

# A coming anarchy?

Pathways from climate change to violent  
conflict in East Africa

Sebastian van Baalen & Malin Mobjörk





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## Preface

The security implications of climate change have attracted increasing attention in policy and research during the past decade. Since climate change has far-reaching implications for human livelihoods and activities, the potential security implications are broad and complex. As stated in the fifth assessment report from the Intergovernmental Panel on Climate Change (IPCC), climate change undermines human security, affects some previously known violent conflict triggers and increasingly shapes the conditions of security and national security policies. Overall, this means that climate change entails different types of security challenges, stretching from human security to state security, which require responses from distinct policy communities – foreign affairs, defence, crisis management, finance, environment and development. These communities are currently in different stages of developing strategies for integrating climate security risks in their work.

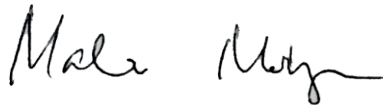
This report was produced within a project funded by the Swedish Ministry of Foreign Affairs (MFA). The main goal of the project was to assist and inform policy making on security risks posed by climate change, with the focus on two specific areas: How policy organisations such as development and defence actors frame and integrate climate security risks in their work; and how and under what circumstances climate change increases the risk of violent conflict. The first topic was examined through a review of the literature and two separate case studies on how organisations integrate climate security risks in their work. The organisations concerned were the European External Action Service (EEAS) and development organisations in three European countries. The second topic was examined through a review on the climate-conflict literature in one specific region, East Africa. All three studies are described in separate reports published in 2016. A synthesising report will be released in September 2016.

The present report probes the climate-conflict issue through a systematic literature review of articles investigating the relationship between climate-related environmental change and violent conflict in East Africa. The concept of climate-related environmental change is used, since most studies in this research area employ data on short-term climate conditions, such as precipitation and temperature, or impacts on environmental conditions that are largely, but not exclusively, affected by climate conditions, such as

drought. What makes this analysis unique is that we include both quantitative and qualitative research, including in-depth case studies. This was deemed essential in order to address our main goal, which was to increase understanding of how and when violent conflict is linked to climate change and its impacts.

The report was produced by researchers at the Department of Political Science, Stockholm University, and at the Stockholm International Peace Research Institute (SIPRI) in collaboration with the Swedish Institute of International Affairs (Ui). During the work on this report, we had fruitful discussions and received valuable comments from the project group, consisting of Niklas Bremberg, Karin Bäckstrand, Maria-Therese Gustafsson, Lisa Maria Dellmuth and Hannes Sonnsjö. We would like to thank Arvid Bring, researcher at the Department of Physical Geography, Stockholm University, and Henning Rodhe, professor emeritus at the Department of Meteorology, Stockholm University, for appreciated comments. We are also grateful to Professor Joakim Öjendal at the Department of Global Studies, Gothenburg University, who acted as a reviewer on the final draft, giving us valuable notes to consider. Finally, we would like to express our gratitude to the Swedish MFA, which made this study possible.

Malin Mobjörk, project leader and senior researcher at SIPRI

A handwritten signature in black ink, appearing to read 'Malin Mobjörk', written in a cursive style.

Stockholm, 2 May 2016

## Executive summary

The warming of the climate system is *unequivocal* according to the Intergovernmental Panel on Climate Change (IPCC), and will have a strong impact on the security of humans and states alike. In the past half-century the climate system has changed in unprecedented ways and future climate change and variability will include long-lasting alterations to all components of the climate system. With the warming of the climate system and the recognition of the implications that this has for the availability and quality of renewable natural resources, scholars and policy-makers fear that the impacts of climate change will also increase the risk of violent conflict and affect their dynamics. However, despite the rather large amount of studies in the field, scholars have yet to move beyond a number of interesting patterns to establish results that remain robust across studies. While this is partly a reflection of the inherent challenge of observing links between uncertain structural factors such as climate change and rare social outcomes such as violent conflict, the field has also been repeatedly criticised for a lack of sound theoretical development. This has been exacerbated by the practice of excluding qualitative research from state of the art reviews. The purpose of this report is to fill this gap by contributing to a better theoretical understanding of the linkages between climate change and violent conflict through consulting the combined quantitative-qualitative literature.

In this report, we seek to answer the question of how, and under what circumstances, climate change influences the risk of violent conflict in East Africa. We specifically focus on the pathways to violence – explanations that link various phenomena – in this case climate change and variability, and violent conflict – through a continuous and contiguous chain of links. We explore the research question through a systematic review of the climate-conflict literature on East Africa, hence obtaining a manageable amount of relevant studies and ensuring some minimal cross-study comparability. East Africa was chosen because of the frequency of violent conflict in the region, its high livelihood dependence on natural resources, high levels of poverty and limited capacity for climate change adaptation. The region is also especially relevant from a Swedish policy perspective, since Sweden has considerable development cooperation engagements in East Africa, for example in assisting climate change adaptation and peacebuilding. The present analysis builds on 44 peer-reviewed articles published between 1989-2015 that examine the relationship between climate-related

environmental change and violent conflict. By focusing on climate-related environmental change, that is a change in biophysical conditions that are or will be affected by a change in the state of the climate or by variations in the mean state of the climate, we widened our analysis beyond climate change to encompass both short- and long-term environmental change.

The analysis is summarised in a conceptual framework that identifies five types of pathways from climate-related environmental change to violent conflict in East Africa. In particular, the negative impact of climate-related environmental change on the availability of natural resources can lead to conflict by worsening livelihood conditions, by increasing migration or by changing pastoral mobility patterns. Taken together, these three types of pathways lead to or exacerbate local resource conflicts that sometimes turn violent. Weather conditions and climate variability can also affect the tactical considerations of armed groups and hence contribute to intensified fighting during certain periods. Finally, the analysis shows that local resource conflicts are susceptible to elite exploitation that often significantly increases the risk and intensity of violent conflict. This highlights the critical role of political and economic elites in explaining how local resource conflicts relate to larger processes of civil war, ethnic cleansing and insecurity.

In the discussion, we deepen the analysis by underlining three critical dimensions inherent in the literature: the temporal, spatial and political dimensions. First, the analysis shows that it is essential to reflect on the temporal dimensions of a climate-conflict link, both with regard to temporal scale of the environmental change in question and the expected time lag from that change to the outbreak of violent conflict. There is no reason to believe that all climate-related environmental changes at different time scales generate the same social outcomes. The bulk of the quantitative literature on East Africa measures conflict onset or intensity as an immediate reaction to climate variability, thus studying the implications of climate variability rather than of climate change. To capture the full spectrum, investigations of a climate-conflict link also need to consider the implications of long-term changes in altered livelihood conditions and rapid-onset disasters such as extreme weather events, as these pose a different kind of challenge for societies to mitigate and respond to. Second, the analysis shows the importance of accounting for the spatial dimension. The impacts of climate-related environmental change are unevenly distributed across space and altered livelihood conditions can offset population movements. There is therefore often no merit in assuming that climate-related environmental change will lead to violence in a certain area without considering how people move between areas characterised by resource scarcity and resource abundance. Third, the analysis emphasises that climate-related environmental change and violent conflict cannot be

understood in an apolitical vacuum, since socio-political processes affect the relative distribution of natural resources, the adaptive capacity of individuals, groups and societies, and the risk of violent conflict. For example, absent, corrupt or non-functional political institutions often increase the risk of local resource conflicts turning violent. Thus, while climate-related environmental change in itself has not precipitated an East African anarchy so far, it has already played a role in the dynamics of violent conflict and will probably continue to do so, even though the consequences are ultimately mediated by human behaviour.

Regarding the implications for policy and future research, three strands of policy implications follow from the analysis. First, since a central claim in the literature is that worsening livelihood conditions make people more likely to engage in violence, efforts that mitigate the impact of climate-related environmental change and that build resilience may also contribute to resilience to violent conflicts. Examples include weather insurance schemes and improved access to markets for pastoralists, income diversification and efforts that improve livelihood conditions. Second, movements across space are a crucial adaptation mechanism for populations affected by climate-related environmental change, particularly for pastoralist groups. This means that efforts that enable and support adaptation to population movements may increase both human security and lower the risk of violent conflict. One example relates to efforts that enable pastoral mobility while providing channels to solve resulting conflicts between pastoralists and farmers. Finally, the analysis shows that institutions, both formal and informal, are crucial for mediating conflicts. Since most communities already have some conflict resolution mechanisms, outside actors should focus on how such local knowledge can be adapted to meet new demands and increased pressure, rather than trying to introduce entirely new mechanisms. Future scholarship should examine the challenges relating to the temporal and spatial dimensions of climate-conflict research by studying the impacts of long-term environmental change rather than climate variability and by accounting for how populations move across space. Future research should also seek to improve data quality, while considering the importance of matching data and methods with the underlying theoretical expectations.

Keywords: Climate change; natural resources; violent conflict; East Africa, literature review.





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## Abbreviations

ACLED	Armed Conflict Location and Event Dataset
ASALs	Arid and Semi-Arid Lands
CEWARN	Inter-Governmental Authority on Development's Conflict Early Warning and Response Network
IGAD	Inter-Governmental Authority on Development
IPCC	Intergovernmental Panel on Climate Change
SPLA	Sudan People's Liberation Army
UCDP	Uppsala Conflict Data Program

# 1. Introduction

The warming of the climate system is *unequivocal* according to the Intergovernmental Panel on Climate Change (IPCC). In the past half-century the climate system has changed in ways that are “unprecedented over decades to millennia” – the oceans have warmed, snow and ice layers have melted and sea levels have risen (IPCC 2014:2). Future climate change and variability,<sup>1</sup> in simplified terms described as long- and short-term changes to the climate, will include further warming and long-lasting changes in all components of the climate system, thereby increasing “the likelihood of severe, pervasive and irreversible impacts for people and ecosystems” (IPCC 2014:8). As such, climate change and variability has – and will continue to have – a strong impact on the security of humans and states alike. The IPCC concludes that “human security will be progressively threatened as the climate changes” and that “some of the factors that increase the risk of violent conflict within states are sensitive to climate change” (Adger et al. 2014:758).

With the warming of the climate system and the recognition of the implications that this has for the availability of renewable natural resources, scholars and policy-makers fear that the impacts of climate change will also increase the risk of violent conflict. Political leaders like Barack Obama and Ban Ki-Moon have issued statements about a climate-conflict link and popular accounts speak of coming “climate wars” in near-apocalyptic terms. The growing policy interest is also reflected in a number of recent policy reports, most prominently the G7-commissioned *A New Climate for Peace* (Rüttinger et al. 2015) and International Alert’s *Topic Guide: Conflict, Climate and Environment* (Peters & Vivekananda 2014).

The suggestion that environmental degradation can work as a driver of violent conflict is not new. Thomas Malthus reflected on the implications of rapid population growth in relation to subsistence production and food scarcity 200 years ago. His pessimistic predictions suggested an inevitable tragedy; on a planet of finite resources, population growth will be checked one way or another, if not by “moral restraint” then by war, disease and

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<sup>1</sup>To streamline the argumentation, we often use the term ‘climate change’ when referring to both climate change and climate variability.

famine (Malthus 1798[2007]:44). Some two centuries later, Robert Kaplan described the environment as “the national-security issue of the early twenty-first century” in his famous article *The Coming Anarchy*. According to Kaplan (1994), “surging populations, spreading disease, deforestation and soil erosion, water depletion, air pollution, and, possibly, rising sea levels in critical, overcrowded regions ... will prompt mass migrations and, in turn, incite group conflicts”.

The predictions by Malthus and Kaplan have been severely criticised for being deterministic and overly pessimistic, but the underlying assumption that environmental degradation can work as a driver of conflict has gained renewed relevance in recent years. With the acceleration of climate change and the recent focus on climate change as a security threat, the academic literature on climate change and violent conflict is now burgeoning, with special issues of *Political Geography* (Nordås & Gleditsch 2007), *Journal of Peace Research* (Gleditsch 2012), and *Climatic Change* (Gemenne et al. 2014) dedicated to the topic. Prompted by the projected changes to the climate system identified by the IPCC and the alterations in available renewable natural resources that will inevitably follow, numerous academic studies have sought to explore whether a climate-conflict link exists and how climate change is – or could be – linked to violent conflict. However, despite the rather large amount of studies in the field, scholars have yet to move beyond a number of interesting patterns to establish results that remain robust across studies (Salehyan 2014:1; Buhaug 2015:269). For example, while Hsiang et al. (2013:1235367) state that “deviations from normal precipitation and mild temperatures systematically increase the risk of conflict”, Buhaug et al. (2014:392) criticise their findings and conclude that “scientific research on climate and conflict to date has produced mixed and inconclusive results”. Similarly, the IPCC concludes that “the evidence on the effect of climate change and variability on violence is contested” (Adger et al. 2014:758).

This raises two sets of questions: first, why have scholars not found any results that remain robust across studies; and second, how can we move past these challenges? The absence of robust results may simply reflect that, to date, climate change has only been of limited importance as a driver of violent conflict relative to other factors (Meierding 2013:186). While this may of course be one explanation, a host of well-written reviews have also linked the absence of robust findings to a number of theoretical and methodological short-comings of climate-conflict research (e.g. Meierding 2013; Ide & Scheffran 2014; Salehyan 2014; Buhaug 2015; Seter 2016). A number of limitations in previous research are regularly raised by these commentators, for example the focus on large-scale rather than small-scale violence, the absence of fine-grained and reliable data, the failure to account

for contextual factors or intervening variables, the difficulties related to temporal and spatial scale, and the delicate complexity in linking actors and agency. These limitations arise at least in part from the high interdisciplinary nature of the field, the lack of adequate theoretical and analytical frameworks and the lack of interactions between quantitative and qualitative scholars (Ide & Scheffran 2014:266–267). Taken together, this has led Buhaug (2015:269) to suggest that “ten years of generalizable quantitative research on climate change and armed conflict appears to have produced more confusion than knowledge”.

We partly agree with this conclusion, although we also acknowledge that there are examples of methodologically and analytically well-executed studies on the linkages between climate change and violent conflict (see e.g. De Juan 2015 for an excellent example). Nevertheless, the absence of robust findings also reflects the inherent challenge of empirically observing links between structural factors embedded in uncertainty, such as climate change, and rare social outcomes like violent conflict. One way of overcoming this challenge is to develop and specify stronger theoretical models of the possible links between climate change and violent conflict, and subsequently formulate hypotheses that can be examined through empirical analysis (Seter 2016:1). Paying attention to pathways is crucial if the aim is to move beyond mere correlational analysis. This is particularly important when dealing with structural causes of violent conflict such as climate change, where there are multiple likely intervening factors (Gerring 2010:1506) and the impact of climate change on human systems occurs as a function of both biophysical exposure and the vulnerability of an exposed society or system (IPCC 2014:124).

In addition to the inherent challenge of studying complex climate-conflict links, the regrettable practice of almost categorically excluding qualitative research<sup>2</sup> from state of the art reviews has further prevented better theoretical development (Ide & Scheffran 2014:270). Previous reviews of the literature have largely focused on the quantitative literature and examined whether climate change increases the risk of violent conflict (e.g. Hsiang et al. 2013; Theisen et al. 2013; Koubi et al. 2014), even though case studies are arguably critical for exploring pathways and adding important layers to simple stimulus-response relationships. Qualitative studies may also illuminate new intervening variables or background factors and identify central research gaps in the literature. In essence, qualitative methodologies are key when seeking to understand how climate change increases the risk of

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<sup>2</sup>Ide & Scheffran (2014:270) note that only two out of the six most recent literature reviews in leading journals draw on qualitative research, and none of these six reviews conducts a systematic analysis of both quantitative and qualitative research.

violent conflict (Solow 2013:180; Gemenne et al. 2014:6). Thus, there is a need to engage in sound and careful synthesis on the basis of *both* quantitative and qualitative research and to break down the unnecessary boundaries that sometimes divide these camps; “bringing together all sources of information will be progress” as Solow puts it (2013:180).

The purpose of this report is to contribute to a better theoretical understanding of the pathways from climate change to violent conflict by consulting the combined quantitative-qualitative literature. We seek to answer the question of *how, and under what circumstances, climate change affects the risk of violent conflict*. By pathways we mean explanations that link various phenomena, in this case climate change and climate variability and violent conflict, through a continuous and contiguous chain of links. We explore the research question through a systematic literature review of the climate-conflict literature on East Africa. By focusing on that particular region we were able to obtain a manageable amount of relevant studies and ensure some minimal cross-study comparability, as certain contextual factors, for example a history of violent conflict, are relatively similar across East Africa. East Africa is also particularly interesting given the frequency of all the different types of violent conflict in the region.

We analysed all articles that examine the links between climate-related environmental change and violent conflict. Few studies in the climate-conflict literature examine independent variables that fall within the definition of climate change provided by the IPCC, that is, “a change in the state of the climate that can be identified ... by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer” (2014:120). Instead, the bulk of the literature focuses on what is known as climate variability – “variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the *climate* on all spatial and temporal scales beyond that of individual weather events” (2014:121, italics in original) – or the effects on natural and human systems. To incorporate all three types of independent variables in the analysis, we therefore included all studies that examine the impact of *climate-related environmental change* on the risk of violent conflict. This term refers to *a change in biophysical conditions that are or will be affected by a change in the state of the climate or by variations in the mean state of the climate*, thus encompassing climate change, climate variability and the impact of these on natural systems. We define violent conflict as *deliberate violent acts perpetrated by a government or organised or semi-organised group against state forces, other organised or semi-organised groups or civilians*, a definition that includes several types of organised violence at the intra-state level. We intentionally excluded inter-state conflicts.

This study makes several contributions, in particular to a deeper understanding of the pathways from climate change to violent conflict. This is done by reviewing the quantitative and qualitative literature, focusing specifically on the links from climate change to violence. When needed, we also add to the analysis by using findings from other subdivisions of conflict research. We are not the first to focus on pathways. Seter (2016), for example, provides a much-needed first effort at outlining pathways that can be subjected to empirical testing. We add to her analysis in a number of ways. By focusing on those pathways that have been examined empirically, we show how some pathways have received more empirical support than others, either because they hold more explanatory power or because they have received more attention than other explanations. By digging deeper into the case study literature, we also identify important nuances and contextual factors that add another layer to our understanding of these pathways. Moreover, we take one step further and suggest an additional pathway that links groups affected by climate-related environmental change to political and economic elites, thus broadening the understanding of how low-intensity resource conflicts relate to larger processes of civil war.

A second contribution is that this study constitutes a much-needed attempt to analyse and synthesise both quantitative and qualitative academic literature on climate change and violent conflict. While there are several literature reviews, meta-analyses and commentaries on the quantitative literature (see e.g. Hsiang et al. 2013; Meierding 2013; Theisen et al. 2013; Koubi et al. 2014; Salehyan 2014; Buhaug 2015; Burke et al. 2015), we are unaware of any previous attempts at providing a systematic overview of the combined quantitative-qualitative literature. Even though this was not our principal intention, the review may provide some inspiration on how to conduct a systematic review of studies from different methodological traditions. Our analysis is limited to one region, East Africa, and encompasses two of the most studied clusters of conflicts that are frequently linked to climate change, Kenya and the Sudans. This could be followed by analysing other regions in a similar vein.

Third, we seek to contribute to evidence-based policy-making by outlining the policy implications of our analysis. A deeper understanding of the pathways from climate change to violent conflict is necessary to design effective strategies to prevent or solve conflicts that are potentially associated with climate change (Gemenne et al. 2014:6). As observed by Vivekananda et al. (2014:488), focusing on pathways helps to identify “potential entry points for peacebuilding which could influence or disrupt potential links between climate change and conflict”.



Finally, this study contributes to advances in the field by highlighting a number of accomplishments and limitations in previous research. By comparing the insights gained in qualitative research with the findings in quantitative studies, we identify important findings, control variables and pathways that could be tested in future quantitative studies. Similarly, by pinpointing important correlations found in quantitative research, we can suggest fruitful designs for qualitative studies.

In order to answer the research question, we conducted a systematic literature review of peer-reviewed studies published between 1989-2015 that explore the relationship between climate-related environmental change and violent conflict in East Africa. We identified 44 relevant articles by conducting a systematic literature search and then analysed these articles using a pre-determined set of questions. This report proceeds as follows. In Chapter 2 we define our main variables of interest, justify our choice of study region and outline the sampling strategy and methodological framework of the study. The methodological section is relatively detailed, in order to increase the transparency of the analysis and provoke more methodological thinking on how to conduct this kind of combined analysis. Chapter 3 provides an in-depth analysis of the pathways from climate change to violent conflict found in the literature. We present our findings by developing a conceptual framework. In Chapter 4 we critically discuss critical theoretical and methodological implications in light of three dimensions – temporal, spatial and socio-political. We also consider to what extent our findings can help understand the future impact of climate-related environmental change on the risk of violent conflict. In Chapter 5, we present our conclusions, discuss the policy implications and reflect on the implications for future research.

## 2. Method

In this chapter, we define our two variables,<sup>3</sup> justify our choice of study region and describe the sampling strategy and methodological framework of the study. Methodological rigour and transparency are essential pillars of scientific inquiry, and literature reviews are no exception. To demonstrate the reasonableness of the analysis and provide some inspiration on how to conduct a systematic review of studies from different methodological traditions, we therefore leave a clear audit trail on the decisions and interpretations made throughout the review process.

To answer the research question, we conducted a systematic review of the literature on climate-related environmental change and violent conflict in East Africa. The review was systematic in the sense that we conducted a comprehensive and transparent search for all relevant studies on the topic and then appraised and synthesised these studies using a pre-determined explicit method. We also critically examined the limitations of the sample that formed the basis for our analysis.

### 2.1 Definitions

The IPCC distinguishes between climate change, climate variability and the impacts of climate change and variability on natural and human systems. While the phenomena are certainly linked to one another, they also differ in terms of temporal scale and their relative dependence on non-climate factors. It is especially important to note that the impacts on human systems occur as a function of climate change, climate variability and the vulnerability of an exposed society and system (IPCC 2014:120–124). These distinctions have sometimes led to confusion within the research field, as variables from these different categories are placed under the umbrella term ‘climate change’. In Table 1 we summarise the definitions of these terms and exemplify how they are operationalised in the literature.

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<sup>3</sup>The term ‘variable’ is used to refer to the phenomena under scrutiny (climate-related environmental change and violent conflict). This should be seen as an attempt to structure the analysis and does not mean that we value quantitative methods more than qualitative approaches.

Even while claiming to explore the links between climate change and violent conflict, the majority of studies within the field actually focus on climate variability or the impacts of climate change and variability. We therefore widen our analysis to *climate-related environmental change* in order to capture all these aspects of a changing climate. We define this term as *a change in biophysical conditions that are or will be affected by a change in the state of the climate or by variations in the mean state of the climate*.<sup>4</sup> Our definition includes direct changes in the climate over different temporal periods (e.g. annual mean temperatures, monthly rainfall standard deviations). It also includes those biophysical changes that to a larger extent are affected by a combination of climate change, non-climate-related biophysical changes and human activities (e.g. soil degradation, vegetation cover changes). Hence, many of the climate-related environmental changes considered in this study are driven by climate change *in combination* with other biophysical and non-biophysical processes. The definition also includes biophysical changes that have mainly been affected by non-climate changes to date, but that may be affected by future climate change, for example soil degradation.

Definitions of violent conflict vary depending on factors such as the intensity, level of organisation and type of actor and incompatibility. Some research programmes, such as the Uppsala Conflict Data Program (UCDP), stipulate relatively high inclusion thresholds, whereas others, for example the Armed Conflict Location and Event Dataset (ACLED), employ relatively low inclusion thresholds and therefore also capture low-intensity conflicts (cf. Raleigh et al. 2010; Sundberg et al. 2012; Pettersson & Wallensteen 2015). Since most scholars agree that climate change is more likely to trigger low-intensity violent conflict than full-scale civil wars (Barnett 2003:10; Nordås & Gleditsch 2007:634; Buhaug 2015:272), here we employ a definition of violent conflict that is able to capture such low-intensity conflicts. In this study, we define *violent conflict* as *deliberate violent acts perpetrated by a government or organised or semi-organised group against state forces, other organised or semi-organised groups or civilians*.

We also distinguish between different types of violent conflict depending on the level of organisation of the parties to the conflict. When we speak of communal conflicts, we refer to violent conflicts between semi-organised non-state groups that are organised along some communal identity, for example pastoralist groups or clans (see Elfvérsson 2015:792). In contrast, when we speak of armed conflicts we refer to violent conflicts between organised armed groups, for example rebel groups or state forces (see

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<sup>4</sup>As such, our definition combines the different definitions provided by the IPCC (c.f. IPCC 2014:120–124).

Sundberg et al. 2012:353; Pettersson & Wallensteen 2015:536). Inter-state armed conflicts are excluded, as we expect that the pathways from climate change to armed conflict between states are significantly different from the pathways from climate change to violent conflicts at the intra-state level, partly because of the unique characteristics of the international system and the different dynamics of inter-state armed conflicts (see also Scheffran et al. 2014:370–371).

Table 1 Climate change, climate variability, and impacts: definitions and operationalisations

Term	IPCC definition	Examples of operationalisation
Climate change	A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer.	Changes in mean temperature over 30 years Changes in precipitation over 30 years Long-term sea level rise
Climate variability	Variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events.	Monthly rainfall standard deviations Frequency of temperature extremes Frequency of extreme weather events
Impacts	The effects on natural and human systems of extreme weather and climate events and of climate change.	Vegetation cover variations Increased resource scarcity Soil degradation and erosion Floods and droughts

Source: (IPCC (2014:120–124)

## 2.2 Sample region

This study focuses on East Africa as defined by the United Nations Statistics Division.<sup>5</sup> While Sudan is not included in this definition, studies examining Sudan are also included in the sample, since Sudan belonged to East Africa up until 2011, when South Sudan succeeded for Sudan. Focusing the analysis on a specific region ensures some minimal cross-study comparability, as certain core socio-political, geographical and climate

<sup>5</sup>According to the United Nations Statistics Division East Africa consists of Burundi, the Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, the Seychelles, Somalia, South Sudan, Uganda, the United Republic of Tanzania, Zambia and Zimbabwe. It also includes the French overseas departments Mayotte and Reunion.

factors are relatively similar across East Africa. The region is particularly relevant since it encompasses much of the variation in the dependent variable; in recent decades the region has seen genocides, civil wars and communal conflicts. It is also relevant since climatologists have observed significant climate changes in East Africa, for example equatorial and southern parts of East Africa have experienced a significant increase in temperature since the beginning of the 1980s and precipitation in eastern Africa has experienced large temporal and spatial variability, with some areas experiencing declines in seasonal rainfall. Future projections suggest significant temperature and precipitation increases across the region, with less predictable seasonal rains (Niang et al. 2014:1206–1210). East Africa is also interesting since it is a well-studied region – in fact, a substantial part of the literature on climate change and violent conflict assesses the impact in East African countries, particularly in Kenya and the Sudans. Finally, given the region’s high dependence on natural ecosystem resources, its history of violence, high levels of poverty and limited state capacity for climate change adaptation, the risk of violent conflict may be especially high, making it particularly interesting when examining pathways to violence.

East Africa is also relevant from a Swedish policy perspective. Sweden has a long history of development cooperation in the region; of the ten countries that receive most foreign aid from Sweden, half are located in East Africa, namely Somalia, Kenya, Tanzania, South Sudan and Zambia (Openaid 2014). Sweden is also directly involved in assisting both climate change adaptation measures and peacebuilding work in a number of the countries in East Africa, for example in Kenya and South Sudan (Sida 2015). This increases the relevance and practical applicability of the policy implications of the study.

## 2.3 Sampling strategy

Our analysis is based on 44 peer-reviewed academic articles selected through a combination of systematic key word searches in online databases and manual reviews of reference lists. We attempted to conduct a rigorous and comprehensive search for all relevant studies that fulfilled the selection criteria and we therefore believe that our sample is largely representative of the literature on climate-related environmental change and violent conflict in East Africa. All articles are peer-reviewed and published in a scientific journal between 1989-2015, thereby assuring a certain scientific standard.<sup>6</sup>

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<sup>6</sup>Although we are aware of the limitations of appraising quality based solely on the peer-review process, for example because it excludes non-peer reviewed studies with perfectly valid methods, an alternative approach would be practically impossible due to the sheer

One limitation in this search strategy is that we only included articles written in English and this could increase the risk of Western bias. However, we do not believe this bias to be particularly worrisome given that the sample included a significant amount of non-Western studies. Another limitation is that we only included articles that focus on the link between climate-related environmental change and violent conflict, and hence excluded studies that examine non-violent conflict or the determinants of violent conflict in general. This does not mean that our sample lacked variation on the dependent variable, however, since the sampled articles encompass that variation in their individual designs, but these aspects are not systematically taken into account in the search strategy.

Qualitative articles were considered to focus on East Africa if they examine at least one country in East Africa, while articles with a quantitative approach were considered to focus on East Africa if they predominantly examine cases in East Africa.<sup>7</sup> Literature reviews and commentaries were excluded from the search. The selection criteria are summarised in Table 2.

Table 2 Summary of selection criteria

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- The article examines the relationship between the climate-related environmental change (independent variable) and violent conflict (dependent variable).
  - The article is published in a peer-reviewed scientific journal.
  - The article is written in English.
  - The article is published between 1989-2015.
  - If the article is qualitative, it examines at least one country in East Africa.
  - If the article is quantitative, it predominantly examines East Africa.
  - Literature reviews and commentaries are excluded.
- 

Systematic key word searches were conducted using the computerised databases ProQuest and EBSCO Discovery Service. We used a Boolean search string consisting of keywords for different climate-related environmental conditions, violent conflict and the countries in the region (Table 3). The initial search generated 492 and 408 articles in the two databases, respectively, of which most were duplicates. The articles were then inspected manually and those articles that were not of direct relevance for the study were omitted. For example, articles examining animal-human conflicts or that only briefly mention climate-related environmental change without additional analysis were removed from the list. Quantitative analyses that examine the entire continent or sub-Saharan region were also excluded, as were editorials and commentaries. All remaining 53 articles

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number of studies. While this approach may ignore some interesting non-peer-reviewed studies, we have no reason to believe that this decision introduces any significant selection bias.

<sup>7</sup>Quantitative studies that examine the entire sub-Saharan African region were excluded.

were assessed and included/excluded based on the selection criteria. For example, some articles were excluded because they focus on non-violent conflict or cooperation under conditions of resource scarcity. The sample was then complemented through a manual review of the reference lists in the articles, in order to create a comprehensive sample and exhaust the literature. This yielded nine additional articles. A full summary of all articles included in the review with regard to their aim, examined locations, methods, independent and dependent variables, and findings can be found in the appendix to this report.

Table 3 Keywords

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The strings and combinations of keywords included:

‘climat\* OR “climat\* change” OR “climat\* variability” OR rainfall OR precipitation OR drought OR “water scarcity” OR “land degradation” OR weather OR disaster OR temperature OR warming OR “sea level rise” OR desertification OR food OR erosion’

AND

‘conflict OR violence OR unrest’

AND

“east africa” OR “horn of africa” OR burundi OR comoros OR djibouti OR eritrea OR ethiopia OR kenya OR madagascar OR malawi OR mauritius OR mayotte OR mozambique OR réunion OR rwanada OR seychelles OR somalia OR sudan OR “south sudan” OR uganda OR tanzania OR zambia’

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## 2.4 Methodological framework

The second step of the systematic review process involved analysis and synthesis of the data according to a pre-determined explicit method. ‘Data’ in this regard refer to the findings in the articles examined. The purpose of this process was to re-assemble the interpretations made in the data into a new order “so that the characteristics and results of the study are summarised in a meaningful way” (Jesson et al. 2011:123), thereby widening our understanding of the relationship between climate-related environmental change and violent conflict.

Using a pre-determined explicit method of data extraction is important to increase the replicability and ensure the transparency of analysis. This study employed the structured focused comparison method, which departs from a number of questions derived from the purpose of the study that function as indicators and steer the analysis (George & Bennet 2005). These questions and the rationale behind their selection are summarised below. Besides the data retrieved based on the structured focused comparison method, additional technical details were also synthesised (Table 4).

Table 4 Data extraction form

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Beyond the questions outlined below, all articles were coded with regard to the following details:

- Author and publication details
  - Research question and purpose
  - Method details (qualitative/quantitative, type of data, study design, etc.)
  - Examined area (region, country, sub-region, community)
  - Dependent and independent variables and their operationalisation
  - Control variables
  - Brief abstract of article
  - Illustrative examples
- 

#### 2.4.1 Examining climate-related environmental change and violent conflict

Climate change will have severe and varying implications on, for example, the climate, ecosystems, water availability, the occurrence of extreme weather events, and the quality of arable land. Since different impacts of climate change can be expected to have different consequences for social behaviour, climate-conflict researchers must be clear on which environmental conditions they will examine (Buhaug 2015:270–271). An important distinction is whether the environmental condition examined constitutes a rapid-onset climate shock (e.g. an extreme weather event) or a slow-onset condition (e.g. decreasing annual rainfall) (Mobjörk et al. 2010). Since a specific social outcome, such as rebellion, is mediated by more factors than just climate-related environmental change, it is also imperative to specify the likely social outcome (Salehyan 2014:3). It is also valuable to distinguish between studies that examine the likelihood of violent conflict onset *vis-à-vis* those that study violent conflict intensity (Seter 2016:4). In order to account for different dependent and independent variables, the following questions were posed when analysing the selected articles:

- What climate-related environmental changes (e.g. desertification, annual rainfall, temperature deviations) are examined?
- What aspects of violent conflict (e.g. civil war onset, communal conflict intensity) are examined?

#### 2.4.2 Exploring the association between climate change and violent conflict

The primary purpose of this study was to assess how, and under what circumstances, the impacts of climate-related environmental change affect the likelihood of violent conflict. As noted in the introduction, existing quantitative research on the association between climate change and violent



conflict often falls short on explicitly specifying the pathways through which certain climate-related environmental changes translate into a social outcome. A related limitation is that few studies explicitly theorise the *ceteris paribus* assumption, that is, under what circumstances certain environmental conditions affect the likelihood of violent conflict (Meierding 2013:194–197). Therefore, the following questions were used to analyse the material:

- How (through which pathways) do climate-related environmental changes affect the risk of violent conflict?<sup>8</sup>
- Under what circumstances does the literature suggest that there is a relationship between climate-related environmental change and the risk of violent conflict?

### 2.4.3 Focusing on actors and agency

Identifying plausible pathways and intervening factors that connect climate-related environmental change and the risk of violent conflict is necessary in order to gain a better theoretical understanding of the links between climate change and violent conflict. However, such an approach also needs to identify the segments of society that are affected by the climate-related environmental changes and connect them to the central actors at play with regard to violent conflict. Organised violence requires both resources and organisational skills that some groups may lack (Buhaug 2015:271–272). Furthermore, violence need not always be instigated by those directly affected by climate-related environmental change, even if they live in an area characterised by both environmental degradation and organised violence. Thus, identifying and specifying actors and also their capacity to act is instrumental in order to illuminate how climate change affects the likelihood of violent conflict. Therefore, the following questions were posed when analysing the selected material:

- Which groups/actors/segments of society (e.g. farmers, pastoralists, the urban poor) are identified as being affected by a certain climate-related environmental change?
- Which groups/actors/segments of society are identified as participating in violent conflict?<sup>9</sup>

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<sup>8</sup>To provide further theorisation of the links between climate-related environmental change and violent conflict based on empirical evidence, only those mechanisms that are supported by the article's empirics are recorded.

<sup>9</sup>These questions are currently particularly relevant with regard to the qualitative literature. In quantitative studies, such links have hitherto almost never been examined.

- How are local resource conflicts related to, for example, larger processes of civil war, ethnic cleansing and insecurity?

Finally, in order to retrieve relevant and empirically founded policy implications, the following question was posed:

- Which potential policy implications are suggested?

## 2.5 Material

Before we turn to the analysis, a closer look at the material is warranted. The sample included articles that predominantly employ qualitative methods and articles that employ quantitative methods. Eight of the countries in East Africa are covered in the sample and two of the studies have a regional focus (Butler & Gates 2012; O’Loughlin et al. 2012). There is a significant bias in favour of studying Kenya and the Sudans, with 19 articles in the sample at least partly focusing on Kenya and 14 articles focusing on the Sudans. This is not necessarily problematic, but it should be kept in mind that part of the sample focuses on a specific context. Although all countries are arid or semi-arid, they differ with regard to the history of violence, with Kenya being relatively peaceful and democratic compared with the rest of the region while the Sudans are among the most violent countries in the region. There is hence reason to believe that these contexts are not representative of East Africa’s wetter regions or of countries with a different history of violence.

The climate-related environmental changes that are examined in the literature only partly reflect the range of impacts identified by the IPCC and often focus only on exposure and not on vulnerability or adaptive capacity (see e.g. Bocchi et al. 2005; Ide et al. 2014 for notable exceptions). Measures of precipitation, drought, water scarcity and vegetation cover dominate, while few or no studies address the implications of floods, changing coastal environments or rapid-onset disasters. This is hardly surprising given the importance of rains in East Africa’s arid and semi-arid lands (ASALs), where the majority of the population relies on rain-fed agriculture and pasture as the basis for their livelihoods (Raleigh & Kniveton 2012:54). However, it does limit the explanatory power of the literature with regard to the importance of climate-related environmental change on the risk of violent conflict. Similarly, few of the studies capture climate-related environmental change over extended time periods of 20–30 years (see De Juan 2015 for a notable exception). This means that our findings may be limited to the impact of climate variability, rather than climate change, on the risk of violent conflict.

With regard to the dependent variable, there is a slight predominance of studies that explore the determinants of communal conflict, especially among pastoralists, but more organised forms of violence are also covered, including genocide. Pastoralist conflict and livestock raiding is certainly less destructive than most civil wars, but sometimes entails high levels of violence, heavy weaponry and the theft of thousands of livestock.<sup>10</sup> Given the dominance of studies that assess the drivers of communal conflict, it should be kept in mind that the explanations outlined in the subsequent sections mainly apply to such forms of violence. An attempt to assess how such forms of violence are related to larger processes of civil war is one way of overcoming this limitation in the literature. It should also be noted that communal conflicts often have an important ethnic component that warrants attention in the wider study of those conflicts.<sup>11</sup> Yet, the purpose of this review was not to outline all the causes of violent conflict, but to examine how climate-related environmental change sometimes contributes to the outbreak and dynamics of conflict.

Finally, it is important to include a brief discussion on the role of publication bias, which is the bias that arises from the research community's perceived preference for positive rather than null results (Hsiang et al. 2013:1235367–10). A similar bias may have arisen from our decision to include only studies that examine the links between climate-related environmental change and violent conflict, in contrast to studies that focus on non-violent conflict or the absence of violent conflict. This could mean that our results are biased in favour of studies that suggest that there is a link between climate-related environmental change and violent conflict. Given that our purpose was to examine *how* climate-related environmental change affects violent conflict rather than *if* it does so, we do not believe that publication bias is likely to drive our findings. Moreover, while our selection strategy is based on the dependent variable, the individual studies incorporate variation in their dependent variables. The inclusion of a large number of case studies further limits the risk, as the value of qualitative research is less dependent on finding positive correlations.

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<sup>10</sup>For example, 54 people, many of them children, were killed in May 2007 when Toposa tribesmen attacked Didinga villagers in Sudan. The assault was “well-coordinated” and involved heavy weaponry, including machine guns, RPGs, 60mm mortars and AKM assault rifles (Leff 2009:191).

<sup>11</sup>Many of the quantitative studies also include ethnicity as a control variable in their analyses (see e.g. Theisen 2012; Olsson & Siba 2013) or as part of the link between climate-related environmental change and violent conflict (De Juan 2015).

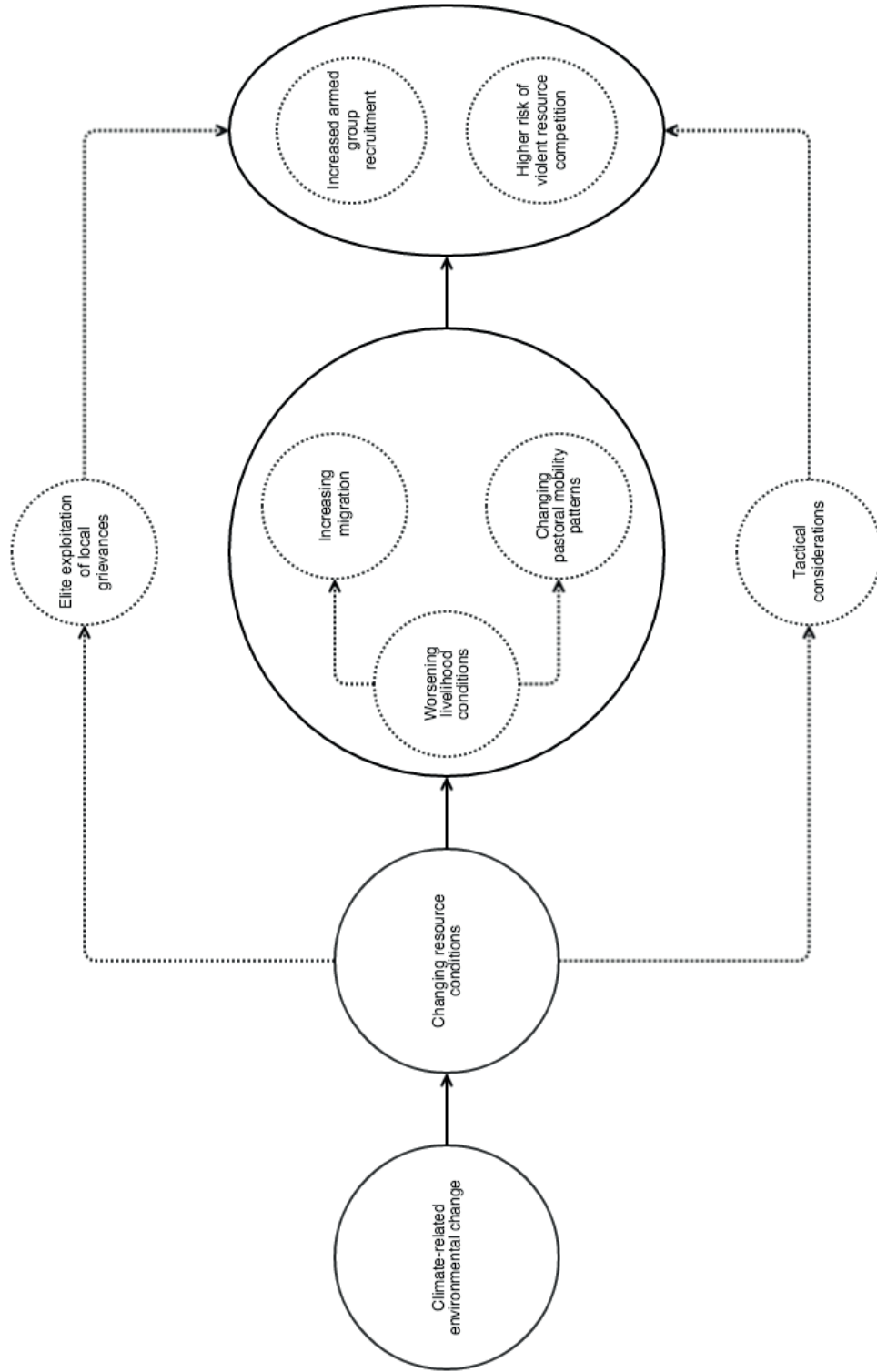
### 3. From climate change to violent conflict

How does climate change affect the risk of violent conflict in East Africa? The purpose of this chapter is to shed light on the pathways from climate-related environmental change to violent conflict. By pathways we mean explanations that link various factors, in this case climate-related environmental change and violent conflict, through a continuous and contiguous chain of links. We treat these relationships in a probabilistic manner, whereby climate-related environmental change affects the risk of, rather than causes, violent conflict. As such, the suggested pathways should be understood as a non-deterministic way of portraying how increased violent conflict risks may arise.

Our analysis is organised around five clusters of explanations about how climate-related environmental change is linked to violent conflict. The results of our analysis are summarised in a conceptual framework (Figure 1), the purpose of which is to distinguish certain types of explanations and to situate them relative to one another. It starts with the impact of climate-related environmental change on the availability of natural resources, both in terms of increased and decreased resource availability. In one way or the other, all studies propose pathways that start with resource availability. The availability of natural resources affects livelihoods in various ways, particularly in areas where the majority of the population relies on agriculture or pastoralism as the basis for their livelihoods (Raleigh & Kniveton 2012:54). *Worsening livelihood conditions* can, under certain circumstances, increase the risk of people joining armed groups and of resource competition turning violent, and explanations of this sort hence constitute a first cluster of pathways to violence in East Africa. Apart from this, worsening livelihood conditions can also trigger other social responses that can increase the risk of violence. We therefore examine two additional types of pathways related to worsening livelihood conditions that are particularly salient in the literature: *increasing migration* and *changing pastoral mobility patterns*. Even though these two pathways are conceptually similar – and to some extent overlapping – in that they both focus on migration, they also inhibit some unique characteristics that warrant special attention. Most importantly, whereas permanent migration mainly refers to stationary groups that resettle in a different location, changing pastoral mobility patterns represent a change in the way that already mobile groups

move across space. The latter is often referred to as circular migration (see Brzoska & Fröhlich 2015:10–11).

In addition, we identify two types of pathways through which climate-related environmental change affects the dynamics of existing violent conflicts. Certain climate-related environmental factors, for example heavy rain and altered vegetation cover, can affect the *tactical considerations* of armed groups (mainly livestock raiders) regarding when to attack by providing certain opportunities afforded by the climate and weather. Existing local resource conflicts can also provide elites with the opportunity and incentive to *exploit local grievances* for selfish reasons, for example by using environmentally marginalised nomadic groups as proxies for state violence. Explanations of this sort hold the potential to explain how local resource conflicts relate to larger processes of civil war, ethnic cleansing and insecurity. It is worth emphasising that this is a theoretical model and that, in reality, these pathways are partly overlapping, frequently interlinked and found simultaneously – separating them chiefly serves the purpose of theoretical clarity.



*Figure 1. Pathways from climate-related environmental change to increased risk of violent conflict in East Africa. Filled arrows indicate that climate-related environmental change increases the risk of violent conflict, whereas dotted arrows indicate that climate-related environmental change affects the dynamics of existing violent conflicts. The diagram is a result of the empirical analysis described in this report.*

### 3.1 Worsening livelihood conditions

Economic hardship has long been recognised as a driver of violent conflict (Homer-Dixon 1991; Collier & Hoeffler 2004). According to theory, when certain natural resources become increasingly scarce and livelihood incomes drop, rational agents stand to lose less from using violence relative to not using violence, thereby increasing the risk of violent conflict. Microeconomic theory refers to this as decreasing opportunity costs. Opportunity costs are the loss of potential gain from other alternatives when one alternative is chosen, for example the loss of future farm yield if a farmer chooses to join an armed group and abandons the farm. Decreasing opportunity costs are frequently cited as an explanation for how environmental degradation can push people to join armed groups or why groups sometimes resort to violence as a way of resolving conflicts. People do not regularly seek immediate rewards through violence as long as they believe that their current occupation can provide them with sufficient resources for themselves and their family in the long term. However, when their prospects and expectations for a better life worsen, i.e. their opportunity costs decrease, joining an armed group becomes a relatively more rational option (Barnett & Adger 2007:644). For groups, resource sharing between groups becomes a zero-sum game in which the gains of some equal the losses of others when certain natural resources become increasingly scarce. When resource distribution becomes a zero-sum game, the value of resource sharing decreases relative to the option of capturing resources through violence, increasing the risk of violent resource competition (Homer-Dixon 1991:106).

Economic hardship in terms of loss of livelihoods is one of the most frequently suggested explanations for how climate-related environmental change increases the risk of violent conflict in East Africa. Since the majority of the population in East Africa relies on rain-fed agriculture or pastoralism for their livelihoods, shifting resource availability has a significant impact on livelihoods in the region, both by affecting the resources needed for agro-pastoral activities (Hundie 2010; Ember et al. 2012, 2014; Raleigh & Kniveton 2012; Schilling et al. 2012; Ide et al. 2014; Linke et al. 2015) and by triggering income reductions (Miguel 2005; O'Loughlin et al. 2012; Maystadt & Ecker 2014; Maystadt et al. 2015). Depending on the nature of the environmental change in question, livelihood losses can occur relatively suddenly as a result of extreme weather events such as floods or droughts, or relatively slowly as a result of slow-onset disasters that extend over years or decades, like rising sea levels or creeping soil erosion. Both rapid-onset and slow-onset environmental change can

decrease the opportunity costs of violence, but there is reason to believe that rapid-onset environmental change is more detrimental, as people have less time to adapt to declining yields or develop peaceful resource-sharing mechanisms (Barnett & Adger 2007:644). This does not mean that long-term environmental degradation is unimportant for understanding the links between climate change and violent conflict since, as we discuss below, long-term environmental change can affect pastoral mobility patterns and the decision to migrate. Yet few studies measure environmental change over longer time periods (for a notable exception, see De Juan 2015).

In line with the logic outlined above, a number of studies claim that periods of relatively unfavourable conditions are positively associated with communal conflict (Miguel 2005; Ember et al. 2012, 2014; O'Loughlin et al. 2012; Raleigh & Kniveton 2012; Maystadt & Ecker 2014; Maystadt et al. 2015) and armed conflict (O'Loughlin et al. 2012; Raleigh & Kniveton 2012; Maystadt & Ecker 2014; Maystadt et al. 2015). For the East Africa region as a whole, large positive temperature anomalies (very hot temperatures) increase the risk of violent conflict, possibly because temperature extremes are associated with livestock losses and harmful effects on crops, thereby decreasing the opportunity costs of violence (O'Loughlin et al. 2012:18347). In Somalia, abnormally high temperatures and drought cause herders to sell more of their livestock than under normal conditions, causing an oversupply of low-quality animals that depresses prices in local consumer markets. This increases the risk of violent conflict between groups by triggering economic price shocks which make people more prone to livestock raiding and susceptible to recruitment by armed groups like al-Shabaab (Maystadt & Ecker 2014:1163. For similar findings for the Sudans, see Maystadt et al. (2015). In Turkana district in Kenya, the frequency of livestock-related violence increases in exceptionally dry months and years, when the depletion of resources necessary for pastoralism, like pasture and water, drives pastoral groups towards more intense competition over natural resources (Ember et al. 2012:176–177).<sup>12</sup> Interviews with raiders from the Turkana ethnic group in Kenya shed further light on why resource competition turns increasingly violent during times of relative scarcity. When resources are abundant, pastoralist communities cooperate

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<sup>12</sup>Witsenburg & Adano (2009) report the opposite pattern for neighbouring Marsabit and Moyale district. There, the intensity of livestock-related violence increases during the rainy season as opposed to the dry season. They explain this by the rainy season providing raiders with certain tactical advantages (see section 3.2). These contradictory findings might be explained by the different operationalisations of the outcome variable. Whereas Ember et al. find that the *frequency* of livestock-related violence increases in dry months, Witsenburg & Adano focus on the increase in the *intensity* of livestock-related violence. This ambivalent use of different outcome variables is unfortunately common practice, as researchers rarely theorise the difference between frequency and intensity *per se* (Eck 2012:126).



and share resources with their neighbours. Under these circumstances violence against neighbouring groups is costly, since all groups would lose the benefits of cooperating while wasting resources for destructive purposes. During times of scarcity, on the other hand, the relative value of cooperation decreases as there is less and less land, pasture and water to share, thus decreasing the benefits of cooperation and making the resort to violence less costly (Schilling et al. 2012:5–6).

Livelihood losses can contribute to violent conflict by aggravating resource sharing and pushing people to join armed groups. When cyclical violence leads to the breakdown of social relations among groups and forces people to adopt maladaptive livelihoods, the livelihoods-conflict cycle can become perpetuated, leading to chronic insecurity. This does not mean that violence automatically follows when peoples' livelihoods are under stress; in some instances joint efforts to solve environmental problems even contribute to better inter-group relations (Ide & Scheffran 2014:274). It seems plausible that slow-onset environmental change is more likely to lead to cooperation than rapid-onset environmental disasters, since groups have more time to build trust, negotiate resource access and develop cooperative mechanisms. Case study evidence from Kenya suggests that when faced with periods of drought, pastoral groups deploy a set of social institutions that mediate agency towards inter-group cooperation and guarantee access to resources, thereby reducing the risk of violent conflict (Adano et al. 2012; see also Linke et al. 2015).

Furthermore, resource scarcity is not an absolute concept (Selby & Hoffmann 2014:361). It depends, for example, on a group's exposure and vulnerability to environmental change, its dependence on natural resources, its adaption capacity and mobility, government policies and marginalisation (see e.g. Schilling et al. 2012; Ember et al. 2014). By using a composite risk index consisting of indicators for exposure and vulnerability to climate change and the general risk of violent conflict onset, Ide et al. (2014:72–77) show that exposure to climate change increases the risk of violent conflict in Kenya and Uganda, and that the risk increases even more in highly vulnerable areas that have a history of conflict. Communities that rely on single subsistence (only one type of income) are more vulnerable than those that engage in multiple subsistence activities, and cattle owners are more vulnerable to drought than camel owners. Moreover, vulnerability can differ throughout the year and across space. Pastoralists are more vulnerable during the dry season when there is insufficient grass for their livestock, farmers during the rainy season when crops are planted and stored supplies are starting to run out. Pastoral groups based in highland camps move during the rainy season, whereas pastoral groups based on plains tend to move during the dry season (Ember et al. 2014:301, 321). Cultural practices and beliefs

also play a part. In Tanzania, income shocks caused by extreme rainfall variability (droughts and floods) are strongly associated with witch killings, as communities which believe in witchcraft blame older women for their misfortune (Miguel 2005).

While climate-related environmental change is correlated with increased levels of violent conflict across East Africa, qualitative research shows that the contribution of temperature and precipitation variability in predicting previous conflict is still relatively modest compared with that of other factors (O'Loughlin et al. 2012:18347). Human behaviour cannot be explained by climate-related environmental change alone, but depends on a combination of political, social, cultural and other circumstantial factors. In conclusion, worsening livelihood conditions can increase the risk of violent conflict by decreasing the opportunity costs of individuals and groups to join armed groups or engage in violent resource competition. This highlights the importance of a deeper understanding of how the motives to engage in violence are related to the conditions under which people live.

### 3.2 Increasing migration

Migration is frequently forwarded as a mechanism linking climate change and violent conflict (Brzoska & Fröhlich 2015). Populations confronted by increasing resource scarcity often respond by moving to areas where resources are available and hence migration is often referred to as an adaptation strategy (Adger et al. 2014:758). There are different types of migration; it can be internal or international, permanent or temporary, urban or rural (for an overview, see Brzoska & Fröhlich 2015), and the type has different implications for the risk of violent conflict. The migration-conflict link found in East Africa predominantly concerns internal migration by sedentary farmers or nomadic groups. Even though changing pastoral mobility patterns are often seen as a form of temporal circular migration, we treat this as a separate type of pathway, given that mobility is a natural part of the pastoral lifestyle and because pastoral groups are linked to certain specific practices (see the next section).

Migration can be the result of rapid-onset disasters such as floods or hurricanes, but no studies on East Africa focus on such disasters. It can also be the result of gradual environmental change that slowly lowers the productive capacity of a community and increases the likelihood that the people who live in the area will migrate to areas where resources are less scarce. In Darfur, for example, some areas experienced increased precipitation and thicker vegetation cover between 1982-2002, whereas others saw the opposite trend, leading to increasing levels of permanent and

seasonal migration to areas with more favourable conditions (De Juan 2015:25–26; for case study evidence, see Mohammed 2004). Likewise, a decline in rainfall in Sudan’s Southern Kordofan region and the ensuing ecological crisis pushed communities to migrate southwards in search of greener pastures (Chavunduka & Bromley 2011). The focus on differences between regional or sub-regional areas, as opposed to temporal variation only, is illuminating since other studies report that, before the outbreak of the conflict in Darfur in 2003, the region as a whole saw only small declines in rainfall (Kevane & Gray 2008) and better than average vegetation growth (Brown 2010). Even within small geographical areas resource conditions can vary considerably, which is why it is important to consider both the temporal and spatial dimension of resource availability when exploring migratory patterns.<sup>13</sup>

Under certain circumstances, internal migration can increase the risk of local resource conflicts in areas of high in-migration. De Juan (2015) argues that those conflicts are particularly likely to escalate to violence because groups from different areas and of differing ethnicity are more likely to lack common conflict resolution institutions and are generally better at mobilising the necessary resources for violence.<sup>14</sup> In a rare quantitative investigation of the relationship between long-term environmental change, migration and violent conflict, that study found that violence during the early phase of the Darfur war was more prevalent in areas that experienced positive vegetation change (more vegetation) between 1982-2002, saw higher levels of in-migration and, as a consequence, increased co-habitation and interaction between Arab and non-Arab groups (De Juan 2015:24). Conflicts may be struggles for access, but may also be driven by more sinister motives such as complete resource capture. This may be particularly common when social order breaks down during violent conflict and the costs of violence are lower. Between 2005-2008, the Janjaweed militia in Darfur deliberately and systematically attacked villages endowed with natural resources: villages close to alluvial soils had a higher risk of being attacked by the Janjaweed than those that were further away. Villages that were abandoned or captured were subsequently taken over by groups loyal to the Janjaweed and colonised (Olsson & Siba 2013:306–310).<sup>15</sup> Non-climate related migration

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<sup>13</sup>Similar conclusions are forwarded in the latest IPCC report, which states that “precipitation in eastern Africa shows a high degree of temporal and spatial variability” (Niang et al. 2014:1209).

<sup>14</sup>According to De Juan (2015:24), ethnic groups are better at overcoming collective action problems. Kahl (1998:92) presents a similar argument, noting that identity groups can use social sanctions to ensure participation in collective action.

<sup>15</sup>While this lends support to the notion that the Darfur war was at least partly driven by the desire to capture and colonise areas endowed with natural resources, Olsson & Siba (2013:310) also test the suggestion that the war was driven by ethnic loyalty. They conclude

could also increase the risk of violent conflict over scarce resources. This is the case in northern Kenya, where access to natural resources has been “a major source” of conflict around the Dadaab and Kakuma refugee camps, which host people fleeing the conflicts in Somalia, the Sudans, Burundi, the Democratic Republic of the Congo and Uganda (Kumssa et al. 2009:1013).

Hence, it can be concluded that climate-related environmental change can push communities to migrate to more fertile lands, and, under certain circumstances, this can heighten tensions between residents and migrants, leading to violence. Two additional points need to be made. First, long-term environmental degradation can explain why people move and why such increasing migration can increase the risk of violent conflict, but it is unlikely to provide an explanation for when violence erupts, which is most likely dependent on other factors. The questions of what causes conflict and what causes violent conflict, while of equal value, are essentially different and need to be addressed in different ways. Second, the decision to migrate is a result of several factors, with environmental degradation being only one of these. To understand migration, it is also necessary to consider the political, social and economic context. It will rarely be possible to distinguish the exact importance of environmental degradation as a driver of migration, especially since environmental change in itself affects economic, social and political drivers of migration. Altogether, this makes the study of environmentally-induced migration and violent conflict a very delicate endeavour (The Government Office for Science 2011:9), but not less relevant.

### 3.3 Changing pastoral mobility patterns

Mobility is key for East Africa’s pastoralists. Pastoralists are groups that herd livestock (e.g. cattle, goats, sheep, donkeys, camels) and that at least partly depend on seasonal mobility between dry and wet season pastures for their livelihoods.<sup>16</sup> Mobility offers flexibility in the highly unpredictable ASALs that extend across East Africa, as herders can trek long distances in search of water and pasture (Adem et al. 2012:5). Many pastoral groups also employ an elaborate set of survival strategies that allow them to survive through long droughts, including “herd diversification, herd splitting, the redistribution of surplus livestock within social networks, the formation of

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that “in all our specifications, the proportion of rebel tribes in the population was the strongest determinant of attacks, even when controlling for numerous other variables, different sample, and different levels of aggregation”.

<sup>16</sup>It is however worth noting that many pastoral groups also practise farming and *vice versa* (see e.g. Inselman 2003; Assal 2006; Ember et al. 2014).

alliances with neighbouring groups and recourse to raiding livestock from other herders” (Hendrickson et al. 1998:187). The pastoral livelihood strategy has developed over centuries and has conditioned pastoralists to accept the harsh environment in which they live. However, with the acceleration of climate change, unpredictability has increased in ways that subject pastoralists to extreme instability, which sometimes increases the risk of violent conflict (Hendrickson et al. 1998). Therefore, mobility patterns are changing and pastoralists are now progressively moving beyond their traditional pastures.

In theory, livestock herders can move freely in search of water and pasture. In practice, customary rules, state borders, climate conditions and conflict limit their mobility. When their mobility is restricted, they become more vulnerable to dwindling rains (Chavunduka & Bromley 2011). This has forced many nomadic groups to change their mobility patterns to escape drought in ways that increase the risk of violent conflict. By moving their herds to areas that are richer in water and pasture, they end up closer to other groups, inciting competition over shared resources and making them more vulnerable to attack by hostile groups (Leff 2009; Hundie 2010; Chavunduka & Bromley 2011; Adem et al. 2012; Ember et al. 2012, 2014; Detges 2014). In Sudan’s Southern Kordofan region, the decline in rainfall has contributed to an ecological crisis that has pushed nomadic groups to move further southwards, bringing them into increasing conflict with farmers (Chavunduka & Bromley 2011; for similar findings from Darfur, see Adam 2004). In northern Kenya pastoral violence is more frequent close to well sites (Detges 2014:62) and near open sources of water such as rivers, permanent pools and springs (Adem et al. 2012:11), where the concentration of people and animals makes raiding more profitable and, in the case of wells, because the bushy depressions in the landscape in which wells are located make herders more susceptible to surprise attacks by raiders (Detges 2014:60). In Ethiopia, resource scarcity has made the Karrayyus less willing to permit Afar herders onto their rangelands, while the Karrayyus have been pushed to cross further into Afar territory in search of pastoral resources, resulting in violent conflict between the two communities (Hundie 2010:141).

If mobility is an essential aspect of pastoralism, the question is then why changing pastoral mobility patterns due to climate-related environmental change contribute to increased resource competition through violence. When following their traditional trekking routes, pastoralists negotiate access and adhere to customary laws that regulate resource access. Conflict resolution institutions and mechanisms for resource distribution often lower the risk of conflict (for Sudan see Suliman 1997; for Ethiopia, Kenya and Uganda, see Meier et al. 2007; for Kenya see Linke et al. 2015). For example, in the

Lolita forest in southern Kenya, the neighbouring Maasai communities traditionally share grazing lands peacefully, “as long as the boundaries of the territories are undisputed and resource use is mediated and regulated by customary laws” (Adano et al. 2012:74). Such mechanisms for peaceful conflict resolution are more likely along traditional pastoral routes. When these routes change, institutions might be non-existent or unable to cope with the increased pressure. Changing mobility patterns may also bring groups from different areas or of different ethnicity closer to one another. These groups are more likely to lack common conflict resolution institutions and are generally better at mobilising the necessary resources for violence, thereby increasing the risk of resource conflicts escalating into violence (De Juan 2015:24).

Changing pastoral mobility patterns are one of the most frequently emphasised pathways from climate-related environmental change to an increased risk of violent conflict in East Africa. Analysis of this pathway requires us to consider the way in which people move across space in search of resources. Changing pastoral mobility patterns explain both why groups end up competing for the same resources and why they struggle to resolve those competing claims peacefully.

### 3.4 Tactical considerations by armed groups

Worsening livelihood conditions, increasing migration and changing pastoral mobility patterns explain how climate-related environmental change affects the motivation to engage in violence. However, agent-based approaches also stress the importance of focusing on the capability to engage in violence, that is, the ability to execute this course of action (see e.g. Schilling et al. 2012). Capability is an essential consideration when seeking to explain the determinants of violence, since some groups may simply lack the necessary resources to engage in violence despite having motive to do so (Buhaug 2015:271–272). While there is a wide range of factors that determine capability, such as available resources, warriors, weapons, skills, information and landscape features, several authors observe how climate variability provides livestock raiders (Meier et al. 2007; Witsenburg & Adano 2009; Rowhani et al. 2011; Adano et al. 2012; Adem et al. 2012; Theisen 2012; Detges 2014; Ember et al. 2014) and armed groups (Raleigh & Kniveton 2012) with tactical opportunities that affect the dynamics of existing conflicts. The idea that the climate and weather affect the tactical decisions made by armed groups is not new. Ancient war theorist Sun Tzu identified “night and day, cold and heat, times and seasons” as one of the five constant factors that govern the “art of war” (ca. 500 B.C. [2005]:33), while the

Prussian military theorist Carl von Clausewitz saw environmental variations as important determinants of cover, access and visibility (1832 [1989]:349).

Weather and climate fluctuations affect the tactical considerations of armed groups, since they determine the level of camouflage and the mobility of forces and material. Most studies examine the tactical considerations of livestock raiders and build on the argument developed by Witsenburg & Adano (2009:520). Drawing on interviews with pastoralists in Kenya, they find that the conditions for livestock raiding are more opportune during the wet season when vegetation and surface water are readily available. This means that the animals are well fed and strong and that there is enough fodder and water along the way, enabling raiders to trek long distances with stolen livestock. The thick vegetation makes it easier to hide after attacks and rains wash away the raiders' tracks. In addition, the adequate supply of rangeland resources during rainy periods provides a surplus of labour so that young men can engage in raiding. In contrast, rebel violence may be more prevalent during dry periods when military movements are easier and conflict logistics require less effort because there are fewer diseases during the dry season and because the harvest period allows for subsistence (Raleigh & Kniveton 2012:54).

Several studies report that livestock-related violence increases during wet periods. In Ethiopia, Kenya and Uganda, communal violence events follow unusually wet periods (Raleigh & Kniveton 2012:62; for Kenya, see Theisen 2012:88). In Kenya's Marsabit and Moyale districts, the number of livestock-related deaths increases threefold during the rainy season as opposed to the dry season (Witsenburg & Adano 2009:525; see also Adano et al. 2012). Similarly, thicker vegetation cover is positively associated with livestock-related violence in Ethiopia, Kenya and Uganda (Meier et al. 2007:731) and with armed conflict in Ethiopia, Somalia, South Sudan and Sudan (Rowhani et al. 2011:217).<sup>17</sup> In Turkana district in Kenya, both the frequency and intensity of livestock-related violence are higher in relatively wetter areas on the plateaus and high ridges when the Turkana are the attackers (Adem et al. 2012:12–14).

Importantly, the argument that climate variability affects tactical considerations and in turn the risk of violence is of a different nature than previous arguments. Whereas the previous three pathways are reminiscent of

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<sup>17</sup>However, Rowhani et al. (2011:219) also observe that thicker vegetation cover could be more likely in areas that have experienced violent conflict, since the population displacements that follow conflict allow the vegetation to regrow around abandoned villages. This highlights the importance of controlling for reversed causality in cross-sectional studies by accounting for the temporal order of the steps in the causal chain.

what Lee (2009:3) refers to as conflict that “only emerges after a sustained period of divergent climate patterns”, tactical considerations are better understood as intervening variables that in themselves do not cause conflict but that “will contribute to it and shape it”. Some authors present the findings summarised above as evidence for the hypothesis that resource abundance increases the risk of violent conflict as there are more rewards – known as selective benefits – for those who participate in violent collective action (see e.g. Seter 2016:6). However, a closer look at the evidence shows that these studies do not focus on *why* livestock raiders engage in raiding as such, but instead explore *when* the desire to raid is most likely to materialise into violence. It would be premature to conclude that future increases in precipitation and thicker vegetation cover due to climate change will heighten the risk of violence simply because it provides raiders with opportunity to raid – it is also necessary to determine the reasons for raiding in the first place. As mentioned earlier, this is more likely to be resource scarcity. Case studies also show that the motivations behind livestock raiding depend on a number of factors, including climate-related environmental change, cultural practices (Schilling et al. 2012; Ember et al. 2014) and the commercialisation of livestock raiding (Hendrickson et al. 1998; Hundie 2010; Schilling et al. 2012). Hence, it can be concluded that climate-related environmental change can affect the dynamics of violent conflict by providing the opportunities to engage in violence, while at the same time it is necessary to stress the importance of distinguishing this argument from those that focus on the long-term causes of conflict.

### 3.5 Elite exploitation of local grievances

In previous sections we have shown that climate-related environmental change can increase the risk of violent conflict, particularly low-intensity conflicts between communal groups. Yet narratives of “climate wars” often refer to conflicts that are highly violent and involve more organised actors. This begs the question of how low-intensity communal conflicts are related to larger processes of civil war and insecurity. This final group of explanations shows how climate-related environmental change can increase the risk of violence because local resource conflicts provide elites with the opportunity to manipulate and politicise those conflicts for selfish reasons. Instigating or fuelling inter-group violence is often perceived by political elites as an effective means of crushing political opponents, diverting attention away from government shortcomings or ensuring the continued support of groups that depend on elites for their survival (Kahl 1998:84–



93).<sup>18</sup> Indeed, recent research shows that governments in sub-Saharan Africa are more inclined to intervene in communal conflicts when the fighting is linked to ethnic constituencies and control over land (Elfverson 2015).

Local grievances or resource conflicts linked to scarce resources constitute situations ripe for elite exploitation. Existing antagonisms between groups are fertile ground for mobilisation, since the organisational structures necessary for collective action are often already present (De Juan 2015:24) and because elites can capitalise on existing grievances and tensions (Kahl 1998:88). At the same time, local elites are likely to seek alliances with national elites in order to gain the upper hand in local conflicts (Kalyvas 2006). While resource scarcity is by no means the only cause of local conflict, the finding that three quarters of all communal conflicts in Africa between 1989-2011 included land as an important source of contestation illustrates the importance of resources as something worth fighting over in communal conflicts (von Uexkull & Pettersson 2013). When local conflicts become tied up with national dynamics they often escalate (Autesserre 2010; Brosché 2014) and can become more difficult to solve (van Baalen & Höglund 2016). In addition, conflicts at national scale also affect communal conflicts indirectly by, for instance, changing local power relations, weakening state structures or destroying natural resources (Brosché & Elfverson 2012:47). Given that “communal conflict is generally seen as a more plausible outcome of environmental degradation than large-scale violence” (Buhaug 2015:272), this type of pathway provides important insights into how such communal conflicts can increase the risk of more severe forms of violence.

The Sudans are a prime example of how elites can exploit local grievances (see Mohammed 2004; Assal 2006; El Zain 2006; Chavunduka & Bromley 2011; Verhoeven 2011; Selby & Hoffmann 2014). When the war between northern and southern Sudan began in the early 1980s, it took place in “the context of a politically and ethnically divided population that was reeling from the effects of a deep drought” (Chavunduka & Bromley 2011:912). Longstanding grievances among ethnic communities and communal conflicts about land provided a fertile recruitment ground for both government forces and the Sudan People’s Liberation Army (SPLA). In turn, these land disputes became more pronounced and continue to be a source of

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<sup>18</sup>Kahl (1998:82) refers to this as “state exploitation”. He contends that “demographic and environmental stress can sometimes lead to civil strife initiated by state elites who seek to capitalize on scarcities of natural resources and related social grievances to advance their parochial interests”, leading to more state-sponsored violence. While we agree with this point, we prefer the term ‘elite exploitation’, since not all such exploitive strategies are carried out by the state.

insecurity long after the secession of South Sudan from Sudan (Chavunduka & Bromley 2011:912). Sometimes entire groups were brought into the dynamics of civil war as a result of environmental marginalisation and elite manipulation. The Rezaigat camel nomads in Darfur are a case in point. They historically cooperated with farmers in the area, trading goods like milk products in exchange for agricultural products and access to grazing lands. But following recurring droughts in the Sahel in the 1970s and 1980s, landowners found their natural resource base too depleted to be shared with the nomads, after which the Rezaigat became increasingly hostile to their neighbours. When southern Sudan rebelled against the central government in Khartoum the government formed an alliance with the Rezaigat against the rebellious Fur and Masalit communities of southern Sudan. The Rezaigat joined the ranks of the infamous Janjaweed militia, the perpetrators of numerous atrocities, acts of genocide and crimes against humanity (Suliman 1997; Mohammed 2004). The links between communal conflicts over natural resources and national politics in the Sudans has led to the conclusion that “rather than being a tribal-ecological war, long-standing political economic asymmetries fused with the fall-out of national power struggles” (Verhoeven 2011:702) and that “rather than environmental change, it is political economic factors which have been the main determinants of water-related violence in the Sudans” (Selby & Hoffmann 2014:367).

Similar links between resource scarcity, communal conflicts and national elites been observed in other parts of East Africa. In Kenya, the Moi regime sought to discredit the push for democratisation in the early 1990s by orchestrating ethnic violence between pastoral groups and farmers. Elite exploitation was made possible because of long-standing land grievances rooted in demographic, environmental and historical factors (Kahl 1998:94). In later years, livestock raids in Kenya have been linked to political competition at the national level, both as a source of income and as a convenient front to hide behind when political elites seek to stir up ethnic tensions before national elections (Meier et al. 2007:719). According to Hendrickson et al., “the occurrence of predatory raiding at the local level often resonates with political events at the national level, especially the heightened inter-ethnic competition which regularly accompanies national elections in Kenya” (1998:192). Similarly, in Ethiopia local resource conflicts between the Afar and Issa communities have become “highly politicized” since the 1970s as the result of both Somali and Ethiopian state policies “contributing to the perpetuation of conflicts between the two ethnic groups” (Hundie 2010:141; see also Markakis 2003). In Uganda, the government has intensified resource conflicts between the Karamojong and their neighbours by siding with settled farmers, since this has led to a decline in social capital and deteriorating tribal relations. The Ugandan government

was motivated in this by a wish to marginalise a pastoral population seen as backward and perceived to contribute to ecological degradation (Inselman 2003:179). In Rwanda, increasing resource scarcity paved the way for the ethnic mobilisation that precipitated the genocide against the Tutsi (Uvin 1996).<sup>19</sup>

The observation that national elites sometimes exploit local grievances accentuates the importance of accounting for how climate-related environmental change interacts with political processes. Climate-related environmental change is neither a necessary nor sufficient cause of elite exploitation. However, it is conceivable that deteriorating livelihoods make communities more susceptible to elite exploitation that leads to, or intensifies, violent conflict.

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<sup>19</sup>However, Percival & Homer-Dixon (1996:282) partly refute this argument, as there is “no conclusive evidence” that those that experienced the most severe effects of environmental scarcity participated in the genocide. Instead, they note that peasants were often coerced into participating in massacres by militias and local authorities.

## 4. Discussion

In the previous chapter, we outline five different types of pathways through which climate-related environmental change is linked to violent conflict in East Africa, thereby contributing to the theoretical development of climate-conflict research. We describe how, in some instances, climate-related environmental change has worsened livelihood conditions, increased migration and pushed pastoralists to change their mobility patterns, which has successively increased the risk of violent conflict. In addition, we describe how climate variability has affected the tactical considerations of armed groups and how resource conflicts have encouraged elite exploitation, changing conflict dynamics and contributing to higher conflict intensity. However, it is important to stress that these pathways are theoretical simplifications that serve to streamline the argumentation. As with any theory, the purpose is to simplify reality rather than to present it in all its complexity.

In this chapter we deepen the analysis by focusing on three critical dimensions – temporal, spatial and socio-political – inherent in the literature. These dimensions provide more insights into the different types of pathways and highlight a number of considerations that need to be taken into account when analysing the links between climate-related environmental change and violent conflict, both with regard to theory and empirical testing. Finally, we discuss the generalisability of our findings with regard to future climate change.

### 4.1 The temporal dimension

Climate-related environmental changes have different temporal horizons. Some environmental changes, like floods or cyclones, unfold in a matter of days and some, like droughts, last for months or sometimes years, while others, like sea level rise or climate change, involve long-term changes that transpire gradually over decades or centuries. Hence, one temporal dimension of the links between climate-related environmental change and violent conflict relates to the time scale on which a certain process is observable and can be expected to have implications for society. Another temporal dimension relates to the expected time lag between a climate-

related environmental change occurring and a violent response being observed. There is no reason to believe that all climate-related environmental changes at different time scales generate the same social outcomes: “short term deviations from normal weather patterns may matter for some social processes, while longer term change can be more important for others” (Salehyan 2014:3). As noted by Lee (2009:3–4), climate-related environmental change can increase the risk of conflict in the long-term, form the circumstantial factors that contribute to and shape the dynamics of existing conflicts, and trigger violent conflicts through rapid-onset changes. Consequently, analysing the link between climate-related environmental change and violent conflict necessitates accounting for both the temporal scale at which the environmental change in question is being measured and the expected time lag from this change to the outbreak of violent conflict. This is a delicate task that requires both theoretical stringency and methodological precision.

Our analysis identified two main challenges related to the temporal dimensions of climate-related environmental change and violent conflict. The first challenge stems from the failure to differentiate explicitly between climate-related environmental change as a driver of conflict in the long-term and as an immediate trigger of violence. This has somewhat unnecessarily become a source of confusion in the literature (Seter 2016:2). To illustrate this point, consider Theisen’s finding that drier years in Kenya between 1989-2004 were in general more peaceful than wetter years. Based on this observation he concludes that “intergroup violence is driven by calculation and political gain rather than desperate scrambles for scarce land, pasture and water resources” (Theisen 2012:81). However, such a study is only consistent with the underlying theoretical assumption that annual drought patterns predict that people will fight in that same year. Alternative theories may suggest that resource scarcity is an underlying cause of violence but that violence materialises when certain tactical opportunities arise, for example when thick vegetation cover provides camouflage. It could very well be the case that there are several pathways at play at the same time and that these operate on different time scales.

An illuminating example is the issue of livestock raiding in East Africa. Qualitative studies show that increasing resource scarcity and droughts, along with cultural, economic and political processes, increase the risk of livestock-related violence in the long-term (see e.g. Leff 2009; Hundie 2010; Schilling et al. 2012). At the same time, quantitative studies show that wet periods shape the patterns of raiding behaviour, as the thick vegetation provides raiders with cover (see e.g. Witsenburg & Adano 2009; Raleigh & Kniveton 2012). These findings should not be seen as contradictory, since they operate on different time scales (long-term stress *vis-à-vis* contributing

factors or triggers). Instead, they should be seen as complementary, with the first strand of literature focusing on the underlying causes of conflict and the second strand on the factors that shape or trigger violence. Exactly why and when violent conflicts are most likely to erupt is ultimately a question about theoretical expectations and depends on “the type of event, the actors involved, and the transmission mechanisms and interacting factors that connect the end points in the causal chain” (Buhaug 2015:272). Future studies would benefit from developing more precise theoretical frameworks that account for the temporal dimension of the climate-conflict link.

The second challenge is that there is a heavy bias in the quantitative literature towards measuring conflict onset or intensity as an immediate reaction to climate variability measured over months or sometimes years. The bulk of the quantitative literature on East Africa actually investigates the implications of climate variability, but draws conclusions about climate change in general.<sup>20</sup> This means that there is a tendency in the quantitative literature to disregard theoretical explanations that outline how long-term degradation can function as a driver of violent conflict over time. As an example, consider the argument that increasing migration increases the risk of violent conflict. Since the decision to migrate often materialises over time and as a result of many factors, including resource scarcity, using short-term measures of climate-related environmental change like monthly rainfall patterns may not always be adequate for testing this theory. A related issue is that measures of climate variability also risk capturing tactical considerations by armed groups rather than environmentally-induced grievances (Selby 2014:842; see Seter 2016:5 for potential solutions). This is not to say that the implications of climate variability are unimportant – some studies even suggest that the unpredictability inherent in increasing climate variability is particularly likely to drive violence (Ember et al. 2012:160). However, it does lower the ability to assess the impacts of future climate change since “an effect of climate variability (anomalously warm or dry periods) on conflict levels cannot automatically be translated into the conclusion that climate change (a warmer planet) will lead to more conflict (Seter 2016:2). An important task for future quantitative studies should therefore be to examine the effects of long-term climate-related environmental change on the risk of violent conflict over extended time periods.

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<sup>20</sup>De Juan (2015), who measures environmental change over two decades, is an inspiring exception.

## 4.2 The spatial dimension

In addition to the temporal dimension of a climate-conflict link, studies also need to consider the spatial dimension. The spatial dimension of climate-related environmental change and violent conflict is important because there is significant spatial variation in the processes under scrutiny. Not all areas experience the same climate-related environmental changes and not all areas exhibit an equally high general risk of violent conflict. Indeed, the IPCC has observed large spatial differences in precipitation across East Africa and projections indicate that this is likely to be the case even in the future (Niang et al. 2014:1209–1210). Similarly, some areas may be more likely to experience violent conflict in general, for example because of certain topographical and geographical features (Adem et al. 2012) or due to a history of violent conflict (Ide et al. 2014). As with the temporal dimension of a climate-conflict link, the relevance of spatial variations ultimately depends on the theoretical expectations. For example, if the focus of the analysis is pastoral violence, it seems unlikely to expect that such violence would occur in urban areas.

However, spatial variations are more than important control variables – they also pinpoint important theoretical considerations. Variations across space are important because they are likely to influence a host of social outcomes. An example relates to the issue of resource scarcity and abundance, which is central in many of the pathways from climate-related environmental change to violent conflict. Resource scarcity is often understood as an individual, group or area having fewer resources *than before*, but equally important is the notion that resource scarcity entails fewer resources *compared with* other individuals, groups or areas. As such, resource scarcity and abundance are concepts that “only make sense in relation to one another” (Selby & Hoffmann 2014:361). This is more than mere theoretical hair-splitting because it has implications for how people move across space. Rethinking resource scarcity in relation to relative resource abundance elsewhere is critical because individuals and groups do not passively watch their herds die of starvation or their agricultural crops dry out. Instead, they move from areas that are relatively scarce in resources to areas where resources are available. Different forms of migration can function as adaptive mechanisms to worsening livelihood conditions. Agricultural communities may send members of the household to urban areas in search of alternative incomes and remittances. Pastoralists may drive their herds farther away from their traditional grazing lands in search of greener pastures. When resource scarcity becomes unbearable, entire communities may dislocate and migrate to more fertile lands. Mobility is both a response to the failure to adapt and an adaptation mechanism in itself (Adger et al. 2014:758; Brzoska & Fröhlich 2015:9). Indeed, several case studies illustrate how migratory

patterns relate to violent conflict (on Ethiopia, see Hundie 2010; on the Ethiopia-Somalia border region Markakis 2003; on Kenya Hendrickson et al. 1998; Schilling et al. 2012; on Sudan Chavunduka & Bromley 2011).

The question of how spatial variations in resource conditions relate to people's movements across space has implications for both theory and empirical testing. Developing pathways that link climate-related environmental change to violent conflict entails theorising whether and how changes in resource conditions may offset movements across space and what the implications are with regard to violent conflict (see e.g. Olsson & Siba 2013; Detges 2014; De Juan 2015). An important future research task will therefore be to understand how mobility patterns relate to the availability of natural resources. Moreover, as people sometimes migrate in search of resources, there is little utility in examining whether local resource scarcity is correlated with violent conflict unless the underlying theoretical explanation suggests that people will fight in areas where resources are scarce. As an example, Rowhani et al. (2011) report that there is no significant relationship between land degradation and armed conflicts in Ethiopia, Somalia, South Sudan and Sudan between 2000-2006. This does not necessarily suggest, as the authors contend, that land degradation is not a driver of violent conflict in general; it only shows that local land degradation does not lead to violence *in that particular locality*.

As has been stressed by other commentators (see e.g. Salehyan 2014; Buhaug 2015; Seter 2016), quantitative studies must determine an adequate geographical scale for their empirical inquiry in light of their theoretical expectations. Using disaggregated data only makes sense if it is believed that the outcome of a certain climate-related environmental change is confined to a certain area.<sup>21</sup> If the theorised pathway involves movements across space, on the other hand, the analysis may better capture the hypothesised relationship by using larger spatial units, extending the analysis to neighbouring grid cells or controlling for migratory patterns. Qualitative research could make an important contribution here by examining the likely geographical distance of people's adaptive strategies, thereby providing insights into the appropriate size of the spatial units of quantitative studies.

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<sup>21</sup>An interesting finding in this regard is the observation by Rowhani et al. (2011:219) that environmental change in Ethiopia, Somalia, South Sudan and Sudan between 2000-2006 was related to malnutrition at the regional level, but not at the village scale. They conclude that whereas "small range population movements allow responding to localized stress ... when a larger geographic entity suffers from repeated droughts and low accessibility, then the population may be affected by malnutrition".



### 4.3 The socio-political dimension

Violent conflict does not arise as a result of climate-related environmental change in a socio-political vacuum, nor do environmental changes mechanically determine human behaviour. Violent conflict is an extreme and rare outcome that only occurs under certain conditions. Both quantitative and qualitative scholars emphasise the importance of studying the climate-conflict link in its socio-political context. For example, even when quantitative analyses show that climate-related environmental change affects the risk of violent conflict, some scholars caution that it only has a modest effect when predicting past conflict in East Africa compared with other factors (see e.g. O'Loughlin et al. 2012:18347; Olsson & Siba 2013:310). Similarly, case studies show that conflicts that are intuitively related to climate-related environmental change cannot be understood without reference to the underlying socio-political processes. For example, although the Rwandan genocide was precipitated by environmental scarcity, a closer look at the processes at work reveals that scarcity only played a limited role (Percival & Homer-Dixon 1996). Similarly, even though local groups in Somalia fought for valuable natural resources such as cropland, those struggles arose out of competition between national elites rather than between environmentally marginalised groups (Webersik 2008). This should not be interpreted as downplaying the impact of past or future climate-related environmental change on the risk of violent conflict – rather, it should be interpreted as a call for re-politicising climate-conflict research. Placing climate-related environmental change and violent conflict in its appropriate socio-political context reintroduces human agency into the calculation, showing that there is political manoeuvrability to prevent “a coming anarchy” beyond combating climate change or solving already violent conflicts.

Socio-political processes permeate every step in the chain from climate-related environmental change to an increased risk of violent conflict. Even though climate-related environmental change has had a significant impact on the availability of natural resources across East Africa, an individual or group's relative resource scarcity is also dependent on a number of other factors – political, social and cultural – that determine the availability and distribution of resources. Changes in any of those factors can bring about changes in resource availability. Moreover, an individual or group's vulnerability to climate-related environmental change is dependent on a combination of exposure, vulnerability and adaptive capacity. This means that, contrary to those studies that focus exclusively on rainfall as the determinant of resource availability, neither scarcity nor vulnerability to environmental change occurs as the result of an apolitical biophysical process. On the contrary, “the environment is quintessentially political”

(Verhoeven 2011:684). While climate-related environmental change certainly affects the biophysical processes that determine resource availability and thus cause low supply, scarcity can also be caused by high demand or can be structurally induced as a result of economic development, forced dispossession, marginalisation and exclusion (Homer-Dixon 1994:10). An example is Sudan, which has “substantial freshwater resources”, including around two-thirds of the Nile basin and considerable groundwater reserves, but still experiences water scarcity as a result of mismanagement and inadequate investment (Scheffran et al. 2014:380).

Our analysis of the case study literature shows why it is crucial to reintroduce socio-political factors into the study of climate-related environmental change, resource scarcity and violent conflict. The example of East Africa’s pastoral groups is again a case in point. Across the region, pastoralist groups face increasing resource scarcity as a result of longstanding political and economic marginalisation and more frequent and longer droughts. Their marginalisation is a result of a discriminatory policy discourse shaped by the ideas of modernity since colonial times, according to which pastoralism is seen as an out-dated and ecologically damaging practice (Leff 2009:192; Butler & Gates 2012:24). These policies include the establishment and closing of national and sub-national borders which, in combination with violent conflict, livestock raiding and drought, has curbed the mobility of herders and intensified their vulnerability to climate change (Inselman 2003:170; Chavunduka & Bromley 2011:914). For the Turkana in Kenya, Hendrickson et al. (1998:187) conclude that the structural causes of famine and impoverishment “have always been as much political as environmental and economic in nature”. In Uganda, the government’s attempts to settle the Karamojong pastoralist group by force has “resulted in greater environmental degradation, a scarcity of grazing land and thus, more conflict” (Inselman 2003:172). In Sudan, resource scarcity is a result of climate change and erratic rainfall in combination with, among other factors, rapid population growth, war, displacement, damaging agricultural practices and deforestation (Suliman 1997:104). To disregard the political aspects of resource scarcity is to risk overlooking the political manoeuvrability that exists, even under circumstances of diminished and worsened environmental conditions.

The case study literature also reiterates why socio-political processes and institutions are imperative when accounting for why some scrambles for scarce resources turn violent, while the vast majority do not. Formal institutions, like the police, judiciary and political system, and traditional institutions and cultural norms provide an alternative to violence when groups make competing claims for the same resource. When those institutions are absent, corrupted or non-functional, the risk of violent

conflict over scarce resources increases. An illustrative example is the abolition of the traditional administration system by the regime in Sudan. By stripping traditional leaders of their administrative functions, their ability to mediate in conflicts and to enforce compliance was undermined, whereupon traditional conflict resolution broke down. Changes in traditional land ownership further intensified resource conflicts, as nomads increasingly demanded access to land claimed by farmers (Assal 2006; Chavunduka & Bromley 2011; Verhoeven 2011; Selby & Hoffmann 2014). In Mohammed's (2004:235) words, "nothing disturbed the communal peace in the region as much as did the abolition of native administration". In Tanzania, decades of bad governance and corruption have led to low public trust in authorities such as the police and judiciary, which "has resulted in actors trying to solve problems through violence" (Benjaminsen et al. 2009:441). Several quantitative studies corroborate this and claim that climate-related violent conflict is more prevalent in areas with a weak state presence or areas that have experienced previous political instability or conflict (O'Loughlin et al. 2012; Raleigh & Kniveton 2012; Theisen 2012; Olsson & Siba 2013; Detges 2014; Ide et al. 2014). This does not mean that insecurity necessarily arises out of 'state weakness' – in many instances violent conflict over scarce resources occurs as a result of state exploitation (Kahl 1998), biased state intervention (Butler & Gates 2012) or processes of internal colonisation (El Zain 2006). Selby & Hoffmann (2014:362) caution that "many of the gravest insecurities in the global South arise not just from state weakness, but rather from militarised state strategies and processes of state-building and internal colonisation which /.../ have necessarily involved wide-spread violence and dispossession".

Another important factor is the role of political economics. Economic exploitation, sometimes mislabelled "development" by corrupt economic elites, can be a significant cause of environmental degradation and can cause conflicts over the resources that are left. In Sudan, the expansion of mechanised farming displaced thousands of farmers and herders, leading to localised scrambles for water and land. Those conflicts deepened with recurrent droughts and intensified when fighting escalated at the regional level (El Zain 2006; Chavunduka & Bromley 2011; Verhoeven 2011; Selby & Hoffmann 2014). In the rangeland on the Horn of Africa, livestock raiding has changed from a cultural phenomenon regulated by norms to an increasingly commercialised practice driven by the incentive of selling livestock on the open market (Hendrickson et al. 1998; Leff 2009; Omolo 2010; Schilling et al. 2012). This transformation of the phenomenon has influenced the frequency and intensity of livestock-related violence, as it has brought in more actors that share few common norms and values, fuelling retaliatory action. It has also become more difficult to negotiate the return of the animals, since raided cattle are quickly brought beyond the reach of the

raided groups (Hundie 2010:143). Thus, while livestock-related violence is related to climate conditions, economic factors have brought new dynamics that make livestock-related conflicts more intense and more difficult to solve.

Finally, one must not forget that important inter-linkages also exist between climate-related environmental change and violent conflict beyond simple one-way causality – some of the factors that make societies vulnerable to climate change also make them vulnerable to violent conflict (Seter 2016:3) and violent conflict in itself also increases the vulnerability to climate change (Buhaug 2015:273). The present analysis of the case study literature shows that it is crucial to place climate change and violent conflict in a broader socio-political context to uncover the underlying dynamics that link the environment to violence.

#### 4.4 Generalising about the future

An important caveat in climate-conflict research in general and in this study in particular is that the analysis is based on historical evidence about the relationship between climate-related environmental change and violent conflict in East Africa. Building analyses on past events is common practice in the study of violent conflict and thus any conclusions about future events of necessity build on the assumption that the future will be reasonably similar to the past. However, the difficulties associated with this assumption are particularly severe given the unprecedented speed of climate change and the possibility of tipping points in nature-society relations (Buhaug 2015:273) that may result in disproportionate impacts and irreversible climate change (Scheffran et al. 2014:373). As the climate system is in the early stage of an on-going major transformation, existing empirical knowledge is, and will continue to be, characterised by uncertainty. Some impacts of climate change are related to changes in weather patterns, whereas other impacts entail entirely new phenomena, such as sea level rise, that have not yet had any significant impacts on human society. Similarly, it is simply not possible to study the implications of a 2°C or 4°C mean temperature increase on the risk of violent conflict because there is no equivalent example in recent history to explore. Thus, as climate change intensifies, the past has diminishing explanatory power.

Nevertheless, the uncertainty of what the future entails does not mean that we are entirely in the dark about the future implications of climate change for the risk of violent conflict. The recent past is not a perfect indication of future events, but it does provide important lessons on previously experienced challenges. While we are not certain of the exact magnitude of

future climate change and how that will affect the risk of violent conflict, we do know that climate-related environmental change has the potential to cause social upheaval and violent conflict. We also know that social and political aspects are important – if not crucial – for whether increased environmental pressure will lead to violence. We cannot control the Earth’s climate system, but we can decrease the vulnerability of societies to climate change and build resilience against both climate change and violent conflict. This gives us significant manoeuvrability to act.

## 5. Conclusion

This report revisits the academic literature on climate-related environmental change and violent conflict in East Africa and seeks to contribute to the burgeoning research field by examining the different types of pathways through which these changes can increase the risk or dynamics of violent conflict.

The main contribution of this report is that it outlines a conceptual framework of these pathways. In particular, it identifies three types of pathways whereby climate-related environmental change increases the risk of violent conflict. Due to the negative impact of climate-related environmental change on the availability of natural resources, *worsening livelihood conditions* can contribute to more resource conflicts that sometimes turn violent. The inability to sustain their livelihoods can also drive people to *migrate* to areas with more resources and hence contribute to resource conflicts elsewhere. Similarly, degraded grasslands and a lack of water can push pastoralists to *change their mobility patterns*, bringing them into conflict over access with neighbouring groups. In addition, two different types of explanations are identified. Weather conditions and climate variability can affect the *tactical considerations of armed groups* and therefore contribute to intensified fighting during certain periods and shape the dynamics of violence. Local resource conflicts are also susceptible to *elite exploitation* that often significantly affects the dynamics and intensity of violent conflict.

In addition to outlining different types of pathways, three dimensions that need to be taken into account when analysing the climate-conflict link are identified. The first dimension is temporal – climate change is only visible in the long-term, whereas climate variability is visible in the short-term. Some events, like rapid-onset disasters, can unfold in a matter of days. Climate-related environmental changes at different time scales are likely to bring about different societal challenges and security implications that need to be theorised and investigated in their own right. A second dimension is spatial – resource conditions show significant spatial variations and altered livelihood conditions can offset population movements. The third dimension concerns the inherent socio-political nature of a climate-conflict link. Resource scarcity is caused by a combination of climate, geographical, social, cultural

and political factors and political exploitation of local grievances or other political processes is often decisive for whether local resource conflicts turn violent or not. Taken together, this analysis emphasises the need to understand the pathways from climate-related environmental change to violent conflict in light of the temporal, spatial and political dimensions of those linkages.

## 5.1 Mitigating the risk of climate-related violent conflict

There are some important policy implications of our analysis. Identifying the processes through which climate change translates into violence is more than an academic question. Unless policy-makers know the links in the chain between climate change and violent conflict, they are left with only two sets of options; battling climate change or increasing efforts to deal with already potent situations of conflict, violence and instability. The broad array of policy implications outlined below bear testimony to the policy relevance of generating a more profound understanding of the pathways to violence.

### 5.1.1 Support impact mitigation and resilience

A central claim in the literature is that worsening livelihood conditions make people more likely to join armed groups or engage in violence. The implication of this is that efforts that mitigate the impact of climate variability and that strengthen climate resilience may also contribute to a lower risk of violent conflict. Several authors suggest that efforts like *weather insurance schemes*, improved *access to markets* and *support for destocking and restocking processes* at times of drought may decrease pastoralist vulnerability to drought. Financial and technical support to *adapt herds to more frequent droughts* may also ease vulnerability and prevent overuse of rangeland resources during times of scarcity (Inselman 2003; Maystadt & Ecker 2014; Maystadt et al. 2015).

Resilience can also be strengthened by making pastoral resources more productive, for example by *combating bush encroachment* on pasture, *controlling infectious insects* like the tsetse fly and ticks and *providing cheap and accessible veterinary services* (Inselman 2003; Benjaminsen et al. 2009). For sedentary populations, formal *insurance systems* against extreme climate shocks can provide households with a means to smoothing their consumption across years with good and bad resource availability (Miguel 2005). *Improving livelihood conditions* through government services can contribute to resilience, as can efforts to *support income diversification*. This may be particularly true for young men who are most likely to engage in raiding or join armed groups (Schilling et al. 2012). It is also important to

remember that economic development need not necessarily promote resilience, as unsustainable industrial and agricultural practices often contribute to environmental degradation and hence increase ecological marginalisation and vulnerability (Chavunduka & Bromley 2011; Verhoeven 2011). Political instruments must hence be chosen with great care and preferably include *conflict sensitivity assessments*.

### 5.1.2 Enable and adapt to mobility and migration

As this analysis shows, pastoralist groups are often at the centre of East Africa's violent conflicts, which means that policies that decrease their vulnerability to climate change may play a positive role in limiting the risk of future violence in the region. Mobility has long been an essential part of the survival strategy of East Africa's pastoralists. Through a combination of discriminatory state policies, conflict, livestock raiding, drought and the establishment of national and sub-national borders, their mobility has been restricted and their vulnerability to climate change intensified (Hendrickson et al. 1998:187–188; Chavunduka & Bromley 2011:914). This intensified vulnerability has contributed to the changing mobility patterns that frequently bring herders into conflict with farmers or other herders. *Embracing mobility and creating institutions that facilitate peaceful seasonal migration* may therefore break the cycle of vulnerability and violence that has become endemic to some of the region's pastoralists (Scheffran et al. 2014:382). The crucial issue is to *design strategies for harmonising the mobility needs of pastoralists with the safety needs of sedentary farmers*. Some suggest *flexible land boundaries* along with the *establishment of institutional settings and processes for handling potential conflicts between farmers and nomads* as a solution (Chavunduka & Bromley 2011:915). Others stress *investments in education services* adapted to a mobile population (Maystadt et al. 2015:667). As a first step, however, development agencies need to *recognise the importance and function of pastoralism as a livelihood strategy* in the ASALs and design their famine relief and pastoral development policies accordingly. This may include raising awareness and lobbying for ensuring unfettered mobility for the region's herders (Hendrickson et al. 1998:195–196), for example by *negotiating secure cross-border movement through international agreements* (Scheffran et al. 2014:378). Finally, contributing to conflict resolution (as outlined below) may be a fruitful path forward, since violence in itself often prevents pastoral mobility.

### 5.1.3 Strengthen existing conflict resolution mechanisms

By focusing on the socio-political dimension of a climate-conflict link, this study identified the importance of institutions for explaining why local



resource conflicts turn violent. When those institutions are absent, corrupted or non-functional, the risk of violent conflict over scarce resources often increases. However, in many instances communities are able to resolve their differences short of violence. Hence, many studies stress the importance of adequate and effective conflict resolution mechanisms as a way to prevent violent conflict. Since most communities already have conflict resolution mechanisms embedded in cultural and institutional norms, outside actors should focus on how to *adapt local conflict resolution mechanisms to meet new demands* instead of trying to introduce entirely new mechanisms (Hendrickson et al. 1998:197; Hundie 2010:146). For example, Linke et al. (2015:42) claim that community dialogue can work as an “informal, but important, institution to mitigate violent conflict risk” that is “more flexible and adaptive to the changing circumstances” than more formal state institutions (see also Meier et al. 2007). Similarly, Schilling et al. (2012:12) suggest that investments in development can contribute to more peaceful relations if they are “embedded into a framework of conflict mitigation which offers incentives for both conflict parties to simultaneously leave the violent conflict path and to invest resources into cooperation”. Some examples include *strengthening out-of-court conflict management procedures* by building capacity among local or traditional authorities or by designing institutions to sanction destabilising practices such as livestock raiding. State-based institutions for conflict resolution may also contribute to peace, since the state is arguably the best forum for mediating conflicts and enforcing settlements in the long run. This includes *strengthening and increasing the legitimacy of central and district level institutions* such as the police and judiciary (Hundie 2010:146) and *including environmental indicators in conflict early warning systems* such as the Inter-Governmental Authority on Development’s (IGAD’s) Conflict Early Warning and Response Network (CEWARN) in the Horn of Africa (Meier et al. 2007:733). There is also a need to *integrate climate change adaptation into development and post-conflict reconstruction programmes*, for example by attempting to diversify the economy or improve resource management (Scheffran et al. 2014:381).

## 5.2 Implications for future research

This report illustrates the value of a systematic literature review. The purpose of research synthesis goes beyond pointing out research gap, as carefully executed synthesis can provide new insights and illuminate patterns that can inform both policy and research. Hence, literature reviews can be valuable in their own right. This does not mean that literature reviews are exempted from conventional scientific standards about transparency and methodological rigour. To increase the impact of future literature reviews,

the review authors should be clearer about the decisions that are made during the review process and the implications of those decisions for the results presented.

There are some implications of our investigation for the research field. Research on climate-related environmental change and violent conflict is advancing rapidly and there are already a host of insightful commentaries on the opportunities and challenges of the field (see e.g. Meierding 2013; Ide & Scheffran 2014; Salehyan 2014; Buhaug 2015; Seter 2016). Our reflections partly amplify earlier commentaries, but also seek to complement and deepen their suggestions.

A common suggestion in previous commentaries is that scholars need to theorise more precise social outcomes (Salehyan 2014; Buhaug 2015; Seter 2016). Our investigation points in the same direction, since the vast majority of the studies reviewed focus on a relatively small repertoire of dependent variables, most notably the outbreak and intensity of communal conflict. Eck's (2012:126) observation that conflict scholars in general rarely theorise violent conflict outbreak, intensity and events *per se* is also relevant for the study of violent conflict in relation to climate-related environmental change; the environmental factors that contribute to violent conflict *outbreak* need not necessarily be the same as those that determine the *dynamics* of that conflict. An example is the suggestion by Ember et al. (2013) that violent conflicts over scarce resources are more likely to see violence against civilians because terrorising civilians will make the targeted population more likely to flee or give up their access to those resources. Another interesting avenue for future research can be to formulate research questions about more specific phenomena related to the recurrence, dynamics and termination of violent conflict, for example about how environmental degradation affects the risk of communal conflict recurrence or the decision to spoil peace processes.

This study also demonstrates the contribution of qualitative research. There is a rich and largely under-analysed body of case study literature on the links between climate change and violent conflict. Case studies are particularly good at examining the pathways to violence and identifying important scope conditions. They are also good at capturing the inherent complexity of climate-driven violent conflicts. Much like previous reflections on the quantitative literature, we believe that these qualitative investigations could contribute even more to the field if they employed solid theoretical frameworks and rigid methods to a greater degree in their analyses. This would also enable them to generalise their findings beyond the individual case. Systematic comparative approaches, like most-similar and most-different designs, could be particularly useful.

Similarly to previous commentaries, this study emphasises the importance of specifying the pathways through which climate-related environmental change increases the risk of violent conflict (see e.g. Ide & Scheffran 2014; Salehyan 2014; Buhaug 2015; Seter 2016). Beyond specifying pathways, the next step is to empirically test the veracity of the proposed pathways (see Seter 2016 for an excellent overview). This is particularly relevant when dealing with structural causes of violent conflict such as climate change, where multiple intervening factors lie between cause and effect (Gerring 2010:1506). For example, if it is suspected that climate change makes people more likely to join armed groups by decreasing future yields from agriculture, hence decreasing the opportunity costs of joining, it is (ideally) necessary to test whether former farmers actually join the armed group because of anticipation of worsening agricultural yield. By showing that (a) there is a correlation between worsening environmental conditions and the number of people joining armed groups, and (b) that those who joined armed groups did so at least in part because of the expectation of worsening agricultural yields, a strong case can be made for the assertion that climate change increases the likelihood of rebel recruitment. This can be done using both quantitative and qualitative techniques, for example through a quantitative two-stage estimation framework (Maystadt & Ecker 2014) or a qualitative process-tracing approach (De Juan 2015).

Finally, our analysis of the temporal and spatial dimensions of a climate-conflict link accentuates the importance of the quality of the data used and how these data reflect the underlying theoretical assumptions. The limitation of simple measurements of climate change and variability in quantitative studies is a recurring criticism of this literature (Salehyan 2014; Buhaug 2015); annual rainfall means or monthly temperature deviations are poor measures of long-term environmental degradation. The challenge is to design studies that can encompass long-term environmental change while still linking these changes to social outcome variables. An additional challenge concerns how to include people's movements across space in the analysis. Micro-level georeferenced data is panacea to the challenges of climate-conflict research unless the operationalisations reflect the theoretical expectations, as disaggregation may actually blur important regional patterns.

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Bold type indicates work included in the literature review, including articles not cited in the text.

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# Appendix

Table 5 Articles included in the systematic review

Reference	Aim of research	Location	Method and material (secondary sources)	Climate-related environmental conditions	Violent conflict	Findings
Rubenson, S. (1991)	To examine the occurrences of environmental stress and degradation in Ethiopia and their relation to social and political conflict.	Ethiopia	In-depth case study (secondary sources)	Environmental stress and degradation	Social and political conflict, banditry, rebellion, civil war.	Drought, locust infestation, crop failures, livestock losses, epidemics, famine and major migrations have been frequent occurrences in Ethiopia and in many instances these have led to social and political conflict, banditry, rebellion and civil war. Armed conflicts have also contributed to the severity of the environmental catastrophes.
Percival, V. & Homer-Dixon, T. (1996)	To examine the role of environmental scarcity in the Rwandan genocide.	Rwanda	In-depth case study (secondary sources)	Environmental scarcity	Genocide	Environmental scarcity did play a role in the violence in Rwanda, but the role was surprisingly limited and mediated by many other factors.
Uvin, P. (1996)	To present a multifactorial explanation of the Rwandan genocide built on political, economic and ecological factors	Rwanda	In-depth case study (secondary sources)	Agricultural production	Genocide	The genocide occurred as a result of ecological, economic and political processes. Resource scarcity was used as a political tool to entrench ethnic hatred and mobilise constituencies.
Suliman, M. (1997)	To examine how environmental change as transformed the civil war in the Sudans.	South Sudan, Sudan	In-depth case study (secondary sources)	Climatic change, rainfall, deforestation	Civil war	Persistent ecological degradation has transformed the ethnic-cultural conflict in the Sudans into a resource conflict. Ecological degradation occurred as function of large-scale mechanised farming and man-made climate change.

Hendrickson, D. et al. (1998)	To examine the complex interaction between drought, livestock raiding and famine.	Kenya (Turkana district)	In-depth case study (field work and secondary sources)	Drought	Livestock raiding	The impact of famines on pastoral livelihoods has become more severe as a result of environmental changes in combination with more intrusive external influences, notably predatory raiding practices. This has negatively affected pastoralists' ability to cope with drought.
Kahl, C.H. (1998)	To demonstrate the plausibility of the state exploitation hypothesis by examining the ethnic violence in Kenya between 1991-1993.	Kenya	In-depth case study (secondary sources)	Environmental stress	Civil strife	Violence erupted in Kenya between 1991-1993 because demographically and environmentally induced social pressures enabled political elites to exploit social grievances to incite ethnic strife as a means of staying in power.
Inselman, A.D. (2003)	To explore the history of pastoral and transhumant theory and administrative policies and actions directed toward the people of Karamoja.	Uganda (Karamoja region)	In-depth case study (interviews)	Land and water scarcity	Violent conflict involving the Karamojong	Ugandan government policies that interfere with the Karamojong's traditional system of resource management have directly or indirectly resulted in increased violent conflict as the group's mobility has been curbed.
Markakis, J. (2003)	To examine the cause of the conflict between the Afar and Ise ethnic groups on the Ethiopian-Somali border.	Ethiopian-Somali border region	In-depth case study	Drought, land and water scarcity	Violent conflict between the Afar and Ise	Clashes are more frequent during droughts. Along natural resources such as land and water, non-traditional resources, like transportation routes, contraband, services and local administrative status, have become bones of contention.
Mohammed, A. (2004)	To study why the Rezaigat camel nomads in Darfur became increasingly hostile towards neighbouring tribes.	Sudan (Southern Darfur)	In-depth case study (interviews and secondary sources)	Drought	Hostility towards neighbouring tribes by the Rezaigat camel nomads	Droughts enhanced the zero-sum nature of conflicts over pasture and water, prompting the Rezaigat to become increasingly hostile towards neighbouring tribes. This was further exacerbated by access to modern firearms and certain government policies, primarily the abolishment of the 'native administration', nationalisation of land, and government bias towards nomadic militias.

Miguel, E. (2005)	To identify the impact of drought-related income shocks on witch killings.	Tanzania (Shinyanga region)	Multivariate regression models (household surveys)	Rainfall variation	Witch killings	Extreme rainfall (droughts and floods) is strongly and positively related to large income drops and an increase in witch killings.
Assal, M.A.M (2006)	To examine the ways in which certain acts undertaken by the state aggravate traditional conflicts and take them to higher thresholds.	South Sudan, Sudan	In-depth case study (secondary sources)	Resource scarcity	Violent conflict	Violent identity politics in the Sudans originate in conflicts over resources that escalated due to certain state policies, prominently changing economic policies.
Bocchi, S. et al. (2006)	To propose tools and methodologies to analyse the state of environmental scarcity over a country.	Kenya	Geographic Information Systems (GIS) mapping. Anecdotal comparison with qualitative data.	Environmental scarcity	Violent conflict	Anecdotal evidence suggests a connection between environmental scarcity and violent conflict in areas identified as suffering from environmental scarcity.
El Zain, M. (2006)	To trace the origins of the high-intensity conflicts that have raged in the Sudans since the 1980s.	South Sudan, Sudan	In-depth case study (secondary sources)	Drought	Civil war and local conflicts	Local resource conflicts became increasingly intense and intertwined with regional conflicts as a result of the expansion of mechanised farming and recurrent droughts.
Meier, P. et al. (2007)	To examine if relative scarcity in precipitation, vegetation cover and availability of forage is associated with a higher frequency and intensity of pastoral conflict.	Ethiopia, Kenya, Uganda (border regions)	Multivariate regression models	Inter-annual rainfall variability, vegetation cover, availability of forage	Frequency and intensity of livestock raids	Organised livestock raids are more likely when the vegetation cover is thicker and groups resort to aggravating behaviour. In contrast, the likelihood of violence decreases when groups engage in reciprocal exchanges and peace initiatives.
Webersik, C. (2008)	To explore if environmental scarcity or abundance has contributed to the perpetuation of the Somali civil war.	Somalia	In-depth case study (secondary sources)	Environmental scarcity, environmental degradation	The perpetuation of the Somali civil war	The study finds that areas of resource wealth are often flash points of conflict, but that other factors, such as ethnicity, economic state in the perpetuation of war, and the fractured nature of clan relations, are perhaps even more important in sustaining violence.

Kumssa, A. et al. (2009)	To examine, within the theoretical context of human security, the causes and effects of conflict in the arid and semi-arid lands of Northern Kenya.	Kenya (northern Kenya)	In-depth case study (fieldwork, secondary sources)	Resource scarcity	Communal conflict	The search for water and green pastures has resulted in conflicts over those resources among different groups. This has been further exacerbated by the proliferation of small arms, the culture of cattle rustling, conflicts between refugees and local communities, and spillover effects of conflicts from neighbouring countries.
Leff, J. (2009)	To review the scale, consequences and responses to pastoral conflicts in Sudan, Uganda and Kenya.	Kenya, South Sudan, Sudan, Uganda	In-depth case study (key informant interviews, retrospective analysis, fieldwork)	Drought	Pastoral conflict	The factors contributing to pastoral conflicts are multidimensional and include environmental factors like drought, colonial and post-colonial policies, the commercialisation of cattle raiding, the lack of state security provisions and the proliferation of small arms.
Witsenburg, K.M. & Adano, W.R. (2009)	To explore if violent livestock raiding in northern Kenya shows any seasonality, and if so, what social response to climate change could possibly be deduced from this pattern.	Kenya (Marsabit and Moyale district)	Quantitative correlation analysis and comparative case studies	Rainfall variability	Violent conflict, livestock-related violence	The results show that the intensity of violent conflicts increases during the rainy season. While the number of livestock raiding events does not fluctuate over time, the intensity of livestock raiding increases threefold during the rainy season.
Brown, I.A. (2010)	To assess if the outbreak of conflict in Darfur was the result of competition for resources between communities.	Sudan (Western and Northern Darfur)	Remote sensing of Normalized Vegetation Index (NDVI)	Environmental scarcity	Violent conflict onset	There is no evidence in the NDVI data for a worsening of the resource situation in Western and Northern Darfur States immediately prior to the outbreak of conflict in early 2003. On the contrary, the mean NDVI increased in Western Darfur between 1981-2006.
Hundie, B. (2010)	To examine the causes and consequences of conflict between pastoral groups.	Ethiopia (Afar state)	Comparative case study (household survey, focus groups, participant observation, key informant interviews)	Drought, environmental scarcity	Pastoralist violence (armed attacks and counter attacks between different pastoral groups).	Resource scarcity, caused by recurrent drought and land confiscations by the state, is an important challenge leading to recurrent clashes among neighbouring groups.

Omolo, N.A. (2010)	To examine how livestock raiding has been transformed over the years, from a cultural practice into a predatory/commercial activity.	Kenya (Turkana district)	In-depth case study (household surveys)	Climate change and variability (vegetation cover, drought)	Livestock raiding	Climate variability and change have led to increased droughts and floods, which have resulted in the loss of animal and human lives, displacements and destruction of property, reduced pasture availability and scarcity of water. This has increased poverty and competition over scarce resources – leading to conflicts, particularly livestock raiding.
Chavunduka, C. & Bromley, D.W. (2011)	To argue that in many instances flexible boundaries among agro-pastoral communities are superior to strict demarcation.	Sudan (Southern Kordofan state)	In-depth case study (field work and secondary sources)	Drought, rainfall	Land conflicts	The decline in rainfall has contributed to land conflicts by pushing communities to migrate southwards, thereby increasing competition for land. This has been further exacerbated by oil developments, the civil war and government policy regarding traditional leadership and border demarcations.
Rowhani, P. (2011)	To improve our understanding of the impacts of climate-related environmental variability on malnutrition and the risk of conflict.	Ethiopia, Somalia, South Sudan, Sudan	Logistic regression models	Vegetation variability, land degradation	Armed conflict (inter-state, extra-state, internationalised internal armed conflict between two or more organised parties, of which at least one is the government of a state)	Armed conflicts were more likely in areas with more vegetation, while there was no significant relationship between land degradation and armed conflict.
Verhoeven, H. (2011)	To challenge the neo-Malthusian understanding of the link between climate change and societal violence in Sudan.	Sudan	In-depth case study (field work, interviews, secondary sources)	Land degradation, water scarcity, resource scarcity, salinization, soil depletion	Societal violence	The ‘climate-conflict’ discourse has been instrumentalised by Sudan’s elites as an apolitical explanation of violence that masks government practices as the main driver of conflict in Sudan.
Adano, W.R. et al. (2012)	To provide evidence of how and under what conditions natural resources contribute to cooperation or violent conflict.	Kenya (Marsabit district and Narok district)	Quantitative correlation analysis and comparative case study	Average annual and monthly rainfall, scarcity of common-pool resources, environmental scarcity	Communal violence	There was more violence in years of high rainfall and in the rainy seasons (Apr-Jun, Oct-Dec). During drought periods, pastoralists deploy social institutions that mediate agency towards cooperation and guarantee access to resources, thereby reducing violent conflict.

Adem, T.A. et al. (2012)	To examine if the frequency and intensity of livestock raids differ across different landscape features.	Kenya (Turkana, and surrounding districts)	Multivariate regression analysis	Spatial variability of rainfall, topographical features (mesa plat, valley gorge, mountain features, hill cliff, standing water, intermitting standing water, flowing water, intermittent flowing water)	Intensity and frequency of livestock-related violence	When the Turkana are the attackers, the frequency and intensity of the livestock is higher in relatively wetter areas on the plateaus and high ridges. When the Turkana are attacked, the worst violence occurs in semi-arid areas or close to dry-season water reserves. Livestock-related violence is also more frequent in areas where water is drawn from open sources.
Butler, C.K. & Gates, S. (2012)	To examine the mechanisms by which resource scarcity or abundance leads to violent conflict or peaceful relations between pastoral groups.	East Africa	Game theory (contest success function)	Changes in resource availability	Violent conflict between pastoral groups	Resource availability alone cannot adequately explain why some pastoral groups engage in conflict over resources while others do not. Instead, it is important to consider the role of property rights protection and the state's bias in protecting these rights.
Ember, C.R. et al. (2012)	To account for the temporal distribution of the outbreak and intensity of livestock raids.	Kenya (Turkana district)	Quantitative correlation analysis	Average monthly rainfall, rainfall unpredictability	Livestock-related violence that involves the Turkana as attackers or the attacked	The most intense livestock violence occurs when rain is less than normal for a typical month, a typical year, and a particular month/year combination.
O'Loughlin, J. et al. (2012)	To examine if climate variability has an effect on conflict risk in East Africa	East Africa (Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Somalia, Tanzania, Uganda)	Multivariate regression models	Precipitation variability, temperature variability	Violent conflict events	Very high temperature deviations from the long-term average increase the risk of violent conflict in East Africa, while higher precipitation than the long-term trends decreases the risk. Yet, compared with other factors, temperature and precipitation variability only makes a modest contribution in predicting conflict.
Raleigh, C. & Kniveton, D. (2012)	To account for the temporal distribution of the intensity intra-state and communal violence.	Ethiopia, Kenya, Uganda	Multivariate regression models	Monthly rainfall variability	Rebel violence intensity, communal conflict intensity	In locations that experience rebel or communal conflict events, the frequency of these events increases in periods of extreme rainfall variation, irrespective of the direction of the rainfall change.

Schilling, J. et al. (2012)	To explore why the Turkana and Pokot pastoral communities engage in violent conflict with each other.	Kenya (Turkana and West Pokot district)	Comparative case study (interviews)	Drought (hunger as motive for raiding), land scarcity (land as motive for raiding)	Violent conflict between the Turkana and Pokot	In Turkana, the majority of raiders indicated hunger and drought as their primary and secondary motives for engaging in livestock raiding. In Pokot, the majority of raiders mentioned dowry and accumulation of wealth and land as the primary and secondary motives.
Theisen, O.T. (2012)	To examine if resource scarcity causes violent conflict.	Kenya	Multivariate regression models	Annual and monthly rainfall deficiency, annual mean temperature, land pressure	Violent conflict outbreak, violent conflict intensity	Years following wetter years experience more violence than drier years. Drier years are more peaceful than wetter years.
Olsson, O. & Siba, E. (2013)	To test whether violence in Darfur is dependent on the ethnicity claim or the natural scarcity claim.	Sudan (Darfur)	Regression models	Vegetation, access to water, access to alluvial soils	Violence against civilians by the Janjaweed militia	The results indicate that the militia has been more prone to attack villages that are closer to alluvial soils. The results also show that abandoned villages were taken over by settlers after being abandoned, supporting the hypothesis that villages were attacked in part because of local resource struggles. Yet, the proportion of rebel tribes in the population was the strongest determinant of attacks.
Ember, C.R. et al. (2014)	To explore why some ethnic groups engage in violent livestock raiding in wet periods while others do so in dry periods.	Kenya (Marsabit district)	Multivariate regression models	Monthly rainfall variability by ethnic group	Livestock-related violence	Different ethnic groups have different subsistence patterns, mobility strategies, and cooperative arrangements and hence there are differences in the way they behave in the face of rainfall variability. While the Borana and (to some extent) Gabra display tendencies for more violence during wet periods, other groups generally employ violence during dry periods.
Detges, A. (2014)	To explain the spatial distribution of pastoralist violence in Northern Kenya.	Kenya (Marsabit, Isiolo, Mandera, Samburu, Turkana and Wajir country)	Multivariate regression models	Average annual rainfall	Pastoralist violence (armed clashes between pastoralist groups)	Pastoralist violence is more likely close to permanent water sources and in wetter areas where animals can be appropriated more easily.



Ide, T. et al. (2014)	To explain the spatial distribution of climate-induced violent conflict.	Kenya, Uganda	Multivariate regression models and comparative case study	Exposure and vulnerability to climate change (includes mean temperatures, mean precipitation, soil degradation)	Violent conflict	The Composite Risk Index (CRI), which includes exposure and vulnerability to climate change, is positively and robustly correlated to violent conflict. The exposure and vulnerability components are positively correlated with three of the four conflict variables.
Maystadt, J.F. & Ecker, O. (2014)	To test the hypothesis that drought fuels conflict through livestock price shocks in Somalia.	Somalia	Multivariate regression models	Temperature variability, precipitation variability, drought length	Violent conflict	An increase in temperature anomaly and drought length by one within-region standard deviation each increases the conflict likelihood by 62%. The analysis also finds support for livestock price shocks being the causal mechanism through which temperature and drought increases the risk of violent conflict.
Selby, J. & Hoffmann, C. (2014)	To propose a new model of environment-conflict relations through a qualitative historical analysis of the links between water and conflict in the Sudans.	South Sudan, Sudan	In-depth case study (field work and secondary sources)	Water availability	Intra-state conflict, communal conflict	Both intra-state and communal conflict are geographically more intimately associated with relative local environmental abundance than with scarcity. Yet, water has not been the primary driver of conflict. Instead, political economic dynamics have been the main proximate determinants of environment-related conflict.
Scheffran, J. et al. (2014)	To clarify conceptual issues by defining and comparing the concepts of violence used in previous research, and to explore a theoretical framework and potential pathways from climate change to violent conflict.	Kenya, Sudan	Comparative case study (secondary sources)	Impacts of climate change	Violent conflict	The article demonstrates the need for a systematic understanding of climate change and violent conflict. The analysis shows that climate change has contributed to violent conflict in both Kenya and Sudan, but that this is dependent on socio-economic marginalisation, access to arms, rent-seeking of non-renewable resources and geo-political forces.

De Juan, A. (2015)	To examine if longer-term changes in the sub-national distribution of water and vegetative resources contribute to explaining the spatial distribution of violence in the early phase of Darfur war.	Sudan (Darfur)	Regression models and in-depth case study	Environmental change (proxy for availability of water and vegetative resources)	Violent conflict (damaged and destroyed villages)	The results indicate a positive association between the magnitude of vegetation change between 1982-2002 and the likelihood and intensity of violence in the area. Similarly, high-level increases in climate variation are associated with a lower likelihood and intensity of violence. The qualitative analysis suggests that this is a result of increasing levels of migration, leading to more resource-related conflicts.
Linke, A.M. et al. (2015)	To clarify some of the possible linkages between environmental variability and violent conflict with a consideration toward intervening and moderating societal influences that might affect such a linkage.	Kenya (Nakuru, Uasin Gishu and Vihiga counties)	Quantitative survey	Perception of climate anomalies	Individual support for violence	There is little evidence that reported worsening of drought at local level is associated with increased support for the use of violence. Community-dialogue is associated with lower levels of support for the use of violence in areas where drought is reported to be getting worse.
Maystadt, J.F. et al. (2015)	To examine the effect of precipitation and temperature variability on violent conflict.	South Sudan, Sudan	Multivariate regression models	Temperature variability, rainfall variability	Violent conflict	A change in temperature anomalies of one standard deviation is found to increase the frequency of conflict by about 32%. Between 1997-2009, temperature variations may have affected about one quarter (26%) of violent events in the Sudans.



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