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On climate, conflict and cumulation

Suggestions for integrative cumulation of knowledge in the research on climate change and violent conflict

Abstract:

Possible links between climate change and intra-state violent conflict have received major scholarly attention in recent years. But with few exceptions, there is still a low level of consensus in this research field. We argue that one reason for this disagreement is a lack of integrative cumulation of knowledge. Such an integrative cumulation is prevented by three obstacles, which have until now hardly been discussed in the literature. The first is the use of inadequate terms, discussed here with a focus on the labels ‘Malthusian’/‘cornucopian’ and the operationalization of key variables. Secondly, the weaknesses of large-N studies in research on climate change and violent conflict are not sufficiently reflected. These include a lack of data on crucial concepts as well as deficits of widely-used datasets. Thirdly, literature that deals with a possible link between adverse environmental change and peace (termed here ‘environmental peace perspective’) has neither been systematized nor adequately considered in the debate so far. We provide examples of these shortcomings and make suggestions of how to address each of them. We also develop an integrative theoretical framework for the environmental peace perspective which facilitates its consideration in research on climate change and violent conflict.

Key words: climate change, violent conflict, cumulation, environment, peace

1 Introduction¹

Climate change is estimated to raise the global mean temperature by between 1.0 and 3.7 degrees by the end of the 21st century, compared to the period 1986-2005.² The negative consequences of this include, inter alia, changed precipitation patterns, melting glaciers, rising sea level, worsening conditions for agriculture and more frequent or intense natural disasters.³ For several years, policy makers and scientists alike have been concerned with whether these consequences of climate change might stimulate more violent conflict.⁴ US Secretary of State John Kerry, for instance, warned: ‘If we don’t respond adequately to the challenge of global

¹ We thank Sarah Nash as well as two anonymous reviewers for their helpful suggestions.

² IPCC, *Climate Change 2013: The Physical Science Basis* (Cambridge: Cambridge University Press, 2013).

³ World Bank, *Turn Down the Heat: Climate Extremes, Regional Impacts and the Case for Resilience* (Washington DC: World Bank, 2013).

⁴ Hans Günter Brauch, ‘Securitizing Global Environmental Change’, in *Facing Global Environmental Change*, eds. Hans Günter Brauch et al. (Berlin: Springer, 2009), 65-104.

climate change over the course of these next years there will be people fighting wars over water and over land.’⁵

But are such claims warranted? Various attempts have been made since the early 1990s to assess the links between environmental problems such as water scarcity or soil degradation and violent conflict.⁶ The arguments developed by this early research are quite similar to those circulating in the discussion about climate change and conflict, which developed rapidly from 2007 onwards.⁷ This is hardly surprising given the fact that climate change is one form of environmental change and that many environmental problems (e.g. scarcity of renewable resources) can be caused by climate change as well as by other factors (e.g. overuse, contamination, unequal distribution).

Previous research largely agrees that environmental problems and climatic changes are unlikely to provoke inter-state violent disputes.⁸ Indeed, there is only a rather thin record of violent environmental conflicts between states. Theoretical reasons also suggest that this will not change soon. States usually have less cost-intensive strategies to cope with environmental problems while the governing elites (which command the military) are rarely personally affected by these challenges.⁹

However, no consensus has yet been reached regarding the question of whether climatic changes increase the risk of intra-state violent conflicts, such as civil wars, paramilitary violence, riots or armed raids. This is a major shortcoming given that intra-state conflicts were more numerous and devastating than inter-state conflicts in the period between 1945 and 2010, a trend which is unlikely to reverse soon.¹⁰ Two main positions can be distinguished in the debate:

- a) Climate Conflict: This perspective makes a twofold argument.¹¹ It starts from the assumption that climate change will cause or aggravate environmental problems including water scarcity, rainfall variability, soil degradation, or a rise in the frequency and intensity of natural disasters (such as storms, floods, or landslides). In a second

⁵ U.S. Department of State, 'Secretary Kerry Holds a Google+ Hangout with NBC's Andrea Mitchell' (2013), <http://www.state.gov/secretary/remarks/2013/05/209273.htm> (15/11/2013).

⁶ Günther Bächler, 'Why Environmental Transformations Causes Violence: A Synthesis', *Environmental Change and Security Project Report* 4, no. 1 (1998): 24-44; Thomas Homer-Dixon, 'Environmental Scarcities and Violent Conflict - Evidence from Cases', *International Security* 19, no. 1 (1994): 5-40.

⁷ Emily Meierding, 'Climate Change and Conflict: Avoiding Small Talk about the Weather', *International Studies Review* 15, no. 2 (2013): 185-203.

⁸ Nils Petter Gleditsch, 'Whither the Weather? Climate Change and Conflict', *Journal of Peace Research* 49, no. 1 (2012): 3-9.

⁹ Idean Salehyan, 'From Climate Change to Conflict? No Consensus Yet', *Journal of Peace Research* 45, no. 3 (2008): 315-26.

¹⁰ Lotta Themnér and Peter Wallensteen, 'Armed Conflict, 1946-2010', *Journal of Peace Research* 48, no. 4 (2011): 525-36.

¹¹ WBGU, *World in Transition - Climate Change as a Security Risk* (London: Earthscan, 2008).

step, these stresses might translate into societal problems commonly identified as increasing the risk of violent conflict, such as hunger,¹² livelihood insecurity,¹³ grievances about resource distribution and availability,¹⁴ predatory and opportunistic behavior by elites,¹⁵ outmigration,¹⁶ or a weakening of the state.¹⁷ But whether environmental stress translates into societal challenges and eventually violent conflicts strongly depends on the sensitivity, adaptive capacity and resilience of the respective societies.¹⁸ This is why climate change-induced violence is most likely to occur in the marginalized areas of economically less-developed and politically unstable countries.¹⁹

- b) Social Conflict: Proponents of this perspective claim that climate change plays no role, or only a minor role, in the onset of violent conflict. When facing environmental degradation, actors can react in various ways. Engaging in violent conflict is usually among the most costly and dangerous options²⁰ and hampered by the interventions of state or traditional institutions (e.g. councils of elders).²¹ There is a wide consensus in conflict research about several political and socio-economic factors (e.g. medium level of democracy, low economic growth, past political violence) which raise the risk of intra-state violent conflict onset,²² while no such agreement exists about environmental or climate variables.²³ The by far greater importance of political and

¹² Per Pinstруп-Andersen and Satoru Shimokawa, 'Do Poverty and Poor Health and Nutrition Increase the Risk of Armed Conflict Onset?', *Food Policy* 33, no. 6 (2008): 513-20.

¹³ Janpeter Schilling, Francis Opiyo, and Jürgen Scheffran, 'Raiding Pastoral Livelihoods: Motives and Effects of Violent Conflict in North-Eastern Kenya', *Pastoralism* 2, no. 25 (2012): 1-16.

¹⁴ Thomas Homer-Dixon and Jessica Blitt, 'Key Findings', in *Ecolviolence: Links among Environment, Population, and Security*, eds. Thomas Homer-Dixon and Jessica Blitt (Lanham: Rowman & Littlefield, 1998), 223-28.

¹⁵ Colin H. Kahl, *States, Scarcity, and Civil Strife in the Developing World* (Princeton: Princeton University Press, 2006).

¹⁶ Rafael Reuveny, 'Ecomigration and Violent Conflict: Case Studies and Public Policy Implications', *Human Ecology* 36, no. 1 (2008): 1-13.

¹⁷ Jon Barnett and W. Neil Adger, 'Climate Change, Human Security and Violent Conflict', *Political Geography* 26, no. 6 (2007): 639-55.

¹⁸ Tom Deligiannis, 'The Evolution of Environment-Conflict Research: Toward a Livelihood Framework', *Global Environmental Politics* 12, no. 1 (2012): 78-100.

¹⁹ Jürgen Scheffran and Antonella Battaglini, 'Climate and Conflicts: The Security Risks of Global Warming', *Regional Environmental Change* 11, no. 1 (2011): S27-S39.

²⁰ Idean Salehyan, 'From Climate Change to Conflict?'

²¹ Hanne Fjelde and Nina von Uexkull, 'Climate Triggers: Rainfall Anomalies, Vulnerability and Communal Conflict in Sub-Saharan Africa', *Political Geography* 31, no. 7 (2012): 444-53; Tobias Hagmann, 'Fighting in the Desert? Conflict and Resource Management in East African Drylands', in *Environmental Peacebuilding: Managing Natural Resource Conflicts in a Changing World*, ed. Didier Péclard (Bern: swisspeace, 2009), 22-27.

²² Jeffrey Dixon, 'What Causes Civil War? Integrating Quantitative Research Findings', *International Studies Review* 11, no. 4 (2009): 707-35.

²³ Ole Magnus Theisen, Nils Petter Gleditsch, and Halvard Buhaug, 'Is Climate Change a Driver of Armed Conflict?', *Climatic Change* 117, no. 3 (2013): 613-25.

socio-economic factors in causing or triggering violent conflict is also underscored by the many cases in which environmental degradation does not coincide with violence.²⁴ The debate has not remained in the theoretical realm. The various arguments of both perspectives have been tested through in-depth case studies as well as large-N studies. From the qualitative case studies, no clear picture emerges regarding a possible link between climate change and violent conflict. Some authors argue that environmental problems (which are or will be exacerbated by climate change) contribute to the onset of violent conflict²⁵ while other studies challenge this claim.²⁶ Evidence from statistical investigations on the link between adverse environmental changes and violent conflict are similarly inconclusive. This is shown by Table 1, which summarizes the large-N studies concerned with a possible climate-conflict link, which cover more than one country and have appeared in the peer review literature. Such studies use countries or more recently grid cells of 0.5 or 1.0° edge length as their spatial unit of analysis. They investigate whether a significant correlation exists between climate-related environmental changes in a given year and the onset or incidence of a violent conflict in the same or the following year. As can be seen from Table 1, only the conflictivity of land degradation seems to be nearly consensual, with five out of seven studies agreeing on that point. But this finding should be approached with caution, given that Fearon as well as Urdal find no correlation between cropland scarcity per capita and violent conflict.²⁷ There are no quantitative studies about the climate-migration-conflict-nexus, presumably because of inadequate or incomplete migration data.²⁸

INSERT TABLE 1 HERE

²⁴ Jon Barnett, 'Destabilizing the Environment-Conflict Thesis', *Review of International Studies* 26, no. 2 (2000): 271-88.

²⁵ Carol C. Ember et al., 'Livestock Raiding and Rainfall Variability in Northern Kenya', *Civil Wars* 14, no. 2 (2012): 159-81; Kahl, *States, Scarcity, and Civil Strife in the Developing World*; Anthony Nyong, Charles Fiki, and Robert McLeman, 'Drought-Related Conflicts, Management and Resolution in the West African Sahel: Considerations for Climate Change Research', *Die Erde* 137, no. 3 (2006): 223-48.

²⁶ Wario Adano et al., 'Climate Change, Violent Conflict and Local Institutions in Kenya's Dryland', *Journal of Peace Research* 49, no. 1 (2012): 65-80; Tor A. Benjaminsen, 'Does Supply-Induced Scarcity Drive Violent Conflicts in the African Sahel? The Case of the Tuareg Rebellion in Northern Mali', *Journal of Peace Research* 45, no. 6 (2008): 819-36; Harry Verhoeven, 'Climate Change, Conflict and Development in Sudan: Global Neo-Malthusian Narratives and Local Power Struggles', *Development and Change* 42, no. 3 (2011): 679-707.

²⁷ James D. Fearon, *Governance and Civil War Onset*, *WDR 2011 Background Paper* (Washington DC: World Bank, 2010); Henrik Urdal, 'People Vs. Malthus: Population Pressure, Environmental Degradation, and Armed Conflict Revisited', *Journal of Peace Research* 42, no. 4 (2005): 417-34.

²⁸ Reuveny, 'Ecomigration and Violent Conflict'.

Thus, the next logical step would be to identify why the findings of the different studies are so disparate, address the reasons for this inconclusiveness and then conduct the next wave of research which hopefully produces more consensual results. But in practice, there is no agreement (and, we suggest, not enough discussion) about the reasons for the inconclusiveness of previous research. Possible explanations include a lack of adequate theoretical arguments or comprehensive analytical frameworks,²⁹ missing interactions between quantitative and qualitative scholars,³⁰ choosing large-scale instead of minor violent conflicts as the dependent variable,³¹ the focus on a too high level of analysis (e.g. whole states instead of singular regions or even households)³² or the absence of high quality, high resolution data.³³ One might add the highly interdisciplinary nature of the subject matter, which is discussed by geographers, political scientists, environmental sociologists, political ecologists and anthropologists, and receives major inputs from natural scientists (e.g. physicists, soil scientists).

This article presents a different (but complementary) answer to the question of why there is still so much disagreement in research on climate change and violent intra-state conflict. In order to do so, it adopts a conceptual focus inspired by Dina Zinnes' classical essay on the problem of cumulation.³⁴ Zinnes distinguishes between two forms or levels of scientific cumulation:

‘By additive cumulation I mean that one study adds some information to the existing literature on the subject [...] Integrative cumulation means that a study ties together and explains a set of research findings.’³⁵

While additive cumulation is a precondition for integrative cumulation, the latter one should be seen as the ultimate goal of scientific research. Additive cumulation means that a study adds a new hypothesis, variable, correlation or finding to an existing body of knowledge. But Zinnes is convinced that ‘most of us want to see a total picture.’³⁶ In other words: Most scholars will prefer an approach that is able to combine elements of previous works, to

²⁹ Meierding, 'Climate Change and Conflict' ; Jürgen Scheffran et al., 'Disentangling the Climate-Conflict-Nexus: Empirical and Theoretical Assessment of Vulnerabilities and Pathways', *Review of European Studies* 4, no. 5 (2012): 1-15.

³⁰ Andrew R. Solow, 'A Call for Peace on Climate and Conflict', *Nature* 497, no. 7448 (2013): 179-80.

³¹ Cullen S. Hendrix and Idean Salehyan, 'Climate Change, Rainfall, and Social Conflict in Africa', *Journal of Peace Research* 49, no. 1 (2012): 35-50.

³² John O'Loughlin, Andrew M. Linke, and Frank D. W. Witmer, 'Modeling and Data Choices Sway Conclusions About Climate-Conflict Links', *PNAS* 111, no. 6 (2014): 2054-55.

³³ Thomas Bernauer, Tobias Böhmelt, and Vally Koubi, 'Environmental Changes and Violent Conflict', *Environmental Research Letters* 7, no. 1 (2012): 1-8.

³⁴ Dina Zinnes, 'The Problem of Cumulation', in *In Search of Global Patterns*, ed. James N. Rosenau (New York: Free Press, 1976), 161-66.

³⁵ *Ibid.*

³⁶ *Ibid.*

explain their results and eventually to make some meaningful statements about the subject under research as a whole (and not just single aspects of it). According to Zinnes, the key obstacle to an integrative cumulation of knowledge is the dominance of an ‘additive mentality’³⁷ in a research field, that is, the assumption that producing more and more information on a topic is sufficient because the integration of this information into a wider and more complete picture would occur automatically.

Research on climate change and violent conflict has become much more integrative in recent years despite the heterogeneity of disciplines dealing with possible climate-conflict links.³⁸ However, we suggest that there are still many factors which promote an additive rather than integrative cumulation of knowledge in the research field, or in other words, that complicate the use, assessment and improvement of existing knowledge on the issue by future studies. In the following sections, we identify three relevant, but so far widely unacknowledged obstacles to the integrative cumulation of knowledge in the research on climate change and violent conflict, illustrate them with examples, and make suggestions as to how to overcome them. The problems discussed include inadequate labels, insufficient reflection on the limits of large-N investigations in the research field and the lack of attention paid to the environmental peace perspective. In order to address this last issue, we suggest an integrative theoretical framework for the environmental peace perspective which should make it easier for climate conflict scholars to integrate findings from this field of investigation.

2 Inadequate labels and terms

Several terms exist in the debate on climate change and violent conflict which are not sufficiently precise and/or are used in a confusing way. This is an important problem, especially bearing in mind that labels can have a large influence on how people judge a certain position. In International Relations, for instance, the Realist school coined the term ‘Idealism’ in order to describe and simultaneously discredit the theories of their counterparts – a move that was largely successful despite the fact that the approaches covered by this label are often not rooted in idealistic perspectives.³⁹ Thus, misleading terms tend to aggravate the cumulation of scientific knowledge.

³⁷ Ibid.

³⁸ Solomon Hsiang, Marshall Burke, and Edward Miguel, ‘Quantifying the Influence of Climate on Human Conflict’, *Science* 341, no. 6151 (2013): 1-14; Janpeter Schilling, Akuno Moses, and Jürgen Scheffran, *On Arms and Adaptation: Climate Change and Pastoral Conflict in Northern Kenya* (Hamburg: CLISEC, 2011).

³⁹ Andreas Osiander, ‘Rereading Early Twentieth-Century IR Theory: Idealism Revisited’, *International Studies Quarterly* 42, no. 3 (1998): 409-32.

A widespread label for the environmental or climate conflict perspective outlined above is Malthusianism or neo-Malthusianism, while proponents of the social conflict perspective are frequently termed cornucopians.⁴⁰ By using these terms, it is implied that the logic behind the climate conflict hypotheses can be traced back to Thomas Malthus' 1798 'Essay on the Principle of Population'.⁴¹ Malthus took a deterministic position by describing the discrepancy between the linear growth of agricultural output and the exponential growth of human populations as an inevitable cause for human misery and conflict. Classical cornucopian positions, in contrast, make anti-deterministic claims that societies either will not face environmental problems like climate change or natural resource scarcity, or are able to conduct adaptation measures to avoid suffering from such problems.⁴² But there is an important difference between the cornucopian and the social conflict position: the latter do not deny the existence of environmental problems with severe and adverse consequences on human societies, but simply doubt whether they are empirically related to violent conflict onset.⁴³

A key issue with the label (neo-)Malthusianism is that the large majority of studies supporting the climate conflict perspective simply do not make use of deterministic arguments. This is true for recent studies which discuss a large number of relevant background conditions and intervening variables such as the commercialization of resources,⁴⁴ ethno-political exclusion,⁴⁵ or 'groupness'.⁴⁶ But also the writing of early environmental conflict scholars, which are most frequently termed Malthusian, rejects deterministic connections between renewable resource scarcity and violent conflict. Bächler emphasizes that 'passing the threshold of violence definitely depends on sociopolitical factors and not on the degree of environmental degradation as such'⁴⁷, while Homer-Dixon states:

⁴⁰ Bernauer, Böhmelt, and Koubi, 'Environmental Changes and Violent Conflict'; Nils Petter Gleditsch, 'Environmental Conflict: Neomalthusians vs. Cornucopians', in *Security and Environment in the Mediterranean: Conceptualising Security and Environmental Conflicts*, eds. Hans Günter Brauch et al. (Berlin/Heidelberg: Springer, 2003), 477-85; Henrik Urdal, 'Population, Resources, and Political Violence: A Subnational Study of India, 1956-2002', *Journal of Conflict Resolution* 52, no. 4 (2008): 590-617.

⁴¹ Thomas Malthus, *An Essay on the Principle of Population, or a View of Its Past and Present Effects on Human Happiness* (Cambridge: Cambridge University Press, 1992 [1798]).

⁴² Bjørn Lomborg, *The Sceptical Environmentalist: Measuring the Real State of the World* (Cambridge: Cambridge University Press, 2001); Julian Simon, 'Paradoxically, Population Growth May Eventually End Wars', *Journal of Conflict Resolution* 33, no. 1 (1989): 164-80.

⁴³ Theisen, Gleditsch, and Buhaug, 'Is Climate Change a Driver of Armed Conflict?'

⁴⁴ Schilling, Opiyo, and Scheffran, 'Raiding Pastoral Livelihoods'.

⁴⁵ Fjelde and von Uexküll, 'Climate Triggers'.

⁴⁶ Kahl, *States, Scarcity, and Civil Strife in the Developing World*.

⁴⁷ Bächler, 'Why Environmental Transformations Causes Violence'.

‘The relationship between environmental scarcity and violence is invariably complex. Scarcity interacts with such contextual factors as the character of the economic system, levels of education, ethnic cleavages, class divisions, technological and infrastructural capacity, and the legitimacy of the political regime.’⁴⁸

Since the attractiveness of positions which are considered deterministic is limited in social science contexts, researchers might ignore the findings and arguments of these supposedly ‘Malthusian’ approaches. The efforts of some scholars show that the insights from Bächler and Homer-Dixon can fruitfully be refined, extended and applied to new questions in the research field.⁴⁹ But the majority of environmental and climate conflict scholars continue to simply term these kind of works Malthusian or deterministic and do not further engage with them. The political ecology tradition of environmental conflict research, for instance, emphasizes the dominance of economic and political elites vis-à-vis marginalized groups in appropriating land, water, and forest resources.⁵⁰ Homer-Dixon stresses the importance of resource capture processes, meaning that the scarcity of important renewable resources ‘encourage[s] powerful groups within a society to shift resource distribution in their favor.’⁵¹ This point (among others) provides an opportunity for fruitful discussion between Homer-Dixon’s work and the political ecology tradition. But both approaches have so far largely either ignored or just criticized each other,⁵² amongst other reasons because the work of one side is continuously (and often simplistically) labeled Malthusianism. This prevents the integrative cumulation of knowledge.

There are other labels which are used in a confusing or imprecise way in the research field. The dependent variable, for instance, is termed ‘armed conflict’⁵³, ‘violent conflict’⁵⁴ or ‘civil war’.⁵⁵ Many quantitative studies of the issue do not provide any clear definition of their dependent variable. The large majority of the large-N studies cited in Table 1 refer to the

⁴⁸ Homer-Dixon and Blitt, 'Key Findings'.

⁴⁹ Deligiannis, 'The Evolution of Environment-Conflict Research'; Kahl, *States, Scarcity, and Civil Strife in the Developing World*; Simon Mason et al., 'Linkages between Sub-National and International Water Conflicts: The Eastern Nile Basin', in *Facing Global Environmental Change: Environment, Human, Energy, Food, Health and Water Security Concepts*, eds. Hans Günter Brauch et al. (Berlin: Springer, 2009), 325-34.

⁵⁰ Sarah Jewitt, 'Political Ecology of Jharkhand Conflicts', *Asia Pacific Viewpoint* 49, no. 1 (2008): 68-82; Nancy Lee Peluso and Michael Watts, 'Violent Environments', in *Violent Environments*, eds. Nancy Lee Peluso and Michael Watts (Ithaca/London: Cornell University Press, 2001), 3-38.

⁵¹ Homer-Dixon, 'Environmental Scarcities and Violent Conflict'.

⁵² Nancy Lee Peluso and Michael Watts, 'Violent Environments: Responses', *Environmental Change and Security Project Report* 9, no. 1 (2003): 93-96.

⁵³ Theisen, Gleditsch, and Buhaug, 'Is Climate Change a Driver of Armed Conflict?', 613.

⁵⁴ Jürgen Scheffran et al., eds., *Climate Change, Human Security and Violent Conflict: Challenges for Societal Stability* (Berlin: Springer, 2012).

⁵⁵ Gerdis Wischnath and Halvard Buhaug, 'On Climate Variability and Civil War in Asia', *Climatic Change* 122, forthcoming (2014), 1.

UCDP/PRIO definitions (and datasets)⁵⁶, which understand 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.’⁵⁷ This definition is at odds with many other studies which contend that climate-related violence is likely to (a) be rather small scale (i.e. below the 25 death threshold), (b) concern the use of natural resources (rather than government or territory), and (c) take place between social groups (i.e. without the involvement of governments actors).⁵⁸ The impacts of climate change and the exact causal chains through which they manifest themselves are very likely to vary regarding, for example, urban riots, pastoralist fights around water points, and full-blown civil wars.⁵⁹ But at the moment, these different (and at times rather imprecise) definitions of the dependent variable are all too often mixed together within the same analytical framework. This is aggravated by the fact that some studies focus on the onset and others on the incidence of violent conflict.

Similar theoretical issues exist with regard to inadequate definitions of the independent variable. Many theoretical and empirical studies do not yet distinguish strongly enough between the condition of natural resource scarcity (e.g. absolute water scarcity⁶⁰), the long-term process of natural resource degradation (e.g. steady precipitation decline⁶¹), and short-term processes of rapid environmental deterioration (e.g. droughts and flash floods⁶²). In addition, the labelling of the independent variable as climate change is problematic in many of the quantitative studies cited in Table 1, since they focus on temperature and precipitation changes within short time periods (usually a year), while climate is usually defined as the average of meteorological conditions over time period of at least thirty years.⁶³ A broader and more systematic consideration of these issues has so far not been conducted in the research on climate change and conflict. Doing so would facilitate communication within the research

⁵⁶ Jürgen Scheffran, Tobias Ide, and Janpeter Schilling, 'Violent Climate or Climate of Violence? Concepts and Relations with Focus on Kenya and Sudan', *International Journal of Human Rights* 18, forthcoming (2014).

⁵⁷ Nils Petter Gleditsch et al., 'Armed Conflict 1946-2001: A New Dataset', *Journal of Peace Research* 39, no. 5 (2002): 615-37, 618f.

⁵⁸ Cullen S. Hendrix and Idean Salehyan, 'Climate Change, Rainfall, and Social Conflict in Africa', *Journal of Peace Research* 49, no. 1 (2012): 35-50; Anthony Nyong, Charles Fiki, and Robert McLeman, 'Drought-Related Conflicts, Management and Resolution in the West African Sahel: Considerations for Climate Change Research', *Die Erde* 137, no. 3 (2006): 223-48; Clionadh Raleigh and Dominic Kniveton, 'Come Rain or Shine: An Analysis of Conflict and Climate Variability in East Africa', *Journal of Peace Research* 49, no. 1 (2012): 51-64.

⁵⁹ 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, no. 10 (2010): 2513-20; Ember et al., 'Livestock Raiding and Rainfall Variability in Northern Kenya'; Sarah Johnstone and Jeffrey Mazo, 'Global Warming and the Arab Spring', *Survival: Global Politics and Strategy* 53, no. 2 (2011): 11-17.

⁶⁰ Homer-Dixon, 'Environmental Scarcities and Violent Conflict'.

⁶¹ Hendrix and Salehyan, 'Climate Change, Rainfall, and Social Conflict in Africa'.

⁶² Rafael Reuveny, 'Climate Change-Induced Migration and Violent Conflict', *Political Geography* 26, no. 6 (2007): 656-73.

⁶³ Gleditsch, 'Whither the Weather?'.

field, stimulate more extensive exchange with related disciplines such as conflict research or meteorology, and thus facilitate integrative cumulation of knowledge.

3 The limits of large-N studies

Methodologically, this research field has been dominated by statistical large-N analyses. For instance, four out of the six most recent literature reviews that appeared in leading journals draw overwhelmingly or exclusively on large-N studies in order to evaluate the state of the art.⁶⁴ Deligiannis and Meierding are the notable exceptions,⁶⁵ although the later focuses in large parts on strategies for improving large-N studies. A similar example is provided by two widely cited special issues on climate change and conflict.⁶⁶ Twelve of the 20 articles (=60%) published in both issues conduct large-N statistical analysis, while only two studies draw primarily on case study evidence (10%).

Large-N studies supply important insights about the generalizability of theories and case study findings. However, by producing a growing number of correlations for more regions and longer time-periods, a largely additive cumulation of knowledge is promoted. Especially in research on the climate-conflict nexus, there have been serious problems with integrating the findings of previous studies. There are two reasons for this, neither of which have been considered at length thus far:

Firstly, statistical analyses of a large number of cases are inherently unsuitable for integrating factors which are hard to quantify, but are nonetheless crucial for the dynamics of (climate-related) violent conflicts, such as identities, narratives or threat perceptions.⁶⁷ Other relevant factors, for example the existence of migrant networks⁶⁸ or traditional, micro-level resource-sharing agreements⁶⁹, may be quantifiable, but collecting data on them for a large number of cases would be very labor- and cost-intensive. Thus, the concepts and findings of environmental sociology, anthropology, political ecology, spatial theory and constructivist

⁶⁴ Hsiang, Burke, and Miguel, 'Quantifying the Influence of Climate on Human Conflict'; Vally Koubi et al., 'Do Natural Resources Matter for Interstate or Intrastate Armed Conflict?', *Journal of Peace Research* 51, no. 2 (2014): 227-43; Scheffran et al., 'Climate Change and Violent Conflict'; Theisen, Gleditsch, and Buhaug, 'Is Climate Change a Driver of Armed Conflict?'

⁶⁵ Deligiannis, 'The Evolution of Environment-Conflict Research'; Meierding, 'Climate Change and Conflict'.

⁶⁶ Gleditsch, 'Whither the Weather?'; Ragnhild Nordås and Nils Petter Gleditsch, 'Climate Change and Conflict', *Political Geography* 26, no. 6 (2007): 627-38.

⁶⁷ Christiane Fröhlich, 'Security and Discourse: The Israeli-Palestinian Water Conflict', *Conflict, Security & Development* 12, no. 2 (2012): 123-48; Stuart Kaufman, *Modern Hatreds: The Symbolic Politics of Ethnic War* (Ithaca/London: Cornell University Press, 2001).

⁶⁸ Giovanna Gioli, Taliman Khan, and Jürgen Scheffran, 'Remittances and Community Resilience to Conflict and Environmental Hazards in Northwestern Pakistan', in *Remittance Flows to Post-Conflict States: Perspectives on Human Security and Development*, ed. Daivi Rodima-Taylor (Boston: Pardee House, 2013), 117-26.

⁶⁹ Ayalneh Bogale and Benedikt Korf, 'To Share or Not to Share? (Non-)Violence, Scarcity and Resource Access in Somali Region, Ethiopia', *Journal of Development Studies* 43, no. 4 (2007): 743-65.

conflict research are hardly ever taken into account when scholars are assessing a possible climate-conflict-link.⁷⁰

In addition, there might be some indicators on which data could be collected more or less easily, but simply no one has done this yet, so no large-N study can incorporate these concepts. Furthermore, there is a possibility that the generalizability of excellent hypotheses is not tested since no adequate large-scale datasets for doing so are available. Raleigh and Urdal, for instance, quite explicitly state that their variable selection is strongly driven by data availability issues: ‘Despite its theoretical importance, we do not attempt to empirically capture resource distribution, as such data are currently not available on the local level.’⁷¹

Secondly, the weaknesses of the datasets which are currently available and widely used are hardly ever reflected in the research on climate change and violent conflict, while doing so is a precondition for the integrative cumulation of knowledge. Rainfall or temperature data are often based on satellite measurements, but it is well known that there can be huge differences between the perceptions of local inhabitants and of scientific experts or orbit satellites about the speed, degree and causes of environmental changes.⁷² The GLASOD data on land degradation used by most studies cited in Table 1 have been criticized for relying on the assessments of few experts using inconsistent definitions.⁷³ Similarly, datasets which collect and geo-code occurrences of low-level violence (the most likely forms climate-related conflicts are going to take) are increasingly used by quantitative studies (see Table 1), but are unable to adequately capture episodes of violence in remote areas.

In order to illustrate this last point, we isolated data on pastoral violence in East Africa, probably the most discussed form of violent conflict in the research field, from ACLED and SCAD, which are the most elaborated and most often used geo-referenced datasets on low-level violence.⁷⁴ We compared these data with the conflict records of CEWARN, which

⁷⁰ Sven Chojnacki and Bettina Engels, *Material Determinism and Beyond: Spatial Categories in the Study of Violent Conflict*. SFB Working Paper 55 (Berlin: SFB, 2013); Adrian Martin, 'Environmental Conflict between Refugee and Host Communities', *Journal of Peace Research* 42, no. 3 (2005): 329-46; Christopher Timura, "'Environmental Conflict" and the Social Life of Environmental Security Discourse', *Anthropological Quarterly* 74, no. 3 (2001): 104-13.

⁷¹ Clionadh Raleigh and Henrik Urdal, 'Climate Change, Environmental Degradation and Armed Conflict', *Political Geography* 26, no. 6 (2007): 674-94. This example is also highlighted by Chojnacki and Engels, *Material Determinism and Beyond*.

⁷² Felipe Murtinho et al., 'Water Scarcity in the Andes: A Comparison of Local Perceptions and Observed Climate, Land Use and Socioeconomic Changes', *Human Ecology* 41, no. 5 (2013): 667-81; Chusak Wittayapak, 'History and Geography of Identifications Related to Resource Conflicts and Ethnic Violence in Northern Thailand', *Asian Pacific Viewpoint* 49, no. 1 (2008): 111-27.

⁷³ Benjaminsen, 'Does Supply-Induced Scarcity Drive Violent Conflicts in the African Sahel?'

⁷⁴ Hendrix and Salehyan, 'Climate Change, Rainfall, and Social Conflict in Africa'; Raleigh and Kniveton, 'Come Rain or Shine'.

collects information on pastoral violence through field research.⁷⁵ Since information on these periods and regions is available in all three databases, our comparison focused on the years 2006-2009 and on the Ethiopian and Kenyan side of the Somali cluster as well as on the Kenyan and Ugandan side of the Karamoja cluster.

As can be seen from Figures 1 and 2, CEWARN collected 1.547 incidents of pastoral violence with 3,000 deaths between 2006 and 2009, while ACLED registered only 258 incidents (16.7% of the amount of incidents collected by CEWARN) with 1,025 deaths (34.2%). Using SCAD, we could only detect 17 incidents (1.1%) responsible for 412 deaths (13.73%) for the same period. These results indicate that – with the partial exception of ACLED’s performance for the Kenyan side of the Somali cluster – even these quite elaborated datasets miss a large percentage of the violent conflicts occurring on the ground. These findings are supported by Ravnborg et al. who also conclude that the large majority of water-related conflict (and cooperation) events in the global South are not recognized by NGO publications and media reports (which are the main sources for ACLED and SCAD).⁷⁶ If the sample of conflict events recorded by ACLED or SCAD is not representative (which is likely given factors such as urban or media biases in the reporting of such events⁷⁷), the validity of the large-N studies correlating these data with environmental or climatic changes is questionable.

INSERT FIGURE 1 AND 2 HERE

As mentioned above, large-N studies have made several valuable contributions to the literature in terms of testing the generalizability of hypotheses and identifying theoretical deficits and data needs. The collection of local-level data through field research, as has already been done by some studies,⁷⁸ can further increase the validity of statistical analyses. But given their constraints, they should increasingly be complemented by qualitative research strategies. This goes well beyond calls to use in-depth case studies in order to assess which causalities are driving the correlations found by large-N studies or to generate hypotheses which have to be tested by quantitative analyses. Although these are important challenges, qualitative research can contribute more to our knowledge on climate change and violent

⁷⁵ CEWARN, 'CEWARN Country Updates', www.cewarn.org/index.php?option=com_docman&task=cat_view&gid=112&Itemid=98 (16/11/2013).

⁷⁶ Helle Munk Ravnborg et al., 'Challenges of Local Water Governance: The Extent, Nature and Intensity of Local Water-Related Conflict and Cooperation', *Water Policy* 14, no. 2 (2012): 336-57.

⁷⁷ Claudia Simons and Franzisca Zanker, *Finding Cases That Fit: Methodological Challenges in Peace Research*, GIGA Working Paper 189 (Hamburg: GIGA, 2012).

⁷⁸ Ember et al., 'Livestock Raiding and Rainfall Variability in Northern Kenya': 159-81; Karen M. Witsenburg and Wario R. Adano, 'Of Rain and Raids: Violent Livestock Raiding in Northern Kenya', *Civil Wars* 11, no. 4 (2009): 514-38.

conflict. If appropriately designed, case studies cannot only generate, but also test hypotheses, for instance when extreme or critical cases are investigated or by using most similar or most diverse cases techniques.⁷⁹ The intensive comparison of a medium number of cases has greatly elaborated our knowledge of the links between natural resource abundance and violent conflict.⁸⁰ This has been the case because such research designs combine a high generalizability of their results with an incorporation of factors that are hard to collect for a large number of cases or to quantify at all (e.g. identities or micro-level institutions).

4 Taking the environmental peace perspective into account

So far the discussions in the research field have overwhelmingly focused on whether or not climate change does increase the number of violent conflict occurrences. Little attention has been paid to a possible link between climate change and peace, defined here in a narrow sense as the absence of violent conflict. While a number of large-N studies find a significant correlation between violent conflict and climate change or variability (see Table 1), several studies indicate a relationship between a reduced risk for violent conflict onset and freshwater scarcity,⁸¹ reduced precipitation,⁸² natural disasters,⁸³ or the scarcity of arable land.⁸⁴ Some case studies conducted in East Africa's pastoral areas found that violent cattle raids are less frequent during times of drought, either because opportunities for raids are unfavorable or because culture-specific rules and norms command cooperation during harsh times.⁸⁵ A whole body of literature on environmental peacebuilding deals with the question whether and under which circumstances the shared handling of environmental problems affecting two or more social groups can contribute to the improvement of relations between those groups.⁸⁶

⁷⁹ Bent Flyvbjerg, 'Five Misunderstanding about Case-Study Research', *Qualitative Inquiry* 12, no. 2 (2006): 219-45; John Gerring, *Case Study Research: Principles and Practices* (Cambridge: Cambridge University Press, 2007).

⁸⁰ Philippe Le Billon, 'The Political Ecology of War: Natural Resources and Armed Conflicts', *Political Geography* 20, no. 5 (2001): 561-84; Michael Ross, 'Does Natural Resource Wealth Influence Civil War? Evidence from 13 Cases', *International Organization* 58, no. 1 (2004): 35-67.

⁸¹ Cullen S. Hendrix and Sarah M. Glaser, 'Trends and Triggers: Climate, Climate Change and Civil Conflict in Sub-Saharan Africa', *Political Geography* 26, no. 6 (2007): 695-715.

⁸² Buhaug, 'Climate Not to Blame for African Civil Wars'; Ole Magnus Theisen, 'Climate Clashes? Weather Variability, Land Pressure, and Organized Violence in Kenya, 1989-2004', *Journal of Peace Research* 49, no. 1 (2012): 81-96; Witsenburg and Adano, 'Of Rain and Raids'.

⁸³ Rune T. Slettebak, 'Don't Blame the Weather! Climate-Related Natural Disasters and Civil Conflict', *Journal of Peace Research* 49, no. 1 (2012): 163-76.

⁸⁴ Pedram Rowhani et al., 'Malnutrition and Conflict in East Africa: The Impacts of Resource Variability on Human Security', *Climatic Change* 105, no. 1 (2011): 207-22; Theisen, 'Climate Clashes?'; Urdal, 'People Vs. Malthus'.

⁸⁵ Adano et al., 'Climate Change, Violent Conflict and Local Institutions in Kenya's Dryland'; Bogale and Korf, 'To Share or Not to Share?'

⁸⁶ Alexander Carius, *Environmental Peacemaking - Environmental Cooperation as an Instrument of Crisis Prevention and Peacebuilding: Condition for Success and Constraints* (Berlin: Adelphi, 2006); Ken Conca and Geoffrey Dabelko, 'The Problems and Possibilities of Environmental Peacemaking', in *Environmental*

Similarly, disaster diplomacy studies focus on the possibility of cooperation between hostile groups, induced by natural disasters.⁸⁷ In the following, we term this body of literature the environmental peace perspective.

So far, there is little exchange between researchers working on environmental peace and those dealing with possible links between environmental/climate change and violent conflict. This is unfortunate because the insights gained by the literature on environmental peace could help climate conflict scholars to understand (a) which factors make societies resilient to environmental stress and violent conflict, (b) the influence of environmental stress on changing intergroup relations (from cooperation to conflict to violence and vice versa) and (c) the conditions under which cooperation around environmental problems fails and environmental conflicts therefore become more likely.

Thus, drawing more strongly on approaches developed and insights gained by environmental peace scholars would benefit the debate about the climate-violence nexus and enhance integrative cumulation of knowledge in the wider research on the role of environmental factors in facilitating peace and conflict. However, one problem in this regard is that there is little interaction between the various research traditions of the environmental peace perspective. Therefore, we use the remainder of this section to suggest an integrative theoretical framework for the environmental peace perspective⁸⁸ in the hope that this will facilitate exchange between research on environmental peacebuilding, disaster diplomacy and environmental/climate conflict.

When defining peace as the absence of inter-group violent conflict, one can distinguish three phases of the process through which shared environmental problems stimulate peace. These phases can be examined from two different theoretical approaches (Figure 2).

We call the first approach sociological since it draws on insights from early disaster sociology.⁸⁹ As noted by Charles E. Fritz, disasters usually produce a ‘community of sufferers’ which is ‘characterized by a strong feeling of mutual suffering and in-group solidarity’ and ‘develops an interactional system uniquely its own’⁹⁰, meaning that pre-

Peacemaking, eds. Ken Conca and Geoffrey Dabelko (Baltimore: John Hopkins University Press, 2002), 220-33.

⁸⁷ Ilan Kelman, *Disaster Diplomacy: How Disasters Affect Peace and Conflict* (London: Routledge, 2012); Philip A. Streich and David Bell Mislán, 'What Follows the Storm? Research on the Effect of Disasters on Conflict and Cooperation', *Global Change, Peace & Security* 26, no. 1 (2014): 55-70. See www.disasterdiplomacy.org for recent developments in the field.

⁸⁸ For a critique of the environmental peace perspective see for instance Hsiang, Burke, and Miguel, 'Quantifying the Influence of Climate on Human Conflict'; or Travis Nelson, 'When Disaster Strikes: On the Relationship between Natural Disaster and Interstate Conflict', *Global Change, Peace & Security* 22, no. 2 (2010): 155-74.

⁸⁹ Emile Durkheim, *Suicide: A Study in Sociology* (New York: Free Press, 1979).

⁹⁰ Charles E. Fritz, *Disasters and Mental Health: Therapeutic Principles Drawn from Disaster Studies* (Newark: Disaster Research Center, 1996).

disaster social, ethnic or political cleavages lose their salience. In a similar way, post-disaster suffering can create empathy between/with the parties affected.⁹¹ This reduces the likelihood of violent conflict onset and might even stimulate cooperation between the affected groups.⁹² This claim should hold true for slow-onset disasters (e.g. droughts) and even more so for rapid-onset disasters (e.g. a cyclones). In a second step, the regular interaction of people from different social groups in order to manage common environmental (or disaster-related) challenges can create mutual trust and understanding, thereby laying the foundations for further cooperation.⁹³ In the final (and more ideal-typical) phase, the perceptions of the involved parties are transformed due to constant interaction and a common identity is (partially) developed.⁹⁴

The second approach has its intellectual roots in functionalist and neo-functionalist theory.⁹⁵ It argues that environmental problems tend to cross the borders between various social groups (environmental interdependence), thus providing material incentives for all affected parties to work together along functionalist rather than territorial or ethnical divides.⁹⁶ Such cooperation can be initiated by political or economic elites (top down) as well as by civil society (bottom up) – a claim that is shared by the functionalist and the sociological approaches.⁹⁷ After cooperation is initiated during the first stage, the occurrence of spill-over effects represents the second stage of environmental peace realization as outlined by the functionalist approach.⁹⁸ Spill-over in this context means that bi- or multilateral environmental cooperation ‘will set in motion economic, social and political progresses which generate pressures towards further integration.’⁹⁹ Finally, there is no genuine third phase within the functionalist approach. All authors agree that ‘the creation of a common regional identity [... and]

⁹¹ James Ker-Lindsay, 'Greek-Turkish Reapproachment: The Impact Of "Disaster Diplomacy"', *Cambridge Review of International Affairs* 14, no. 1 (2000): 215-32.

⁹² Jean-Christophe Gaillard, Elsa Clavé, and Ilan Kelman, 'Wave of Peace? Tsunami Disaster Policy in Aceh, Indonesia', *Geoforum* 39, no. 1 (2008): 511-26; Slettebak, 'Don't Blame the Weather!'

⁹³ Raul Lejano, 'Theorizing Peace Parks: Two Models of Collective Action', *Journal of Peace Research* 43, no. 5 (2006): 563-81.

⁹⁴ Ken Conca, 'The Case for Environmental Peacemaking', in *Environmental Peacemaking*, eds. Ken Conca and Geoffrey Dabelko (Baltimore: John Hopkins University Press, 2002), 1-22.

⁹⁵ Ernst B. Haas, 'The Study of Regional Integration: Reflections on the Joy and Anguish of Pretheorizing', *International Organization* 24, no. 4 (1970): 607-46.

⁹⁶ Saleem Ali, 'A Natural Connection between Ecology and Peace?', in *Peace Parks: Conservation and Conflict Resolution*, ed. Saleem Ali (Cambridge: Cambridge University Press, 2007), 1-18; Nicole Harari and Jesse Roseman, *Environmental Peacemaking, 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: FoEME, 2008).

⁹⁷ Conca and Dabelko, 'The Problems and Possibilities of Environmental Peacemaking'.

⁹⁸ Seden Akcinaroglu, Jon DiCicco, and Elizabeth Radziszewski, 'Avalanches and Olive Branches: A Multimethod Analysis of Disasters and Peacemaking in Interstate Rivalries', *Political Research Quarterly* 64, no. 2 (2011): 260-75.

⁹⁹ Jeppe Tranholm-Mikkelsen, 'Neo-Functionalism: Obstinate or Obsolete? A Reappraisal in the Light of the New Dynamism of the EC', *Millenium* 20, no. 1 (1991): 1-22.

mutually recognized rights and expectations'¹⁰⁰ rather than the rational engagement in more and more cooperation due to functional needs represents the final stage of environmental-induced peace development.

INSERT FIGURE 3 HERE

Based on existing empirical research, one can further specify the framework presented above. Firstly, both the sociological and the functionalist approaches agree that the three phases develop consecutively over time, while it can be assumed that during all phases the risk of violent conflict onset is reduced. But the process of creating peace through being affected by or cooperating over shared environmental problems can fail at the initial phase or before entering the second and third phases respectively, with the potential to frustrate and alienate hostile groups even further.¹⁰¹ According to Kelman, this is empirically even the most likely outcome.¹⁰² The symbolic embedment of natural resources in contradictory narratives and identities, the ignorance of the needs of local inhabitants, as well as trade-offs between ecological conservation and economic utilization are, among other factors, critical obstacles to a peace-inducing effect of environmental problems.¹⁰³

Secondly, there are several conditions which are likely to facilitate the development of environmental peace, such as the absence of recent occurrences of violence, the active involvement of civil society organizations and scientific networks or the existence of mutual trust and elite support.¹⁰⁴ Thirdly, as already implied by the last two statements, political and socio-economic factors are more important for the existence of peace than shared environmental problems or environmental cooperation, especially in the long run.¹⁰⁵ And fourthly, although they can clearly be distinguished on a theoretical basis, elements of the

¹⁰⁰ Carius, *Environmental Peacemaking - Environmental Cooperation as an Instrument of Crisis Prevention and Peacebuilding*.

¹⁰¹ Ken Conca, Alexander Carius, and Geoffrey Dabelko, 'Building Peace through Environmental Cooperation', in *State of the World 2005: Redefining Global Security*, ed. Worldwatch Institute (Washington DC: Worldwatch, 2005), 144-57.

¹⁰² Kelman, *Disaster Diplomacy*.

¹⁰³ Ken Conca and Jennifer Wallace, 'Environment and Peacebuilding in War-Torn Societies: Lessons From the UN Environment Programme's Experience with Post-Conflict Assessment', in *Assessing and Restoring Natural Resources in Post-Conflict Peacebuilding*, eds. David Jensen and Steve Lonergan (London: Earthscan, 2012), 63-84; Arthur Green, 'Social Identity, Natural Resources, and Peacebuilding' (paper presented at the CAPRI Workshop on Collective Action, Property Rights, and Conflict in Natural Resources Management, Siem Reap, 28/06-01/07/2010).

¹⁰⁴ Carius, *Environmental Peacemaking - Environmental Cooperation as an Instrument of Crisis Prevention and Peacebuilding*; Moira Feil, Diana Klein, and Meike Westerkamp, *Regional Cooperation on Environment, Economy and Natural Resource Management: How Can It Contribute to Peacebuilding?* (Brussels: Initiative for Peacebuilding, 2009); Ilan Kelman, 'Acting on Disaster Diplomacy', *Journal of International Affairs* 59, no. 2 (2006): 215-40.

¹⁰⁵ Kelman, 'Acting on Disaster Diplomacy'.

sociological and functionalistic approach are usually intertwined in the frameworks of most empirical studies and even more so in the real situations on the ground.

The environmental peace perspective described here has not received sufficient scholarly attention until now, and consequentially, many tasks for future research remain.¹⁰⁶ There are only few comprehensive case studies on the link between (climate change-induced) environmental stress and the absence of violence, especially on the intra-state level. While many large-N studies on environmental or climate change and violent conflict exist, there is no statistical analysis explicitly concerned with environmental peace. Such studies could ask, for instance, whether all environmental problems have similar impacts or whether there are differences between, for example, soil degradation, tropical storms and droughts. It is also worth knowing whether environmental problems stimulate just the absence of violence, or even the occurrence of cooperation, or both, or none of these outcomes. Since, to our knowledge, no subnational, geo-referenced dataset on cooperative behavior exists, we suggest either to operationalize the Global Data on Events, Location and Tone (GDELT) dataset which covers all kinds of (not just conflict or violent) events¹⁰⁷ or to collect local level data through field research.¹⁰⁸ The last option would also help to overcome some of the problems with large-N studies described in the previous section. Case and statistical studies should also take seriously the three-staged model derived from the literature above and investigate whether the occurrence of environmental problems lead to the absence of violence/onset of cooperation in the short-, medium- or/and long-term.

5 Conclusion

This article started with a review of the existing literature on climate change and violent conflict, which has its roots in the research on environmental conflicts. While climate change is unlikely to be associated with inter-state wars, there is no consensus regarding a possible link between climate change and intra-state violent conflicts. We claimed that one reason for this disagreement between climate conflict scholars is the lack of integrative cumulation of knowledge (as defined by Zinnes) in this highly interdisciplinary research field.

Based on this assumption, three suggestions for facilitating integrative cumulation of knowledge in the research on climate change and violent conflict have been formulated. Firstly, authors should avoid confusing terminology. The labels cornucopian and Malthusian

¹⁰⁶ Streich and Mislán, 'What Follows the Storm?'

¹⁰⁷ Kalev Leetaru and Philip A. Schrodt, 'GDELT: Global Data on Events, Location and Tone, 1979-2012' (paper presented at the 54th ISA Annual Convention, San Francisco, 03/04/-06/04/2013).

¹⁰⁸ Ravnborg et al., 'Challenges of Local Water Governance'.

as well as the operationalization of key variables were discussed in greater detail. Secondly, the limits of large-N studies in the research field should be reflected more carefully in order to assess the explanatory power of these studies, improve their design and complement them with good qualitative research. These limits are the availability of data – especially on concepts such as identities or micro-level institutions – and the reliability of existing datasets. Possible solutions for this include the collection of local-level data through field research or to rely stronger on systematically designed case studies. Thirdly, climate conflict researchers would benefit from insights in and approaches of the environmental peace literature in order to gain a more complete understanding about the importance of environmental factors in inducing cooperation, conflict and violence. Such a perspective could also draw our attention to possible opportunities for improving inter-group relations which are opened up by climate change. In order to facilitate exchange between both areas of study, we suggested an integrative framework for the environmental peace perspective

There are certainly other problems regarding the integrative cumulation of knowledge in the research on climate change and violent conflict. These are either examined by other recent reviews of the literature or remain to be discussed in future works. To name just three examples: There are other communication problems besides confusing labels which aggravate the integrative cumulation of knowledge, such as the lack of exchange with scholars from the global South with a high expertise on the regions under discussion. Similarly, the environmental peace perspective is not the only insightful approach that is hardly ever considered by research on climate change and violent conflict. As discussed above, exchange with political ecologists could be especially productive since both approaches focus on a similar subject matter.¹⁰⁹ Finally, Nordås and Gleditsch encouraged scholars several years ago to ‘balance the positive and negative effects of climate change’, for instance by taking into account longer growing seasons in higher latitudes or increasing precipitation levels in some regions.¹¹⁰ But this call has widely gone unheard, with the partial exception of some studies highlighting the positive impacts of migration.¹¹¹

Based on our experience of conducting research on climate change and violent conflict, we discussed three obstacles to the integrative cumulation of knowledge that we believed to be among the most relevant and most unnoticed to date. We hope that the suggestions developed

¹⁰⁹ Kristina Dietz and Bettina Engels, 'Immer (mehr) Ärger wegen der Natur? - Für eine gesellschafts- und konflikttheoretische Analyse von Konflikten um Natur', *Österreichische Zeitschrift für Politikwissenschaft* 43, forthcoming (2014).

¹¹⁰ Nordås and Gleditsch, 'Climate Change and Conflict'.

¹¹¹ Richard Black et al., 'Migration as Adaptation', *Nature* 478, no. 7370 (2011): 447-49; 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, no. 1 (2012): 119-27.

above stimulate discussion among researchers and contribute to the answering of the question of whether, and if so under which circumstances, climate change stimulates violent conflict – or even peace.

Consequence of climate change	Significant relation to violent conflict onset ¹¹²	No significant relation to violent conflict onset
Higher temperatures	Burke et al. 2009 ^a Hsiang et al. 2011 ^d O'Loughlin et al. 2012 ^c	Buhaug 2010 ^a Koubi et al. 2012 O'Loughlin et al. 2014 ^a Wischnath & Buhaug 2014 ^c
Reduced precipitation	Fjelde & von Uexkull 2012 ^b Hendrix & Glaser 2007 ^b Hendrix & Salehyan 2012 ^a Hsiang et al. 2011 ^d Miguel et al. 2004 ^b Raleigh & Kniveton 2012 ^c	Buhaug 2010 ^a Buhaug & Theisen 2012 ^a Brückner & Ciccone 2010 ^b Burke et al. 2009 ^a Koubi et al. 2012 Nel & Righarts 2008 O'Loughlin et al. 2012 ^c O'Loughlin et al. 2014 ^a Theisen et al. 2012 ^a Wischnath & Buhaug 2014 ^c
More rainfall extremes	Hendrix & Salehyan 2012 ^a Raleigh & Kniveton 2012 ^c	Koubi et al. 2012 Wischnath & Buhaug 2014 ^c
Lower availability of freshwater	Gizelis & Wooden 2010 Hauge & Ellingsen 1998 Raleigh & Urdal 2007	Hendrix & Glaser 2007 ^b Theisen 2008
Land degradation	Biermann et al. 1998 Esty et al. 1999 Hauge & Ellingsen 1998 Raleigh & Urdal 2007 Theisen 2008	Hendrix & Glaser 2007 ^b Rowhani et al. 2011 ^c
Climate-related natural disasters	Besley & Persson 2011 Drury & Olson 1998 Hsiang et al. 2011 ^d Nel & Righarts 2008	Bergholt & Lujala 2012 Omelicheva 2011 Slettebak 2012

See Appendix I for the full references for this table.

^a Focuses only on Africa.

^b Focuses only on Sub-Saharan Africa.

^c Focuses only on parts of East Africa.

^d Focuses only on countries affected by El Niño/Southern Oscillation (ENSO).

^e Focuses only on Asia.

Table 1: Overview about large-N studies concerning a possible climate-conflict link

¹¹² Even if the relationship is weak, indirect or dependent on scope conditions.

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