Projecting long-term armed conflict risk: an underappreciated field of inquiry?

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1. Introduction

How will climate change affect armed conflict in the long-term future? Which regions will face increased risk, following what sudden events and underlying grievances? We do not know. We can, however, picture various plausible futures, which correspond to different scenarios of socio-economic and environmental change. But while scenario development has advanced in the context of climate change (IPCC 2018, 2019), the environment (Ahmadalipour et al. 2019; Doelman et al. 2018) and socio-economic conditions (Rao et al. 2019; Dellink et al. 2017; van Meijl et al. 2020), there have been few attempts to develop scenario-based armed conflict risk projections in response to these various scenarios (von Uexkull and Buhaug 2021). Against the backdrop of emerging scenario development in climate, environmental, economic and demographic fields that gained significant political authority from the 1970's onwards (Raskin et al. 2005), the prevalence of long-term armed conflict risk projections to support policy-making is limited. This gap is worrying, especially in the light of climate change impacts having a two-way interaction with conflict. On the one hand because climate change could affect conflict risk through its impacts on conditions that are known to increase armed conflict risk, such as loss of income and frustration over poor governance responses (Mach et al. 2019). On the other hand because social trade-offs of climate change are sensitive to armed conflict, such as poverty, health issues and hunger (Gates et al. 2012). Thereby can the outbreak of armed conflict obstruct climate mitigation and adaptation efforts by weakening governance structures and environmental degradation (Landholm et al. 2019; Schillinger et al. 2020). In other words, we miss a lot if we project long-term socio-economic and climate change impacts and implicitly assume that the future will be peaceful.

While methodological development and policy-uptake of long-term conflict risk projections in response to climate change is mostly absent, the potential role of climate variability or climate change impacts for the historical onset and intensity of armed conflict has received increasing attention in recent years, in both scientific and political communities (Koubi 2019; Mach et al. 2019; von Uexkull and Buhaug 2021; UNSC 2017). This increased attention has resulted in a growing body of evidence on historical climate and conflict interactions, primarily directed at armed conflict within countries (von Uexkull and Buhaug 2021). This evidence has hitherto not translated in academic efforts to identify future regions-at-risk in a context of climate change, with Witmer et al. (2017) being one of the few studies that addresses this research gap. This seems surprising since it is likely that worsening impacts of climate change will increase future conflict risk via different pathways (Mach et al. 2019).

The construction and exploration of different alternative futures can contribute to much needed insights for policy (Mach and Kraan 2021; Maier et al. 2016). The goal of future scenario assessment is not to gain knowledge on what is likely to happen in the 'foreseeable' future with a high level of accuracy, as it is in short-term prediction or forecasting, but rather to trigger deliberations about possible futures and, in turn, to provide a starting point for interventions and adaptive policy options (Mahmoud et al. 2009; Gilmore et al. 2017). Scenario-based conflict risk projection linked to climate change could also serve these goals and, more specifically, improve scientific impact assessments of climate change and could highlight security implications of alternative policy decisions. Additionally, conflict projections can serve as valuable input to projections of other socio-economic variables that historically are sensitive to conflict (Buhaug and Vestby 2019)

In this perspective article we argue why scenario-based conflict risk projections are largely missing in academia and policy, and why we deem this problematic. We do this by first deliberating the causes for limited scientific progress, followed by a discussion on how these projections are useful for policy and science, and by subsequently providing the major future research directions of this field of research.

2. Recent advances in short-term predictions and long-term projections

Different from long-term armed conflict projection developments, the scientific efforts and application of short-term prediction and early warning mechanisms have advanced considerably due to new approaches and methods (Cederman and Weidmann 2017; Muchlinski et al. 2016). We have recently seen the development of a variety of new conflict early warning mechanisms, such as the West Africa Early Warning and Early Response Network (WANEP 2021); the EU conflict Early Warning System (European Commission 2019); the Water, Peace and Security Tool (WPS 2021) and the Violence Early-Warning System (Hegre et al. 2019).[1]

Currently, these early warning systems are neither extended nor complemented with long-term risk projections. Some studies have tried to show the potential of projections: Hegre et al. (2013) developed a statistical model for internal armed conflict over the period 1970-2009 to forecast conflict towards 2050 (reviewed by Hegre et al. 2021 Hegre et al. (2021)); Hegre et al. (2016) offer internal armed conflict projections towards 2100 under different climate change scenarios, following quantifications of the storylines of the Shared Socio-economic Pathways (SSPs); and Witmer et al. (2017) forecast subnational patterns of future violence in Africa, making use of socio-economic developments coupled with climate anomalies. Nevertheless, these handful long-term projections are not yet applied in policy processes as are early-warning mechanisms.

3. Why is there so little research on long-term conflict projections?

The lack of scientific progress in long-term conflict projections can be roughly attributed to two causes. The first and most prominent cause can be found in the methodological difficulties to specify the causal mechanisms that explain the uncertainty in the outbreak of armed conflict due to its volatile and complex nature (Gartzke 1999). The potential but ambiguous role of climate change in armed conflict only complicates this challenge. The second cause refers to the seemingly restricted applicability of conflict risk projections in response to climate change in policy. These two factors mutually influence each other: lacking interest from policy makers limits an impulse for scientific funds and consequently efforts to improve policy applicability.

The methodological difficulties limiting scientific progress originate from five major complications that link primarily to the quantitative modelling of conflict risks in response to climate change. First, internal armed conflict is typically caused by a wide combination of different factors materialising on different levels, ranging from lacking opportunities to socio-economic divisions, including inequalities between ethnic groups to governance or power issues (see overviews in Blattman and Miguel (2010); Cederman et al. (2013); Hegre and Sambanis (2006)). When it comes to conflict projection in response to climate change, an additional challenge is the often weak and unstable empirical estimates of present associations (Koubi 2019). To make sure the ‘right’ indicators are captured in modelling these

[1] For more on forecasting, see the special issues on Forecasting in Peace Research by The Journal on Peace 2017 (Hegre et al. 2017).

long-term risks, evaluating model performance in predicting out-of-sample conflict is essential (Hegre et al. 2021). Second, even if new machine learning techniques would be able to grasp the complex dynamics in underlying data, systemic geopolitical shifts (e.g. fall of the Berlin Wall; the Arab Spring; future governance of climate crisis) with lasting impact on the baseline of conflict risk, are hard, or even impossible to include in long-term projections (Cederman 1997). The possibility of geopolitical shifts could be incorporated into ensemble projections, but this would substantially increase uncertainty as well as the number of possible futures. Third, some empirical observations and interpretations are difficult or even impossible to quantify, such as dynamics resulting from local cultural traditions, identity group formation, or historically-specific processes or ideas. This limits quantification of possible drivers of conflict, restricting model developments (Demmers 2017; Cramer 2006). Though, this limitation is arguably especially important in accurately forecasting armed conflict. Fourth, there is a lack of reliable data and long-term conflict records, especially in conflict-prone regions, enlarging uncertainty when quantifying drivers of conflict (Visser et al. 2020). And last, the interplay between the assumed drivers of conflict may not be constant over time, but depend on the specific context (Bowlsby et al. 2019), making it challenging to take historical relations as a fixed basis for long-term projections. The potential indirect and direct security impacts of climate change may in particular become more prominent when these impacts worsen (Mach et al. 2019).

The second, more speculative cause of the limited scientific progress of long-term conflict risk projections relates to the applicability of these projections. These projections are hardly shaping the global security agenda since the nature of conflict resolution and peace building is mostly reactive and setting long-term goals that serve as a benchmark for policies and interventions is not common. Where Integrated Assessments Models (IAMs) have become policy relevant as a result of their capability to meet emerging knowledge demands on behalf of the policy community (van Beek et al. 2020; Mach and Kraan 2021), there seems to be no such demand for knowledge and benchmarking in the global security community. The adoption of Sustainable Development Goal 16 – promote just, peaceful and inclusive societies – marks the first time that violence and conflict are being addressed in a dedicated global development goal (EPRS 2020). However, this qualitative medium-term (2015-2030) global goal has not yet led to an increased demand for conflict risk projections that could inform actions for different scenarios.

Although there seems to be no urgent demand for conflict risk projection in working towards global goals, nations and treaty organisation make use of non-academic long-term strategic foresights and scenario studies. The publicly available studies are for example used to sketch long-term societal processes or military technology developments (Muzalevsky 2017; Lucarelli et al. 2014). Thereby is it likely that non-public scenario studies inform and prepare strategic operations and stationing. Climate change begins to play a role in strategic foresights, not only in terms of perceived security risks, but also in terms of climate-related vulnerabilities of people, material or infrastructure to for example flooding and melting permafrost (Department of Defence USA 2019; Gemenne et al. 2020). However, the goal in these foresights is not to come to a shared global understanding and perspectives for action of the way forward, but rather to serve the interests of individual states or bonds of states.

4. What are useful and necessary purposes for long-term conflict risk projections?

To advance scientific progress and the policy relevance of long-term conflict risk projections in response to climate change, defining the possible purposes of these projections is an important first step. We identify three possible and related purposes: first, highlighting regions at particular risk that deserve attention in conflict-sensitive climate adaptation and conflict prevention efforts; second, spurring discussion between different actors stimulating a shared understanding of short- and long-term risks; and third, better integrating conflict risk in the wider field of scenario advances for sustainable development in general and climate change more specifically.

Long-term conflict risk projections in response to climate change could serve conflict prevention and conflict-sensitive climate adaptation efforts implemented by individual countries, non-governmental organisation or intergovernmental bodies, and unions of countries. Policy design for conflict prevention such as the Instrument for Stability and Peace at the EU level, involves longer-term processes and annual decision cycles, supporting inter alia socio-economic development through aid programs and diplomacy, which could be improved by addressing possible futures of conflict in relation to climate change. For climate adaptation to be effective and inclusive, the wider potential social and ecological context and possible societal effects should be considered, in the present and in the future (Eriksen et al. 2011). In regions with high conflict risks, these effects can be different than in regions facing low conflict risk.

A second purpose, in line with the first, is the creation of a mutual understanding between researchers and decision-makers about imaginable intersecting long-term climate risks and short-term interests. Facilitating discussions between policymakers on projections can lead to a better understanding of what information is needed from projections to develop well-informed long-term policies (Muhonen et al. 2020; van Beek et al. 2020). This process can also contribute to a balance between actors' short- and medium-term interests and long-term developments by connecting these (Jones et al. 2017). By bringing policymakers together to discuss possible long-term developments beyond reactions to urgent crises, these insights can contribute to improved policies.

A last useful and necessary purpose is the consolidation of socio-economic and environmental scenario development. Even though the outbreak of conflict diminishes progress in economic, educational and environmental efforts (Gates et al. 2012), long-term scenarios in these fields are yet to incorporate adverse impacts of future armed conflict (Buhaug and Vestby 2019). Including projections of conflict risk in the wider agenda of long-term human development would provide a more complete picture of potential issues and set-backs (Gilmore et al. 2021 unpublished). Especially potential conflict risks in a climate-stressed world require a pro-active approach building on long-term strategies, most prominently in regions with high climate vulnerability and limited governance capacities (Busby et al. 2014). Long-term conflict risk projections along various socio-economic and environmental scenarios can be a valuable tool to inform decisionmakers about implications of alternative policy choices related to adaptation, mitigation, and sustainable development.

5. Future research directions

We see the scarcity of long-term conflict risk projections in response to climate change as an important research gap. Such projections should guide future research to inform various long-term policies and to integrate conflict risk in sustainable development scenarios and impacts assessments of climate change. Both the development of quantitative models as well as expert elicitation and qualitative scenario development can fill this gap, ideally in conjunction with each other, since there is not one approach that can overcome all methodological difficulties addressed.

Methodological progress in Machine Learning and Artificial Intelligence techniques may be able to better grasp the complex dynamics leading to conflict and deal with imbalanced data availability (Colaresi and Mahmood 2017; Muchlinski et al. 2016; Hoch et al. 2021). These quantitative data-driven methods can handle non-linear and often complex nature of conflict processes and contribute to a better understanding of conflict drivers. The resulting insights can then be the basis for conflict risk projections, in interplay with diverging trends of social, economic, political and environmental conditions. The quantitative dimension of projecting long-term conflict risk could also advance by the development of enhanced scenarios, by including negative feedbacks resulting from natural disasters or outbreak of conflict on socio-economic development (Gilmore et al. 2021 unpublished). Extant socio-economic and political scenario projections, such as quality of governance (Andrijevic et al. 2020) and economic development (Dellink et al. 2017), very likely over-estimate future growth in developing countries due to an inability to account to plausible destructive forces of future armed conflict and climate change impacts (Buhaug and Vestby 2019). Since governance and economic growth are important factors in the eruption and duration of a conflict (Mach et al. 2019), these positive projections imply almost automatically a more peaceful future when following these storylines, as is the case in Hegre et al. (2013).

Besides these quantitative approaches, qualitative insights based on expert judgement and field experiences are essential to the development of this field, to account for the methodological difficulties of quantitative approaches. First, qualitative methods can capture highly disruptive events affecting conflict risk which are currently not part of the coherent storylines in quantitative scenarios such as the SSPs. See for example the provocative argumentation of Nassim Taleb about the potentially enormous impacts of a highly improbable event (Taleb 2010). In line with dystopic events, qualitative story lines can include highly dystopic futures. For example, what security risks could follow from a situation in which almost 20 % of the earth's land surface would become inhabitable for humans, as pictured by Xu et al. (2020)? Second, qualitative approaches are important to interpret the plausibility of quantitative scenarios developed, when integrating long-term risk profiles into policies. Third, qualitative expert assessments can help to address the fact that historical relations and interactions driving conflict risk are shown to be unstable over time (Bowlsby et al. 2019). And last, qualitative methods can facilitate the inclusion of the valuable on-the-ground experiences of diplomats, peacekeeping missions and non-governmental organisations in identifying context-specific solution pathways.

Future directions of research should not be limited to making conflict risk projections. The research community should also aid the utilisation of new insights by policy-makers, as these conflict projections are a new development in the field. This means that both scientists and users need to go through a process of co-creation where conflict projections are improved in concerted actions, based on the needs of the users and the possibilities provided by science (Muhonen et al. 2020; van Beek et al. 2020). Including both qualitative and quantitative scenario insights should be combined to gain confidence, reliability and trust in these insights, and for becoming policy-relevant.

6. Concluding remarks

Today, long-term projections of conflict risk in response to climate change are not widely available primarily due to methodological difficulties, which might explain their undervaluation in policy communities and in socio-economic scenarios and climate change impact assessments. As long as there are hardly any studies on conflict risk projections, they are unlikely to be used in policy agendas and wider socio-economic scenarios or climate change impact assessments. The scientific community should take up the challenge to improve quantitative and qualitative conflict risk projections linked to climate change. Although full knowledge on future armed conflict-driver interactions and data availability provides challenges, especially about the magnitude of climate change impacts, combining insights from qualitative and quantitative risk assessments is a viable way forward. This should be the start of an iterative cycle on the interface of science and policy that will ultimately lead to improved reliability and usability of the much-needed future conflict risk projections.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Author contributions

SdB designed this study, developed the methodology and performed the analysis, JH and NW supported the methodology development and analysis. NW acquired the funds for this project. All authors contributed to the scientific discussion, writing and proof-reading of the manuscript.

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