



# THE SECURITY IMPLICATIONS OF CLIMATE CHANGE

**Annotated Bibliography**

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## Annotated Bibliography

### THE SECURITY IMPLICATIONS OF CLIMATE CHANGE

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#### Key Questions:

- How will climate change impact the world in the next decade and beyond?
- How will it affect resource and human security as well as national and international security?
- How can the security effects of climate change be mitigated or managed?

#### Panel Topics:

1. Climate Projections 2021
2. Security Projections 2021
3. Migration and Other Disruptions to Human Habitat
4. Weaponization of Resources
5. Competition over the Arctic
6. Scoping the Needed Military-Technical Responses
7. Managing Climate Change Amidst Strategic Rivalry
8. Building the Needed New Partnerships for Resilience

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## Panel 1: Climate Projections 2021

- What predictions do climate models make for the coming decade and beyond?
- Are there major uncertainties? What can climate scientists say with confidence about changes in the properties of different types of extreme events?

Diffenbaugh, Noah S. and Marshall Burke. "Global warming has increased global economic inequity." *Proceeding of the National Academies of Science* 116, no. 20 (2019): 9808-9813. <https://doi.org/10.1073/pnas.1816020116>

Citing the difference between the Natural and Historical scenarios from the Coupled Model Intercomparison Project (CMIP5), the authors identify the change in temperature due to anthropogenic forcing in various countries and the impact of climate change on countries' gross domestic product (GDP). The authors find that climate change has increased inequality between states through the following mechanism: increasing temperatures in cooler countries, which tend to have higher starting GDPs, further increases GDP, whereas increasing temperatures in warmer countries decreases GDP. While the authors contend that temperature is not the only cause for variation in countries' GDP, their analysis reveals that there is a relationship between the two.

Eyring, Veronika, Peter M. Cox, Gregory M. Flato, Peter J. Gleckler, Gab Abramowitz, Peter Caldwell, William D. Collins, Bettina K. Gier, Alex D. Hall, Forrest M. Hoffman, George C. Hurtt, Alexandra Jahn, Chris D. Jones, Stephen A. Klein, John P. Krasting, Lester Kwiatkowski, Ruth Lorenz, Eric Maloney, Gerald A. Meehl, Angeline G. Pendergrass, Robert Pincus, Alex C. Ruane, Joellen L. Russell, Benjamin M. Sanderson, Benjamin D. Santer, Steven C. Sherwood, Isla R. Simpson, Ronald J. Stouffer and Mark S. Williamson. "Taking climate model evaluation to the next level." *Nature Climate Change* 9 (2019): 102-110. <https://www.nature.com/articles/s41558-018-0355-y>

This perspective, written by researchers from various institutions who contribute to Coupled Model Intercomparison Project (CMIP), describes efforts to speed up model comparisons with climate observations, to identify observables that are most relevant to future climate predictions, and to improve the weighting of certain observables within climate models. CMIP is a global, collective effort that combines different simulations from various research groups. Results from CMIP form the basis for the Intergovernmental Panel on Climate Change (IPCC)'s assessment reports, the sixth of which (referred to as AR6) is forthcoming in 2021. The latest phase of CMIP has also outlined a set of experiments and tools that evaluate climate model performance.

van Vuuren, Detlef P., Jae Edmonds, Mikiko Kainuma, Keywan Riahi, Allison Thomson, Kathy Hibbard, George C. Hurtt, Tom Kram, Volker Krey, Jean-Francois Lamarque, Toshihiko Masui, Malte Meinshausen, Nebojsa Nakicenovic, Steven J. Smith, and Steven K. Rose. "The representative concentration pathways: an overview." *Climate Change*. 109, no. 5 (2011). <https://link.springer.com/article/10.1007/s10584-011-0148-z>

This paper describes the development and characteristics of the various Representative Concentration Pathways (RCPs) investigated in the fifth IPCC assessment report (AR5, released in 2014). The authors compare the RCPs to other emission pathways or scenarios used in the literature and give recommendations for their use. RCPs are future scenarios, usually carried out to the year 2100 or 2300, that are tied to specific atmospheric greenhouse gas concentrations and consequent balance between incoming and outgoing energy from the sun, called radiative forcing. Each scenario has a set of technological, socio-economic, and policy factors that would lead to the RCP. For example, the RCP8.5 assumes a radiative forcing of 8.5 W/m<sup>2</sup> by the end of the century and is often described as a “baseline” or “business as usual” scenario because it assumes a continued increase in current greenhouse gas emissions and concentrations.

Schwalm, Christopher R., Spencer Glendon, and Philip B. Duffy. “RCP8.5 tracks cumulative CO<sub>2</sub> emissions.” *Proceedings of the National Academy of Science* 117, no. 33 (2020): 19656-19657. <https://www.pnas.org/content/117/33/19656>

The authors argue that RCP8.5 is the most useful AR5 scenario for calculating near-term (i.e., until 2050) climate risk. RCP8.5 is the highest radiative forcing scenario investigated by AR5; it assumes relatively high greenhouse gas emissions and fossil fuel use compare to the other RCPs with lower radiative forcings (RCP 2.6, RCP 4.5, RCP6.0). Predictions from RCP8.5 are closest to 2020 emissions levels. For predictions out to 2050, the authors compared the predictions from the various RCP scenarios to predicted future emissions from the International Energy Agency (IEA). Here too, the authors find that the RCP8.5 scenario from AR5 most closely matches the IEA predictions given climate policies currently in place (what the paper calls “business as usual”) and given stated policy objectives (“business as intended”). The authors acknowledge shortcomings in the RCP8.5 scenario—that it overestimates economic growth, carbon intensity, use of coal, and price of renewables—but still argue that this scenario is the best for anticipating future outcomes.

Hausfather, Zeke and Glen P. Peters. “RCP8.5 is a problematic scenario for near-term emissions.” *Proceedings of the National Academy of Science* 117, no. 45 (2020): 27791-27792. <https://www.pnas.org/content/117/45/27791>

In a rebuttal to the previous article in the annotated bibliography, the authors argue that RCP6.0 or RCP4.5 are better for estimating current climate risk. The authors point out that the CO<sub>2</sub> emissions in the RCPs predicted by Schwalm et al have two contributing factors: 1) cumulative fossil fuel and industry CO<sub>2</sub> emissions and 2) land use emissions, which describe emissions due to changes in forests, croplands, grasslands, and residential areas. The IEA predictions, however, only take into account the first factor. When land use emissions are removed from the calculations, the RCP4.5 and RCP6.0 scenarios more closely match the current policies (what Schwalm et al. call “business as usual”) and stated policies (what Schwalm et al call “business as intended”) than RCP8.5. They also questioned predictions for land use emissions in the Schwalm et al analysis. In a response to this rebuttal, Schwalm et al justify their analysis.

Xu, Chi, Timothy A. Kohler, Timothy M. Lenton, Jens-Christian Svenning, and Marten Scheffer. "Future of the human climate niche." *Proceedings of the National Academy of Science* 117, no. 21 (2019): 11350-11355. <https://www.pnas.org/content/117/21/11350>

The authors find that the human climate niche, or range of conditions in climate and land that are favorable to human populations, will shift more in the next fifty years than in the past six millennia. Furthermore, assuming no migration, one third of the world's population will live in conditions that are significantly different (mean temperatures more than 10° C warmer) from the niche. To identify the human climate niche, the authors compile demographic, land use, and climate data sets from the past millennia and identify conditions conducive to human populations. They then examine where they conditions are likely to occur in the future. Their future predictions combine forecasts from RCP8.5 and the third Shared Socioeconomic Pathway (SSP3). SSPs are scenarios describing a set of global socioeconomic factors that will be incorporated into the upcoming sixth IPCC assessment report (AR6 forthcoming in 2021-2022). SSP3 specifically describes a scenario where countries take a regional focus placing little priority in addressing international concerns such as environment or inequality. The authors in this study describe the combination of RCP8.5 and SSP3 as "business as usual."

## Panel 2: Security Projections 2021

- How will climate change aggravate existing security problems?
- What new problems will it create?
- Will impacts differ by region? If so, how?
- What frameworks exist for evaluating these risks?

Defense Science Board Task Force. "Trends and Implications of Climate Change on National and International Security." Washington, D.C.: Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, 2011. <https://apps.dtic.mil/dtic/tr/fulltext/u2/a552760.pdf>

The report posits that climate change will be an exacerbating factor of social conflict rather than its root cause, influencing conflict through factors such as food prices, migration patterns, and competition for water and other resources. The impact of climate change will be most severe in the most vulnerable areas, i.e., those lacking expertise and financial resources to respond to existing problems. For the United States, these vulnerable regions are both the source of mineral resources and terrorist threats. The report is notable for its detailed discussion on the implications of climate change for Africa as well as its concept of iterative and adaptive climate change risk management process as a framework for climate change decision-making.

Guy, Kate. "A Security Threat Assessment of Global Climate Change: How Likely Warming Scenarios Indicate a Catastrophic Security Future." Product of the National Security, Military, and Intelligence Panel on Climate Change. Edited by Francesco Fermia and Caitlin Werrell. Washington, D.C.: The Center for Climate and Security, an institute of the Council on Strategic

Risks, 2020. <https://climateandsecurity.org/wp-content/uploads/2020/03/a-security-threat-assessment-of-climate-change.pdf>

The report discusses the interaction between climate and security in terms of two main categories of risk: physical shocks and social tensions. Physical shocks encompass food, water, and resource stress; extreme weather; and sea level rise. Social tensions include migration, public health issues (including infectious diseases outbreaks), state fragility, and conflict. The report presented regional climate security threat assessments divided by U.S. Geographic Combatant Commands. At anticipated low levels of warming between now and 2050 NORTHCOM and EUCOM will experience less severe risks than other regions. By the end of the century, however, higher levels of warming will pose catastrophic security risks around the world.

National Intelligence Council. Global Trends: Paradox of Progress. Office of the Director of National Intelligence, 2017. <https://www.dni.gov/files/documents/nic/GT-Full-Report.pdf>

This periodic report by the National Intelligence Council analyzes key global trends and their implications through 2035. Climate change is described in this edition both as a threat and as a litmus test on the willingness and ability of individuals, groups, and governments to cooperate on future global challenges. The report posits that climate change will be simultaneously a driver of global competition and cooperation. However, due to its uneven impact on different regions of the world, the political pressure on decision-makers to address climate change will vary by time and geography. Governments will face tradeoffs in budget allocations between crisis response and long-term resiliency and adaptation strategies.

National Research Council. "Chapter: 2 Climate Change, Vulnerability, and National Security: A Conceptual Framework" in: *Climate and Social Stress: Implications for Security Analysis*, 35-52. Washington DC: National Academies Press, 2013. <https://doi.org/10.17226/14682>

This study supports Intelligence Community efforts to better understand the climate-security nexus over a ten-year horizon. The framework for climate-security relationships presented in the report posits that the security outcomes of climatic events should be assessed using three factors - 1) the socioeconomic and political pre-existing conditions; 2) the susceptibility to harm; and 3) the reaction: coping, response, and recovery - all of which change over time at different rates. The report concludes that observing only climate trends and projections will not be sufficient to anticipate related security risks, as these are trans-disciplinary problems. Authors discuss several approaches for a risk-based climate-security analysis, including forecasting approaches; early warning approaches; system vulnerabilities analyses; and policy vulnerability analyses.

Halden, Peter. "The Geopolitics of Climate Change: Challenges to the International System." Swedish Defence Research Agency, 2007. <https://www.foi.se/rest-api/report/FOI-R--2377--SE>

The report focuses on how climate change affects the conditions for conflict and international cooperation until the year 2050, examining separately the direct impacts on

natural systems and the indirect impacts on political systems. The report argues that in the short- to medium-term climate change is unlikely to increase the incidence of conflict, because the effects of climate change are conditioned by the existing economic, political and social structures. However, in the long-term, both climate change as well as the mitigation and adaptation measures taken to address climate change may alter social and political systems and lead to both internal and interstate conflicts.

CNA Military Advisory Board. *National Security and the Accelerating Risks of Climate Change*. Alexandria, VA: CNA Corporation, 2014. [https://www.cna.org/cna\\_files/pdf/MAB\\_5-8-14.pdf](https://www.cna.org/cna_files/pdf/MAB_5-8-14.pdf)

The CNA Military Advisory Board describes the effects of climate change not only as threat multipliers but also as catalysts of instability and conflict, especially in Africa, Asia, the Middle East, and the Arctic. The situation will be aggravated as the world population grows faster in the most vulnerable regions (costal and urban areas) and dynamic population growth coupled with climate change puts additional pressure on the water-food-energy nexus. The report notes that climate change can have a direct impact on the U.S. military (especially through readiness, logistics, and base resilience) and U.S. critical infrastructure.

### **Panel 3: Migration and Other Disruptions to Human Habitat**

- What risk does climate change pose to water, food, and energy systems?
- How will resource instability affect social and political systems, both regionally and globally?

Beddington, John, Mohammed Asaduzzaman, Adrian Fernandez, Megan Clark, Marion Guillou, Molly Jahn, Lin Erda, Tekalign Mamo, Nguyen Van Bo, Carlos A. Nobre, Robert Scholes, Rita Sharma, Judi Wakhungu. "Achieving food security in the face of climate change: Final Report from the Commission on Sustainable Agriculture and Climate Change." Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), 2014. <https://hdl.handle.net/10568/35589>

This report details how agriculture is currently failing to meet the related challenges of food supply, climate change mitigation, and climate change resilience. Presently, agriculture contributes about one-fifth of global greenhouse gas emissions, mainly through deforestation, livestock emissions, and fertilizer production. Population growth and the changing diets of wealthier populations are set to worsen these trends, growing agriculture's share of emissions even as both malnutrition and obesity rates increase. In turn, climate change threatens the viability of current agriculture practices through long-term climate trends and increased variability in weather patterns. Climate change of up to 2°C will require new farming practices to meet global food demand; climate change past 3°C will threaten catastrophic food shortages even with adaptation. The authors conclude with recommendations for a sustainable food system that meets human needs while maintaining balance with the planet's resources and ecology.

International Organization for Migration. "Climate Change and Migration in Vulnerable Communities: A snapshot of the least developed countries, landlocked developing countries and small island developing states." Geneva, Switzerland: International Organization for Migration, 2019. <https://environmentalmigration.iom.int/climate-change-and-migration-vulnerable-countries-snapshot-least-developed-countries-landlocked>

This report focuses on how climate change affects migration in the most vulnerable countries, which are also the countries contributing the least to climate change. Least developed countries, landlocked developing countries, and small island developing states constitute 91 states with 1.1 billion people. Climate change increases the pace and severity of slow-onset processes compelling migration, like sea-level rise, desertification, and land degradation. It also worsens the frequency of sudden-onset hazards that displace people, like drought, floods, and storms. Altogether, these phenomena contribute to migration that strains government capacity and worsens poverty.

National Intelligence Council. "Implications for U.S. National Security of Anticipated Climate Change." Washington DC: NIC WP 2016-01, 2016. [https://www.dni.gov/files/documents/Newsroom/Reports%20and%20Pubs/Implications for US National Security of Anticipated Climate Change.pdf](https://www.dni.gov/files/documents/Newsroom/Reports%20and%20Pubs/Implications%20for%20US%20National%20Security%20of%20Anticipated%20Climate%20Change.pdf)

This memorandum describes pathways and timelines for climate change's effects on U.S. national security. The authors assess that over the following five years, the greatest risks to U.S. security from climate change will come from distinct extreme weather events and the worsening of already strained conditions like water shortages. Over the next 20 years, additional risks will come from the combination of broader, systemic changes such as sea level rise, ocean acidification, and land and air quality degradation. These natural phenomena will influence security by increasing political tensions, threatening food and water supply, increasing health risks, and hurting economic competitiveness.

National Intelligence Council. "Natural Resources in 2020, 2030, and 2040: Implications for the United States." Washington, D.C.: NICR 2013-05, 2013. [NICR 2013-05 US Nat Resources 2020, 2030 2040.pdf \(dni.gov\)](https://www.dni.gov/files/documents/Newsroom/Reports%20and%20Pubs/NICR%202013-05%20US%20Nat%20Resources%202020%202030%202040.pdf)

This report, prepared by Chatham House for the National Intelligence Council, identifies the natural resource trends over the next 20 years most important to U.S. national security. Growing population and prosperity around the world will put strain on commodity markets that are already stressed by climate change. Agricultural products, particularly wheat and maize, are likely to increase in price and experience price shocks as significant production occurs in climate-vulnerable regions. Markets for oil and gas will likely remain tight in the near future. Commodity price shocks will also stress governance in both producing and consuming countries, particularly those with weak governance and high economic inequality.

Femia, Francesco, and Caitlin Werrell. "Climate change before and after the Arab awakening: The cases of Syria and Libya." In *The Arab Spring and Climate Change: A Climate and Security Correlations Series*. edited by Caitlin E. Werrell and Francesco Femia, 23-32.. Washington, D.C.:



Center for American Progress, 2013.

<https://climateandsecurity.files.wordpress.com/2012/04/climatechangeearabspring-ccs-cap-stimson.pdf>

This article highlights how climate change helped contribute to the civil wars in Syria and Libya. In Syria, land and water mismanagement combined with climate-induced droughts to create severe crop failures in up to 60% of Syria's land from 2006 to 2011. This displaced hundreds of thousands of Syrians from rural areas into cities, where they encountered a system already overtaxed since 2003 by an influx of Iraqi refugees. This series of ecological disasters left disaffected, hollowed-out rural communities and restive, overcrowded urban populations, both of which may have contributed to the Syrian revolution's beginning. In Libya, the crisis of water mismanagement from the Qaddafi era has persisted due to the ongoing civil war. Use of groundwater for agriculture in a 93% arid country has depleted finite underground aquifers and threatens Libya's relations with neighboring states with whom it shares these resources. The authors argue that if the internationally recognized Libyan government finds a sustainable solution to the water crisis, it can increase its legitimacy among the population.

#### **Panel 4: Weaponization of Resources**

- How will states or non-state actors attempt to exploit vulnerable resources or populations?
- What implications will these have for global stability?
- Can they be stopped? By whom?

Goodman, Sherri, and Clara Summers. "Will Russia Weaponize its Wheat as the World Combats the Coronavirus?" *The National Interest*, July 18, 2020. <https://nationalinterest.org/feature/will-russia-weaponize-its-wheat-world-combats-coronavirus-165031>

This article addresses the way COVID-19, in conjunction with climate change, has exposed another theater for asymmetrical engagement between Russia and its clients: wheat. Rising temperatures due to climate change in Russia have aided in the expansion of their agricultural sector. Russia is projected to control "20 percent of grain export markets by 2028." In the past, Russia's manipulation of grain markets in times of crisis has led to global spikes in the price of food that were linked to the Arab Spring. A similar pattern of behavior has emerged during the COVID-19 pandemic, underscoring the growing vulnerability countries face when they are forced to rely on the Kremlin for grain exports. The authors prescribe aggressively addressing climate change to deter the cascading threat it will have on food security and the construction of an international institute that would administer an emergency grain supply, decreasing nations' dependence on Russia for these necessary goods.

Hsiang, Solomon M., Marshall Burke, Edward Miguel. "Quantifying the Influence of Climate on Human Conflict." *Science*, 341, (2013):  
<https://science.sciencemag.org/content/341/6151/1235367.full>

The authors of this article have amassed a broad spectrum of cross-disciplinary literature on anthropogenic climate change in order to systematically assess its impact on human conflict. By relying on quantitative sources, the authors argue there is a causal link between deviations in normal precipitation\temperatures and an increase in conflict, and this connection is apparent across a broad spectrum of spatial and temporal gradations. According to their findings, a 1-degree change in temperature corresponds to “an average 2.3% increase in the rate of interpersonal conflict and a 13.2% increase in the rate of intergroup conflict.” Given that populations of the future mirror the behavior of their contemporary analogues, these findings are a useful tool for scaling conflict potential in regions contending with precipitation and temperature volatility, but only within the broader context of that region.

King, Marcus D., and Julia Burnell. “Water Weaponization: The Weaponization of Water in a Changing Climate.” In *Epicenters of Climate and Security: The New Geostrategic Landscape of the Anthropocene*, edited by Caitlin E. Werrell and Francesco Femia. Washington, D.C.: The Center for Climate and Security, 2017: 67-73. [https://climateandsecurity.org/wp-content/uploads/2017/06/8\\_water-weaponization.pdf](https://climateandsecurity.org/wp-content/uploads/2017/06/8_water-weaponization.pdf)

King and Burnell claim that water weaponization is a facet of contemporary subnational conflict due to climate change’s contributions to situations of water stress in arid states. Many of these regions are already plagued by water stress due to overexploitation and poor management of their native resources. They classify the three main methods of water weaponization by violent non-state actors as: 1) strategic – largescale utilization to control or destroy a territory or population, or as an asset “to fund state-like activities;” 2) tactical – generally smaller scale, focusing on predominantly military targets; and 3) coercive – utilization for subjugation. Water scarcity also works as an accelerator of violence in increasingly arid regions. Without swift action, King and Burnell predict water stress will increasingly contribute to state fragility and internal instability.

Mach, Katharine, J W. Neil Adger, Halvard Buhaug, Marshall Burke, James D. Fearon, Christopher B. Field, Cullen S. Hendrix, Caroline M. Kraan, Jean-Francois Maystadt, John O'Loughlin, Philip Roessler, Jürgen Scheffran, Kenneth A. Schultz, and Nina von Uexkull. “Directions for Research on Climate and Conflict.” *Earth’s Future* 8, issue 7 (July 2020). <https://doi.org/10.1029/2020EF001532>

The objective of this paper is to construct a hierarchy for assessing climate change and conflict linkages in order to direct and systematize future research. This is necessary because scholarship on the topic lacks consensus and often disagrees over the causal mechanisms and/or the extent of the effects of climate change on armed conflict. The authors suggest two questions for directing research on potential climate-conflict links: 1) What are the links? 2) When do the links matter/how do we break them? In order to assess what research is most pressing, they suggest exploring local-to-global scale climate-conflict risks by exploiting the growing body of literature on climate change, spanning granular analysis to aggregate approaches; collaborative research between researchers, practitioners, policy-makers, and stakeholders; and extending focus beyond

historical experience to predictive analysis in order to construct policy-relevant research on conflict-sensitive regions that will aid in mitigating and managing conflict

Thomas, Kimberly Anh, and Benjamin P. Warner. "Weaponizing vulnerability to climate change." *Global Environmental Change*, 57 (July 2019). <https://doi.org/10.1016/j.gloenvcha.2019.101928>

This article explains how populations are made vulnerable or more vulnerable through human adaptation and response to climate change by introducing five typologies of climate change response that produce, reproduce, or are likely to produce differential vulnerability to climate change. These "modes of vulnerabilization" are threat displacement, climate gentrification, elite fortification, disaster capitalism, and weaponizing vulnerability. These modes are informed by a shift in the dialogue that previously understood climate change in terms of "risk" and now views it through the lens of "security threat." A "security threat" is characterized as existential in nature and demands urgent response and/or adaptation. This shift has had the deleterious effect of weaponizing climate-vulnerable populations' vulnerability against them. In essence, threatened populations are perceived as threatening populations; this personification exposes a hierarchy in which underlying environmental factors tend to be perceived as lower-level threats compared to social expressions of climate vulnerability.

## Panel 5: Competition over the Arctic

- Which states have strategic interests in the Arctic?
- What new sources of competition will emerge due to changes in Arctic climate and geography?
- How can this competition be managed?

Pincus, Rebecca, and Walter A. Berbrick; "Gray Zones in a Blue Arctic: Grappling with China's Growing Influence." *War on the Rocks*. October 24, 2018. <https://warontherocks.com/2018/10/gray-zones-in-a-blue-arctic-grappling-with-chinas-growing-influence/>

This article lays out China's "gray-zone" activities for increasing their influence in the Arctic. Their investment in infrastructure and the beginning of "debt-trap" lending to Nordic countries signals China's growing presence. By acquiring key real estate and providing much needed infrastructure, China is investing heavily in Greenland. China is also increasing scientific research in climate change and improving their icebreaker designs for the Arctic operational environment, including nuclear-powered carriers. The authors argue the United States needs to pursue a balanced strategy and educate policymakers about the Arctic region to counter Chinese activities.

Graham, Thomas, and Amy Myers Jaffe; "There is No Scramble for the Arctic: Climate Change Demands Cooperation, Not Competition, in the Far North." *Foreign Affairs*. July 27, 2020.

<https://www.foreignaffairs.com/articles/russian-federation/2020-07-27/there-no-scramble-arctic>

The authors lay out the challenges facing the United States and Russia due to climate change in the Arctic and steps to prevent escalation. As icecaps melt, the creation of new trade routes has resulted in increased military presence and concerns regarding territorial disputes. The authors note Russia and the United States have started to develop new military capabilities focused on submarine warfare. Climate change also threatens oil and gas facilities in the Arctic, but this presents opportunities for cooperation. Graham and Myers Jaffe argue the Arctic Council would be a starting point to create a code of conduct to regulate military ambitions and create further multilateral cooperation.

Goldstein, L.J. "What Does China Want with the Arctic?" *The National Interest*, September 7, 2019. <https://nationalinterest.org/feature/what-does-china-want-arctic-78731>

China's main focus in the Arctic is not a military build-up but an economic build-up through unregulated fishing and logging industries. China aims to "break the monopoly position" of Scandinavian countries and become a maritime power. The main concern is Chinese companies endangering the Arctic's ecosystem due to poor regulation and unsustainable practices according to Goldstein.

Norwegian Institute for International Affairs. *A Governance and Risk Inventory for a Changing Arctic: Background Paper for the Arctic Security Roundtable at the Munich Security Conference 2020*. 2020.

<https://www.wilsoncenter.org/sites/default/files/media/uploads/documents/MSCArcticSecurityRoundtable2020Paper.pdf>

The report highlights the key security challenges facing the Arctic as a starting point for discussions. The author argues there is a promising record of cooperation in the Arctic, but demanding security dynamics, geopolitical dynamics between Arctic and non-Arctic states, and economic development pose challenges. Specifically, Russia's continued military presence and China's claim of being a near-Arctic state pose challenges. To counter these challenges, the world needs to build on current international regimes and be aware of political tipping points to avoid rivalries spilling over into the Arctic region. Military developments must also be balanced, transparent, and predictable.

Titely, David and Katarzyna Zysk. "A Melting Arctic: Signal, Noise and Swans in the Arctic." In *Epicenters of Climate and Security: The New Geostrategic Landscape of the Anthropocene*, edited by Caitlin E. Werrell and Francesco Femia, 74-79. Washington, D.C.: The Center for Climate and Security, 2017. [https://climateandsecurity.files.wordpress.com/2017/06/9\\_a-melting-arctic.pdf](https://climateandsecurity.files.wordpress.com/2017/06/9_a-melting-arctic.pdf)

Titely and Zysk argue it is best to focus on the ongoing trends while hedging against the wild cards instead of focusing on shorter-term "noise" in the Arctic. The rapid environmental changes may be a political wake-up call, especially with little historical knowledge to draw upon. With economic development happening at a slower pace than originally imagined, the environmental trends are the bigger concerns. The authors also

pay special attention to “wild card” scenarios, including shipping or oil disasters, disputes about Northwest Passage sovereignty, Russian regional military superiority, and the possibility of an independent Greenland. This paper also highlights the need for the United States to “partner with, learn from, and respect the native cultures” in the Arctic.

van Schaik, Louise and Ties Dams. “The Arctic Elephant: Europe and the Geopolitics of the High North, Clingendael Policy Brief,” November 14, 2019. [The Arctic Elephant: Europe & geopolitics of the high north | Clingendael](#)

This policy brief calls attention to the failure in current diplomatic architecture to discuss the security challenges in the Arctic. The United States, China, and Russia are focusing on the geopolitics of the Arctic; the authors argue Europe needs to do the same in order to help shape Arctic diplomacy. To do this, the European Union (EU) should call for an expanded Arctic security and cooperation organization to include all key players, specifically Russia, China, the United States, and EU member states. The authors also highlight the need for NATO to define an Arctic strategy.

## Panel 6: Scoping the Needed Military-Technical Responses

- What adaptations to US military strategy, operational planning, and capability development are warranted?
- What can and should other U.S. departments and entities contribute to the needed whole of government approach?
- Where should technology developers focus?

Army War College. “Implications of Climate Change for the U.S. Army,” 2019. [https://climateandsecurity.files.wordpress.com/2019/07/implications-of-climate-change-for-us-army\\_army-war-college\\_2019.pdf](https://climateandsecurity.files.wordpress.com/2019/07/implications-of-climate-change-for-us-army_army-war-college_2019.pdf)

According to the report, the three greatest climate change-related problems the Army is facing are: 1) changing operating environments; 2) lack of military-wide coordination and climate intelligence sharing; and 3) threats to power grids and the nuclear arsenal. Given the Army’s unpreparedness for the lasting effects of climate change, the branch must rapidly mobilize its members to starting adequately preparing for likely changes at the operational and tactical level. Logistical issues like potable water in combat zones and environmental challenges such as flash floods will make establishing a U.S. presence abroad difficult and will also expose the shortcomings of the domestic infrastructure system, especially with regards to the nuclear arsenal. The authors argue global warming will affect the average water temperature used for cooling nuclear reactors, ultimately putting the effectiveness of continued nuclear materials production at risk.

Crawford, Neta C. “Pentagon Fuel Use, Climate Change, and the Costs of War.” *Costs of War Blog*. November 13, 2019. [Microsoft Word - Pentagon Fuel Use, Climate Change and the Costs of War Revised November 2019 Crawford.docx \(brown.edu\)](#)



than 1,700 military installations worldwide in coastal regions likely to be impacted by sea-level rise and extreme weather, but only major military installations with a Plant Replacement Value of more than \$2.067 billion are required to account for storm surges, flooding, and sea level rise in long-term master planning. The following must be done for Congress to effectively address this issue in the National Defense Authorization Act: 1) require small and medium bases to account for extreme weather; 2) require climate projections to be included in master planning; and 3) require adoption of standard definitions of extreme weather terms.

Office of the Under Secretary of Defense for Acquisition and Sustainment. "Report on Effects of a Changing Climate to the Department of Defense," Department of Defense, January 2019.

<https://media.defense.gov/2019/Jan/29/2002084200/-1/-1/1/CLIMATE-CHANGE-REPORT2019.PDF>

In response to a Congressional tasking, this report offers a comprehensive overview of the efforts the Department of Defense has taken to address climate change thus far. The report outlines recurrent flooding, drought, desertification, wildfires, and thawing permafrost as the greatest climate change risks and lists installations that have either already faced these issues or are at risk due to their location. By increasing collaboration between Combatant Commands, the Strategic Environmental Research and Development Program (SERDP), and Environmental Security Technology Certification Program (ESTCP), military leaders can start planning for how climate change-related disasters or societal changes will affect the mission and sustainability of deployed forces worldwide. Part of this planning will include advanced humanitarian and relief missions training to assist in additional locales when needed.

## **Panel 7: Managing Climate Change Amidst Strategic Rivalry**

- How will climate change affect great power rivalry?
- Will climate change create new sources of competition and/or cooperation?
- How can this competition be managed and cooperation improved?

Brenton, Sir Anthony. "Great Powers' in climate politics." *Climate Policy* 13, issue 5 (2013): 541-546. <https://www.tandfonline.com/doi/abs/10.1080/14693062.2013.774632>

Cooperation between great powers (in the climate space this includes the EU, the U.S., China, Japan, Russia, Brazil, India, and Canada) is necessary for the success of global climate change agreements, but it has not always been a given. Great powers have not always viewed climate as an international concern, despite its global implication. Furthermore, there are divisions among the great powers on both the direction of future climate actions and who bears the most responsibility. These divisions have stymied previous accords, such as the 1992 Rio convention and 1997 Kyoto protocol. Great power participation in forums outside of these discussions, such as the Major Economies Forum since 2005, have increased cooperation in the following global climate discussions, namely the 2009 Copenhagen Accord.

Bordoff, Jason. "Everything You Think About the Geopolitics of Climate Change is Wrong," *Foreign Policy*, October 5, 2020. <https://foreignpolicy.com/2020/10/05/climate-geopolitics-petrostates-russia-china/>

The author believes there will likely be a shift in how the world uses and sources energy. Many argue that this transition will have implications for the global world order, specifically that "electrostates" will increase their power at the expense of petrostates. This author, however, suspects that much of the conventional wisdom is likely to be wrong and that the transition will be much more nuanced. Bordoff first points out that leading production in green technologies, such as electric car batteries or solar cells, will not necessarily lead to the same level of geopolitical influence as that given to global oil suppliers. Furthermore, Russia, a fairly powerful petrostate, might not experience a loss in global influence if many states include nuclear energy in their energy transition.

Pflüger, Friedbert. "A new security challenge: The geopolitical implications of climate change," Washington, D.C.: Atlantic Council, 2020. <https://www.atlanticcouncil.org/blogs/energysource/a-new-security-challenge-the-geopolitical-implications-of-climate-change/>

The author argues that climate change is increasingly becoming a geopolitical concern and that actions beyond climate adaptation action plans, such as the Paris Agreement, will be needed. Pflüger finds five areas where the impact of climate change will become a prominent geopolitical consideration: 1) the Arctic and Greenland, 2) Antarctica, 3) Central Asia, 4) China and India, and 5) the Middle East. The author outlines U.S., Chinese, and Russian interests in these regions, often noting that these three actors often have competing aims. Furthermore, other actors, such as Australia in the Antarctic, will play a large role in these regions as well.

Saha, Sagatom. "The climate risks of China's Belt and Road Initiative," *Bulletin of Atomic Scientists* 76, issue 5 (September 8, 2020): 249-255. <https://doi.org/10.1080/00963402.2020.1806584>

In this article, the author critiques China's claim that the Belt and Road Initiative (BRI) is a green project. Despite promoting the project as such and declaring dramatic emissions reductions, projects in the BRI has only addressed environmental concerns in a cursory way and these projects are not included in China's emissions calculations. The author finds that many of the projects in the BRI would also conflict with host countries' climate mitigation efforts. The author finds that the BRI projects, as they have been promoted, would strengthen Chinese influence at the expense of the United States. Saha offers actions the U.S. could pursue to call attention to environmental concerns with the BRI and ways the United States and its allies could provide a green alternative for countries interested in participating in the BRI.

Scott, Wyatt, Francis Gassert, and Sharon Burke. "Great Power Resource Competition in a Changing Climate: New America's Natural Security Index." Washington, D.C.: New America



Foundation, 2019. <https://www.newamerica.org/resource-security/reports/great-power-resource-competition-changing-climate/>

This report compares the national security of China and the United States by using a Natural Security Index, which factors in the countries' resources, production, imports, and exports. The authors feel that the natural security, or the ability to secure energy, food, minerals, and water, of both China and the United States will have global impacts in the rest of the world. The authors find that while the United States has an inherent natural security and advantage in great power competition, Chinese natural resources are significant. Australia could be an important future player, either in competition or cooperation, as a natural security partner for China and a U.S. strategic ally. The U.S. and China will compete globally for natural resources, specifically mineral resources, in other countries and global natural resources are expected to change dramatically due to climate change.

Stern, Todd. "Can the United States and China reboot their climate cooperation?" Washington, D.C.: Brookings, 2020. <https://www.brookings.edu/articles/can-the-united-states-and-china-reboot-their-climate-cooperation/>

The author argues that United States and China must cooperate to successfully take on the climate challenge, despite a recent deterioration in the overall relationship between the two superpowers. Stern argues for a better balance between cooperation and competition with China, in light of the dire climate warnings from the IPCC, Pentagon, and intelligence communities. Despite cooperation on the Paris Agreement, the landscape is markedly different in 2020 and beyond. Both countries will face challenges towards achieving the stated Paris goals. An incoming President Biden will need to include climate change in future summits with China and expand cooperation with a U.S.-China Climate Change Working Group to make substantive progress on this issue.

## **Panel 8: Building the Needed New Partnerships for Resilience**

- What partnerships already exist at the national, international, multinational, and public-private levels? Which are functioning well? Poorly? Why?
- What new partnerships are needed?
- What more can be done to boost the needed national and international resilience?

Congressional Research Service. "Climate Change Risk Mitigation by U.S. Foreign Assistance Agencies," R46585, October 29, 2020. <https://crsreports.congress.gov/product/pdf/R/R46585>

This report discusses how foreign assistance agencies are addressing climate change in their operational and internal planning. 2014 Executive Order 13677 requires international development agencies to integrate climate resilience considerations into their overseas work, but implementation varies across agencies due to different interpretations and the rollback of other environmental policies. Funding for addressing climate issues in overseas programming is difficult to measure without reporting

requirements or a statutory framework. The report finds that environmental risk efforts of foreign assistance agencies are largely shaped by executive orders and individual agency policies. As a result, agency responsibilities are unclear. To correct these deficiencies, Congress could consider designating a coordinator for federal sustainability policies and administering risk mitigation guidance.

Government Accountability Office. "A National System Could Help Federal, State, Local, and Private Sector Decision Makers Use Climate Information," GAO-16-37, November 2015.  
<https://www.gao.gov/assets/680/673823.pdf>

Although many federal efforts are under way, this Government Accountability Office (GAO) report asserts that the climate information needs of local, state, federal, and private sector entities could be improved by organizational changes and better data coordination. The report draws on examples from programs in Germany, the Netherlands, and the United Kingdom to assess best practices and evaluate the strengths and limitations of possible interagency changes in the United States. The report concludes that a federally coordinated national climate information system, in addition to a nonfederal provider of technical assistance, may make it easier to streamline relevant information to decision-makers and stakeholders at all levels of government. These efforts would be supplemented by quality assurance guidelines for decision-makers to better understand the data. The report recommends that the Executive Office of the President implement these changes to reduce long-term federal fiscal exposure while mandating climate information services.

Lippert, Tyler H. "NATO, Climate Change, and International Security: A Risk Governance Approach." Santa Monica, CA: RAND Corporation, 2016.  
[https://www.rand.org/pubs/rgs\\_dissertations/RGSD387.html](https://www.rand.org/pubs/rgs_dissertations/RGSD387.html)

This dissertation applies the International Risk Governance Council's (IRGC) Risk Governance Framework to the North Atlantic Treaty Organization's (NATO) ability to address the security consequences of climate change. Lippert identifies weaknesses in NATO's risk governance posture, including insufficient data and analytical methodology. Lippert asserts that NATO's consensus-based decision-making process hinders its ability to formulate a comprehensive position on climate change. NATO's interest in the relationship between the environment and security will be bolstered by the strategic considerations of climate change in the Middle East and North Africa region and the Arctic. To prepare for climate-related exigencies, Lippert concludes that NATO should pursue a two-pronged strategy of adaptation and mitigation, including problem framing, data analysis, and strong partnerships for risk management.

Markkanen, Sanna, and Annela Anger-Kraavi. "Social impacts of climate change mitigation policies and their implications for inequality," *Climate Policy* 19, issue 7 (2019): 827-844.  
<https://www.tandfonline.com/doi/full/10.1080/14693062.2019.1596873>

This analysis argues that climate change mitigation policies are linked to both co-benefits and adverse side-effects that have the potential to compound societal inequalities in

vulnerable populations. The authors contend that a better understanding of contextual factors in policy design, development, and implementation can help mitigate the risk of negative social outcomes from climate change policies. The social impacts of climate mitigation policies can be anticipated and addressed through careful planning and multi-stakeholder engagement. Local participation in the decision-making process, targeted interventions, and government subsidies should all be considered to avoid adverse outcomes.

Smith, Steven. "Domestic Resilience is Homeland Security." *Solutions*. 11, no. 4 (2020): <https://www.thesolutionsjournal.com/article/domestic-resilience-homeland-security/>

In this article, the author connects adaptation to climate change to U.S. national security and domestic resilience, ultimately arguing that resilience to climate change should receive similar attention as other military threats. The author argues for leveraging both intellectual capital, such as planning exercises and coordination, along with economic resources. The author frames resilience to climate change in terms of five principles: domestic resilience, plans, execution of said plans, goals and values, and coalitions across government and private sector actors to address these issues. The Alliance for a Climate Resilient Earth (ACRE) organization, which the author contributes to on a voluntary basis, is an example of such a coalition that prioritizes these principles.

Verbeek, Alexander. "Planetary Security: The Security Implications of Climate Change," *NATO Review*, December 10, 2019. <https://www.nato.int/docu/review/articles/2019/12/10/planetary-security-the-security-implications-of-climate-change/index.html>

Due to competing short-term interests and a lack of urgency, Verbeek argues that societies have been slow to address the long-term security implications of climate change. While conflict and instability are historically hard to predict, the proliferation of big data and artificial intelligence could help improve the capacity to forecast future security threats. Verbeek discusses the potential for a "digital ecosystem" to help integrate private and public initiatives for risk assessment and transparency. This could be important for building a longer-term structure to consolidate the knowledge and roles of all relevant stakeholders. Verbeek highlights the work of groups such as the World Resources Institute and the Water, Peace, and Security partnership as good examples of undertaking this important challenge.



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