred in Chad's east" (Sudan Tribune 2006b). Sudan-backed militias known as the "Janjaweed", mainly comprised of Sudanese and Chadian Arabs, have carried out raids across the porous Chadian-Sudanese border. Their name (transl. 'devils on horseback') seems suited, as they have engaged in looting, livestock raiding and the raping and killing of primarily non-Arabs. The Chadian government accuses them of destroying the coexistence of different ethnic groups by spreading fear and mistrust (NZ Herald 2006). Still, these allegations are questionable at best. Military sources within the ANT alleged that the Chadian government armed both Arabs and Kibets to "provoke violence between two groups it thought had allied themselves with the Chadian rebels" (HRW 2007: p. 23).[14]

[14] According to an ANT officer, Déby sent soldiers and a government minister to Salamat to arm both groups. They told the Arabs: "This land is yours. The Kibet are immigrants." To the Kibets, they said: "The Salamat, they are with the rebels. They will do you wrong. You need to defend yourselves." A similar story was told by a senior member of the Déby administration: "Déby called the white leaders [Arabs] in Salamat and said 'The blacks take your land. They work against the herders.' He armed the white Arabs. Then he went to the black leaders [non-Arabs]. He said, 'The whites trample your land.' He gave them guns as well." (HRW 2007: 23).

4.2.2. Case analysis

Climate change played a role in each of these conflicts, though its impact on the onset of conflict varied from case to case. Before discussing climate-conflict links, some light should be shed on the climate conditions for the locations and periods of communal conflict. These conditions are perhaps most clearest in the case of the Khouzam and Walat Rachid herders. In the conflict year 2000, Djedaa saw a wet period with notably less rainfall than normal (-23.57% deviation, which is very close to the threshold of drought; see also Annex 3 for more detailed rainfall data). It is possible that conditions were worse than estimated, due to additional drought-inducing factors such as high temperatures and poor soil quality. This is supported by media coverage of the conflict between the pastoral communities. The UCDP describes the conflict area as "drought-stricken" in its Non-State Conflict Dataset, based on AFP coverage (Sundberg et al. 2012). The source of conflict, a waterhole, provides further indication that drought affected livelihoods to a substantial degree and that resources, most importantly water, were scarce.

Climate conditions are somewhat less evident in the other cases. Conflict between Tama and Zaghawa and between Arab and Kibet communities broke out in 2006, the former continuing into 2007. Judging by wet period deviation levels, these were normal years in terms of rainfall. In Wadi Fira region, the wet periods of 2005-2007 all saw positive deviations between 10 and 15%. Further southwards, in Salamat region, the deviation had been negative (-15.01%) in the year preceding conflict, but was positive (3.65%) in the conflict year. These conditions exclude the occurrence of drought. Anomalous rainfall in specific months (Sep. 2006 and Aug. 2007 in Wadi Fira with resp. 70.37 and 41.09% deviation) suggest rainfall abundance, but this remains uncertain due to other factors, e.g., rainfall intensity, temperatures, and soil quality.

The role of mediating mechanisms

Three mechanisms that mediate the effects of climate change on conflict will be discussed here. These are resource scarcity, elite exploitation, and migration. Rainfall conditions indicate that resource scarcity triggered conflict between pastoral communities in Batha region. Rainfall had been considerably lower than normal during the wet period, which should have diminished the availability of resources, most importantly water. Intercommunal conflict broke out at the start of November, one month into the dry period which in the semi-arid zone lasts through May. At this time, it would have been clear that water supplies would not be replenished for months. It would also be clear that there likely was not enough water to sustain both communities. Hence, resource sharing had become a zero-sum game “in which the gains of some equal the losses of others” (Van Baalen & Möbjork 2016: p. 20). This implies that the benefits of sharing no longer outweighed the costs of violence and that violence became the more rational option. Therefore, the hypothesis that rainfall variability leads to conflict when resources are scarce seems to hold up in this particular case. In the other cases, this process was not observed. As explained above, rainfall conditions in those cases indicated normal precipitation, although rainfall deviation was noticeably more strongly positive in Wadi Fira region than in Salamat. Hence, resource scarcity likely was not an issue. Nevertheless, the conflict involving Tama and Zaghawa communities did have a resource dimension, as it was partially fought over access to pastureland and natural resources (HRW 2007: p. 21; ECC Platform). Favorable rainfall conditions may have facilitated livestock raiding, a common element of the attacks. Abundant rain indicates that surface water is more readily available, which is necessary for both humans and animals to survive. Also, the vegetation cover should be more dense, making it easier to hide. The positive rainfall deviation in 2006-07 may suggest that these conditions were present in Wadi Fira. Moreover, an increase in cattle theft was reported in Jul. ‘06, lending more credibility to this supposition (HRW 2007: p. 30). In short, resource *abundance* may have motivated violence to some degree.

There is evidence that the communal conflicts that took place against the backdrop of the civil war were exploited by political elites. By withdrawing the military, the government might have deliberately created a security vacuum in Chad’s east that allowed those loyal to the regime to eradicate the supposed supporters of its enemies, without fear of being punished. In Salamat region, the government let two rival groups it thought had allied with the rebels eradicate each other. It has been stated that the government’s failure to condemn the violence and to investigate attacks “amounts to official tolerance” (HRW 2007: p. 34). Moreover, local officials allegedly distributed arms to either one side, when this side was loyal, or to both, when it perceived none as loyal. In this way, elites effectively manipulated and altered local power relations. It can be argued that this escalated conflicts that otherwise would have remained low in intensity. Lastly, it should be noted that this mechanism is closely connected to the one discussed above. More specifically, elite exploitation enabled wealth-seeking behavior of Zaghawa militia’s. It is stated that groups aim to achieve complete resource capture “when social order breaks down during violent conflict and the costs of violence are lower” (Van Baalen & Möbjork 2016: p. 24). This is what occurred in Dar Tama; yet, were it not for the actions of elites, social order would likely not have broken down as severely and resource capture would have been too costly.

For two cases, little information could be found to test the hypothesis that rainfall variability leads to conflict when migration increases the interaction between different groups. However, in the case of the Tama and Zaghawa, the mechanism of migration proves to be quite evident. Low rainfall and the degradation of pastureland have brought about a change in the migratory routes of Zaghawa pastoralists. Compared to thirty or forty years ago, they now penetrate deeper into Dar Tama, in some years even moving as far south as Ouaddaï and Salamat region (Jánszky & Jungstand 2013: p. 371). Moreover, their stay here has become longer, as they begin moving their herds sooner after the end of the rainy season (*ibid.*). Besides changing mobility patterns, many Zaghawa have also permanently settled in Tama heartland.[15] These developments have increased interactions between Tama and Zaghawa dramatically – it should be noted that Tama lands used to be relatively mono-ethnic and scarcely populated (*ibid.*: p. 365, 372). The arrival of the Zaghawa signified increased pressure on the environment, resulting in several problems. First, camels held by pastoralists tend to destroy farmland; second, sometimes land is cultivated that surrounds a well or lies on transhumance routes; and third, the gathering of wild fruits and herbs has become less profitable due to increased competition (*ibid.*: p. 374-380). A disparity in power obstructs the functioning of traditional resolution methods, causing the Tama to almost always lose resource disputes (*ibid.* p. 373). Power abuse by Zaghawa is commonplace as well and manifests itself most clearly in the increased frequency and brutality of cattle theft. In short, the drought-induced migration of Zaghawa herders starting in the 1980s increased interaction with Tama populations, leading to a variety of grievances and violent conflict.

To conclude, the impact of climate variability on the onset of communal conflict is mediated through different mechanisms which often reinforce each other. Resource competition appears to be the most common driver of conflict, although it seems to not always be scarcity that leads to conflict. Abundance may spur wealth-seeking behavior or even complete resource capture. Migration was found to be a mechanism that sets conflict generating processes in motion, while elite exploitation lets these processes escalate and increase the intensity of conflict. Moreover, it is rarely a single mechanism that mediates the effects of climate change. Instead, mechanisms appear to be linked and therefore should be perceived in relation to each other.

[15] It has been estimated that there are approximately 3,000 Zaghawa settlements in Dar Tama. Most of these were founded early in the 1990s, after Idriss Déby took power in N'Djamena (Jánszky & Jungstand 2013: 371).

5. Discussion & conclusion

5.1. Main findings

This study attempted to answer the question how rainfall variability contributes to the onset of communal conflict in Chad, using the concept of mediating mechanisms. It also explored how rainfall and conflict are associated on the national and the regional level. It was found that 3 out 5 conflict events took place in a low rainfall year. These years also saw nearly three times more fatalities than high rainfall years. This contrasts with some of the existing literature: Adano et al. found an increase of violent deaths in years of high rainfall, though they analyzed only local pastoral conflicts instead of a variety of conflict types (2012: p. 69); Hendrix & Salehyan, who did study several types of conflict, found evidence that civil war and insurgency are more likely in wetter years (2012: p. 45). No correlation was found for precipitation and conflict or specific conflict types on either the national or regional level. This lack of correlation suggests that there are other drivers of civil conflict which are more important than rainfall.

When zooming in on the distribution of conflict within the calendar year, a few observations could be made. Overall, the wet period saw less conflict events and fatalities than the dry period. In high rainfall years, wet periods were notably less violent than during low rainfall years. Yet, conflict in the wet period was relatively more frequent in high rainfall years. Thus, while less conflict events are seen in the wet period during low rainfall years, these events are relatively deadlier. This distribution of conflict throughout the year may be interpreted as follows. The wet period likely provides less incentive for individuals to join rebel groups. Resources should be more abundant and employment higher, as the wet period overlaps with the cropping season. Moreover, the abundance of resources likely stimulates cooperation, since violence is relatively costly (Van Baalen & Möbjork 2016: p. 20). During the dry period, when resources are scarcer, individuals may be more likely to engage in rebellion "to redress economic grievances or simply to obtain food and income" (Von Uexkull 2014: p. 16-17). In addition, the dry period might be more favorable to rebel movement as the land is more accessible, there are fewer diseases and the harvest period allows for subsistence (Raleigh & Kniveton 2012: p. 54). The relatively high concentration of conflict events in the dry period during low rainfall years could indicate that there are more economic grievances and incentives to rebel are stronger in those years. Conflict and fatalities resemble a normal distribution when placed on an axis with rainfall deviation levels. Extra-governmental conflict appears to be more common than anti-government conflict at anomalously high or low deviation and more violent at negative deviation.

The quantitative analysis provides some indication in which direction deviations from mean rainfall levels are associated with civil conflict. Still, it does not show how rainfall variability contributes to the onset of conflict. Therefore, a qualitative analysis was conducted of a number of high-intensity communal conflicts, with increased attention devoted to local conditions. It was tested whether the effects of variable rainfall are mediated via other drivers of conflict, or so-called mechanisms. Rainfall variability appeared to have an effect on conflict by intensifying the competition for natural resources. This occurred not solely when resources were scarce and individuals found themselves in a 'zero-sum' game; in at least one case, resource abundance triggered wealth-seeking behavior within the more powerful group. These findings support the 'zero-sum' and 'abundance' narrative as described by Raleigh & Kniveton (2012: p. 54). Elite exploitation was found to be quite evident in two cases, both taking place in eastern Chad during the civil war. Manipulative and exploitative actions by state agents, including the distribution of arms and the potentially deliberate creation of a security vacuum, suggest that local resource conflicts had become entangled with the wider political situation in Chad. Finally, the impact of migration was demonstrated in one case. Altered mobility patterns as well as the settlement of Zaghawa pastoralists in Tama heartland increased interactions between groups with different livelihoods. This led to a rise in resource disputes, in which the Zaghawa usually held the upper hand due to their more powerful position in society. Ethnic tension increased during the civil war and would escalate into the most deathly of the conflicts here examined.

With the exception of Adano et al. (2012), the reviewed literature fails to describe mediating links between climatic factors and the incidence of conflict. It consists predominantly of cross-national, quantitative works that, by design, overlook the local specifics of small-scale conflict. Regarding resource availability, Adano et al. found that scarcity fosters cooperation in Kenya's drylands and that conflict is associated with wet conditions which facilitate livestock raiding (2012: p. 71). This provides indication for both a 'no-gain' and 'abundance' narrative (Raleigh & Kniveton 2012: p. 54). Hence, Adano et al. partially corresponds to the findings of this study, since evidence was found that supports the logic of 'abundance'. It should be noted that these logics or narratives often simplify conflict cases. The incidence of communal conflict in Chad is likely a result of many factors and interactions of factors. Therefore, mechanisms should not only be perceived in relation to conflict onset, but to each other as well. To clarify, migration intensifies the competition over resources, exacerbating resource scarcity in times of drought. And political elites may enable resource capture by groups they support with arms or protect otherwise from rival groups. Hence, the mediating mechanisms of 'climate conflicts' appear to be interlinked, which complicates climate-conflict pathways. Yet, this research has shed at least some light on the relationship between climate change and conflict. This knowledge may help local institutions to decide how to adapt to climatic changes in order to prevent conflict.

5.2. Research limitations

There are a few limitations to this research in terms of reliability and validity. Inherent to the single case study is its low external validity, which implies that it is impossible to make robust generalizations on the basis of just one case. Different factors and processes may be present in other cases. To clarify, the effects of climate change on the African continent are not the same across countries or even within them. While North Africa and the Sahel cope with intensifying desertification, East Africa is projected to become wetter (Adano & Daudi 2012: p. 2). Besides, not all countries are equally vulnerable to climate change. Mauritius, South Africa and some North African countries have been deemed highly resilient; on the other hand, regions of Chad, the DRC and Somalia are found to be the most vulnerable (Busby et al. 2013: p. 155).

Another limitation is the heavy reliance on existing datasets and literature. Because of the characteristics of communal conflict (its presumed cyclical nature, occurrence in often remote rural areas and low number of casualties), little information is available on conflict events. Field research and collecting data in person would have helped to overcome this issue. However, due to practical constraints, this was not possible. Furthermore, issues of data availability influenced the manner in which communal conflict is operationalized. Low-intensity conflicts (<25-battle related deaths) largely remain under the radar of both scholars and the media. For that reason, they were excluded from the analysis, which might create a selection bias. Finally, this study is biased towards cases of conflict. Cases where climate events did not lead to conflict fall beyond the scope and focus of this research. Naturally, exploring variation in the dependent variable conflict would produce more reliable findings. Unfortunately, insufficient data on the local level made it impossible to analyze cases of non-conflict as in-depth as conflict cases.

5.3. Future recommendations

Lastly, I shall provide some recommendations for future research. To begin, more local level case studies are needed to broaden our understanding of climate conflict in local contexts. The focus should be on 'hotspots', countries or regions with high climate vulnerability; not countries that are the most convenient to study. Furthermore, cases of 'non-conflict' should receive more attention to overcome the existing bias towards conflict cases. Niger, another erstwhile French colony that is often overlooked in discussions of environmental security, despite being a hotspot of climate conflict, could be a starting point for more in-depth research on local level climate clashes. Unfortunately, the limited availability of data for many African countries will continue to pose a challenge. Still, this should not be used as an excuse to neglect countries, particularly those with high relevance. The threat of climate change to the coexistence of different groups, in Africa, but perhaps at some point in the near future closer to home as well, should not be underestimated. We should continue to study climate-conflict links, to understand how climate change may alter the world we know and hopefully to prevent it from doing so.

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ANNEX

Annex 1. Body of knowledge: climate change/small-scale conflict

Scholars	Main factors	Mediating factors	Results
Adano et al. 2012	*Rainfall*: classification of years as 'drought year', 'year after drought', 'average year' or 'wet year'. *Violent conflict*: number of deaths related to livestock raiding in a given season or year.	*Resource competition*: raiding of livestock. *Institutional arrangements*	Increase of violent deaths in wet years as a consequence of livestock raiding in northern Kenya; peaceful settlement over common property resources in southern Kenya.
Hendrix & Salehyan 2012	*Rainfall deviation*: the percentage deviation from long-term mean rainfall in a given country per year divided by the panel standard deviation. *Social conflict* and *armed conflict*: number of conflict events per country-year, with a distinction made between civil conflict onset, total events, nonviolent events, violent events, government-targeted events, and nongovernmental events.	*Regime type*: Polity score ranging from -10 (full autocracies) to 10 (full democracies). *Level of development/economic growth*: GDP per capita/GDP growth. *Population/population growth*	Evidence that civil war and insurgency correlate with rainfall. Extremes in rainfall increase the probability of all other types of political and social conflict. Violent events are most likely during wet periods. Non-violent events, on the other hand, are more common when water is scarce.
Raleigh & Kniveton 2012	*Rainfall variability*: positive/negative deviation of average rainfall level by month and season. *Violent conflict*: number of incidents of rebel conflict and communal violence.	*Demography*: composition of the population in conflict locations. *Relative poverty*: deviation level from the national mean of underweight children under five. *State capacity*: distance (in degrees) of the conflict location to the nearest urban center (defined as a center with a population larger than 50,000).	Rainfall variability appears to be a marginal driver of conflict frequencies. Rebel conflict is more common in extreme dry periods of time, whereas communal violence occurs more frequently in extreme wet conditions. Both an abundance as well as a scarcity of resources can instigate competition between groups and consequently violence.
Theisen 2012	*Rainfall deficiency*: the percentage deviation from mean rainfall in a given cell (territorial unit) per year divided by the panel standard deviation. *Temperature*: Same as rainfall deficiency.	*Poverty*: proportion of the population living below the poverty line per square kilometer.	Strong evidence that years following wetter years are more violent than drier years, probably due to the fact that people in pastoralist societies tend to cooperate and seek reconciliation in times of extreme scarcity.

	Conflict: events with more than 25 persons killed, including events with less deaths that are part of a conflict that killed 25 persons in a given year.	*Ethnic heterogeneity*: number of ethnic groups.	
Von Uexkull 2014	*Drought*: Standardized Precipitation Index-score. Sustained drought: number of consecutive years of drought according to the SPI6-scores. *Rainfed agriculture*: grid cells are classified as agricultural when at least 0.5% of the area of the grid is covered with rainfed cropland. *Civil conflict incidence*: number of conflict events in an intrastate armed conflict resulting in at least 1 battle-related death per grid cell per year.	*Economic development*: gross cell product (local equivalent of gross domestic product). *Population*: amount of people living in a grid cell. *Ethnic exclusion*: inclusion of the majority ethnic group in a cell in the government in a given year.	Increase of civil conflict violence on a subnational level following periods of drought. After periods of sustained drought and in regions that mainly rely on rainfed agriculture, risk of civil conflict is even more pronounced. Violence following drought seems to be most likely to occur in agricultural regions where conflicts or ethnic tensions are already present.

Scholars	**Time**	**Location**	**Direct/indirect link**
Adano et al. 2012	1929-1999; 1980s-1990s	Marsabit and Narok Districts in Kenya	Indirect link
Hendrix & Salehyan 2012	1990-2009	All African countries with a population above one million including North Africa	Indirect link
Raleigh & Kniveton 2012	1997-2010	Uganda, Kenya and Ethiopia	Indirect link
Theisen 2012	1989-2004	Kenya	Indirect link
Von Uexkull 2014	1989-2008	Sub-Saharan Africa	Indirect link

Annex 2. Map of Chad

Note: Since 2012, Ennedi region is divided in Ennedi-Est and Ennedi-Ouest. Source: Da Costa & Karlsrud (2011).

Annex 3. Monthly rainfall variability

Annex 3.1. Monthly rainfall variability in Djedaa in mm (latitude: 13.3; longitude: 18.3)

	May	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Wet period*	*Seasonal*
Climatological standard normal	13.40	33.60	109.10	153.90	61.80	4.30	89.60	62.68
1999	29.30	0.00	167.40	167.90	60.60	78.00	98.98	83.87
Deviation	118.66	0.00	53.44	9.10	-1.94	814.00	10.47	33.81
2000	27.40	12.80	138.70	100.90	21.50	0.50	68.48	50.30
Deviation	104.48	-61.90	27.13	-34.44	-65.21	-88.37	-23.57	-19.75

Annex 3.2. Monthly rainfall variability in Wadi Fira region in mm (latitude: 14.3; longitude: 22.3)

	May	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Wet period*	*Seasonal*
Climatological standard normal	4.98	39.12	132.27	218.23	39.62	5.59	107.31	73.30
2005	18.80	16.90	119.30	300.50	49.10	0.00	121.45	84.10
Deviation	277.51	-56.80	-9.81	37.70	23.93	0.00	13.18	14.73
2006	1.70	33.00	137.90	257.40	67.50	4.60	123.95	83.68
Deviation	-65.86	-15.64	4.26	17.95	70.37	-17.71	15.51	14.16
2007	1.00	28.00	103.60	307.90	41.00	0.00	120.13	80.25
Deviation	-79.92	-28.43	-21.68	41.09	3.48	0.00	11.95	9.48

Annex 3.3. Monthly rainfall variability in Salamat region in mm (latitude: 10.8; longitude: 20.3)

	May	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Wet period*	*Seasonal*
Climatological standard normal	62.25	126.18	197.10	270.57	139.54	38.53	183.35	139.03
2005	88.90	79.00	130.00	260.60	153.70	9.30	155.83	120.25
Deviation	42.81	-37.39	-34.04	-3.68	10.15	-75.86	-15.01	-13.51
2006	89.40	123.30	198.20	307.30	131.40	42.00	190.05	148.60
Deviation	43.61	-2.28	0.56	13.58	-5.83	9.01	3.65	6.88

Explanation: The shading denotes how the amount of rainfall in a given month deviated from the climatological standard normal. Green/dark green means rainfall was higher/significantly higher (≥25%) than normal; red/dark red means rainfall was lower/significantly lower (≤25%) than normal. The last columns 'wet period' and 'seasonal' demonstrate the monthly average rainfall of resp. the Jun.-Sep. and May-Oct. period. For these columns, cells are colored yellow in case the deviation was less than 25%, indicating normal rainfall conditions.