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Polar Environmental Security: Challenges, Threats, and Realities

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The role of the environment in structuring the ecology of plants and animals has long been a focus of classical ecological research; however, recent developments in environmental security literature suggest that ecological conditions extend beyond flora and fauna to impact human security (Dalby 2018; Lee 2018), and potentially to defence and other areas of security. For example, Dalby (2018) proposed the concept of environmental security to encompass relative inequalities in environmental resources as a source of envy, disagreement, and conflict among human groups. Rising competition between groups of people has resulted in resource wars between poor and rich regions (Renner, 2002).

Over time, researchers have proposed a variety of interconnected variables that may impact environmental security. Early research suggested that acute human conflict can result from environmental change, specifically direct association of environmental degradation and scarcity with conflict among groups and "nation-states" (Homer-Dixon, 1991). Other research has examined a strong one-way, two-factor interaction between the human-based valuations of the environment and a generalized assessment of "human security" (Dalby 2018; Lee 2018). In this two-factor interaction between the human-based valuation of the environment and a generalized assessment of human security, the driver is the magnitude

of disparity in an environmental resource of value, necessity, or strategic advantage (Conca and Beevers 2018; Gleditsch 1998). The more significant the difference between the assessed value of environmental resources and the availability of those resources, the more likely the prospect of conflict. Accelerators in this type of interaction may include the nature and degree of civil or social instability or the status of human security and change in the relative status of environmental resources, whether through time or by comparison between regions.

In contrast to socio-political perspectives, Klubnikin and Causey (2002) viewed potential interactions between the environment and human populations from an ecological perspective. Specifically, they argued that environmental change dynamics underlie a strong three-factor interaction among environmental security, human security, and defence security. Stated differently, changes in the natural ecology of the environment may drive significant interactions among and between these factors. Some are two-factor interactions like environmental status and human resource actions (Dalby 2018; Lee 2018). Other changes, not previously recognized in this context, include intra- and international environmental prerogatives in protection activities, the acquisition of resources, and the use of unprocessed and processed natural resources. Thus, to better understand drivers and interactions resulting in changes in environmental security homeostasis and how to address it, we pose the following questions: Does a pragmatic environmental security framework exist to make sense of the challenges, threats, and realities that affect ecological, human, and defence security in the polar regions? What is a better way to unify scientific research and multiple viewpoints, and how does that work?

In this chapter, we argue that challenges, threats, and realities in polar regions may be associated with changes in ecological, human, and defence security conditions. These conditions may contribute to the predictability of the overall status of environmental security in the polar regions and may structure future strategic discourse. We present a tripartite environmental security framework comprising ecological, human, and defence security, and discuss the use of multi-track diplomacy to navigate plausible polar scenarios that may affect the North American Arctic security landscape.

Challenges, Threats, and Realities

Challenges in Polar Regions

In broad aspect, the polar regions are like other areas of the world: they are international landscapes structured by multi-national geopolitical interactions, they have long histories as economic centres for renewable and non-renewable resource extraction, and they have substantial terrestrial and marine environments. In other ways, the polar regions differ by their relative isolation from population centres, lack of substantial built infrastructure, and extreme cold environmental conditions. Both broad features present challenges and opportunities. Distinct challenges include the tyranny of time and space and the uncertainty and lack of cohesive and responsive systems encompassing a multitude of shortfalls in areas critical for humans to thrive, not least of which is a robust logistics environment, the complexity of the polar ecosystem, and differing stakeholder values and motivations.

The Arctic and Antarctic share similarities but are nevertheless distinct from each other. Both are major components of the cryosphere, thus have glaciers and icebound environments, and are distinguished by low precipitation. Major differences include geography, political structure, and human occupation. The Arctic region is dominated by a central ice-covered ocean and surrounded by coastal terrestrial environments that are all sovereign territories; Indigenous peoples have occupied the Arctic region for thousands of years, and the coastal biotic environment is dominated by terrestrial-based plants and animals. By contrast, the Antarctic region is dominated by an ice-covered continent surrounded by the Southern Ocean. It is shaped by history and governed by international treaties (Sheikh, Vaughn, and Procita 2021). There are no sovereign territories or permanent inhabitants. The coastal environment is dominated by marine birds and mammals, with only a few isolated areas with any vegetation. As we discuss below, these ecological and geopolitical aspects play a significant role in structuring the security environment of the polar regions. We focus on the Arctic region, given its greater complexity of social, environmental, and geopolitical realities, and reflect on its differences and similarities with the Antarctic region.

Threats

Threats to environmental security may be interruptions in homeostasis in the ecological, human, and defence realms. In the polar regions, a critical threat is a lack of situational awareness. This may negatively affect the comprehension of baseline conditions, which in turn may lead to unforeseen changes without foresight into what and how to change.

Realities

The polar regions are experiencing profound physical changes: reduced sea ice, thawing permafrost, wildfires, diminished shore-fast ice, precipitation events, and increasing storm severity. Generally, researchers expect continued change, particularly in the form of reduced ice coverage at the peak of the summer season. Specifically, current climate research indicates that the Arctic maritime region is experiencing a decrease in sea ice extent and thickness (and thus "volume") due to changes in atmospheric and maritime conditions. Associated with changes in the Arctic Ocean and the adjoining Bering, Beaufort, and Chukchi Seas, which are associated with the US Arctic Extended Economic Zone, are a number of fine-scale changes in the marine environment's physical, chemical, and biological characteristics, most of which are projected to continue through the twenty-first century. Research suggests that in maritime and coastal regions, terrain frozen for more than a millennium may thaw, creating unique challenges for residents affecting infrastructure, eroding coastal and riverine environments, and jeopardizing current ways of life in villages and small communities (Huntington and Pungowiyi, 2009). Associated with these disruptions are ecological perturbations in Arctic flora and fauna, such as invasive species like beavers and killer whales, along with changes in resident species.

The "New Arctic"

As physical changes continue, the region is more readily accessible to a broader range of actors, vessels, and marine activities (Causey and Greaves, 2021). Some research indicates that by the mid-2030s, Canada's Northwest Passage and Russia's Northern Sea Route may be more reliably open from midsummer to autumn. Increasingly, forecasters predict that transpolar maritime routes may become navigable by ice-hardened vessels and vessels

following in convoys behind icebreaking ships as early as the late 2020s or early 2030s. This access could facilitate further changes if commercial maritime traffic commences large-scale efforts and significantly reduces the distance to transit between Asia and Europe via a transpolar maritime route. While a transpolar route connecting Europe and East Asia reduces transit time and allows for substantially larger vessels when compared to the Panama Canal or the Suez Canal routes, neither distances nor vessel size necessarily dictates route-determination decisions by commercial shippers, particularly for container and cargo vessels that compete for tightly scheduled pier space at on-load or destination ports (Causey and Greaves 2021; Churchill 2015). Commercial marine transits in the polar regions, and the Arctic in particular, are governed by the International Maritime Organization's Polar Code. There is the relative lack of service ports and ports of refuge, inconsistencies as regards quality and frequency of marine weather forecasts, unpredictable insurance requirements and costs, and other factors (McDorman and Schofield, 2015).

Indigenous peoples increasingly seek to take advantage of shifts in the Arctic environment as diminishing ice creates changes in access. At the same time, Indigenous peoples have inhabited the North American Arctic for millennia and have created irreplaceable cultures and resilient communities adapted to the harsh difficulties of the region (Huntington and Pungowiyi, 2009). However, this resilience is challenged in new and unanticipated ways with increased cultural and material influences from lower latitudes and a physical environment that is less predictable, all of which affects traditional subsistence-based lifestyles.

Intra- and Interstate Interactions

In the past four to five decades, the Canadian and the US federal governments, the State of Alaska, and Canadian territories have enacted legislation and policies intended to address actions from the preceding century that affected Indigenous Arctic residents in North America. However, new questions have arisen about whether further legislation and policies are needed to preserve and protect communities from the array of influences from lower latitudes. Catalyzed by physical environmental changes and broader geopolitical considerations, interest in the Arctic continues to evolve. What has remained relatively constant among Arctic nations is

an interest in continuing to seek ways to preserve the region as an area of collaboration and peace; however, with continued changes in the environment, competition over resources resulting from increasing access in the Arctic may arise (Palosaari and Tynkkynen, 2015). Although the Arctic is militarized, the region is not generally characterized as a zone of armed conflict. Arctic nations base military systems in the region for national defence readiness and active assistance in diverse homeland security operations. For example, Russia has deployed civilian and military infrastructure and systems to the Arctic, such as the S-400 Triumph anti-aircraft weapon and Bastion mobile coastal missile systems. The regional defence measures pursued by the United States include expanding fifth-generation fighter jets (F-22s and F-35As) and anti-ballistic missiles in Alaska to protect against intercontinental missile attacks. Considering rising security concerns, the leadership of the United States Coast Guard has testified before Congress about the potential need to arm icebreakers in the future. Additionally, China has introduced the concept of the Polar Silk Road (Willis and Dupledge, 2015). This action, combined with attempts to use Arctic resources to "pursue national interests" and investments in the region, sets the stage for a potential power competition not seen since the close of the Cold War. Other non-Arctic nations and actors, including the Japanese, the United Kingdom, the Netherlands, Germany, and the European Union, demonstrate interests spanning a wide variety of areas, ranging from alternate transit routes, foreign trade, and marine transport to the exploration of rare earth minerals, fishing, tourism, and scientific research. Additionally, with the North American Arctic, regional Canadian and Alaskan law-enforcement organizations note a rise in illicit activities.

Maritime security and safety issues in lower latitudes may eventually manifest in the Arctic maritime, and limited Canadian and US law-enforcement resources are needed to cover the vast yet sparsely populated region. Patrolling and policing for illicit human trafficking, illegal fishing, unregulated mineral extraction, and unsafe tourism practices present an array of complex issues that will likely worsen as opportunists and criminals conduct activities that often go undetected. An additional concern is the lack of understanding of risk and the insufficient capability to address increasing vessel traffic in vulnerable regions, such as the Bering Strait.

These concerns extend to non-maritime areas whose economic zones and border regions are for the most part unpatrolled and unsecured. As illicit activities are to likely increase, so will the risk to local, regional, national, and global security.

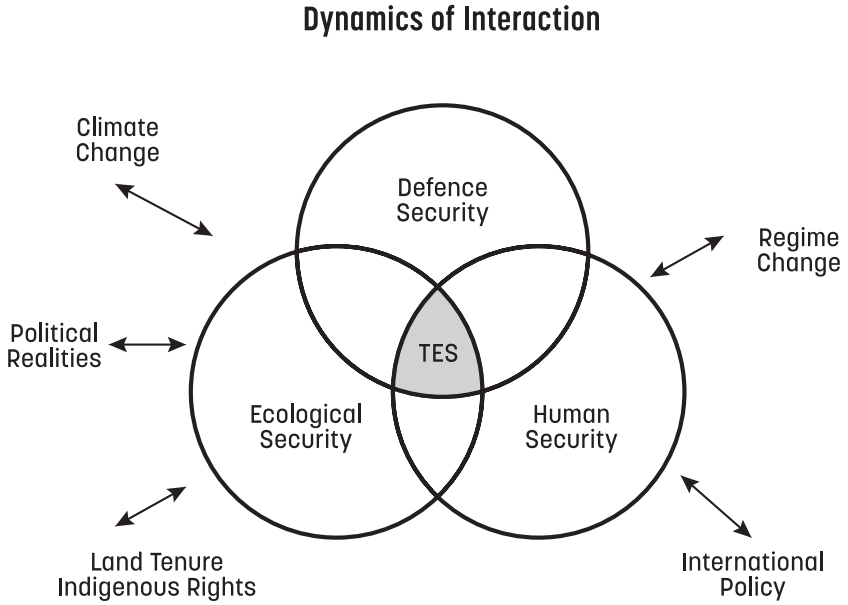
The polar regions are vast, and although these regions are largely associated with the maritime domain, the regions also include land, air, space, and cyber realms. The polar regions are sparsely populated. In the Arctic, there are only four million inhabitants (in Antarctica, no permanent residents exist). Thus, there are approximately four million unique local perspectives on life in the Arctic. This number does not account for outside perspectives. Views of reality are shaped by geographical location, cultural values, physical and mental attributes, and political and economic conditions, for both individuals and groups. Multiple perspectives from outside the Arctic and multiple external perspectives of uninhabited Antarctica further add to the complexity of security perspectives in the polar regions.

Tripartite Environmental Security Conceptual Framework

These factors discussed above can be aggregated within a tripartite environmental security (TES) framework as a practical way to unify trans-disciplinary research and activities (see figure 1.1 below). Use of a TES framework approach can lead to a deeper understanding of the variables and interactions affecting environmental security in the polar landscape. These components—categorized in one of three realms: ecological security, human security, and defence security—interact to contribute to the totality of environmental security in the polar regions. The outcomes of these interactions among and between components and sub-components can be predictable or unpredictable. Interruptions to desirable states and unknown factors and interactions, however, may result in instability and unpredictability. TES provides a visualization of threshold management in a constant temporal environment to secure solidarity measurements. In addition, the framework enables the exploration of polar scenarios that may extend beyond the region.

A review of environmental security literature found that perspectives on this topic are diverse and varied: as a component (Dalby, 1992), as a consequence (Gudev 2016; Loring and Gerlach 2015) and/or as a driver

Figure 1.1. Components of tripartite environmental security (TES).



(Berner et al. 2016; Fillion et al. 2016) of human security. Environmental security is also viewed as an antagonist (Gudev, 2016), as a facilitator (Ford 2009; Greaves 2016), or as a mitigating factor (Watts et al. 2017; White et al. 2007). Environmental security can be considered a summary outcome of these factors (Eicken et al. 2011; Stokke 2011), or of none of these (Doel et al. 2014). Varying definitions stem primarily from the lack of a single operating assumption with which to unify multiple perspectives and understandings in the literature. Further, regardless of the perspective, many terms are used interchangeably and thus the discussions so far have been obscured by lack of a collective understanding of the components and their interactions (Bazely et al. 2014; Ebinger and Zambetakis 2009).

Environmental Security as a Function of Ecological Security, Human Security, and Defence Security

Ecological Security

For this discussion, we begin by redefining traditional definitions of environmental security as ecological security to delineate between often overlapping definitions of ecology and environment; we then map these onto the TES framework. Ecological security is a statement of the relative stability of ecological processes. Changes in the polar regions may be either predictable or unpredictable. In the Arctic, rapidly thawing permafrost with consequent coastal erosion (Stokke, 2011) and melting and retreating sea and land ice (Eicken et al. 2011; Greaves 2016) may strongly interact with human security (Churchill, 2015). Furthermore, changes in habitat and species distribution will have a direct effect on food and water security, primarily (though not exclusively) by changing distributions of traditional subsistence food items (Huntington, Loring, and Gannon 2018; Medeiros et al. 2017; Natcher et al. 2016). Such changes will present a challenge to local adaptation efforts. This weakening of the internal structure of environmental interconnections may be conceptualized as a weakening of "ecosystem health" or ecological complexity. Still, direct measurement of these changes has vexed environmental ecologists from the onset of focused study (Klubnikin and Causey, 2002; 2005).

Human Security

Introduced and championed by the United Nations and summarized in the *Our Common Future* report by the World Commission on Environment and Development (1987), the concept of human security is contextual and determined by local people and communities. In the Arctic, local knowledge and local contexts are informed by history, tradition, and experience—a concept both evident and essential (Huntington and Pungowiyi 2009). Bazely et al. describe human security as providing "a framework in which local peoples can identify issues and solutions that will increase their security, and many policies, pathways, and options become available" (2014, 139). By contrast, environmental security is a statement of the relative stability of ecological processes (Klubnikin and Causey 2002).

Ecological status is classified into three categories: predictable (stable), reaching stability, or becoming unstable. Elevated levels of ecological unpredictability or instability in the Arctic, such as rapidly thawing permafrost with consequent coastal erosion (Stokke, 2011) as well as melting and retreating sea and land ice (Eicken et al. 2011; Greaves 2016) will be strongly interacting factors for human security.

Various measures can be utilized, such as productivity, population growth, or decline; however, few describe the whole state. The literature suggests that no single variable or assessment sufficiently describes the complexity of interactions between human security and environmental stability interactions (Hoel, 2015). Further research is needed to explore interactions among and between factors and to test and expand on this integrative framework.

Defence Security

Lack of situational awareness may result in misinformation, misunderstanding, or misplaced action, thereby risking a potential "security dilemma" (Byers, 2020). Until recently, defence security in polar regions—that is, nation-state assessment of threat and consequence—was often described as a distant, low-level factor of little consequence (Byers 2019; Gabrielsson and Sliwa 2014). As a result, Arctic security has traditionally been left to defence actors, militaries, and coast guards, and in the case of non-defence-related security, the Arctic Council. However, defence security in the polar regions often involves using more than just militaries; it involves diplomacy, information, military, and economics (or DIME). Given the evolving challenges, threats, and realities in the defence-security landscape, the complexities at play in the polar regions require an expanded range of powers that complement the DIME approach: finance, intelligence, and law enforcement (or DIME-FIL). Unlike DIME, DIME-FIL is not as widely addressed in the literature. But these are important factors when it comes to establishing priorities of effort within a security framework in a region with an existing history of co-operation among actors. The United States is not alone in considering these additional factors; China and Russia have long employed additional elements of power (Rodriguez, Walton, and Chu 2020).

Environmental Conflict

There are many different issues and combinations that may be characterized as environmental conflict, but there are at least four general interactions relevant to the polar regions (Lee, 2018). *Territorial and resource conflict* derives from limited access to resources and can lead to conflict that ranges from minor skirmishes to full-scale war fought for specific resources (i.e., "resource wars") (Renner 2002). *Extraterritorial resource conflict* is based in the control of resources through claims made outside of the boundaries of nation-state. *Conflict using the environment* results in environmental destruction in war and in the denial of strategic resources. *Environment in conflict* occurs when the environment is used to wage war. We use the term "conflict" intentionally to describe a general disagreement or struggle, rather than one specifically tied to aggressive disputes or armed intervention. The gradient of responses to conflict can span from parliamentary resolutions to armed conflict or outright war. Several types of environmental conflict relate directly or indirectly to the consequences associated with war and are beyond the scope of this discussion.

The study of environmental conflict reveals several commonalities (Lee, 2018). The relative abundance of a resource can be a strong driver of environmental conflict. The United States' purchase of Alaska from Russia was made with strong consideration of the availability of fur seals, a valuable natural resource that was a suitable replacement for the increasingly limited supply of beaver elsewhere in the mid-nineteenth-century United States. Later, the discovery of gold, and more recently an interest in other valuable minerals, has led to increasing competition between developers and environmentalists, culminating in the highly charged debate within the State of Alaska over the Pebble Mine copper and gold development in Bristol Bay, involving Alaska Native groups, local people, environmental activists, and the mining industry (National Parks Conservation Association, 2019).

Links between the state of environmental resources and conflict are often indirect (Gleditch 1998; Swain and Ojendal 2019). Lack of potable water, whether caused by human activities, drought, or climate change, is a global concern, and one that increasingly manifests in the Arctic. Immediate responses are often possible when public health is affected;

however, long-term responses often require regional, state, or federal action, involving complex funding, timing, and alternative negotiation (Causey and Edwards 2008; Essak 2018; Mackenzie et al. 2013; Ruscio, Brubaker, and Glasser 2015).

In polar regions, all responses—immediate to long-term—can be summarized in two categories: environmental access and environmental control.

Environmental access occurs when participants have unequal access to resources; this is often termed territorial resource conflict (Lee, 2018). Typical cases of this type of environmental conflict include degradation or disruption of ecological resources or ecosystem functions, including "ecosystem services" such as water quality, and soil stability. This may occur naturally, through fire, erosion, or weather, or it may be the result of human-created pollution or over- or under-use of existing resources. In this case, the conflict concerns specific resources and is often of an intra-state nature. Typical cases in Arctic regions involve access to potable water and restrictions on subsistence hunting and gathering (Huntington, Loring, and Gannon 2018).

Conflict over *environmental control* involves disputes for resources that lie outside of territorial limits. These occur when significant disparities as regards environmental resources exist between regions (Homer-Dixon, 1991); perhaps new means of acquisition are being developed, or a new resource is discovered. Typical cases for polar regions involve control or management of coastal fisheries or subsurface seabed claims in the Arctic and Southern Oceans (Ørebech, 2016).

Changes in environmental factors and associated conflict rarely occur simultaneously. Sometimes the change in the abundance or availability of an environmental resource is small, with only incremental effects detectable. Over time, the effects amass, and human activities are affected at a scale that behaviour is affected. An example of this is shore erosion in coastal villages in Alaska. In the coastal villages of Kaktovik, located on the Beaufort Sea, and Shishmaref, located on the Chukchi Sea, changes in environmental factors have been noticed by local people for years, but only in the past decade have the aggregated effects spurred external actors to address the impacts on these local communities. Changes in the environment in these coastal communities resulted in a need to relocate

at great expense, which then gave rise to the questions of by whom and how the associated costs would be paid: by local villages, associated tribal authorities, state, or federal resource providers? In most active cases in the Arctic region and across the State of Alaska, these issues remain unresolved (Sutter, 2017).

The Advent of Defence Security as an Interactor

For many inhabitants of the United States, the Arctic region is a distant, remote, and relatively unimportant region located at the top of the map. Accordingly, the Arctic is deemed intractable, inaccessible, and the haven of polar bears and Indigenous hunters (Doel et al. 2014; Nopens 2010). Likewise, Antarctica is characterized as a region of penguins, seals, and visiting scientists, differing only in that the region is located at the bottom of a Mercator projection map.

Characteristics of polar regions include small populations above the Arctic Circle. Approximately four million people are year-round residents of the Arctic, roughly 50 per cent of whom live in Russia, all with limited infrastructure and a history of international co-operation or an absence of international conflict. Antarctica has no permanent inhabitants. Instead, it is principally a destination for visiting scientists and support personnel associated with research activities. Typical assessments of the polar regions as regions of co-operation have been attributed to a lack of underlying drivers of conflict consequently resulting in peace, co-operation, and stability.

The concept of limited conflict in the polar regions due to similarities and isolation is flawed. Differences in geography, land tenure and ownership, history, economics, and governance exist. When viewed through a geographical lens, the Arctic is an ice-covered polar ocean surrounded by the low-population coastal regions of nation-states. By contrast, the Antarctic is an uninhabited continent surrounded by an ice-covered stretch of the Southern Ocean. Antarctica fits the definition of *terra nullius*; however, the Arctic rarely has been so considered. A few small and isolated localities—Svalbard and the North Pole—fit that definition. However, the Arctic is home to various Indigenous peoples whose presence and land tenure predate European explorations and inhabitation, whereas Antarctica has none. In this sense, the closest equivalency for the polar regions is in marine transportation: the use of and access to polar

regions from the beginning have been primarily by sea. Thus, traditional concepts of free passage apply to both the Arctic and the Antarctic (Burgess et al. 2017).

Multi-Track Diplomacy

Track One Diplomacy

Track one diplomacy is a *traditional* diplomatic interaction, otherwise known as *official diplomacy*: "an instrument of foreign policy for the establishment and development of contacts between governments of different states through the use of intermediaries mutually recognized by the respective parties" (Magalhaẽs, 1988). This type of formal, state-to-state interaction follows traditional protocols and is exercised by diplomats, government officials, and heads of state (Mapendere, 2006). This approach has its strengths and weaknesses. A key strength is that negotiators speak with the full authority of the entities they represent. A disadvantage is that apolitical considerations often supersede political ones.

Track Two Diplomacy

Track two diplomacy is defined as "unofficial, informal interaction between members of adversary groups or nations that aim to develop strategies to influence public opinion . . . [or] organize human and material resources in ways that might help resolve their conflict" (Montville, 1991). A key strength of track two diplomacy is the unofficial nature of the interactions and the opportunity for incremental iterations that advance ways of achieving reconciliation through lower-risk engagement. Negotiating parties are not inhibited by political or constitutional power; however, they have limited ability to influence foreign policy and political power structures (Mapendere, 2006). Regardless, track two diplomacy is often employed by negotiating powers, and is a key tool employed by the US Department of State and the diplomatic agencies of other nation-states for issues that are not deemed crises and that require time or knowledge to reach a consensus or agreement. In the past several decades, an alternative approach to conflict or crisis diplomacy has expanded from the original two tracks to nine tracks or more (Diamond and McDonald, 1996). A comprehensive discussion of all tracks is beyond the scope of this chapter.

Instead, we focused on tracks one and two above and discuss an alternative below.

Track One and a Half Diplomacy

To fill the gap between tracks one and two, environmental security experts have recently developed the concept of track one and a half diplomacy (Staats, Walsh, and Tucci 2019). Originally described as "long-term unofficial facilitated joint analysis among negotiators," track one and a half is defined as follows:

> Public or private interaction between official representatives of conflicting governments or political entities such as popular armed movements, which is facilitated or mediated by a third party not representing a political organization or institution. Such interaction aims to influence attitudinal changes between the parties to change the political power structures that caused the conflict. (Mapendere 2006, 69)

Track one and a half diplomacy differs from tracks one and two in both the status and the diversity of participants. Here, a third party, not representing a nation-state or political entity, acts as a negotiator. Further, the negotiating participants are official representatives of the conflicting groups. In track two diplomacy, the negotiating parties are often influential citizens, including former government leaders and formal officials. Track on and a half diplomacy, also known as hybrid diplomacy, blends the features of tracks one and two to enable resolution and agreement (Mapendere, 2006).

Whether intended or not, the Arctic Council is considered by some a notable example of track one and a half diplomacy. It seeks to identify, and often works to resolve, environmental security concerns in the Arctic (Sarson et al. 2019), though matters of "hard" security are not addressed. Similarly, several participating entities have described the Arctic Council as a model of multi-track diplomacy (Conley and Zagorski, 2017). The Arctic Council includes eight Arctic nation-states: Canada, the Kingdom of Denmark (Greenland), Finland, Iceland, Norway, Russia, Sweden, and the United States, and six international organizations representing Arctic

Indigenous peoples, as well as other entities with observer status. Some researchers suggest that despite the fact that the Arctic Council lacks the formal ability to create, implement, or enforce treaties, working as it does entirely by consensus, it has been able to address many non-security-related Arctic issues (Heininen and Finger 2018; Rowe and Blakkisrud 2014; Sergunin and Konyshev 2014). However, there is considerable debate as to whether and how these processes should or could be advanced into a more formalized set of governance policies (Stokke, 2015).

A Pragmatic Approach to Environmental Security in the Polar Regions

Based on an informed understanding of existing models, and an examination of outcomes of policies and practices, our approach is both pragmatic and integrative, connecting multiple perspectives and formal inquiries to deliver on a continual basis actionable knowledge to address environmental security in the polar regions, with a principal focus on the Arctic. Advancing an improved posture of environmental security in the polar regions may enable the ability to identify the risks of a changing polar physical ecosystem categorized and then reconciled against factors that matter across the diplomacy, information, military, economics, finance, intelligence, and law-enforcement DIME/DIME-FIL construct.

An analytic investigation of the three-factor environmental security paradigm first introduced by Klubnikin and Causey (2002) will contribute to practical and applicable problem-solving capabilities with which to address current and future challenges, threats, and realities. We believe this approach addresses the dichotomy between various perspectives on environmental security and published research to produce previously unavailable knowledge. The dual nature of truth and knowledge from beliefs allows for a range of practical and useful environmental security solutions to address a wide range of challenges, threats, and realities. This approach provides a foundation and a conceptual framework to identify, categorize, and assess ecological security, human security, defence security attributes, and interactions. Unpredictability may be the norm in environmental security, but the desired outcome is predictability. These interactions may result in either homeostasis (stability), or positive or negative interruptions

to homeostasis. The principles of pragmatism (Peirce, 1935) used to design TES promote the ongoing researcher-practitioner partnership and promote the development of practical solutions that enhance environmental security in the polar regions.

The response to complex and diverse problems is flexibility and a diversity of solution sets derived from multiple perspectives, a transdisciplinary approach, objective and subjective explorations, and qualitative and quantitative research strategies. The TES framework attempts to identify and assess consequences and interruptions to homeostasis and helps focus for challenge-prevention measures. TES acknowledges the spatial and temporal qualities of threats, challenges, and realities, and the interconnectedness of perspectives and published scientific research.

Discussion

Changes across the polar regions, and associated variations in the impact of these changes, mean that the nature of environmental security in the Arctic is rapidly transforming. Old scenarios and solutions may no longer be relevant. This applies not just to the nature of potential disasters, but also to the way security actors respond. Changing conditions in the Arctic Ocean and surrounding coastal regions demonstrate the need for security and defence professionals to seek and account for environmental security factors in order to reduce risk and better accomplish their missions to secure and defend their respective territories.

Arctic security has traditionally been left to defence actors such as navies, other armed forces, or associated national coast guards. However, law-enforcement organizations, other security personnel, and finance professionals have an increasingly vital role to play. Challenges, threats, and realities will continue to evolve and will need to be addressed, including through search and rescue, disaster mitigation, and humanitarian aid. This raises the question of the role of geopolitics in regional development and governance: Will geopolitics become increasingly competitive, or will it tilt toward a greater degree of peaceful co-operation as Arctic states either maintain the status quo or become even more mindful of the common threats they face and the attendant need for regional stability? To date, Arctic stakeholder relationships have remained relatively peaceful and co-operative; however, associated threats and capacity challenges may

result from changes in the environment, increased tourism and maritime activity, and geopolitical tensions among and between Arctic stakeholders. Conversely, the Antarctic region remains governed by the Antarctic Treaty (United Nations, 1959). Nevertheless, both signatory and non-signatory nations will have to address and reconcile governance measures in the future, without an existing body, along the lines of the Arctic Council, that they can leverage as a venue of co-operative dialogue.

Growing security and operational risks continue to evolve; this includes defining the level of risk for a maritime incident in the Arctic and how to respond to challenges posed by increasing globalization and economic activity, criminal activity, smuggling, and policing. Impacts associated with diminishing ice affect subsistence harvesting, culture, safety, transportation, and building in the Arctic region. Traditional villages are at risk from these changes, thereby affecting the people of the region. The opening of greater commercial possibilities in the Arctic Ocean, especially as non-Arctic countries invest in the region, raises questions about the global impact of these changes. Actors in both Canada and the United States must contemplate risk-mitigation strategies. While general awareness, as well as some overarching plans, already exist, the multiple actors involved means that there is no single, shared perspective as regards issues like funding or political intentions.

It is imperative that we improve charting in the high latitudes and make additional investments in hydrographic mapping of the Arctic region to address challenges like supply-chain management and tourism safety. While the lack of such hydrographic mapping in the region has long been recognized, as marine traffic continues to rise across the circumpolar North, so does the risk to mass maritime response operations and their ability to potentially save hundreds to thousands of passengers on vessels in distress due to the impacts of uncharted obstacles.

In the United States, while the need to commit to a new generation of icebreakers has received some recognition, the pace of development thus far has not matched the rising, security-driven need to replace dated platforms and deliver new capacities. Canada offers icebreaking capabilities that contribute to North America's overall defence posture. Further, we must better synthesize and visualize Arctic sea ice and associated risks and hazards for maritime operation for nations, industry, and Arctic

communities. This aligns with the Arctic Council's broader goals to enhance Arctic marine safety, protect Arctic people and environments, and build Arctic maritime infrastructure.

However, some security experts identify the challenge of rising great power competition, primarily among the People's Republic of China, the Russian Federation, and the United States, as one of the principal factors demonstrating the need for greater collaborative efforts in the polar regions, and especially the Arctic. There is a potential disconnect between the hope for continued Arctic exceptionalism and the reality of the strategic geopolitical tensions that were reignited in January 2007 with the return of Russian Long Range Aviation overflights across much of the Arctic. While collaboration often assumes a normative function among Arctic nations, Russia's manoeuvring and its opaque defence-planning process continue to create uncertainty and the potential for rising tension and risk of miscalculation. Additionally, non-Arctic national actors claiming sovereignty over some part of the region may pose threats to peaceful geopolitical relations in the Arctic Ocean by introducing military activities that, if not carefully messaged and understood, may also escalate tensions and risks. Whereas competition and the potential for confrontation in and through the Arctic are substantially less than they were during the Cold War, there is nonetheless a risk of miscalculation and the possibility of rising tension and conflict. Management of this tension and the associated potential for escalation has not been fully resolved among Arctic regional militaries, and it must therefore remain a focus.

Local Community Preparedness

In addition to threats arising from great power rivalries in the Arctic, there are also a host of challenges when it comes to building community preparedness for natural and human-created disasters. This demonstrates the need to make connections between state and non-state actors, such as the Alaska Federation of Natives and the United States military, including the United States Coast Guard. With their mutual interest in ensuring security in the Arctic, established security and defence forces and Indigenous communities in Alaska and Canadian coastal communities can increase their efforts to share knowledge and improve their preparedness and community resilience (Fabbi, 2015).

Due to permafrost thawing and changing hydro- and thermodynamics, the environmental transformation of the Canadian Arctic is outpacing the design of new infrastructure. The transformation of the environment affects all communities, challenging locally based security strategies and traditional subsistence lifestyles. Arctic communities can provide critically needed infrastructure bases during emergencies and security events. A dynamically changing environment requires more flexibility in planning as well as greater preparation for stochastic events.

The changing environment influences all communities in some ways. Access to old hunting routes is becoming more difficult, affecting cultural identity as well as food security. Overall, the sustainability of local communities is at risk. Yet sustainable communities are essential to Arctic security—a case in point being the Canadian Rangers community patrol groups. These play a critical role in patrolling northern territories. Such community-based observers and defenders are a citizen-security force, adapted to the harsh and difficult environment of the North American Arctic.

Nevertheless, environmental change challenges even these basic security practices. Concern about supply chains and the logistics involved in sustaining communities and local security teams in the Arctic remain acute. For example, the transportation of essential commodities, such as fuel, to remote Arctic villages across Canada is poised between stability and instability, and this is especially troubling when security agencies rely on these communities to provide temporary infrastructure bases during emergencies or security events. We must therefore address challenges related to infrastructure and remote resourcing in order to reduce risk and improve security in the North American Arctic.

The Role of Environmental Intelligence

As the Arctic's physical environment becomes increasingly dynamic, more information on weather and climatic conditions is needed to improve domain awareness and understanding and to form the core of a new environmental security relationship between defence forces and security communities. In particular, the US National Weather Service (NWS), as one operational arm of the Department of Commerce's National Oceanic and Atmospheric Administration, routinely receives questions and requests

for information related to the ice forming or thawing in the Arctic. The NWS believes there is a need for inter-agency and international collaboration and coordination when it comes to answering these questions. At risk are potentially large energy projects and marine environments—for example, a potential fifteen billion barrels of oil in the Chukchi Sea and another estimated eight billion barrels in the Beaufort Sea.

While increased human activity in the polar regions, and especially in the Arctic, is likely to increase, such activity in the associated ecological environment remains difficult to model and forecast with precision due to lack of data, whether satellite, terrestrial, or marine based. This comes at a time when the associated aspects of a changing environment are increasingly dynamic, and less amenable to forecasting. As a result, there is a need for increased efforts in support of sustained, internationally coordinated environmental observations at various echelons, from the local to the regional and to pan-Arctic, so as to advance and provide needed data to support better forecasting. Current forecasting methods, while helpful, are limited in their ability to predict long-term changes. Most forecasts are predicated on hindcasts; they are therefore useful predictors of the future only if the future resembles many of the facets of the past.

Increased demand for fish protein, mineral wealth, and petrochemicals may drive industry and nations to further develop Arctic ecosystems, despite their having signed on to restraining moratoriums toward the Arctic. Marine traffic may continue to rise, and with such traffic, increased concerns about safety and our ability to respond to disasters as more ships ply the region's poorly sounded waters. A future Arctic will likely include increased cruise ship and liquefied natural gas transport, and increased transits in hard-to-navigate and unpredictable areas due to the presence of sea ice in waterways such as the Northern Sea Route, Transpolar Sea Route, and Northwest Passage, thereby introducing the potential for increased risk (Churchill, 2015). Difficult terrain, extreme cold weather conditions, and cycles of light and darkness, among other factors, must be factored into the region's already limited and expensive transportation and communication infrastructure and networks.

In the polar regions, and particularly in the Arctic, there is also a need for better technologies and the improved use of existing technologies, such as finding replacements for tracked land vehicles, advocating for an

increased maritime surface presence for the United States military, and in particular the US Navy and US Coast Guard, and layering intelligence tools for added capacity. Similarly, we must develop better tools to assess long-term ice and climate predictions and aid safe operations. In addition, there is a need to integrate well-established traditional Arctic knowledge with current research-derived knowledge from the scientific community and to better share and understand available knowledge. Environmentally precise information for security, economic, and transit purposes is currently difficult to obtain.

The inability to secure maritime approaches to the North American Arctic regions underscores all areas of weakness in Canada and the United States. This stems from an overall level of sustained commitment. Various departments and agencies in Ottawa and Washington sponsor studies, strategies, initiatives, and papers that address the importance of the Arctic and the need to secure each country's respective national interests in the region. However, the sustained commitment of resources to the area, particularly in ensuring individual national interests, remains lacking. The economic strength of both Canada and the United States can advance each nation's Arctic security in the face of growing great power competition within the region. Still, concerted efforts to devote resources and implement strategies and policies are needed.

A Pragmatic Approach

The pragmatic approach we propose utilizes an ecological understanding of this complex system. Delineating the interaction framework for the Arctic and Antarctic in these contexts may provide a clearer understanding of changes in these regions. Current research indicates that the effects of climate change on the polar regions are becoming increasingly apparent (Palosaari and Tynkkynen, 2015). The consequent impact on human systems and regional, national, and international settings is recognized as having potentially profound implications on multi-state actions (Burnett and Adger 2007; CNA Military Advisory Board 2014; Doel et al. 2014; Heininen 2016; Stokke 2011). The concept of environmental security as a three-factor interaction complex involving environmental stability, human security, and defence security that structures activities within the

Arctic region is now receiving greater attention from interested parties (Doel et al. 2014), but much work remains.

We offer a pragmatic approach and the tripartite environmental security framework in order to improve our understanding of the complexities of the polar regions. The TES model includes factors and their constituent components and will help describe and quantify the effects that environmental status—whether stable or moving to a new regime state—may have on the other interacting components of TES. Applying this approach and framework to complex challenges, threats, and realities may improve our understanding of changes in the polar regions. Moreover, these conditions may contribute to the predictability of the overall status of environmental security in the polar regions and may structure future strategic discourse.

Conclusion

In this chapter we have shown that the challenges, threats, and realities of polar environmental security can be addressed within a conceptual framework comprising ecological security, human security, and defence security. Formal and informal diplomacy, including multi-track diplomacy, facilitates solutions for these difficult issues, specifically by use of track one and a half diplomacy (Staats, Walsh, and Tucci 2019) with Arctic stakeholders from Canada, Norway, the United Kingdom, and the United States (ADAC, 2019). While much work remains if we are to address environmental security in the polar regions, researchers have begun to look more closely at the perceived drivers, interactions, and outcomes of various scenarios, and have categorized these actions into the components of TES: ecological, human, and defence security. Our research here suggests that a relative abundance of natural resources may be a principal driver of environmental conflict (Lee, 2018). Links between environmental resources and conflict have often been found to be indirect (Causey and Edwards 2008; Essak 2018; Mackenzie et al. 2013; Ruscio, Brubaker, and Glasser 2015), and change in environmental factors and associated conflict rarely co-occur.

At the nexus of these and other changing conditions are concerns about risk and resiliency, examples of which manifest at all levels: local, regional, national, and global. Multi-track diplomacy (Conley and Zagorski 2017; Sarson et al. 2019), as employed in the Arctic Council and in

an ADAC–Trent University workshop (ADAC, 2019), hold promise. Still, challenges like risk comprehension and such realities as the differing perspectives and values of stakeholders remain. Additionally, little is known about the risk comprehension and risk literacy of stakeholders working to advance environmental security issues in uncertain conditions.

Transforming traditional approaches to environmental security in the polar regions may involve testing our conceptual framework, addressing issues using multi-track diplomacy, and conducting relevant research into future studies and workshops. Additional areas for future research include more mixed-method environment security research bridging theories and known issues affecting the polar regions. Such efforts should go a long way toward the co-production of new and highly valuable knowledge, science, and solutions, thereby strengthening polar and Arctic security by contributing to the predictability of the overall status of environmental security in the polar regions, potentially structuring future strategic discourse.

REFERENCES

ADAC (Arctic Domain Awareness Center). 2019. *North American Arctic Marine and Environmental Security Workshop: Assessing Concern, Advancing Collaboration*. Anchorage, AK: Arctic Domain Awareness Center. https://arcticdomainawarenesscenter.org/Downloads/PDF/Arctic%20MaLTE/ADAC_Arctic%20MaLTE%202019_CANUS_Arctic%20Maritime%20and%20Environmental%20Security_Report_190109.pdf.

Bazely, D. R., J. Christensen, A. J. Tanentzap, and G. H. Gjorv. 2014. "Bridging the Gaps between Ecology and Human Security." In *Environmental and Human Security in the Arctic*, edited by G. H. Gjorv, D. R. Bazely, M. Goloviznina, A. J. Tanentzap, 129–50. New York: Routledge.

Berner, J., M. Brubaker, B. Revitch, E. Kreummel, M. Tcheripanoff, and J. Bell. 2016. "Adaptation in Arctic Circumpolar Communities: Food and Water Security in a Changing Climate." *International Journal of Circumpolar Health* 75:33820. DOI: 10.3402/ijch.v75.33820.

Burgess, J., L. Foulkes, P. Jones, M. Merighi, S. Murray, and J. Whitacre. 2017. *Law of the Sea: A Policy Primer*. Medford, MA: Fletcher School of Law and Diplomacy, Tufts University. https://sites.tufts.edu/lawofthesea/files/2017/07/LawoftheSeaPrimer.pdf.

Burnett, J., and W. N. Adger. 2007. "Climate Change, Human Security, and Violent Conflict." *Geography* 26:639–55.

Byers, M. 2019. "Cold, Dark, and Dangerous: International Cooperation in the Arctic and Space." *Polar Record* 55:32–47. DOI: 10.1017/S0032247419000160.

———. 2020. "Arctic Security and Outer Space." *Scandinavian Journal of Military Studies* 3:183–96. DOI: https://doi/org/10.31374/sjms.56.

Causey, D., and S. V. Edwards. 2008. "Ecology of Avian Influenza Virus in Birds." *Journal of Infectious Disease* 197 (Suppl. 1): S23–33. DOI: 10.1086/524991.

Causey, D., W. Greaves. 2021. "Climate Change: Reshaping the Face of the Canadian and Circumpolar Arctic." In *Beyond the Cooperation-Conflict Conundrum: Proceedings of an Arctic Security Webinar Series*, edited by P. W. Lackenbauer and P. Mason, 23–48. NAADSN Special Reports. Peterborough, ON: North American and Arctic Defence and Security Network.

Churchill, R. 2015. "The Exploitation and Management of Marine Resources in the Arctic: Law, Politics and the Environmental Challenge." In *Handbook of the Politics of the Arctic*, edited by L. C. Jensen and G. Honneland, 147–84. Northampton, MA: Edward Elgar Publishing.

CNA (Center for Naval Analysis) Military Advisory Board. 2014. *National Security and the Accelerating Risks of Climate Change*. Alexandria, VA: CNA Corporation.

Conca, K., and M. D. Beevers. 2018. "Environment and Conflict." In *Handbook of Environmental Conflict and Peacebuilding*, edited by A. Swain and J. Ojendal, 54–72. New York: Routledge.

Cokely, E. T., M. Galesic, E. Schulz, S. Ghazal, and R. Garcia-Retamero. 2012. "Measuring Risk Literacy: The Berlin Numeracy Test." *Judgment and Decision Making* 7:25–47.

Conley, H. A., and A. Zagorski. 2017. "The Arctic." In *A Roadmap for U.S.-Russia Relations*, edited by A. Kortunov and O. Oliker, 23–35. Boulder, CO: Rowman and Littlefield.

Dalby, S. 1992. "Ecopolitical Discourse: 'Environmental security' and Political Geography." *Progress in Human Geography* 16 (4): 503–22. DOI: 10.1177/030913259201600401.

———. 2018. "Climate Change and Environmental Conflicts." In *Handbook of Environmental Conflict and Peacebuilding*, edited by A. Swain and J. Ojendal, 42–53. New York: Routledge.

Diamond, L., and J. McDonald. 1996. *Multi Track Diplomacy: A Systems Approach to Peace*. West Hartford, CT: Kumarian Press.

Doel, R. E., R. M. Friedman, J. Lajus, S. Sorlin, and U. Wrakberg. 2014. "Strategic Arctic Science: National Interests in Building Natural Knowledge—Interwar Era through the Cold War." *Journal of Historical Geography* 44:60–80. DOI: 10.1016/j.jhg.2013.12.004.

Ebinger, C. K., and E. Zambetakis. 2009. "The Geopolitics of Arctic Melt." *International Affairs* 85 (6): 1215. DOI: 10.1111/j.1468-2346.2009.00858.x.

Eicken, H., J. Jones, F. Meyer, A. Mahoney, M. Druckenmiller, M. V. Rohith, and C. Kambhamettu. 2011. "Environmental Security in Arctic Ice-Covered Seas: From Strategy to Tactics of Hazard Identification and Emergency Response." *Marine Technology Society Journal* 45 (3): 37–48. DOI: 10.4031/MTSJ.45.3.1.

Essak, S. Y. 2018. "Environment: The Neglected Component of the One Health Triad." *Lancet Planetary Health* 2 (6): e238–39. DOI: 10.1016/S2542-5196(18)30124-4.

Fabbi, N. C. 2015. "Inuit Foreign Policy and International Relations in the Arctic." In *Handbook of the Politics of the Arctic*, edited by L. C. Jensen and G. Honneland, 482–500. Northampton, MA: Edward Elgar Publishing.

Fillion, M., T. A. Kenny, S. Weshe, A. Philibert, and L. H. M. Chan. 2016. "Impacts of Environmental Change on Food Security in the Canadian Arctic." *International Journal of Circumpolar Health* 75:1.

Ford, J. D. 2009. "Vulnerability of Inuit Food Systems to Food Insecurity as a Consequence of Climate Change: A Case Study from Igloolik, Nunavut." *Regional Environmental Change* 9:83–100. DOI: 10.1007/s10113-008-0060-x.

Gabrielsson, R., and Z. Sliwa. 2014. "Arctic—the New 'Great Game' or Peaceful Cooperation?" *Baltic Security Defence Review* 16:203–33.

Garcia-Retamero, R., A. Sobkow, D. Petrova, D. Garrido, and J. Traczyk. 2019. "Numeracy and Risk Literacy: What Have We Learned So Far?" *Spanish Journal of Psychology* 22:E10. DOI: 10.1017/sjp.2019.16.

Ghazal, S., E. T. Cokely, and R. Garcia-Retamero. 2014. "Predicting Biases in Very Highly Educated Samples: Numeracy and Metacognition." *Judgment and Decision Making* 9:15–34.

Gigerenzer, G., interview by David Brockman. 2011. "Annual Question 2011: What Scientific Concept Would Improve Everybody's Cognitive Toolkit?" Edge.org, accessed 21 July 2022. https://www.edge.org/response-detail/10624.

Gleditsch, N. P. 1998. "Armed Conflict and the Environment: A Critique of the Literature." *Journal of Peace Research* 35 (3): 381–400. DOI: 10.1177/0022343398035003007.

Greaves, W. 2016. "Arctic (in)Security an Indigenous Peoples: Comparing Inuit in Canada and Sami in Norway." *Security Dialogues* 47 (6): 461–80. DOI: 10.1177/0967010616665957.

Gudev, P. A. 2016. "[Non-Military Threats to the Arctic Security]." *Mirovaya Ekonmika I Mezhdunarodnye Otnosheniya* 60:72–82.

Heininen, L. 2016. "Security of the Global Arctic in Transformation—Potential for Changes in Problem Definition." In *Future Security of the Global Arctic: State Policy, Economic Security and Climate*, edited by L. Heininen, 12–34. London, Palgrave Pivot.

Heininen, L., and M. Finger. 2018. "The 'Global Arctic' as a New Geopolitical Context and Method." *Journal of Borderlands Studies* 33 (2): 199–202. DOI: 10.1080/08865655.2017.1315605.

Hoel, A. H. 2015. "Oceans Governance, the Arctic Council and Ecosystem-based Management." In *Handbook of the Politics of the Arctic*, edited by L. C. Jensen and G. Honneland, 265–80. Northampton, MA: Edward Elgar Publishing.

Homer-Dixon, T. F. 1991. "On the Threshold: Environmental Changes as Causes of Acute Conflict." *International Security* 19:5–40.

Huntington, H. P., and C. Pungowiyi. 2009. "Indigenous Perspectives." *Norwegian Polar Institute Report Series* 129:11–17.

Huntington, H. P., P. A. Loring, and G. Gannon. 2018. "Staying in Place during Times of Change in Arctic Alaska: The Implications of Attachment, Alternatives, and

Buffering." *Regional Environmental Change* 18:489–99. DOI: 10.1007/s10113-017-1221-6.

Klubnikin, K., and D. Causey. 2002. "Environmental Security and Conflict: Paradigm for the 21st Century." *Journal of Diplomacy and International Relations* 3:104–33.

———. 2005. "Beyond Trees: Forests, War, and Uneasy Peace." *European Tropical Forest Research* 43:27–28.

Kortunov, A., and O. Oliker, eds. 2017. *A Roadmap for U.S.-Russia Relations. A Report of the CSIS Russia and Eurasia Program and the Russian International Affairs Council*. Lanham, MD: Rowman and Littlefield.

Lee, J. R. 2018. "Environment and Conflict." In *Handbook of Environmental Conflict and Peacebuilding*, edited by A. Swain and J. Ojendal, 17–28. New York: Routledge.

Loring, P. A., and S. C. Gerlach. 2015. "Searching for Progress on Food Security in the North American North: A Research Synthesis and Meta-Analysis of the Peer-Reviewed Literature." *Arctic* 68 (3): 380–92. DOI: 10.14430/arctic4509.

Mackenzie, J. S., M. Jeggo, P. Daszak, and J. A. Richt. 2013. *One Health: The Human-Animal-Environment Interfaces in Emerging Infectious Diseases*. Berlin: Springer.

Magalhaës, C. J. 1988. *The Pure Concept Our Diplomacy*. New York: Greenwood Press.

Mapendere, J. 2006. "Track One and a Half Diplomacy and the Complementarity of Tracks." *Culture of Peace Online Journal* 2:66–81. https://peacemaker.un.org/sites/peacemaker.un.org/files/TrackOneandaHalfDiplomacy_Mapendere.pdf.

McDorman, T. L., and C. Schofield. 2015. "Maritime Limits and Boundaries in the Arctic Ocean: Agreements and Disputes." In *Handbook of the Politics of the Arctic*, edited by L. C. Jensen and G. Honneland, 207–26. Northampton, MA: Edward Elgar Publishing.

Medeiros, A. S., P. Wood, S. D. Wesche, M. Bakaic, and J. F. Peters. 2017. "Water Security for Northern Peoples: Review of Threats to Arctic Freshwater Systems in Nunavut, Canada." *Regional Environmental Change* 17:635–47. DOI: 10.1007/s10113-016-1084-2.

Montville, J. 1991. *Track Two Diplomacy: The Arrow and the Olive Branch*. Vol. 2 in *The Psychodynamics of International Relations*, edited by V. D. Vokan, J. Montville, and D. A. Julius, 161–75. Lexington, MA: Lexington Books.

Natcher, D., S. Shirley, T. Rodon, and C. Southcott. 2016. "Constraints to Wildlife Harvesting among Aboriginal Communities in Alaska and Canada." *Food Security* 8:1152–67. DOI: 10.1007/s12571-016-0619-1.

National Parks Conservation Association. 2019. "Position on the Pebble Mine Project." National Parks Conservation Association, 23 October 2019. https://www.npca.org/articles/2328-position-on-the-pebble-mine-project.

Nopens, P. 2010. "The Impact of Global Warming on the Geopolitics of the Arctic: A Historical Opportunity for Russia?" *Egmont Security Policy Briefs* 8: 1–9. https://www.egmontinstitute.be/the-impact-of-global-warming-on-the-geopolitics-of-the-arctic-a-historical-opportunity-for-russia-2.

Ørebech, P. T. 2016. "Terrus Nullis, Inuit Habitation and Norse Occupation—with Special Emphasis on the 1933 East Greenland Case." *Arctic Review on Law and Policies* 7:20–41. DOI: https://doi.org/10.17585/arctic.v7.262.

Palosaari, T., and N. Tynkkynen. 2015. "Arctic Securitization and Climate Change." In *Handbook of the Politics of the Arctic*, edited by L. C. Jensen and G. Honneland, 87–104. Northampton, MA: Edward Elgar Publishing.

Peirce, C. S. 1935. *The Collected Papers of Charles Sanders Peirce*. Edited by C. Hartshorne and P. Weiss. Vols. 1–6. Cambridge, MA: Harvard University Press.

Renner, M. 2002. *The Anatomy of Resource Wars*. Worldwatch Paper No. 162. New York: Worldwatch Institute, NY.

Reyna, V. R., W. L. Nelson, P. Jean, and N. F. Dieckmann. 2009. "How Numeracy Influences Risk Comprehension and Medical Decision Making." *Psychological Bulletin* 135:943–73. DOI: 10.1037/a0017327.

Rodriguez, C. A., T. C. Walton, and H. Chu. 2020. "Putting the FIL into DIME." *Joint Forces Quarterly* 97. https://ndupress.ndu.edu/Media/News/News-Article-View/Article/2106566/putting-the-fil-into-dime-growing-joint-understanding-of-the-instruments-of-pow/.

Rowe, E. W., and H. Blakkisrud. 2014. "A New Kind of Arctic Power? Russia's Policy Discourses and Diplomatic Practices in the Circumpolar North." *Geopolitics* 19:66–85. DOI: 10.1080/14650045.2013.789863.

Ruscio, B. A., M. Brubaker, J. Glasser, W. Hueston, and T. W. Hennessy. 2015. "One Health—A Strategy for Resilience in a Changing Arctic." *International Journal of Circumpolar Health* 74:27913. DOI: 10.3402/ijch.v74.27913.

Sarson, L., V. Muzik, B. Ray, G. Gambrell, L. Yona, and R. Comeau. 2019. "The Model Arctic Council: Simulated Negotiations as Pedagogy and Embodied Diplomacy." *American Review of Canadian Studies* 49:105–22. DOI: 10.1080/02722011.2019.1570955.

Sergunin, A., and V. Konyshev. 2014. "Russia in Search of its Arctic Strategy: Between Hard and Soft Power?" *Polar Journal* 4:69–87. DOI: 10.1080/2154896X.2014.913930.

Staats, J., J. Walsh, and R. Tucci. 2019. "A Primer on Multi-Track Diplomacy: How Does It Work?" US Institute for Peace, 31 July 2019. https://www.usip.org/publications/2019/07/primer-multi-track-diplomacy-how-does-it-work.

Sheikh, P. A., B. Vaughn, and K. Procita. 2021. *Antarctic: Overview of Geopolitical and Environmental Issues*. CRS Report R46708. Washington, DC: Congressional Research Service Report. https://sgp.fas.org/crs/misc/R46708.pdf.

Stokke, O. S. 2011. "Environmental Security in the Arctic." *International Journal* 66 (4): 835–48. DOI: 10.1177/002070201106600412.

———. 2015. "Institutional Complexity in Arctic Governance: Curse or Blessing?" In *Handbook of the Politics of the Arctic*, edited by L. C. Jensen and G. Honneland, 328–51. Northampton, MA: Edward Elgar Publishing.

Sutter, J. D. 2017. "Tragedy of a Village Built on Ice." CNN, 29 March 2017. https://www.cnn.com/2017/03/29/us/sutter-shishmaref-esau-tragedy/index.html.

Swain, A., and J. Ojendal. 2018. "Environmental Conflict and Peacebuilding: An Introduction." In *Handbook of Environmental Conflict and Peacebuilding*, edited by A. Swain and J. Ojendal, 1–13. New York: Routledge.

United Nations. 1959. Antarctic Treaty. 1 December 1959, 402 UNTS 71. https://treaties.un.org/doc/Publication/UNTS/Volume%20402/volume-402-I-5778-English.pdf.

Watts, P., K. Koutouki, S. Booth, and S. Blum. 2017. "Inuit Food Security in Canada: Arctic Marine Ethnoecology." *Food Security* 9:421–40. DOI: 10.1007/s12571-017-0668-0.

WCED (World Commission on Environment and Development). 1987. *Our Common Future*. Oxford: Oxford University Press.

White, D. M., S. C. Gerlach, P. Loring, A. C. Tidwell, and M. C. Chambers. 2007. "Food and Water Security in a Changing Arctic Climate." *Environmental Research Letters* 2:045018. DOI: 10.1088/1748-9326/2/4/045018.

Willis, M., and D. Dupledge. 2015. "How We Learned to Stop Worrying about China's Arctic Ambitions." In *Handbook of the Politics of the Arctic*, edited by L. C. Jensen and G. Honneland, 388–407. Northampton, MA: Edward Elgar Publishing.