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Achieving Climate Security

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Making Peace Possible

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INTRODUCTION

In late 2021, the US Department of Defense (DoD) directed its 2 million-person, $1.5 trillion organization to adopt new, ambitious climate change policies. "The Department is responding to climate change in two ways: adaptation to enhance resilience to the effects of climate change; and mitigation to reduce greenhouse gas emissions," declared the DoD Climate Adaptation Plan.[1] The Defense Climate Risk Analysis soon added: "DoD will integrate the security implications of climate change into key strategic documents, programs, and international partner engagements."[2] The guidance to all defense components was clear: it is time to act on climate security.

About three months later, the US Africa Command, the organization that manages US military activities across the African continent, moved to implement the new guidance. The command's top strategists pulled together personnel from various departments to hear from a range of experts in a two-day conference and discuss how they might incorporate climate-related risk into the command's theater strategy and campaign plans.[3] One prominent scholar, joining by video, told the audience of military officers and defense professionals that there was no link between climate change and conflict and questioned the motives of those who say otherwise. The next speaker countered that there was a link, but it was complicated, talking about job trends in the Lake Chad region. Then a climate scientist showed projections of temperature changes expected over the next 50 years, with fuzzy lines and shaded areas indicating a very wide range of uncertainty. At one point, one of the military officers hosting the meeting leaned over and whispered, "Why . . . are we here?"[4]

The ambition of civilian leaders at the Pentagon to bring climate security policy to scale quickly is running into the shoals of a peculiar reality: climate security as a concept is not well defined and controversial, even as climate impacts on societies are mounting. There is clearly a connection between the effects of a changing climate and security—security both in the broadest

[1] US Department of Defense, "Department of Defense Climate Adaptation Plan," September 1, 2021, www.sustainability.gov/pdfs/dod-2021-cap.pdf.
[2] US Department of Defense, "Department of Defense Climate Risk Analysis," October 2021, https://media.defense.gov/2021/Oct/21/2002877353/-1/-1/0/DOD-CLIMATE-RISK-ANALYSIS-FINAL.PDF.
[3] The author attended the conference in Stuttgart, Germany in February 2022, so this is all first-hand reporting, but presentations and discussions were under Chatham House rules and cannot be attributed by name to the speakers.
[4] The individual made the comment directly to the author; the profanity is elided.

sense of the safety and well-being of human societies and in the narrower sense of threats to civil order—but there is insufficient climate security research and analysis to guide policy. As governments and international organizations increasingly seek to put climate security policies into motion, there is an urgent need for a stronger informational base to build on, spurred on by troubling signs of accelerating climate change.

This paper reviews the origins of the concept of climate security as it has evolved in the United States (and the controversy surrounding the term), provides an overview of some of the tools being developed to provide information to policymakers and guide their decisions on climate security, and concludes with suggestions for new research.

WHAT IS CLIMATE SECURITY, ANYWAY?

Behind every war, there is a constellation of causality, one made up of grievances, avarice, desperation, legacies, and the drive for economic and political power. At times, the earth itself has been a contributing casus belli, with natural resources, droughts, famines, and disease interacting with all those other variables in ways that have shaped conflict and in turn been shaped by conflict, from ancient Mesopotamia to modern Ukraine.

In particular, naturally occurring shifts in climate have had a profound effect on humanity,[5] and weather and warfare have a long-shared past.[6] This is the first time in history, however, that humans are significantly shaping the global climate rather than the other way around, and it is not yet clear what that means for the peace and security of societies around the world. In 2022 alone, military forces around the world helped respond to record floods, fires, and storms. Sweden and Finland announced plans to join NATO, making Russia the only Arctic nation not in the alliance, in a year when Russian combat assets illegally entered or neared the Arctic airspace or territorial waters of Denmark, Norway, Sweden, and the United States. China suspended climate change negotiations over the visit of then Speaker of the House Nancy Pelosi to Taiwan. The longest and most severe drought in recent history continued to ravage the Horn of Africa,

[5] See Benjamin Lieberman and Elizabeth Gordon, *Climate Change in Human History: Prehistory to the Present* (New York: Bloomsbury, 2018); and Brian Handwerk, "How Climate Change May Have Shaped Human Evolution," *Smithsonian Magazine,* September 30, 2014, www.smithsonianmag.com/science-nature/how-climate-change-may-have-shaped-human-evolution-180952885.
[6] Harold A. Winters et al., *Battling the Elements: Weather and Terrain in the Conduct of War* (Baltimore, MD: Johns Hopkins University Press, 1998).

especially Ethiopia, Kenya, and Somalia, which all struggled with either armed conflict or social unrest or both. And an estimated one-third of nuclear-armed Pakistan was inundated by epic floods, with millions of people displaced[7] and a top Pakistani official demanding restitution from high-carbon emitting countries.[8] There is urgency to understanding the relationship between climate change and security better, especially for slow-onset climate changes, such as sea-level rise or droughts, where it can be harder to chart how they may fit into the constellation of causality leading to instability and conflict. For governments around the world, part of the urgent need to understand is the obligation to translate ideas into policies and investments that protect their populations. Increasingly, that translation is also going to require prioritization, as the costs for preventing and adapting to climate change mount.

The link between climate and security seems clear, and the urgent need for action equally so, and yet the concept of "climate security" remains controversial. Prominent scholars have a heated debate about whether there is in fact a causal link between climate change and war, advocacy groups question the morality of a military role in fighting climate change, and a number of major greenhouse gas emitting countries oppose labeling climate change a security issue in international diplomacy. To be clear, government climate security policies, investments, and priorities are happening regardless of the range of opinions, and too often in the absence of good scholarship and information or even a clear definition of what the term "climate security" really means.

At the most basic level, the definition of climate security is a global climate that is favorable to human societies. Climate security, in that sense, has not been the norm for most of the geological history of the Earth.[9] As greenhouse gas concentrations in the atmosphere rise, trapping heat near the surface of the earth, these changes translate into a climate less favorable to humanity and the ecosystems we depend on. The path to achieving climate security will be paved with massive economic shifts, unprecedented innovation, and sweeping changes in individual, community, and state behaviors, especially from more industrialized nations. But in the narrower sense of the consequences of climate change for societal stability, climate security is best defined

[7] UN Refugee Agency, "Humanitarian Needs Remain Acute for Displaced in Flood-Hit Areas Of Pakistan," September 20, 2022, www.unhcr.org/en-us/news/briefing/2022/9/63297ee24.html.
[8] Nina Lakhani and Shah Meer Baloch, "Rich Nations Owe Reparations to Countries Facing Climate Disaster, Says Pakistan Minister," September 24, 2022, *The Guardian*, www.theguardian.com/world/2022/sep/04/pakistan-floods-reparations-climate-disaster.
[9] Caroline H. Lear et al., "Geological Society of London Scientific Statement: What the Geological Record Tells Us about our Present and Future Climate," *Journal of the Geological Society* 178 (December 28, 2020).

as the interactions between change in global, regional, or local climate patterns and the political, economic, and social risks to peace, security, and stability. Or, in brief, climate security is the effect of climate change on the risks to peace and security. Militaries have a role to play in that definition, but not a predominant one—unless the industrialized nations of the world fail to cut greenhouse gas emissions and the global climate becomes a worst-case scenario of a profoundly destabilized world.

History of a Controversial Term

While there is an ancient heritage to the concept of a link between war and the natural world, environmental degradation as a modern security issue arguably dates to Lester Brown's 1977 paper, "Redefining National Security."[10] Jessica Tuchman Matthews published another influential article, "Redefining Security," in 1989 in *Foreign Affairs*, calling to broaden "the definition of national security to include resource, environmental, and demographic issues."[11] Thomas Homer Dixon's landmark articles and books throughout the 1990s explored the link between natural resources and violent conflict.[12] But it was not until 2003 that Jon Barnett's "Security and Climate Change," published in *Global Environmental Change*, laid the groundwork for climate security specifically.

2003 was also the year that US defense officials first started thinking about climate change. The Department of Defense's Office of Net Assessment, an influential, internal think tank in the Pentagon, commissioned a report on climate change from two business risk professionals, Peter Schwartz and Doug Randall.[13] The paper was a highly speculative look at what a worst-case climate scenario might look like. (Although nothing came of the report within the Pentagon at the time, it allegedly inspired a 2004 disaster movie.[14]) Then, in 2007, there was a burst of defense-

[10] Lester R. Brown, "Redefining National Security," Worldwatch Paper 14, Worldwatch Institute, October 1977, https://files.eric.ed.gov/ fulltext/ED147229.pdf.
[11] Jessica Tuchman Matthews, "Redefining National Security," *Foreign Affairs,* Spring 1989, www.foreignaffairs.com/united-states/redefining-security.
[12] See, for example, Thomas F. Homer-Dixon, *Environment, Scarcity, and Violence* (Princeton, NJ: Princeton University Press, 1999); and "Environmental Scarcities and Violent Conflict: Evidence from Cases," *International Security* 19, no. 1 (1994): 5–40. Homer-Dixon continues to be a prolific writer of both scholarly and more popularly oriented works, which can be found on his website at https://homerdixon.com.
[13] Peter Schwartz and Dough Randall, "An Abrupt Climate Change Scenario and Its Implications for United States National Security," October 2003, https://training.fema.gov/hiedu/docs/crr/catastrophe%20readiness%20and %20response%20-%20appendix %202%20-%20abrupt%20climate%20change.pdf.
[14] As told to the author by one of the report's authors.

related activity on climate change. First, the federally funded research and development organization CNA released its landmark report, "National Security and the Threat of Climate Change." The report was the product of a review panel of retired military generals and flag officers convened by Sherri Goodman, a former DoD official.[15] Although that report did not actually use the term "climate security," it did develop the concept, including describing climate change as a "threat multiplier," a formulation that continues to be widely used. In the same month, the United Kingdom introduced a debate linking energy, climate, and security in the United Nations Security Council for the first time. Later in 2007, the Center for a New American Security released "The Age of Consequences: The Foreign Policy and National Security Implications of Global Climate Change," edited by former defense official Kurt Campbell,[16] which was later released as a book.[17] Soon after, the Council on Foreign Relations published "Climate Change and National Security: An Agenda for Action" by Joshua Busby, a scholar who frequently publishes more policy-oriented work. Then, in February 2010, the Department of Defense enshrined a military-centric statement of climate security in its Congressionally mandated Quadrennial Defense Review:

> Climate change and energy will play significant roles in the future security environment. The Department is developing policies and plans to manage the effects of climate change on its operating environment, missions, and facilities. The Department already performs environmental stewardship at hundreds of DoD installations throughout the United States, working to meet resource efficiency and sustainability goals. We must continue incorporating geostrategic and operational energy considerations into force planning, requirements development, and acquisition processes.[18]

The themes of effects on the operating environment, missions, and facilities, stewardship, efficiency, and geopolitics have continued to be a part of the defense-oriented definition of climate security common in the United States. It is worth noting, however, that the Department of

[15] CNA Corporation, "National Security and the Threat of Climate Change," 2007, https://www.cna.org/reports/2007/national-security-and-the-threat-of-climate-change.
[16] Kurt M. Campbell et al., *The Age of Consequences: The Foreign Policy and National Security Implications of Global Climate Change* (Washington, DC: Center for Strategic and International Studies and Center for a New American Security, November 2007), www.cnas.org/publications/reports/the-age-of-consequences-the-foreign-policy-and-national-security-implications-of-global-climate-change.
[17] Kurt M. Campbell, ed., *Climatic Cataclysm: The Foreign Policy and National Security Implications of Climate Change* (Washington, DC: Brookings Institution Press, 2008).
[18] US Department of Defense, "Quadrennial Defense Review 2010," February 2010, https://history.defense.gov/Portals/70/Documents/quadrennial/QDR2010.pdf.

Defense did not follow up this verbiage in 2010 with significant resourcing, either in institutional capacity or funding, though that appears to be changing under the Biden administration.[19]

In 2020, the US Congress codified a definition of "climate security" (50 USC § 3060(e)(1), describing it as the effects of climate change on:

- the national security of the United States, including national security infrastructure;
- subnational, national, and regional political stability;
- the security of allies and partners of the United States; or
- ongoing or potential political violence, including unrest, rioting, guerilla warfare, insurgency, terrorism, rebellion, revolution, civil war, and interstate war.[20]

Note that this defense-dominated definition is not necessarily shared internationally (more on that later), but in this case reflects a structural element of the US government with domestic cultural resonance, given the high public approval for the armed forces.[21] There is also a closely related concept of "climate fragility," which refers to countries that are both exposed and vulnerable to climate change, with an interlocking range of political, social, and economic challenges. This concept was first fleshed out in 2015's *A New Climate for Peace*, which was commissioned by the G7.[22] The term is generally used by civilian and civil society officials in Western countries to emphasize peacebuilding, rather than a military approach. In practice, there is considerable overlap between climate security and climate fragility, particularly in the underlying drivers of stability and instability.

[19] This is a personal observation of the author, who was a defense official responsible for energy and climate change issues from 2010-2014, and again as a transition official in 2020-2021. The Biden administration has added staffing and has identified $617 million for climate-related initiatives in Fiscal Year 2022 and $3.1 billion in Fiscal Year 2023, although some of that was existing programming. There are also several executive orders and internal memos directing defense components to incorporate climate change into military strategy, planning, and infrastructure management.
[20] National Security Act of 1947, as amended, www.govinfo.gov/content/pkg/COMPS-1493/pdf/COMPS-1493.pdf.
[21] Public confidence in the US armed forces is far higher than for any other governance institution, and higher than most civic institutions, as well. See Jeffrey M. Jones, "Confidence in U.S. Institutions Down; Average at New Low," Gallup, July 5, 2022, https://news.gallup.com/poll/394283/confidence-institutions-down-average-new-low.aspx.
[22] Lukas Ruttinger et al., *A New Climate for Peace: Taking Action on Climate and Fragility Risks* (G7 Germany: 2015).

Evolving US Defense Department Response on Climate Security

When it comes to actually implementing policies, one advantage of using the term climate security is that it is more inclusive of military actors. The US Department of Defense, in particular, has unique capabilities to tackle climate security issues and to shape public discourse around climate change. In addition to having the largest budget of all US federal agencies, the Department of Defense is responsible for more than 80 percent of federal energy consumption and 75 percent of all US federal government greenhouse gas emissions, a considerable amount, though less than one percent of overall US emissions.[23] The Department has announced an intention to improve its greenhouse gas accounting, however, to include indirect emissions from vendors, so the proportion of national emissions may shift. That energy and environmental footprint can be a liability, but it has also presented opportunities. Note that the militaries of other countries have the same sorts of liabilities and opportunities, but not at the US scale.

One opportunity is to leverage the political tenability of national security for what is otherwise a politically contentious topic in the United States. This aspect of the US climate security approach has been successful, given that Congress has included energy and resilience investments at the Department of Defense in annual authorizing legislation since 2008, even when Congress has not passed climate change legislation more generally.

Another opportunity is to leverage defense dollars and the innovative power of conflict, especially when it comes to energy. US armed forces have two main categories of energy use and emissions: installations and operations. Installations or military bases, where US forces live and train, are like small cities, generally with intricate links to the actual civilian cities or communities around them. Fort Bliss in El Paso, Texas, for example, is home to 90,000 service members and their families and covers more than one million acres. Everything from electricity to education flows from the civilian community onto the base, and the base shares the strengths and weaknesses of the community's human and public works infrastructure. Fort Bliss, for example, did not have the extended water and power outages other military communities experienced in Texas during Winter Storm Uri in 2019 because El Paso is not on the Texas electric

[23] See data from the US Department of Energy, "Comprehensive Annual Energy Data and Sustainability Performance," https://ctsedwweb.ee.doe.gov/Annual/Report /ComprehensiveGreenhouseGasGHGInventoriesByAgencyAndFiscalYear.aspx.

grid.[24] For decades, the Department of Defense has used the relationship between bases and surrounding communities and the scale of the military's energy demand to make investments in alternative energy. There has been a geothermal generating station on the grounds of the Naval Air Weapons Station in China Lake, California since 1987, for example, and the military departments have projects with local utilities and other private companies around the country for a range of efficiency improvements and renewable energy supplies. Some of these projects use financing instruments and other assets (such as land or reliability of electricity demand) to attract private investment, rather than taxpayer dollars.

As of January 2022, the US Army's energy security and resilience portfolio contained projects at 22 military bases, with projects ranging from applications of solar and wind technologies to work on energy storage and supply.[25]

While US installations have a $4 billion annual electricity bill, the majority of DoD's energy use is actually "operational," meaning the result of military training and operations, and mostly involves petroleum-based fuels. While combat equipment or "platforms," such as the Abrams tank or F-35 combat aircraft, are significant consumers of fuel, often with terrible fuel economy, it is worth noting that they do not have the same use profiles as their civilian counterparts. Civilian aircraft constantly cross the country and the world with passengers and cargo; roads and highways around the world are full of vehicles traveling trillions of road miles. Even in a combat situation, an Abrams tank is not in constant use, nor is an F-35 going to be flying 24/7; their "duty cycle" is inherently intermittent and tied to the tempo of war. These operational energy uses are also harder to change than the energy use at installations since they are so directly tied to war. Regardless, energy innovation can mean logistics and other military gains on the battlefield. Indeed, the Pentagon has looked to promote operational energy innovation primarily for that reason, though Biden administration and NATO officials have included emissions reductions as a goal for operations and equipment, as well as installations.[26]

In other words, some leaders in the US government have looked to leverage the large role the military plays in national governance to advance climate change goals. That does not mean

[24] Sierra Juarez, "El Paso Heeded the Warnings and Avoided a Winter Catastrophe," *Texas Monthly*, February 19, 2021, www.texasmonthly.com/news-politics/el-paso-electric-winter-storm-2021.
[25] US Army energy projects, January 2022, www.asaie.army.mil/Public/ES/oei/projects.html.
[26] See, for example, "United States Army Climate Strategy," February 2022, www.army.mil/e2/downloads/rv7/about/2022_army_climate_strategy.pdf; and NATO, "Climate Change and Security Impact Assessment," June 28, 2022, www.nato.int/nato_static_fl2014/assets/pdf/2022/6/pdf/280622-climate-impact-assessment.pdf.

US armed forces have enthusiastically embraced climate security, or that the Department of Defense is the best institution for leading climate security efforts. The agency's core mission is to fight wars, after all, and war consumes resources and destroys lives, built infrastructure, and the natural environment. Moreover, uncertainty is an inherent part of the nature of war; conflict rarely leads to the exact outcomes the combatants originally aim to achieve, making it an inherently risky instrument of national policy, but especially for an indirect driver or consequence like climate change. Finally, despite all the attention given to DoD's energy consumption, the US military continues to add new equipment with high fuel demand, such as the B-21 long-range bomber,[27] armored multi-purpose vehicles,[28] and guided missile destroyers[29]— a reminder that fighting wars, not saving energy, is its top priority. For that matter, more than 90 percent of all greenhouse gas emissions—and the most important solutions to climate challenges—come from the civil sector.

Challenges in a Defense-Oriented Definition of Climate Security

While DoD's approach to climate security has been critical in transitioning its energy systems to more modern technologies, there is little evidence of a direct, causal relationship between climate change and armed conflict at this time.[30] This matters in practical terms because many governments have agency when it comes to dealing with the effects of climate change. In other words, an exceptional drought does not automatically mean a civil war, nor is poor economic policy an adversary that can be defeated through the force of arms. Furthermore, the language of warfare, of combat and adversaries, is at odds with the most important climate solutions, such as innovation, international cooperation, and equity, which rely on collaboration within civil society and across national borders. In fact, in too many countries, militaries tend to undercut or even threaten civil society and civilian government. That is not to say that armed forces have no role,

[27] C. Todd Lopez, "World Gets First Look at B-21 Raider," *DoD News*, December 3, 2022. www.defense.gov/News/News-Stories/Article/Article/3235326/world-gets-first-look-at-b-21-raider.
[28] Mark Schauer, "New Armored Multi-Purpose Vehicle Shows its Stuff at the Army's Cold Regions Test Center," US Army, October 13, 2022, www.army.mil/article/261117/new_armored_multi_purpose_vehicle_shows_its_stuff_at_the_armys_cold_regions_test_center.
[29] "U.S. Navy Launches First Flight III Guided Missile Destroyer, the Future Jack H. Lucas," *NAVSEA News*, June 7, 2021, www.navsea.navy.mil/Media/News/Article/2647779/us-navy-launches-first-flight-iii-guided-missile-destroyer-the-future-jack-h-lu.
[30] Gabrielle Daoust and Jan Selby (2022): "Understanding the Politics of Climate Security Policy Discourse: The Case of the Lake Chad Basin," *Geopolitics*, 28, no. 3 (2023): 1285-1322.

especially in a worst-case scenario of unstoppable, extreme climate change, but they do not have the core responsibility when it comes to building climate security.

It is no surprise, then, that there has long been pushback to the framing of climate change as a defense issue. This is especially true of scholarly research, which in many ways starts with the mid-1990s Copenhagen School, a group of British and European international relations theorists who developed the concept of "securitization." Securitization refers to nation-states that seek to redefine a political, economic, or social issue as a security threat in order to raise a sense of urgency and unlock the possibility of more extraordinary means for dealing with the issue.[31] Securitization is not so much reassigning other missions to the military as it is assigning warlike salience or status to nonmilitary challenges.[32] Still, there continues to be a robust scholarly debate about securitizing climate change, including about the concept of securitization itself.

The social science research on climate security seems to suffer at times from cycles of refutation.[33] These intellectual debates can be an important part of strengthening the research and making the ideas more accurate and broadly applicable. The critics of the concept are not usually disputing that climate change is occurring, or that it is likely to have profound effects on societies around the world. Those seeing causality between climate change and conflict are not usually disputing that the relationship may be indirect. There are mostly methodological and context disagreements, which at times have starved the literature of new ideas or analysis.[34] The

[31] Barry Buzan, Ole Wæver and Jaap de Wilde, *Security: A New Framework for Analysis* (Boulder, CO: Lynne Rienner, 1998).

[32] Securitization has also come under criticism for evolving out of colonialist and racist mindsets. See Stephanie J. Baele and Diana Jalea, "Twenty-Five Years of Securitization Theory: A Corpus-Based Review," *Political Studies Review* 21, no. 2 (2022): 376–89.

[33] See, for example, the debate surrounding "Warming Increases the Risk of Civil War in Africa" by Marshall Burke et al., published in 2009. The research found strong historical linkages between civil war and temperature in sub-Saharan Africa by using data on climate variation and conflict events, suggesting a 54 percent increase in armed conflict by 2030. Soon after, Halvard Buhaug published "Climate Not to Blame for African Civil Wars," and Michael Ward et al., argued that focusing too much on finding statistically significant relationships overlooked other variables that could improve the ability to predict civil wars. Theisen et al., asserted that the policy debate on climate and security ran far ahead of scientific evidence, claiming a definitive effect should not be accepted as fact. In 2014, Hsiang and Burke countered the critics, surveying 50 rigorous quantitative studies in "Climate, Conflict, and Social Stability: What Does the Evidence Say?" This resulted in another wave of response, such as Jan Selby's "Positivist Climate Conflict Research: A Critique." Selby challenged the causal assumptions underlying analysis tying conflict to climate, the ability to predict conflict, and the influence of "northern" policy perspectives on the analysis, though he himself is also "northern." More recently, Gabrielle Daoust and Jan Selby examined a range of analytical and boundary research on Lake Chad and found generally that the work is guided by political agendas and poor research methods, calling for a more rigorous and cautious engagement between climate security researchers and scientific evidence.

[34] For an overview of the literature, see Julie Snorek and Daniel Abrahams, "The Climate Security Nexus," Oxford Bibliographies, January 15, 2019, www.oxfordbibliographies.com/display/document/obo-9780199874002/obo-

boundary or gray literature produced by journalists, think tanks, and other policy research organizations does not suffer from the same tit-for-tat publishing, but it does tend to have a fairly weak evidentiary base, with little primary sourcing or references to peer-reviewed science or analysis. Moreover, there is limited cross-fertilization between scholars and boundary researchers; peer-reviewed articles rarely cite the work of think tanks, and think tank reports infrequently cite peer-reviewed research. Though to be fair, the staff at some think tanks are serious scholars in their own right,[35] and other think tanks include scholars in their affiliated staff.[36] Some universities have their own think tanks, as well.

While some environmental organizations have embraced the Department of Defense's role in energy and climate security,[37] there has been criticism from other nongovernmental groups. The Netherlands-based Transnational Institute, for example, has claimed that placing climate change in a security context is a way to perpetuate a "repressive security state" with a "bloated military" and untrammeled corporate power.[38] An American scholar, Neta Crawford, published a 2019 study with Brown University's Cost of War project labeling the US military as the world's largest polluter, following up the report's success with a book on the same topic in 2022.[39] In 2023, the advocacy group Common Defense released a video and report claiming that the climate security narrative is the work of "white supremacists and war profiteers" and feeds right-wing demonization of immigrants.[40] These critiques are part of the public narrative about climate security, and possibly a growing part of the discourse.

9780199874002-0200.xml; and Katherine Mach et al, "Climate as a Risk Factor for Armed Conflict," *Nature,* June 12, 2019, www.nature.com/articles/s41586-019-1300-6.

[35] See, for example, Louise van Shaik at The Netherlands' Clingendael Institute www.clingendael.org/person/louise-van-schaik.

[36] See, for example, the Center for Climate Security in the United States https://climateandsecurity.org/staff.

[37] See, for example, The Pew Charitable Trusts, "Power Surge: How the Department of Defense Leverages Private Resources to Enhance Energy Security and Save Money on U.S. Military Bases," January 2014, www.pewtrusts.org/-/media/legacy/uploadedfiles/peg/publications/report/pewdodreport2013ks10020314pdf.pdf; and Scott Powers, "New EDF Ad Accuses Donald Trump of Ignoring Military Warnings on Climate Change," Florida Politics, www.floridapolitics.com/archives/352737-new-edf-ad-accuses-donald-trump-of-ignoring-military-warnings-on-climate-change.

[38] Nick Buxton, "Primer on Climate Security," Transnational Institute, October 12, 2021, www.tni.org/en/publication/primer-on-climate-security.

[39] Neta C. Crawford, "Pentagon Fuel Use, Climate Change, and the Costs of War," Watson Institute for International and Public Affairs, June 12, 2019, https://watson.brown.edu/research/2019/pentagon-fuel-use-climate-change-and-costs-war.

[40] Common Defense, "Security for All: Demilitarizing Our Climate Narratives," 2022, https://commondefense.us/climate-briefing-2022.

Table: Definitions of Climate Security

EU/UN/adelphi	"Climate-related security risks" are understood as the adverse impacts of climate change on human security—the freedom from fear and want, but also as they relate to the security of the state, and the maintenance of international peace and security, under the United Nations Charter.
Clingendael	Climate Security Practices (CSPs) are tangible actions implemented by a (local or central) government, organization, community, private actor or individual to help prevent, reduce, mitigate or adapt (to) security risks and threats related to impacts of climate change and related environmental degradation, as well as subsequent policies.
SIPRI	Climate-related security risks are multifaceted (i.e., involve different consequences, such as drought, floods and sea-level rise) and can simultaneously undermine the security of different reference objects (e.g., humans, communities, states, the international system, the environment, and ecology). Moreover, climate-related security risks span different policy areas, such as foreign, military, development, the economy, and the environment.
Mercy Corp	The result of the interaction between the effects of climate change (e.g., rising temperatures, shifting rainfall patterns), macro level trends (e.g., population growth), environmental impacts, and socioeconomic tensions and fragility.
NATO	Climate change is becoming a threat multiplier. It is likely to accelerate resource scarcity and global food and water insecurity. As ocean levels rise, and the world's habitable landmass is reduced, migration flows could accelerate towards NATO territory.

Source: Wyatt Scott, "Building a Community of Practice," New America, May 26, 2021, www.newamerica.org /resource-security/natural-security-blog/climate-security-building-a-community-of-practice.

Climate security also has a mixed record in international diplomacy. Since 2007, there have been repeated efforts to persuade the UN Security Council to adopt resolutions and endorse action on climate security; slow-onset climate change, especially sea-level rise around vulnerable Pacific Islands, has been a repeated theme. Note, though, that Russia, China, and India have consistently opposed defining climate change as a security matter and elevating climate security in the UN Security Council. In late 2022, Brazil also expressed concerns, suggesting that it was a

way for industrialized communities to avoid the conversation about compensation for loss and damage due to climate change.[41]

In other cases, international discussions of climate security have embraced a broader concept of security, less focused on military roles and missions. In 2009, for example, a report from the Secretary-General of the United Nations on the security implications of climate change talked about "social, economic, and environmental threats or stresses" on "individuals, communities, and states." The stresses included "poverty, hunger and disease; the rapid growth of informal urban settlements with substandard shelter and inadequate infrastructure and services; high unemployment, particularly of youth; and the growing scarcity of land, water and other resources."[42] In 2015, the G7-commissioned report *A New Climate for Peace*, which discussed climate change in terms of "state fragility" and called climate change a "variable that aggravates simultaneously occurring environmental, social, economic, and political pressures and stressors."[43] The European think tanks SIPRI, Clingendael, and adelphi have all published foundational work on defining climate security in this way (see the table on the preceding page).

(RE)TOOLING CLIMATE SECURITY RESEARCH

While an understanding of climate security continues to evolve, it is clear that many governments, international institutions, and nongovernmental organizations (NGOs) are already beginning to address the underlying issues. In many cases, these organizations are looking for guidance and information to help them set priorities and as inputs to making specific decisions.

Based on a survey of recent peer-reviewed and boundary (i.e., "gray literature" from think tanks, news, and policy organizations) articles, observations from live events, and interviews with experts, there is insufficient, high-quality research on climate security at this time to provide the intellectual infrastructure for better governance. That is not to say there is no good research—many scientific and social science scholars have contributed important and pathbreaking insights

[41] United Nations, "Arria-Formula Meeting on Climate, Peace, and Security," November 29, 2022, https://media.un.org/en/asset/k13/k13i83wzan.
[42] United Nations General Assembly, "Climate Change and its Possible Security Implications: Report of the Secretary-General," A/64/350, September 11, 2009, https://undocs.org/A/64/350.
[43] Ruttinger et al., *A New Climate for Peace*.

on this subject.[44] The core research question about climate security is how the effects of a geophysical phenomenon will interact with human systems, and what the consequences may be for peace and security. This is an inherently interdisciplinary question that relies on cooperation between physical and social scientists, which has been lacking. A clear exception would be the reports of the United Nations Intergovernmental Panel on Climate Change (IPCC), which have provided the authoritative baseline understanding of climate change and its effects and impacts, including the implications for human security. At the same time, the IPCC reports are not highly accessible to a general public audience, nor are the recommendations easily translated into policy decisions.

Some researchers express concerns that the policy community is outstripping the evidence, with the potential for bad outcomes and high opportunity costs.[45] While those concerns are important, the answer cannot be for policy to slow down; governments already face relentless climate choices, which they will make without research and analysis if there is no other choice. Research that can guide action, or "actionable research," is sorely needed.

Fortunately, scientific and technological advances mean there is unprecedented access to data, observations, and computing power to analyze and inform these choices, which is producing a new set of tools that can directly support policymakers and investors. The pace of change in this space is astonishing; in June 2023, for example, the Complex Risk Analytics Fund, a multinational partnership between Germany, the Netherlands, the United States, and the United Nations, announced awards for new or improved data and tools to anticipate, prevent, or respond to complex risks in fragile or crisis-affected regions.[46]

Given the uncertainties, huge impacts, and timescales involved in climate security, more sophisticated decision support tools could have great utility for governments in both policymaking and communications about climate security risk. These tools tend to work best when they are developed in cooperation with end users and are easy to use. On the other hand, users have to have realistic expectations: mathematical models are only as good as the data and assumptions

[44] Case study literature is particularly robust. See, for example, Daniel Abrahams, "Land is Now the Biggest Gun: Climate Change and Conflict in Karamoja, Uganda," *Climate and Development*, 13, no. 8 (2021): 748–60.
[45] See Gabrielle Daoust and Jan Selby, "Understanding the Politics of Climate Security Policy Discourse: The Case of the Lake Chad Basin," *Geopolitics*, 28, no. 3 (2023): 1285–1322. In the boundary literature, see Katie Peters et al., "Climate Change, Conflict and Fragility An Evidence Review and Recommendations for Research and Action," Overseas Development Institute, June 2020, https://cdn.odi.org/media/documents/odi_climate_change_conflict_and_fragility.pdf.
[46] United Nations, "What is CRAF'D?," https://crafd.io.

that go into them, and even then, local context is often important and hard to incorporate into such tools. They can be powerful aids in making good policies, but they are by no means infallible or definitive.

The following section provides an overview of promising approaches to such climate decision support. The focus is on tools that are geared for supporting decision-making, rather than public education or information. While there is no universal ontology at this time for the different kinds of decision support tools, they could be loosely categorized as early warning systems, risk assessments, and scenario analysis.

Early Warning Systems

Early warning systems use data, models and simulations, and other analyses to monitor and forecast everything from earthquakes[47] to students at risk of dropping out of school.[48] The explosion of capability in collecting and analyzing very large datasets has opened up new possibilities for creating and improving such forecasting decision support tools. Moving from forecasts that are largely based on scientific data to those that incorporate political, economic, and social drivers remains a challenge for such tools, however. The timescales, uncertainties, and complexities of climate change, and then the even more complicated links to human behavior and societal security, make anticipating the future of climate security difficult. It is therefore not surprising that there are not yet any credible climate security early warning tools. New technologies and techniques are promising, though, and there are a number of environmental and conflict early warning tools now in use that may provide models.

One early warning tool in wide use in the United States and internationally is the Famine Early Warning Systems Network (FEWS NET), developed by the US Agency for International Development (USAID). Launched in 1985 in response to devastating famines in East and West Africa, FEWS NET today involves a range of technical partners and covers 30 countries, still with a focus on Africa. The map-based tool compiles weather forecasts, Climate Hazards Group InfraRed Precipitation with Station (CHIRPS) data, other agricultural information, (such as trade and market data), and satellite and remote sensing observations to monitor and where possible

[47] US Geological Survey, "Early Warning/ShakeAlert," www.usgs.gov/programs/earthquake-hazards/early-warningshakealert.
[48] US Department of Education, "Issue Brief: Early Warning Systems," September 2016, www2.ed.gov/rschstat/eval/high-school/early-warning-systems-brief.pdf.

anticipate food insecurity. Once a month, USAID releases a food security outlook report, working closely with local science partners. The science partners help assemble information from the data and share assumptions with food security analysts to make assessments. Scientists involved in FEWS NET believe the tool could increase its forecasting utility, including with climate change projections.[49] The barrier lies not in the data or analysis, according to one scientist, but in translating the data and analysis into a policy response. This requires overlapping communities of practice to integrate the information into decision-making.

The World Food Programme has a number of early warning tools, as well, including the Platform for Real-time Impact and Situation Monitoring (PRISM), which assesses risk and forecasts the impact of climate hazards to design risk reduction activities and target disaster responses. PRISM layers datasets on drought, socioeconomic data and security vulnerability data, and monitoring crop yield and damage which could be useful for slow-onset changes in the climate. Similarly, the Water Peace and Security Partnership Global Conflict Risk Tool uses a range of indicators to forecast conflict risk, including environmental variables such as precipitation and surface area of lakes and reservoirs. The tool uses a machine learning-based methodology with a random forest model. In developing the tool, the designers tested more than 80 variables, narrowing the sample down to the 18 most significant. In stark contrast to this large dataset approach, the Conflict Early Warning and Response Mechanism (CEWARN) relies on community-based human field observers around the Horn of Africa. Observers collect data on a weekly basis on more than 50 diverse indicators, which are then conveyed to country-level situations rooms and a headquarters office, which feeds the data into a predictive model.

See Appendix 1 for examples of early warning decision support tools.

Risk Assessments

The concept of risk revolves around preparing for an uncertain future. Human societies have been trying to understand and manage risk for thousands of years for a range of purposes, from improving human health to figuring out insurance rates for teenage drivers. Risk assessment as a distinct field of science and practice has a more recent history, starting in earnest around 40 years

[49] Based on personal interviews with FEWS NET developers in December 2021 and January 2022.

ago.[50] Today, risk assessments are employed across many sectors and organizations—including the US government[51]—to guide decisions based on a range of possible outcomes. Specifically, there is a growing professional practice of climate change risk assessments, including commercial products.

In general, climate risk assessments identify hazards, vulnerabilities, and exposure to hazards, and analyze potential consequences for assets, populations, and other factors. Risk assessments are often highly quantitative, capturing a range of data, but they can also be qualitative, based on case studies or scenarios. A recent study by the UK-based think tank Chatham House underscored the importance of risk assessments for enabling climate policy and investment—and the primacy of communication.[52] One of the study's authors, Kris de Meyer, noted that in the focus groups they convened for the study, the perception of risk was as important as the actual assessment of risk.[53] He also distinguished between risk communication aimed at storytelling and risk communication for decision-making. The IPCC reports, for example, are primarily focused on storytelling and do not lead to any government action, per se.

USAID has an approach to calculating climate risk,[54] and given that USAID programs address root elements of both insecurity and peacebuilding, the agency's efforts in this space are inherently about climate security risk. USAID requires all its mission, project, and activity managers to assess climate risk or explain why climate risk is not germane. The agency offers a climate risk toolkit at the strategy, program, and activity level, as well as country and regional fact sheets that complement and support the tools. These tools are not risk assessments in the classic sense, in that they do not necessarily use data and other quantitative observations to

[50] The Society for Risk Analysis defines risk assessment as "the systematic process to identify risk sources, threats, hazards and opportunities; understanding how these can materialize/occur, trigger events/event sequences, and what their consequences can be; representing and expressing uncertainties and risk; and determining the significance of the risk using relevant criteria." Terje Aven et al., *Risk Analysis: Fundamental Principles*, Society for Risk Analysis, August 2018, www.sra.org/wp-content/uploads/2020/04/SRA-Fundamental-Principles-R2.pdf.
[51] For the US Department of Defense's definition of risk assessment, see, for example, "DoD Policy and Responsibilities for Critical Infrastructure," Directive 3020.40, Department of Defense, January 14, 2010, https://policy.defense.gov/Portals/11/Documents/hdasa/newsletters/302040p.pdf. For the US Environmental Protection Agency's definition of risk assessment, see "Guidelines for Ecological Risk Assessment," April 1998, www.epa.gov/sites/default/files/2014-11/documents/eco_risk_assessment1998.pdf.
[52] Daniel Quiggin et al., "Climate Change Risk Assessment 2021: The Risks are Compounding, and Without Immediate Action the Impacts Will Be Devastating," Chatham House, September 2021, www.chathamhouse.org/sites/default/files/2021-09/2021-09-14-climate-change-risk-assessment-quiggin-et-al.pdf.
[53] Personal interview, November 9, 2021.
[54] US Agency for International Development, "Climate Risk Management for USAID Projects and Activities A Mandatory Reference for ADS Chapter 201," May 10, 2021, www.usaid.gov/sites/default/files/documents/201mal.pdf.

assess physical or financial risk; they are more akin to a screening or a checklist. There was consensus among the USAID officials interviewed for this paper that these screening tools are useful for identifying and incorporating climate risk, though the effectiveness depends on the level of effort of the individual user, which is a potential weakness of all risk assessment tools that are directly in the hands of users. The country and regional profiles tend to be high quality, according to the focus groups, but they are static, and updating them is labor intensive, so they may not have pertinent current data. There were other concerns about the ability to capture nuances at the local and hyper-local level, as well as of root causes of insecurity and conflict situations, and to adapt these tools to fast-moving climate and conflict conditions. "The tools are really useful at a strategic level," one senior leader commented, "but where implementation is concerned, the granular data just isn't there." USAID also has potentially germane quantitative resources, such as Geo-Center, which contains maps and data, and SERVIR, a collaboration between NASA, USAID, and geospatial organizations in Africa, Asia, and Latin America to make satellite imagery and data available to partner countries.

Indeed, the USAID focus groups were not sure there is actually any shortage of risk assessment and other decision support tools. Instead, the groups were concerned that analysts and decision-makers do not always know what is available or how to integrate analytical output from such tools into projects and activities. This may be especially true when it comes to climate security. One regional official noted that climate change is still considered a "niche" issue, lacking broad familiarity across the agency. He said that there is an opportunity for better integration into policy priorities across the agency, including in the field. Another field official noted she is still using a climate analysis from 2014 and needs access to more sophisticated tools for forecasting.[55]

NATO released its own climate impact assessment in June 2022.[56] NATO's 2022 Strategic Concept recognizes that climate change aggravates issues related to conflict, fragility, and geopolitical competition, especially among its neighbors, and impacts the NATO region's own security.[57]

[55] The author conducted two USAID climate and security focus groups with the support of USIP in December 2021.
[56] See NATO, "Climate Change & Security Impact Assessment," 2022, www.nato.int/nato_static_fl2014/assets/pdf/2022/6/pdf/280622-climate-impact-assessment.pdf.
[57] See NATO, "NATO 2022 Strategic Concept," June 2022, www.nato.int/nato_static_fl2014/assets/pdf/2022/6/pdf/290622-strategic-concept.pdf.

The US Department of Defense has a Defense Climate Assessment Tool that it uses to look at asset-level climate risk of military bases around the world. DoD also released a "climate risk analysis," which was more aimed at conflict risk, in October 2021, in compliance with President Biden's Executive Order 14008. The document gave general concept guidelines for climate security risk and directed defense components to conduct risk assessments but left the specific methodology and data up to the various defense components to determine. DoD has not publicly released any climate security risk analysis or Defense Climate Assessment Tool data, though there was a recent announcement that the tool is being shared with other countries.[58]

See Appendix 2 for examples of risk assessment decision support tools.

Scenario Analysis

Scenario exercises or war games are analytical tools originally pioneered by the military. While these sorts of exercises are sometimes used to educate or even entertain an audience,[59] the military has traditionally used them as actual planning tools—a way to test a military campaign plan, a new piece of equipment, an alliance, or a strategy. In each case, participants in the exercise make decisions in a conflict or competitive environment and then react to the consequences; human behavior and imagination are a key part of this analytical methodology. The exercise planner and sponsors use the observations and findings to make tangible improvements in a program, plan, or process, though sometimes exercises can validate existing priorities or investments. In particular, such games are often a way to imagine and stress test for the future, and then to devise policies and investments that better anticipate a complex environment and unknowable events. There are also discussion-based seminars that involve considering various future scenarios—a similar concept, though not technically a war game.

Climate security is very complex, with a range of geophysical and societal variables interacting in unpredictable ways; forecasting future conditions of climate insecurity is full of uncertainties. In the case of climate change, models such as those produced by the IPCC use a kind of scenario approach to posit different potential pathways. Each projection involves multiple un-

[58] C. Todd Lopez, "DOD Makes Climate Assessment Tool Available to Partner Nations," US Department of Defense, April 21, 2023, www.defense.gov/News/News-Stories/Article/Article/3370578/dod-makes-climate-assessment-tool-available-to-partner-nations.
[59] For an example, see *Foreign Policy*, "An Innovative Approach to Managing International Crises," https://peacegame.foreignpolicy.com.

certainties about the science of how atmospheric changes may affect ocean and terrestrial conditions, but also about how economies and societies may adjust and adapt. The relationship between physical changes, such as drought, and human reactions, whether migration or violence, is even harder to predict in the present day, let alone at some point in the future. While foresight and risk assessment tools can be very useful in trying to anticipate future conditions, they do so largely by trying to identify key variables and examine their behavior through the use of mathematical models and other quantitative techniques. Their purpose is really to clarify or simplify complexity and manage uncertainties. Scenario analyses, on the other hand, embrace complexity; this is a tool that is especially useful for considering how to make tangible decisions in the context of uncertainty. This methodology is well-matched for making decisions about climate security.

Ed McGrady, a longtime professional war game designer, said there is tremendous potential for war gaming climate security at a strategic, operational, and tactical level. On the other hand, in his personal experience, it is also a problematic topic to game. Specifically, he noted that too much focus on specific future events can result in an exercise that ends up being about consequence management. There is nothing wrong with a consequence management game, and in fact the US Department of Homeland Security makes extensive use of scenario analyses precisely for that purpose. But an exercise that focuses on a hurricane scenario may well yield more insights about hurricane response than climate security.[60]

To date, there have been a few notable scenario exercises on climate security. Sharon Burke (the author of this paper), who was then at the Center for a New American Security, designed the first large climate security game in 2008. The scenario was an international negotiation set in the year 2015, designed to reach an emergency agreement on mitigation, adaptation, and migration, and the objective was to test climate security as a frame of reference. One of the main findings—that China would be the decisive player in any future negotiations—proved apt.[61] McGrady also designed several pathbreaking climate security exercises, including one for CNA in 2015, as well as a climate negotiations game for the UN Foundation in 2019. All of these were immersive, role-playing scenario exercises, with the 2015 game also incorporating a

[60] Interview with Ed McGrady, February 2022.
[61] Sharon Burke and Christine Parthemore, "Climate Change War Game: Major Findings and Background," Center for a New American Security, June 2009, https://s3.us-east-1.amazonaws.com/files.cnas.org/documents/Climate_War_Game_Working-Paper_0.pdf.

playing board. The UN's Climate Security Mechanism engaged in a seminar-style climate security scenario exercise in 2021: participants considered a range of alternate futures, largely with the intention of socializing climate security across the UN agencies. The US Office of the Secretary of Defense conducted two classified climate security exercises in 2021 and 2022 focused on future scenarios in East Africa and in Latin America and the Caribbean. The games, Elliptic Thunder and Precipitous Storm, were aimed at exploration and education rather than planning or concept development. DoD published the following findings from the exercise:

- Climate and environmental change will exacerbate existing threats and security challenges via increased frequency and severity of environmental stressors and extreme events. Compounding and cascading events are likely to be particularly disruptive.
- Environmental changes have implications across the department with respect to great power competition, counterterrorism, our alliances and partners, basing, access to ports and landing sites, infrastructure investments and more.
- DOD will need to develop and/or refine policies, authorities and organizations—as well as processes, budget and funding to best prepare for and respond to climate threats.
- Improved understanding of emerging threats will help prevent and prepare for future environmental and climate security challenges. Enabling a shift to prevention activities will help avoid simply responding to crises.
- Building partner capacity and resiliency will be critical to manage climate risks. Effective diplomacy and strategic messaging will be essential to countering adversaries who will seek to exploit climate-related insecurity for strategic advantage.
- A whole-of-government approach is needed to address climate and environmental security threats across the federal government. Partnerships with industry, academia and non-profit organizations can improve sharing and coordination of data-collection, modeling, disaster response initiatives and early warning best practices.[62]

The US Navy also conducted an informational climate security scenario exercise in 2022, which was focused on a fictionalized Asia scenario, which tested the geopolitical context of severe weather. Several other US defense components—including US Africa Command, European Command, Central Command, Indo-Pacific Command, and the Joint Staff—are conducting climate security scenario exercises or are incorporating climate change data and narratives into

[62] David Vergun, "DoD Exercise Highlights Need to Address Climate Change, Its Impacts," *DoD News*, May 17, 2021, www.defense.gov/News/News-Stories/Article/Article/2596591/dod-exercise-highlights-need-to-address-climate-change-its-impacts.

other war games in 2023. NATO and the United Kingdom's Ministry of Defence have similar plans.[63] Ideally, these exercises will not be limited to military organizations and will include experts from the development, diplomacy, science, trade, and other communities, given the centrality of civilian organizations to climate security. The output of these games could potentially inform strategy development, planning activities, requirements generation, partner cooperation, training, and other projects, programs, and investments.

NEXT STEPS

In June 2023, US Africa Command convened another climate security conference, this time in Gaborone, Botswana, in partnership with more than 30 African militaries. In one presentation, a representative of the Kenya Defence Forces noted that climate change was first incorporated into his country's national military strategy in the year 2000, 22 years before the US Department of Defense did so.[64] Although this paper focuses on the United States, the United States is by no means the only voice when it comes to the observed security impacts of climate change. Again, there is much room for more expansive study on this topic.

Nevertheless, the term "climate security" was first coined in the United States, which makes sense, given the high cultural relevance of security for Americans. Since its founding, the country has not gone a decade without deploying armed forces beyond its borders,[65] and the military has been one of the most trusted institutions for some time.[66] Finally, although half of the federal budget is devoted to social programs (Social Security, Medicare, and Medicaid), defense makes up more than half of all discretionary spending,[67] with support from both political parties. Using the language of security and incorporating climate change into military priorities will

[63] Based on interviews with US Combatant Commands, NATO personnel, and UK Ministry of Defence personnel in November and December of 2021 and January and February of 2022.
[64] Personal observation of the author, who attended the Security Implications of Climate Change III conference in Gaborone, Botswana, June 26–28, 2023.
[65] Barbara Salazar Torreon and Sofia Plagakis, "Instances of Use of United States Armed Forces Abroad, 1798-2022," Report no. R42738, Congressional Research Service, March 8, 2022, https://crsreports.congress.gov/product/pdf/R/R42738/38.
[66] Gallup, "Confidence in Institutions" (current to 2022), https://news.gallup.com/poll/1597/confidence-institutions.aspx.
[67] Defense outlays are higher when all nuclear programs and veterans' benefits are included. See Congressional Budget Office, "Discretionary Spending in Fiscal Year 2021: An Infographic," September 20, 2022, www.cbo.gov/publication/58269.

remain important for political agreements and public acceptance of climate action in the United States.

At the same time, US scholars, boundary organizations, and government officials should broaden the definition of climate security in a way that improves the utility of the term globally and across disciplines. A solely defense-focused definition does not line up well with the path climate change takes through a range of variables before it may provoke instability at the community and state level. Furthermore, four of the world's most important "climate superpowers"[68]—China, India, Russia, and Brazil—reject the military lens when it comes to climate change.[69]

There is a strong need for dialogue and collaboration among scientists, scholars, boundary researchers, activists, and practitioners. The fragmentation and fissures in the loose-knit, small community of researchers and practitioners go beyond the definition of climate security and speak to the quality of the research base. While scientists and scholars should not be bound by the needs of governments, both communities could benefit from a better understanding of each other's perspectives and capabilities when it comes to climate security. Boundary researchers have a crucial role to play in translating between research findings and the sometimes frenetic pace of policy, and they could also benefit from a deeper dialogue on the evidentiary base and the governance needs. This engagement could further benefit from community meetings to define the information gaps and the needs, to improve both scholarship and policy outcomes. Conducting research also requires good data, which is lacking in many regions of the world affected by climate change. By expanding and strengthening the available data beyond temperature and precipitation through partnerships with academic, government, and scientific institutions around the world, the research community could continue testing hypotheses and improving analysis on the channels through which climate affects security.

The list of decision support tools in this paper's appendices is by no means comprehensive. In fact, as USAID officials noted, the wealth of such tools, while a welcome development, presents problems when it comes to uptake. The US government, NATO, the United Nations, or an NGO may want to consider creating a dynamic, online resource that identifies various tools, with

[68] Janka Oertel, Jennifer Tollmann, and Byford Tsang, "Climate Superpowers: How the EU and China can Compete and Cooperate for a Green Future," E3G, December 3, 2020, www.e3g.org/publications/climate-superpowers-how-the-eu-and-china-can-compete-and-cooperate-for-a-green-future.
[69] See for example https://press.un.org/en/2021/sc14732.doc.htm.

some kind of evaluation of their quality against best practices in their data collection and analytical techniques. Many of the tools profiled in this paper, for example, use the Armed Conflict Location and Event Data (ACLED) project, which is generally superior to similar databases that rely on machine reading because it uses human curation of conflict data and reduces the noise of misreporting (e.g., different articles about the same event may read as different events to an artificial intelligence data scraper). ACLED, on the other hand, is run by an independent NGO dependent on a range of funders and individuals who have opinions; the reliability and credibility of the project is not a given. Producing a catalog of such tools would also be helpful because these tools seem to be proliferating; if it is not easy for policymakers to find what is available, they are unlikely to make use of even the best of tools. This could be especially useful for cities, provinces, and countries that do not have the human or resource capacity to assess the risks posed by rising sea levels, prolonged droughts, and other slow-onset climate change. There is also a need for training and other assistance to key policymakers. Even when these tools are intuitive, when and how to apply them to governance challenges is not always obvious.

Finally, scenario exercises for climate security have an important role to play in policy development, but there may be an expertise gap. First, as NATO, US military commands, USAID, and the US State Department increase their use of such exercises, they will need subject matter experts to play in these games, and there are not many climate security experts in these institutions. Those organizations will also be looking for data and research to support scenario design. In particular, this methodology is relatively underutilized for civilian agencies, which is a lost opportunity. Investments in peacebuilding should be planned with the same rigor as investments in warfighting.

One of the core reasons it is so important to reevaluate the definition of climate security and improve the scholarship and decision support is the pace of change. The world is fast heading into climate conditions that are unprecedented for settled human societies, and the relationship between those changing conditions and peace and security will likewise be unprecedented. Governments around the world are going to face increasingly difficult choices about how to build resilience to the societal disruptions from slow-onset climate change, respond to sudden disasters, and continue to cut greenhouse gas emissions. They will have to set priorities and make tough tradeoffs, with or without good information. It would be infinitely better if there were a solid foundation of good information behind those choices.

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APPENDIX 1:
A SAMPLER OF EARLY WARNING DECISION SUPPORT TOOLS

CauseMos

Sponsor: Defense Advanced Research Projects Agency (DARPA) World Modelers Program

Purpose: This is a research project, but the intent is to develop a tool to help decision-makers identify root causes of a conflict situation, including environmental stressors, and test various prevention strategies for efficacy.

Description: CauseMos is an AI-enabled integrated analysis platform. The software ingests qualitative information and quantitative data and allows users to build causal influence maps, informed by their own insights, and use these to test scenarios, counterfactuals, and interventions. CauseMos uses machine reading to extract and aggregate relevant knowledge from these documents, such as key factors and events and the influence relationships between them. It also draws on dozens of quantitative datasets from publicly available sources, such as regional precipitation levels and the Fragile States Index. CauseMos is capable of integrating climate change data.

Availability: Still in development and/or transition; not publicly available.

* * *

Conflict Early Warning and Response Mechanism (CEWARN)

Sponsor: Intergovernmental Authority on Development (IGAD)

Purpose: The project started not just to document patterns of conflict, especially resource and livelihood-related conflict, but also to promote peacebuilding interventions for governments in the Horn of Africa.

Description: Community-based human field observers collect data on a weekly basis on more than 50 diverse indicators, which are conveyed to country-level situation rooms, and a headquarters office, which feeds the data into a predictive model.

Availability: While the CEWARN Reporter is available to civil society groups, the primary users are national governments in the region.

* * *

Continental Early Warning System (CEWS)

Sponsor: African Union (AU)

Purpose: Part of the AU's peacebuilding commitments.

Description: An AU situation room collects and analyzes data and provides reports to member states.

Availability: For internal AU use.

* * *

DisasterAWARE

Sponsor: Pacific Disaster Center

Purpose: To provide multi-hazard warning information and intelligence to governmental, private sector, and nongovernmental customers.

Description: This web-based mapping tool pulls from 300 data sources, from satellite imagery to demographic data, and is constantly updated with real-time or near real-time data on global hazards. The tool includes both historical trends and predictive analysis, including climate change projections. The user can customize the data in layers to get a composite view, including socio-economic information.

Availability: Free for governments and nongovernmental organizations at www.pdc.org/disasteraware.

* * *

Famine Early Warning Systems Network (FEWS NET)

Sponsor: US Agency for International Development (USAID), Bureau of Humanitarian Affairs

Purpose: To help governments and international organizations anticipate food crises, primarily in Africa, in the relatively near term.

Description: The map-based tool compiles weather forecasts, Climate Hazards Group InfraRed Precipitation with Station (CHIRPS) data; other agricultural information, such as trade and market data; and ground weather stations, satellite, and remote sensing observations to monitor and, where possible, anticipate food insecurity. Once a month, USAID releases a food security outlook report. While FEWS NET does not include climate change projections or long-term forecasts, researchers involved in the network note that the tool could be adapted to do so.

Availability: https://fews.net

* * *

Global Conflict Risk Index

Sponsor: European Commission

Purpose: Supports the European Union's peacebuilding efforts through the Conflict Early Warning System.

Description: According to the website, the index uses 22 variables across six dimensions (social, economic, security, political, geographical/environmental, and demographic) and then uses historical data to train the model, providing a forecast for the next one to four years. The raw data is open source.

Availability: For internal European Union use. More information here https://drmkc.jrc.ec.europa.eu/initiatives-services/global-conflict-risk-index.

* * *

Platform for Real-Time Impact and Simulation (PRISM)

Sponsor: World Food Programme (WFP)

Purpose: Forecasts the impact of climate hazards to design risk reduction activities and target disaster responses for WFP.

Description: PRISM layers geospatial observations with datasets on drought, socioeconomic factors, security vulnerability, and crop yield and damage.

Availability: Not publicly available.

* * *

Vulnerability Analysis and Mapping

Sponsor: World Food Programme

Purpose: For use by WFP teams and other humanitarian organizations

Description: Monitors food consumption, market access, health, drought conditions, rainfall, and conducts mobile surveys throughout the year, providing insights on conditions across the country. From this analysis, WFP gathers general insights to see if food security is improving or deteriorating. Data is real-time and updated on a daily basis. However, limited funding means mapping can only be generated at the province level. This is more a tool that provides a snapshot of current conditions, but it can be used to anticipate changing conditions.

Availability: Publicly available at https://dataviz.vam.wfp.org.

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Water, Peace, and Security Global Tool

Sponsor: Water, Peace, and Security Partnership (Netherlands and German governments)

Purpose: Supports conflict prevention and response for global defense, development, diplomacy, and disaster relief organizations, as well as national governments.

Description: The map-based tool includes data on a range of indicators, including a number of water-related variables, such as precipitation and surface area of lakes and reservoirs. Although the designers are careful to qualify that they are not claiming any causal relationships in their variables, they do note that the model is able to predict conflict with 86 percent accuracy, albeit with false positives. This a web-based tool, where the user controls the research.

Availability: Publicly available at www.waterpeacesecurity.org/map.

APPENDIX 2:
A SAMPLER OF RISK ASSESSMENT TOOLS

Climate Change Vulnerability Index

Sponsor: Verisk Maplecroft

Purpose: The company works with clients to screen physical assets, investments, supply chains, and other concerns for climate risk.

Description: Data for 193 countries, a subnational map with spatial resolution of 22 square kilometers, and consistent data since 2013.

Availability: Commercial product.

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Climate-Conflict Risk Assessment Tool

Sponsor: Mercy Corps

Purpose: A methodology for incorporating climate security risks into Mercy Corps' development, humanitarian, and emergency relief projects.

Description: Project managers have guidelines for considering climate shocks and stresses, macro trends, fragility factors, and compounded shocks and stressors.

Availability: For use by Mercy Corps programs; as of 2022, testing on a pilot project basis.

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Notre Dame Global Adaptation Initiative (ND-GAIN)

Sponsor: Notre Dame University

Purpose: To support public and private decision-makers and researchers in assessing a range of climate change risks, including relative risks for different countries.

Description: There are several ND-GAIN risk assessment tools, including the Country Index, which provides a web-based, mapping tool that assesses climate risks in 180 countries. The tool includes large datasets across 45 different indicators, summarizing each country's vulnerability to climate change and its readiness to adapt. Note that the Country Index assigns a score to each country and ranks countries.

Availability: Publicly available at https://gain.nd.edu/

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Climate Security Risk Matrix

Sponsors: The Hague Centre for Strategic Studies and the International Military Council on Climate and Security

Purpose: The visual tool is intended to help "identify and evaluate climate-driven risk by assessing the probability and consequences (impact) of potential hazardous events" at global, regional, and national levels.

Description: Using the risk matrix generates a score for countries based on the probability of a climate-related hazard, calculating climate security risk as a function of probability and potential impact of a hazard on humans, infrastructure, institutions, resources, and institutions. Vulnerability of a country is defined as the ability to manage, mitigate, or avert the physical shocks of the hazard. The risk assessment produces scores for approximately 140 countries.

Availability: Publicly available (but currently under revision) at www.hcss.nl/report/climate-security-assessment-a-methodology-and-assessment-of-the-nexus-between-climate-hazards-and-security-of-nations-and-regions.

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ClimateScore

Sponsor: Jupiter Intelligence

Purpose: Supports customers in assessing climate change risk to assets and prioritizing risk mitigation.

Description: Assesses risks from flood, wind, and wildfires for hospitals, military bases, airports, ports, factories, and homes, as well as a portfolio service for banking and investments. The platform draws on large datasets, including GIS, and incorporates probabilities of different climate scenarios in five-year increments.

Availability: Commercial product.

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Defense Climate Assessment Tool (DCAT)

Sponsor: US Department of Defense (DoD), Office of the Secretary of Defense

Purpose: DCAT is used to screen military installations for exposure and sensitivity to climate hazards; the tool is currently being updated to include vulnerability and other considerations.

Description: DCAT uses historical trends and combines them with climate projections. According to DoD's 2021 Climate Adaptation Plan, DCAT "provides a screening-level assessment of an installation's future climate exposure related to eight hazards: coastal flooding, riverine flooding, heat, drought, energy demand, land degradation, wildfire, and historical extreme weather events. Climate hazard exposure encompasses two scenarios—lower future warming and higher future warming—and two future epochs: 2035–2064 (reported at 2050) and 2070–2099 (reported at 2085)."

Availability: US government–use, but as of June-2023, DCAT has also been shared with some allies or partner countries.

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Flood Factor

Sponsor: First Street Foundation

Purpose: A free online tool directly integrated for every property on Realtor.com and Redfin.

Description: Peer-reviewed flood model to calculate past, present, and future flood risk of every property in the United States.

Availability: Publicly available at www.firststreet.org/risk-factor/flood-factor.

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Global Climanomics

Sponsor: The Climate Service (S&P Global)

Purpose: Climate risk analytics software platform for investors, companies, and communities to understand risks from climate change and the opportunities from transitioning to a low-carbon economy.

Description: Using simple charts, graphs, narrative, and data related to the location, severity, and timing of physical and transition climate risks.

Availability: Commercial product.

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STRATA

Sponsor: United Nations Environment Programme

Purpose: Map-based, open-access data platform on environment and climate security, which is meant to be engaged by a wide range of governmental, nongovernment, international, and private sector users, not delivered as a consulting product.

Description: Identifies earth stresses and integrates them with socioeconomic hot spots, providing near real-time geospatial data. Users are able to customize their queries using a simple menu system. The strength of the system is that it is a

single visualization of a convergence of data: a hotspots map cross references stressors (climate and environmental stress, as well as peace and security stress) with an exposure score and a vulnerability score. Although the data is updated in real time, STRATA is not anticipating the future and does not incorporate risk probabilities or cascading impacts; it is a snapshot of the current moment.

Availability: Publicly available at www.unepstrata.org.

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Weathering Risk

Sponsor: adelphi

Purpose: Creates country risk profiles that can support the peacebuilding efforts of partners or other users.

Description: Impact analyses look at both sudden- and slow-onset effects and impacts, ranging from geophysical effects such as high heat, impacts such as precipitation variability and water availability, and consequences, such as decreases in crop yields and biodiversity loss. Then the project combines quantitative and qualitative conflict indicators (such as government corruption) with the climate impact scenarios.

Availability: Some aspects public, some commercial: www.weatheringrisk.org/en