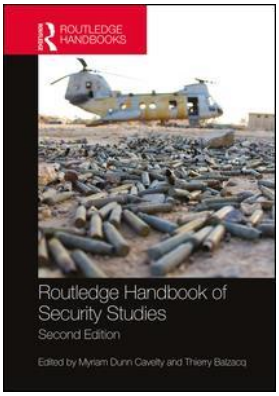

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RESOURCES, THE ENVIRONMENT, AND CONFLICT

Ole Magnus Theisen and Nils Petter Gleditsch

Since the Second World War, around 250 armed conflicts in over 150 countries and territories have claimed some 10 million lives in battle-related violence.[1] The current number of armed conflicts has declined markedly since the early 1990s, despite a recent upswing. Persons killed in battle have shrunk dramatically since the Second World War and mortality from violence overall is on a long-term decline (Pinker 2011). However, the thirty-plus ongoing armed conflicts continue to represent a crucial component of human insecurity. In addition to the direct loss of life in battle, armed conflict claims high human costs through disease, refugee flows, and the destruction of infrastructure (Gates et al. 2012). Reducing armed conflict makes a major contribution to improving human security. Can we look forward to a continued reduction in global violence?

A number of potential hurdles to a continued decline of violence have been proposed. One of them is increasing resource scarcity. A common perspective is to view scarce renewable resources as a motive for fighting – be it with your neighbour, another group, or even the state. Increasing concern with the condition of the world's environment in the 1970s led many to believe that environmental degradation might become sufficiently serious to lead to violence. Many saw the role of resources as filling the explanatory gap as armed conflict continued even after the decline of ideological conflicts associated with the Cold War. This perspective has been identified as neo-Malthusian.

Climate change has now arguably replaced classical neo-Malthusian concerns as the most debated model of 'environmental conflict'. Since the social mechanisms in the causal model linking resource scarcity to conflict are largely unchanged, we refer to both as the 'ecoviolence' perspective. This view in turn has been fundamentally challenged by environmental optimists,[2] as well as by political ecologists and liberals.[3]

This chapter has three major parts. First, we review the main strands of thought in the debate before providing a brief survey of the empirical state of the art. We find the more dramatic version of the ecoviolence model to have little empirical foundation, particularly if scarcity in and by itself is expected to produce conflict. We round off by pointing out some of the main problems of the empirical literature and discuss future priorities.

Schools of thought

Ecoviolence

The original model of Malthus (1993[1798]) assumed that any human population would grow at a geometrical ratio, while food production could only grow arithmetically – resulting in recurrent demographic collapses. Important elements of this model survive in current ecoviolence models. Natural resources are seen as limited on 'spaceship Earth' and so is human rationality under stressful conditions. Population growth, increasing consumption, and harmful methods of extraction combine to deplete or depreciate resources. The resulting scarcity can lead to competition and eventually armed conflict.

Moderate ecoviolence scholars argue that this generally happens through increased grievances or by weakening the state (Homer-Dixon 1999), but also by making the alternatives to legal labor more attractive, ranging from petty theft to joining an insurgent movement (Burke et al. 2009). This line of thinking is found in the Club of Rome's *The Limits to Growth* (Meadows et al. 1972), in the report by the Brundtland Commission (1987) on the environment and development, and in several scholarly works (e.g. Homer-Dixon 1999; Myers 1993; see Kahl 2006 for a modification). It is also reflected in the literature of most environmental pressure groups, many environment ministries, and other official bodies, as well as in the justification for awarding the Nobel Peace Prize for 2004 to Wangari Maathai and for 2007 to Al Gore and the Intergovernmental Panel on Climate Change (IPCC).

Scarce resources considered important enough to fight for include land, fresh water, and food; these resources are thought to become even scarcer due to population growth. For instance, a great deal of public attention has been given to the prospects of 'water wars', where upstream countries would dam or consume river water and provoke water-constrained downstream countries to go to war (Starr 1991). A favourite case is Egypt's anger with Ethiopia's damming of the Blue Nile potentially spilling over into conflict. For developing countries, ecoviolence scholars foresee a decline in food production. More recently, climate change with increasing temperatures, shifting precipitation patterns, an increased frequency of extreme weather events, melting ice-sheets, and sea-level rise has taken centre stage within the ecoviolence argument, often leading to very dire projections (Hsiang et al. 2013, though see Buhaug et al. 2014 for a rebuttal).

Environmental optimists

Environmental optimists stress that natural resources are generally more abundant than realized in ecoviolence models. Resources can be substituted and recycled when necessary, and technological progress makes it possible to consume less. In this view, the relative importance of renewable resources decreases as technological advance is driven by human ingenuity and demands from the market economy. The optimists seldom comment on conflict (see Simon 1989 for a rare exception), but their views have clear implications: if resources are globally abundant and can be priced, substituted, and traded to avoid serious scarcities, and if the increase in population can be held in check, there is no obvious reason why groups or countries should fight over natural resources. If resources are scarce to the point where people will fight for them, it is because politics has interfered. To avoid waste, inefficiency, and local scarcity, resources must be properly priced and trading allowed.

Ecoviolence scholars counter these points by stating that markets and institutions are frequently dysfunctional in developing states, and they thus fail to alleviate scarcities. New technologies (as illustrated by desalination of salt water or the Green Revolution) are usually too

expensive for poor farmers and frequently lead to further degradation. Moreover, some resources, such as water, are non-substitutable. Finally, environmental degradation often follows a non-linear pattern, complicating detection and making preventive measures harder to apply (Homer-Dixon 1999; Kahl 2006).

Environmental optimists are somewhat divided on the demographic issue. Boserup (1965) argues that population growth is conducive to rural economic growth[4] and Simon (1996) argues that human ingenuity is the only scarce resource. Thus, continued population growth will provide an advantage in the indefinite future. Most environmental optimists, however, argue that the second demographic transition (lower fertility) is now cancelling out the effects of the first (lower mortality). A recent UN population projection (UN 2012) indicates that world population is likely to increase from its current level of 7 billion to close to 11 billion at the end of the twenty-first century, with Africa experiencing a fourfold increase (Gerland et al. 2014). UN population projections have been criticized by Lutz et al. (2014) for not accounting properly for the effects of education and for overlooking recent survey material on fertility for pivotal countries. These scholars project that world population will peak at 9.4 billion in 2070 and then gradually decline. In any case, neither projection implies a 'population explosion', although some regions still have high population growth.

Figure 20.1 shows the trend in food prices for the period 1960–2014. The long-term development up to the year 2000 lends little support to a prediction of a global food crisis. The most recent decade and a half, however, has seen a rise in food prices, which has been linked to climate extremes and which in turn has been said to cause social unrest. According to this view, the Arab spring was caused by increases in food prices triggered by drought in China's wheat-growing region. In turn, this led to major purchases of wheat in the global market, doubling the price of wheat, with important political implications for Egypt, the world's largest importer of grain (Sternberg 2012). However, the IPCC's Fifth Assessment Report (IPCC 2014: 495) states that even though prices may have become more sensitive to extreme weather in recent years, the effect of oil on prices is increasing. Thus, it is difficult to attribute global price fluctuations to weather phenomena. Disregarding the impact of climate, some analyses have found a link between food production or prices and different forms of political instability (Arezki and Brückner 2014; Maystadt et al. 2014), while others have failed to do so (Buhaug et al. 2015).

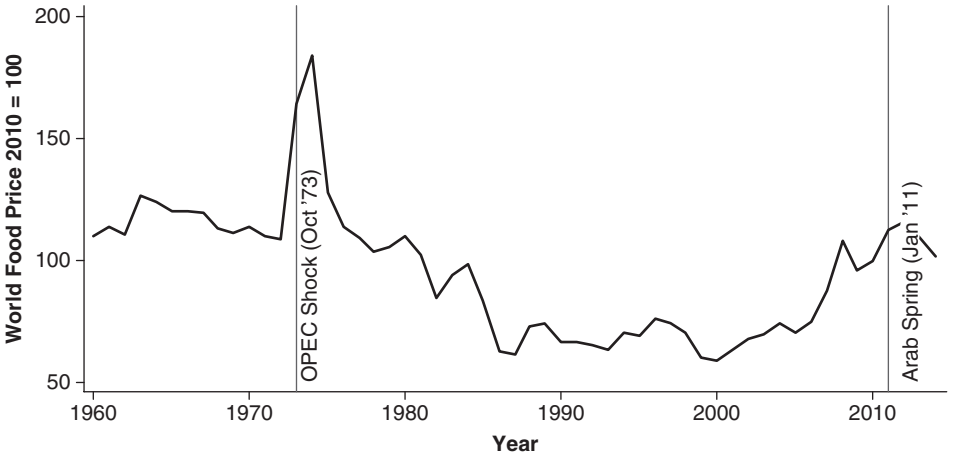

Figure 20.1 International food prices 1960–2014

Note: Global food prices weighted by the Manufactures Unit Values Index (World Bank 2015).

The role of institutions: liberals and political ecologists

Liberal conflict theory rests primarily on the role of cooperation and the role of democracy. It argues that an emerging resource scarcity may stimulate cooperation as well as violent conflict. Fighting over a shared resource may be more costly than working out ways to share it. Low-level conflict may serve as a warning signal that prompts states or groups into cooperation (Lonergan 2001; Wolf 2007).

Democracy is relevant to resource conflict in two ways. First, liberal theorists argue that democracy is likely to promote resource conservation (Gleditsch and Sverdrup 2002; Payne 1995) or at least environmental commitment (Neumayer 2002). Sen (1989) points out that famines rarely, if ever, occur in democracies, because press freedom and other features of democracy provide warning signals and mobilize countermeasures when food shortages occur. Second, stable democracies are very unlikely to fight each other (Gleditsch and Hegre 1997) or to suffer serious internal violence (Hegre 2014; Hegre et al. 2001). If democracies very rarely fight internally or among themselves for any other reason, they are not likely to do so because of resource scarcity.

Political ecology, the fourth general strand of thought, refutes any strong *direct* linkage between renewable resource scarcity and conflict (Turner 2004). If scarcity appears to promote conflict, there is most likely a third factor causing both. Issues of distribution, power, and institutions are therefore more important than absolute resource scarcity as they mediate the actors' access to more or less scarce resources. While political ecologists do not generally side with the optimists, they are critical of ecoviolence models (see Hartmann 2014; Peluso and Watts 2001). Liberals share with many environmental optimists a belief in the beneficial effects of the market. With political ecologists, they share a focus on institutions, which they see as more important than the physical state of the environment. While liberals tend to focus on democracy and cooperation, political ecologists usually emphasize questions of distribution. Hence, these two schools often have divergent views of the effects of trade liberalization on livelihoods in the developing world.

The state of research

Theoretical shortcomings

The argument between the different schools of thought has generated much heat. Can we adjudicate this debate by means of systematic empirical evidence? The existing empirical literature suffers from several methodological problems. We will first deal with the case-based literature. We then turn to contemporary large-*n* research, which has recently grown too rapidly to permit a discussion study by study.

Case studies from the ecoviolence tradition, primarily represented by Homer-Dixon (1999) and his associates, as well as Bächler (1999) and Kahl (2006), have been criticized for lack of detail. The lack of archival research, detailed field research, and opinion surveys makes it difficult for the reader to identify the conflict actors and trace their motivations. Surprisingly few studies show clearly 'who did what to whom when and why' in conflicts where scarce renewable resources are said to play a role (Deligiannis 2012: 86). Moreover, studies that do contain such detailed information have only recently started to inform theoretical arguments in quantitative analyses. The lag has arguably occurred because such studies frequently belong to political ecology, anthropology, and geography – fields international relations scholars and economists are not very familiar with. Although some high-quality studies have been published in the last few years (e.g. Adano et al. 2012), case studies without sufficient detail still dominate the field,

risking leading large-*n* researchers astray as processes driving complex conflicts are sometimes compared to aggression in baseball (see Raleigh et al. 2014 for a critique).

Homer-Dixon (1999) and his associates limited their studies to cases with armed conflict. Such a design provides a good starting point for a research programme, but makes it impossible to judge whether the conflict cases suffer from more severe scarcities than the peaceful cases, or what contextual factors matter. An improved research design was used by Bächler (1999), who studied twenty-one conflict and twenty-one non-conflict cases, and who reached more moderate conclusions regarding the role of renewable resources.

Another issue is how to measure scarcity. The concept of environmental scarcity (Homer-Dixon 1999) includes *supply-induced scarcity*, referring to the absolute supply of a resource, the ways of extracting it, and its vulnerability; *demand-induced scarcity*, which is driven by increasing consumption per capita; and *structural scarcity,* the distribution of a resource.[5] This operationalization has been criticized for lumping together quite disparate processes that could be seen as causes or effects of each other rather than supplements. For instance, scarcity of farmland (i.e. demand-induced scarcity) is frequently seen as a motivation for more intensive crop methods and economic diversification, while severe pollution or degradation (i.e. supply-induced scarcity) is much less likely to produce the same outcome (Fairhead 2001: 219).

Finally, scholars across methodological divides frequently refer to future wars as evidence. The statement by Ehrlich (1968: 11) that the battle to feed humanity has been lost is one example, the many references to 'climate wars' another (Schwartz and Randall 2003). While there may well be a potential for future conflict, pessimistic predictions must be accompanied by a solid theoretical argument for why future societies will be sufficiently different from the present to bring about such dramatic changes.

*Large-*n *studies*

The vast expansion of the quantitative literature on resource scarcity and conflict inspired hopes of discovering strong and robust relationships. If scarcities increase in the future, it could then be plausibly argued that we should expect more scarcity-based conflict. Although both methods and data are improving, the field is far from reaching agreement on linkages that are robust to different methods, operationalization of key concepts, time periods, or types of conflict (Bernauer et al. 2012; Buhaug et al. 2014; IPCC 2014; Meierding 2013; Scheffran et al. 2012).

An early review by Theisen (2008) shows that there is little consensus on the neo-Malthusian idea that scarcity of land and water is an important driver of civil conflict at the national level. Studies at sub-national levels are somewhat more supportive of land pressure and different forms of violence (e.g. André and Platteau 1998; Raleigh and Urdal 2007; Tadjoeddin et al. 2012). A number of studies have investigated the 'water wars' argument. Gleditsch et al. (2006) found that sharing a river increases the risk of low-level interstate conflict, although water scarcity does not appear to be very important. Brochmann and Gleditsch (2012), however, found with new data that it was difficult to distinguish between the effects of being neighbours and sharing a river. Hensel et al. (2006) analyzed specific river claims and found that water scarcity in the challenger state increases the risk of militarization of a river claim, while specific river institutions decrease the risk of a militarized outcome. Wolf (2007) found very few violent skirmishes in modern times but a very strong record of cooperative behaviour over water issues.

From an initial concern with slower-moving processes such as land pressure, the literature has shifted to a focus on shorter-term phenomena such as drought, temperature spikes, and natural disasters. Two studies in particular have generated heated debates. Miguel et al. (2004) used year-on-year changes in rainfall as an instrument for economic shocks, concluding that loss of

rainfall increases conflict through its effect on economic growth. Although not targeted at the climate–security debate, the study has served as inspiration for several such studies. The study has been criticized for its conflict coding (Jensen and Gleditsch 2009) as well as for its measure of climate anomalies (Ciccone 2011). Several other studies have failed to find a robust link between rainfall as an instrument for growth on the one hand, and civil conflict as an outcome (Koubi et al. 2012; van Weezel 2014). Studies testing the direct effect of precipitation on civil conflict have found that less rainfall increases risk (Hendrix and Glaser 2007) and has no effect on conflict (Theisen et al. 2012), or decreases conflict risk (Hendrix and Salehyan 2012; Salehyan and Hendrix 2014). Over ten studies have analyzed rainfall and civil conflict in sub-Saharan Africa, without reaching consensus (Theisen et al. 2013).

A highly publicized study of temperature and conflict (Burke et al. 2009) found civil war in sub-Saharan Africa to be significantly more likely during warmer years, leading to an increase in civil war incidence of about 50 per cent by 2030 on current climate emission trajectories. This finding was challenged by Buhaug (2010), who demonstrated that their results are sensitive to the choice of estimation technique, sample period, and the choice of conflict data. While the jury is still out on the methodological divide, Burke et al. (2010) concede that temperature is unrelated to African civil war if more recent years are added to the analysis. Other recent studies fail to find robust effects of temperature on civil conflict (Couttenier and Soubeyran 2013; Klomp and Bulte 2013; Salehyan and Hendrix 2014).

A 'coming anarchy'?

The failure of the research community to reach a consensus begs the question whether there are any systematic relationships outside specific contexts. Most quantitative studies have focused on the role of scarcity in the form of droughts, heat waves, or natural disasters as motivations behind violent collective action. In this they have relied heavily on ecoviolence studies, or less tenable assumptions derived from psychology, which might be problematic, as they often overlook relevant literature that could point out other potential effects of contemporaneous or near-contemporaneous weather. Detailed research on farmer–herder conflicts in the Sahel (Turner 2004) or cattle raiding in East Africa (Adano et al. 2012) has shown that such fights are rarely motivated by a sudden fall in access to water or pasture. The immediate effects of weather in these contexts generate tactical responses that bear more resemblance to how the weather has affected tactical considerations in the conduct of conventional warfare (Winters 2001), than causing spontaneous fights over dwindling resources. Thus, analysis of contemporaneous relationships between weather and conflict run the risk of conflating tactical considerations about when to fight (or remain peaceful) with underlying motivations for fighting (see Landis 2014; Salehyan and Hendrix 2014 for recent discussions of this). Lagging the effect of resource variables by a few time-units would reduce this risk, but it would then deprive the researcher of the ability of analysing 'shocks' as potential triggers of violence.

In the search for the possible effects of scarce renewable resources on grievances, the potentially contradictory effects of adverse weather and land value in the short term often go unnoticed. As a drought sets in with the concomitant fall in food production, land prices tend to fall, and cattle prices even more so (Sen 1982). Thus, the motivation for fighting over scarce food – more valuable in drought years – might increase, while land and cattle – comparatively *less* valuable in drought years – could provide less of a motivation for fighting.[6] Conversely, in climatically good times the value of land and cattle rises and could provide greater motivation for contest.

Spatial factors also need more attention. Recently several studies have heeded the call of analysing potential local effects of resource scarcity (e.g. Theisen et al. 2012), but very few studies have been able to capture long-distance effects of weather or climate on resource scarcity. As the discussion

of the Arab Spring in Egypt shows, suggested causes and effects may be thousands of miles apart and involve several steps between the ultimate cause and the final outcome. Moreover, geographically disaggregated analyses aiming at capturing local scarcity may suffer from myopia by conflating the actual locality of the fighting with the area where grievances have their origin (Detges 2014).

Based on this review of the literature, the more drastic apocalyptic scenarios forecasting global scarcities, mass deprivation, and major interstate and intrastate violence should be viewed with scepticism. However, local and regional scarcities are still possible, and in some cases even plausible. A major war over shared water resources seems very unlikely, while local and smaller armed clashes and military posturing cannot be ruled out. Resource scarcity is also likely to interact with factors such as economic development and political institutions in increasing the risk of conflict. Two channels, food security and migration (Bernauer et al. 2012), often feature as the most plausible links between climate change and violence. Some research has been carried out on food prices and different forms of violence (see above), but data constraints have impeded cross-national research on environmentally induced migration and violent conflict. The 'environmental migration' literature tends to overlook conventional explanations of migration and therefore overemphasizes environmental factors (Doevenspeck 2011). Similarly, alarmist claims about widespread conflicts over food caused by crop failures often overlook essential insights into how starvation and famines arise through processes of entitlement loss (Sen 1982).

Could drastic shifts change this picture? Human-induced climate change is often presented as the ultimate ecoviolence scenario. Figure 20.2 shows the Northern Hemisphere temperature patterns for the last 1500 years. This is the famous 'hockey stick', with the recent rise in temperature as the blade of the stick. Earlier versions of this graph have been criticized for underestimating extremes in the pre-1850 period.[7] Moreover, the last fifteen years have seen slower growth. Historically, this is a short period and the causes of the slowdown of global warming are not clear (IPCC 2013:194). There is broad scientific agreement that globally the past thirty to fifty years are warmer than any other period of that length during the last 800 years, and that this is mainly attributable to anthropogenic emissions (IPCC 2013: 386).

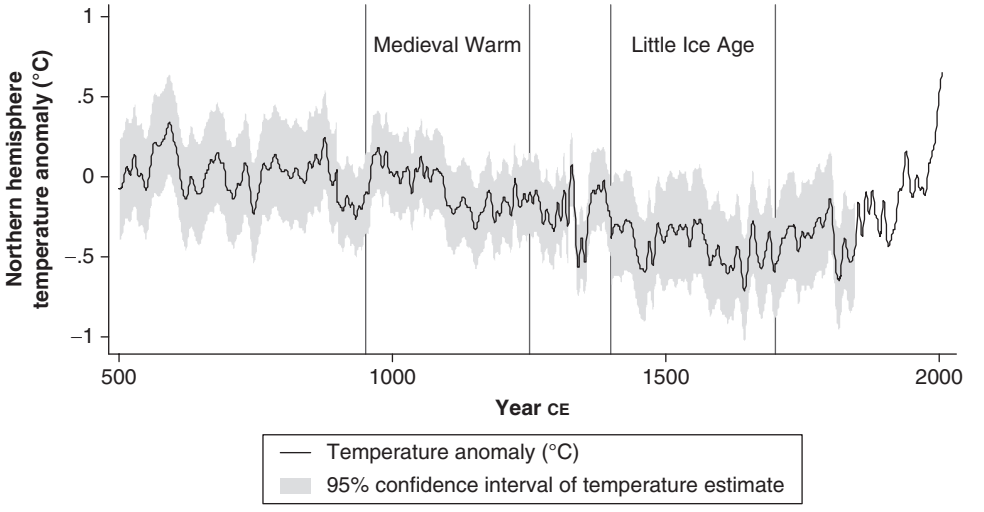

Figure 20.2 Northern Hemisphere temperature anomalies 500–2006 CE

Note: The graph shows the Northern Hemisphere mean temperature. Data from Mann et al. (2008).

The rise in temperatures plays a key role in some ecoviolence scenarios which foresee that some parts of the world will be more prone to violent conflict (e.g. Burke et al. 2009). But can year-to-year variations in weather – by far the most frequently used way to capture climatic effects on conflict – yield relevant information about social effects of long-term climate change? Climate is generally interpreted as the average weather over a longer period, typically thirty years (IPCC 2013). Critics, including the authors of Chapter 18 of the most recent IPCC assessment of the social effects of climate change, warn against conflating weather anomalies with climate change.[8] Studies using annual or monthly deviations from a period mean assume stationarity in the longer-term climate, which is unlikely (Busby et al. 2012), although for the short to medium term for Africa, the most studied region, 'observed rainfall variability is *greater* than changes [in levels] suggested by climate models for the next 50–100 years' (Adger et al. 2003: 187, italics in original). Analyses of climatic changes over the centennial and even millennial scale are more in line with the conventional definition of climate. Such studies have consistently found that periods with a climate less suitable for agricultural production, i.e. a *colder* climate in the temperate zone, see more upheavals and wars (e.g. Tol and Wagner 2010; Zhang et al. 2011), although an increasingly industrialized and globalized economy makes it hard to generalize these findings to the modern era.

Thus, we cannot be very specific about the implications of longer-term climate change on the risk of future violent conflict. Even within the generally accepted scenarios of a human-induced rise in global average temperature of 2–4 °C in the twenty-first century, we are unable to account reliably for the negative and positive effects on human affairs. While the Maldives and substantial parts of Bangladesh may be flooded by sea-level rise, Siberia may bloom from rising temperatures. Drastic climatic change will require adaptation which, while costly, may also lead to innovation. However, if nations act in unison to combat climate change and its adverse consequences, it could also have a rallying effect and lead to more cooperation and less conflict. Environmental and resource factors in conflict certainly warrant our attention; but our knowledge is limited. Only by mobilizing considerable hubris can we take for granted that man's domination of his environment is as benevolent as envisaged by the optimists or as malevolent as outlined in ecoviolence scenarios.

Notes

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1 Based on the UCDP/PRIO conflict data, which include all armed conflicts with more than 25 battle-related deaths in a given year (Gleditsch et al. 2002; Themnér and Wallensteen 2014). The figures for battle deaths are from Lacina and Gleditsch (2005) and include civilian as well as military fatalities.
2 Also called cornucopians, Prometheans, or technological optimists.
3 We leave out the 'resource curse' hypothesis, as it focuses on locally abundant but globally scarce (primarily) non-renewable resources (Basedau and Lay 2009).
4 In the Machakos District in Kenya both the area's population and development level increased, resulting in higher yields per hectare and labor shortage (Tiffen et al. 1994).
5 A similar operationalization was applied by Kahl (2006).
6 See Adano et al. (2012) for argument along these lines concerning cattle. See Toulmin (1991) for a discussion of cattle and grain prices in response to drought.
7 For supplementary information on the data and the hockey-stick debate, cf. note 1 above.
8 Cf. Gleditsch and Nordås (2014: 5).

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