14 How does path dependence affect the climate change-conflict nexus?

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Table of Contents

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Abstract

In sociology, path dependence can be defined as a self-reinforcing process with the tendency towards a lock-in. This concept can be applied to the climate-conflict nexus to assess how path dependence, this particular characteristic of a process, affects the complex potential causalities of climate-induced conflict. Does path dependence enhance the conflict potential through butterfly effects or does it rather pacify by increasing conformity? The nature of climate change-induced conflict is analyzed with an integrative framework that is based on a review of peer-reviewed related case studies. Using the methodology of mathematical sociology, a complex causal chain is drawn to reflect the influence of path dependence in the situation of climate change-induced conflict. Sociological conflict theories are used to depict, in which way and to what extent path dependence may or may not influence the societal reaction to climate change.

KEYWORDS: *path dependence, climate change, conflict, sociology, feedback loops.*

Introduction

Can path dependence or climate change induce violent conflict? This is the title of my cumulative dissertation, which combines new developments in path dependence theory with research on the climate change-conflict nexus. A key issue is how path dependence affects the climate change-conflict nexus.

> Climate change in IPCC usage refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the Framework Convention on Climate Change, where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods (Parry et al. 2007, p. 6).

From a sociological perspective, the role of humans is more important than the mere climatic changes as "natural scientists have recognized that climate change is a "people problem": it is caused by human behaviors, it poses real threats to humans, and it requires collective action for its amelioration" (Dunlap and Brulle 2015). An indirect consequence of climate change, which is a threat to humans, can be conflict. Even though conflict is usually something very active, in the discussion of climate change-induced conflict, conflict gets a passive connotation.

Conflict is a main term in sociology and is used in various contexts. However, the induction of conflict by anything else than social agents is only rarely reflected. In the empirical literature on the climate change-conflict nexus, which tries to assess whether or not there is a linkage between climate change and conflict, usually the definition of conflict is drawn from the data used. For example, there are data on conflict within a state or among states differing on whether or not the government is involved [state as an actor] and that vary with regard to the defined minimum number of casualties in a specific time span and region to make it count aws violent conflict. Moreover, of course, only documented or observed conflicts are counted. The identification of "reasons" for conflict onset is even trickier. A statistical correlation does not explain the underlying mechanisms. One main mechanism considered in the climate-conflict nexus is resource scarcity. Explained in terms of action theory, actors are expected to react in a conflictive manner when their resources get scarcer, as is potentially the case due to climate change. Such affected resources can be for example water availability due to changes in precipitation patterns or assets due to losses in extreme events. However, particularly for water, scarcity has often led to cooperation instead of violent conflict, which is documented in many international water agreements. And sometimes even the opposite effect can be discovered: in parts of Kenia violent conflict is more present when more cattle are available and

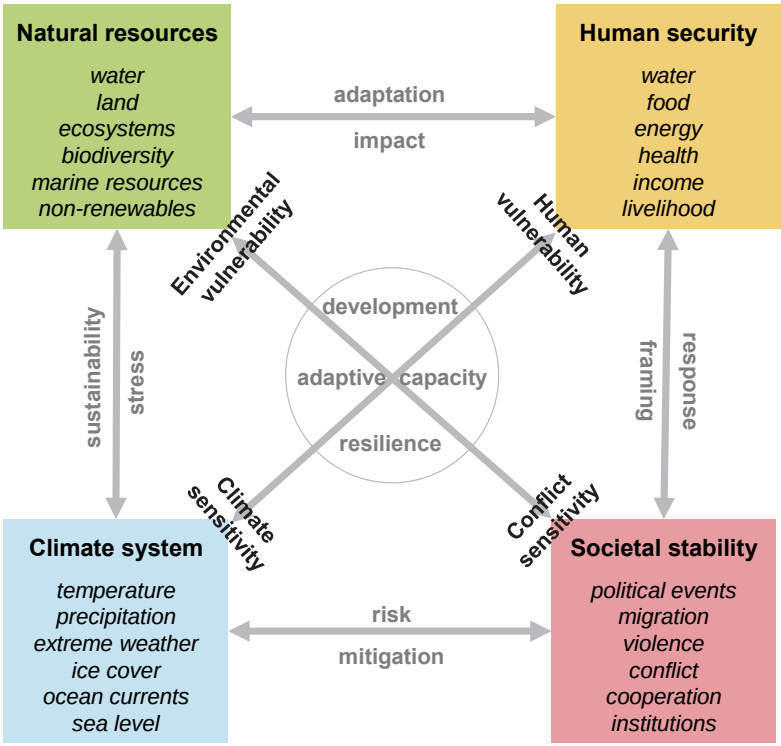

Figure 1: Analytical framework of linkages between the climate system, natural re-sources, human security, and societal stability. Source: Scheffran et al. 2012a.

in good shape for raiding during the rainy seasons (Schilling et al. 2012). Thus, the climate change-conflict nexus is complex (Figure 1).

Path dependence is generally used in social sciences in a sense of "history matters" or "former events shape later ones" where the "path" is formed by a sequence of events and the order matters (for further reading on reactive sequences, e. g., Mahoney 2000). For example, the invention of the steam engine (one event) has triggered the industrial revolution (next event), which has triggered climate change (subsequent event). In this example, the industrial revolution depends on the invention of the steam engine and climate change depends on the industrial revolution. Thus, climate change depends on the invention of the steam engine. However, if the steam engine had been invented without triggering any substantially large-scale applications during the industrial revolution, it is likely that less carbon dioxide would have been emitted in the

20th and 21st centuries and climate change would have been less intense or would not have occurred at all. Thus, each of the events matter as well as the logical order of the events. A more process-oriented view of path dependence considers self-reinforcing dynamics such as positive feedbacks and the occurrence of lock-ins such as tipping points. In this definition, which I use fundamentally throughout my work and also in this essay, a path-dependent process is defined as a self-reinforcing process with the tendency towards a lock-in (Sydow et al. 2005, 2009).

By now, of course, there is substantial literature on climate change and violent conflict. Some of this research addresses whether or not a linkage exists in theoretical or meta-study reflections. Furthermore, there are case studies in various regions with diverse stakeholders and differing conflict intensity. However, none of these peer reviewed published studies reflects on the role of path dependence on the linkage between climate change and conflict, how path dependence shapes the intensity of the outcome or the dynamics of the involved mechanisms (Link 2018). This issue is addressed in this essay. The research question is how climate change can induce a path-dependent process that self-reinforces conflict. To answer this research question a mix of three methods is used:

1. An analytical framework on climate change and conflict (Figure 1; Scheffran et al. 2012a);
2. A comparative review of the peer reviewed scientific literature on the linkages between climate-related indicators and data on violent conflict using large-n designs, published between 2004 and 2012: "To come to conclusions about the effect of climate change on violent conflict with validity beyond single cases, we limit the analysis to (quantitative) empirical studies using regression analysis based on conflict and climate data because of their increasing importance in the recent debate and the difficulties associated with the comparison of (qualitative) field-research studies. We analyze the results of recent relevant studies, classifying them with the help of a number of criteria such as specified climate-conflict link, conflict type, region, analyzed period […] and data used to carve out differences and similarities. We limit the analysis to studies published since 2004 and accept their academic credibility as articles published in peer-reviewed scientific journals" (Scheffran et al. 2012b);
3. Theoretical deductions about potentially induced dynamics based on the results of the above methods and path dependence theory, especially self-reinforcing processes.

Within the analytical framework (first method), I note the potential mechanisms extracted from the empirical literature (second method). Then I describe in further theoretical deductions (third method), how these mechanisms can be triggered by climate

change and in particular, how they link conflict to climate change in a self-reinforcing spiral via increasing vulnerabilities. This is done using aggression theory and rational choice as conflict theory, which is basically resource conflict theory.

This essay concludes with a short summary of the findings, including a short note about another application of path dependence theory on climate change-induced conflict.

How can climate change induce a path-dependent process that self-reinforces conflict?

The main conflict theories used in the climate-conflict nexus are resource conflict theories and aggression theory, as these are action-centered and related to natural resources and human security, which are both depicted in Figure 1. Resource conflicts can be triggered by altered resource distribution or changes in resource availability. Aggression theory incorporates the idea that conflicts may worsen or break out if people get more aggressive. This can potentially be the case if physical conditions vary due to climate change.

Human aggression can be defined as the violation of a norm, which implies current or potential harm by a responsible person. The act of the violation can be means or end of action but without any arguments or excuses (following Mees 1990, p. 286). The classical frustration-aggression-theory tries to include the reason for human aggression before the act, an inner frustration. An environmental component, which is necessary to be able to reflect on climate change-induced conflict, is empirically studied by Berkowitz:

> Take high temperatures as a case in point. Have you ever found yourself in a very hot room that you couldn't leave for several hours, for one reason or another? If you're like many other persons, according to a growing body of research, there's a good chance that you became irritable and perhaps even openly hostile (Berkowitz 1993, p. 51).

Berkowitz' neoassociationistic aggression model is a revision and development of the classical frustration-aggression-theory (Bonacker 2008). The model describes that automatically feelings of fear or anger arise in affected people. These feelings are then connected to "flight or fight". Experiments have shown that the larger the changes in environmental conditions are (room temperature during the experiments) and the worse the considered person is feeling, the lower the threshold to actually perform aggression and violence on others becomes. In the experiments, the presence of weapons has significantly increased the likelihood of the considered peo-

ple to interpret their own feelings as anger, which increases the likelihood to act aggressively (Berkowitz 1993, p. 72ff.). Thus, existing conflicts can increase the likelihood of further aggression even if this aggression is not directly related to the existing conflict constellation. Aggressive behavior can induce further conflicts and enhance existing ones. The inclusion of the environmental component makes it applicable in the context of potential climate change-induced conflicts.

In climate-conflict research, the conflict theoretical basis is often not clearly defined. In my research, I base resource conflicts on rational choice theory. Rational choice theory is a very large field of sociology at the intersection to economics seeking to explain every potential social behavior as the outcome of individual interaction, which is supposed to be basically rational (Coleman 1990; Esser 1993). One fundamental model is RREEMM:

> Resourceful: man can search for and find possibilities; he can learn and be inventive;
> Restricted: man is confronted with scarcity and must substitute (choose);
> Expecting: man attaches subjective probabilities to (future) events;
> Evaluating: man has ordered preferences and evaluates (future) events;
> Maximizing: man maximizes (expected) utility when choosing a course of action;
> Man (Lindenberg 1985).

RREEMM is a sociological development of the homo oeconomicus who is a special case of RREEMM. Within this model thinking, actors can be considered to their subjective expected utility (SEU) on the micro level and play pairwise prisoner's dilemmas. Even though both would be better off in performing cooperative behavior, each individual is better off defecting and thus the Nash-equilibrium is the situation of both defecting, i. e. the situation of conflict (Bonacker 2008). Rational choice theory and the SEU can be applied to explain arms races and resource conflicts (Scheffran 1989, 2008; Scheffran and Hannon 2007), too. In the further deductions, these theories are used as broader background theories but they are not applied via utility functions or game theory. The idea is to show the overall linked mechanisms and their interaction dynamics with regard to climate change and conflict.

How does path dependence affect the climate change-conflict nexus?

Here, I start with the second method, the comparative literature review of research published between 2004 and 2012 that is presented by Scheffran and others (2012a) and further elaborated in a second paper (Scheffran et al. 2012b). There are large differences between regions and time periods, different types of conflict are addressed, and

even the variables that have been studied vary among the different cases. Still each of the papers analyzed states whether the authors have found a correlation of the analyzed variables, changes in precipitation, temperature changes, occurrence of disasters, land degradation or changes in the vegetation, and conflict with or without involvement of the state and using different data sets. Geographic foci range from African regions, East Asia, or Europe to global analyses. While this variability points to no direct comparability, 16 of the 27 studies have found a link between the analyzed climate change variable and conflict. Most of these examined the relationship between precipitation change and possible conflict onset, other key drivers studied include temperature, disasters, and land use change (Scheffran et al. 2012b), with a focus on conflicts that involve state actors. In contrast, six explicitly stated that there was no link among their analyzed climate variable and conflict variables. That leaves five studies, which state that in their cases the linkage has been ambiguous, giving arguments both for and against a climate-conflict-link. These studies look at water resources and land use change as conflict drivers and point to increased conflict likelihood for substantial deviations of the drivers from current mean states. And even if long-term historical studies rather suggest a linkage and studies that are more recent rather do not: a mere statistical correlation does not reveal the underlying mechanisms of induction.

Thus, searching for the underlying mechanisms of induction, the next focus is not only on the climate variables and potential conflict variables they induce but also on potential intermediate factors, taking into account that a potential induction is not necessarily direct.

> Since the 1990s, there has been an extensive scientific debate on how the scarcity of natural resources such as minerals, water, energy, fish, and land affects violence and armed conflict (Bächler 1999; Homer-Dixon 1994). While many case studies suggest that environmental degradation and resource scarcity undermine human well-being, the effect on violent conflict "appears to be contingent on a set of intervening economic and political factors that determine adaptation capacity" (Bernauer et al. 2012, p. 1). Particular attention has been placed on the following intermediate factors (Scheffran and Battaglini 2011; WBGU 2008) (Link 2018, p. 91f.).

These intermediate factors can be summed up as:

- precipitation change and variability,
- freshwater resources and scarcity,
- land and food,
- weather extremes,
- environmental migration.

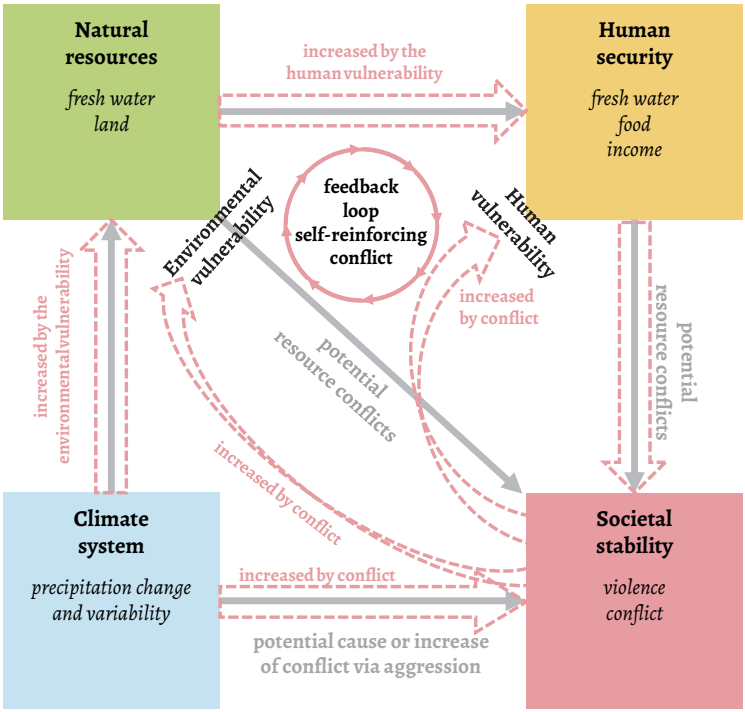

Figure 2: Central intermediate factors in the analytical framework (Figure 1). *Note: Marked in red are the potential feedbacks via violent conflict and vulnerability, induced by climate change.*

Focusing on the region that is affected by climate change, environmental migration as outmigration is rather an adaptation measure and likely to reduce conflict in the originally affected regions. Whether or not weather extremes lead to local crises still needs to be studied because some cases of crisis have induced cooperation rather than conflict. The rest can be connected by causal chains such as precipitation change and variability can lead to impacts on the availability of freshwater resources and to impacts on land and food production. Associated conflicts that have been analyzed are framed as potential resource conflicts, thus fitting with the theoretical basis of this deduction. For freshwater resources, rather induced cooperation is mentioned instead of conflicts due to the increasing number of international water agreements.

Therefore, the extracted linkage of intermediate factors is that climate change can cause precipitation change and variability in water availability, which in turn can

lead to impacts on land and food production. In the following, I describe in detail how I place this linkage in the context of the framework mentioned above (Figure 2).

In the next step, I selected these intermediate factors, which are considered to play a crucial role in the process of induction of conflict by climate change from the components in the analytical framework of linkages between the climate system, natural resources, human security, and societal stability (Figure 1).

> In Figure [2], the final three intermediate factors and the conflict potentials have been sketched in the scheme of the complex analytical framework (Figure [1]). Afterwards, I have added the potential feedbacks that conflict can have on the vulnerabilities, i. e. the human vulnerability and the environmental vulnerability, via the conflict's potential impacts on the adaptive capacity and the sensitivity to climate change, referring to: Vulnerability can be broken down into three factors: (i) exposure to climate change, (ii) sensitivity to climate change, and (iii) adaptive capacity (Parry et al. 2007). The last two can be affected by conflict (Link 2018, p. 60).

That way, conflict can increase environmental vulnerability, which increases the effect of changes in the climate system on the environmental system (Buhaug 2015). Along the causal chain, conflict can increase the impact of changes in the environmental system on human security as well by increasing human vulnerability (Matthew 2015). The accumulated impacts can further lead to increased resource conflicts (Vivekananda et al. 2014). This causal deduction describes a feedback loop induced by climate change, in which conflict feeds back on increasing conflict and thus self-reinforces conflict (Link 2018). Does this self-reinforcing process of conflict approach a lock-in? That depends on the kind of conflict. There are lock-ins possible for resource conflicts: on the one hand, a theoretically trivial lock-in would be reached if the conflicting parties destroyed each other or if only one of them survived. Another lock-in could be reached if the conflict was institutionalized such as the conflict over land between Israel and Palestine (Chapman and Benson 2015; Gerner 2018). In the first type of lock-in, the level of violent conflict escalates up to destruction while in the second type of lock-in, the conflict becomes an institution, which can be fought out on various levels without destroying each other. Instead, it maintains the conflict even in times of lower levels of intensity of violence (Link 2018).

Consequently, climate change can induce the path-dependent process of self-reinforcing conflict. This matches the discussion of climate change being a threat multiplier of existing conflicts rather than causing them initially. But the application of aggression theory allows the description of one mechanism how climate change could induce conflict, i. e. if people react increasingly aggressively due to the feeling

of being affected by environmental change (Figure 2, arrow at the bottom directly from the climate system to the societal stability) (Link 2018).

Conclusion

This essay describes my research in the context of the Research Group Climate Change and Security (CLISEC) and my dissertation (Link 2018) on the specific question how climate change can induce a path-dependent process that self-reinforces conflict. From empirical literature, potential mechanisms for climate change-induced conflict are extracted and connected in the analytical framework of the interacting climate system, natural resources, human security, and societal stability. This framework is used to visualize how these extracted induction mechanisms can form a self-reinforcing process that reinforces conflict by stepwise increasing environmental and human vulnerability, which intensify the effects of climate change on the induction mechanisms. Based on aggression theory and the theory of resource conflicts during the described self-reinforcing process, climate change acts as a multiplier enhancing existing conflicts and increases the likelihood of triggering or spreading further conflicts.

Current political developments such as global climate demonstrations reveal even more applications of path dependence theory on climate change induced conflict: In my dissertation, I have shown mathematical sociologically that the more an agent is affected by path dependence, the more that agent tends to perform a following behavior. Considering opposing hierarchies such as climate change activists and climate change deniers, path dependence reinforces their opposition whenever an event triggers their path-dependent social network (Link 2018). That way, climate change can induce conflict among those opponents, which is reinforced via path dependence. This is another example of how path dependence affects the climate change-conflict nexus, highlighting the necessity to more strongly appreciate the role path dependence plays in determining people's actions.

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