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Representing Arctic Change and Environmental Security Through a One Health Lens

Ellee Parry
Research and Analysis Division, Ted Stevens Center for Arctic Security Studies, 8414 McGuire Avenue, Anchorage, AK 99506, USA

The whole notion of security as traditionally understood in terms of political and military threats to national sovereignty - must be expanded to include the growing impacts of environmental stress - locally, nationally, regionally, and globally.

- *Our Common Future, United Nations Commission on Environment & Development, 1987 (Brundtland, 1987)*

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Introduction

The Arctic region is home to diverse ecosystems that thrive in some of the most extreme conditions on the planet. As a result, the region's plant, animal, and human inhabitants are inherently resilient. However, Arctic temperatures continue to rise at nearly twice the rate of other parts of the world, resulting in a cascade of ecological ramifications that threaten the region's environmental security (IPCC, 2021). Such ramifications include changes in the magnitude and frequency of extreme weather events, altered plant and animal species distribution, increased coastal erosion, and permafrost degradation (Dudley et al., 2015). The direct impact of these changes disrupts the region's ecological integrity, while the indirect effects on the natural, social, and built systems are multifaceted, dynamic, and inextricably intertwined. These challenges impact political stability, human security and resilience, and the global economy, making environmental security a critical pillar of the United States' (U.S.') national security (Katsos, 2018).

Given the complex and multifaceted nature of climate change in the Arctic region, holistic and transdisciplinary perspectives, and corresponding approaches, are critical to addressing environmental security in the Arctic today, and into the future. One Health is a paradigm acutely relevant to this discussion, which, to our knowledge, has yet to be implemented as a lens through which to approach environmental security in the Arctic region. One Health urges an integrative and systems-based model that attempts to break down disciplinary siloes by requiring a holistic, collaborative, and interdisciplinary lens (Hueffer et al., 2019; Lebov et al., 2017). The approach is further focused on using a transdisciplinary perspective for the early identification, mitigation, and prevention of risks that intertwine the realms of human, animal, and environmental health (Ruscio et al., 2015).

Given the inextricable link between the health of humans, animals, and their shared environment in the Arctic region, it is a particularly relevant perspective in which to both examine, and address, the impacts of climate change on the Arctic's environmental security. In particular, using a One Health lens to assess climate change could enhance understanding of its multifaceted impact on Arctic environmental security, while also facilitating holistic and collaborative solutions. This special report will explore this notion by first seeking to define environmental security through a One Health lens. Next, a One Health lens will be used to examine three major environmental security challenges in the Arctic: food security, the transmission of infectious diseases, and water security. Lastly, this paper will conclude with a discussion of areas for further research.

Defining Arctic Environmental Security Using a One Health Lens

The U.S. Department of Defense's (DoD's) current understanding of the term "environmental security" can be traced back to 1987 when the United Nations World Commission on Environment and Development first referenced the term in their paper, Our Common Future (Stricof, 2021). The term emerged in recognition of climate change as a 'threat multiplier' to national security (Ibid.). The term was first coined in 2007 by the Center for Naval Analysis (CNA) Military Advisory Board to emphasize the widespread and multifaceted implications of climate change on national security (Ibid.). From a DoD perspective, these implications act as destabilizing forces, which drive the department's focus on building 'stability' and 'resilience' to ensure environmental security (Stricof, 2021). The threat multiplier concept of climate change goes hand in hand with a One Health lens, where each views the world through a systems approach and moves beyond siloed thinking (Goodman & Baudu, 2023). Where the two concepts differ slightly, however, is what makes their convergence particularly relevant to Arctic environmental security.

Using a One Health lens to approach environmental security broadens the notion in two critical ways. First, while the threat multiplier perspective of environmental security highlights the interconnected effects of climate change on the built, natural, and social systems, a One Health lens broadens this perspective to additionally emphasize the intersecting interactions with the animal health system. This more holistic emphasis is particularly relevant to the Arctic's remote and Indigenous communities who depend on wildlife harvested from marine, freshwater, and terrestrial ecosystems for both physical and cultural survival (Dudley et al., 2015). Furthermore, the COVID-19 pandemic has highlighted the need to focus on infectious diseases as a critical element of security. Applying a One Health lens to this notion illuminates the growing threats of zoonotic diseases[1], which are of increasing concern as climate change continues to alter the dynamics of disease transmission in the Arctic region (Hueffer et al., 2019; Waits et al., 2013).

Second, a critical characteristic of the One Health lens is its constructivist perspective, in which complex issues are viewed as a sum of their individual and intersecting components (Hueffer et al., 2019). In this light, solutions are focused on addressing the root causes of an issue from the bottom up, rather than simply treating the symptoms. Applying this to environmental security, this lens emphasizes the criticality of building resilience from the local and community levels in order to build strength and stability from the core. In this report, "resilience" refers to the ability of a system to recover and thrive during and after shocks and disturbances (SDWG, 2019). Numerous recent U.S. national plans and strategies additionally urge the need to focus on building community resilience, including the *2022 National Security Strategy (NSS)*, *2022 National Security Strategy for the Arctic Region (NSAR)*, and the Interagency Arctic Research Policy Committee's (IARPC's) *2022-2026 Arctic Research Plan*. While Arctic communities are inherently resilient, the characteristics of a harsh climate, rugged terrain, limited resources, and remoteness exacerbate the impacts of climate change, making it particularly challenging to ensure and maintain environmental security and resilience. In the following sections, this paper will discuss three particularly difficult challenges facing Arctic communities, while emphasizing the value of examining these issues through a One Health lens.

Food Security

In its simplest form, food security is described as a compilation of three major pillars: access, availability, and utilization (Walch et al., 2018). Access refers to the ability to attain food, availability is having sufficient and consistent food, and utilization denotes meeting daily nutritional requirements to fulfill a healthy and active lifestyle (Ibid., FAO, 2020). In the context of the Arctic, however, food security is far more complex than this description portrays. In particular, drivers to food security for many Arctic residents are intimately intertwined with the health of wildlife and the environment. However, the effects of climate change are altering the availability and predictability of these wild resources. Indigenous hunters and gatherers have identified changes in ice and trail conditions as major consequences of climate change that impact their ability to obtain subsistence[2] resources safely and sufficiently (Hueffer et al., 2019). Resource processing mechanisms are also threatened by climate change. For instance, thawing permafrost hinders the use of traditional permafrost storage cellars, resulting in food spoilage with obvious risks to food safety and human health (Ibid.). The traditional diets of many Arctic residents, which include large quantities of fish,

[1] Zoonotic diseases are infections that are spread between people and animals.
[2] In this paper, subsistence refers to a way of life that is drawn from the land.

birds, and marine mammals, further expose subsistence consumers to a variety of toxins and contaminants that circulate at high levels in Arctic ecosystems (Dudley et al., 2018). Climate change may additionally increase the levels of environmental contaminants found in key subsistence species by increasing their rates of mobilization (Ibid.). Compounding matters is a poor market food distribution system (ADLS, 2019). As illustrated by Figure 1, many Arctic communities are disconnected from the road system, and as a result, marine and/or air transportation are the primary sources of store-bought goods and services for many residents (Nordregio, 2019). Not only does this drastically increase prices, but it also means that food access and availability hinge upon the characteristics of a harsh climate, rugged terrain, expansive distances, low population densities, and thousands of islands. Such intersecting and complex threats to the food system are not as visible when examining food security using a conventional cash-economy perspective – a perspective that is standard and relevant for much of the non-Arctic regions of the Global North. A One Health lens allows for a more interdisciplinary, multidimensional, and holistic view of the drivers and barriers to food security in the region (Heuffer et al., 2019; White et al., 2007).

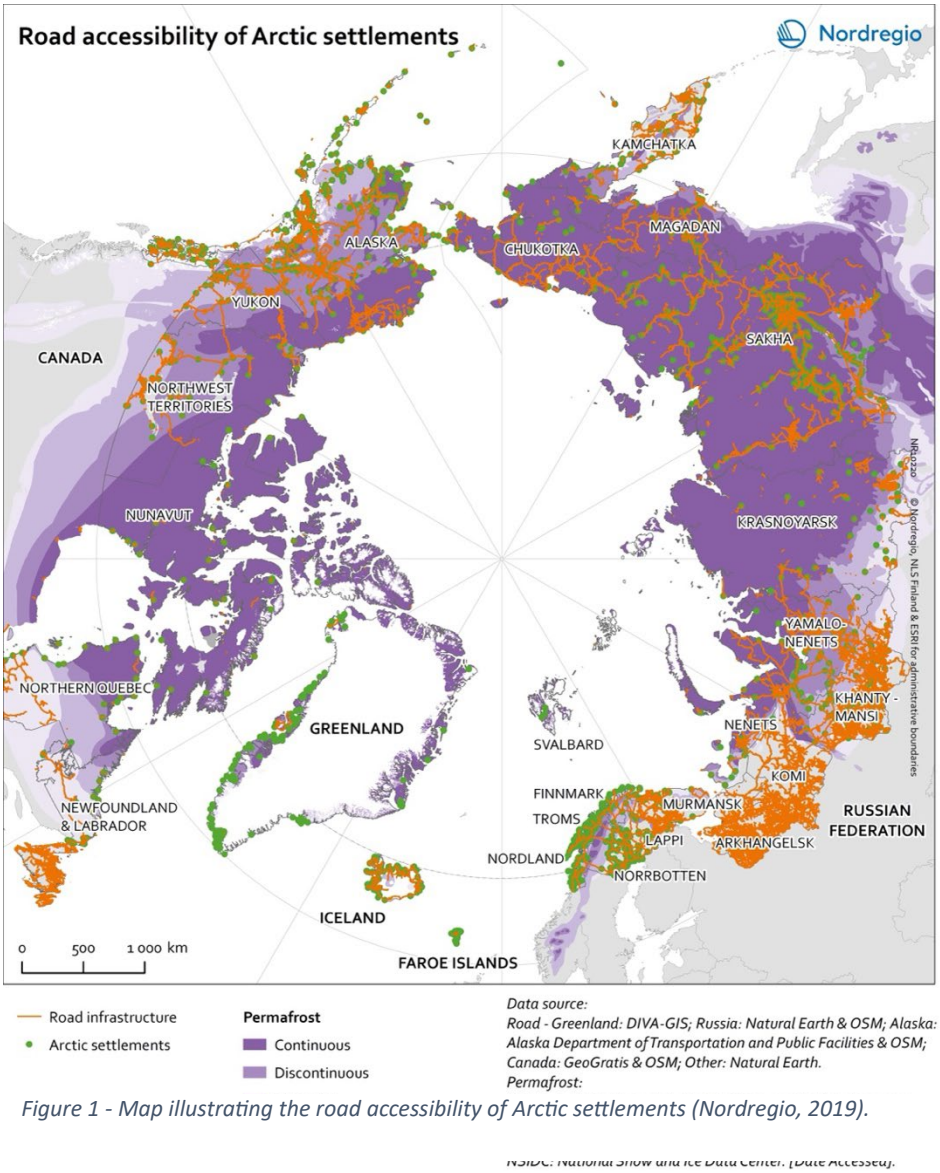

Figure 1 - Map illustrating the road accessibility of Arctic settlements (Nordregio, 2019).

Infectious Diseases

According to the World Health Organization (WHO), climate change's most detrimental impacts on human health will be driven by undernutrition and infectious diseases. A One Health lens highlights that many infectious diseases, particularly zoonotic diseases, are climate-sensitive, in which their emergence and spread are dependent on climate-related ecological conditions and changes (Parkinson et al., 2014). Changing temperatures may shift both the density and distribution of wildlife species that can serve as either reservoirs or vectors for infectious diseases, which could have significant implications on human

and animal health due to geographical shifts in disease ranges (Ibid.). Increasing temperatures may also allow a greater number of infected animals to survive winters, subsequently increasing the size of their populations and habitat ranges (Ibid.).

Zoonotic diseases can be spread either directly through human-animal contact, or indirectly through an intermediate vector (Rodríguez-Morales, 2014). Those of mounting concern in the Arctic include brucellosis, toxoplasmosis, rabies, tularemia, and anthrax (Coates & Norton, 2021; Hueffer et al., 2019). While these diseases have clear implications for human and animal health regarding the spread and transmission of illness, they also significantly threaten the food security of thousands of Arctic residents who maintain a subsistence way of life. For instance, brucellosis is a highly contagious disease caused by bacteria that occurs naturally in caribou, and toxoplasmosis can occur from eating raw or undercooked meat (such as caribou, waterfowl, or seal) (Hueffer et al., 2013). Rabies is transmitted directly to humans by both wild and domestic animals, with a greater risk from infected domestic dogs in the rural Arctic, which are frequently used as a source of transportation for hunting and gathering (Waits et al., 2018). Humans can become infected with both tularemia and anthrax through exposure to contaminated water or by handling infected animal carcasses, which is of increasing concern as thawing permafrost is exposing the carcasses of animals infected with the diseases during historical outbreaks (Ibid.).

Public health officials are also concerned with the potential for the increased transmission of zoonotic diseases as a result of human migration and transit. Humans have migrated for millennia for environmental, socioeconomic, and political reasons (Coates & Norton, 2021). In the climate change literature, migration is referenced as one of the multiple ways in which humans may adapt to the negative impacts of climate change (McLeman & Hunter, 2010). Increased migration to Northern latitudes could lead to a subsequent increase in both human-human and human-animal interactions, elevating the risk of transmission and spread of infectious diseases in the Arctic. Mass migration additionally destabilizes healthcare infrastructure, which is already critically limited throughout the Circumpolar North.

Water Security

Water security epitomizes the notion of a One Health concept, as it intersects with all aspects of life. United Nations Water defines water security as “[t]he capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability” (UNW, 2013). In the Arctic, ensuring water security is particularly complex as many Arctic communities lack piped water systems (Cassivi et al., 2023). As a result, many residents rely on surface water for both domestic and transportation purposes (White et al., 2007). Surface water availability and safety, however, are dependent on the surrounding climatic conditions, which adds a significant layer of complexity and vulnerability when it comes to harvesting subsistence foods, as well as preventing the transmission and spread of infectious diseases. Changes in precipitation, timing of freeze and break-up, and fire regimes can each cause hydrological changes with cascading impacts on sanitation, safe drinking water, and the food systems of many remote and Indigenous populations (Ibid). This includes implications on transportation, the accessibility of harvesting areas, the migration of key subsistence species, and the ability to mitigate the risks associated with water-borne illnesses and toxins (Ibid.; Cassivi et al., 2023).

Implementing a One Health Lens to Enhance Environmental Security in the Arctic: Areas for Future Research

Not only does One Health provide a lens through which to evaluate the complex and interconnected threats to Arctic environmental security, but also to develop collaborative and transdisciplinary plans and solutions that are focused on building resilience from the bottom up. Research can provide the foundation for the development of these plans and solutions, particularly in the form of decision-support tools, but collaboration among local, tribal, state, and federal agencies, public health professionals, academics, policymakers, and Indigenous communities and leaders is needed to develop the most comprehensive and innovative solutions. This echoes similar calls to action made by recent U.S. national plans and strategies.

As described previously, food security in the Arctic is a complex and dynamic challenge that is disproportionately impacting the region's rural and Indigenous communities. The 2022 NSS stated that "[t]his requires working across entire food systems to consider every step from cultivation to consumption, and to integrate these efforts within the larger climate, health, conflict mitigation, and peacebuilding work" (TWH, 2022a, pg. 29). Applying this to food security in the Arctic region, working across the entire food system first calls for the development of holistic measurement tools with the ability to assess the system. However, conventional metrics are focused on the monetary variables of food security, such as income, unemployment, and the average cost of food (Deaton et al., 2020). While these factors are relevant to cash economies, they lack the ability to capture the One Health aspects of food security that make it a critical component of environmental security in the Arctic region, such as drivers from climate change, animal migration, and zoonotic diseases. This is of particular importance to Indigenous populations who maintain subsistence lifestyles and economies and are disproportionately impacted by the impacts of climate change. To develop the most accurate tools relevant to the entire Arctic food system, cooperation and partnership amongst Indigenous communities, public health professionals, scientists, and decision-makers would be required.

The 2022 NSAR additionally highlighted that diminishing sea ice is opening new shipping routes which could facilitate a substantial increase in human transit throughout the region, particularly among small, remote coastal communities (TWH, 2022b). This increase in mobility is coupled with an increased risk of multi-hazard events, both natural and manmade. In the Arctic, these events exist at the interplay between the built, social, and natural environments, particularly in remote areas where many communities have limited infrastructure, disaster response capabilities, and law enforcement, in addition to maintaining mixed cash/subsistence-based economies. These characteristics add a significant layer of complexity and vulnerability when it comes to ensuring the health security, environmental security, and corresponding stability, of the Arctic region. To address these complex and interdisciplinary threats, more research is needed to develop holistic risk analyses for the communities facing the greatest impacts of increased maritime traffic. A One Health lens can assist in developing comprehensive and multidisciplinary risk assessments as decision support tools. This would require involvement and collaboration from the maritime shipping domain, Indigenous communities, veterinarians, public health professionals, and even disaster response practitioners.

Conclusion

Environmental security in the Arctic is exceedingly complex. One Health is a transdisciplinary lens ideally suited for both examining these complexities, as well as for developing innovative and collaborative approaches to addressing these challenges. An integral characteristic of the One Health perspective is its emphasis on using bottom-up approaches to enhance stability and resilience at the community level.

Ensuring strength and resilience at this foundational level serves as a mechanism to strengthen the core of the Arctic system. Research serves as a critical vehicle to employ One Health approaches and should focus on enhancing our scientific understanding of the multifaceted threats facing Arctic communities. As stated by the 2022 NSS, "[t]he future of America's success in the world depends upon our strength and resilience at home" (TWH, 2022a, pg. 14).

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