Violent Climate or Climate of Violence?
Concepts and Relations with Focus on Kenya and Sudan

Jürgen Scheffran[a], Tobias Ide[a,b] and Janpeter Schilling[a,c]

[a] *Research Group Climate Change and Security, University of Hamburg;* [b] *School of Integrated Climate System Sciences (SICSS), University of Hamburg;* [c] *International Alert, London*

Published in: International Journal of Human Rights 18 (3), p. 369-390

Addressing deficits of current research on the link between climate change and violent conflict, this article aims to contribute to a more systematic understanding of the violence concept in the context of environmental change. We present a theoretical framework and potential pathways between climate change and violence and an agent-based approach to assess the interplay between capabilities and motivations for violence and the conditions for conflicting or cooperative interactions. Acting as a "threat multiplier", climate change could exceed the adaptive capacities and undermine the livelihoods of communities. In the most affected regions the erosion of social order and state failure as well as already ongoing violent conflicts could be aggravated, leading to a spiral of violence that further dissolves societal structures. Against this background we analyse case studies in Kenya and Sudan, focusing on factors multiplying or preventing a spiral of violence. While interpastoral conflicts in northwestern Kenya result in limited numbers of casualties, the Darfur conflict has been shaped by the civil war in Sudan, involving the government, rebel forces and militias, causing significant loss of lives and destruction. The impact of climate change is less direct in Sudan than in Kenya. To avoid a spiral of violence, in both cases it is essential to reduce socio-economical marginalization, develop resource sharing mechanisms and restrain access to arms as part of long-term strategies for a sustainable and peaceful intervention to contain the adverse impacts of climate change.

Keywords: climate change; violent conflict; Sudan; Kenya

1 Introduction

In recent years there has been an increasing debate on the security risks of anthropogenic climate change.[1] Freshwater scarcity, food insecurity, more (intense) natural disasters and environmental migration[2] are being discussed as key processes that are affected by climate change and potentially relevant to the onset of violent conflict.[3] However there is no scientific consensus yet. Climatic changes are found to contribute to violent conflicts in some cases while other studies do not support such a conclusion.[4] Part of the heterogeneity can be explained by the different concepts of violence that are applied.

In this paper we first seek to clarify conceptual issues by defining and comparing the concepts of violence used in studies on climate change and violent conflict. Then we explore a theoretical framework and potential pathways from climate change to violent conflict. Here we discuss how climate change can feed into a spiral of violence in which the use of violence provokes more violence. Against this background we focus on Kenya and Sudan to give practical examples of the role of climate change in situations of reciprocal use of violence and how it could be prevented. The last section combines the key findings of the previous sections and considers how a spiral of violence fuelled by climate change can be avoided.

2 Concepts of violence in research on climate change and violent conflict

2.1 Basic concepts

Following Bonacker, a conflict can be defined as a situation in which the incompatible expectations of at least two actors meet.[5] If the differences and tensions cannot be overcome, conflicting actions generate mutual losses and escalate, pushing conflict parties towards extreme actions, such as the use of violence. While often causing severe losses, conflicts can also be a constructive force for social change.[6] In cases of undesirable conflicts, conflict resolution may help to reduce the incompatibility of the actors' expectations to pave the way for de-escalation and even cooperation. Conflict resolution requires adaptation towards common positions and mutually beneficial actions that stabilize the interaction. Whether this succeeds depends on several factors, including the governance capacity of societies to manage conflicts.

Like conflict, violence has a broad range of meanings. The World Health Organization defines violence as "the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation."[7] This definition associates the intention to apply violence with the capability to use force which usually requires some kind of arms applying a destructive mechanism. Common in conflict studies is the definition of armed conflict "as a contested incompatibility that concerns government or territory or both where the use of armed force between two parties results in at least 25 battle-related deaths. Of these two parties, at least one is the government of a state."[8] An armed conflict is a particular form of collective violence which is committed in an institutionalized manner by larger groups or by states. Among the most devastating forms of collective violence is genocide which according to the 1948 Genocide Convention means intentional acts committed "to destroy, in whole or in part, a national, ethnic, racial or religious group".[9] In contrast to behavioural violence which involves an acting subject, structural violence in the sense of Galtung is indirect and built into the societal structure, affecting the distribution of resources and life chances.[10] The post liberal tradition refers

to structural violence in broader historic contexts, ranging from the contest for land in settler colonialism[11] to today's extractive industries[12] which may have consequences similar to those of genocide.

2.2 Violent conflict and environmental change

Among the expected consequences of climate change are renewable resource scarcity (such as water, land or food) and migration in response to more frequent or intense natural disasters. These are all factors identified as potentially relevant for conflict.[13] The large majority of studies on a possible climate-conflict-nexus focus on violent conflicts within states, between groups, and in the global South. This is not surprising given the fact that violent conflicts between states are less likely to be influenced by environmental factors than intra-state ones.[14] Similarly, many locations in the global South are more vulnerable to climate change and especially prone to intergroup violence. The ignorance of individual-level violence by conflict scholars may be explained by the traditional focus of peace and conflict research on group-level conflicts. In addition, policy makers, funding agencies and the wider public tend to pay more attention to intergroup violence (at least in the global South) than to domestic violence or robbery rates. One possible explanation is that individual-level violence, in contrast to many forms of intergroup violence, is not suspected to cause large scale conflict or migration towards the global North.[15]

Studies on the link between environmental or climate change and violent conflict often do not explicitly define their concepts of conflict or violence.[2; 16] Other authors provide lists of phenomena they subsume under the term violent conflict, but they give no explanation about how these phenomena are defined or related to each other.[17]

In recent years, there has been a trend in conflict studies in general and especially in the research on violence induced by environmental or climate change to conduct large-N studies with statistical methods. Every dataset used by this strand of research is usually delivered with a codebook specifying which events of violent conflict were included based on which criteria. We reviewed 45 definitions of violence used in 39 large-N studies[18] on the connection between climatic changes, resource scarcity or natural disasters and violence in order to answer the following questions: What does violence mean? Who uses violence? Against whom is violence used? Is violence reciprocal or one-sided? The results are summarized in Table 1.

Aspect	Specification	Number of usages (n=45)
meaning of violence	intended killing of people (by arms)	38
	intended destruction of substantial property	3
	not clearly stated	5
actors of violence	state vs. armed group/civilians[1]	29
	organized group vs. organized group/civilians	9
	social group vs. social group	7
direction of violence	Reciprocal	35
	one-sided	10

Table 1: Overview of concepts of violence as used in large-N studies

As Table 1 shows, most studies investigating a possible link between environmental or climate change and violent conflict define violence as the intended, direct and organised killing of people, usually with the help of arms and in battles (38 usages). Only three studies integrate the destruction of property into their definition of violence, while no study uses the sole hurting of humans as a violence threshold or includes structural forms of violence. The majority of the studies examined requires at least one conflict party to be a state for a violent event or conflict to be recognized (29 usages). We found only nine definitions referring to violence used by organized groups and seven definitions referring to (not well-organized) social violence. Finally, violence was most often understood as a reciprocal process (35 usages), while only ten studies allowed for violence to be a one-sided process (such as massacres or genocides). The standard definition of violence in the quantitative research on climate change and violent conflict can thus be summed up as follows: *Violence is the direct, intended and reciprocal killing of people taking place between state forces and an organized non-governmental group*. This definition is strongly influenced by the definition of violence of the UCDP /PRIO armed conflict dataset[8], which was used 21 times in the studies examined, equal to nearly 50% of all usages.

The identified standard definition seems to fit also many qualitative studies. Consider, for instance, Colin Kahl, who defines his major dependent variable, civil strife, "as large scale, sustained, and organized violent conflict within a country. This includes revolution, rebellion, insurgency, civil and ethnic war, and sustained campaigns of terrorism."[19]

[1] Many of these specifications also include violence between two or more states, but this kind of violent conflict is hardly influenced by climate change.

However, while the quantitative literature so far is mainly concerned with instances of violence involving at least one state actor, there is a growing awareness that climate change is more likely to lead to small-scale communal violence without state involvement. Thus, recent case studies[20] and some large-N investigations[21] also include violence between organized armed or social groups. In addition, some qualitative studies pay attention to forms of violence which do not necessarily result in killing.[2; 22] But still, more research is necessary to address the discrepancy that climate change will more likely be associated with small-scale violent events while good data are available mainly for more visible events such as armed conflicts involving the state.

3 Conceptual framework of climate change and violent conflict

To address the complex interlinkages between climate change and different forms of violence respectively violent conflict, we now provide and discuss a conceptual framework to assess the environmental and societal conditions for the use of violence.

3.1 Environmental degradation, human security and societal stability

Given the ambiguities, uncertainties, and limitations of current research on the relationship between climate change and violent conflict, there is need for an integrative assessment that supplements quantitative empirical analysis and qualitative case studies. A promising approach is the analysis of possible complex pathways and feedbacks between climate change, natural resources, human security and societal stability.[23] Such a systemic framework not only addresses the direct interaction between the climate system and societal stability, including violent conflict, but also the impacts on natural resources and human security, which may in turn affect society and the likelihood of violent actions.

The impact of environmental change on human communities depends on their vulnerability which is a function of the exposure and sensitivity to climate change as well as the adaptive capacity that is specific for each region.[24] These factors affect human security, which is defined by Barnett and Adger as “the condition where people and communities have the capacity to manage stresses to their needs, rights, and values”.[25] The causes and factors that affect human security and determine the ability to adapt to and mitigate the effects of climate change are unevenly distributed. People who are already poor, politically marginalized or affected by violent conflicts may be more sensitive and less able to adapt to climate change-related disasters and resource scarcities, which contribute to different dimensions of human insecurity such as hunger, poverty and disease. Generally, societies with high dependence on agriculture and low levels of economic income are more dependent on natural resources and ecosystem services than those with high income who can buy food or clean water or build appropriate shelters to protect themselves from economic and

social risks caused by environmental change.[26] These asymmetries and inequalities of human insecurity are partly associated with the legacy of colonialism, capitalist globalization and neo-liberal structural reforms.[27]

If environmental change severely affects human security, this could lead to socio-economic stress, societal instability and violent conflict. When societal structures, such as states or traditional conflict mediation and resource sharing practices, are undermined, they may lose credibility and support from citizens, become weak and unable to maintain social order. Climate risks could multiply other societal problems that together could overwhelm the problem-solving capacity of societies, disrupt governments and trigger societal instability events, including a smaller number of large-scale events (such as civil wars) and a larger number of small-scale events (protests, riots, intergroup and individual violence). Climate change is therefore often predicted to be a "threat multiplier" rather than a direct cause of violent conflict.[28] Due to non-linear effects, an increase in global temperature above a certain threshold (such as 2°C) may result in disproportionate impacts and abrupt climate change. Tipping elements and cascading sequences could in the long-term overwhelm the adaptive capacity even of wealthy nations.

3.2 Conditions and dynamics of violent action

In the following, we describe a conceptual framework for the use of force and violence in terms of three factors that are of basic relevance for human action: motivation, capability, and the natural and societal context (Figure 1). We use a structural-systemic approach, being aware that each of the mechanisms is subject to subjective perspectives and societal discourses and embedded into power relations:

(1) Acts of behavioural violence require the capability to cause damage and destruction which relies on particular tools, such as arms or soldiers. The impacts of force also depend on the vulnerability of those affected by it, which is a function of the defence capabilities and the ability to recover after the use of violence. However, some insecurity always remains, for instance from unexpected surprise attacks such as suicide bombings that can overwhelm even powerful defences.

(2) Motivation is represented by the reasons and incentives why actors use violence, e.g. to pursue particular goals or prevent certain acts of others, which depends on expected gains, costs and potential losses/risks (e.g. by individual or collective violence) as well as on prevalent concepts of enemies.

(3) The natural and societal context provides the environment that supports, contains or transforms the use of individual or collective violence. In an environment of insecurity and violence, people feel threatened and pressed to acquire and use force to protect themselves and their property

from the threat of others, possibly leading to a self-stabilizing collective "climate of violence". Whether such an environment is supportive of cooperative, confrontative or even violent behaviour depends on the political-economic conditions, the dominant identity configurations, the particular class and power structures and ethnic make ups of the respective societies and how these filter environmental stresses, affect vulnerabilities, restrain human capacities and drive political responses.

Once critical thresholds of insecurity and violence have passed, a self-enforcing spiral of violence may emerge when violent acts provoke more violent acts. The conflict dynamics increasingly shape the societal context and affects both motivation (shifting the original incentives towards survival and countering opponents) and capability (increasing losses and needs for violent force). Violence can transform[29] (e.g. from intercommunal violent conflict to insurgencies and even interstate wars) and spread to neighbouring states or regions[30], e.g. through (cross-border) migration, ethnic links, natural resource flows, black markets or arms exports. Other features also become crucially important for escalation dynamics, such as rough terrain or oil reserves for insurgencies, gender norms for household violence or cultures of violence for armed struggle between different communities. Particularly prone to the development of spirals of violence are (parts of) societies that are in transition or on the edge to instability, such as fragile and failing states with social fragmentation, weak governance structures and inadequate management capacities.[31] These states cannot guarantee the core functions of government, such as law and public order, welfare, participation and basic public services (e.g. infrastructure, health and education), and the monopoly on the use of force. In consequence, the power vacuum is filled by actors such as international troops (e.g. UN missions), private security companies, terrorist groups, warlords or local militias.

Key variables and pathways of interaction between two actors are presented in Fig. 1. Here the resources and capabilities of each actor may be applied for productive purposes (creation of wealth assets) or for destructive purposes (building and use of violent force). While the former is associated with cooperative forms of interaction, including sharing and trading of goods on markets, conflictive and violent forms involve theft, raiding and battle. While actors can choose to switch from productive to destructive purposes (and vice versa) according to their motivations, collective mechanisms could drive actors into self-enforcing cycles of cooperation or cycles of violence. Insecurity tends to feed a spiral of violence where resources and capabilities are increasingly transferred into rearmament and use of violent force for attack and defence in battle, while an environment of peace, security and disarmament supports a cycle of cooperation. Changes in the natural and social environment may affect this interaction and trigger a transition between the cycles of violence and cooperation.

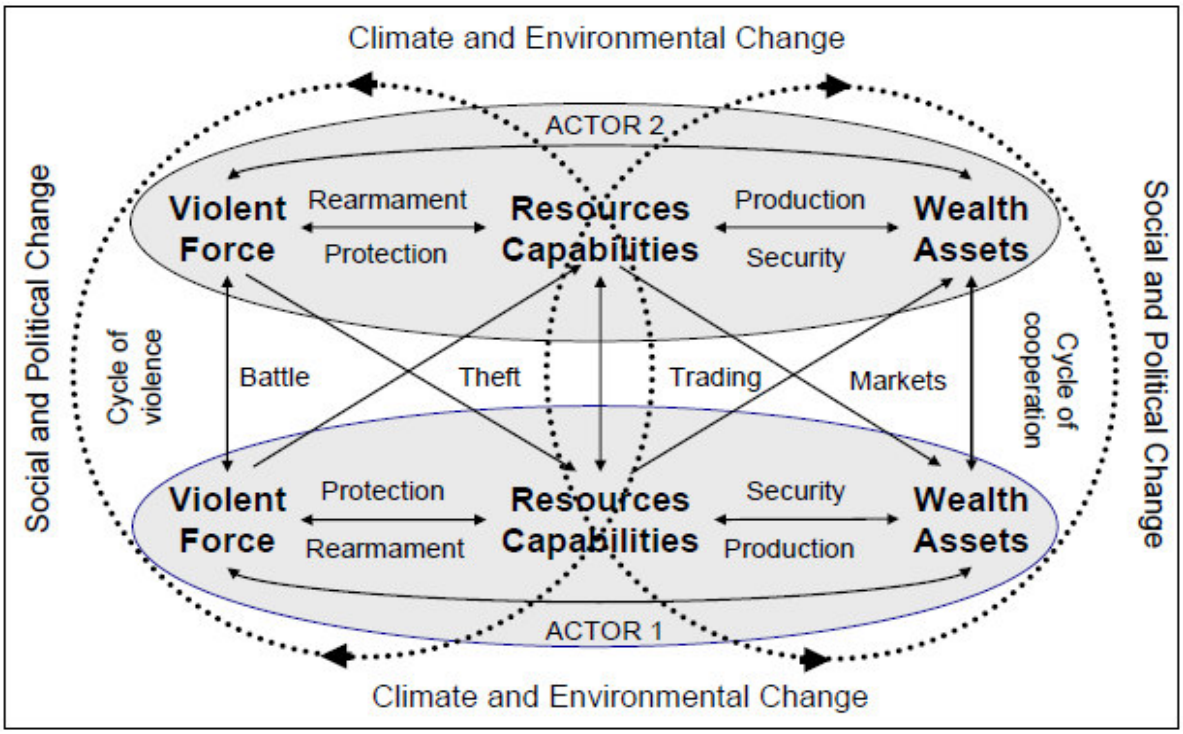

Figure 1: Framework of interaction between two actors, with key variables and pathways indicating cycles of violence and cycles of cooperation.

3.3 Possible linkages between natural resources, environmental change and violence

After introducing the systemic framework of climate-society interaction and the agent-based framework of violent interaction, in the following we discuss potential linkages connecting environmental change (in particular climate change and natural resources) to violence, which are interlinked in multiple and complex ways:

(1) Since human beings need resources for living, resource scarcity can increase the motivation to acquire or defend resources by use of violence, individually or collectively.[25; 32] This can in turn contribute to resource destruction. When people are forced to migrate, this can cause conflicts due to scarce resources or cultural differences in the receiving areas.[17]

(2) Resource scarcity and natural disasters can undermine state capacities and reduce state legitimation (due to decreasing taxes, more demand for state support etc.), thus supporting the conditions for state failure and insecurity. The erosion of social order and state failure could be aggravated, leading to a spiral of corruption, crime and violence that could involve non-state actors such as private security companies, terrorist groups and warlords.

(3) The abundance of valuable natural resources may provide an incentive to acquire these resources violently. Access to resources may in turn raise the capabilities of actors to use violence, e.g. because they enable them to buy weapons or pay soldiers.[33] It is often the

unrestrained resource demand of wealthy communities that enable this connection between natural resources and behavioural violence.

(4) Violence can serve as an instrument of political elites to enforce environmentally harmful policies. Under certain circumstances, this is countered by violent resistance of the people affected, making conflict escalation or a spiral of violence possible. The case of copper mining in Bougainville (Papua New Guinea) is illustrative here.[34]

(5) Climate change, as expressed by harsher climatic conditions and more (intense) natural disasters can disrupt established human-environment relationships to overwhelm the adaptive capacities of groups and threaten livelihood of entire communities. This may endanger human security and aggravate already challenging living conditions which can be interpreted as a form of structural violence caused by CO_2-intensive lifestyles.

(6) Strategies against climate change may cause conflicts which could lead to violent conditions. Examples are food insecurity caused by bioenergy, nuclear proliferation triggered by nuclear energy, or the struggle over the intentional manipulation of the climate system by climate engineering (violent conflict induced by climate policies).

(7) Finally, environmental change may not only contribute to structural violence but can also make societies more vulnerable to different forms of behavioural violence. Violence in turn can make societies more vulnerable to environmental change, leading to a trap from which it is difficult to escape. This double exposure of violence and environmental hazard can be observed in a number of countries with low human development.[35]

These multiple linkages between environmental change and violence may interact with each other in complex ways. The violent conflict in Afghanistan, for example, was not caused by environmental factors. However, insecurity about future resource access in times of war and land mines covering farming land lead to a rapid overexploitation of natural pistachio woods, which in turn caused deforestation, soil erosion and water scarcity. Today, the very environmental change (and livelihood insecurity accompanied by it) caused by the war make is harder to end the violent conflict.[36]

The seven violent pathways suggested above and their combination could turn into existential threats to both ecosystems and social systems. A large-scale destruction of the natural environment could result in “ecocide” which entails extensive or lasting harm to the natural environment on a massive scale.[37] This may become a precursor to the elimination of the living spaces, cultures, economies and even inhabitants of communities depending on this environment. Thus, very large-scale environmental change may have consequences similar to genocide although this is usually not an intended act, but an inadvertent (although often consciously accepted) side-effect. Whether justified or not, there are concerns that “ecocide and genocide may mutually enforce each other.”[38]

Ecocide can indirectly cause genocide not just by inducing behavioural violence but structural violence, destroying the extra-human material environment and thus underminig the foundations of societies and communities. There are several historical cases that describe the societal collapse brought on by man-made ecological destruction.[39] Recent studies take a broader view on crimes and harms affecting the environment, human and non-human life and the whole planet,[40] including industrial pollution and illegal disposal of toxic waste, the impact of military operations on landscapes, water supply, air quality and living organisms; and more generally the exploitation of the earth's resources and degradation of the environment which might have genocidal consequences, such as large famines or mass refugee movements. A frequently mentioned example for a link between environmental change and genocide is Rwanda which is not the focus of this article.[41] Some studies focus on cases of "industrial genocide" which have severe ecological and human consequences. An example are Tar Sands in northern Alberta in Canada, which pollute the environment and affect the lives of many indigenous groups by undermining their ability to hunt, trap and fish.[12] A new debate is emerging on responses for more effective and appropriate models of justice and law that consider "ecocide" as an international crime against peace and human rights.[40]

3.4 Transformation to prevent a spiral of violence

Whether climate change will fuel a cycle of environmental change, under-development and violent conflict, or whether a cycle of security, sustainability and cooperation can be achieved, depends on the human and societal responses to climate change. Strategies that reduce the vulnerability to climate change, address the underlying causes of conflict and tackle the factors encouraging conflict escalation can be effective in preventing violence. To reduce the risk of climate change-related violence, transformations to stable cooperative human-environment and human-human interactions are necessary. To succeed it is relevant how fast and adequate these transformations take place compared to the speed and intensity of climate change. Those transformations offer opportunities for constructive social change and even the resolution of conflicts if new problems can be avoided, e.g. through maladaptation.[42] Strategies that provide communities with additional viability and resilience can strengthen the social capability of people in their effective, creative and collective efforts to handle the problems of climate change as well as other problems they confront.[43] While in the end it is always the individual who chooses to use or not to use violence[44], the avoidance of violence related to climate change can be located at several levels, encompassing next to the individual persons in their various roles also local and global communities as well as state institutions.

4 Regional case studies in Africa

To investigate the conceptual framework of climate change and violence, we will discuss two case studies in Africa, each highlighting a different aspect. In northwestern Kenya the impact of precipitation patterns on violent raiding is being extensively discussed. Darfur (Sudan) has been described as one of the first areas for climate conflicts but the environment is only one of many roots of violence in the region.

4.1 Spiral of violence in northwestern Kenya

4.1.1 Background

Northwestern Kenya is a region characterized by socio-economic marginalisation, poverty and harsh climatic conditions.[45] The most viable livelihood here is pastoralism. Pastoralists from a variety of ethnic backgrounds move with their herds in search of water and pasture. Both resources and livestock itself are subject to conflicts between pastoral groups.[46] Neither these resource conflicts nor the occurrence of drought are new phenomena in northwestern Kenya.[47] However, in recent decades some conflicts have escalated while the drought frequency has increased, likely because of climate change. [48; 49] We use the violent conflicts between the ethnic groups of the Turkana of Kenya and the Pokot of Kenya and Uganda to illustrate how drought in combination with socio-economic marginalisation has fuelled the spiral of violence.

Violence in this case is used to gain or secure the control over water, pasture and livestock. It is mostly conducted in form of violent livestock thefts, called “raids” which are executed reciprocally by the male youth.[47] Periodically, the Kenyan government interferes with the raiding cycle between the Turkana and Pokot through disarmament or punishment campaigns.[50] These campaigns have in several cases led to violence between governmental forces and the concerned pastoral group. In combination with the increased drought-related resource scarcity, the hostilities create a strong perception of insecurity.[51]

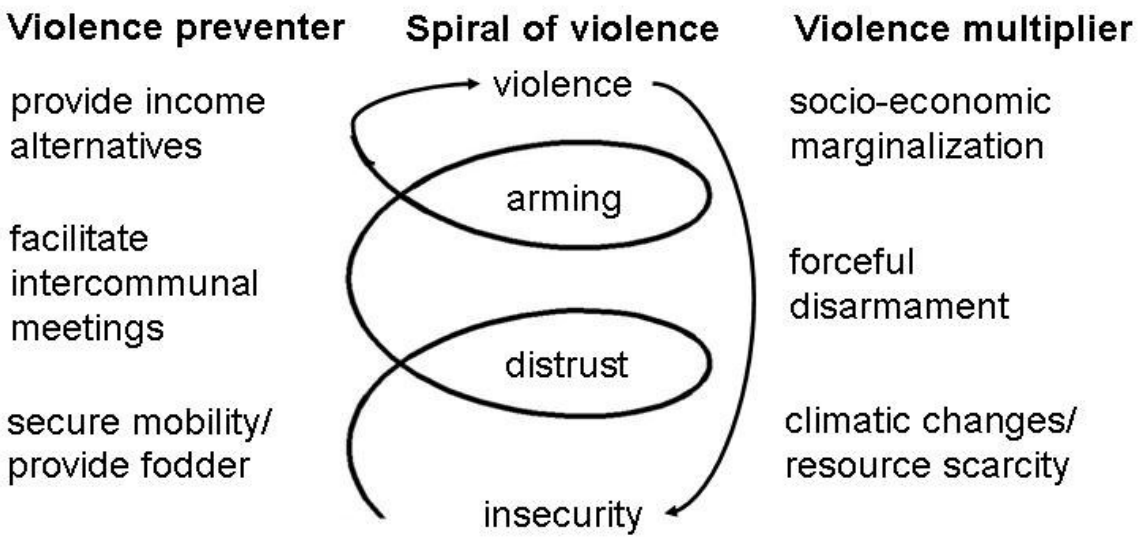

Figure 2: Spiral of violence in northwestern Kenya

4.1.2 Spiral of Violence

The insecurity can be seen as the starting point of the spiral of violence (Fig. 2). Abandonment of cooperative resource sharing, for example in the form of reciprocal grazing arrangements, which increases resource scarcity and distrust between communities, are key ingredients of the next loop.[51] Both insecurity and distrust increase the need for protection which the communities seek to satisfy through arming.[52] Full automatic weapons, primarily Ak-47s, are widely available, inexpensive and powerful.[46] They are used by their owners to defend themselves or to acquire livestock or related resources.[47] Hence, the groups have both motivation and capability needed to execute violence (see above).

So far, the government of Kenya has had very limited success in preventing or decreasing the intercommunal violence. In only 13.4% of the raids conducted between 2006 and 2009 in Turkana, the government has taken action.[53] Only 8.2% of the stolen animals were recovered. The limited number of governmental security forces in northwestern Kenya face multiple challenges. Poor road and communication infrastructure, few vehicles, and outdated equipment reduce the chance to prosecute raiders who are highly mobile and familiar with the remote and partly rough terrain. Alternatives to raiding are limited by high levels of poverty and socio-economic marginalisation.[54] Some authors have pointed out that parts of the pastoral production system in West Pokot are integrated into the wider market economy through "commercialised raids" in which livestock is stolen and then sold on the market instead of kept to restock own herds.[55] However, in Turkana there is little indication of commercialised raiding [56]. Instead, the region has started to experience the externalities of the capitalist mode of production as significant oil resources are now being exploited in Turkana.[57] Environmental degradation, loss of access to land, and interruption of

migration routes by pipelines are attributes of the "resource curse" that oil exploitation brings to pastoral areas.[58]

Apart from these socio-economic developments the water and pasture availability has decreased mainly due to the higher frequency of prolonged droughts.[49] In addition, the rainfall variability has increased which in turn decreases the reliability and predictability of water and pasture resources.[59] Climate projections for East Africa indicate that the trend of strong warming and increased precipitation variability will continue.[59] Then the multiplier factors listed on the right side of Fig. 2 may lead to a renewed start of the spiral of violence.

4.1.3 Preventing and interrupting the spiral of violence

The left side of Fig. 2 shows options to prevent a "climate of violence" in northwestern Kenya. As identified above, the key causes of pastoral insecurity are hostile interactions with other pastoral groups and resource scarcity which varies with climatic conditions.[54] In addition, structural factors play a role. Commercialisation of livestock raiding partly drives the motivation of the Pokot to use violence as a means to increase wealth while for the Turkana oil exploitation is likely to aggravate resource scarcity and limit mobility. This is critical as mobility is the central element of pastoralism. So far, free and safe movement of pastoralists within Kenya and across international borders is not guaranteed. Turkana pastoralists have reported that they are being stopped and harassed by Ugandan security forces when they enter the country in search of water and pasture.[54] Here, international agreements between Kenya and its northern neighbours Uganda, South Sudan, Ethiopia and Somalia are needed. Attempts in this direction have been made but measures have not been implemented on the ground yet.[60] Secure cross border movement and a limitation of the oil exploitation would take pressure off the inner Kenyan conflict between the Turkana and the Pokot but it would most likely not solve it. To decrease conflicts about water and pasture during periods of resource scarcity, especially during droughts, governmental and non-governmental organisations (NGOs) could provide not only food relief, but also fodder subsidies and veterinarian services in order to strengthen the resilience of pastoral communities and buffer drought related shocks.

When distrust between communities has already built up, it is most promising to undertake measures geared to improve relationships. Intercommunal (peace) meetings can be useful here. For instance, a peace treaty between the Turkana and the Matheniko of Uganda has worked for the past 40 year. However, the peace meetings between the Turkana and the Pokot which were mostly facilitated by NGOs showed little success so far. One reason for the limited success maybe that mostly elders and chiefs attend the peace meetings while the youth as the actual conflict actor is neglected.[51] To provide other options of income can decrease the youth's motivation to engage in raiding and violence. Investments in the poor educational infrastructure would offer the youth the

perspective to find a job in other economic sectors. In the short run, however, children and youth attending schools are missing as labor force to look after the herds and to provide security for the community.

In summary, the spiral of violence between the Turkana and the Pokot originates from a strong perception of insecurity in both communities which is fuelled by a variety of human and climate drivers. On the other side, several potential violence preventers exist. If properly and fully utilised these preventers have the potential to break and prevent the spiral of violence.

4.2 Violent climate in Darfur, Sudan

4.2.1 Background

For several decades Sudan has been devastated by political instability and violent conflict, aggravated by national power games, regional fights and global geopolitics (e.g. related to oil and terrorism).[61] On the domestic level, major drivers have been the attempt to control power and resources by an Arab ruling elite, and the marginalization and exclusion of peripheral regions such as Darfur which contributed to national disintegration and secession. The second civil war between North and South started in 1983, while violence in Darfur escalated in 2003.

Natural resource problems and environmental change have contributed to the both conflicts. The competition over oil and gas resources was a driving force in the North-South civil war as well as in the violent conflict in Darfur and remains a source of political tension until today. The cold war between the US and the Soviet Union played a major role as does now the competition between the US and China over oil, notably regarding the production of oil pipe-lines and investments in Southern Sudan.

Environmental degradation caused by large-scale resource-related development projects, such as the Jonglei canal, also contributed to tensions which stimulated the North-South conflict. The continued degradation of rangelands in the northern Sahel zone, related to several severe droughts in the 1980s, increases the competition over resources between pastoralists groups and sedentary farmers. The Darfur region has been controversially discussed as an example of how climate impacts may or may not interfere with security. The environmental drivers and preventers in the resulting spiral of violence in Darfur are discussed in the following (Figure 3).

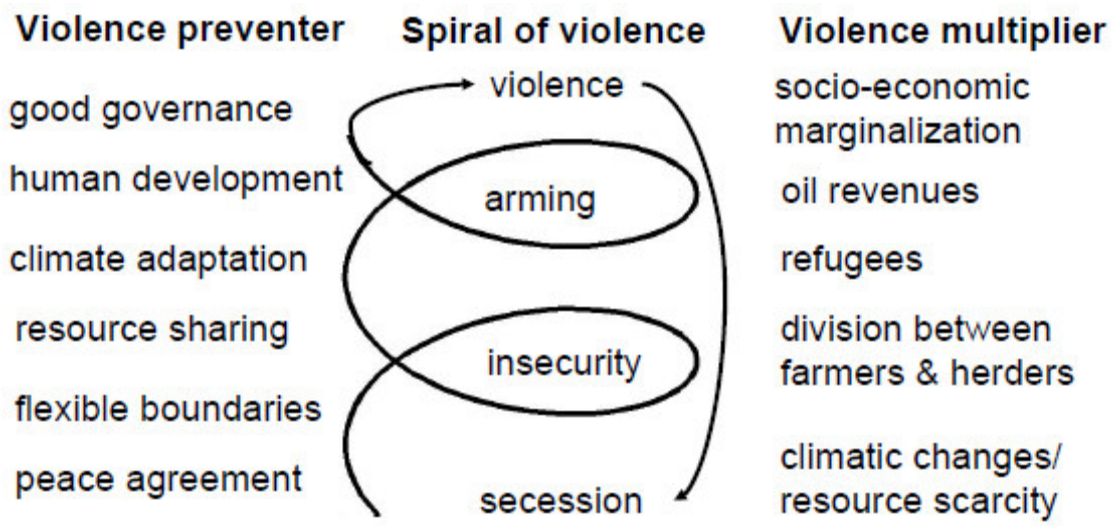

Figure 3: Spiral of violence in Darfur, Sudan

4.2.2 Drivers in the spiral of violence

The conflict constellation in Darfur is highly complex, with a number of destabilizing factors and interactions that mutually enforce each other. In recent decades, average temperature increased, rainfall significantly declined, and the number of droughts increased, possibly shifting the boundary between semi-desert and desert.[62] These trends are likely to continue and combine with population pressure, unsustainable land exploitations and deforestation to diminish agricultural productivity, aggravate food insecurity and expand diseases like malaria. Although Sudan has substantial freshwater resources, including almost two-thirds of the Nile basin and considerable groundwater reserves, due to mismanagement and inadequate investments the access to safe drinking water has declined, contributing to bad health and sanitation conditions.[63]

Increasingly nomadic groups from the North have moved southward in the dry season in search of water and grazing for their cattle, adding to the pressure on scarce resources in the areas of destination and increasing tension with settled farmers.[64] The expansion of rainfed mechanized farming systems deprived nomadic herders of much of their traditional migration routes and expropriated traditional smallholder farmers from their land, leading to severe conflicts and boundary disputes.[65] Traditionally, differences over land use were resolved by negotiation among tribal leaders, but the government's attempt to establish new administrative structures weakened the established tribal system.[66]

This already critical constellation overlapped with the conflict between the Khartoum government, supported by Janjaweed and other militias, and the Sudan People's Liberation Army/Movement (SLA/M). While the predominately Arab government headed for the exploitation of the rich oil resources of Darfur, the mostly African rebel forces protested against the inadequate compensation and the socio-economic marginalization of the region in general. The government

began to frame the conflict as a struggle between "African" settled farmers and "Arabic" nomadic pastoralists, in spite of the fact that both were indeed very heterogeneous groups. It thus transformed already existing, resource-related tensions into (perceptions of) an identity conflict, thus allying with (and supporting) the pastoralists in order to eliminate the supposed alliance of rebels and farmers.[67] By combining these two conflicts, it increased the spiral of violence in Darfur which was also fuelled by the flow of arms into the region. The resulting acts of evictions, killings, destructions and abuses further increases the already prevailing insecurity and created a general climate of violence which involved genocidal acts. The high population density in Darfur's refugee camps, in turn, created further environmental and health problems, e.g. infectious diseases and deforestation around the camps due to excessive fuelwood collection.[68] However, the role of climate change as a threat multiplier or even cause of the war in Darfur remains disputed. While some conclude that Darfur is a "tragic example of the social breakdown that can result from ecological collapse"[62], other studies warn of the "danger of oversimplifying Darfur"[69] and criticize that blaming climate change could distract from the political causes of the conflict.[70] Altogether, conflicts are caused by a multiplicity of factors, where environmental and political factors represent different and sometimes interconnected dimensions.

4.2.3 Preventing and interrupting the spiral of violence

Pending the future avoidance of military action between North and South Sudan, one lesson that can be drawn from the Darfur case is that climate change adaptation should be integrated into development and also post-conflict reconstruction efforts. Possible measures include a diversification of the (predominately agricultural) economy, improved water resource management or a more effective early warning system for disasters like droughts.[63] A key challenge in this context is to develop a stable system for rural land tenure which is adaptive to changing environmental conditions, addressing long-standing boundary disputes between communities of farmers and pastoralists.

Accountability and transparency of private sector and government decision making have to be increased, especially concerning large investments in the energy, water and agricultural sector. Resource use needs to generate considerable benefits in the region it takes place, especially with regard to livelihood security, health and education. [63] The weak institutional structures for environmental governance could be improved to overcome the deficits in funds and staff and the lack of enforcement of environmental legislation, building on the Comprehensive Peace Agreement and the Sudan Multi-Donor Trust Funds which coordinate the reconstruction and development needs of North and South Sudan.

Involvement of international organizations can support national initiatives in Sudan to contain the multiple factors driving the spiral of violence. Organizations like UNEP, the European Commission or the Nile Basin Initiative are encouraged to continue the dialogue with Sudanese authorities to identify joint initiatives for environmental and resource management to support peace building and development in Sudan.[63] They could provide a frame for an open and regular dialogue on Nile waters.

5 Conclusion: Integration and policy implications

This article demonstrates the need for a broad and systematic understanding of the climate-conflict-violence nexus and its central concepts. Based on the analysis of the mainly quantitative literature, we showed some blind spots of the current research on the link between climate change and violence. We then presented a theoretical framework and potential pathways between climate change and violent conflict which provides a basis for more systematic research. To understand the role of environmental factors in emerging spirals of violence, an agent-based approach is applied to assess the dynamic interaction between conflict parties and the conditions for conflicting or cooperative interactions.

Particular attention is paid to the concept of climate change as a possible "threat multiplier", exceeding the adaptive capacities of communities and undermining their livelihoods. If actors react with violent strategies to secure or acquire resources, this could lead to insecurity and increased threat perceptions, driving a security dilemma that increasingly diverts resources into the spiral of violence. In the most affected states the erosion of social order and state failure as well as already ongoing violent conflicts could be aggravated, leading to a cycle of corruption, crime and behavioural violence that further dissolves state structures.

Against this background we analyse case studies in Kenya and Sudan, focusing on factors multiplying or preventing a spiral of violence. While we analysed an interpastoral conflict with limited number of deaths in Kenya, the Sudan study represents a civil war between (state-controlled) militias, rebel forces and local people who have experienced tremendous numbers of casualties and refugees. While socio-economic marginalization and access to arms are relevant in both cases, rent seeking of non-renewable resources (mainly oil) and geo-political forces are stronger motives in Sudan. Here, the impact of climate change is also less direct than in the case of Kenya. In both cases, it is essential to reduce political and economic marginalization, develop resource sharing mechanisms and maintain mobility for pastoralists. For Sudan this is particularly challenging as Darfur is a strongly marginalized region and the devastating war allows for little development or adaptation measures.

To avoid climate-related violence in the future it is important to develop an integrated framework and long-term strategies for a sustainable and peaceful mitigation of and adaptation to climate change. The following strategies can be suggested to support a transition to a more sustainable society and prevent instances of climate change-related behavioural as well as structural violence:

- Implementation of ambitious climate change mitigation strategies to limit the rise of the global mean temperature and its knock-on effects on resource availability and structural violence. Foremost, mitigation means to transfer the basis of capitalism and globalisation from a carbon-intensive energy system to one composed of renewable energies such as wind, solar and hydropower.
- New capabilities should be developed to manage disasters, including emergency planning and decision-making structures. Global information systems for early warning could help with timely responses to extreme events.
- Adaptation strategies allow societies to develop technology, physical, human and social capital to sustain human livelihood under changing climatic conditions, e.g. by utilising natural resources more efficiently, growing and producing new types of natural resources, and providing sustainable energy supply.
- Human migration is an adaptive response to climate change that is not simply a threat, but could also offer opportunities.[71] Migrant networks can facilitate the exchange of knowledge, income and other resources across regions to strengthen adaptive capacities and resilience against climate change.[72]
- Regional security concepts would reduce the motivation to use violence by crisis prevention, conflict resolution and common security to stabilize fragile and weak states threatened by climate change. This is accompanied by mechanisms to restrain violent forces in conflicts by arms control, non-proliferation and disarmament.
- Innovative social mechanisms and institutional processes, including participative concepts, stakeholder dialogues, mediation, and adaptive governance, support people in regions affected by climate change in their creative efforts for protection of livelihoods, joint risk management and fair sharing of resources.
- Analysis of the drivers behind the economic determinants and geopolitical forces that shape globalisation and government responses to climate change, including the rise of neo-liberalism and the ignorance of traditional institutions at the local level, that influence the feasibility of all recommendations and strategies to deal with climate change..

Acknowledgements

This research was partially founded by the German Environmental Foundation (DBU) and the Cluster of Excellence "Integrated Climate System Analysis and Prediction – CliSAP" (EXC177), University of Hamburg, funded by the German Science Foundation (DFG). We thank Jürgen Zimmerer and two anonymous reviewers for their valuable comments.

References

1. For a definition see the glossary of the IPCC (www.ipcc.ch/publications_and_data/ar4/wg1/en/annex1sglossary-a-d.html): "Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are most often surface variables such as temperature, precipitation and wind." "Climate change refers to 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. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use."
2. WBGU (German Advisory Council on Global Change), *World in transition - climate change as a security risk* (London: Earthscan, 2008).
3. Jürgen Scheffran, Michael Brzoska, Hans Günter Brauch, Peter Michael Link and Janpeter Schilling (ed.), *Climate change, human security and violent conflict: challenges for societal stability* (Berlin: Springer, 2012); Hans Günter Brauch,'Securitzing global environmental change', in *Facing global environmental change: environmental, human, energy, food, health and water security concepts*, ed. Hans Günter Brauch, Úrsula Oswald Spring, John Grin, Czeslaw Mesjasz, Patricia Kameri-Mbote, Navnita Chadha Behera, Béchir Chourou and Heinz Krummenacher (Berlin, Heidelberg, New York: Springer, 2009), 65-102; Jürgen Scheffran and Antonella Battaglini, 'Climate and conflicts: the security risks of global warming', *Regional Environmental Change* 11 (2011): S27-S39.
4. Jürgen Scheffran, Michael Brzoska, Jasmin Kominek, P. Michael Link and Janpeter Schilling, 'Climate change and violent conflict', *Science* 336 (2012): 869-871; Nils Petter Gleditsch, 'Special issue on climate change and conflict', *Journal of Peace Research* 49 (2012): 3-257.
5. Thorsten Bonacker,'Konfliktttheorien', in *Handbuch Soziologische Theorien*, ed. Georg Kneer and Markus Schroer (Wiesbaden: VS-Verlag, 2009), 179-197.
6. Douglas P. Fry and Kay Björkqvist, *Cultural variation in conflict resolution: Alternatives to violence* (Mahwah: Lawrence Erlbaum Publishers, 1997).
7. Etienne Krug, Linda Dahlberg, James Mercy, Anthony Zwi and Rafael Lozano, *World report on violence and health* (Geneva: World Health Organization, 2002).
8. Nils Petter Gleditsch, Peter Wallensteen, Mikael Eriksson, Margareta Sollenberg and Håvard Strand, 'Armed Conflict 1946-2001: A New Dataset', *Journal of Peace Research* 39 (2002): 615-637.
9. U.N. General Assembly, 'Convention on the Prevention and Punishment of the Crime of Genocide', http://www.historyplace.com/worldhistory/genocide/genocide-convention.htm.
10. John Galtung, 'Violence, Peace, and Peace Research', *Journal of Peace Resarch* 6 (1969): 167-191.
11. Patrick Wolfe, 'Settler colonialism and the elimination of the native', *Journal of Genocide Research* 8 (2006): 387-409.

12. Jennifer Huseman and Damien Short, 'A slow industrial genocide: tar sands and the indigenous peoples of northern Alberta', *The International Journal of Human Rights* 16 (2012): 216-237.
13. Ole Magnus Theisen, Nils Petter Gleditsch and Halvard Buhaug, 'Is climate change a driver of armed conflict?', *Climatic Change* 117 (2013): 613-625; Jürgen Scheffran and Antonella Battaglini, 'Climate and conflicts: the security risks of global warming', *Regional Environmental Change* 11 (2011): S27-S39.
14. Jon Barnett, 'Security and climate change', *Global Environmental Change-Human and Policy Dimensions* 13 (2003): 7-17; Thomas Homer-Dixon, 'Environmental Scarcities and Violent Conflict - Evidence from Cases', *International Security* 19 (1994): 5-40.
15. Betsy Hartmann, 'Rethinking climate refugees and climate conflict: Rhetoric, reality and the politics of policy discourse', *Journal of International Development* 22 (2010): 233-246; Cord Jakobeit and Chris Methmann,''Climate Refugees' as Dawning Catastrophe? A Critique of the Dominant Quest for Numbers', in *Climate Change, Human Security and Violent Conflict: Challenges for Societal Stability*, ed. Jürgen Scheffran, Michael Brzoska, Hans Günter Brauch, Peter Michael Link and Janpeter Schilling (Berlin: Springer, 2012), 301-314.
16. Günther Bächler, 'Why Environmental Transformations Causes Violence: A Synthesis', *Environmental Change and Security Project Report* 4 (1998): 24-44; Oli Brown, Anne Hammill and Robert McLeman, 'Climate change as the 'new' security threat: implications for Africa', *International Affairs* 83 (2007): 1141-1154; Idean Salehyan, 'From climate change to conflict? No consensus yet', *Journal of Peace Research* 45 (2008): 315-326.
17. Rafael Reuveny, 'Climate change-induced migration and violent conflict', *Political Geography* 26 (2007): 656-673.
18. See appendix I for an overview.
19. Colin H. Kahl, *States, scarcity, and civil strife in the developing world* (Princeton, New Jersey: Princeton University Press, 2006).
20. Janpeter Schilling, Francis Opiyo and Jürgen Scheffran, 'Raiding pastoral livelihoods: motives and effects of violent conflict in North-Eastern Kenya', *Pastoralism* 2 (2012): 1-16; Wario Adano, Ton Dietz, Karen M. Witsenburg and Fred Zaal, 'Climate change, violent conflict and local institutions in Kenya's dryland', *Journal of Peace Resarch* 49 (2012): 65-80.
21. Hanne Fjelde and Nina von Uexkull, 'Climate triggers: Rainfall anomalies, vulnerability and communal conflict in Sub-Saharan Africa', *Political Geography* 31 (2012): 444-453; Ole Magnus Theisen, 'Climate clashes? Weather variability, land pressure, and organized violence in Kenya, 1989-2004', *Journal of Peace Research* 49 (2012): 81-96.
22. John O´Loughlin, Frank Witmer, Andrew Linke, Arlene Laing, Andrew Gettelman and Jimy Dudhia, 'Climate variability and conflict risk in East Africa, 1990-2009', *PNAS* 109 (2012): 18344-18349.
23. Jürgen Scheffran, P. Michael Link and Janpeter Schilling,'Theories and models of climate-security interaction: framework and application to a climate hot spot in North Africa', in *Climate change, human security and violent conflict*, ed. Jürgen Scheffran, Hans Günter Brauch, Michael Brzoska, P. Michael Link and Janpeter Schilling (Berlin, Heidelberg: Springer, 2012), 91-131.
24. IPCC (Intergovernmental Panel on Climate Change), *Climate change 2007: climate change impacts, adaptation and vulnerability* (Geneva: Cambridge University Press, 2007); Hans-Martin Füssel, 'How inequitable is the global distribution of responsibility, capability, and vulnerability to climate change: A comprehensive indicator-based assessment', *Global Environmental Change* 20 (2011): 597-611.
25. Jon Barnett and W. Neil Adger, 'Climate change, human security and violent conflict', *Political Geography* 26 (2007): 639-655.

26. D. H. Smith,'Poverty-Environment Linkages and their Implications for Security', in *Environmental Change and Human Security: Recognizing and Acting on Hazard Impacts*, ed. P.H. Liotta, David A. Mouat, William G. Kepner and Judith M. Lancaster (Dordrecht: Springer, 2008), 327-340.
27. Nancy Lee Peluso and Michael Watts,'Violent Environments', in *Violent Environments*, ed. Nancy Lee Peluso and Michael Watts (Ithaca, London: Cornell University Press, 2001), 3-38.
28. See for instance: CNA, *National security and the threat of climate change* (Alexandria: CNA, 2007); European Commission, *Climate change and international security: Paper from the high representative and the European Commission to the European Council* (Brussels: European Commission, 2008).
29. Nicholas Sambanis, 'Using Case Studies to Expand Economic Models of Civil War', *Perspectives on Politics* 2 (2004): 259-279.
30. Sebastian Schutte and Nils B. Weidmann, 'Diffusion Patterns of Violence in Civil Wars', *Political Geography* 30 (2011): 143-152.
31. Jennifer Milliken and Keith Krause,'State failure, state collapse and state reconstruction: concepts, lessons, and strategies', in *State Failure, Collapse and Reconstruction*, ed. Jennifer Milliken (London: Blackwell, 2003), 1-24; Ulrich Schneckener,'States at Risk - zur Analyse fragiler Staatlichkeit', in *States at Risk*, ed. Ulrich Schneckener (Berlin: Stiftung Wissenschaft und Frieden, 2004), 5-28; H. Starr, 'Failed States, Special Issue', *Conflict Management and Peace Science* 25 (2008):
32. Thomas Homer-Dixon, *Environmental scarcity and violence* (Princeton: Princeton University Press, 1999).
33. Philippe Le Billon, 'The Political Ecology of War: Natural Resources and Armed Conflicts', *Political Geography* 20 (2001): 561-584.
34. Michael Renner, *The Anatomy of Resource Wars* (Washington D.C.: Worldwatch, , 2002).
35. Jürgen Scheffran, Michael Brzoska, Jasmin Kominek, Michael Link and Janpeter Schilling, *Past and future research on climate change and violent conflict* (Hamburg: University of Hamburg, Research Group Climate Change and Security, 2012).
36. UNEP (United National Environment Programme), *From Conflict to Peacebuilding: The Role of Natural Resources and the Environment* (Nairobi: United Nations Environmental Programme, 2009).
37. http://www.thisisecoside.com (07/08/2013).
38. Charles Eisenstein, *The Ascent of Humanity* (Harrisburg: Panenthea Productions, 2007).
39. Jared Diamond, *How Societies Choose to Fail or Succeed* (New York: Penguin, 2011).
40. Polly Higgins, Damien Short and Nigel South, 'Protecting the planet: a proposal for a law of ecocide', *Crime, Law and Social Change* 59 (2013): 251-266.
41. Stephen Brosha, 'The Environment and Conflict in the Rwandan Genocide', *Atlantic International Studies Journal* 3 (2006): ; Vadi Moodley, Alphonse Gahima and Suveshnee Munien, 'Environmental causes and impacts of the genocide in Rwanda: Case studies of the towns of Butare and Cyangugu', *African Journal of Conflict Resolution* 10 (2010):
42. Nicole Harari and Jesse Roseman, *Environmental Peacebuilding, Theory and Practice: A Case Study of the Good Water Neighbours Project and In Depth Analysis of the Wadi Fukin/Tzur Hadassah Communities* (Amman/Bethlehem/Tel Aviv: Friends of the Earth Middle East, 2008).
43. W. Neil Adger, 'Social Capital, Collective Action, and Adaptation to Climate Change', *Economic Geography* 79 (2003): 387-404.
44. Wolfgang Sofsky, *Zeiten des Schreckens: Amok, Terror, Krieg* (Frankfurt/Main: S. Fischer, 2002).
45. GoK (Government of Kenya), *National policy for the sustainable development of arid and semi arid lands* (Nairobi: Government of Kenya, 2007).

46. Kennedy Mkutu, *Guns and governance in the Rift Valley - pastoralist conflict and small arms* (Bloomington: Indiana University Press, 2008).
47. David Eaton, *Violence, revenge and the history of cattle raiding along the Kenya-Uganda border* (Halifax: Dalhousie University, 2008).
48. UNDP (United Nations Development Programme), *Drought and potential conflict scenarios in northern Kenya and other arid lands: a situational report* (Nairobi: UNDP, 2011).
49. Andrew Mude, Christopher B. Barrett, Michael R. Carter, Sommarat Chantarat, Munenobu Ikegami and John McPeak, *Index based livestock insurance for northern Kenya's arid and semi-arid lands: the Marsabit pilot* (Nairobi: International Livestock Research Institute, 2010).
50. Manasseh Wepundi, James Ndung'u and Simon Rynn, *Lessons from the frontiers - civilian disarmament in Kenya and Uganda* (Nairobi: Saferworld, 2011).
51. Janpeter Schilling, Francis Opiyo and Jürgen Scheffran, 'Raiding pastoral livelihoods: motives and effects of violent conflict in northwestern Kenya', *Pastoralism* submitted (2012):
52. Kennedy Mkutu, 'Complexities of livestock raiding in Karamoja', *Nomadic Peoples* 14 (2010): 87-105; George Kaimba, Bernard Njehia and Abdi Guliye, 'Effects of cattle rustling and household characteristics on migration decisions and herd size amongst pastoralists in Baringo district, Kenya', *Pastoralism: Research, Policy and Practice* 1 (2011): 1-16.
53. TUPADO (Turkana Pastoralist Organisation), *Turkana pastoralist organisation incident register 2000-2010* XXX.
54. Janpeter Schilling, *On Rains, Raids and Relations: A Multimethod Approach to Climate Change, Vulnerability, Adaptation and Violent Conflict in Northern Africa and Kenya* (Hamburg: PhD thesis, 2012).
55. David Eaton, 'The Rise of the 'Traider': the Commercialization of Raiding in Karamoja', *Nomadic Peoples* 14 (2010): 106-122; Saverio Krätli and Jeremy Swift, *Understanding and managing pastoral conflict in Kenya* (Sussex: University of Sussex, 2003); Kennedy Agade Mkutu, 'Complexities of Livestock Raiding in Karamoja', *Nomadic Peoples* 14 (2010): 87-105.
56. Janpeter Schilling, Francis Opiyo and Jürgen Scheffran, 'Raiding Pastoral Livelihoods: Motives and Effects of Violent Conflict in North-western Kenya', *Pastoralism* 2 (2012): 1-16.
57. http://www.tullowoil.com/index.asp?pageid=432 (2 November 2012).
58. Sara Pantuliano, 'Oil, land and conflict: the decline of Misseriyya pastoralism in Sudan', *Review of African Political Economy* 37 (2010): 7-23.
59. Carol McSweeney, Mark New and Gil Lizcano, 'UNDP climate change country profiles - Kenya', http://country-profiles.geog.ox.ac.uk/.
60. United Nations Office for the Coordination of Humanitarian Affairs UNOCHA, 'Security in mobility', http://ochaonline.un.org/kenya/Advocacy/SecurityinMobility/tabid/6735/language/en-US/Default.aspx.
61. Charles Chavunduka and Daniel W. Bromley, 'Climate, carbon, civil war and flexible boundaries: Sudan's contested landscape', *Land Use Policy* 28 (2011): 907-916.
62. UNEP (United Nations Environment Programme), *Sudan post-conflict environmental assessment* (Nairobi: United Nations Environment Programme, 2007); Ian A. Brown, 'Assessing eco-scarcity as a cause of the outbreak of conflict in Darfur: a remote sensing approach', *International Journal of Remote Sensing*, 31:10 (2010): 2513-2520.
63. Dahlberg, *Sudan Environmental Policy Brief* (Gothenburg: Gothenburg University, Environmental Economic Unit, 2007).
64. International Commission of Inquiry on Darfur, *Report of the International Commission of Inquiry on Darfur to the United Nations Secretary-General* (Geneva: UN, 2005).

65. Alex de Waal and Y. Ajawin (ed.), *Facing Genocide: The Nuba of Sudan* (London: African Rights, 1995); Abdelmoneim Hashim Elnagheeb and Daniel W. Bromley, 'Rainfed mechanized farming and deforestation in central Sudan', *Environmental and Resource Economics* 2 (1992): 359-371; M. Suliman, 'Civil war in the Sudan: from ethnic to ecological conflict', *The Ecologist* 23 (1993): 104-109.
66. B. Swallow and D. Bromley, 'Institutions, governance and incentives in common property regimes for African rangelands', *Environmental and Resource Economics* 6 (1995): 99-118.
67. Julie Flint and Alex de Waal, *Darfur: a new history of a long war* (London/New York: Zed Books, 2008).
68. Alex de Waal, *Sudan: International Dimensions to the State and its Crisis* (London: Crisis States Research Centre, 2007); Khalid Y. Khalafalla, 'Der Konflikt in Darfur', *Aus Politik und Zeitgeschichte* 2005 (2005): 40-46.
69. Declan Butler, 'Darfur's climate roots challenged', *Nature* 447 (2007): 1038.
70. Harry Verhoeven, 'Climate Change, Conflict and Development in Sudan: Global Neo-Malthusian Narratives and Local Power Struggles', *Development and Change* 42 (2011): 679-707; Marcel Leroy, *Environment and Conflict in Africa - Reflections on Darfur* (Addis Ababa, Ethiopia: University for Peace, 2009).
71. R. Black, D. Kniveton and K. Schmidt-Verkerk, 'Migration and climate change: towards an integrated assessment of sensitivity', *Environment and Planning A* 43 (2011): 431-450.
72. Jürgen Scheffran, Elina Marmer and Papa Sow, 'Migration as a contribution to resilience and innovation in climate adaptation: Social networks and co-development in Northwest Africa', *Applied Geography* 33 (2012): 119-127.