2

Conceptualizing Climate and Security

Weather anomalies happen all the time, often accentuated by natural processes like El Niño and La Niña.[1] However, the accumulation of record-breaking hot years and new developments like unprecedented temperatures at the poles suggest a broader change is well underway.[2] While scientists continue to learn more about how climate change will manifest in different parts of the world, the general contours are clear – more warming of the earth's surface, higher temperature extremes during the day with little respite at night, and more erratic rainfall.[3]

And, with changes in mean temperatures and rainfall, we are also witnessing what are called fatter tail effects, more temperature distributions lying in the extreme territory of very hot temperatures, more heavy rainfall events, and more extreme periods of prolonged drought.[4] Scientists have also become a lot better at the science of "attribution" and being able to say that individual events were made more likely by climate change.[5] The journalist David Wallace-Wells captured the dynamism of a climate system that is characterized by more extremes: "The truth is actually much scarier. That is, the end of normal; never normal again. We have already exited the state of environmental conditions that

[1] Real Climate 2017. [2] Northon 2017. [3] IPCC Working Group I 2014; IPCC 2011.
[4] Wagner and Weitzman 2015.
[5] Kelley et al. 2015; Fountain 2015; BMAS 2014; Climate Central 2014; Fountain 2017. The field of attribution, whereby scientists seek to connect individual weather events to climate change, is a young and somewhat controversial field, but increasingly scientists are able to tease out whether climate change enhanced the likelihood and severity of individual weather events.

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allowed the human animal to evolve in the first place, in an unsure and unplanned bet on just what that animal can endure."[6]

What do these changes mean for security? In its Fifth Assessment Report published in 2014, the Intergovernmental Panel on Climate Change (IPCC) included a chapter on "human security" for the first time in the organization's nearly thirty-year history. In using the lens of "human security," the chapter is eclectic and covers everything from connections between climate change and armed conflict to other areas such as threats to livelihoods and cultural integrity.[7] The IPCC's inclusion of the chapter suggests the issue of climate and security has matured as a distinct area of inquiry.[8]

At the same time, the breadth of coverage also papers over some of the differences within the scholarly community between those who embrace the broad concept of "human security" and those who worry about conceptual stretching and are thus committed to a narrower focus on armed conflict.[9] My contribution is pitched somewhere between these two views, seeing human security as a bridge too far and overly vague while a focus on conflict is overly restrictive.

How then can we understand the links between climate change and security? I begin with my understanding of security before reviewing the virtues and limits of the research on environmental security to date. In Chapter 3, I make a synthetic argument about the intersection of state capacity, government inclusiveness, and external aid and how certain configurations make negative security outcomes more likely.

THE MEANING OF SECURITY

The traditional meaning of national security is "protection from organized violence caused by armed foreigners."[10] Although it historically referred to protecting the state from existential threats to its territorial integrity, it has a broader meaning than state survival. Countries have interests beyond their borders for which they may be willing to fight. These "vital interests" may be tied to the country's "way of life," its access

[6] Wallace-Wells 2019, 18. [7] Adger et al. 2014.
[8] This chapter builds on material developed in Busby 2008; Busby 2018b; Busby 2017b.
[9] For a sophisticated early treatment of human security and climate change, see Webersik 2010.
[10] Del Rosso 1995, 183.

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to critical natural resources, and be considered so important that a challenge would threaten national security.[11]

Moves to link environmental issues to security date back to the mid-1980s when scholars and advocates sought to widen the concept to encompass environmental concerns, health, human rights, and development. In 1983, Richard Ullman wrote that defining security in military terms "causes states to concentrate on military threats and to ignore other and perhaps even more harmful dangers."[12] He called for a different approach based on harms that could (1) quickly and drastically cause a degradation in the quality of life of a people and (2) threaten to narrow the options available to governments and other actors in response. With this definition in hand, other issues like "natural" disasters such as droughts and floods or epidemics could rise to the level of concern long occupied by interstate war and internal violence.[13]

In the academic field of climate and security, prominent political scientists such as Thomas Homer-Dixon narrowed the emphasis to study the relationship between environmental change and violent conflict, justifying the move as a way to define a more tractable research question. Compared to security, he wrote, "Violence is easier to define, identify, and measure; this focus helps bound our research effort."[14]

While Homer-Dixon restricted the focus to violent conflict, others sought to broaden the agenda under the umbrella concept of "human security."[15] As I have noted, efforts to inject a human security frame into the climate discussions culminated in a chapter on human security in the 2014 IPCC report. There, human security was defined "as a condition that exists when the vital core of human lives is protected."[16] The "vital core" of human security extends beyond material well-being to include "culturally specific" nonmaterial factors that people require to fulfill their interests. This broad definition of security has its detractors. As Roland Paris argued, "human security seems to encompass everything from substance abuse to genocide."[17] Moreover, the definition makes causal analysis challenging since factors that could cause human security are part of the definition.[18] While I largely agree that "human security" may

[11] Art 2003, 3. [12] Ullman 1983, 129. [13] Ibid., 133.
[14] Homer-Dixon and Levy 1995b, 189.
[15] United Nations Development Programme 1994; Dalby 2009. Since 1996, the Global Environmental Change and Human Security (GECHS) program has been one of the leading voices on human security and the environment; Barnett, Matthew, and O'Brien 2010, 18.
[16] Adger et al. 2014, 759. [17] Paris 2004, 371. [18] Ibid.

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conceptually stretch the concept of security too far, the attention to individual well-being has some salutary properties, emphasizing the safety and well-being of individuals and not just the territorial integrity of states.

Despite these efforts, the narrower research agenda on the environment and violence has dominated and been the primary focus of criticism. Dan Deudney's critique has continued resonance. He saw efforts to securitize the environment – that is, to label the environment as a security issue – as a strategic ploy by advocates to generate more attention. While national security issues typically command higher priority and resources, securitizing the issue has risks, including the tendency for countries to interpret responses to security problems in terms of national self-interest rather than the collective good.[19]

These concerns notwithstanding, there now exists a well-developed literature focused on the links between climate change and violent conflict. While I agree that the tight emphasis on conflict makes research easier, it narrows research possibilities in ways that the literature has already found confining. For example, as I discuss in the section The Second Debate, the links between climate-related processes and civil wars have been somewhat inconclusive and contested. As a consequence, scholars have expanded their research agenda to focus on lower-level communal conflicts as well as other forms of social conflict including riots and strikes. It is arguable whether these constitute threats to national security or are merely security-related because they involve violence.[20]

As I argued in Chapter 1, security threats can be defined more expansively without broadening the scope to encompass all harms to human welfare. The test is whether the damage potential from climate effects are commensurate to the threat posed by a traditional armed external attack. Maximally, security threats include risks to the survival of the country but also more limited dangers such as the vulnerability of the seat of government, the survival of the regime, threats to critical infrastructure, and large-scale loss of life.[21] What these have in common is the risk of damage on a scale that would create unacceptable losses. While both large-scale damage and unacceptable losses are both necessarily ambiguous in their meaning, they help assess the stakes in whether or not a specific episode rises to the level of a security threat, what elevates a fire, flood, drought, or

[19] Deudney 1990, 467. For more recent applications to the securitization of climate change, see Rothe 2017; Diez, Lucke, and Wellmann 2016; Hardt 2017.
[20] This section builds on Busby 2008.
[21] My approach has some similarity to the work of Price-Smith 2001.

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hurricane from a disaster emergency risk to something more significant, given the seriousness of the threat.

For some low-lying island nations, climate change constitutes an existential threat to the country's survival. An invasion by a foreign government might mean your state ceases to exist as an independent entity. By the same token, if sea-level rise and storm surge require Vanuatu or Kiribati to be abandoned, that would be as consequential as an external invasion. Even if an entire country was not threatened, its seat of government might be highly exposed to climate hazards. A government might believe this to be a security threat, since a devastating weather emergency could pose the kind of dangers posed by a decapitation strike on the country's capital from an external aggressor. Even large-scale losses of life and large-scale damage to critical infrastructure could rise to the level of security challenges. Once again, we can imagine the reaction if a neighboring country bombed one's refineries or depopulated a city. A country would surely consider these national security threats. By the same logic, a major storm, like Hurricane Katrina, that killed and made homeless thousands and damaged and destroyed critical infrastructure would raise a similar level of concern.

While we might assume that what makes armed attacks security challenges is the agency of the external party, there are several reasons to believe that the scale of damage to life and property is more important to the definition. First, there are direct implications of climate effects for the military. Military bases themselves are often in harm's way from climate-related events,[22] and bases depend on wider civilian infrastructure for power, transport interconnections, and their workforce.[23] Humanitarian emergencies often require the mobilization of the military for response and rescue. In the context of the United States, we can think of the mobilization of 50,000 members of the US National Guard after Hurricane Katrina in 2005 as an illustration.[24] Thus, security-oriented agencies in a state have to have contingency plans for these actions at home (and, in the case of powerful countries like the United States, for overseas deployment as well). Even if one rejects the view that the deployment of security forces for domestic humanitarian operations constitutes a security problem, the opportunity costs of diverting security

[22] Department of Defense 2019; US Department of Defense 2018; Banerjee 2018; Department of Defense 2014.
[23] Busby 2019a. [24] Orrell 2010.

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professionals from defense of the nation from external threats to internal disaster relief has to be considered.

Second, humanitarian emergencies often compromise a state's monopoly on the use of force for a limited period of time over a specific geographic area. Local police stations may be damaged, and in the face of downed power lines, interrupted water and waste services, and closed shops and banks, desperate people and/or unscrupulous individuals may take advantage of post-emergency chaos to loot property and/or engage in violence. Climate-related emergencies, particularly for swift-onset hazards like cyclones, may thus require a pulse of external security to restore order. Here, we can think of the portraits of localized looting after Typhoon Yolanda struck the Philippines in 2013.[25]

In rare circumstances, these threats could constitute threats to the regime in power, not from the direct physical effects of the weather emergency itself, but as a result of calls for resignations and regime change for failed government responses to emergencies. Governments are frequently blamed for weak responses to climate-related emergencies, such as US presidents George W. Bush after Hurricane Katrina and Donald Trump after Hurricane Maria, as well as Pakistan's president Asif Ali Zardari after the 2010 floods. There is an emergent literature on whether democracies or autocracies face differential punishment pressures from publics for perceived failures of preparation and response.[26]

Arguably, here the threats to regimes are largely internal. While in many functioning democracies, peaceful protest will be considered merely an expression of democratic liberties, collective expressions of discontent in other countries may be considered threats to state security, even if mobilization is peaceful. In some country contexts, already riven by conflict and with active militant groups, these events can serve as a source of grievance, recruitment, and mobilization or can facilitate the emergence of such groups. This is, at least, the stylized narrative for protest activity that emerged in the wake of the Syrian droughts of the 2000s. Here too, there is a literature on whether natural disasters make conflict more likely. Like much of the climate–conflict literature, the research on disasters and conflict has produced mixed findings as discussed in the section The Second Debate. For present purposes, it is enough to lay out the logic that might elevate these threats to security challenges.

[25] Yap 2013. [26] Smith and Flores 2010; Quiroz Flores 2015.

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Another pathway I discuss in more detail is that climate hazards may undermine the long-term economic growth of countries and thus deprive the state of resources required to exercise a monopoly on the use of force over its territory. Indeed, given the importance of low economic growth in many empirical studies of conflict onset, this rationale of state capacity undermined by climate hazards is an important one that I will return to later in the chapter, also in the section The Second Debate.

What this discussion means is that the study of climate and security rightfully ought to be extended beyond an exclusive focus on climate and conflict. One can both broaden and still reasonably bound one's climate security aperture to include conflict as well as large-scale climate-related disasters. What qualifies as a large-scale disaster?[27] What matters less is the specific threshold but whether local officials consider these disasters to have created negative consequences for security. This section has provided a preliminary defense for why climate hazards may constitute security challenges beyond their potential contribution to conflicts. In the next section, I review the arguments put forward by scholars on the explicit links to conflict in the two generations of scholarship on environmental security.

THE FIRST GENERATION OF ENVIRONMENTAL SECURITY

As the Cold War wound down in the late 1980s and early 1990s, the demand to broaden the definition of security gained more traction. There was considerable optimism the environment could finally get the attention it deserved. Jessica Mathews captured this perspective in 1989, writing: "Man is still utterly dependent on the natural world but now has for the first time the ability to alter it, rapidly and on a global scale."[28] The dystopian underpinning of environmental threats loomed large in this assessment. The journalist Robert Kaplan captured the zeitgeist in his 1994 essay "The Coming Anarchy" in which he suggested the

[27] What distinguishes a large-scale climate-related disaster from smaller events may be somewhat context specific, given that states face differential exposure to different hazards and vary in size and by population. Existing natural disaster databases like the EM-DAT International Disaster Database have thresholds for damage and other criteria by which exposure to physical hazards merit inclusion in the dataset in the first place. Datasets like these include a number of minor events. To be more precise, we can establish some arbitrary thresholds for large-scale events such as those that cause loss of life, affect populations, or cause monetary damages in the top 90th or 95th percentile of the distribution for that country.

[28] Mathews 1989, 177; for a similar view, see Myers 1989.

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environment would be the defining national security issue of the early twenty-first century.[29]

That essay made Thomas Homer-Dixon more well known. Homer-Dixon is a Canadian scholar, at the time based at the University of Toronto. He and his collaborators in the Environmental Change and Acute Conflicts Project (ECACP) delivered an ambitious and complex portrait of the links between the environment and conflict, drawing on the case studies of Rwanda, South Africa, and other places.[30] Homer-Dixon's scholarship and Kaplan's cruder version helped catapult environmental security onto the agenda of the Bill Clinton administration.[31]

Homer-Dixon foresaw a future of environmentally driven scarcity potentially leading to violence, particularly within developing countries.[32] While inspired by the eighteenth century cleric Thomas Malthus, Homer-Dixon sought to avoid criticism of being seen as an "environmental determinist."[33] He wrote that environmental factors were neither necessary nor sufficient for conflict.[34] Moreover, understanding the environmental contribution to conflict was complicated given a tangled chain of causation, interactions between environmental and social causes, effects that only occur above certain thresholds, and feedback loops.[35] While he despaired of assessing the relative causal importance of environmental factors, Homer-Dixon argued that some conflicts cannot be understood without including environmental scarcity.[36]

He distinguished three different kinds of environmental scarcity that could, when coupled with social and political factors, lead to conflict. The first was *supply-induced scarcity* due to environmental degradation, the second *demand-induced scarcity* due to population growth, and the third *unequal resource-based distribution*.[37] Whether situations lead to violence depends on the capacity for societies to innovate and overcome scarcity.[38] Here, it is important to note that Homer-Dixon focused on renewable resources, such as fisheries and timber or processes like the

[29] Kaplan 1994.
[30] Homer-Dixon 1991, 1994, 1999; Homer-Dixon and Blitt 1998; Percival and Homer-Dixon 1998.
[31] Peluso and Watts 2001, 4. [32] Homer-Dixon 1991, 78.
[33] Malthus thought the rate of population growth would inexorably exceed the capacity of food production to expand, leading to boom–bust cycles of population growth and famine; Malthus 1798.
[34] Homer-Dixon 1999, 7. [35] Homer-Dixon 1991, 86, 107; 1999, 105–106, 174.
[36] Homer-Dixon 1999, 7–9. [37] Ibid., 15; Homer-Dixon 1994.
[38] Homer-Dixon 1999, 1994.

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hydrological cycle and the climate. Nonrenewable resources like oil and minerals, which scholars of the resource curse think of as important drivers of conflict, are not part of his framework.[39]

Homer-Dixon generated three hypotheses of conflict types: (1) simple scarcity between states; (2) group identity-based conflicts within states affected by internal migration; and (3) relative deprivation conflicts where economic decline disrupts social institutions and leads to domestic strife. He found little support for the first hypothesis but stronger support for the other two.[40]

By virtue of its visibility and far-reaching claims, the work of Homer-Dixon and collaborators was always a likely target for vigorous criticism.[41] As I noted in Chapter 1, one of the most potent lines of critique was the absence of paired cases in the research. Without side-by-side cases of conflict and nonconflict, it was not possible to tease out the scope conditions for when environmental scarcity would lead to violence. For his part, Homer-Dixon's rejoinder was that early in a research program it is appropriate to select on the dependent variable (that is, choose only cases of conflict) and most likely cases (those where there was environmental degradation) to trace the specific role environmental factors played: "The aim is to determine if the independent and dependent variables are actually causally linked and, if they are, to derive inductively from a close study of many such cases the common patterns of causality and the key intermediate and interacting variables that characterize these links."[42] While that might have been defensible two decades ago in the emergence of the environmental security literature, we have yet to see that critique manifest in case study work on climate and security.

The climate and security literature, for its part, has largely been dominated by quantitative work. The case studies that have been written,

[39] Ross 2015.

[40] Homer-Dixon 1994, 18–25. Along with Homer-Dixon's research, the Swiss scholar Günther Baechler's initiative, the Environmental Conflicts Project (ENCOP), is also recognized. Baechler and his collaborators produced a multivolume set, initially in German, of forty qualitative case studies of "environmental conflict." They identified different pathways, types, and syndromes where environmental stress leads to conflict (and the threat of violence). They hypothesized that environmental conflicts manifest if and when actors "instrumentalize" cleavages such as ethnic differences; Baechler 1999a, 108, 1998.

[41] For a trenchant, quasi-Marxist critique, see Peluso and Watts 2001.

[42] Homer-Dixon and Levy 1995a, 194. Homer-Dixon and collaborators defended the project elsewhere with a call for methodological pluralism and the virtues of single case studies in exploring causal mechanisms; Schwartz, Deligiannis, and Homer-Dixon 2001.

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many of them in policy publications, typically suffer from the same methodological critique offered by Levy in the 1990s of single cases that trace the role played by climate factors in various conflicts in South Sudan, Syria, and North Africa.[43] Other case study work by regional studies experts is often more speculative, seeking to assess what climate change might mean for security in particular countries in the future.[44]

As Nils Petter Gleditsch argued in 1998 in his critique of Homer-Dixon, quantitative studies have the virtues of generalizability, of being able to capture correlations over a wide range of cases.[45] However, until the last decade, time-series, spatially disaggregated environmental data was limited in availability. This meant that early studies that sought to leverage quantitative evidence to assess the claims of environmental security with crude measures produced mixed findings.[46]

THE SECOND DEBATE: CLIMATE CHANGE AND SECURITY

A new literature on climate and security emerged in the mid-2000s and leveraged high-resolution, time-series data on environmental indicators made possible by improved satellite and geo-referenced coverage.[47] This revolution facilitated statistical tests of connections between proxies for climate change related processes (i.e. droughts, temperature change, and rainfall volatility) and security outcomes, namely, the onset and incidence of violent conflict within states.

However, after more than a decade, we are left with a large body of research that has produced mixed findings. As the 2014 IPCC chapter on human security concluded: "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."[48] Where there are reasonably robust correlations between climate hazards and conflict, such as for temperature, there has been insufficient exploration of causal mechanisms to understand when climate

[43] Faris 2007; Ki-moon 2007; Werrell and Femia 2013; Gleick 2014; Kelley et al. 2015.
[44] Moran 2011. [45] Gleditsch 1998.
[46] Hauge and Ellingsen 2001; de Soysa 2000; Esty et al. 1999.
[47] There is a different literature on water and conflict that finds inter-state water wars have almost never occurred; Wolf 1998. See also my discussion on security and water; Busby 2017a.
[48] Adger et al. 2014, 758. Several authors have carried out periodic stock-taking exercises on this literature, including Nordås and Gleditsch 2007; Gleditsch 2012; Salehyan 2014.

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factors lead to violence and other security-related outcomes. To understand this assessment, it helps to walk through a number of studies.

The connections between climate and security emerged in the mid-2000s in the policy community.[49] Debates accelerated after the release of several US think tank reports around 2007, including one by the CNA Corporation, a joint Center for a New American Security and Center for Strategic & International Studies (CNAS–CSIS) effort, and a paper I wrote for the Council on Foreign Relations.[50] These emphasized the potential role of climate change as a threat multiplier in the exacerbation of security problems, with a particular focus on US national security.[51] These discussions culminated in high-level attention to climate and security by the US government and the United Nations Security Council.[52] As I discussed in Chapter 1, some policy-oriented research in this space sought to identify the potential connections between climate factors and specific conflicts such as in Darfur, Sudan, and Syria.

A parallel academic discussion emerged contemporaneously with the policy debates.[53] This research focused largely on whether proxies for climate change were correlated with conflict, with rainfall and Africa receiving particular attention. In much of this work, it is not absolute scarcity of rainfall per se that is thought to cause conflict, but the extent to which rains deviate from expected levels, with the emphasis on lower than normal rainfall.

Early studies looking at rainfall found promising results. In 2004, Edward Miguel and collaborators found, using rainfall variation as a proxy for economic growth, that negative growth shocks of 5 percent increased the likelihood of civil conflict in Africa by more than 12 percent in the following year. They argued that lower economic growth would both increase individual incentives to engage in conflict and undermine state capacity to repress violence.[54] A second study by Cullen Hendrix and

[49] Nigel Purvis and I wrote a study for the United Nations in 2004, in which we emphasized climate-driven humanitarian emergencies as the most proximate concern; see Purvis and Busby 2004.

[50] CNA Corporation 2007; Campbell et al. 2007; Busby 2007. See also my 2008 paper in *Security Studies* for a more theoretical account of the ways climate change could pose a threat to US national security; Busby 2008.

[51] Other countries like Germany and the UK also carried out similar efforts; WBGU 2007; Mabey 2008.

[52] Busby 2016a. [53] Barnett 2003; Barnett and Adger 2007.

[54] Miguel, Satyanath, and Sergenti 2004. Ciccone provided a critique of this methodology and suggested these findings disappear if one uses rainfall levels rather than growth rates in rainfall; Ciccone 2011.

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Sarah Glaser also focused on civil conflict in Africa. They examined the contribution of long-term trends (including a location's climate suitability for agriculture and freshwater availability) to conflict onset. They also assessed the contribution of interannual deviations from normal rainfall to the triggering of conflicts. They found that higher than normal rains and land suitable for agriculture were negatively correlated with conflict, but only when controlling for other social, political, and economic factors. Hendrix and Glaser argue that good rains in a single year reduce the incentives for engaging in conflict because farming is more attractive. At the same time, areas that are amenable to agriculture over the long term have higher economic returns, also diminishing the likelihood of conflict.[55] In a third study, Marc Levy and collaborators assessed the connections between rainfall anomalies and conflict outbreaks worldwide using spatially disaggregated data. They found rainfall anomalies were correlated with high-intensity civil conflicts but not low-intensity ones. They argue that rainfall variability affects the economy and state capacity to manage conflicts.[56]

However, other studies produced discrepant results. Researchers associated with the Peace Research Institute of Oslo (PRIO) found no association between drought and civil wars in Africa.[57] In Theisen's study of Kenya, lower than normal rains were actually correlated with reduced conflict.[58] In other articles, it appeared that abundance might be a more potent mechanism that triggers conflict as groups have more reason to clash in time of plenty. Better rains might give raiding parties engaged in communal conflict more cover to conceal attacks.[59] Clionadh Raleigh and Dominic Kniveton found this pattern of rainfall abundance accentuated communal conflict (such as between herders and farmers) while anomalously dry conditions enhanced civil conflict (between rebel movements and governments).[60]

Still other studies have emphasized political variables over environmental ones. In their assessment of range wars between pastoralists and farmers in East Africa, Christopher Butler and Scott Gates argued that asymmetric property rights rather than resources per se fuel banditry by poorer parties.[61] Similarly, in their examination of similar conflicts in the

[55] Hendrix and Glaser 2007. [56] Levy et al. 2005.
[57] Theisen, Holtermann, and Buhaug 2012. [58] Theisen 2012.
[59] Meier, Bond, and Bond 2007; see also Hendrix and Salehyan 2012; Salehyan and Hendrix 2014.
[60] Raleigh and Kniveton 2012. Fjelde and von Uexkull 2012 found the opposite – that large negative deviations in rainfall in Africa were associated with more conflict.
[61] Butler and Gates 2012.

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Sahel, Tor Benjaminsen and collaborators attributed violence to agricultural encroachment that impeded mobility by pastoralists, opportunism in rural areas with the decline of the state, and rent-seeking behavior by elites.[62]

The climate–conflict literature has generated a sharp dispute between quantitative scholars aligned with PRIO[63] and California-based scholars Edward Miguel, Marshall Burke, and Solomon Hsiang.[64] PRIO scholars, for the most part, have not found strong correlations between climate-related variables and conflict, while Miguel and coauthors, by contrast, have. At the risk of oversimplification, their disputes have largely been based on model specification and differences over methodology.[65]

A 2009 Burke et al. paper found that for every 1 degree increase in Celsius, there was a 4.5 percent increase in the incidence of violent conflict.[66] Halvard Buhaug found the results did not hold up when one included additional data, used alternative model specifications, or included other variables such as political exclusion.[67] A 2013 meta-analysis by Solomon Hsiang and co-authors fueled the debate further. They estimated the average effects of a variety of climate indicators (temperature increases, positive deviations in rainfall, negative deviations in rainfall) on violence across sixty different studies, examining both "personal violence" (which included studies of baseball pitchers beaning more batters on hot days) as well as "inter-group" violence (which included studies of state collapse, civil wars, and other measures). Their provocative claim was that for every 1 standard deviation of climate

[62] Benjaminsen et al. 2012.

[63] Buhaug 2010; Theisen, Holtermann, and Buhaug 2012; Buhaug et al. 2014; Buhaug 2014; Nordås and Gleditsch 2007; Buhaug, Gleditsch, and Theisen 2008; Gleditsch and Nordås 2014; Gleditsch 2012; Gleditsch, Nordås, and Salehyan 2007; Theisen 2008.

[64] Miguel, Satyanath, and Sergenti 2004; Burke et al. 2009; Hsiang, Meng, and Cane 2011; Hsiang, Burke, and Miguel 2013; Hsiang and Meng 2014.

[65] Other prominent scholars include Marc Levy who, after earlier contretemps with Thomas Homer-Dixon, became more convinced of the links between climate change and conflict/national security. Another prominent scholar is John O'Loughlin whose publications are in line with the PRIO school. Idean Salehyan, Cullen Hendrix, and Clionadh Raleigh are important, more idiosyncratic scholars. Other eclectic researchers include Jürgen Scheffran at the University of Hamburg and collaborators in the Research Group Climate Change and Security (CLISEC). This group, along with Hans Günter Brauch, has contributed multivolume books on climate and security through the Hexagon Series on Human and Environmental Security and Peace. Three special issues – a 2007 issue of *Political Geography*, a 2012 issue of the *Journal of Peace Research*, and a 2014 issue of *Political Geography* – included many leading figures.

[66] Burke et al. 2009. [67] Buhaug 2010.

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indicators the frequency of interpersonal violence increased by 4 percent and intergroup conflict by 14 percent.[68] Buhaug and coauthors raised various objections – about model specification, choice of control variables, and other arcana – that resulted in a back and forth with Hsiang and his collaborators.[69]

Leaving aside which side is right in these disputes, the California research on temperature as well as the wider meta-analysis is largely silent on the question of causal mechanisms. While they identify some plausible mechanisms and pathways, they acknowledge more work needs to be done: "To date, no study has been able to conclusively pin down the full set of causal mechanisms, although some studies find suggestive evidence that a particular pathway contributes to the observed association in a particular context."[70] While their research focused on finding correlations between climate phenomena and conflict, the field has moved toward identifying discrete causal pathways between specific climate phenomena (such as too much rain) and particular kinds of conflict (such as communal violence).

Heretofore, most studies of climate and conflict tested direct relationships between physical hazards and conflict rather than indirect pathways through food prices, effects on agriculture, migration, disasters, and economic growth. Research has started to address these lacunae. 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.[71]

In terms of agriculture, there are two dimensions, one focusing on food production and another on food prices. Emily Meierding 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.[72] 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 Nina von Uexkull and colleagues focused on growing season droughts. They found conflict incidence in Africa and Asia to be more likely when droughts occurred in agriculturally dependent areas

[68] Hsiang, Burke, and Miguel 2013.
[69] Buhaug et al. 2014; Hsiang and Meng 2014; Buhaug 2014.
[70] Hsiang, Burke, and Miguel 2013, 7. [71] Busby 2018b; Busby 2019d.
[72] Meierding 2013.

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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.[73] That study informed subsequent research to identify countries at risk in the wake of severe water deficits; this examined countries which had high agricultural dependence, a history of conflict, and discriminatory institutions.[74] Another paper in this vein by Maystadt and Ecker connected drought to civil conflict in Somalia through the effects on depressed livestock prices that, in turn, make recruitment by rebel groups more attractive and conflict more likely.[75]

Research by Ore 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.[76] Koren argued that food-rich regions become sites of contention as a means of denying opponents sufficient food to field forces.[77] In previous work, he and his coauthor found that food insecurity was also highly correlated with conflict.[78] 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.[79]

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 producers – spurred protest activity.[80] Lagi claimed 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.[81] Smith, however, noted 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 become more likely if domestic food prices increase.[82] 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

[73] von Uexkull et al. 2016. [74] Busby and von Uexkull 2018.
[75] Maystadt and Ecker 2014. [76] Koren 2018. [77] Koren 2019b.
[78] Koren and Bagozzi 2017. [79] Kahl 2006. [80] Werrell and Femia 2013.
[81] Lagi, Bertrand, and Bar-Yam 2011. [82] Smith 2014.

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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.[83]

A second related and understudied pathway is through the effects of climate and conflict 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 by undermining state capacity to suppress violence and to provide services. Early work in this space has been inconclusive.[84] There is also a vigorous empirical debate in economics on the effects of natural disasters on long-term economic growth.[85] This research has not been connected to that on conflict, 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.[86]

A third underexplored pathway to conflict is through migration. Reuveny argued that climate-related migration could lead to interethnic conflict over resources, distrust, and rivalry between socioeconomic groups.[87] Research by Idean Salehyan and Kristian Gleditsch suggests that refugees can bring newcomers into conflict with longtime residents over limited resources and government programs, with conflicts spilling over to neighboring polities.[88] Clionadh Raleigh and coauthors suggested climate migrants, to the extent that 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.[89] With some locations, low-lying island nations in particular, becoming inhospitable to human settlement, it is little less clear if many population movements *will* be temporary. Early empirical work on migration and conflict by Koubi et al. was inconclusive.[90] In specific cases, migration has been

[83] Hendrix and Haggard 2015. [84] Koubi et al. 2012; Koubi 2017.
[85] Shabnam 2014; Cavallo et al. 2013. [86] Collier 2007.
[87] Reuveny 2007; see also Reuveny and Moore 2009.
[88] Salehyan and Gleditsch 2006; Reuveny 2007; Reuveny and Moore 2009.
[89] Raleigh, Jordan, and Salehyan 2008. [90] Koubi et al. 2016a; Freeman 2017.

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identified as a driver of conflict – for example, in the Syrian civil war.[91] As I explain further below, several scholars have, however, contested the links in this case.[92] This is an area that 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.[93] 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 due to other factors is a challenge.

A fourth channel is the effects of climate disasters on security. Disasters may lead to conflict through the effects on economic growth or, potentially, when failed disaster response leads to grievances among affected populations. Nel and Righarts showed the effects of disasters on conflict to be the most severe in low- and medium-income countries with high inequality, low economic growth, and mixed political regimes (either partially democratic or partially authoritarian). While the effects were stronger for earthquakes and volcanoes, the results held up for climate-related disasters.[94] However, Slettebak found climate-related disasters actually made conflict less likely.[95] Other studies have examined connections between disasters and regime survival.[96] A separate small literature outside of security studies has examined the correlates of disaster mortality; poverty, population exposure, and government effectiveness loom large across different accounts and multiple hazards.[97]

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 need 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, when groups rally around the common challenge of survival, 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

[91] Gleick 2014; Werrell and Femia 2013; Kelley et al. 2015.
[92] Fröhlich 2016; de Châtel 2014; Selby et al. 2017a; Hendrix 2017b; Gleick 2017; Kelley et al. 2017; Selby et al. 2017b.
[93] Abel et al. 2019. For a critique, see Koren 2019a. [94] Nel and Righarts 2008.
[95] Slettebak 2012; for similar results, see Bergholt and Lujala 2012.
[96] Quiroz Flores 2015; Flores and Smith 2010.
[97] Peduzzi et al. 2009; Peduzzi et al. 2010; Yonson, Gaillard, and Noy 2016.

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flows.[98] There is also good related work by Alejandro Quiroz Flores and Alastair Smith on disasters and leader survival, that is, whether failed responses to disasters lead to leadership challenges in certain regimes.[99]

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. focus on how political institutions that exclude certain groups exacerbate the risk of conflict in agricultural societies experiencing growing season droughts.[100] Linke et al. draw attention to both official government and customary domestic institutions and how rules over natural resource management potentially amplify or moderate conflict.[101] For transboundary river basins, well-designed institutions diminish the risks of conflict by allocating water, planning for shocks, and facilitating dispute resolution.[102]

Scholars have exploited better geo-referenced datasets to examine subnational conflict patterns and a variety of kinds of conflict. We are also seeing scholarship on regions other than Africa, including Asia and the Middle East. The best work seeks to specify the conditions under which climate-related hazards lead to particular kinds of conflict, distinguishing between kinds of states (e.g. between exclusive and inclusive institutions, states with stark group cleavages), kinds of contexts (e.g. between urban and rural areas), and kinds of hazards (e.g. swift onset versus slow onset).[103] While this disaggregated analysis is a productive step forward, there still may be room for a more unifying theoretical framework on the causal pathways between climate change and security outcomes that includes but is not limited to conflict.[104] What follows in Chapter 3 is an effort to do just that.

[98] Kelman 2006; Egorova and Hendrix 2014.
[99] Quiroz Flores 2015; Flores and Smith 2010.
[100] von Uexkull et al. 2016.
[101] Linke et al. 2018b.
[102] De Stefano et al. 2012; Tir and Stinnett 2012.
[103] For a similar take, see Hendrix, Gates, and Buhaug 2016.
[104] Several papers have tried to synthesize what we know about the links between climate and conflict, including Mach et al. 2019; Koubi 2019; Theisen 2017.

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