Climate Diplomacy

REPORT

CLIMATE AND CONFLICT: REVIEWING THE STATISTICAL EVIDENCE

A summary for policy-makers

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CLIMATE AND CONFLICT: REVIEWING THE STATISTICAL EVIDENCE

A summary for policy-makers

EXECUTIVE SUMMARY

A growing number of studies analysing the statistical relationship between climate change and violent conflict have appeared in recent years. Whilst this research offers a comprehensive and systematic assessment of emerging climate-security risks, its results remain ambiguous and are often misinterpreted. This is all the more serious as quantitative evidence dominates current discussions on the security implications of climate change and therefore has a major bearing on policy-making. In response to this problem and in order to help non-expert readers navigate the rapidly growing quantitative literature on climate and conflict, this paper provides a brief overview of this research, discusses its main findings and draws key lessons for policymakers.

- Overall, quantitative studies on the relationship between climate and conflict have produced mixed evidence. Yet the absence of clear evidence does not imply evidence of the absence of a strong link between climate adversity and political fragility.

- Quantitative climate-conflict analysis is not a uniform body of research. Studies use a wide range of indicators and come to very different conclusions. It is therefore important to avoid sweeping generalisations and instead focus more specifically on where, when and how particular climate-conflict risks are likely to emerge in order to design appropriate policy responses.

- Where it emerges, the relationship between climate and conflict is mediated by social and economic factors. Preliminary evidence suggests that declining rural incomes, in particular, play a key role in connecting climatic shocks and conflict risk in some countries. Hence, efforts to help rural communities in these countries to adapt to changing climatic conditions can play an important role in preventing emerging climate-security risks.

- Context matters. Violence in connection with climatic extremes is more likely to occur in places where institutions are less effective, people are excluded from power, and essential services are difficult to obtain. Efforts to prevent climate-security risks therefore need to target countries and regions where such conditions prevail. Priority areas include the Sahel, East Africa and the Middle East, but also parts of Central and South-East Asia.

- Like any scientific method, quantitative analyses also have their limitations. Overcoming these will not only depend on better data and more sophisticated statistical models. First and foremost it will require a sober-minded view of quantitative climate-conflict analyses and systematic cross-evaluation of statistical findings with qualitative data, such as field work evidence and knowledge from expert practitioners.

INTRODUCTION

Quantitative analyses represent a significant proportion of climate-conflict research and thus a key source of information for policy-makers. A recent survey estimated that quantitative analyses make up nearly 60 % of peer-reviewed articles on climate and conflict published in major research journals since 2007 *(Ide 2017)*. The same survey also notes a bias towards statistical analyses in climate-conflict research, with qualitative research methods often being seen as 'mere supportive tools' *(Ide 2017:2)*. This means that statistical analyses form a major part of the scientific evidence used to discuss and predict the possible security implications of climate change.

Yet the findings of these studies are often misunderstood, leading to misconceptions about the relationship between climate and conflict, and in the worst cases to flawed policies. On the one hand, there is the tendency to oversell the findings of large-N analyses and falsely advertise them as simple answers to complex questions. Casual readers of quantitative research literature – and this does not only pertain to the literature on climate and conflict – are often unaware of the significant limitations of the data, research designs and assumptions that underlie statistical studies. This problem is compounded by the selective use of statistical evidence to promote particular policies. On the other hand, and partly in reaction to the above, there is at times exaggerated scepticism vis-à-vis quantitative methods, which, like any research method have their limitations, but still remain a useful and powerful tool of scientific inquiry. The result is that the relevance of statistical results is often either over- or underestimated in the present discussions on climate and security.

This paper attempts to remedy this problem. Building on a systematic assessment of quantitative analyses conducted over the past 20 years[1], it presents the main findings and issues of this literature and draws key lessons for decision-makers. Intended as a short guide for non-expert readers, it helps navigate ongoing debates and make sense of seemingly contradictory statements in current research. Moreover, readers are made aware of major methodological issues and provided with approaches to better assess the true scientific contribution of quantitative climate-conflict analyses.

[1] This paper draws on an in-depth review of quantitative climate-conflict research as part of the author's doctoral thesis. All data and figures presented are based on a comprehensive selection of peer-reviewed quantitative studies by Hsiang et al. (2013), which was complemented by a list of newer articles that cite studies from the original selection. In total 86 peer-reviewed studies and 195 results are considered. Whilst this survey is not exhaustive, it nevertheless comprises the majority of peer-reviewed articles published on the subject, including the most influential ones, and thus gives a fair representation of the state of the art. A list of all the articles considered in this analysis can be found in the Appendix.

I. ABSENCE OF EVIDENCE IS NOT EVIDENCE OF ABSENCE

The most immediate insight gained from this review of quantitative studies is that indicators of climate and conflict do not interact in a uniform and unambiguous way. While some studies find a systematic link between higher levels of climatic stress and insecurity *(e.g. Burke et al. 2009)*, other analyses conclude that higher temperatures, excessive rainfall variability and similar variables do not influence the risk of armed conflicts and political instability *(e.g. Buhaug 2010; Dell et al. 2012; Theisen et al. 2012)*, or produce mixed evidence *(e.g. O'Loughlin et al. 2012; Couttenier & Soubeyran 2013)*. The failure of the large-N literature to converge towards a single robust finding becomes particularly apparent when looking at the record of studies investigating the effect of climate variables on the risk of violent conflict and political instability (see Figure 1).

Overall, quantitative studies on the relationship between climate and conflict have produced mixed evidence.

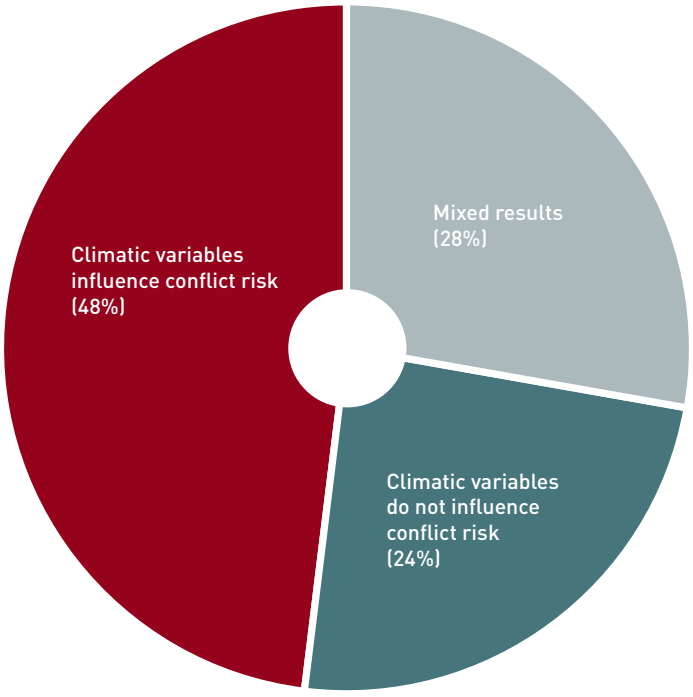

Figure 1: Results of large-N analyses that study the relationship between climate and violent conflict or political instability.

Whether climate change and extreme weather events augment the risk of violent conflicts remains a debated question.

This heterogeneity of findings is also reflected in high-profile scientific debates. While scholars such as Marshal Burke and Solomon Hsiang observe a 'remarkable convergence' in the large-N literature towards recognizing important deviations from normal rainfall and temperatures as potential sources of violent conflict *(Hsiang et al. 2013; see also Burke et al., 2015),* other contemporary reviews of the literature come to very different conclusions *(see Meierding 2013; Ide & Scheffran 2014; Salehyan 2014; Buhaug et al. 2014; Buhaug & Nordkvelle 2014).* In particular, the chapter on human security in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change states that 'collectively the research does not conclude that there is a strong positive relationship between warming and armed conflict' *(Adger et al. 2014: 772).*

Yet the absence of conclusive quantitative evidence for a causal link between climate and conflict should not be seen as evidence for the absence of any connection between the two phenomena *(Kallis & Zografos 2014:77).* Seemingly contradictory findings in statistical analyses should not lead to a sweeping dismissal of the climate-conflict hypothesis. Rather, they should lead to careful examination of the quantitative literature in order to find out why results differ so widely across studies and refine existing hypotheses. Indeed, a closer look at this literature reveals that seemingly inconsistent findings can often be accounted for by important differences in observed regions and periods, measurement levels, or the indicators used *(see Salehyan 2014; Buhaug 2015),* which brings us to the next point.

II. APPLES AND ORANGES

Quantitative climate-conflict research is far from being a uniform body of research, in part because there are no single agreed-upon measures for climate and conflict. Statistical analyses in this domain use measures as diverse as monthly changes in temperatures, yearly deviations from historical precipitation averages, the incidence of tropical storms, or long-term shifts in average temperatures as their independent variable. Likewise, commonly used dependent variables include a wide range of phenomena: civil war, local clashes between ethnic groups, assault and murder, or individual support for armed groups. There is also important heterogeneity in utilised spatial and temporal scales from the local to the international level, as well as from weekly and monthly observations over the course of a few years to decadal observations over the course of centuries (see Box 01). These differences do not only account for important deviations in the results of statistical analyses, but make it also difficult to compare findings across studies and draw more general conclusions about the relationship between climate and conflict.

Different indicators of climate variability and conflict risk produce different results.

To the contrary, experimentation with different research designs has revealed significant variation in the effects of different climatic variables at different scales and with regard to different social outcomes. For instance, available evidence mainly supports the hypothesis that changes in mean temperature influence the risk of inter-personal violence, including assault and murder *(e.g. see Ceccato 2005; Mares & Moffet 2016; Ranson 2014),* whereas studies investigating the relationship between temperature and large-scale violence, including civil conflict, have produced more mixed results. Similarly, research conducted at the local level provides much stronger evidence for a systematic link between abnormal rainfall and conflict risk than research conducted at the national level. Across the board, statistical results also show that the social consequences of sudden climatic shocks, such as floods following a peak in rainfall, are very different from those of more gradual changes in climatic conditions, such as shifts in mean annual precipitation. This is not surprising, when considering that these two types of climatic influences pose very different challenges for affected people and governments, not least because they imply different time horizons for adaptation and policy responses.

The upshot of this discussion is that there is no easy and quick answer to the question whether or not climatic changes influence conflicts and political stability. If anything, 20 years of quantitative research shows that this question can be misleading as it implies a homogeneity of climate effects that is not consistent with real world experience. A more productive way of thinking about climate and fragility would therefore be to avoid sweeping generalisations and instead focus more specifically on when, where and how particular climate-conflict risks are likely to emerge *(see Salehyan 2014).*

The discussion above also has important practical implications. Policy-makers need to differentiate the nature, scale and scope of distinct climate-related challenges when assessing the potential risks of a changing climate. This is particularly important as observations pertaining to specific hazards (e.g. flash floods vs. gradual warming) or contexts (e.g. local vs. national) cannot be used unambiguously to describe relationships between other variables in other contexts. This further implies that solutions designed to counter particular climate-fragility risks cannot readily be used to address other problems in different contexts. For instance, the creation of formal institutional bodies has been found to reduce the worldwide risk of water-related disputes in international river basins *(see Tir & Stinnett 2012),* but does not seem to be relevant for the mitigation of local resource conflicts in Kenya. As indicated by *Linke et al. (2015),* these result from a lack of effective informal mechanisms such as dialogue, rather than from the failure of local administrations to enforce formal rules.

Box 1 **QUANTITATIVE CLIMATE-CONFLICT RESEARCH AT A GLANCE**

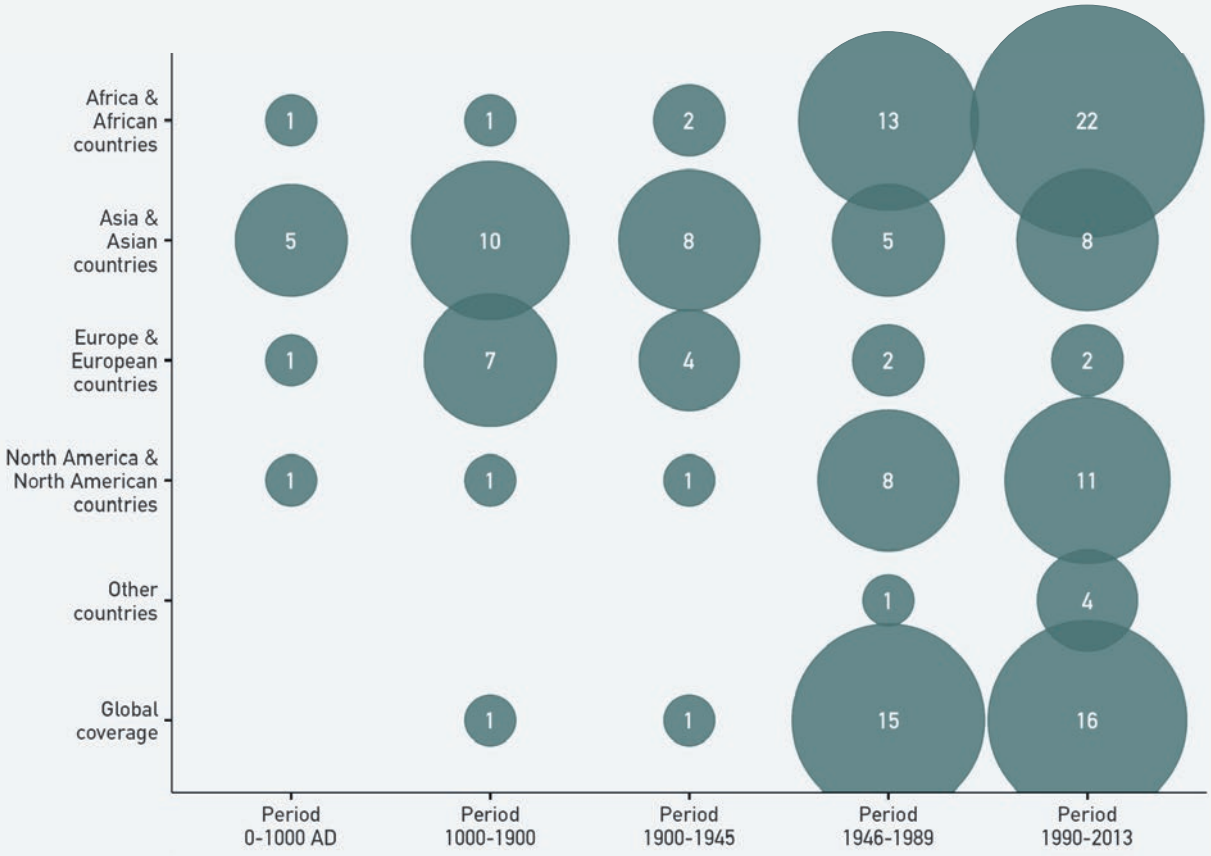

Fig A. Number of studies by observed region and period.

Quantitative climate-conflict analysis is far from being a uniform body of research. Existing studies differ widely in their spatial and temporal coverage. As can be seen from Figure A, most of the studies reviewed for this summary focus on periods between 1990 and 2013 and in particular on Africa and African countries (22 out of 86 studies). On the other hand, only a few studies cover periods prior to 1900 and those that do mainly focus on Europe and Asia.

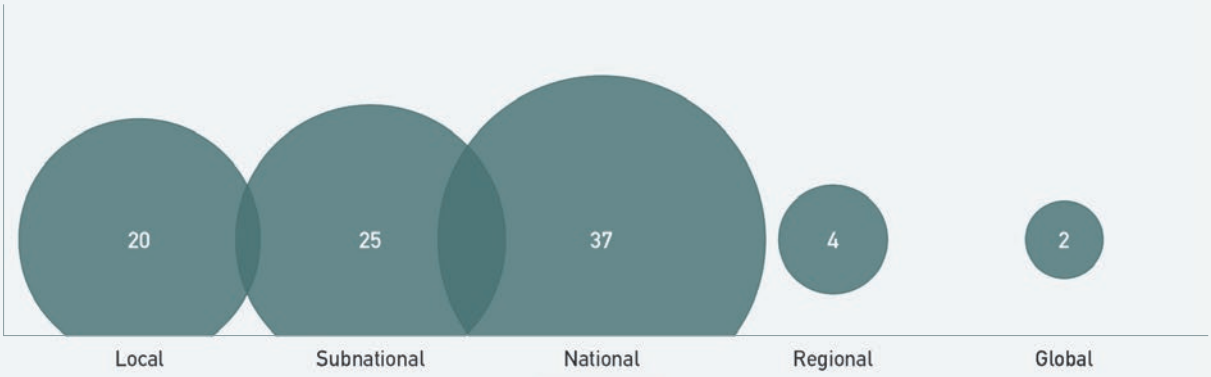

Fig B. Number of studies by utilised spatial scale.

The bulk of large-N analyses reviewed for this summary study climate-conflict connections at the national level, but an increasing number of studies also account for sub-national variations in climate and conflict risk (see Figure B), which is in line with the observation that both climatic shocks and violent conflicts are sometimes confined to distinct territories within countries and hence an analysis based on national-level measures would not be appropriate *(c.f. Gleditsch 2012; Fjelde & von Uexkull 2012:447).*

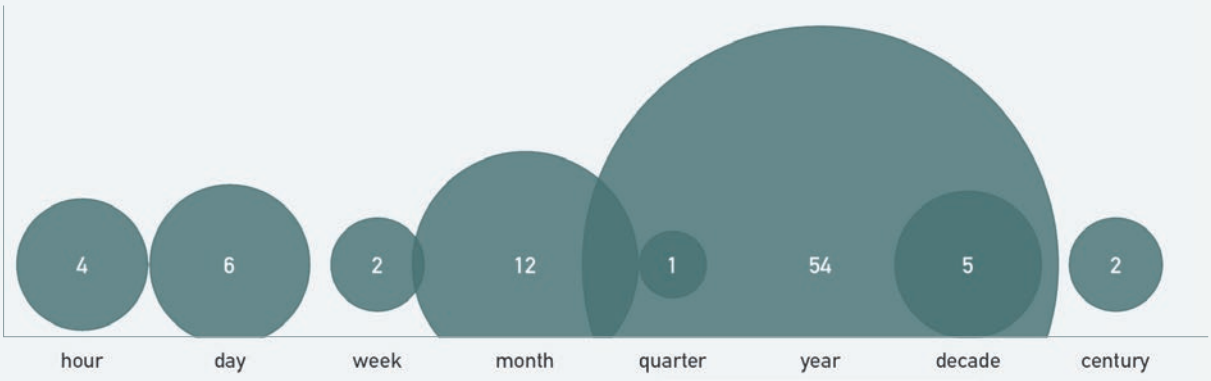

Fig C. Number of studies by utilised temporal scale.

With regard to time, it is most common for quantitative climate-conflict researchers to use yearly observations (see Figure C), although monthly observations are increasingly used in analyses that focus on more tactical aspects of climate-related conflicts, such as the timing of particular attacks. For instance, there are contending hypotheses as to whether East African pastoralists are more likely to engage in violent attacks during the dry or rainy seasons. On the one hand, extremely dry conditions can kill livestock and force herders to engage in cattle raids to replenish their herds. On the other hand, livestock raiding is easier during wet months, when raiders can use the more dense vegetation as cover and stolen animals are more likely to survive *(see Bond et al. 2007; Witsenburg & Adano 2009; Ember et al. 2014).* To test these kinds of hypotheses, quantitative researchers increasingly focus on monthly time intervals.

Fig D. Number of studies by analysed security risk.

Finally, there are important differences with regard to the climate and conflict variables used. Civil conflicts (i.e. lethal conflicts between organised rebel groups and the armed forces of a sovereign state) are the most frequently analysed type of violence, closely followed by inter-personal violence (e.g. assaults, murder) (see Figure D). On the other hand, inter-state military disputes are studied much less frequently, not least because they are commonly assumed to be an unlikely outcome of adverse environmental stress *(see Gleditsch 2012)*.

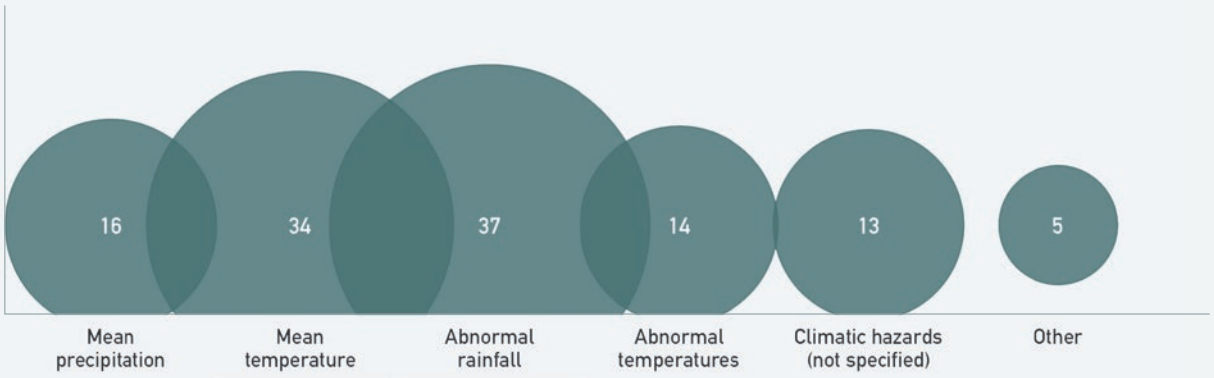

Fig E. Number of studies by utilised climatic variable.

Climatic factors studied in large-N climate-conflict research mainly involve temperature and rainfall (as well as anomalies thereof, e.g. meteorological droughts and heatwaves), as data on these variables is readily available (see Figure E). Just a handful of studies focus on climatic hazards more broadly, which also include tropical storms and wildfires, for instance.

III. NO SIMPLE AND DIRECT LINK

Recent evidence in large-N climate-conflict research has begun to confirm what qualitative research has claimed for several years: that climate and conflict are unlikely to be connected in a direct and simple way. Where it emerges, the relationship between climatic shocks and conflict risk is indirect – that is, mediated by a number of social and economic effects, which translate adverse environmental changes into tangible challenges to human livelihoods and political institutions *(see Buhaug 2015)*.

Where it emerges, the relationship between climate and conflict is mediated by social and economic factors. Preliminary evidence suggests that rural incomes in particular play a key role in connecting climatic shocks and conflict risk in some countries.

This finding follows recent methodological developments in quantitative research. Today, the use of more sophisticated statistical models allows for rudimentary tests of some of the most popular causal explanations suggested in the case study literature on climate and conflict. By using a technique known as instrumental variables, recent statistical analyses are able to estimate multi-stage chains of effects and thus are able to identify key intermediary variables that connect climatic pressures and violent conflict. This research is still however in an early stage, mostly due to the fact that comprehensive data on a range of possible intermediary variables does not yet exist, and that a number of concepts that are supposedly relevant for understanding the climate-conflict nexus, such as identity politics or grievances, are inherently difficult to quantify *(see Ide, 2017:4)*. Hence, results must be regarded as preliminary.

So far, a handful of studies show that, in some countries, rural incomes play a key role in connecting climatic shocks, such as droughts and floods, to a higher risk of violent conflicts. For example, *Maystadt and Ecker (2014)* find that administrative regions in Somalia where droughts have led to a decrease in livestock prices also show a higher risk of violent conflicts. They explain that drought conditions force herders to sell more animals than they would otherwise, as water and fodder become too scarce to sustain a large herd. In a mostly closed rural economy, this implies a sharp decline in livestock prices, as drought-affected herders rush to the nearest markets to sell their animals. Lower prices, in turn, imply lower incomes, which, in absence of viable alternatives, can give herders strong incentives to join armed groups that offer food and money.

Likewise, *Caruso, Petrarca and Ricciuti (2016)* find that higher temperatures during the rice growing season lead to a higher risk of subsequent political violence in Indonesia. They attribute this effect to failed rice harvests, which lead to lower incomes and food insecurity in heat-affected rural areas. Comparing different municipalities in Colombia, *Dube and Vargas (2013)* produce similar evidence for an indirect effect of temperature and precipitation on the risk of armed violence via reduced incomes for coffee producers.

There is also some indicative evidence that migration acts as a transmission mechanism between precipitation shocks and violence in India. *Bhavnani and Lacina (2015)* find that Indian states with high in-migration from drought and flood-affected neighbouring states have a higher risk of experiencing subsequent riots. As shown by their results, this applies in particular to states where migrants are politically marginalized and inadequately protected by public authorities, providing stronger incentives for anti-migrant violence.

Results are however less clear in international comparisons. On the one hand, *Koubi et al. (2012)* find that countries with low economic growth have a higher risk of experiencing civil conflicts. Yet their results reveal that climatic factors such as annual temperatures and rainfall do not have a discernible effect on economic growth. On the other hand, *Bergholt and Lujala (2012)* find that climate-related natural disasters are generally associated with lower economic growth, but lower economic growth does not necessarily lead to a higher risk of armed conflict. Focussing on Sub-Saharan countries, *Buhaug et al. (2015)* finally assert that low rainfall has a negative effect on agricultural output, but that agricultural downturns do not necessarily lead to social protest and rebellion. This apparent contradiction between national-level and international studies suggests that, where they appear, (indirect) linkages between climate variability and conflict risk are contingent upon the presence of further, context-specific enabling conditions (these are the subject of the next section).

Distress migration in connection with extreme rainfall is a source of social tensions in India.

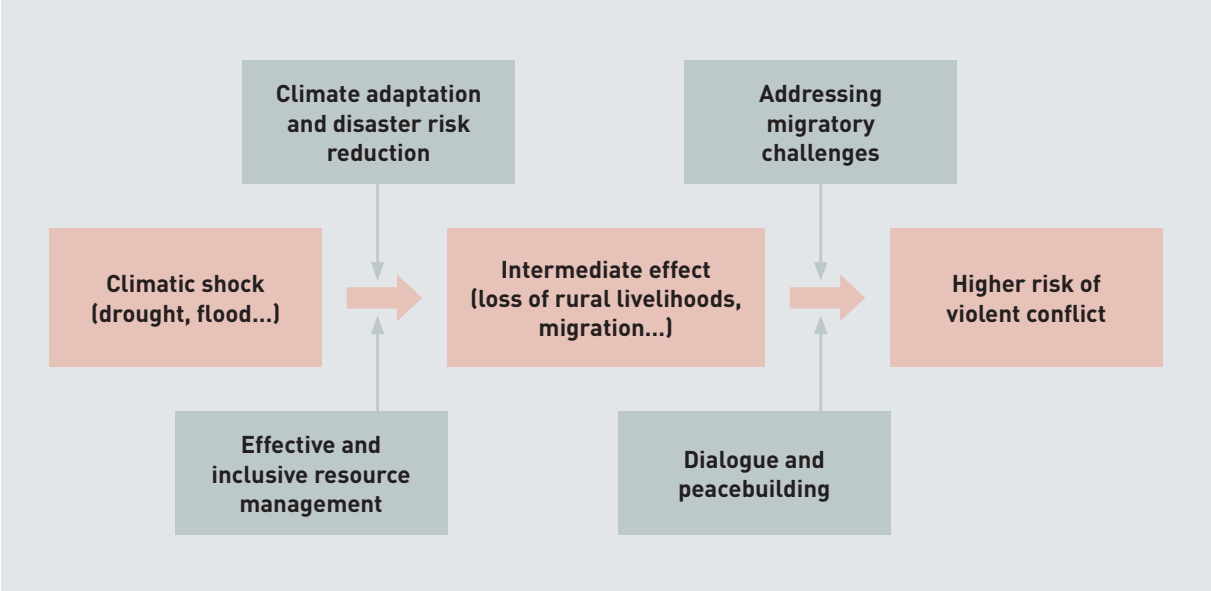

Figure 2: Indirect effects of climatic shocks on the risk of violent conflicts with possible entry points for conflict prevention. This is of course no exhaustive list of policy measures, but merely an illustrative example based on the current state of quantitative research.

The rather intuitive findings presented in this section do not mean that climatic changes, political fragility and violence would not interact in other ways. Rather, they underline those relationships that are sufficiently straightforward to be statistically robust across numerous cases, and for which empirical evidence already exists (while other effects of climate change might still be unfolding and lacking adequate historical precedents). Many indirect security risks related to adverse climatic conditions are much harder to capture with quantitative analyses, due, among other reasons, to higher data requirements when multiple intervening variables are included in statistical models. Nevertheless, the above findings offer some important preliminary insights into the mechanisms connecting climatic stress and violent conflict and thus reveal possible entry points for conflict prevention.

If rural incomes indeed play a key role in connecting climate and conflict in some countries, targeted interventions in these countries to assist rural communities adapt to adverse environmental conditions are a logical starting point for conflict prevention. Feasible solutions here include early warning systems, insurance schemes and social safety nets that compensate for production shortfalls, readily available funds that are earmarked for rapid disaster response, financial and technical support to introduce more resistant crops, or, more generally, the promotion of alternative livelihoods *(see UNEP 2015; Wiebe et al. 2015; Bachofen et al. 2015)*. These measures are not only geared towards increasing farmers' resilience to climatic shocks, but, if managed effectively, can also build confidence in public authorities and strengthen state-citizen relations. Hence, they can play a double role in addressing climate-related threats to peace and political stability.

Development initiatives such as the National Adaptation Plan process (NAP) and agreements such as the Sendai Framework for Disaster Risk Reduction offer opportunities for addressing climate variability and thus reducing climate-related security risks. Moreover, they can serve as a channel to raise awareness about the possible security implications of extreme climatic events and highlight the importance of climate adaptation and disaster risk reduction for conflict prevention.

Similarly, a proactive management of migration from climate vulnerable regions, as well as provisions to protect and assist those that flee their homes in the wake of major climatic shocks can make an important contribution to political stability where migration acts as an intermediary variable between climate vulnerability and violence *(see also Buhaug & Rudolfson 2015).* Preliminary evidence shows that this is the case in India, but it is easy to imagine similar scenarios in other regions that are both exposed to frequent climatic shocks and deep social divisions.

Following up on the work of the Nansen Initiative, the Platform on Disaster Displacement (2016) provides an inter-governmental forum for addressing migratory challenges in the wake of climatic shocks. Drawing on effective practices and lessons learnt in different countries, it facilitates regional and international cooperation in order to address the needs of people displaced by disasters and the adverse effects of climate change. It supports the Nansen Initiative Protection Agenda, which, among other recommendations, encourages states to adopt adequate measures to protect displaced people from discrimination and violence, as well as from exploitation by criminal organisations and extremist groups *(The Nansen Initiative 2015).*

Strengthening people's resilience to climatic shocks goes a long way in preventing climate-related conflicts.

IV. CONTEXT MATTERS

Climatic shocks are unlikely to aggravate social conflicts, unless they meet otherwise favourable conditions for the escalation of violence. This argument, which is widely accepted among climate-security experts, also receives some support from recent quantitative studies *(see Rüttinger et al. 2015:5).* These studies illustrate that, in a given place, the probability of experiencing a violent conflict following an adverse climatic shock is very much dependent on the ability of people and institutions to effectively manage climate-induced challenges to livelihoods and political stability. In particular, climate-related conflicts are more likely to occur in places where people are vulnerable to adverse climatic conditions, institutions ineffective and essential services difficult to obtain.

Climate-related conflicts are more likely to occur in places where people are vulnerable to adverse climatic conditions, institutions ineffective and essential services difficult to obtain.

For example, *von Uexkull (2014)* finds that regions in Sub-Saharan Africa which are particularly dependent on rainfall for agricultural production are also more likely to experience civil conflict following droughts *(see also Salehyan & Hendrix 2014).* This finding is confirmed by more recent evidence showing that social groups in Africa and Asia that are highly reliant on rain-fed agriculture are also more likely than other groups to rebel after experiencing a devastating drought *(von Uexkull et al. 2016).* A similar argument is made by *Detges (2016),* who finds that regions in Africa with poorly developed infrastructures are more vulnerable to the effect of drought and thus also more prone to drought-induced conflict escalation.

Other studies point at the differentiating role of effective and inclusive institutions: *Fjelde and von Uexkull (2012)* find that areas in Africa which host a politically excluded ethnic minority are also more likely to experience communal conflict in the wake of extreme deviations from normal rainfall *(see also von Uexkull et al. 2016).* Similarly, *Schleussner et al. (2016)* observe that violent conflicts in connection with climatological hazards are more likely in the presence of an ethnically divided society. *Couttenier and Soubeyran (2013)* further highlight the role of democratic institutions in mitigating climate-related security risk in Sub-Saharan Africa. Their results illustrate that less democratic countries are more likely to experience civil wars following major droughts than more democratic countries. Interviewing a large sample of respondents in rural Kenya, *Linke et al. (2015)* finally conclude that respondents which do not have access to effective conflict mitigation mechanisms such as inter-communal dialogue are also more likely to support political violence in times of climatic stress.

Despite their preliminary nature, these findings suggest collectively that adverse climatic conditions do not lead per se to a higher risk of violent conflict, but only in combination with a number of other social and political issues. This corroborates the popular notion of climatic shocks as a 'risk multiplier' that can feed into, and aggravate already fragile political situations *(see Rüttinger et al. 2015:5).*

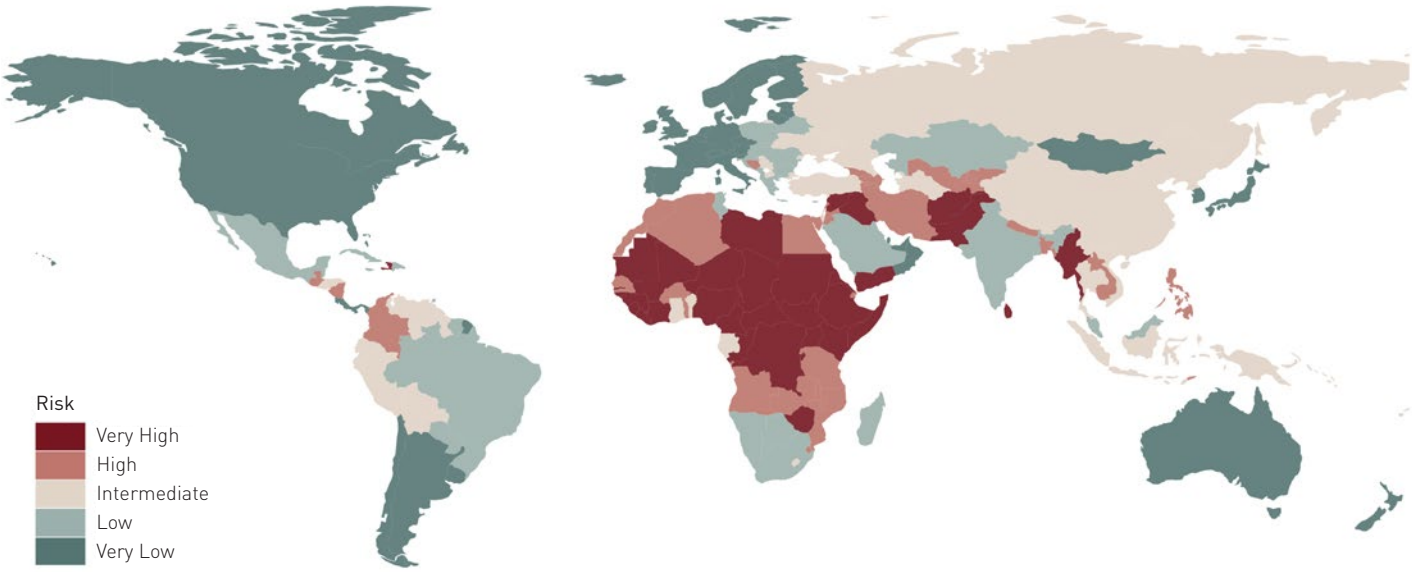

Figure 3: Heat map of countries with group grievances, high social inequalities, poor public service provision and/or weak democratic institutions - Data from the Fragile States Index 2016 (see fsi.fundforpeace.org).

Figure 3 shows the spatial distribution of some of the dimensions of political fragility that, according to quantitative research, can interact with adverse climatic shocks to produce conditions ripe for violent conflict. It is interesting to note that many high risk countries are located in regions that are also frequently exposed to climatic hazards, such as the Sahel, East Africa and the Middle East[2]. These countries need to be at the centre of political efforts to curb climate-security risks.

[2] See de Sherbinin (2014) for a comprehensive review of climate vulnerability mapping efforts.

CONCLUDING REMARKS

Overall, we see that quantitative climate-conflict analysis is far from being a uniform body of research that produces consistent results. Neither is it a silver bullet for predicting the future security implications of adverse climatic change, as some experts and researchers tend to suggest. Whether and how the climate will influence violent conflicts and fragility depends on a number of intervening socio-economic and institutional variables that have not yet been fully determined.

Careful examination of the quantitative literature gives us some preliminary insights as to where and how climatic shocks are likely to aggravate fragile social and political conditions and, thus, can help us detect some of the climate-security risks we face in the future. But important gaps still remain. First, statistical results are only as reliable as the data they are drawn from and extant data on climate and security risks have obvious limitations. In particular, there is a dearth in historical data on long-term climatic changes, especially in countries and regions that have historically been prone to violent conflicts (a notable exception are China and Western Europe, for which rich archival information exists). This precludes researchers from investigating the longer-term political effects that gradual changes in temperature and precipitation patterns have had in the past – not to mention that, even if such historical data were available, they could not be used unambiguously to predict future climate security trends *(see Selby 2014:844).*

Similarly, relevant data on a range of social and political conditions that presumably shape climate-conflict interactions are missing. Migration patterns, adaptive efforts and local institutions for the management of natural resources arguably all have a bearing on whether political fragility and violent conflicts are likely to emerge in connection with adverse climatic conditions. Yet systematic and comprehensive information on these variables is largely missing. Matters are further complicated by the fact that local perceptions of climate change and conflicts – which are highly relevant to the study of climate and conflict – might differ from official data and that relevant concepts such as ethnic identity and animosity are inherently difficult to measure and quantify *(Ide 2017:4).* Efforts to gather more and better data will alleviate some, but not all of these issues. Therefore, policy-makers and practitioners will need to stay vigilant to the possible weaknesses of data underpinning future climate-conflict analyses.

Second, and even more importantly, statistical studies – even the more advanced ones testing for indirect connections – ultimately detect correlations rather than causal linkages. Yet causal interpretation – the expectation that changing one variable will cause another variable to change – is essential for planning and targeting political interventions. In order to be interpretable, statistical results need to be contextualised and connected with sound theory and convincing anecdotal evidence. This means that quantitative research cannot stand on its own, but is highly dependent on inputs from other, more theory-oriented or qualitative research areas. A systematic cross-evaluation of statistical results, field work evidence and expert knowledge on the ground is thus necessary in order to translate quantitative findings into policy-relevant conclusions.

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APPENDIX: LIST OF ANALYSED QUANTITATIVE STUDIES

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