



SSRC

THE FIELD OF CLIMATE AND SECURITY: A SCAN OF THE LITERATURE

APRIL 2019

JOSHUA BUSBY

LBJ School of Public Affairs, University of Texas at Austin

This work carries a Creative Commons Attribution-NonCommercial-NoDerivs 3.0 License. This license permits you to copy, distribute, and display this work as long as you mention and link back to the Social Science Research Council, attribute the work appropriately (including both author and title), and do not adapt the content or use it commercially. For details, visit <http://creativecommons.org/licenses/by-nc-nd/3.0/us/>.

About the SSRC

The Social Science Research Council (SSRC) is an independent, international, nonprofit organization founded in 1923. It fosters innovative research, nurtures new generations of social scientists, deepens how inquiry is practiced within and across disciplines, and mobilizes necessary knowledge on important public issues.

Introduction

The SSRC Academic Network on Peace, Security, and the United Nations is a new Council initiative that emerged out of a request from the UN Secretariat to provide UN entities and departments charged with responsibility for peace and security with better, more systematic access to new and emerging research from the field and from within the academy. The Network also aims to facilitate collaborative engagements between various institutions, research networks, and professional associations on conflict-management relevant research, and between the UN and these academic institutions.

The first meeting of the Academic Network examined the frameworks and methodologies used by academics to study the nexus between climate change and risks to sustaining peace, as well as the ways in which climate factors might affect the UN prevention agenda. The SSRC commissioned Joshua Busby, Associate Professor of Public Affairs at the Lyndon B. Johnson School of Public Affairs at the University of Texas at Austin, to write a literature review on the intersection of climate change and conflict. The review was distributed to participants in this meeting, which was off-the-record and conducted under the Chatham House Rule.

Research Questions

What are the leading research questions in the literature that address the nexus between climate change and conflict? How have the central questions evolved over time? How is the question of causality being addressed in current academic literature? What are the main schools in this debate, and is there a growing consensus on how to frame the intersection between climate change and conflict?

Since the early 2000s, scholars and practitioners alike have explored the links between climate change and security. Like the earlier scholarly debate on environmental security (T. F. Homer-Dixon 1991, 1994, 1999; Baechler 1999), the academic community has largely focused narrowly on the relationship between environmental factors—in this case, proxies for climate change—and armed conflict, mostly within rather than between countries.¹ Some scholars have also examined the impact of climate change on “human security,” which is less focused on state security and more concerned with the impacts of climate change on factors related to human well-being, such as livelihoods, food and water security, and cultural integrity (Barnett, Matthew, and O’Brien 2010; Barnett and Adger 2007; Dalby 2009, 2010).²

Policymakers have wider security interests than whether climate change will cause conflict, including the impact of climate change on military installations as well as impacts such as humanitarian emergencies, migration, changes to food and water security, and the existential threat to low-lying island countries (Fingar 2008; WBGU 2007; UN Security Council 2007; Rüttinger et al. 2015; Morisetti 2014; Office of the Director of National Intelligence 2015; National Intelligence Council 2012).

With wars between states rare, much of the last fifteen years of study has focused on determining whether climate change is a causal factor in the onset of internal conflicts within countries. In other words, are new conflicts started (at least in part) because of climate factors? Some studies have examined indicators such as conflict incidence, which gets at whether conflicts, regardless of how they started, might continue because of climate factors (von Uexkull et al. 2016).

There is also a small but robust literature on transboundary river basins and the potential effects of climate change on interstate conflict (Tir and Stinnett 2012; de Stefano et al. 2012). A few scholars have also explored the wider security consequences of climate change, such as humanitarian emergencies (Purvis and Busby 2004; J. W. Busby et al. 2013; J. W. Busby, Smith, and Krishnan 2014; J. Busby et al. 2018).

In terms of internal conflict, many studies have focused on civil wars, namely wars in which a government is a party (Miguel, Satyanath, and Sergenti 2004; Raleigh and Urdal 2007; Burke et al. 2009; Theisen, Holtermann, and Buhaug 2012). The literature has evolved to examine the connection between climate change and other security outcomes, such as communal conflict between social groups—for example, farmer-herder conflicts over grazing land and water—as well as other forms of social contestation, such as riots and strikes (Salehyan and Hendrix 2014; C. S. Hendrix and Salehyan 2012; Raleigh and Kniveton 2012).

Of late, there has been more focus on the causal pathways and the mediating factors between climate phenomena and conflict. This new focus reflects an appreciation that the circumstances under which climate change leads to conflict are conditional upon the specific context, such as the nature of the government (e.g., are authoritarian governments different from democracies?) and the degree to which a country is dependent on agriculture. Some contexts are more favorable for conflict than others. Moreover, this move reflects the recognition that climate change operates through processes such as agricultural production, economic growth, and human mobility, and it is through these indirect channels that climate change can lead to negative security outcomes (J. W. Busby 2017; C. Hendrix, Gates, and Buhaug 2016; Theisen 2017).

In both the grey literature and peer-reviewed publications, there have been highly contentious explorations of whether distinct conflicts—such as the civil war in Darfur, Sudan (de Waal 2007; T. Homer-Dixon 2007; Faris 2007; Kevane and Gray 2008); the Arab Spring (Werrell and Femia 2013; Lagi, Bertrand, and Bar-Yam 2011); the Syrian civil war (Kelley et al. 2015; Gleick 2014; Femia and Werrell 2012; Châtel 2014; Fröhlich 2016; Gleick

1 This review is informed by previous work, including J. W. Busby 2017, 2018.

2 See also the chapter on human security in the IPCC Fifth Assessment Report [Adger et al. 2014].

2017; Selby et al. 2017a; C. S. Hendrix 2017; Kelley et al. 2017; Selby et al. 2017b); and the Lake Chad crisis³—were caused by climate change–related factors. There is also an emergent discussion of the “backdraft” potential for conflict, which refers to the ways in which responses to climate change (such as biofuel mandates, land grabs, geoengineering, and rare earths mining) may become as or more important drivers of conflict than climate change itself (Dabelko et al. 2013; Risi 2017).

Leading Academics, Groups, and Consortiums

While a number of individual academics have written extensively on climate and security, the two most prominent research groups include those affiliated with the Peace Research Institute of Oslo (PRIO), mostly quantitative political scientists based in Europe,⁴ and those affiliated with scholars at the University of California, Berkeley, mostly economists.⁵ The Minerva Initiative of the US Department of Defense has financed two climate-related projects on Africa and Asia at the University of Texas that have delivered many publications, issue briefs, and data tools, with participating researchers from a variety of institutions.⁶ Other prominent scholars in this space include Neil Adger, Geoff Dabelko, and Jon Barnett, who, among other things, contributed to the IPCC Fifth Assessment Report’s chapter on human security.

Leading US think tanks that have explored the relationship between climate and security include the CNA Corporation, the Center for Climate and Security, and the Woodrow Wilson Center, through its Environmental Change and Security Program. The first two are especially focused on the impact of climate change on the US military. A variety of other US think tanks have occasionally produced work on climate and security (Campbell et al. 2007; J. Busby 2007; J. W. Busby, White, and Smith 2010; J. Busby 2009; Holland 2010; Bhattacharyya and Werz 2012).

The leading European group on climate and security is the Germany-based organization adelphi. adelphi has produced research tools on this topic, including a factbook of case studies

and a mapping of causal pathways. International Alert has also produced important work on climate and security. The Stockholm International Peace Research Institute (SIPRI) has an active program on climate and security focused on multilateral organizations. The Planetary Security Conference, an annual conference organized in The Hague, has been an important European venue for climate security discussions since 2015.

It is interesting to note that there is not an extensive literature from scholars based in the global South on climate and security in peer-reviewed journals. The exception are a few scholars in Nigeria who have written about Boko Haram, Lake Chad, and/or the Middle Belt and conflict (Ilo, Jonathan-Ichaver, and Adamolekun 2019; Schaller and Nagarajan 2018; Abdullahi 2018). There is also a commission of retired military in India, Bangladesh, and Pakistan who have warned about the regional and internal risks of climate change for security (Ghazi, Muniruzzaman, and Singh 2016).⁷

Data

What data are being collected and analyzed to conduct this research? What data gaps are emerging?

Scholars are using a variety of data sources on the environment and on conflict and security to pursue their research. Whereas the environmental security literature from the 1990s largely relied on qualitative case studies, the climate security literature draws more on large quantitative datasets that incorporate increasingly fine-grained, high-resolution data sources on climate phenomena with some spatially disaggregated conflict and security data.

Anthropogenic climate change is indicated by long-run changes in precipitation, temperature, and weather systems as a result of human activity, principally from the emission of greenhouse gases. Social scientists typically use historical events as proxies for climate-related factors such as rainfall, temperature, or extreme weather events. One challenge of collecting and measuring climate change data is that the same concepts can

3 See adelphi’s Lake Chad Risk Assessment Project.

4 Scholars include Halvard Buhaug, Ole Magnus Theisen, Tor Benjaminsen, and Håvard Hegre, among others.

5 These include scholars such as Edward Miguel, Marshal Burke, and Solomon Hsiang.

6 Scholars include Joshua W. Busby, Cullen Hendrix, Idean Salehyan, and Clionadh Raleigh.

7 An earlier treatment of environmental security in the region focused more on human security impacts (Najam 2003).

be operationalized in different ways. Drought, for example, does not have a single definition or operationalization, with some measures reflecting changes in precipitation and others capturing combined effects of rainfall and temperature (Lyon 2011; Theisen, Holtermann, and Buhaug 2012).

Even if past patterns prove revealing of a particular association between climate factors and security outcomes, the indicators may not be capturing the effects of climate change but merely the effects of weather phenomena on security risks over a particular period (Wagner and Weitzman 2015; J. W. Busby et al. 2012). Closer approximations of the effects of climate change use deviations from historical baselines, comparing rainfall or temperature levels to conditions from some prior period. More sophisticated methods move away from annual averages to compare monthly means for rainfall/temperature to prior averages for the same months (Smith 2014). Other efforts look more specifically at shocks to rainfall in growing-season months (von Uexkull et al. 2016). While most scholars have examined historical data, some have ventured into scenario forecasting, which holds some promise (and danger) as a theoretically informed way to assess how the future might unfold (Hegre et al. 2016; Burke et al. 2009).

The conflict data often used are georeferenced datasets of civil war, communal conflict, and/or social conflict, including riots and strikes. Prominent examples include the Uppsala Conflict Data Program (UCDP) datasets on armed conflict, the Armed Conflict Location and Event Dataset (ACLED), and the Social Conflict Analysis Dataset (SCAD). While georeferenced conflict data is now more available, there are still geographic holes, and subnational indicators of governance and economic data are harder to come by, though some try to use proxies such as lights at night as an alternative.

Methods

What are the methodological debates? How does the choice of methodology affect the research results?

While climate security research has not been exclusively quantitative, the improved availability of data has allowed for more statistical/econometric research that examines the correlations between proxies of climate change and security outcomes. These so-called large N studies have a large number of observations and seek to establish whether climate factors, controlling for other variables, are correlated with security

outcomes, usually operationalized as some form of internal conflict. They sometimes use country-level data and look for generalizations and patterns across many cases, either for individual countries (Wischnath and Buhaug 2014; Theisen 2012; Maystadt and Ecker 2014), for regions (Raleigh and Kniveton 2012; Raleigh 2010; Meier, Bond, and Bond 2007), for continents (C. S. Hendrix and Salehyan 2012; C. S. Hendrix and Glaser 2007; Theisen, Holtermann, and Buhaug 2012), or across wider geographic scales (von Uexkull et al. 2016; C. S. Hendrix and Haggard 2015; C. Hendrix and Brinkman 2013; Salehyan and Hendrix 2014). A number of studies have taken advantage of georeferenced datasets to disaggregate country-level analysis to subnational units such as provinces, states, or grid squares.

Most studies have examined the *direct* correlation between climate variables and conflict. That is, they include a proxy for climate change, such as a rainfall levels, to see if it was correlated with conflict (usually onset), alongside some other variables. They typically do not examine whether climate factors influence other processes, such as agricultural production, which in turn might affect conflict dynamics.

As I note below, the findings on the direct correlation between climate factors and conflict are highly contested. There was a sharp debate between the Berkeley economists and the PRIO-affiliated political scientists about whether the evidence showed a correlation between proxies for climate change and conflict. The economists argued they found strong correlations across studies, including a meta-analysis of the field, which aggregated many studies to evaluate the average causal effect of rainfall shocks and temperature change on both intergroup violence and interpersonal violence (Burke et al. 2009). They found that a one-standard-deviation change in rainfall or higher temperatures from the normal led to a 4 percent increase in interpersonal violence (e.g., criminal assaults) and a 14 percent increase in intergroup conflict (e.g., civil wars) (S. Hsiang, Burke, and Miguel 2013).

The political scientists disputed these findings and suggested they largely disappeared when one included additional years of data or control variables (Halvard Buhaug 2010; H. Buhaug et al. 2014). These disagreements mostly turned on whether political and social factors ought to be included as control variables in statistical models, alongside climate factors. The Berkeley economists were of the view that climate factors may affect those political and social processes, so including them all in the

same model would end up underestimating the role played by climate factors (S. M. Hsiang and Meng 2014). The PRIO group worried that leaving out political and social variables biased the findings in the other direction, underweighting processes political scientists find compelling (O'Loughlin, Linke, and Witmer 2014). The debate was never resolved fully. Both sides moved on to other research questions, and the field as a whole has shifted focus to the indirect effects of climate change on security and an effort to better understand causal mechanisms and pathways, as discussed below.

Beyond statistical studies, other methods employed include hot spot mapping of “climate security vulnerability,” defined in terms of the risk of large-scale loss of life from exposure to extreme weather events, either directly or as a result of further instability and violence. Such work maps subnational climate vulnerability in different regions using georeferenced, disaggregated indicators of climate hazards, population, household and community resilience, and governance (J. W. Busby et al. 2013; J. W. Busby, Smith, and Krishnan 2014; J. Busby et al. 2018; de Sherbinin 2014). Others have carried out similar maps with overlays of different data sources, such as physical exposure and state fragility (A. Moran et al. 2018) or low-lying coastal zones and population density (Levy et al. 2008). Such efforts are not meant to explore causal pathways between climate change and security outcomes, but rather to identify areas where governments bear a double burden of climate exposure and other problems.

Qualitative case study work in this space has not methodologically matured alongside the quantitative literature. Most of the qualitative work in this space consists of single case studies, either in peer-reviewed journals or in think tank publications, that assess whether a particular conflict—the Darfur conflict or the Syrian civil war, for example—was made more likely by climate change.⁸ Some interesting research commissioned by the US government asked area studies experts to speculate on the security consequences of climate change for particular countries (D. Moran 2011).

While many of the think tank pieces are thoughtful, they still suffer from the same kind of problem Levy identified in 1995 in his critique of the first wave of research on environmental security. By selecting single cases where environmental

change is thought to cause conflict, we cannot assess the scope conditions for a given study's applicability. There would be great value in studying paired cases of similar physical exposure that yield very different security outcomes. That strategy would allow us to better understand why one place experienced negative outcomes and the other did not (Levy 1995, 57). For example, both Somalia and Ethiopia have had severe droughts in recent years, but only Somalia experienced a famine.

Findings

What is the evidence base that links climate change to the enhanced risk of conflict, or identifies it as a multiplier of instability?

Before reviewing the evidence in more detail, it is useful to understand the causal mechanisms underpinning this research, understudied as they are. The climate security literature is informed by the earlier literature on environmental security in which scarcity as a driver of conflict loomed large. In those accounts, scarcity (such as land degradation) facilitated conflicts between groups over resources and/or encouraged leaders to divert scarce and degraded resources to themselves and favored groups (T. F. Homer-Dixon 1991, 1994; Kahl 2006).

In most of the climate security research, climate hazards or variability are thought to affect the likelihood of conflict through their effects on livelihoods, state capacity, and/or intergroup tensions. In some accounts, extreme weather or variability lower the rewards of agriculture and/or other livelihoods and make rebellion or violence more attractive. These same processes can also deprive states of tax revenue and undermine their capacity to suppress violence and provide public goods and exacerbate tensions between groups, as in the scarcity-driven conflicts studied in the 1990s (Koubi et al. 2012; Koubi 2017).

One problem was that different studies produced discrepant findings on what kinds of climate changes contributed to conflict. Some studies found that more abundant rainfall was correlated with conflict. Some explained this finding by focusing on the tactical advantages of higher grasses that might facilitate raiding parties in communal conflicts (Meier, Bond, and Bond 2007). A slightly different interpretation sees abundant rainfall as providing more to fight over as a source of rent-seeking. Raleigh and Kniveton (2012) found that in East

8 Some more methodologically informed exceptions include Benjaminsen et al. 2012; Bretthauer 2015; Seter, Theisen, and Schilling 2018.

Africa, lower rainfall was correlated with a higher likelihood of rebel conflicts, but abundant rainfall contributed to the higher likelihood of communal conflicts. Similarly, Salehyan and Hendrix (2014) in their global study found that abundance contributed to political violence while lower-than-normal rainfalls had a pacifying effect. The logic here was that reduced rainfall made it harder for rebel groups to sustain themselves, but that effect was present only in poorer, agriculturally dependent countries.

Studies have not produced consistent results on abundance or scarcity, which may be a function of different ways of operationalizing deviations from normal rainfall, differences in control variables and model specification, or the different spatial resolution of the data, as well as substantive differences between civil wars and communal conflict.⁹ One of the more consistent conclusions from this literature was that variability in rainfall, rather than scarcity per se, was more likely to be damaging to citizens because it would upend planning and agriculture, making it harder for people to sustain livelihoods in the event of unexpected negative surprises. There also appears to be a reasonably strong correlation between higher-than-normal temperatures and an increased likelihood of conflict.

These discrepant findings and the clash between PRIO and Berkeley led the authors of the IPCC Fifth Assessment Report in their chapter on human security to conclude that “the evidence on the effect of climate change and variability on violence is contested. Although there is little agreement about direct causality, low per capita incomes, economic contraction, and inconsistent state institutions are associated with the incidence of violence” (Adger et al. 2014).

The 2018 National Climate Assessment for the US government reached a similar conclusion: “Direct linkages between climate-related stress and conflict are unclear, but climate variability has been shown to affect conflict through intermediate processes, including resource competition, commodity price shocks, and food insecurity” (USGCRP 2018, chap. 16).

Both quotes hint at the need for scholars to study the indirect pathways between climate change and negative security outcomes. Scholars have begun to focus on the causal pathways to negative security outcomes through their effects on agriculture, economic growth, disasters, and migration, as well

as the mediating role of institutions. I summarize some of the findings here.

Agriculture and food prices. Meierding (2013) urged scholars to study the indirect pathways, focusing on the agricultural sector and food prices because those parts of the economy are the most tightly coupled to climate processes. Depressed agricultural production (and lower income) makes joining a rebellion more attractive, and higher food prices might serve as a source of grievance for consumers.

One study by von Uexkull et al. (2016) focused on growing-season droughts. They found conflict incidence in Africa and Asia to be more likely when droughts occurred in agriculturally dependent areas with high levels of political exclusion. This work focused on the more contextual and contingent factors that led to conflict and examined climate data from periods most consequential for farming. That study informed subsequent research to identify countries at risk in the wake of severe water deficits, which examined countries with high agricultural dependence, a history of conflict, and discriminatory institutions (J. Busby and von Uexkull 2018).

Research by Koren underscores the complex role food production plays in sustaining armies. One study, using crop yield data on wheat and corn in Africa, concluded that food abundance, rather than scarcity, was correlated with political violence. Food-rich regions may draw in a variety of actors seeking control of harvests for their own gain (Koren 2018). In recent work, he argues that food-rich regions become sites of contention as a means of denying opponents sufficient food to field forces (Koren forthcoming). In earlier work, he and his coauthor found that food insecurity was also highly correlated with conflict (Koren and Bagozzi 2017). We might reconcile these discrepant findings by noting that while some may enjoy abundance, others may not. In areas experiencing declining resources, areas with local abundance might become sites of contestation (Kahl 2006).

Other research has examined the effects of food price shocks on social conflict. The role of food price shocks in the Arab Spring looms large, the argument being that the increase in global food prices, emanating from weather-related harvest reductions in Russia, Argentina, and other grain-producing countries, spurred protest activity (Werrell and Femia 2013). Lagi claimed

⁹ For a review, see Theisen 2017.

that global food price shocks in the lead-up to the Arab Spring were highly correlated with “food riots” in the Middle East and North Africa (Lagi, Bertrand, and Bar-Yam 2011). Smith (2014) noted, however, that many countries insulate their publics from global food price shocks through domestic subsidies. Using rainfall as a driver of domestic food price increases, he found that protests and riots do become more likely if domestic food prices increase. Hendrix and Haggard further showed that regime type mattered in whether food price hikes led to riots or protests. They found that democracies were more likely to experience protests than authoritarian regimes, in part because authoritarian regimes tend to subsidize food to insulate urban consumers. In authoritarian regimes, food price shocks may serve as important drivers of protests, which can lead to coups and regime turnover, as Sudan may be experiencing at the moment (C. S. Hendrix and Haggard 2015).

Economic growth. A second related and understudied pathway to conflict is through the effects of climate on economic growth. Here, climate changes and variability could depress economic growth (perhaps through the effects on agriculture or as a result of disasters), either making it more attractive for people to rebel and/or undermining state capacity to suppress violence and provide services. Early work in this space has been inconclusive (Koubi et al. 2012; Koubi 2017). There is also a vigorous empirical debate in economics on the effects of natural disasters on long-term economic growth (Shabnam 2014; Cavallo et al. 2013). That research has not been connected to the conflict piece, but if it can be established that disasters have a negative impact on economic growth, then the well-established link between economic growth and conflict would likely be operative, with disasters having an impact on conflict through economic growth (Collier 2007).

Migration. A third underexplored pathway to conflict is through migration. Research by Salehyan and Gleditsch (2006) suggests that refugee flows can bring newcomers into conflict with long-time residents over limited resources and government programs, with conflicts spilling over to neighboring polities (Reuveny 2007; Reuveny and Moore 2009). Raleigh et al. suggested climate migrants, to the extent this is an identifiable category, might be different from refugees. They argued that many environmental migrants’ movements are likely to be temporary; their departures might be seen as forced by acts of

nature, making them more sympathetic to receiving locations. Moreover, environmental migrants might be so vulnerable that they are less likely to engage in violence (Raleigh, Jordan, and Salehyan 2008). With some locations, low-lying island nations in particular, becoming inhospitable to human settlement, it is less clear if many population movements will be temporary. Early empirical work on migration and conflict by Koubi et al. (2016) was inconclusive (Freeman 2017). When we think about specific cases, migration has been identified as a driver of conflict in the Syrian civil war (Gleick 2014; Werrell and Femia 2013; Kelley et al. 2015). As I explain further below, several scholars have contested the links in that case (Fröhlich 2016; Châtel 2014; Selby et al. 2017a; C. S. Hendrix 2017; Gleick 2017; Kelley et al. 2017; Selby et al. 2017b). This area is difficult to study. Using data on asylum applications, a recent study creatively sought to assess the effects of climate change on conflict and the effect of conflict on migration in Western Asia (Abel et al. 2019).¹⁰ Whether migration leads to conflict, climate migration itself may be a security concern in its own right, given the sensitivity of the topic. Teasing out whether people moved because of climate change or other factors is a challenge.

Disasters. A fourth channel is the effects of climate disasters on security. Disasters may lead to conflict through their effects on economic growth or potentially where failed disaster response leads to grievances among affected populations. The findings here are ambiguous, partially a function of whether we distinguish between hazards (as physical phenomena) and disasters (as social outcomes that represent failures of preparation and response). We may also have to distinguish between swift-onset hazards such as cyclones and storms and slow-onset ones such as drought. Some work suggests that disasters may precipitate peace rather than conflict in cases where groups rally around the common challenge of survival, where rebel movements have been too weakened by the disaster to continue the fight, or where the disaster makes a conflict ripe for resolution with targeted and well-distributed aid flows (Kelman 2006; Egorova and Hendrix 2014). Research in this space has produced conflicting findings (Slettebak 2012; Nel and Righarts 2008; Brancati 2007; Bergholt and Lujala 2012). There is also good related work by Quiroz Flores and Smith on disasters and leader survival—whether failed responses to disasters lead to leadership challenges in certain regimes

¹⁰ For a critique, see Koren 2019.

(Quiroz Flores 2015; Flores and Smith 2010). Even if establishing a link between climate-related disasters and conflicts eludes us, the human costs on populations and the diversion of military capacity for response are security challenges.

Institutions. The role of institutions is another mediating factor between climate phenomena and security outcomes. Institutions, both local and international, may diminish or exacerbate the likelihood of conflict, depending on how they are designed and implemented. Institutions affect the distribution of services, the capacity of response, and whether disputes escalate. As noted above, von Uexkull et al. (2016) focus on how political institutions that exclude certain groups exacerbate the risk of conflict in agricultural societies experiencing growing season droughts. Linke et al. (2018) draw attention to both official government and customary domestic institutions and how rules over natural resource management potentially amplify or moderate conflict. For transboundary river basins, well-designed institutions diminish the risks of conflict by allocating water, planning for shocks, and facilitating dispute resolution (de Stefano et al. 2012; Tir and Stinnett 2012).

Most climate security research has focused on water and water-related extremes and conflict. Limited scholarship has explored why higher-than-normal temperatures are correlated with conflict. Some have posited psychological mechanisms (that people are more prone to anger when it gets hot), but we have not advanced very far in our understanding of the role of temperature change (S. Hsiang, Burke, and Miguel 2013; Bollfrass and Shaver 2015). Moreover, most of the debate thus far has focused on conflict onset and whether climate factors make conflict more likely. Much productive work should focus on how climate affects the dynamics of conflict, moving beyond the obvious effects of recurrent seasonal changes in rainfall and temperature on fighting cycles. Here, we can start to think about whether conflicts are prolonged or shortened under certain kinds of climate change. Finally, how climate factors intersect with other sources of environmental damage, such as land degradation, has scarcely been studied.

Disciplinary Divides

How is this topic approached by different disciplines in the social sciences and the natural sciences? Are there scholars using an interdisciplinary approach?

The divisions between political scientists and economists over model specification and control variables have been discussed already.

Geographers have been among the leading scholars of climate and security, and their methods and insights with respect to mapping and data have heavily influenced the turn to disaggregated, georeferenced data.¹¹

Natural scientists have not contributed to this literature to a great extent. Some scholars with more climate and hydrology expertise have waded into the debates about whether drought was a factor in the Syrian civil war. Kelley is a climate scientist who wrote about the severe drought in the 2007–2008 period in Syria. Most of the evidence he offered focused on the physical data on rainfall (Kelley et al. 2015). Gleick is an energy and earth systems scientist with expertise in water. He also wrote about the drought in Syria. Most of the evidence he offered focused on indicators of water in the lead-up to the civil war, including streamflow data, extent of irrigation, and rainfall (Gleick 2014). A number of political scientists and area studies scholars disputed the connections between climate change and the Syrian civil war, suggesting that water mismanagement, market liberalization, and other factors were more important drivers of the conflict. They disputed the quality of the data that connected the drought to internal migration in Syria, and, in turn, the link between migration and conflict more generally (Selby et al. 2017a; Fröhlich 2016; Châtel 2014; C. S. Hendrix 2017). It is unclear if this is a methodological bias or motivated reasoning on the part of different scholars.

Think tank researchers of climate and security have sided with the natural scientists, and these kinds of debates about relative causal weight have also been observed between political scientists in Thomas Homer-Dixon and Alex de Waal's discussion of the Darfur conflict. Analysts like de Waal emphasize political processes as drivers of conflict and worry that an emphasis on physical phenomena potentially lets leaders off the hook for bad or repressive policies.

Some natural and social scientists have sought to collaborate with each other. For example, Hendrix and Glaser's assessment of climate and conflict used historical proxies of climate change as well as models of future climate change (C. S. Hendrix and Glaser 2007). Scholars at the Columbia's Earth Institute have collaborated to bring hydrology models and conflict analysis

11 John O'Loughlin and his former students Clionadh Raleigh and Andrew Linke are prominent examples.

together (Levy et al. 2005). Busby collaborated with climate scientists to generate a downscaled regional climate model for Africa and paired that with hot-spot vulnerability analysis (J. W. Busby et al. 2014).¹² One of the challenges of such interdisciplinary work is that climate models historically focused on 2100 outcomes, far beyond the time horizons relevant to policy audiences. Moreover, it is difficult to combine future-oriented climate projections with present-day or historical data on social and political processes. Projecting social and political dynamics into the future is a fraught exercise.

Policy Impacts

How are these debates influencing international policy processes? Is policy responding to evidence in research? Conversely, are policy agendas driving academic research?

Some scholarship has informed policy. However, because academics have produced conflicting findings and limited guidance for policymakers, it is not quite clear what lessons have been drawn. The policy community may have been more influenced by think tank reports and grey literature, particularly pieces like *A New Climate for Peace*, which was commissioned by the G7 (Rüttinger et al. 2015).

Perhaps the most lasting framing has been climate change as a “threat multiplier,” from the 2007 report by the CNA Corporation and its board of retired US military.

Because the independent effect of climate change is difficult to establish, it has been easier to say that climate change along with other factors may make conflict more likely (CNA Corporation 2007; Campbell et al. 2007). As I have argued elsewhere, while that creates room for climate change as a factor in the mix among others, that framing is not very helpful for policy unless you know what combination of factors leads to negative security outcomes. Even where we have robust findings from large datasets on the causes of conflicts, such findings are less helpful for country- or region-specific problem-solving unless we have a better idea of what to do with that information.

Even as debates between scholars continue, the policy community has to make contingency plans about how to prepare for a variety of climate-related security consequences,

including conflict but also military operations, humanitarian emergencies at home and abroad, shocks to global food markets, transboundary disputes over the Arctic and river basins, people on the move, and the existential challenges to low-lying island nations (National Intelligence Council 2012; Office of the Director of National Intelligence 2015; Department of Homeland Security 2012; Fingar 2008; Office of the Director of National Intelligence 2016). With a narrow focus on internal conflict, scholars run the risk of being ignored in favor of more applied, problem- and country-specific work by think tanks. If policy becomes too divorced from academic research, practitioners may make expensive investments in initiatives that do not work, fail to address the underlying drivers, or generate unforeseen consequences.

The policy community has supported climate security research, including two multi-million-dollar research projects under the US Department of Defense’s Minerva Initiative as well as research projects to inform efforts by the US intelligence community. The G7-commissioned report conceptualized seven different climate-fragility risks, which were similar to the causal pathways discussed above. The G7 then sought a more focused inquiry on the Lake Chad Basin. USAID sought to understand the geography of overlapping climate and security risks in the commissioned report on state fragility and climate exposure and has commissioned a number of country-specific research projects.

That said, there are limits to scholarly influence. The research community needs more empirics on what kinds of peacebuilding institutions, practices, and projects tend to dampen the risk of conflict and other negative security consequences. Researchers have more specific ideas for how institutions can dampen conflicts over transboundary rivers, but the academic community does not really know what institutional configurations can prevent or resolve climate-related conflicts. Scholars also have to widen their aperture beyond the study of conflict to examine other security outcomes, such as humanitarian emergencies and migration.

¹² For an earlier effort with an ecologist, see J. W. Busby et al. 2012.

Bibliography

- Abdullahi, Murtala. 2018. "How Climate Change Has Become a National Security Issue in Nigeria." *Medium* (blog). October 28, 2018. <https://medium.com/@murtalaa46/how-climate-change-is-a-national-security-issue-in-nigeria-b7aa2ede7a48>.
- Abel, Guy J., Michael Brottrager, Jesus Crespo Cuaresma, and Raya Muttarak. 2019. "Climate, Conflict and Forced Migration." *Global Environmental Change* 54 (January): 239–49. <https://doi.org/10.1016/j.gloenvcha.2018.12.003>.
- Adger, W.N., J.M. Pulhin, J. Barnett, G.D. Dabelko, U. Oswald Spring, and C.H. Vogel. 2014. "2014: Human Security." In *Climate Change 2014 – Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, et al., 755–91. Cambridge: Cambridge University Press.
- Baechler, Günther. 1999. "Environmental Degradation in the South as a Cause of Armed Conflict." In *Environmental Change and Security: A European Perspective*, edited by Alexander Carius and Kurt M. Lietzmann, 107–30. Berlin: Springer.
- Barnett, Jon, and W. Neil Adger. 2007. "Climate Change, Human Security and Violent Conflict." *Political Geography* 26 (6): 639–55.
- Barnett, Jon, Richard A. Matthew, and Karen L. O'Brien. 2010. "Global Environmental Change and Human Security: An Introduction." In *Global Environmental Change and Human Security*, edited by Richard A. Matthew, Jon Barnett, Bryan McDonald, and Karen L. O'Brien, 3–32. Cambridge, MA: MIT Press.
- Benjaminsen, Tor A., Koffi Alinon, Halvard Buhaug, and Jill Tove Buseth. 2012. "Does Climate Change Drive Land-Use Conflicts in the Sahel?" *Journal of Peace Research* 49 (1): 97–111. <https://doi.org/10.1177/0022343311427343>.
- Bergholt, Drago, and Päivi Lujala. 2012. "Climate-Related Natural Disasters, Economic Growth, and Armed Civil Conflict." *Journal of Peace Research* 49 (1): 147–62. <https://doi.org/10.1177/0022343311426167>.
- Bhattacharyya, Arpita, and Michael Werz. 2012. *Climate Change, Migration, and Conflict in South Asia*. Washington, DC: Center for American Progress. <https://www.americanprogress.org/issues/security/report/2012/12/03/46382/climate-change-migration-and-conflict-in-south-asia/>.
- Bollfrass, Alexander, and Andrew Shaver. 2015. "The Effects of Temperature on Political Violence: Global Evidence at the Subnational Level." *PLOS ONE* 10 (5): e0123505. <https://doi.org/10.1371/journal.pone.0123505>.
- Brancati, Dawn. 2007. "Political Aftershocks: The Impact of Earthquakes on Intrastate Conflict." *Journal of Conflict Resolution* 51 (5): 715–43.
- Bretthauer, Judith M. 2015. "Conditions for Peace and Conflict: Applying a Fuzzy-Set Qualitative Comparative Analysis to Cases of Resource Scarcity." *Journal of Conflict Resolution* 59 (4): 593–616. <https://doi.org/10.1177/0022002713516841>.
- Buhaug, H., J. Nordkvelle, T. Bernauer, T. Böhmelt, M. Brzoska, J. W. Busby, A. Ciccone, et al. 2014. "One Effect to Rule Them All? A Comment on Climate and Conflict." *Climatic Change* 127 (3–4): 391–97. <https://doi.org/10.1007/s10584-014-1266-1>.
- Buhaug, Halvard. 2010. "Climate Not to Blame for Africa's Civil Wars." *Proceedings of the National Academy of Sciences* 107 (38): 16477–82.
- Burke, Marshall B, Edward Miguel, Shanker Satyanath, John A Dykema, and David B Lobell. 2009. "Warming Increases the Risk of Civil War in Africa." *Proceedings of the National Academy of Sciences* 106 (49): 20670–74. <https://doi.org/10.1073/pnas.0907998106>.

- Busby, Joshua. 2007. "Climate Change and National Security: An Agenda for Action." Council Special Report no. 32, Council on Foreign Relations, New York, NY. www.cfr.org/publication/14862.
- . 2009. "Feeding Insecurity? Poverty, Weak States, and Climate Change." In *Confronting Poverty: Weak States and U.S. National Security*, edited by Susan Rice, Corinne Graff, and Carlos Pascual. Washington, DC: Brookings Institution Press.
- Busby, Joshua, Todd G. Smith, Nisha Krishnan, Charles Wight, and Santiago Vallejo-Gutierrez. 2018. "In Harm's Way: Climate Security Vulnerability in Asia." *World Development* 112 (December): 88–118. <https://doi.org/10.1016/j.worlddev.2018.07.007>.
- Busby, Joshua, and Nina von Uexkull. 2018. "Climate Shocks and Humanitarian Crises." *Foreign Affairs*, November 29, 2018. <https://www.foreignaffairs.com/articles/world/2018-11-29/climate-shocks-and-humanitarian-crises>.
- Busby, Joshua W. 2017. "Environmental Security." In *Handbook of International Security*, edited by William C. Wohlforth and Alexandra Gheciu, 471–86. Oxford: Oxford University Press.
- . 2018. "Taking Stock: The Field of Climate and Security." *Current Climate Change Reports* 4 (4): 338–46. <https://doi.org/10.1007/s40641-018-0116-z>.
- Busby, Joshua W., Kerry Cook, Edward Vizi, Todd Smith, and Mesfin Bekalo. 2014. "Identifying Hot Spots of Security Vulnerability Associated with Climate Change in Africa." *Climatic Change* 124 (4): 717–31. http://econpapers.repec.org/article/sprclimat/v_3a124_3ay_3a2014_3ai_3a4_3ap_3a717-731.htm.
- Busby, Joshua W., Jay Gullede, Todd G. Smith, and Kaiba White. 2012. "Of Climate Change and Crystal Balls: The Future Consequences of Climate Change in Africa." *Air & Space Power Journal Africa and Francophonie*, no. 3, 4–44. http://www.airpower.au.af.mil/apjinternational/apj-af/2012/2012-3/eng/2012_3_05_Busby.pdf.
- Busby, Joshua W., Todd G. Smith, and Nisha Krishnan. 2014. "Climate Security Vulnerability in Africa Mapping 3.0." *Political Geography*, Special Issue: Climate Change and Conflict, 43 (November): 51–67. <https://doi.org/10.1016/j.polgeo.2014.10.005>.
- Busby, Joshua W., Todd G. Smith, Kaiba White, and Shawn M. Strange. 2013. "Climate Change and Insecurity: Mapping Vulnerability in Africa." *International Security* 37 (4): 132–72.
- Busby, Joshua W., Kaiba White, and Todd G. Smith. 2010. "Mapping Climate Change and Security in North Africa." Climate and Energy Paper Series, German Marshall Fund of the United States, Washington, DC. <http://www.gmfus.org/archives/mapping-climate-change-and-security-in-north-africa-full-text/>.
- Campbell, Kurt M., Jay Gullede, J.R. McNeill, John Podesta, Peter Ogden, Leon Fuerth, R. James Woolsey, et al. 2007. *The Age of Consequences*. Washington, DC: Center for Strategic and International Studies. http://www.csis.org/media/csis/pubs/071105_ageofconsequences.pdf.
- Cavallo, Eduardo, Sebastian Galiani, Ilan Noy, and Juan Pantano. 2013. "Catastrophic Natural Disasters and Economic Growth." *Review of Economics and Statistics* 95 (5): 1549–61. https://doi.org/10.1162/REST_a_00413.
- Châtel, Francesca De. 2014. "The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution." *Middle Eastern Studies* 50 (4): 521–35. <https://doi.org/10.1080/00263206.2013.850076>.
- CNA Corporation. 2007. *National Security and the Threat of Climate Change*. Alexandria, VA: CNA Corporation. <http://securityandclimate.cna.org/report/>.
- Collier, Paul. 2007. *The Bottom Billion: Why the Poorest Countries Are Failing and What Can Be Done about It*. New York: Oxford University Press. <http://www.loc.gov/catdir/toc/ecip074/2006036630.html>.

- Dabelko, Geoffrey D., Lauren Herzer Risi, Schuyler Null, Meaghan Parker, and Russell Sticklor, eds. 2013. *Backdraft: The Conflict Potential of Climate Change Adaptation and Mitigation*. Washington, DC: Wilson Center. <https://www.wilsoncenter.org/publication/backdraft-the-conflict-potential-climate-change-adaptation-and-mitigation#sthash.k8mQTIYp.dpuf>.
- Dalby, Simon. 2009. *Security and Environmental Change*. 1 edition. Cambridge, UK ; Malden, MA: Polity.
- . 2010. "Environmental Security and Climate Change." In *The International Studies Encyclopedia : International Studies Compendium Project*, edited by Robert A. Denemark. Blackwell Publishing Online.
- De Sherbinin, Alex. 2014. "Climate Change Hotspots Mapping: What Have We Learned?" *Climatic Change* 123 (1): 23–37. <https://doi.org/10.1007/s10584-013-0900-7>.
- De Stefano, Lucia, James Duncan, Shlomi Dinar, Kerstin Stahl, Kenneth M. Strzepek, and Aaron T. Wolf. 2012. "Climate Change and the Institutional Resilience of International River Basins." *Journal of Peace Research* 49 (1): 193–209. <https://doi.org/10.1177/0022343311427416>.
- De Waal, Alex. 2007. "Is Climate Change the Culprit for Darfur?" *African Arguments*, June 25, 2007. <https://africanarguments.org/2007/06/25/is-climate-change-the-culprit-for-darfur/>.
- Department of Homeland Security. 2012. Department of Homeland Security Climate Change Adaptation Roadmap." Washington, DC: Department of Homeland Security. https://www.dhs.gov/sites/default/files/publications/Appendix%20A%20DHS%20FY2012%20Climate%20Change%20Adaptation%20Plan_0.pdf.
- Egorova, Aleksandra, and Cullen Hendrix. 2014. "Can Natural Disasters Precipitate Peace? Research Brief – August 2014." CCAPS Program Research Brief No. 22, Strauss Center for International Security and Law, Austin, TX. <https://www.strausscenter.org/ccaps/publications/research-briefs.html?download=261>.
- Faris, Stephan. 2007. "The Real Roots of Darfur." *The Atlantic Monthly*, April 2007.
- Femia, Francesco, and Caitlin Werrell. 2012. "Syria: Climate Change, Drought and Social Unrest." *The Center for Climate & Security* (blog). February 29, 2012. <https://climateandsecurity.org/2012/02/29/syria-climate-change-drought-and-social-unrest/>.
- Fingar, Thomas. 2008. "National Intelligence Assessment on the National Security Implications of Global Climate Change to 2030." Testimony to the House Permanent Select Committee on Intelligence and House Select Committee on Energy Independence and Global Warming, June 25, 2008. http://www.dni.gov/testimonies/20080625_testimony.pdf.
- Flores, Alejandro Quiroz, and Alastair Smith. 2010. "Surviving Disasters." Working paper, New York University, NY. http://politics.as.nyu.edu/docs/IO/14714/Surviving_Disasters.pdf.
- Freeman, Laura. 2017. "Environmental Change, Migration, and Conflict in Africa: A Critical Examination of the Interconnections." *The Journal of Environment & Development* 26 (4): 351–74. <https://doi.org/10.1177/1070496517727325>.
- Fröhlich, Christiane J. 2016. "Climate Migrants as Protestors? Dispelling Misconceptions about Global Environmental Change in Pre-Revolutionary Syria." *Contemporary Levant* 1 (1): 38–50. <https://doi.org/10.1080/20581831.2016.1149355>.
- Ghazi, Tariq Waseem, A.N.M. Muniruzzaman, and A.K. Singh. 2016. "Climate Change & Security in South Asia." Global Military Advisory Board on Climate Change Paper no. 2. <http://gmacc.org/gmaccc-publishes-climate-change-security-in-south-asia-cooperating-for-peace/>.
- Gleick, Peter H. 2014. "Water, Drought, Climate Change, and Conflict in Syria." *Weather, Climate, and Society* 6 (3): 331–40. <https://doi.org/10.1175/WCAS-D-13-00059.1>.
- . 2017. "Climate, Water, and Conflict: Commentary on Selby et Al. 2017." *Political Geography* 60: 248–50.

- Hegre, Håvard, Halvard Buhaug, Katherine V. Calvin, Jonas Nordkvelle, Stephanie T. Walldhoff, and Elisabeth Gilmore. 2016. "Forecasting Civil Conflict along the Shared Socioeconomic Pathways." *Environmental Research Letters* 11 (5): 054002. <https://doi.org/10.1088/1748-9326/11/5/054002>.
- Hendrix, Cullen, and Henk-Jan Brinkman. 2013. "Food Insecurity and Conflict Dynamics: Causal Linkages and Complex Feedbacks." *Stability: International Journal of Security and Development* 2 (2). <https://doi.org/10.5334/sta.bm>.
- Hendrix, Cullen, Scott Gates, and Halvard Buhaug. 2016. "Environment and Conflict." In *What Do We Know about Civil Wars?*, edited by T. David Mason and Sara McLaughlin Mitchell, Reprint edition, 231–46. Lanham, Maryland: Rowman & Littlefield Publishers.
- Hendrix, Cullen S. 2017. "A Comment on 'Climate Change and the Syrian Civil War Revisited.'" *Political Geography* 60: 251–52.
- Hendrix, Cullen S., and Sarah M. Glaser. 2007. "Trends and Triggers: Climate Change and Civil Conflict in Sub-Saharan Africa." *Political Geography* 26 (6): 695–715. <http://www.cicero.uio.no/humsec/papers/Hendrix&Glaser.pdf>.
- Hendrix, Cullen S., and Stephan Haggard. 2015. "Global Food Prices, Regime Type, and Urban Unrest in the Developing World." *Journal of Peace Research* 52 (2): 143–57. <https://doi.org/10.1177/0022343314561599>.
- Hendrix, Cullen S., and Idean Salehyan. 2012. "Climate Change, Rainfall, and Social Conflict in Africa." *Journal of Peace Research* 49 (1): 35–50. <http://jpr.sagepub.com/content/49/1/35>.
- Holland, Andrew. 2010. *The Arab Spring and World Food Prices*. Washington, DC: American Security Project. <http://americansecurityproject.org/reports/2012/climate-change-the-arab-spring-and-food-prices/>.
- Homer-Dixon, Thomas. 2007. "Cause and Effect." <https://homerdixon.com/cause-effect/>. SSRC Blogs – Climate and Environment, Making Sense of Sudan, August 2, 2007 (Originally published at <http://www.ssrc.org/blog/2007/08/02/cause-and-effect/>).
- Homer-Dixon, Thomas F. 1991. "On the Threshold: Environmental Changes as Causes of Acute Conflict." *International Security* 16 (2): 76–116.
- . 1994. "Environmental Scarcities and Violent Conflict: Evidence from Cases." *International Security* 19 (1): 5–40.
- . 1999. *Environment, Scarcity, and Violence*. Princeton, N.J.: Princeton University Press.
- Hsiang, Solomon, Marshall Burke, and Edward Miguel. 2013. "Quantifying the Influence of Climate on Human Conflict." *Science* 341 (September).
- Hsiang, Solomon M., and K. C. Meng. 2014. "Reconciling Disagreement over Climate-Conflict Results in Africa." *Proceedings of the National Academy of Sciences* 111 (6): 2100–2103. <https://doi.org/10.1073/pnas.1316006111>.
- Ilo, Udo Jude, Ier Jonathan-Ichaver, and 'Yemi Adamolekun. 2019. "The Deadliest Conflict You've Never Heard Of." *Foreign Affairs*, January 23, 2019. <https://www.foreignaffairs.com/articles/nigeria/2019-01-23/deadliest-conflict-youve-never-heard>.
- Kahl, Colin H. 2006. *States, Scarcity, and Civil Strife in the Developing World*. Princeton: Princeton University Press.
- Kelley, Colin P., Shahrzad Mohtadi, Mark A. Cane, Richard Seager, and Yochanan Kushnir. 2015. "Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought." *Proceedings of the National Academy of Sciences* 112 (11): 3241–46. <https://doi.org/10.1073/pnas.1421533112>.
- Kelley, Colin P., Shahrzad Mohtadi, Mark Cane, Richard Seager, and Yochanan Kushnir. 2017. "Commentary on the Syria Case: Climate as a Contributing Factor." *Political Geography* 60: 245–47.

- Kelman, Ilan. 2006. "Island Security and Disaster Diplomacy in the Context of Climate Change." *Les Cahiers de La Sécurité* 63: 61–94. <http://www.disasterdiplomacy.org/kelman2006cce.pdf>.
- Kevane, Michael, and Leslie Gray. 2008. "Darfur: Rainfall and Conflict." *Environmental Research Letters* 3 (3). http://www.iop.org/EJ/article/1748-9326/3/3/034006/erl8_3_034006.html#erl281852s4.
- Koren, Ore. forthcoming. "Food Resources and Strategic Conflict." *Journal of Conflict Resolution*.
- . 2018. "Food Abundance and Violent Conflict in Africa." *American Journal of Agricultural Economics* 100 (4): 981–1006. <https://doi.org/10.1093/ajae/aax106>.
- . 2019. "Climate Change and Conflict." *Political Violence at a Glance* (blog). February 4, 2019. <http://politicalviolenceataglance.org/2019/02/04/climate-change-and-conflict/>.
- Koren, Ore, and Benjamin E Bagozzi. 2017. "Living off the Land: The Connection between Cropland, Food Security, and Violence against Civilians." *Journal of Peace Research* 54 (3): 351–64. <https://doi.org/10.1177/0022343316684543>.
- Koubi, Vally. 2017. "Climate Change, the Economy, and Conflict." *Current Climate Change Reports* 3 (4): 2000–2009.
- Koubi, Vally, Thomas Bernauer, Anna Kalbhenn, and Gabriele Spilker. 2012. "Climate Variability, Economic Growth, and Civil Conflict." *Journal of Peace Research* 49 (1): 113–27. <https://doi.org/10.1177/0022343311427173>.
- Koubi, Vally, Gabriele Spilker, Lena Schaffer, and Thomas Bernauer. 2016. "Environmental Stressors and Migration: Evidence from Vietnam." *World Development* 79 (March): 197–210. <https://doi.org/10.1016/j.worlddev.2015.11.016>.
- Lagi, Marco, Karla Z. Bertrand, and Yaneer Bar-Yam. 2011. "The Food Crises and Political Instability in North Africa and the Middle East." ArXiv e-print 1108.2455. <http://arxiv.org/abs/1108.2455>.
- Levy, Marc A. 1995. "Is the Environment a National Security Issue?" *International Security* 20 (2): 35–62.
- Levy, Marc A., Bridget Anderson, Melanie Brickman, Chris Cromer, Brian Falk, Balazs Fekete, Pamela Green, et al. 2008. "Assessment of Select Climate Change Impacts on U.S. National Security." Working paper, Center for International Earth Science Information Network (CIESIN), Columbia University, New York, NY. http://www.ciesin.columbia.edu/documents/Climate_Security_CIESIN_July_2_008_v1_0.ed.pdf.
- Levy, Marc A., Catherine Thorkelson, Charles Vörösmarty, Ellen Douglas, and Macartan Humphreys. 2005. "Freshwater Availability Anomalies and Outbreak of Internal War: Results from a Global Spatial Time Series Analysis." Paper presented at the Human Security and Climate Change Workshop, Oslo, Sweden, June 21–23, 2005. http://www.cicero.uio.no/humsec/papers/Levy_et_al.pdf.
- Linke, Andrew M., Frank D. W. Witmer, John O'Loughlin, J. Terrence McCabe, and Jaroslav Tir. 2018. "Drought, Local Institutional Contexts, and Support for Violence in Kenya." *Journal of Conflict Resolution* 62 (7): 1544–78. <https://doi.org/10.1177/0022002717698018>.
- Lyon, Bradfield. 2011. "Quantifying Drought – Some Basic Concepts." Memo for Workshop on Mapping and Modeling Climate Security Vulnerability, LBJ School of Public Affairs, University of Texas at Austin. http://strausscenter.org/images/pdf/climateworkshop/lyon_memo_for_web.pdf.
- Maystadt, Jean-François, and Olivier Ecker. 2014. "Extreme Weather and Civil War: Does Drought Fuel Conflict in Somalia through Livestock Price Shocks?" *American Journal of Agricultural Economics*, March, aau010. <https://doi.org/10.1093/ajae/aau010>.
- Meier, Patrick, Doug Bond, and Joe Bond. 2007. "Environmental Influences on Pastoral Conflict in the Horn of Africa." *Political Geography* 26 (6): 716–35. <http://www.sciencedirect.com/science/article/pii/S0962629807000820>.

- Meierding, Emily. 2013. "Climate Change and Conflict: Avoiding Small Talk about the Weather." *International Studies Review* 15 (2): 185–203. <https://doi.org/10.1111/misr.12030>.
- Miguel, Edward, Shankar Satyanath, and Ernest Sergenti. 2004. "Economic Shocks and Civil Conflict: An Instrumental Variables Approach." *Journal of Political Economy*, 112 (4): 725–53.
- Moran, Ashley, Josh Busby, Raleigh, Clionadh, Todd Smith, Roudabeh Kishi, Nisha Krishnan, and Charles Wight. 2018. *Intersection of Global Fragility and Climate Risks*. Washington, DC: USAID.
- Moran, Daniel, ed. 2011. *Climate Change and National Security: A Country-Level Analysis*. Original edition. Washington, D.C: Georgetown University Press.
- Morisetti, Neil. 2014. "Failure to Set a Robust 2030 Climate Target Will Hurt Our National Security." EURACTIV. Com, January 21, 2014. <http://www.euractiv.com/section/sustainable-dev/opinion/failure-to-set-a-robust-2030-climate-target-will-hurt-our-national-security/>.
- Najam, Adil, ed. 2003. *Environment, Development and Human Security: Perspectives from South Asia*. Lanham, Md: UPA.
- National Intelligence Council. 2012. "Global Water Security." Special report, ICA-2012-08, February 2012. http://www.dni.gov/files/documents/Special%20Report_ICA%20Global%20Water%20Security.pdf.
- Nel, Philip, and Marjolein Righarts. 2008. "Natural Disasters and the Risk of Violent Civil Conflict." *International Studies Quarterly* 52 (1): 159–185.
- Office of the Director of National Intelligence. 2015. *Global Food Security Intelligence Community Assessment*. Washington, DC: ODNI. <https://www.dni.gov/index.php/newsroom/reports-and-publications/207-reports-publications-2015/1265-global-food-security-intelligence-community-assessment>.
- . 2016. *Implications for US National Security of Anticipated Climate Change*. Washington, DC: ODNI, September 21, 2016. <https://www.dni.gov/index.php/newsroom/reports-publications/reports-publications-2016/item/1629-implications-for-us-national-security-of-anticipated-climate-change>.
- O'Loughlin, John, Andrew M. Linke, and Frank D. W. Witmer. 2014. "Modeling and Data Choices Sway Conclusions about Climate-Conflict Links." *Proceedings of the National Academy of Sciences* 111 (6): 2054–55. <https://doi.org/10.1073/pnas.1323417111>.
- Purvis, Nigel, and Josh Busby. 2004. "The Security Implications of Climate Change for the UN System. Submission to the United Nations High-Level Panel on Threats, Challenges, and Change." Environmental Change and Security Program Report no. 10, Wilson Center, Washington, DC. http://www.wilsoncenter.org/topics/pubs/ecspr10_unf-purbus.pdf.
- Quiroz Flores, Alejandro. 2015. "Protecting People from Natural Disasters: Political Institutions and Ocean-Originated Hazards." *Political Science Research and Methods First View* (December): 1–24. <https://doi.org/10.1017/psrm.2015.72>.
- Raleigh, Clionadh. 2010. "Political Marginalization, Climate Change, and Conflict in African Sahel States." *International Studies Review* 12 (1): 69–86. <http://onlinelibrary.wiley.com/doi/10.1111/j.1468-2486.2009.00913.x/abstract>.
- Raleigh, Clionadh, Lisa Jordan, and Idean Salehyan. 2008. "Assessing the Impact of Climate Change on Migration and Conflict." The Social Dimensions of Climate Change working paper, World Bank, Washington, DC. http://siteresources.worldbank.org/EXTSOCIALDEVELOPMENT/Resources/SDCCWorkingPaper_MigrationandConflict.pdf.
- Raleigh, Clionadh, and Dominic Kniveton. 2012. "Come Rain or Shine: An Analysis of Conflict and Climate Variability in East Africa." *Journal of Peace Research* 49 (1): 51–64. <http://jpr.sagepub.com/content/49/1/51>.
- Raleigh, Clionadh, and Henrik Urdal. 2007. "Climate Change, Environmental Degradation and Armed Conflict." *Political Geography* 26 (6): 674–94.

- Reuveny, Rafael. 2007. "Climate Change-Induced Migration and Violent Conflict." *Political Geography* 26 (6): 656–73.
- Reuveny, Rafael, and Will H. Moore. 2009. "Does Environmental Degradation Influence Migration? Emigration to Developed Countries in the Late 1980s and 1990s." *Social Science Quarterly* 90 (3): 461–79.
- Risi, Lauren Herzer. 2017. "Backdraft Revisited: The Conflict Potential of Climate Change Adaptation and Mitigation." *New Security Beat* (blog). January 12, 2017. <https://www.newsecuritybeat.org/2017/01/backdraft-revisited-conflict-potential-climate-change-adaptation-mitigation/>.
- Rüttinger, Lukas, Dan Smith, Gerald Stang, Dennis Tänzler, and Janani Vivekananda. 2015. *A New Climate for Peace*. adelphi, Wilson Center, International Alert, The European Institute for Security Studies. <http://www.newclimateforpeace.org/>.
- Salehyan, Idean, and Kristian Skrede Gleditsch. 2006. "Refugees and the Spread of Civil War." *International Organization* 60 (2): 335–66.
- Salehyan, Idean, and Cullen S. Hendrix. 2014. "Climate Shocks and Political Violence." *Global Environmental Change* 28 (September): 239–50. <https://doi.org/10.1016/j.gloenvcha.2014.07.007>.
- Schaller, Stella, and Chitra Nagarajan. 2018. "We Must Not Get Stuck in Policy Circles – How to Handle Climate Change and Conflict at Lake Chad." *Climate Diplomacy*. January 9, 2018. <https://www.climate-diplomacy.org/news/we-must-not-get-stuck-policy-circles-%E2%80%93-how-handle-climate-change-and-conflict-lake-chad>.
- Selby, Jan, Omar S. Dahi, Christiane J. Fröhlich, and Mike Hulme. 2017a. "Climate Change and the Syrian Civil War Revisited." *Political Geography* 60: 232–44.
- . 2017b. "Climate Change and the Syrian Civil War Revisited: A Rejoinder" *Political Geography* 60: 253–55.
- Seter, Hanne, Ole Magnus Theisen, and Janpeter Schilling. 2018. "All about Water and Land? Resource-Related Conflicts in East and West Africa Revisited." *GeoJournal* 83 (1): 169–87. <https://doi.org/10.1007/s10708-016-9762-7>.
- Shabnam, Nourin. 2014. "Natural Disasters and Economic Growth: A Review." *International Journal of Disaster Risk Science* 5 (2): 157–63. <https://doi.org/10.1007/s13753-014-0022-5>.
- Slettebak, Rune T. 2012. "Don't Blame the Weather! Climate-Related Natural Disasters and Civil Conflict." *Journal of Peace Research* 49 (1): 163–76. <https://doi.org/10.1177/0022343311425693>.
- Smith, Todd Graham. 2014. "Feeding Unrest: Disentangling the Causal Relationship between Food Price Shocks and Sociopolitical Conflict in Urban Africa." *Journal of Peace Research* 51 (6): 679–95. <https://doi.org/10.1177/0022343314543722>.
- Theisen, Ole Magnus. 2012. "Climate Clashes? Weather Variability, Land Pressure, and Organized Violence in Kenya, 1989–2004." *Journal of Peace Research* 49 (1): 81–96. <https://doi.org/10.1177/0022343311425842>.
- . 2017. "Climate Change and Violence: Insights from Political Science." *Current Climate Change Reports* 3 (4): 210–21. <https://doi.org/10.1007/s40641-017-0079-5>.
- Theisen, Ole Magnus, Helge Holtermann, and Halvard Buhaug. 2012. "Climate Wars? Assessing the Claim That Drought Breeds Conflict." *International Security* 36 (3): 79–106. http://www.mitpressjournals.org/doi/abs/10.1162/ISEC_a_00065.
- Tir, Jaroslav, and Douglas M. Stinnett. 2012. "Weathering Climate Change: Can Institutions Mitigate International Water Conflict?" *Journal of Peace Research* 49 (1): 211–25. <https://doi.org/10.1177/0022343311427066>.
- UN Security Council. 2007. "Security Council Holds First-Ever Debate On Impact Of Climate Change On Peace, Security, Hearing Over 50 Speakers. New York, United Nations." Press release no. SC/9000, April 17, 2007. <http://www.un.org/News/Press/docs/2007/sc9000.doc.htm>.
- USGCRP. 2018. *Fourth National Climate Assessment*. Washington, DC: US Global Change Research Program. <https://nca2018.globalchange.gov>.

- Von Uexkull, Nina, Mihai Croicu, Hanne Fjelde, and Halvard Buhaug. 2016. "Civil Conflict Sensitivity to Growing-Season Drought." *Proceedings of the National Academy of Sciences*, October, 201607542. <https://doi.org/10.1073/pnas.1607542113>.
- Wagner, Gernot, and Martin L. Weitzman. 2015. *Climate Shock: The Economic Consequences of a Hotter Planet*. Princeton: Princeton University Press.
- WBGU. 2007. *Climate Change as a Security Risk: Summary for Policymakers*. Berlin: WBGU. http://www.wbgu.de/wbgu_jg2007_kurz_engl.html.
- Werrell, Caitlin E., and Francesco Femia, eds. 2013. *The Arab Spring and Climate Change*. Washington, DC: Center for American Progress, Stimson Center, and the Center for Climate and Security. <http://www.americanprogress.org/issues/security/report/2013/02/28/54579/the-arab-spring-and-climate-change/>.
- Wischnath, Gerdis, and Halvard Buhaug. 2014. "Rice or Riots: On Food Production and Conflict Severity across India." *Political Geography*, Special Issue: Climate Change and Conflict, 43 (November): 6–15. <https://doi.org/10.1016/j.polgeo.2014.07.004>.