What is Climate Security?

Establishing the Foundation for a Collaborative Regional Center Inquiry[1]

Dr. Kathryn Bryk Friedman

North American Arctic Policy Advisor
Ted Stevens Center for Arctic Security Studies

CLEARED
For Open Publication
May 17, 2024
Department of Defense
OFFICE OF PREPUBLICATION AND SECURITY REVIEW

Distribution Code(s): A-Approved for Public Release
Distribution Statement: Public Release and Foreign Release
Citation Classification: Unclassified
Report Classification: Unclassified
Collection: P40

Abstract

Climate security is the ultimate systems-level challenge, i.e., it is highly complex, non-linear, and multidimensional. Since 2021, when the Secretary of Defense directed all defense components to include climate change in strategies and plans, the Pentagon has released multiple key assessments, policies, tools, and classified and unclassified reports related to climate change threats, trends, hazards, impacts, risks, vulnerabilities, and resilience. These documents do speak to climate change impacts on defense strategies, plans, capabilities, missions, and equipment, yet collectively these are imprecise. That is, although there seems to be an understanding that climate security means the security implications of climate change – which is not incorrect – it is quite vague. Quite simply, if climate security is everything, then it risks being nothing. This Special Report asks two fundamental, yet practically-oriented questions, with strategic implications: How does DoD define climate security? Relatedly, what are the key climate security dimensions in the Arctic most relevant to DoD? These questions serve as the foundational inquiry in a collaborative effort among several of the DoD Regional Centers to create a climate security framework for DoD and its Allies and partners.

Keywords: climate security, framework, Arctic, dimensions, systems-level

"No nation can find lasting security without addressing the climate crisis."

Secretary of Defense Lloyd J. Austin, April 2021

The Arctic presents a unique confluence of significant climate trends that are impacting US security interests in the region in profound and meaningful ways. Whether referred to as the "climate-security nexus" (Bastian, et al., 2023; Nevitt, 2023) or simply "climate security" (Goodman, et al., 2021), this phenomenon is the ultimate systems-level challenge, i.e., it is highly complex, non-linear, and multidimensional. It involves dynamic interactions among political, social, economic, cultural, environmental, and strategic factors (Ahkinga, et al., 2022; NIE, 2021).

Since 2021, when the Secretary of Defense directed all defense components to include climate change in strategies and plans, the Pentagon has released multiple key assessments, policies, tools, and classified and unclassified reports related to climate change threats, trends, hazards, impacts, risks, vulnerabilities, and resilience. Others in the national security ecosystem also have addressed this challenge (NATO, 2021; Yllemo, 2022). These documents do speak to climate change impacts on defense strategies, plans, capabilities, missions, and equipment, yet collectively these are imprecise. That is, although there seems to be an understanding that climate security means the security implications of climate change – which is not incorrect – it is quite vague. Quite simply, if climate security is everything, then it risks being nothing.

More than two years after the initial release of climate security documents in 2021, it is time to take stock. This Special Report asks two fundamental, yet practically oriented questions, with strategic implications: How does DoD define climate security? Relatedly, what are the key climate security dimensions in the Arctic most relevant to DoD? These questions serve as the

foundational inquiry in a collaborative effort among several of the DoD Regional Centers to create a climate security framework for DoD and its Allies and partners.

Creating a climate security conceptual framework is important for two reasons. First, coherent thinking requires conceptual framing. A climate security framework, therefore, would foster a shared understanding and align awareness of climate impacts toward tangible considerations around DoD missions, functions, and roles. This shared understanding would allow DoD to clarify how it will respond and adapt to different situations or circumstances (Gray, 2021). This would move the DoD needle away from crisis mode – which is less effective and more expensive (M. Nathanson, personal communication, December 18, 2023).

Second, a framework would reduce the complexities surrounding climate security in a way that makes relationships and ideas simpler to grasp (Gray, 2021). DoD personnel and senior leadership, therefore, would gain useful insights from a climate security framework. Expert and non-expert defense and security personnel would have a better understand of how climate change trends impact their areas of expertise. This, in turn, would support training and equipping a climate ready workforce and strengthening climate literacy (DCAP, 2021; DCAP-PR, 2022).

Relatedly, a climate security framework would support climate-informed decision making (DCAP, 2021; DCAP-PR, 2022). Climate threats will continue to increase demands on DoD resources. A climate security framework, therefore, would assist leadership in more clearly delineating resource tradeoffs among the different dimensions, e.g., certain capabilities for humanitarian assistance and disaster response vis-à-vis national defense concerns, and more easily identifying adaptation, mitigation, and resilience strategies and operations (Nevitt, 2023). From this framework, a series of practical questions for decisionmakers would emerge and help DoD refine its processes, budget, and planning to address climate security concerns.

As a first-step in this collaborative Regional Center effort, this Special Report 1) identifies key climate change trends most relevant to the DoD mission, operations, and installations in the Arctic; 2) reviews the most relevant unclassified national strategies and DoD documents related to climate security in the Arctic; 3) synthesizes key Arctic climate security dimensions culled from these documents; and 4) recommends next steps in the collaborative Regional Center effort to create a climate security framework for DoD and its Allies and partners.

Arctic Climate Trends

The Arctic is increasingly warmer, less frozen, and wetter, with regional extremes in climate patterns, weather, and ecosystem responses (NOAA, 2023). Climate trends during the past year have brought unambiguous super-charged impacts to people and ecosystems (Thoman, Moon & Druckenmiller, 2023). The following are among the most significant climate trends in the Arctic that are most relevant to DoD:

Increasing Surface Air Temperature

Warming near-surface air and upper-ocean temperatures in the Arctic represent an ongoing signature of Arctic change (Ballinger et al., 2022). Over the past 50 years, the Arctic has warmed nearly four times faster than the global average due to a combination of complex climate feedbacks referred to as Arctic amplification (Westerveld, et al., 2023). Arctic amplification is a widely recognized phenomenon in which global warming is amplified at the poles, causing the Arctic to warm more quickly than the rest of the globe. Multiple factors enhance warming at high latitudes, but the main one is that warming reduces snow and ice, which would otherwise reflect incoming sunlight (NOAA, 2023).

October 2022–September 2023 was the sixth-warmest year in the Arctic since records began in 1900 (Lindsey & Scott, 2023). It was the 14th consecutive year in which Arctic temperatures exceeded the 1991–2020 average. The widespread warmth averaged out to a record-warm summer in 2023 (Lindsey & Scott, 2023).

Declining Sea Ice Extent

Arctic sea ice is the frozen interface between the ocean and the atmosphere (Meier, et al., 2021). It reduces the absorption of solar energy because of its high albedo relative to the darker open ocean surface. Additionally, as a physical barrier, it modifies the heat and moisture transfer between the atmosphere and ocean.

Sea ice plays a critical role in modulating ecosystem and human activity in the Arctic (Meier, et al., 2023). Sea ice provides an essential habitat for marine life and modulates the biogeochemical balance of the Arctic. With regard to human activity, sea ice cover traditionally has played a cultural role in Indigenous communities. Additionally, sea ice historically limited national and commercial activities in the region, however, decreased ice cover is influencing commercial transportation, resource extraction, and national security.

Sea ice extent, i.e., the total area covered by ice of at least 15% concentration, is a commonly used indicator of long-term Arctic sea ice conditions (Meier, et al., 2023). Sea ice extent continues to decline, with most recent reporting demonstrating that sea ice extent was the 6th lowest in the satellite record since 1979 (Mersmann, 2023). August 2023 mean sea surface temperatures show continued warming trends for 1982-2023 in almost all Arctic Ocean regions that are ice-free in August (NOAA, 2023). Mean sea surface temperature over regions between 65° N and 80° N is increasing at a rate of ~0.9°F (~0.5°C) per decade (NOAA, 2023).

Permafrost

Permafrost, i.e., ground that remains frozen for at least two years, occurs in the Earth's coldest reaches, including the Arctic (Westerveld, et al., 2023; Schwing, 2023). Permafrost is found virtually everywhere in the region, with the largest expanses occurring in Alaska, Canada, Kalaallit Nunaat (Greenland), and Russia (Westerveld, et al., 2023). Smaller areas of permafrost occur in Iceland, Scandinavia, Svalbard, and in high mountain areas of Europe. This vast but largely unseen characteristic influences not only the flora and fauna of these regions, but also the lives, livelihoods, and cultural identities of Indigenous peoples who live and work there (Westerveld, et al., 2023, p. 13).

Permafrost thawing is a significant trend in the Arctic, decreasing in terms of both area and volume (Westerveld, et al., 2023). This degradation is resulting in subsidence, i.e., the sinking or collapsing of ground. Additionally, because permafrost stores vast amounts of carbon (nearly twice as much as in the atmosphere), thawing permafrost will become an increasing source of greenhouse gases, releasing carbon dioxide and methane into the atmosphere and further exacerbating climate change (Guy & Churchill, 2021).

Wildfires

Wildfires represent "high impact events" that are a clear signature of sustained climate change (Thoman, Moon & Druckenmiller, 2023). Although wildfires in the Arctic and sub-Arctic boreal forest are a natural part of the ecosystem, these are now more extreme, broader in geographic scope, occurring more frequently, and lasting longer. For example, in 2023, Canada experienced its worst national wildfire season on record. Multiple communities in the Northwest Territories were evacuated during August 2023 as a precaution, including more than 20,000 people from Yellowknife (Thoman, Moon & Druckenmiller, 2023). In contrast to the Northwest

Territories, the area burned in the Yukon Territory approximated 328,000 hectares (810,000 acres), which is slightly above the previous 30-year median (Thoman, Moon & Druckenmiller, 2023). In Alaska, wildfires burned 119,500 hectares (295,000 acres), less than half of the 30-year median (Alaska Interagency Coordination Center, 2023).

Increased Frequency and Intensity of Storms

Storms in the Arctic, ranging from cyclones to boreal vortices, have increased in terms of both frequency and intensity. These storms are characterized by stronger winds, larger temperature variations, and heavier rainfall and snowfall. For example, researchers at the University of Alaska Fairbanks concluded that strong vortices, with lower core pressures, appeared in the Arctic more often on average in each year of the last decade since the 1950s (Ogasa, 2023). These were up approximately 20% in the summer and 35% in the winter (Ogasa, 2023). These scientific observations have been confirmed by Indigenous observers, who noted increased intensity and frequency of storms that contribute to flooding and erosion (Glenn-Borade, 2023).

What is Climate Security in the Arctic?

A Review and Synthesis of Key Unclassified DoD Documents

DoD has official definitions of various terms related to climate security. For example, Directive (DoDD) 4715.21 "Climate Change Adaptation and Resilience" took effect in 2016 and outlines DoD policies, roles, and responsibilities related to climate change. DoDD 4715.21 defines climate change as:

> "[V]ariations in average weather conditions that persist over multiple decades or longer that encompass increases and decreases in temperature, shifts in precipitation, and changing risk of certain types of severe weather events" (DoDD 4715.21, 2016).

DoD also has defined adaptation, mitigation, hazard, resilience, and risk (DCRA, 2021; DoDD 4715.21, 2016).

Climate security is difficult to define, due in part to the complex dynamics at play across the globe in different contexts and with varying impacts. The National Security Council is preparing a new climate security definition that will be released after COP28 (M. Nathanson, personal communication, December 6, 2023). In the meantime, DoD uses the definition of climate security drawn from legislation that established the White House Climate Security Advisory Council in 2020:

> "Climate security – The effects of climate change on the following: (a) the national security of the United States, including national security infrastructure; (b) subnational, national, and regional political stability; (c) the security of allies and partners of the United States; and/or (d) ongoing or potential political violence, including unrest, rioting, guerrilla warfare, insurgency, terrorism, rebellion, revolution, civil war, and interstate war" (50 USC § 3060).

This definition is comprehensive, and, as a result, could encompass every conceivable risk posed by climate change. At first blush this doesn't seem particularly problematic. Nonetheless, from a strategic standpoint, if climate security can mean everything, it risks meaning nothing. This puts DoD in an unenviable position.

To distill what DoD means by climate security, the following national security strategies (unclassified) and DoD documents (unclassified) were reviewed and synthesized as related to the Arctic:[2]

- 2023 National Strategy for the Arctic Region Implementation Plan (NSAR-IP)
- 2022 National Security Strategy (NSS)

- 2022 National Strategy for the Arctic Region (NSAR)
- 2022 National Defense Strategy (NDS)
- 2022 Department of Defense Climate Adaptation Plan Progress Report (DCAP-PR)
- 2022 Department of Defense Inspector General Report on the Arctic (IGRA)
- 2021 NORAD/USNORTHCOM Strategy (NORAD/USNORTHCOM)
- 2021 National Intelligence Estimate on Climate Change (NIE)
- 2021 Department of Defense Climate Risk Assessment (DCRA)
- 2021 Department of Defense Climate Adaptation Plan (DCAP)

The following dimensions of climate security emerged from a synthesis of these documents:

National Defense

The most obvious dimension of climate security in the Arctic is national defense. Warming temperatures and decreasing sea ice extent are making the Arctic "more accessible than ever" (NSS, 2022, p., 44) and creating new corridors of strategic interaction (NDS, 2022, p., 6; see also NSAR-IP, 2023; NSAR, 2022; NORAD/USNORTHCOM, 2021). China and other non-Arctic states are increasing their presence in the region, which likely will amplify security concerns on the part of Arctic states (NIE, 2021, p., 8). There is the possibility of miscalculation over strategic competition in the Arctic leading to conflict (NIE, 2021., p. 8). To counter these and other threats, DoD has prioritized shared maritime domain awareness; leveraging space domain awareness; leveraging early warning systems and ISR capabilities; partnering with Canada to improve NORAD capabilities; and improving polar communications capabilities

(NSAR-IP, 2023; NSS, 2022; NSAR, 2022; NDS, 2022; NORAD/USNORTHCOM, 2021NORAD/USNORTHCOM, 2021).

Additionally, according to these documents, demands on US forces will be amplified. These demands include disaster response capabilities; pressures on training capabilities and readiness; manpower challenges; and degrading installations and infrastructure (NSS, 2022; NDS, 2022; DCAP, 2021; DCRA, 2021; NIE, 2021; DoDD 4715.21; IGRA, 2022). With regard to the latter, the potential impacts of permafrost thaw are among the most troubling aspects of climate security in the Arctic. Alaska alone has six military bases and 49 national guard posts (Marlatt, 2020). There are two F-35 advanced fighter squadrons at Eielson Air Force Base and a half-billion dollars in investment to host those squadrons, including 36 new buildings and 54 aircraft hangers (Cusick & E&E News, 2023). Pituffik Space Base, Eielson Air Force Base, Fort Wainwright, and the Alaska Radar System and North Warning System are susceptible to moderate to considerable risk from permafrost thaw that would cause differential settlement, thus impairing structural integrity or allow ground water infiltration into ground voids leading to freeze/thaw heave (Department of Defense, Office of the Undersecretary of Defense for Acquisition and Sustainment, 2023).

Additionally, intensifying wildfires are having – and will continue to have – an impact on US installations and troops in the Arctic. At Fort Wainwright, Alaska, heightened wildfire risks in 2019 interrupted training for two Pacific Air Force squadrons, so that one was able to carry out only 59% of planned training for a period (IGRA, 2022). Moreover, Arctic coastal erosion caused by intense storms also is threatening US military infrastructure (Efron, et al., 2020).

Human Security

Human security emerged as a key climate security dimension. The concept of human security represents an effort by the United Nations Development Programme to reconceptualize security to focus on the individual as opposed to the state (Jolly & Ray, 2006, p. 5). According to U.N. General Assembly resolution 66/290, "human security is an approach to assist Member States in identifying and addressing widespread and cross-cutting challenges to the survival, livelihood[,] and dignity of their people." Human security encompasses threats to socio-economic and political conditions; culture; food; health; water; and community conditions (Jolly & Ray, 2006, p. 5).

As a dimension of climate security in the Arctic, the documents reviewed and synthesized emphasize economic, cultural, and community conditions (NSAR-IP, 2023; NSS, 2022; NSAR, 2022; NDS, 2022; DCAP, 2021; DCRA, 2021). For example, the NSS states that the US "seeks an Arctic that is peaceful, stable, prosperous, and cooperative. . . . Climate change is . . . threatening Arctic communities . . . creating new potential economic opportunities. . ." (NSS, 2022, 44; see also NSAR-IP, 2023; NSAR, 2022). It further states that the US will invest in infrastructure; improve livelihoods; encourage responsible private sector investment by the United States, our Allies and partners; and uphold its commitment to honor Tribal sovereignty and self-governance through regular, meaningful, and robust consultation and collaboration with Alaska Native communities (NSS, 2022, p. 45). NSAR reinforces this theme, stating "We will pursue sustainable development and improve livelihoods in Alaska, including for Alaska Native communities, by investing in infrastructure, improving access to services, and supporting growing economic sectors. We will also work with allies and partners to expand high standard investment and sustainable development across the Arctic region" (NSAR, 2022, p. 3).

As a theme, economic security in the Arctic demonstrates the systems-level complexity confronting DoD. Economic security in the Arctic includes access to shipping lanes, oil and natural gas deposits, and an estimated $1 trillion in precious minerals (NIE, 2021, p. 8). It also includes warming ocean temperatures, which will likely push fish stocks from the Bering Sea northward. While at first blush an economic security issue, this situation could increase illegal commercial fishing activity and exacerbate regional disputes between Arctic and non-Arctic nations, pushing it to a significant national defense challenge (NIE, 2021, p. 8; DCRA, 2021, p. 9).

Last, but certainly not least, health security emerges as a theme, given the potential of diseases proliferating and spreading (NSAR-IP, 2023; NSS, 2021; NSAR, 2021; NDS, 2021; NORAD/USNORTHCOM, 2021; DCRA, 2021). As temperatures rise, sea ice melts, and permafrost thaws, the distribution of vector-borne diseases will change (DCRA, 2021, p. 9). Identifying, preventing, and mitigating health risks in humans, animals, and the environment is a key climate security priority for DoD.

Environmental Security

Environmental security is defined in terms similar to human security, i.e., when people do not have enough food, water, or shelter, or the natural resources to live (Goodman, 2012). More recently, it has been defined as the ecological conditions necessary for sustainable development (Dalby, 2020). This dimension emerged in the document review (NSAR-IP, 203; NSS, 2022; NSAR, 2022). Perhaps the most obvious example is the NSAR (2022), which has climate change and environmental protection as one of its four pillars. According to NSAR (2022), the US government will partner with Alaskan communities and the State of Alaska to build resilience to the impacts of climate change, while working to reduce emissions from the

Arctic as part of broader global mitigation efforts, to improve scientific understanding, and to conserve Arctic ecosystems (NSAR, 2022; see also NSAR-IP, 2023). The four objectives of this pillar are to advance community adaptation and climate resilience; pursue international initiatives to mitigate emissions in the Arctic; expand research to better understand climate change and inform policy decisions; and conserve and protect Arctic ecosystems, including through Indigenous Co-Production and Co-Management (NSAR, 2022, pp. 10-11).

Key Insights and Proposed Next Steps

Climate security is complex and multifaceted, with a vast number of elements and interrelationships. All of the documents reviewed reference climate impacts on traditional national defense concerns in the Arctic. Some, too, point to dimensions that are connected to US national interests, and can be enhanced or defended through military power. These latter dimensions, however, are non-military sources of instability in the human and environmental realms.

This Special Report asked two foundational questions, yet in the process, many more questions emerged. For example, are the climate security dimensions identified as most relevant to the Arctic – national defense, human security, and environmental security – sufficient? Should we classify and categorize environmental security as part of human security, as adopted by UNDP? Or is it a separate dimension, as suggested by Goodman (2012)? Is disaster response a component of traditional national defense or human security? Is health security part of human security, environmental security, or both? Are there other ways to conceptualize relevant security dimensions?

Perhaps more to the point: What would a DoD climate security framework look like? Would it integrate these different dimensions as a realistic assessment of the direct and indirect

impacts of climate change on DoD (M. Nathanson, personal communications, December 6, 2023 and December 18, 2023)? Or, given the complexity of the subject, is that too tall of an order? Should we strive toward a framework that parses out the different dimensions and risks so that DoD personnel understand their roles in this complex undertaking (M. Schell, personal communication, November 22, 2023; D. McDonald, personal communication, December 7, 2023)?

The Regional Centers are up for the task of exploring these questions, and others, in an effort to strengthen climate security for DoD. Two next steps are proposed. First, specifically with respect to the Arctic, mapping the climate security dimensions of our Allies and partners is essential because building awareness of how other nations are preparing for climate change is critical to understanding the risks and opportunities across strategic, operational, and tactical environments (DCRA, 2021, p.6). Second, a roundtable comprising experts to discuss the contours of a climate security framework seems to be in order.

At the end of the day, climate-inducted impacts are now referred to as DoD's new "forever war" (Gramer & Lu, 2021). DoD cannot be responsible for all aspects of climate security. Nonetheless, the Department is poised to lead (Condit 2023). A climate security framework could go a long way in reducing complexities and fostering a shared understanding of the challenges that await the US and its Allies and partners in the decades ahead.

REFERENCES

Ahkinga, O., Alexander, E., Apassingok, M.D., Baker, B., Baker, M., Berman, M., Blair. M., Bloom, E., Burns, N.J., Copenhaver, A.E., Cravalho, E.Q., Donatuto, J., Dunton, K., Fletcher, S.V., Froehlich, E., George, J.C., Harris, C., Heavner, M., Hoffbeck, M., Holland, M., Jorgenson, M.T., Kelly, B.P., Kerttula, E., Kling, G.W., Koch, C.W., Landrum, L., Lange, S., Lukin, M.K., Marino, E., Metcalf, V.K., Nunn, C., Pincus, R., Pungowiyi, P., Robards, M., Schaeffer, J.Q., Shahbazi, A., Shultz, A., Turner, D.T., Walsh, J.E., Wiese, F., Wong, G., & Wilson, J. (2022). Consequences of rapid environmental arctic change for people. NOAA Technical Report OAR ARC; 22-16. National Oceanic and Atmospheric Administration. Office of Oceanic and Atmospheric Research. DOI: 10.25923/kgm2-9k50

Alaska Interagency Coordination Center. (2023). https://fire.ak.blm.gov/

Ballinger, T.J., Bigaalke, S., Walsh, J.E., Brettschneider, B., Thoman, R.L., Bhatt, U.S., Hanna, E., Hanssen-Bauer, I., Kim, S-J., Overland, J.E., & Wang, M. (2023). Surface air temperature. Arctic Report Card: Update for 2023. National Oceanic and Atmospheric Administration. https://arctic.noaa.gov/report-card/report-card-2023/surface-air-temperature-2023/

Ballinger, T. J., Overland, J. E., Wang, M Walsh, J. E., Brettschneider, B., Thoman, R. L, Bhatt, U. S., Hanna, E., Hanssen-Bauer, I., Kim, S.-J. (2022). Surface air temperature. *NOAA Technical Report OAR ARC; 22-02*. National Oceanic and Atmospheric Administration. Office of Oceanic and Atmospheric Research. DOI: https://doi.org/10.25923/13qm-2576

Bastian, K., Apitz, C.C., Hagemann, F., & Tettweiler. F. (2023). Translating the climate-security nexus. *George C. Marshall Center Policy Brief*. Policy Brief "Translating the Climate-Security-Nexus" (marshallcenter.org)

Condit, C. (2023, September 18). Shifting the climate security narrative: How the department of defense can lead. *New Security Beat: The Blog of the Environmental Change and Security Program.* Woodrow Wilson International Center for Scholars. Shifting the Climate Security Narrative: How the Department of Defense Can Lead | New Security Beat

Cusick, D. & E&E News. (2023, May 24) US military sees growing threat in thawing permafrost. *Scientific American*. US Military Sees Growing Threat in Thawing Permafrost | Scientific American

Dalby, S. 2020. Environmental security and climate change. *International Studies*. International Studies Association and Oxford University Press. https://doi.org/10.1093/acrefore/9780190846626.013.168

Department of Defense. (2016, January 14). Climate change adaptation and resilience. *Directive 4715.21*. https://dod.defense.gov/Portals/1/Documents/pubs/471521p.pdf

Department of Defense, Office of the Undersecretary of Defense (Acquisition and Sustainment). (2021, September 1). Department of defense draft climate adaptation plan (DCAP). *Report Submitted to National Climate Task Force and Federal Chief Sustainability Officer*. https://media.defense.gov/2021/Oct/07/2002869699/-1/-1/0/DEPARTMENT-OF-DEFENSE-CLIMATE-ADAPTATION-PLAN-2.PDF

Department of Defense, Office of the Undersecretary for Policy (Strategy, Plans, and Capabilities). (2021, October). Department of defense climate risk analysis (DCRA).

Report Submitted to National Security Council. https://media.defense.gov/2021/Oct/21/2002877353/-1/-1/0/DOD-CLIMATE-RISK-ANALYSIS-FINAL.PDF

Department of Defense, Office of the Inspector General. (2022, April 13). (U) Evaluation of the department of defense's efforts to address the climate resilience of U.S. military installations in the arctic and sub-arctic (IGRA). Report No. DODIG-2022-083: (U) Evaluation of the Department of Defense's Efforts to Address the Climate Resilience of U.S. Military Installations in the Arctic and Sub-Arctic

Department of Defense, Office of the Undersecretary of Defense (Acquisition and Sustainment). (2022, 4 October). Department of defense climate adaptation plan 2022 progress report (DCAP-PR). *Report Submitted to National Climate Task Force and Federal Chief Sustainability Officer*. https://media.defense.gov/2022/Oct/06/2003092213/-1/-1/0/2022-DOD-CAP-PROGRESS-REPORT.PDF

Department of Defense. (2022, October 27). National Defense Strategy of the United States of America (NDS). 2022 National Defense Strategy, Nuclear Posture Review, and Missile Defense Review

Department of Defense, Office of the Undersecretary of Defense (Acquisition and Sustainment). (2023, May). Report to congress: Permafrost thaw on infrastructure, facilities, and operations of the department of defense. USA002211-22 RTC Permafrost Thaw USD.pdf (osd.mil)

Doyle, C. (2023, July 21). The climate security nexus: A transatlantic conversation with NATO. *New Security Beat: The Blog of the Environmental Change and Security Program*.

Woodrow Wilson International Center for Scholars. The Climate Security Nexus: A Transatlantic Conversation With NATO | New Security Beat

Efron, S., Klein, K. & Cohen, R.S. (2020). Environment, geography, and the future of warfare: The changing global environment and its implications for the US air force. *Research Reports.* RAND Corporation. https://www.rand.org/pubs/research_reports/RR2849z5.html

Glenn-Borade, R.T., Adams, B., Schaeffer, R., SimsKayotuk, C., Omnik, G., Leavitt, J.M., & Hauser, D.D. W. (2023). Nunaaqqit savaqatigivlugich: Working with communities to observe the arctic. Arctic Report Card: Update for 2023. *DOI: 10.25923/2sx6-kx89*

Goodman, S. (2012, April 15). What is environmental security? *Yale insights*. https://insights.som.yale.edu/insights/what-is-environmental-security

Goodman, S., Guy, K., Maddox, M., Hansen, V.V., Sending, O.J., & Winther, I.N. (2021, January). Climate change and security in the arctic. Francesco Femia and Erin Sikorsky (eds.). *The Center for Climate and Security (CCS), an institute of the Council on Strategic Risks (CSR), and The Norwegian Institute of International Affairs (NUPI).* https://climateandsecurity.org/wp-content/uploads/2021/01/Climate-Change-and-Security-in-the-Arctic_CCS_NUPI_January-2021-1.pdf

Gramer, R. & Lu, C. (2021, August 5). Climate change disaster response is the military's new forever war. *Foreign Policy*. https://foreignpolicy.com/2021/08/05/climate-change-military-new-forever-war-wildfires/

Gray, D. (2021, April). What makes successful frameworks rise above the rest? *MIT Sloan Management Review*. https://sloanreview.mit.edu/article/what-makes-successful-frameworks-rise-above-the-rest/

Guy, K. & Churchill, K. (2021, May). Temperatures and tensions rise: security and climate risk in the arctic. Temperatures and Tensions Rise (arcgis.com)

Lindsey, R. & Scott, M. (2023, December 12). Arctic Report Card: Update for 2023. *Climate.gov*. National Oceanic and Atmospheric Administration. https://www.climate.gov/news-features/understanding-climate/2023-arctic-report-card-image-highlights

Jolly, R., & Ray, D.B. (2006). The human security framework and national human development reports: a review of experiences and current debates. United Nations Development Programme: National Human Development Report Unit.

Marlatt, R. (2022, October 27). The intersection of U.S. military infrastructure & alaskan permafrost through the 21st century. The Arctic Institute. https://www.thearcticinstitute.org/intersection-military-infrastructure-alaskan-permafrost-21st-century/

Meier, W. N., Perovich, D., Farrell, S., Haas, C., Hendricks, S., Petty, A.A., Webster, M., Divine, D., Gerland, S., Kaleschke, L., Ricker, R., Steer, A., Tian-Kunze, X., Tschudi, M., & Wood, K. (2021). Sea ice. Arctic Report Card: Update for 2021. National Oceanic and Atmospheric Administration. *DOI: 10.25923/y2wd-fn85*

Meier, W.N., Petty, A., Hendricks, S., Kaleschke, L., Divine, D., Farrell, S., Gerland, S., Perovich, D., Ricker, R., Tian-Kunze, X., & Webster, M. (2023). Sea ice. Arctic Report Card: Update for 2023. National Oceanic and Atmospheric Administration. *DOI: 10.25923/f5t4-b865*

Mersmann, K. (2023, September, 25). Arctic sea ice 6th lowest on record; Antarctic sees record low growth. https://www.nasa.gov/centers-and-facilities/goddard/arctic-sea-ice-6th-lowest-on-record-antarctic-sees-record-low-growth/

National Intelligence Council. (2021). National intelligence estimate (NIE). Climate change and international responses increasing challenges to US national security through 2040. Office of the Director of National Intelligence. https://www.dni.gov/files/ODNI/documents/assessments/NIE_Climate_Change_and_National_Security.pdf

National Oceanic and Atmospheric Administration (NOAA). (2023). Arctic report card: Update for 2023. https://arctic.noaa.gov/report-card/report-card-2023/

NATO, (2021, 14 June). NATO climate change and security action plan. NATO - NATO Climate Change and Security Action Plan, 14-Jun.-2021

Nevitt, Mark (2023, January 6). The climate-security nexus. *American Bar Association 60th Anniversary Anthology (National Security Law*). SSRN: https://ssrn.com/abstract=4321229

NORAD/USNORTHCOM. (2021). Strategy: Executive summary. https://www.northcom.mil/Portals/28/(U)%20NORAD-USNORTHCOM%20Strategy%20EXSUM%20-%20Signed.pdf

Ogasa, N. (2023, January 17). Cyclones in the Arctic are becoming more intense and frequent. *Science News*. https://www.sciencenews.org/article/cyclones-arctic-intense-frequent-climate

Schwing, E. (2023, December 13). Researchers just created the world's first permafrost atlas of the entire arctic region. *Scientific American: Science, Quickly*.

https://www.scientificamerican.com/podcast/episode/researchers-just-created-the-worlds-first-permafrost-atlas-of-the-entire-arctic/

Thoman, R.L., Moon, T.A, & Druckenmiller, M.L. (2023). Executive summary. *Arctic Report Card: Update for 2023*. National Oceanic and Atmospheric Administration. https://arctic.noaa.gov/report-card/report-card-2023/executive-summary-2023/

Westerveld, L., Kurvits, T., Schoolmeester, T., Mulelid, O. B., Eckhoff, T. S., Overduin, P. P., Fritz, M., Lantuit, H., Alfthan, B., Sinisalo, A., Miesner, F., Viitanen, L.-K., & the NUNATARYUK consortium (2023). Arctic permafrost atlas. GRID-Arendal, Arendal. https://www.grida.no/publications/998

The White House. (2022, October). National security strategy (NSS). https://www.whitehouse.gov/wp-content/uploads/2022/11/8-November-Combined-PDF-for-Upload.pdf

The White House. (2022, October). National strategy for the arctic region (NSAR). https://www.whitehouse.gov/wp-content/uploads/2022/10/National-Strategy-for-the-Arctic-Region.pdf

Yllemo, J. O. (2022, Spring). Climate security and national security. *American Security Project. Spring 2022 Briefing Note.*