Redefining Canadian Arctic Sovereignty in a Changing Climate: An Interdisciplinary Analysis of Environmental Change, Governance, and Security

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Abstract

Climate change is transforming the Canadian Arctic at an unprecedented rate, creating significant implications for Canada's geopolitical sovereignty. Accelerated Arctic warming, driven by Arctic amplification, is altering the region's physical geography through declining sea ice, permafrost degradation, changing ocean circulation, and increasing environmental variability. These changes are expanding accessibility, reshaping strategic interests, and challenging the environmental landscape where Canadian sovereignty has historically been based. This research examines the question: *How does accelerated temperature rise in the Canadian Arctic impact Canada's ability to protect its geopolitical sovereignty?*

Using an interdisciplinary qualitative research design, this study combines environmental science, political geography, and security studies to examine the relationship between Arctic climate change and Canadian sovereignty. Increased maritime accessibility, growing geopolitical competition, infrastructure vulnerability from permafrost degradation, and the expanding role of Indigenous governance collectively illustrate that sovereignty can no longer be understood solely through territorial possession or military presence. Effective sovereignty now depends on Canada's capacity to adapt its governance institutions, defence policies, and infrastructure systems to a rapidly changing Arctic environment.

This research argues that climate change should be understood not only as an environmental issue but also as a defining challenge for Canadian governance and national security. By integrating physical geography with environmental governance and geopolitical analysis, this study demonstrates that the future of Canadian Arctic sovereignty will depend on adaptive, collaborative, and resilient governance capable of responding to continued environmental transformation while balancing defence, environmental stewardship, reconciliation, and international cooperation.

Key Words: Geopolitical Sovereignty, Arctic Climate Change, Arctic Amplification, Security and Defence, Political Ecology, Adaptive Governance

Foreword

This Major Research Paper represents the culmination of my Master of Environmental Studies degree at York University. Through an interdisciplinary approach, this research examines how accelerated climate change in the Canadian Arctic influences Canada's ability to defend its geopolitical sovereignty, drawing on environmental science, governance, public policy, and climate security perspectives. By investigating the relationship between Arctic amplification, environmental change, and national defence, this research addresses an emerging issue at the intersection of environmental sustainability and Canadian public policy.

The research fulfills the requirements of the Master of Environmental Studies program by applying interdisciplinary environmental inquiry to a complex socio-environmental challenge. It integrates concepts from environmental governance, climate adaptation, political ecology, and security studies to better understand how environmental change shapes decision-making and policy responses in the Canadian North.

This research also contributes to the Graduate Diploma in Business and the Environment by examining how climate change influences economic activity, infrastructure development, resource interests, and governance within the Arctic, highlighting the interconnected roles of governments, industries, and other stakeholders in responding to environmental change. Furthermore, it fulfills the Graduate Diploma in Environmental Sustainability Education by synthesizing complex environmental issues into an accessible interdisciplinary analysis that supports informed decision-making and promotes greater understanding of the sustainability challenges facing Arctic regions.

Ultimately, this research contributes to ongoing discussions surrounding climate security, environmental governance, and Canada's evolving role in the Arctic. It provides insight into the ways environmental change influences national priorities and to encourage interdisciplinary approaches to addressing the environmental and geopolitical challenges of a rapidly changing Arctic.

AI Disclaimer: During the preparation of this work, the author used Grammarly for grammar, spelling, and readability proofreading assistance. The author reviewed and edited all suggestions and take full responsibility for the final content of this thesis.

Acknowledgements

When I think of my time in this program, I first look back to when I finally decided to apply for a Master's program. I was on a 10 hour train ride from Vienna, Austria to Zurich, Switzerland towards the end of my 3 month solo backpacking trip across Europe. I had to think of what my next steps would be, where I wanted to go, and who I wanted to become. While this wasn't the exact moment I officially applied, it was when I decided that there was more for me to learn, more to explore, and more I wanted to learn about myself from education. It lead me to where I am today, almost two and half years after that moment.

The past two years have been incredibly rewarding and exciting, but also extremely hard. I have enjoyed every step, even when I often felt lost and confused on how to move forward. Early on I changed my thesis topic a few too many times because I had so many ideas it was hard for me to decide on just one. The paper I ended up writing was absolutely the right choice for me and really opened my mind to new possibilities when addressing Arctic Climate Change, a topic that I am so passionate about. It also gave me the opportunity to utilize the interdisciplinary aspect of this program and bridge my topic to current political discussions surrounding security in the Canadian Arctic, an industry I hope to work in someday.

I couldn't have gotten through any of this alone, without the support and listening ears of my family and friends. Mom, you sat with me more than once creating lists of the pros and cons of each topic I presented to help me choose not just the best academic option, but also my favourite one, a topic I could be proud to work on for another 2 years. Thank you for always being an open ear, a shoulder to lean on, and a hug at the end of each hard day, even when you didn't fully understand all the crazy things I was talking about.

Jack, Bennet, Adam, and Beatrice, I could not have asked for better friends throughout this program. Our hours of sitting in empty classrooms before long night classes and laughing about everything and nothing is what I will fondly look back on during this time.

Lastly, I would like to thank my advisor and subsequent supervisor Liette who took me on late into the first semester and got me back on track when I felt I didn't understand where to go next and felt done with it all. Thank you for always pointing me in the right direction and reading my lengthy ramblings and helping me to edit them down to acceptable lengths.

This experience is one I will never forget and I look forward to completing my PhD someday

Dedication

per aspera ad astra; through hardships to the stars

To my Grandpa Bill, the person I discussed all my academic aspirations with.
I wish you could have read this paper, I know you would have loved it.
This is for you

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1. Introduction

The Canadian Arctic and surrounding circumpolar region are one of the most environmentally critical and influential ecosystems on Earth. Working alongside the Antarctic, the Arctic helps to cool the planet, support temperature stabilization, and influence the intensity of winter months, making the Arctic increasingly important as climate change accelerates and the planets core temperature rises (Serreze and Barry, 2011; IPCC, 2021). Compared to lower latitudes, the Arctic region is warming four times faster than the global average, a phenomenon known as Arctic amplification (Rantanen et al., 2022). This rapid change in increasing temperatures impacts glacier melt, sea level rise, permafrost melt, albedo effect, and other identifying features which have critical effects on local and global environmental systems (IPCC, 2021). The importance of the Arctic region is in its ability to act as a global air conditioner, circulating cold air and water to the rest of the world, lowering its temperatures, playing a critical role in regulating global climate systems and environmental stability worldwide.

The eight circumpolar nations making up the Arctic region include Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and the United States, which form the geographical Arctic region with direct access to Arctic and sub-Arctic latitudes, and maintain a sovereign presence north of 55° latitude; where the circumpolar north begins (Arctic Council, 2024). These eight nations founded the Arctic Council forum in 1996 following the signing of the Ottawa Declaration to promote cooperation, support environmental protection, improve sustainable development, and increase Indigenous participation in regional concerns (Arctic Council, 2021). While all eight nations are officially apart of the Council, cooperation only currently exists among seven, with Russia's participation suspended since 2022 due to its predatory actions

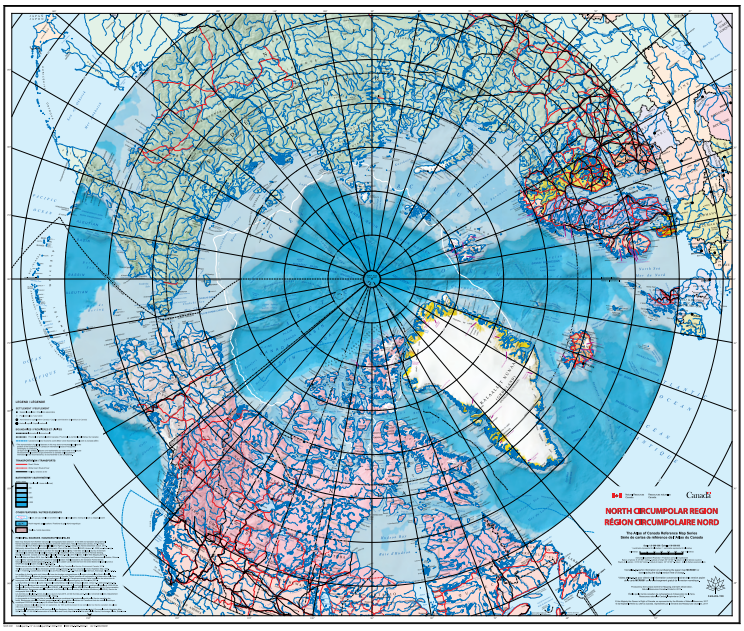


Figure 1: Circumpolar Map (Natural Resources Canada, 2017)

against Ukraine (Arctic Council, 2024). The Council does not serve as an official governing authority and can only make recommendations within its scope of discussion, explicitly excluding military and security matters (Arctic Council, 2024). As a result, the Arctic Council lacks the authority to address and respond to emerging geopolitical tensions in a rapidly changing Arctic, where there is increasing strategic interest from non-Arctic states. There are progressively more countries who are starting to consider themselves 'near-Arctic states' like China, or 'Arctic Observers' like many southern European countries who are interested in the strategic geopolitical opportunities that Arctic climate change creates (Heininen et al., 2015).

Beyond its environmental impacts, climate change in the Arctic is becoming increasingly recognized as a critical security concern, where the shifting physical environment alters access for trade and transportation, infrastructure stability, resource competition, and geopolitical dynamics in the region. The study of Canadian Arctic climate change and its implications for geopolitical sovereignty therefore sit at the intersection of environmental science, public and private sector involvement, international geo-political relations, and strategic governance.

This research examines the question: *How does accelerated temperature rise in the Canadian Arctic impact Canada's ability to protect its geopolitical sovereignty?* Within Canada, the Arctic territory is not only significant to the Canadian identity and geopolitical status as a northern nation, but is also critical for national defence. This research argues that the Canadian Arctic is no longer just a location of isolated climate significance but a geopolitical frontier, where melting ice reshapes international boundaries, access to resources, shipping routes, and global power dynamics. These changes are not confined to the climate systems of the Circumpolar North, but will influence governance policies and strategic decisions through which Canada defends its territory, making the Arctic biome both a regional and international concern.

Given the current global geopolitical climate and Canada's increasingly complex relationship with the United States, Canadian geopolitical sovereignty represents a dynamic and contested concept that is continually shaped by evolving relationships with key Arctic actors, including the United States and Russia. Given the scope and rapidly changing nature of these geopolitical relationships, this study is unable to critically engage with all aspects of Canada's relationships with these actors. The analysis focuses primarily on information and perspectives of Canadian Arctic policy presented through government policies, reports, and official documents, recognizing that these relationships and the broader geopolitical context may continue to evolve following the completion of this research.

1.1. Territorial Boundaries, Maritime Jurisdiction, and Climate Change in Canada's Arctic

The governance and defence of Canada's Arctic region extend beyond defined terrestrial boundaries to encompass complex systems of maritime jurisdiction and seabed rights. While

Arctic sovereignty is often conceptualized in terms of land-based territory, it is equally defined by the legality of offshore environments under international law. Canada's Arctic boundaries are structured through a layered framework of ocean territory, exclusive economic zones (EEZ), and continental shelf claims, as established under the United Nations Convention on the Law of the Sea (UNCLOS) (Government of Canada, 2019; Gray, 2020). As climate change accelerates environmental transformation in the Arctic, these boundaries are becoming increasingly significant in the geopolitical sector where intense physical conditions that once limited access to remote regions are rapidly diminishing. This shift has heightened the geopolitical and strategic importance of Arctic maritime spaces, placing renewed pressure on how Canada asserts and maintains sovereignty in the region.

Canada's Arctic territory is embedded in its northern landmass and extensive Canadian Arctic Archipelago (see Figure 2), which together form the second largest Arctic domain among the eight Arctic nations; with almost 40% of Canada's landmass considered Northern and Arctic Territory (Global Affairs Canada, 2024). This territory represents roughly 25% of the global Arctic biosphere (Canadian Geographic, 2022). Canada's Arctic geography is characterized by a vast network of islands, straits, and channels, many of which are covered by sea ice for much of the year. The relationship between these landforms and surrounding waters is central to Canada's sovereignty claims, particularly in relation to internal waters and navigation routes such as the Northwest Passage. While terrestrial sovereignty in the Arctic is generally uncontested, the surrounding marine environment introduces additional layers of legally and politically complex discussions, especially as environmental conditions deteriorate.

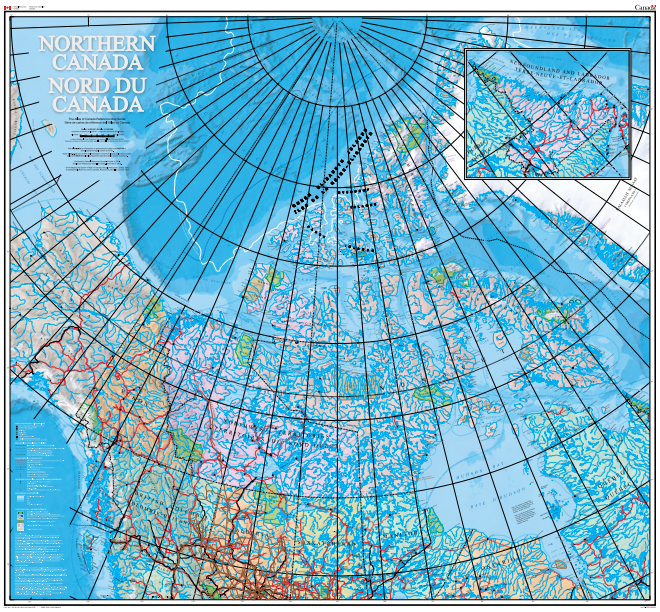


Figure 2: Map of Canada's North (Natural Resources Canada, 2012)

Under UNCLOS, Canada's maritime jurisdiction is defined through several key zones that extend outward from its coast line. The first of these is the territorial sea, which extends up to 12 nautical miles from the coastline where Canada has full sovereignty of the water column and seabed below, unless exempt under certain navigational rights such as innocent passage (i.e., civilian navigation without threat to peace, security, or sovereignty) (Gray, 2020). Beyond the territorial sea lies the Exclusive Economic Zone (EEZ), which extends up to 200 nautical miles beyond the terrestrial coastline (Gray, 2020). Within the EEZ, Canada does not possess full sovereignty of the environment, but holds sovereign rights for the purposes of exploring, exploiting, conserving, and managing natural resources, including both living resources such as fisheries and non-living resources such as oil and gas (Gray, 2020). This distinction is critical, as it highlights the differences between territorial control and resource jurisdiction which is often overlooked in broader discussions of Arctic sovereignty.

Beyond the 200 nautical mile limit, UNCLOS provides the possibility of Canada gaining further territory of its Arctic continental shelf, where a coastal state can demonstrate that the

seabed or continental shelf that the country resides on, is a natural prolongation of its land territory (Gray, 2020). In these circumstances, nations can establish extended sovereign rights over the seabed and subsoil beyond the 200 nautical mile EEZ, although this does not extend to the water column above (Gray, 2020). Canada submitted a claim in 2019 of their continental shelf (see Figure 3) where the Canadian Arctic land and ocean preside, called the 'Arctic Shelf', showcasing evidence to support the extension of its current territory beyond the 200 nautical mile limit (Government of Canada, 2019). This claim is particularly significant to gain territory of the Lomonosov Ridge, an 1,800 km underwater mountain range in the Arctic Ocean estimated to hold 22% of the world's undiscovered oil and gas, where overlapping submissions from other Arctic states, notably Russia and Denmark, have created geopolitical tension (see Figure 4) (Britannica, 2016; Polar Journal, 2023). These competing claims do not imply inevitable conflict, as UNCLOS provides defined contingencies for negotiation; however, they do emphasize the strategic importance of Arctic seabed resources and the need for clearly defined legal boundaries. While the legality of Arctic boundaries is currently as stable as can be expected in the present political environment, climate change is fundamentally altering how these boundaries will operate in the future and how countries competing for Arctic control will respond.

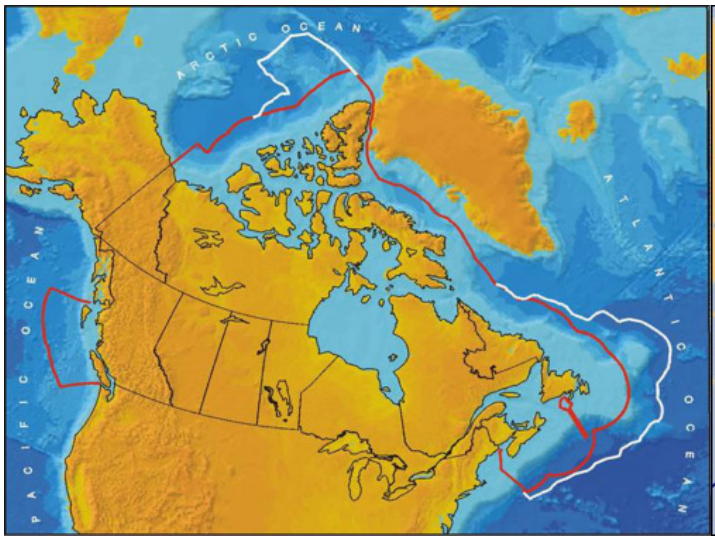


Figure 3: Canada's Extended Continental Shelf Claim (Gray, 2020)



Figure 4: Map of Disputed Arctic Territory (Durham University, 2005)

Maritime boundaries are constantly evolving as increasing temperatures due to climate change perpetuate physical changes such as a reduction in sea ice throughout the year. These physical changes are increasing the likelihood of international presence and activity in the Arctic. Shipping routes, such as the Northwest Passage in Canada (see Figure 5), and the Northern Sea Route in Russia, are becoming navigable for longer periods of the year, raising questions of territory and sovereignty control, regulation, and the legal status of these waters to whether they fall within internal waters or not. With these changes, the likelihood of accessing offshore resources, including hydrocarbons and critical minerals, has intensified interest from both Arctic and non-Arctic states. In these circumstances, clearly defined and internationally recognized boundaries of both terrestrial and marine regions are essential for managing competing interests and maintaining stability in the region.



Figure 5: Northwest Passage Shipping Routes (Senate Committee on the Arctic, 2019)

Climate change does not alter the legal boundaries themselves, but rather transforms their practical significance in how nations address political concerns in the Arctic. Boundaries that

were once remote and largely theoretical due to inaccessibility are becoming increasingly relevant to political agendas as human activity expands into the Arctic to develop and obtain in-demand resources. This shift places greater emphasis on Canada's ability to monitor, enforce, and defend its political and military sovereignty across vast and often remote maritime spaces. It also highlights the limitations of existing governance frameworks, which may not be fully equipped to address the complex intersection of environmental change, economic opportunity, and geopolitical competition. In Canada, the implications of these developments are extensive. The claim of Arctic sovereignty is no longer solely a matter of territorial possession on a map, but of effective governance and presence across marine and terrestrial environments. This includes legal evidence and authentication of boundaries under UNCLOS, but also the capacity to preserve those boundaries through active infrastructure, surveillance, and international diplomacy. As climate change continues to reshape the Arctic environment, the importance of these boundaries will only increase, reinforcing their central role in Canada's broader strategy for defending its geopolitical sovereignty.

2. Physical Processes Affecting Arctic Climate Change

In order to understand how Canada's geopolitical sovereignty is threatened by climate change, you must first understand the physical processes that force these changes. Climate change in the Arctic, while exponentially accelerated by anthropogenic greenhouse gas emissions, is also driven by complex interactions between atmospheric, oceanic, and cryospheric physical processes that regulate Earth's climate systems. These interconnected processes influence the transfer of heat, moisture, and energy throughout the planet and play a significant

role in determining the rate and intensity of Arctic warming (IPCC, 2021). As a result, the Arctic has become one of the most climatically sensitive regions on Earth, experiencing temperature increases at a rate 4x faster than the global average (Rantanen et al., 2022).

The Arctic region functions as a critical component of the global climate system through its influence on atmospheric circulation, ocean currents, sea ice dynamics, and thermohaline processes (IPCC, 2021). Historically, highly reflective sea ice and snow cover contributed to the regulation of global temperatures by reflecting incoming solar radiation back into the atmosphere (IPCC, 2021). However, the continued reduction of Arctic sea ice has altered this fragile balance, increasing the absorption of solar energy into darker ocean surfaces and intensifying regional warming through positive feedback mechanisms (IPCC, 2021). In addition to cryospheric feedbacks, ocean circulation systems such as thermohaline circulation and the Atlantic Meridional Overturning Circulation (AMOC) play an essential role in transporting heat and salinity throughout the global ocean system. Variability within these systems has the potential to influence sea ice formation, atmospheric temperatures, precipitation patterns, and long-term climate conditions across the Northern Hemisphere (IPCC, 2021).

Atmospheric oscillations and climate variability patterns further complicate the Arctic climate system. Large-scale oscillatory processes, including the El Niño–Southern Oscillation (ENSO), can influence Arctic weather and temperature conditions through teleconnections (large-scale climate anomalies) that affect atmospheric pressure systems, storm tracks, and ocean-atmosphere interactions (Woods Hole Oceanographic Institution, 2026). Although these oscillations originate outside the Arctic region, their impacts can be felt in high northern latitudes and contribute to seasonal and annual climate variability. The interaction between these

atmospheric processes and Arctic feedback mechanisms demonstrates that Arctic climate change cannot be understood as an isolated regional phenomenon, but rather as part of a broader Earth system, interconnected through dynamic physical processes (IPCC, 2019).

Understanding these physical processes is essential for assessing the broader implications of Arctic climate change. The accelerating transformation of the Arctic environment has consequences extending beyond the circumpolar North, influencing global weather systems, sea-level rise, biodiversity, and geopolitical conditions. As Arctic warming intensifies, changes within oceanic and atmospheric circulation systems may contribute to increasingly unpredictable climatic conditions across mid- and low-latitudes (IPCC, 2019). Examining the physical mechanisms that drive Arctic climate change is not only necessary for understanding the implications for global climate stability, but to evaluate how Canada will need to approach future arctic policies and defence capabilities.

2.1. Arctic Amplification

The primary driving force behind Arctic climate change is a phenomenon known as Arctic amplification, which refers to the Arctic region experiencing increased warming at a rate significantly faster than the global average due to atmospheric, oceanic, and cryospheric feedback mechanisms (NASA, 2013). Recent research indicates that the Arctic has warmed nearly four times faster than the global average since 1979 (see Figure 6) (Rantanen et al., 2022; NOAA, 2022). This accelerated warming is driven by sea ice decline, albedo (sunlight refraction) reduction, atmospheric heat transfer, and changes in ocean circulation patterns. As highly reflective sea ice and snow surfaces diminish, darker ocean and land surfaces absorb more

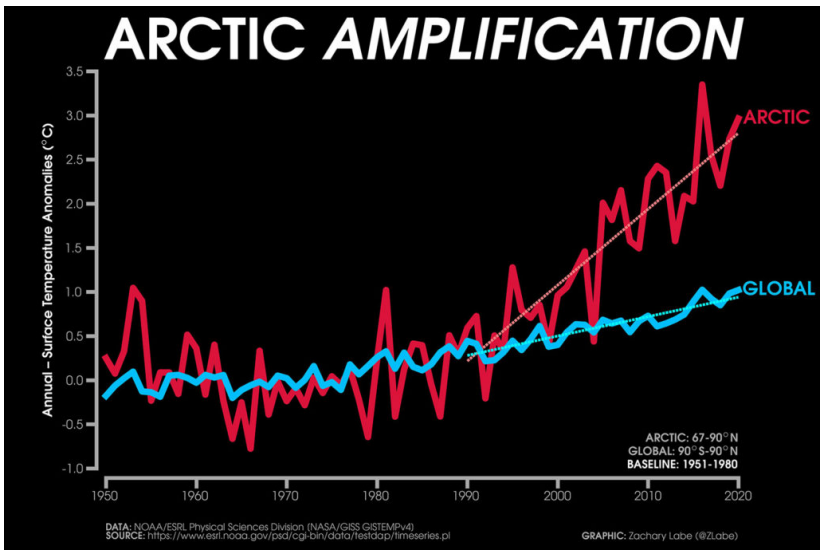


Figure 6: Arctic Amplification Graph (NOAA, 2022)

solar radiation, increasing heat retention and intensifying warming through positive feedback loops (NASA, 2019). The Arctic amplification phenomenon represents broader implications for the destabilization of Earth system processes and a profound environmental, geopolitical, and security consequence for Canada's ability to protect its sovereignty and defend its territory.

Within Canada, Arctic amplification is fundamentally reshaping the physical geography of its northern environment. Rising temperatures have accelerated the thawing of permafrost across large portions of the Canadian Arctic, destabilizing terrain that has remained frozen for thousands of years. This permafrost degradation contributes to coastal erosion, land subsidence, altered hydrological systems, and ecosystem transformation across Canada, significantly affecting both natural and industrial human-build environments, increasing the vulnerability of northern communities and their infrastructure (Box et al., 2019). Ice roads, airports, pipelines, communication systems, and military installations previously constructed on stable frozen ground are increasingly threatened by this land instability and constant erosion. In many Arctic regions of Canada, warming temperatures have also reduced the predictability and duration of seasonal ice coverage, changing long-established transportation routes and affecting the mobility

of all Canadian northern populations throughout the year. This transition has introduced areas into geopolitical discussion that were once geographically isolated as accessible maritime spaces which are valuable in natural resources and are possible strongholds for sovereignty and defence. The opening of these Arctic waters creates new opportunities for private businesses, shipping, tourism, resource exploration, and scientific activity, while increasing geopolitical interest in the region. As a result, maritime zones within Canada's exclusive economic zone and extended continental shelf are becoming more economically and strategically significant.

For Canada, these changes present substantial defence and security challenges. Conventional approaches to Arctic defence were historically shaped by assumptions of geographic isolation and environmental inaccessibility. Harsh climatic conditions and extensive sea ice coverage functioned as natural protective barriers which limited foreign activity and reduced the necessity for continuous northern operational capacity (Senate of Canada, 2023). Arctic amplification is increasingly undermining these assumptions. As environmental conditions become less predictable and Arctic waters become more navigable, Canada faces growing pressure to strengthen surveillance, transportation infrastructure, emergency response systems, and military presence throughout the North. Increased maritime traffic and foreign interest by other global powers such as the United States, Russia, and China in Arctic waterways also raise legal and strategic concerns for the Northwest Passage. Canada maintains the Northwest Passage as internal waters while other states consider it may constitute an international strait where Canada's sovereign laws do not apply (Dodds & Nuttall, 2015).

Climate change in the Arctic is increasingly understood as a 'threat multiplier' which intensifies pre-existing political, economic, and security pressures rather than creating entirely

new geopolitical dynamics (CNA Military Advisory Board, 2014). As sea ice retreats and Arctic accessibility increases, competition surrounding shipping routes, resource extraction, and territorial jurisdiction becomes more pronounced among Arctic and non-Arctic states. Increased access to critical minerals, offshore hydrocarbons, and strategic maritime corridors has elevated the geopolitical significance of Canada's northern territory and intensified the need for effective Arctic governance and defence planning.

In addition to geopolitical competition, Arctic amplification also threatens Canada's existing defence infrastructure. Military installations, early warning systems, runways, ports, and transportation corridors across northern Canada are vulnerable to permafrost degradation, coastal erosion, and changing weather conditions (Senate of Canada, 2023). Infrastructure previously designed and installed in a historically stable frozen environment is becoming more difficult and costly to maintain as conditions rapidly evolve. These environmental changes complicate Canada's ability to project sovereignty and maintain operational readiness across the vast remote Arctic territory. As a result, Arctic amplification is not solely an environmental issue, but a strategic challenge that directly affects the long-term stability of Canada's northern defence systems and sovereignty practices.

The implications of Arctic amplification extend beyond military considerations and intersect with governance, environmental stewardship, and international cooperation. Arctic sovereignty can no longer be understood solely through territorial possession or militarization, but must also incorporate adaptive governance, Indigenous participation, and environmental resilience (Folke et al., 2005; Chapin et al., 2015). As climate change transforms the Arctic environment, Canada's capacity to defend sovereignty depends on its ability to adapt institutions,

infrastructure, and governance systems to rapidly changing socio-ecological conditions. The accelerated warming of the Arctic alters environmental conditions that have historically shaped northern security strategies, transforming the region from a relatively inaccessible frontier into an increasingly contested geopolitical space. Understanding Arctic amplification is essential for analyzing the physical processes of Arctic climate change and their implications for Canada's sovereignty and defence.

2.2. Arctic Ocean and Sea Ice Dynamics

In cooperation with Arctic amplification, the Arctic Ocean plays a critical role in regulating regional and global climate systems through its unique interaction with sea ice, freshwater inputs, and ocean circulation (Bhatt et al., 2014). Unlike other ocean basins, the Arctic Ocean is largely enclosed by surrounding landmasses, creating a semi-isolated marine environment that is highly sensitive to environmental change. Sea ice forms a defining component of this system, where energy is exchanged between the atmosphere and ocean to act as a physical barrier for maritime activity (Bhatt et al., 2014). As temperatures rise throughout the Arctic, the dynamics of sea ice formation, seasonal longevity, and decline have become central indicators of rapid environmental change.

Sea ice contributes significantly to climate regulation through the albedo effect, where highly reflective ice surfaces return a substantial proportion of incoming solar radiation back into the atmosphere. As Arctic temperatures increase, declining sea ice exposes darker ocean surfaces that absorb greater amounts of solar energy, leading to additional warming and further ice loss. This positive feedback mechanism represents one of the primary drivers of Arctic amplification

and contributes to the accelerated rate of warming observed across the circumpolar North (Bhatt et al., 2014; Rantanen et al., 2022). The reduction of sea ice extent and thickness is notably pronounced in the Canadian Arctic Archipelago, where multiyear ice has historically served as a stable environmental feature and natural barrier impeding navigation. Figure 7 illustrates sea ice concentration in Canadian waters in June 2026, a period of increasing seasonal accessibility. While substantial ice remains throughout much of the Arctic Archipelago, the distribution of sea ice demonstrates how changing ice conditions are gradually expanding opportunities for navigation, research, and resource access within Canada's northern maritime territory.

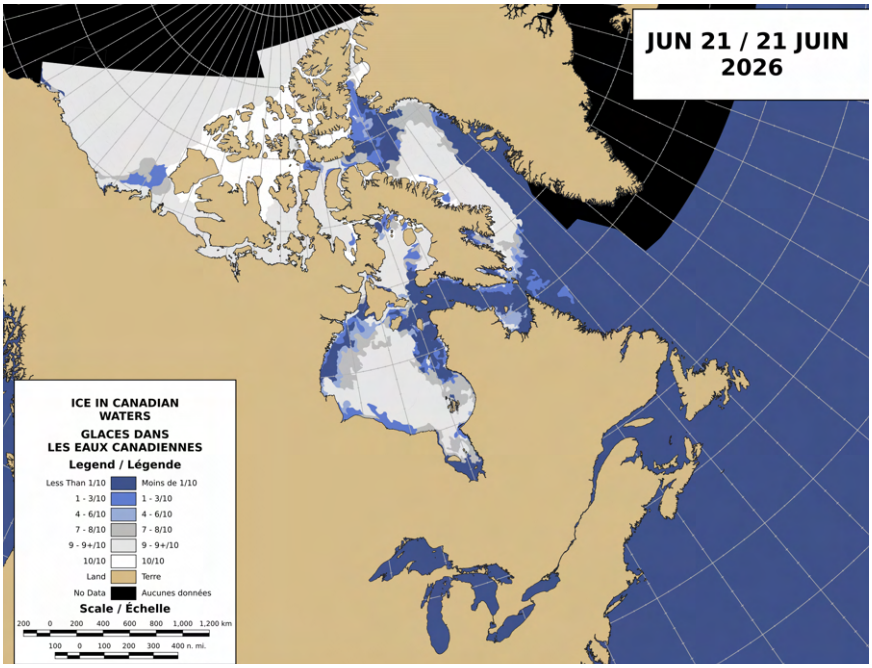


Figure 7: Canadian Sea Ice Concentration Map (Environment and Climate Change Canada, Canadian Ice Service, 2026)

The Arctic Ocean also receives substantial freshwater inputs from river estuaries precipitation, glacier melt, and the Greenland Ice Sheet. These freshwater contributions alter ocean salinity and influence local circulation patterns throughout the Arctic Basin. Increased freshwater accumulation has become a defining characteristic of contemporary Arctic climate

change and is consequential to broader changes in ocean circulation throughout the North Atlantic (Box et al., 2019). Atmospheric oscillations such as the Arctic Oscillation and North Atlantic Oscillation influence sea ice distribution and regional weather patterns but do not drive long-term Arctic warming. Rather, they contribute to sea ice variability and can either reinforce or temporarily offset warming trends in particular years (Box et al., 2019; Woods Hole Oceanographic Institution, 2026).

Increasing navigability has transformed the Arctic Ocean into a region of growing strategic significance. Shipping routes like the Northwest Passage are becoming accessible for longer periods of the year, increasing opportunities for commercial transportation, tourism, scientific research, and resource exploration (Smith & Stephenson, 2013). Environmental change is altering the physical geography which Canada's Arctic sovereignty and defence strategies have historically been based. The Arctic Ocean is no longer characterized by isolation and inaccessibility but is a space of mobility, connectivity, and geopolitical interest.

2.3. Thermohaline Circulation and Atlantic Meridional Overturning Circulation

The global climate system is strongly influenced by large-scale ocean circulation patterns that redistribute heat, nutrients, and salinity throughout the world's oceans. Among the most significant of these processes is thermohaline circulation (see Figure 8), a density-driven system of ocean currents often described as the global ocean conveyor belt (NOAA, 2013). Thermohaline circulation is driven by differences in water temperature and salinity, which determine seawater density. Cold, saline rich water becomes denser and sinks, while warmer, less dense water with varying salinity levels remains closer to the surface. Through this process,

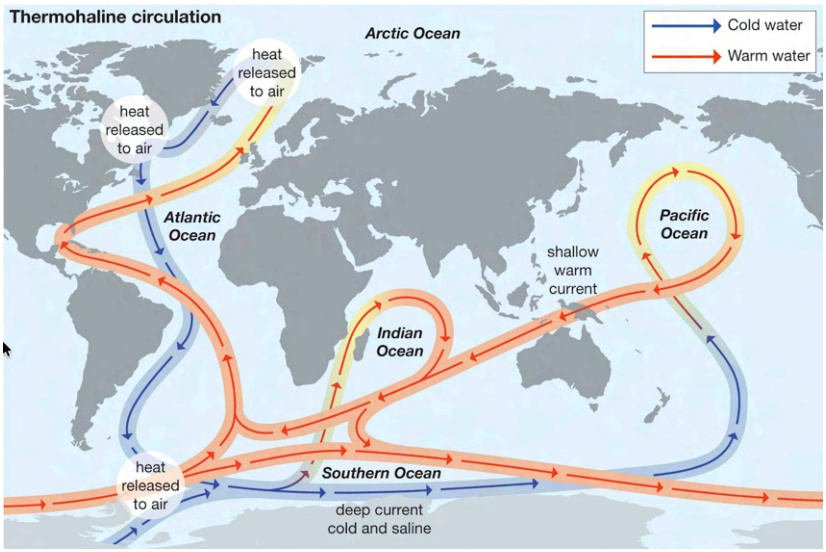


Figure 8: Thermohaline Circulation (Britannica, 2025)

ocean waters continuously circulate between polar and equatorial regions, facilitating the transfer of heat throughout the Earth system (NOAA, 2013).

The Arctic plays a particularly important role within this circulation system because polar regions serve as major sites of deep-water formation. As sea ice forms, salt is expelled into surrounding waters, increasing salinity and contributing to the sinking of dense water. These processes help drive thermohaline circulation and influence climate conditions around the rest of the planet. However, rapid Arctic warming has introduced new uncertainties into this system. Increased freshwater input from melting glaciers, sea ice decline, and enhanced precipitation reduce surface water salinity, potentially disrupting cold water columns that support deep-water formation (IPCC, 2021).

One of the most significant components of thermohaline circulation is the Atlantic Meridional Overturning Circulation (AMOC) (see Figure 9), a system of currents that transports warm surface waters northward through the Atlantic Ocean and returns colder, denser waters southward deep in the ocean. The AMOC functions as a major mechanism of global heat redistribution and contributes to climate regulation across Europe, North America, and the

Arctic. Because the Arctic and North Atlantic are closely connected through ocean circulation pathways, environmental changes occurring in the Arctic can influence the strength and stability of the AMOC (NOAA, 2018).

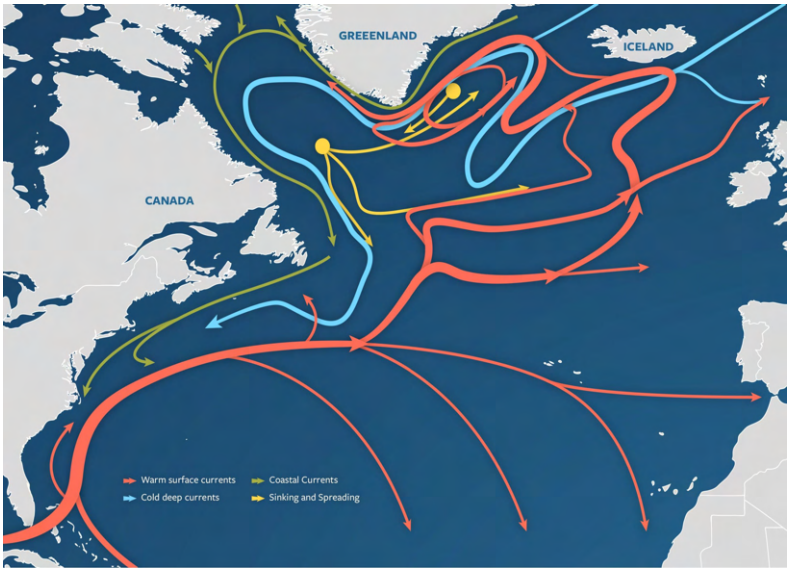


Figure 9: Atlantic Meridional Overturning Circulation (Woods Hole Oceanographic Institution, 2025)

Recent research suggests that increasing freshwater runoff from Arctic ice melt and Greenland ice sheet loss may contribute to a weakening of AMOC circulation. Although there is still uncertainty regarding the timing and potential impact of these changes, a weakened AMOC could alter regional temperature patterns, precipitation, and sea ice dynamics across the Northern Hemisphere (IPCC, 2021). These changes would have implications not only for environmental conditions but also for current and future infrastructure planning, transportation systems, and national security strategies throughout Arctic regions.

For Canada, understanding thermohaline circulation and the AMOC is important because they demonstrate how interconnected Arctic climate change is to the rest of the world. Environmental transformations occurring within Canadian Arctic waters do not remain isolated within the region but contribute to broader shifts affecting ecosystems, weather patterns, and

ocean conditions throughout the North Atlantic. This showcases that Canadian Arctic climate change represents both a regional environmental issue and a component of larger Earth system processes with global implications for how Canada approaches and deals with political conflict.

2.4. Permafrost and Cryosphere Changes

The cryosphere encompasses all frozen components of the Earth, including glaciers, ice sheets, sea ice, snow cover, and permafrost. Within the Canadian Arctic, permafrost represents one of the most significant cryospheric features, existing in much of the northern landscape and creates a foundational basis for both natural ecosystems and human infrastructure. Arctic amplification has accelerated cryospheric change throughout the region, contributing to widespread permafrost thaw, glacier retreat, and variations in seasonal snow cover (Meredith et al., 2019).

Permafrost is defined as ground that remains at or below 0°C for at least two consecutive years. Historically, permanently frozen ground provided a stable foundation for transportation networks, buildings, communication systems, and military infrastructure throughout northern Canada (Brown, 1970). However, rising Arctic temperatures are increasingly destabilizing these frozen landscapes. As permafrost thaws, previously stable ground becomes susceptible to subsidence, erosion, and structural deformation, creating significant challenges for communities and infrastructure development (Box et al., 2019).

The impacts of permafrost degradation extend beyond local environmental concerns. Roads, airports, fuel storage facilities, ports, radar installations, and military infrastructure throughout the Canadian Arctic depend upon stable ground conditions for safe operation (see

Figure 10). As thawing accelerates, maintenance costs increase while infrastructure reliability declines. Facilities may require substantial redesign or relocation to remain operational under changing climatic conditions. These vulnerabilities are particularly important within the context of Arctic defence, where transportation and surveillance infrastructure form critical components of sovereignty enforcement and emergency response capabilities. In 2020, Canada created a 'Rapid Response Assessment of Coastal and Offshore Permafrost' report to study and catalog these various permafrost conditions within Northern Indigenous communities (Natural Resources Canada, 2020).

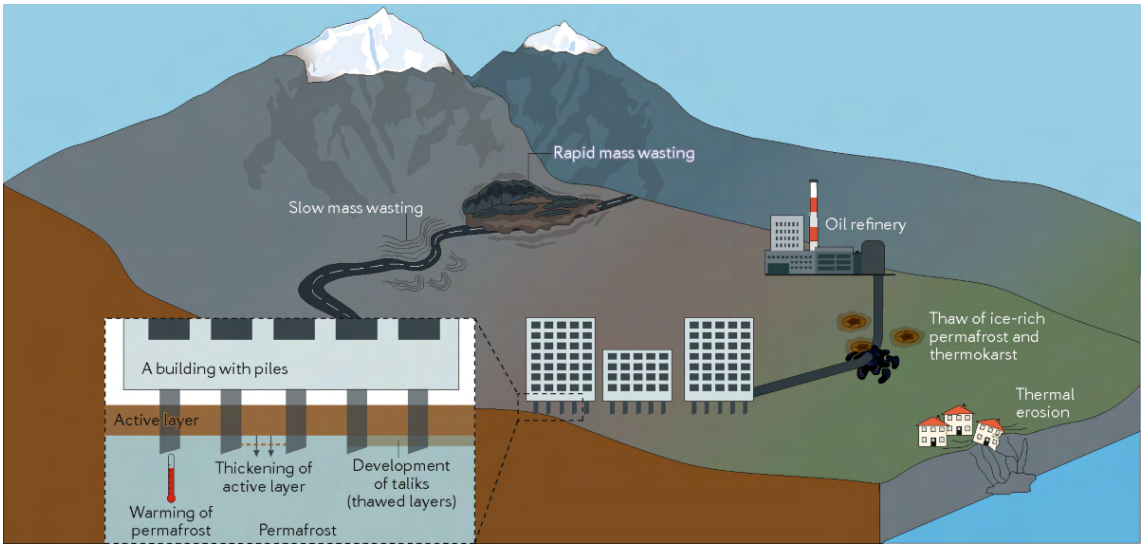


Figure 10: Impacts of Permafrost Degradation on Infrastructure (Hjort, 2022)

Cryospheric change also influences coastal stability and ecosystem processes. Increased coastal erosion resulting from sea ice decline exposes Arctic shorelines to greater wave action and storm impacts, threatening communities and infrastructure located near coastlines. Collectively, these transformations illustrate how Arctic climate change extends beyond temperature increases alone and Arctic amplification encompasses fundamental changes to the physical geography of northern Canada impacting Canada's geopolitical sovereignty.

2.5. Implications of Arctic Physical Change for Sovereignty and Defence

The physical processes associated with Arctic climate change collectively reshape the environmental landscape that Canadian sovereignty and defence strategies have historically been built. Arctic amplification, sea ice decline, changing ocean circulation, and permafrost degradation are not isolated environmental phenomena but interconnected processes that alter accessibility, infrastructure stability, and geopolitical dynamics throughout the Canadian Arctic. Understanding these relationships is essential for evaluating how climate change generates a variety of security concerns, influencing Canada's ability to assert, maintain, and defend sovereignty in our Northern Territory.

Historically, the Arctic's extreme environmental conditions acted as natural barriers limiting foreign access and reducing the frequency of human activity. Extensive sea ice coverage, harsh climatic conditions, and geographic remoteness contributed to a strategic environment characterized by relative isolation. However, ongoing climatic degradation is altering these conditions. Declining sea ice has increased accessibility to northern waters, while longer navigation seasons have expanded opportunities for shipping, tourism, scientific, and resource exploration activities (Smith & Stephenson, 2013). These developments increase the strategic importance of Arctic maritime spaces and create new challenges for monitoring and regulating activity throughout Canada's northern territory.

At the same time, climate change threatens the infrastructure required to maintain sovereignty and support defence operations. Permafrost degradation, coastal erosion, and increasingly unpredictable environmental conditions place growing pressure on transportation networks, military installations, and surveillance systems throughout the Arctic region.

Infrastructure originally designed for stable frozen environments must now adapt to rapidly changing conditions. As a result, Arctic climate change creates a paradox; increasing accessibility attracts greater international interest while undermining the foundation for infrastructure necessary to govern and defend the region from new political advances.

These environmental transformations are frequently described within climate security literature as 'threat multipliers' because they intensify existing political, economic, and strategic pressures rather than creating entirely new security concerns (CNA Military Advisory Board, 2014). Increased land and water accessibility showcases the significance of shipping routes, resource deposits, and maritime boundaries, while increased environmental instability complicates Canada's capacity to monitor, respond to, and manage activity throughout its Arctic territory. Climate change transforms the Arctic from a relatively passive geographic space into a dynamic geopolitical environment characterized by increasing uncertainty and competition.

The implications of these physical changes extend directly into current discussions of Arctic governance and defence policy. As environmental conditions continue to evolve, Canada's ability to defend its sovereignty will depend not only on military capabilities, but also on adaptive governance, resilient infrastructure, environmental monitoring, and cooperation with northern and Indigenous communities. Examining Canada's current Arctic defence and environmental policy frameworks and evaluating how existing strategies are equipped to respond to the rapidly changing conditions of the Canadian Arctic are critical to how Arctic policies will continue to adapt in the future. The physical processes examined throughout this section demonstrate that climate change is not merely an environmental issue but a transformative force reshaping the strategic landscape of the Canadian Arctic. By altering accessibility, destabilizing

infrastructure, and increasing geopolitical interest in the region, Arctic climate change creates new challenges for the governance and defence of Canadian sovereignty in our northern territory.

3. Canada's Arctic Sovereignty in a Changing Climate

As climate change reshapes the physical geography of the Canadian Arctic, it simultaneously transforms the political, economic, and strategic realities of the region. As a result, understanding Arctic climate change is not simply an exercise in environmental observation but a requirement for evaluating Canada's future capacity to govern, protect, and maintain its sovereignty. Historically, Canada's Arctic sovereignty has benefited from the region's environmental inaccessibility. Extensive sea ice coverage, extreme weather conditions, and geographic remoteness limited human activity and reduced the frequency of international interaction. These environmental characteristics acted as natural barriers that reinforced territorial control and reduced external pressures on northern governance systems. However, the changing physical processes demonstrate that the environmental foundations supporting these historical assumptions are rapidly degrading. Declining sea ice, increasing temperatures, and shifting climatic conditions are transforming the Arctic from a relatively isolated region into one characterized by increasing accessibility, mobility, and strategic interest (Smith & Stephenson, 2013).

The growing strategic significance of the Arctic has important implications for Canadian defence policy. Defence approaches often relied on assumptions of environmental stability and geographic isolation. Anthropogenic climate change challenges these assumptions by creating a more dynamic and accessible operational environment. Arctic defence can no longer be

understood solely through conventional military frameworks. Instead, effective defence depends on the integration of environmental monitoring, climate adaptation planning, infrastructure investment, and cooperative governance arrangements capable of responding to rapidly evolving conditions. Climate change necessitates adaptation within Canada's environmental policy framework. The pace and scale of Arctic transformation require governance systems capable of responding to uncertainty and rapidly incorporating new scientific knowledge into decision-making processes. The intersection of environmental policy and sovereignty is especially significant within the Canadian Arctic. Sovereignty is understood not simply as legal ownership of territory but as the capacity to effectively govern and steward that territory. Effective governance requires more than military presence; it depends on functioning infrastructure, environmental monitoring systems, community resilience, and meaningful collaboration with Indigenous governments and northern communities.

Recent federal policy demonstrates a shift away from viewing climate change solely as an environmental issue and toward understanding it as a factor that directly influences national security, sovereignty, infrastructure resilience, and international relations. This evolution reflects that the physical processes are not occurring in isolation but are actively reshaping the strategic environment in which Canada operates. Canada's Arctic Foreign Policy, released in 2024, identifies climate change as the overarching challenge affecting the Arctic region and acknowledges that rising temperatures, diminishing sea ice, and increasing accessibility are transforming geopolitical dynamics across the circumpolar North. The policy argues that the Arctic can no longer be viewed as a region separate from global strategic competition and emphasizes that climate change, Russia's invasion of Ukraine, Donald Trump's desire to annex

Greenland to the United States, and growing interest from non-Arctic states in the Arctic's capabilities, have fundamentally altered Canada's security environment (Global Affairs Canada, 2024). As a result, the policy prioritizes strengthening Canada's sovereignty, reinforcing partnerships with Arctic allies, supporting Indigenous participation in Arctic governance, and maintaining a stable rules-based international order in the region where environmental stewardship and security are increasingly interconnected objectives.

These concerns are echoed within 'Our North, Strong and Free: A Renewed Vision for Canada's Defence,' a 2024 document from the Canadian Department of National Defence, which identifies climate change as a destabilizing force that is reshaping Canada's northern security environment. The document highlights growing Russian military activity, increasing Chinese interest in Arctic shipping and scientific activities, and the emergence of new technological threats capable of making Arctic military approaches to North America. In response, the policy commits to strengthening Canada's Arctic presence through investments in surveillance capabilities, Arctic and Offshore Patrol Vessels, NORAD modernization initiatives, and expanded infrastructure designed to support military operations in northern environments (Department of National Defence, 2024). The policy reflects an important shift in Canadian defence thinking, recognizing that environmental change is not an afterthought, but a central factor influencing future defence planning and sovereignty protection.

Similarly, the Senate Committee on National Security, Defence and Veterans Affairs (2023) emphasized the urgency of addressing Arctic security challenges in its report, 'Arctic Security Under Threat: Urgent Needs in a Changing Geopolitical and Environmental Landscape.' The report identifies climate change as a major 'threat multiplier' that is increasing human

activity throughout the Arctic while simultaneously undermining existing infrastructure through permafrost degradation, coastal erosion, and environmental instability. The Senate Committee argues that increased accessibility resulting from climate change creates new demands for surveillance, search and rescue operations, border management, and military preparedness. The report stresses that Arctic security must be understood broadly, incorporating environmental, social, economic, and Indigenous dimensions rather than relying exclusively on conventional military approaches (Canadian Senate Committee on National Security, Defence and Veterans Affairs, 2023).

Collectively, these policy documents demonstrate that the physical processes driving Arctic climate change have become central considerations within Canadian defence and environmental policy. Arctic amplification, declining sea ice, changing ocean circulation, and permafrost degradation are increasingly understood not only as environmental concerns but as factors that influence sovereignty, infrastructure resilience, geopolitical competition, and Canada's ability to effectively govern its northern territories. Understanding the relationship between environmental change and security has become essential for evaluating whether Canada's existing governance frameworks and defence strategies are capable of adapting to a rapidly transforming Arctic region.

It is important to recognize that government policies and official documents primarily represent stated governmental intentions, priorities, and objectives, rather than reflecting their implementation or outcomes in practice. Policy language is often necessarily broad and aspirational, where stated commitments should not be interpreted as evidence that these objectives have been fully realized and their intended outcomes have been achieved.

4. Analytical Frameworks

Understanding how Arctic climate change impacts Canada's ability to defend its geopolitical sovereignty requires an interdisciplinary analytical approach. The Canadian Arctic is simultaneously an environmental system undergoing rapid climatic transformation, a geopolitical space experiencing increased international interest, and a governance challenge requiring adaptation across multiple institutional scales. Because of its multifaceted responsibilities, no single theoretical framework is sufficient to explain the complex interactions between environmental change, sovereignty, security, and global political-economic forces that take place in the current Arctic biome. This research adopts a multi-layered analytical framework consisting of adaptive governance, climate security, and world-systems theory.

The need for an interdisciplinary approach comes from the interconnectedness of Arctic climate change itself. Climate change processes, such as Arctic amplification, sea ice decline, ocean circulation changes, and permafrost degradation are not merely short term environmental phenomena, they alter accessibility, infrastructure stability, resource availability, and geopolitical dynamics throughout the circumpolar North. Environmental transformations of this magnitude create governance challenges that extend beyond traditional environmental management and intersect with private industries related to defence, sovereignty, and international relations. As a result, examining Canada's response to Arctic climate change requires analytical tools capable of addressing both environmental and political dimensions simultaneously.

The adaptive governance framework serves as the primary theoretical lens for this research because it emphasizes institutional flexibility, resilience, and collaborative decision-making within rapidly changing socio-ecological systems (Folke et al., 2005). Given the

unprecedented pace of Arctic climate change, adaptive governance provides a framework for evaluating whether Canadian governance institutions possess the capacity to respond effectively to environmental uncertainty and evolving sovereignty challenges.

Complementing this perspective, the climate security framework conceptualizes climate change as a 'threat multiplier' capable of intensifying existing political, economic, and strategic vulnerabilities (CNA Military Advisory Board, 2014). This framework allows climate-driven environmental change to be analyzed not solely as an ecological issue but as a factor influencing national security, defence planning, and geopolitical competition in the Arctic.

Finally, world-systems theory provides a broader structural perspective through which the Canadian Arctic can be situated within global political-economic systems. This framework highlights how resource extraction, international investment, strategic competition, and global economic pressures influence Arctic governance and sovereignty decisions (Wallerstein, 1974; Zellen, 2009). Together, these frameworks provide complementary perspectives through which the environmental, geopolitical, and economic dimensions of Arctic climate change can be examined. The following sections outline each framework individually before discussing their application within the methodological approach of this research.

4.1. Adaptive Governance Framework

The adaptive governance framework serves as the primary analytical lens for this research because it provides a means of understanding how institutions respond to environmental uncertainty and rapid socio-ecological change. Originally developed within resilience theory and social-ecological systems research, adaptive governance emphasizes flexibility, learning,

collaboration, and institutional responsiveness in the face of environmental transformation (Folke et al., 2005). Rather than assuming stable environmental conditions, adaptive governance recognizes that governance systems must continuously evolve to address changing ecological realities. This perspective is particularly relevant in the Arctic, where climatic conditions are transforming at a pace unprecedented in modern history.

Adaptive governance emerged in response to the limitations of conventional governance models that previously relied on centralized decision-making and static policy structures. Folke et al., (2005) argue that environmental systems are inherently dynamic and characterized by uncertainty, making rigid governance arrangements increasingly ineffective when confronted with complex ecological change. Adaptive governance emphasizes learning processes, stakeholder collaboration, and institutional flexibility as mechanisms for improving resilience within social-ecological systems.

The Arctic provides a particularly important context for applying adaptive governance theory. Climate change processes are fundamentally altering the environmental conditions upon which governance institutions have historically relied. These transformations affect transportation and navigation systems, infrastructure planning, resource management, emergency response capabilities, and territorial administration throughout northern regions. As environmental baselines shift, governance institutions must possess the capacity to adjust policies and practices in response to emerging challenges.

Within Arctic research, adaptive governance has frequently been linked to conservation, resilience, and Indigenous co-management approaches. Chapin et al. (2015) argue that effective Arctic governance requires institutions capable of integrating diverse knowledge systems while

responding to environmental uncertainty. Similarly, Stepien et al. (2014) emphasize that governance structures designed for historical environmental conditions may become increasingly ineffective in our current epoch as climate change accelerates. These perspectives suggest that successful Arctic governance depends not only on policy implementation but also institutional adaptability and the capacity for continuous learning and changing.

For Canada, adaptive governance is particularly relevant because Arctic climate change challenges long-established assumptions regarding sovereignty and territorial control. The environmental conditions supporting transportation infrastructure, community resilience, and defence operations are evolving rapidly, requiring governance systems capable of responding to each new reality as it is presented. Particular attention need to be given to questions of institutional flexibility, environmental adaptation, Indigenous participation, and long-term governance resilience. This framework provides an effective lens to evaluate whether Canadian Arctic governance institutions possess the flexibility necessary to address climate-driven environmental change.

4.2. Climate Security Framework

While adaptive governance focuses on institutional responses to environmental change, the climate security framework provides a way of understanding how climate change influences broader security dynamics. Climate security scholarship challenges precedents of security that focus exclusively on military threats by recognizing environmental change as a factor capable of intensifying political, economic, and strategic vulnerabilities. Within this framework, climate change is frequently conceptualized as a ‘threat multiplier’ because it exacerbates existing

pressures and creates new challenges for governance and security institutions (CNA Military Advisory Board, 2014).

The concept of climate security has gained increasing prominence as researchers and policymakers recognize the security implications of environmental change. Climate-induced disruptions to infrastructure, resource availability, migration patterns, and economic stability can increase tensions within and between states. Climate security scholars do not argue that climate change directly causes conflict. Rather, environmental change interacts with existing political and social conditions to create new forms of vulnerability and uncertainty (Greaves, 2016).

The Arctic represents one of the clearest examples of climate change functioning as a security concern. Rapid warming has reduced sea ice coverage, increased accessibility to previously isolated regions, and intensified interest in Arctic resources and transportation routes. These environmental changes alter the strategic landscape of the circumpolar North by increasing opportunities for commercial activity, scientific research, and geopolitical competition. Climate change therefore influences security not through direct confrontation but through its capacity to transform the physical environment in ways that affect political and strategic decision-making.

Within the Canadian context, climate security provides a useful framework for understanding how environmental change affects sovereignty and defence planning. Arctic climate change challenges historical assumptions regarding geographic isolation and environmental stability, requiring greater emphasis on surveillance, infrastructure resilience, emergency preparedness, and operational flexibility. This framework facilitates an examination of how climate-driven environmental transformation influences Canadian security priorities and

shapes responses to emerging Arctic challenges. This research applies a climate security framework to evaluate how Canadian policies conceptualize climate change as a strategic concern and whether current approaches adequately address the security implications of Arctic environmental transformation. Particular attention is paid to infrastructure vulnerability, maritime accessibility, resource competition, and sovereignty-related challenges associated with a rapidly changing Arctic environment. Alongside the adaptive governance framework, the climate security framework provides a direction and context for new environmental policies to work within, allowing Canada to emerge as a leader in Arctic climate defence.

4.3. World-System's Theory

While adaptive governance and climate security focus primarily on institutional adaptation and strategic implications, both frameworks focus on responses occurring within Canada and their own Arctic region, world-systems theory provides a broader structural perspective through which Arctic climate change can be situated within global political-economic systems. Developed by Wallerstein (1974), world-systems theory argues that global economic relations are structured through hierarchical relationships between core, semi-peripheral, and peripheral regions. These relationships shape patterns of resource extraction, economic development, and political power across the international system.

Although originally developed to explain global capitalism, world-systems theory can be applied within Arctic scholarship to understand how environmental change intersects with global economic interests and geopolitical competition. The Arctic possesses significant reserves of hydrocarbons, critical minerals, fisheries, and strategic transportation routes, making it attractive

for states and private actors seeking economic opportunities (Keil, 2014; Exner-Pirot, Heininen, & Plouffe, 2019). As climate change enhances accessibility throughout the region, these interests become increasingly influential in shaping governance and sovereignty debates.

From a world-systems perspective, Arctic climate change cannot be understood solely through environmental processes occurring within the region itself. Rather, Arctic transformation is linked to broader global systems of production, consumption, and resource demand. International interest in shipping routes, resource extraction, and infrastructure development reflects economic pressures originating beyond the Arctic and demonstrates how global economic structures influence regional governance decisions (Glomsrød & Aslaksen, 2009).

For Canada, this perspective highlights the external forces shaping Arctic policy and sovereignty debates. Decisions regarding infrastructure investment, resource development, defence planning, and environmental governance are influenced not only by domestic priorities but also by international markets, geopolitical competition, and global economic trends. Climate change amplifies these dynamics by increasing accessibility and exposing previously inaccessible resources to potential development and extraction.

World-systems theory is therefore used to examine how global economic and geopolitical pressures interact with environmental change to shape Canadian Arctic governance. By situating the Canadian Arctic within broader international systems, this framework provides insight into the structural forces influencing sovereignty, resource development, and strategic decision-making throughout the region.

The integration of these three frameworks allows Arctic climate change and geopolitical sovereignty to be examined across multiple scales of analysis. Adaptive governance focuses on

institutional adaptation at the governance level, climate security examines the strategic implications of environmental change for sovereignty and defence, and world-systems theory situates these developments within broader global structures of power and economic competition. Together, these complementary frameworks provide a comprehensive understanding of how Arctic environmental change affects Canada's capacity to adapt, govern, protect, and maintain sovereignty over its Arctic territory.

5. Methodology

This research asks: *How does accelerated temperature rise in the Canadian Arctic impact Canada's ability to protect its geopolitical sovereignty?* Answering this question requires an approach that extends beyond the examination of physical climate processes. Arctic climate change is simultaneously an environmental, geopolitical, governance, and security issue. To better understand these connections, my research adopts an interdisciplinary qualitative methodology to examining the complex interactions between environmental change and governance.

An interdisciplinary approach is particularly beneficial because no single academic discipline fully captures the complexity of Arctic climate change and sovereignty. Environmental science provides an understanding of the physical processes driving climatic transformation, while political science, international relations, and security studies offer insight into how these environmental changes influence sovereignty, defence, and governance. Integrating perspectives from these disciplines enables a more comprehensive examination of Canada's Arctic than would be possible through any single disciplinary lens. Interdisciplinary research is essential for

addressing complex socio-environmental challenges, particularly involving climate change and policy development (Creswell & Creswell, 2018).

Given the exploratory nature of my research question, this study adopts a qualitative research design. Qualitative methodologies are valuable for examining complex policy analysis because they facilitate the interpretation of ideas, governance approaches, institutional priorities, and strategic narratives rather than measuring relationships through numerical data (Creswell & Creswell, 2018). The purpose of this research is not to determine the impacts of Arctic climate change, as these relationships have been extensively documented within climate science literature (IPCC, 2021). Instead, my study seeks to understand how current Canadian governance and defence institutions conceptualize, interpret, and respond to those environmental transformations. A qualitative approach provides the adaptability to examine policy development, strategic decision-making, and the evolving relationship between climate change and Canadian sovereignty.

My research employs a qualitative document analysis as its primary methodological approach. Government policy documents, defence strategies, parliamentary reports, and international governance reports provide valuable evidence of how climate change is understood within contemporary Canadian Arctic policy. Through a close reading and analysis of these documents, my research identifies recurring themes related to governance adaptation, climate security, sovereignty, infrastructure resilience, international cooperation, and geopolitical competition to be interpreted through the chosen theoretical frameworks of adaptive governance, climate security, and world-systems theory.

5.1. Research Design and Qualitative Document Analysis

Qualitative document analysis serves as the primary methodological approach as a systematic process for reviewing, interpreting, and analyzing written documents to identify recurring themes, concepts, and patterns relevant to the particular research question (Bowen, 2009). The use of qualitative document analysis is especially appropriate within Arctic governance research because contemporary Arctic policy is largely communicated through official government strategies, defence policies, parliamentary reports, and international governance documents. These publications not only advise government actions for the policy they describe, but express how Arctic climate change, sovereignty, security, and governance are conceptualized and prioritized by policymakers. Examining these documents provides an opportunity to understand how Canada's response to Arctic climate change has evolved and how environmental transformation is incorporated into future defence and governance planning.

The document collection for this research was selected using purposive sampling, a strategy within qualitative research where documents are selected intentionally based on specific traits to provide the most relevant information to address the research question (Creswell & Creswell, 2018). Rather than attempting to analyze all Canadian Arctic policy documents, I focus on a targeted selection of recent government strategies, defence policies, parliamentary reports, and international climate governance documents that collectively represent Canada's contemporary approach to Arctic governance and security. Documents were selected based on four criteria: (1) relevance to Arctic climate change, sovereignty, or defence; (2) publication by authoritative governmental or intergovernmental organizations; (3) contemporary policy

relevance; and (4) applicability to one or more of the three theoretical frameworks guiding this research.

The documents included in this study (see Table 1) are representative of multiple levels of governance and policy development in Canada and globally, ranging from scientific assessments to national defence strategies and international governance reports. Primary documents guided my analysis while supporting documents provided context and reinforcement for the primary documents. Together, they create a comprehensive overview of how climate change is understood and addressed within Canadian Arctic governance. While each document alone serves a distinct purpose, collectively they establish a detailed policy landscape through which Canada's response to Arctic climate change is evaluated.

Table 1: Documents Included in the Qualitative Document Analysis

Document	Organization	Year	Primary Purpose	Reason for Inclusion
Canada's Arctic Foreign Policy	Global Affairs Canada	2024	Foreign Policy	Primary Canadian Arctic Governance Strategy
Our North, Strong and Free: A Renewed Vision for Canada's Defence	Department of National Defence	2024	Defence Policy	Primary Canadian Defence Strategy for Arctic Security
Arctic Security Under Threat	Canadian Senate Committee on National Security, Defence, and Veterans Affairs	2023	Parliamentary Report	Independent Assessment of Arctic Security Challenges
Arctic and Northern Policy Framework	Government of Canada	2019	Whole-of-Government Arctic Policy	Provides Governance Context and Policy Evolution
IPCC AR6 & SROCC	IPCC	2019 - 2021	Climate Science	Scientific Baseline Informing Policy Context
Arctic Council Reports	Arctic Council	2021 - 2024	International Arctic Governance	Circumpolar Governance and Environmental Cooperation

Grey filled rows are primary documents of Canadian policy, white filled rows are supporting documents

After the collection of documents was chosen, a systematic qualitative analysis framework was created to distinguish themes (see Table 2) that will be used to analyze each document. Each theme was then connected to one or more of the theoretical frameworks to guide the reading of each policy document and correspond each document to an analytical focus.

Table 2: Analytical Theme Framework

Analytical Themes	Adaptive Governance	Climate Security	World-System's Theory
Climate Adaptation	✓		
Institutional Flexibility	✓		
Indigenous Governance	✓		
Environmental Monitoring	✓	✓	
Infrastructure Resilience	✓	✓	
Sovereignty	✓	✓	✓
Military Readiness		✓	
Maritime Accessibility		✓	✓
Shipping Routes		✓	✓
Resource Development/Competition		✓	✓
Critical Minerals		✓	✓
International Cooperation	✓	✓	✓
Geopolitical Competition		✓	✓
Global Economic Interests			✓
Foreign Investment			✓

The established themes ensure that all documents are evaluated using the same analytical criteria while allowing individual themes to be interpreted through complementary theoretical

perspectives. Importantly, many themes intersect multiple frameworks, reflecting the interdisciplinary nature of Arctic climate change, governance, and security. Once the overarching themes had been established and connected to each of the theoretical frameworks, a guiding question and focus of each theoretical framework emerged (see Table 3) and guided my analysis.

Table 3: Operationalization of Theoretical Frameworks

Theoretical Framework	Guiding Question	Analytical Focus
Adaptive Governance	How does each policy demonstrate institutional adaptation to progressing climate change?	Governance Flexibility, Resilience, Indigenous Participation, Adaptation
Climate Security	How is arctic climate change discussed as a security and defence challenge?	Defence, Infrastructure, Sovereignty, Surveillance, Operational Readiness
World-System's Theory	How do global political and economic forces influence Arctic policy?	Resource Competition, Shipping, International Relations, Geopolitical Positioning

Collectively, the research design, document selection process, analytical theme framework, and operationalization of the theoretical frameworks established a systematic approach for examining Canada's contemporary Arctic governance and defence policies. By integrating qualitative document analysis with the complementary frameworks of adaptive governance, climate security, and world-systems theory, a structure of evaluating how Canadian institutions conceptualize and respond to the evolving environmental, political, and strategic challenges associated with Arctic climate change emerged. The following section applies the developed analytical focuses from table 3 to the selected policy documents, examining the extent of Canada's current governance and defence strategies to see if they can adequately adapt to the realities of a rapidly transforming Arctic.

6. Strategic Sovereignty Analysis

This section applies the theoretical and methodological frameworks established in the previous sections to examine how Canada's established contemporary Arctic policy looks at the correlation between climate change, sovereignty, and defence. The strategic sovereignty analysis analyzes how environmental transformation is reflected within Canada's current Arctic governance and security policies, and what steps are being taken to put those policies into action. Rather than treating sovereignty as a fixed legal status, this analysis determines sovereignty as an active and evolving practice shaped by territorial access, infrastructure capacity, defence readiness, international competition, and relationships with Indigenous governments and northern communities.

The section uses a strategic sovereignty analysis to examine how climate-driven physical changes alter the pathways through which Canada asserts and maintains its sovereignty in the Arctic. As established in the physical processes section, Arctic amplification, sea ice decline, permafrost thaw, and shifting oceanic systems are not merely environmental processes with no political importance; they reshape mobility, accessibility, governance demands, and strategic interest in the Canadian North. These changes require Canada to move beyond historical assumptions that Arctic sovereignty is protected primarily by geographic remoteness and environmental inaccessibility. Instead, sovereignty must be reimagined in Canada's ability to monitor, govern, adapt to, and defend a rapidly changing Arctic environment.

The initial analysis focuses on the three primary documents selected in Table 1: *Canada's Arctic Foreign Policy* (Global Affairs Canada, 2024)*, Our North, Strong and Free: A Renewed Vision for Canada's Defence* (Department of National Defence, 2024), and *Arctic Security Under*

Threat: Urgent Needs in a Changing Geopolitical and Environmental Landscape (Canadian Senate Committee on National Security, Defence and Veterans Affairs, 2023). These documents were selected because they represent recent and authoritative perspectives on Canada's Arctic foreign policy, defence position, and parliamentary assessment of Arctic security challenges. Together, they provide insight into how Canadian institutions conceptualize Arctic climate change as a governance, security, and sovereignty issue.

This discussion section is organized around four thematic areas developed through the qualitative document analysis: Territory Accessibility and Mobility; Defence, Resource Competition, and Geopolitical Tension; Infrastructure Vulnerability and Adaptation; and Indigenous Sovereignty and Co-Management in the Arctic. Each theme is examined through the complementary theoretical frameworks of adaptive governance, climate security, and world-systems theory. This structure allows the analysis to assess whether Canadian policy recognizes the significance of Arctic climate change in each theme, and how effectively these documents respond to its implications for the future of Canada's geopolitical sovereignty.

The initial analysis in Table 4 below provides a comparative overview of how the three primary documents address the major themes identified through the qualitative document analysis. The matrix establishes a foundation for the strategic thematic analysis by showing where each policy document places emphasis and where limitations or differences emerge across Canada's Arctic policy landscape. The significance of these themes is not only their emphasis, but how they are framed within Canada's contemporary Arctic governance and defence strategies. The classifications used in the matrix; high and moderate, do not represent

quantitative measurements, but rather indicate the relative prominence of each theme based on the document's language, framing, policy priorities, and strategic focus.

Table 4: Comparative Policy Matrix

Theme	Canada's Arctic Foreign Policy	Our North, Strong and Free	Arctic Security Under Threat
Climate Change	High	High	High
Sovereignty	High	High	High
Defence	Moderate	High	High
Infrastructure	Moderate	High	High
Indigenous Governance	High	Moderate	Moderate
Maritime Accessibility	High	High	High
Resource Development	Moderate	Moderate	High
International Cooperation	High	Moderate	Moderate

The comparative policy matrix establishes the analytical foundation for the subsequent discussion of the principal themes across the three primary policy documents and serves as an overview of the findings. By analyzing the documents in greater depth, this section evaluates how Canada's policy response reflects the realities of a rapidly changing Arctic and the implications for maintaining its geopolitical sovereignty.

6.1. Territory Accessibility and Mobility

Territory accessibility and mobility represent one of the most immediate strategic consequences of Arctic climate change in the Canadian Arctic and provide the foundation for many broader sovereignty and security challenges to emerge. Extensive sea ice coverage,

prolonged periods of darkness, extreme temperatures, and geographic remoteness have previously limited navigation, resource development, and sustained human activity throughout much of the Canadian Arctic. These environmental characteristics acted as natural barriers that restricted access to the region, reducing both the frequency of foreign activity and the demands placed upon Canadian governance and defence institutions (Byers, 2019; Huebert, 2010). Although Canada has consistently maintained its sovereignty through international law, governance, and occupation, the physical environment historically strengthened these claims by making much of the Arctic difficult to access for extended periods of the year (Wang & Aporta, 2024).

Accelerated climate change is fundamentally altering these long-established environmental conditions. While the Canadian Arctic remains a challenging operating environment, diminishing sea ice and changing climatic conditions are gradually increasing the accessibility of regions that were once naturally protected by persistent ice cover. These changes have expanded opportunities for commercial shipping, tourism, fisheries, resource exploration, and scientific research, while also increasing the presence of other Arctic and non-Arctic states.

The growing accessibility of the Canadian Arctic has significant implications for geopolitical sovereignty as legal ownership of territory alone does not effectively govern, monitor, and exercise authority over that territory. As maritime activity, international interest, and economic opportunities increase, Canada faces greater demands to demonstrate effective governance through surveillance, regulatory enforcement, emergency response, environmental stewardship, and continued presence across its northern territory. Accessibility is not merely a physical consequence of climate change but a strategic transformation that reshapes how

sovereignty is exercised and maintained. The ability to adapt governance institutions, defence capabilities, and policy frameworks to an increasingly accessible Arctic is a significant challenge for Canada's long-term sovereignty. All primary policy documents identify increasing Arctic accessibility as a key driver for evolving governance and security priorities. Although the documents differ in their institutional focus and strategic objectives, they all acknowledge that the physical transformation of the Arctic requires adaptations in Canada's approach to sovereignty, defence, and governance.

6.1.1. Changing Maritime Accessibility

One of the clearest observations across Canada's contemporary Arctic policy documents is the recognition that climate change is fundamentally altering maritime accessibility. While each document approaches the issue from a different institutional perspective, all acknowledge that declining sea ice and longer navigable seasons are transforming the operational environment and have significant implications for Canadian sovereignty, governance, and security. Rather than presenting increased accessibility solely as an economic opportunity for growth, the documents consistently frame it as a strategic consequence of climate change that requires new approaches to governance and defence.

Canada's Arctic Foreign Policy identifies climate change as the principal force reshaping the Arctic and emphasizes that diminishing sea ice is increasing human activity throughout the circumpolar North (Global Affairs Canada, 2024). The policy recognizes that longer periods of open water are creating greater maritime access for commercial shipping, scientific research, and tourism. These recognized environmental transformations will not only impact the physical

characteristics of the Arctic but also how Canada approaches diplomatic and governance responsibilities. This framing reflects an understanding that maritime accessibility is not an isolated environmental phenomenon, but influences Canada's ability to exercise authority throughout its northern waters.

Similarly, *Our North, Strong and Free* report presents increased Arctic accessibility as a defining feature of Canada's future security environment (Department of National Defence, 2024). The defence policy recognizes that diminishing sea ice is exposing Canada's northern approaches to greater levels of international activity. Rather than only viewing accessibility through the lens of economic development and what can be gained from this accessibility, this policy includes the implications for surveillance, domain awareness, and military readiness. Increased mobility throughout Arctic waters requires a more persistent Canadian presence capable of monitoring maritime approaches, supporting northern operations, and responding to an increasingly dynamic security environment. This shows that accessibility becomes a defence planning requirement rather than simply an afterthought or environmental consequence of climate change.

Arctic Security Under Threat report argues that longer navigation seasons and increasing marine traffic are placing growing demands on Canada's ability to monitor, regulate, and respond within its Arctic waters (Canadian Senate Committee on National Security, Defence and Veterans Affairs, 2023). These demands create additional requirements for search and rescue capabilities, maritime surveillance, emergency response, and environmental protection while simultaneously increasing opportunities for foreign activity throughout the region. Unlike the federal defence policy, this Senate report places greater emphasis on the institutional and operational capacity

required to manage these pressures with a need for coordinated responses across multiple departments and levels of government.

Although each document emphasizes different aspects of maritime accessibility, several common themes emerge. All three documents recognize that declining sea ice is increasing physical access to the Canadian Arctic and fundamentally altering the strategic environment. Each acknowledges that accessibility creates new governance responsibilities extending beyond existing defence functions to include environmental monitoring, regulatory enforcement, emergency management, and international cooperation. The documents reject the assumption that Canada's current Arctic geography provides sufficient protection and recognize that environmental change is reducing the natural barriers that have limited human activity. Although the Northwest Passage remains a challenging operating environment with unpredictable ice conditions, variable weather, and limited supporting infrastructure, climate change is increasingly extending the season of maritime activity and accessibility. For Canada, these maritime accessibility changes represent more than an increase in navigational opportunities, and serve as the foundation for many other territory concerns.

6.1.2. Government Presence and Surveillance

As the Canadian Arctic becomes increasingly accessible, the ability to maintain an effective government presence throughout the region is critical to preserving sovereignty. While accessibility creates new opportunities for navigation, scientific research, and economic activity, it also increases the responsibility of the Canadian state to monitor and regulate its Arctic

territory. Across the three primary policy documents, increased accessibility is consistently linked to the need for enhanced surveillance, awareness, and government presence.

Our North, Strong and Free report places the greatest emphasis on these requirements by recognizing environmental change as fundamental for continued operations and necessitating a stronger presence to detect, monitor, and respond to activities occurring throughout Canadian territory (Department of National Defence, 2024). Rather than portraying surveillance solely as a 'boots on the ground' military approach, the policy recommends situational awareness to continued sovereignty. Investments in Arctic surveillance technologies and intelligence capabilities alongside expanded operational presence are framed as essential components of maintaining effective governance in a changing security environment.

Although *Canada's Arctic Foreign Policy* approaches the issue from a diplomatic and governance perspective, it similarly recognizes that greater accessibility requires a more visible and coordinated Canadian presence. The policy argues that effective governance depends upon Canada's ability to monitor environmental change, support safe navigation, cooperate with Arctic partners, and maintain a sustained presence throughout the North (Global Affairs Canada, 2024). This broader conception of presence extends beyond military capabilities to include scientific monitoring, regulatory oversight, environmental stewardship, and continued engagement with northern communities.

Similarly, *Arctic Security Under Threat* identifies surveillance and awareness as critical requirements for responding to increased Arctic activity. The report argues that growing maritime activity and expanding international interest place greater demands on Canada's capacity to understand what is occurring throughout its Arctic territory (Standing Senate Committee on

National Security, Defence and Veterans Affairs, 2023). This argument emphasizes the importance of integrated surveillance systems, improved information sharing, and greater coordination among federal departments responsible for Arctic governance. These surveillance systems will act as the foundation to build effective governance, emergency response, and sovereignty.

Canada must demonstrate effective control and continuous awareness rather than relying solely upon legal claims or geographic isolation. Geopolitical sovereignty over Canada's territory is realized through ongoing governmental presence capable of monitoring activities, enforcing regulations, and responding to emerging challenges. As climate change increases accessibility, Canada's ability to maintain their comprehensive territory becomes increasingly significant because sovereignty is demonstrated not only through legal jurisdiction that many other states challenge, but through a continuous ability to govern its Arctic territory effectively.

Increasing accessibility requires a corresponding effort for Canada to effectively exercise sovereignty where government presence is not solely periodic patrols or symbolic demonstrations of authority but sustained surveillance coordination and environmental monitoring. These findings show that as the Arctic becomes more accessible, Canada's capacity to maintain awareness and presence throughout the region is critically important to exercise effective sovereignty.

6.1.3. Governance Challenges Created by Accessibility

While increasing accessibility creates new opportunities throughout the Canadian Arctic, it also generates a range of governance challenges that extend beyond existing defence

considerations. As maritime activity expands, so too do the responsibilities associated with regulating navigation, coordinating emergency response, protecting sensitive ecosystems, and ensuring that Canada's governance institutions remain capable of responding to a rapidly evolving environment. The Senate report, *Arctic Security Under Threat,* provides the most comprehensive discussion of these broader governance challenges, emphasizing that climate-driven accessibility requires coordinated responses across multiple sectors rather than isolated defence initiatives. The report argues that increasing maritime accessibility places growing pressure on Canada's existing governance capacity to expand the range of presence to monitor activities occurring throughout the Arctic (Standing Senate Committee on National Security, Defence and Veterans Affairs, 2023). Increased activities such as greater commercial shipping, tourism, and research generate demands for possible search and rescue operations, environmental monitoring, maritime regulation, emergency preparedness, and interdepartmental coordination. Effective Arctic governance depends on the ability of federal institutions to anticipate and adapt to these emerging responsibilities in a coordinated way rather than reacting to individual incidents as they arise.

Canada's Arctic Foreign Policy similarly recognizes that environmental transformation requires governance systems capable of responding to increased human activity while balancing environmental protection, sustainable development, and international cooperation (Global Affairs Canada, 2024). The federal policy emphasizes that Arctic governance must remain adaptive as environmental conditions continue to evolve, acknowledging that changing accessibility introduces new legal, environmental, and diplomatic considerations that cannot be addressed through fixed policy approaches and require ongoing process of adaptation.

While *Our North, Strong and Free* focuses primarily on defence priorities, it also acknowledges that effective security depends on coordination between military and civilian institutions. The policy recognizes that defence capabilities alone cannot address the full range of challenges associated with a more accessible Arctic, particularly where environmental emergencies, maritime incidents, and increased civilian activity require cooperation across multiple levels of government (Department of National Defence, 2024). This reflects an understanding that governance and security are increasingly interconnected in contemporary Arctic environments.

Increasing accessibility from climate change is expanding the scope of governance beyond current territorial administration to include environmental regulation, maritime safety, international cooperation, and adaptive policy development. As human activity intensifies throughout the Arctic, governance institutions must remain flexible to respond to changing environmental conditions while maintaining effective oversight in a complex ecosystem.

The comparative analysis demonstrates that increasing accessibility is transforming governance demands throughout the Canadian Arctic. Greater access increases expectations for Canadian institutions to effectively regulate maritime activity, coordinate emergency responses, protect the environment, and maintain sovereignty of northern waters. Accessibility represents not only a physical transformation of the Arctic environment but also a governance challenge requiring institutions to adapt to a rapidly changing Arctic and corresponding geopolitical conditions.

6.2. Defence, Resource Competition, and Geopolitical Tension

The physical transformation of the Arctic increases accessibility and fundamentally redefines the region's geopolitical significance. As declining sea ice, longer navigation seasons, and changing environmental conditions increase opportunities for human activity, the Arctic is becoming an increasingly contested strategic space with a growing military interest, expanding economic opportunities, and heightened international competition. These developments represent a significant departure from historical conceptions of the Arctic as a remote and relatively isolated region where military operations were difficult to direct and typical warfare strategies were unsuitable. Instead, climate change is contributing to a geopolitical environment where Canada's Arctic is central to national security debates given that other Arctic and non-Arctic states are vying for Arctic territory and resource development.

For Canada, climate-related changes challenge historical assumptions regarding Arctic sovereignty and defence. Canada has grown used to its northern geography and harsh environmental conditions limiting sustained foreign activity throughout the Arctic archipelago. However, increasing accessibility has expanded the strategic relevance of the region by facilitating greater maritime activity, enhancing opportunities for resource exploration, and increasing interest of both Arctic and non-Arctic states. Arctic sovereignty is no longer maintained solely through legal jurisdiction or historical occupation but now also depends on Canada's ability to respond to the rapidly evolving geopolitical landscape.

This sovereignty analysis, using primarily climate security and world-system's theory frameworks, examines how Canada's contemporary policy documents conceptualize the relationship between climate change and emerging geopolitical competition within the Arctic.

The analysis focuses on three interconnected components: expanding strategic competition among Arctic and non-Arctic states, increasing competition for Arctic resources and economic opportunities, and the evolution of Canada's defence capabilities in response to these changing strategic realities. Together, these components demonstrate that climate-driven environmental change is reshaping not only the Arctic's physical geography but also the international political environment in which Canadian sovereignty is exercised.

6.2.1. Expanding Strategic Competition in the Arctic

One of the most consistent observations across the three primary policy documents is the recognition that climate change is contributing to an increasingly competitive Arctic security environment. Although geopolitical competition within the Arctic is not solely the result of environmental change, declining sea ice and increasing accessibility have expanded opportunities for state activity throughout the region, intensifying strategic interest among both Arctic and non-Arctic nations. While each policy document acknowledges these developments, *Our North, Strong and Free* provides the most comprehensive assessment of how the changing Arctic is reshaping Canada's security environment.

Canada's current defence policy identifies the Arctic as an increasingly important strategic region where climate change, technological advancement, and geopolitical competition are occurring simultaneously (Department of National Defence, 2024). The document argues that diminishing sea ice is exposing Canada's northern coastline to greater levels of international activity while reducing many of the environmental barriers that historically limited military and commercial operations. While the Arctic biome faces continuous environmental evolution, the

Department of National Defence specifically identifies Russia as Canada's most immediate strategic concern in the Arctic, citing its continued military modernization, expanded Arctic infrastructure, and sustained investment in their northern regions (Department of National Defence, 2024). The policy further recognizes China as an increasingly significant Arctic risk, despite its status as a non-Arctic state, but as a country with a growing scientific presence, investment interests, and self-identification as a "near-Arctic State." Collectively, these developments contribute to a more complex and contested Arctic environment requiring Canada to strengthen its ability to monitor and respond to activities occurring throughout its Northern territory.

Canada's Arctic Foreign Policy similarly recognizes that the northern geopolitical environment has fundamentally changed in recent years. While maintaining a strong emphasis on diplomacy, international cooperation, and the rules-based international order, this policy acknowledges that Russia's invasion of Ukraine has significantly altered circumpolar cooperation and contributed to a deterioration in Arctic security (Global Affairs Canada, 2024). The policy also recognizes growing interest from non-Arctic states, including China, whose expanding economic, scientific, and diplomatic engagement in northern spaces demonstrates that the Arctic's strategic importance now extends well beyond the eight terrestrial Arctic nations. These shifts require Canada to not only reinforce its own presence throughout the Arctic rather relying solely on a military proximity but also to strengthen relationships with its allies.

The Senate report *Arctic Security Under Threat* reinforces these observations by arguing that Canada's Arctic security environment has become increasingly complex as environmental change intersects with international strategic competition (Canadian Senate Committee on

National Security, Defence and Veterans Affairs, 2023). It highlights Russia's continued military investments throughout the circumpolar North, China's expanding Arctic ambitions, and the growing importance of cooperation with NATO allies in maintaining regional stability. The interaction between climate change and defence becomes a threat multiplier because it creates conditions under which geopolitical competition is increasingly likely to intensify.

Climate change has transformed the Arctic from an inaccessible glacial desert to a strategic region of global interest in Arctic governance, maritime routes, and strategic positioning. Contemporary Arctic security must be shaped by environmental change, power competition, and evolving governance arrangements rather than by military considerations alone. Despite the increase in geopolitical interest, countries must caution against portraying the Arctic as an inevitable arena of conflict. While there is broad agreement that environmental transformation has elevated the region's geopolitical significance, cooperative engagement in the territory remains possible.

Across the three primary policy documents, it is evident that climate change is consistently presented as a catalyst to amplify existing geopolitical dynamics rather than creating entirely new security challenges. The documents all recognize that Russia, China, and NATO increasingly view the Arctic as strategically significant, while Canada must adapt its defence and foreign policy accordingly.

6.2.2. Resource Competition and Economic Interests

The increasing accessibility of the Arctic has not only altered the region's security environment but has also intensified its economic and strategic significance. The Arctic is

increasingly viewed as a region of growing economic opportunity, possessing significant reserves of hydrocarbons, critical minerals, fisheries, and emerging shipping corridors that have attracted the attention of Arctic and non-Arctic states alike. Across the three primary policy documents, these physical developments are recognized as significant contributions to the increasing economic value and evolving geopolitical landscape.

Canada's Arctic Foreign Policy presents economic transformation as one of the defining consequences of climate change within the circumpolar North. While emphasizing Canada's commitment to environmental stewardship and sustainable development, the policy acknowledges that diminishing sea ice and increasing accessibility are expanding opportunities for responsible economic activity, scientific research, and international investment throughout the Arctic (Global Affairs Canada, 2024). The policy further recognizes that these opportunities are accompanied by increasing international interest in Canada's Arctic shipping routes, critical mineral development, fisheries, and other natural resources, requiring Canada to balance the opportunity of economic development with environmental protection and effective governance.

Our North, Strong and Free similarly identifies Arctic resources as contributing to the region's growing strategic importance. Although the defence policy focuses primarily on national security, it acknowledges that expanding access to natural resources and maritime transportation corridors increases the geopolitical significance of Canada's Arctic territory where other nations could possibly take military action to gain its resources (Department of National Defence, 2024). Growing international interest in the region cannot be separated from broader defence considerations, as economic competition and critical infrastructure closely intersect with national security priorities. Safeguarding Canada's northern interests require not only military

preparedness but also the capacity to protect vital economic assets and transportation corridors that contribute to Canada's long-term strategic resilience.

Arctic Security Under Threat reinforces these observations by identifying resource development and expanding economic activity as factors contributing to the Arctic's changing security landscape (Canadian Senate Committee on National Security, Defence and Veterans Affairs, 2023). The report argues that increased accessibility is expanding opportunities for shipping, fisheries, tourism, and natural resource development while simultaneously increasing the complexity of Arctic governance. The growing international demand for critical minerals and other strategic resources is likely to increase interest in Canada's North, placing greater pressure on governance responsible for regulating economic activity, protecting sensitive ecosystems, and ensuring that development occurs within Canada's sovereignty objectives.

The Arctic is estimated to contain substantial reserves of undiscovered oil and natural gas, significant deposits of critical minerals essential for emerging technologies, productive fisheries, and maritime routes that have the potential to reduce shipping distances between major global markets (Dodds & Nuttall, 2015; U.S. Geological Survey, 2008). While the economic viability of many potential Arctic projects remains constrained by current environmental conditions, infrastructure limitations, and fluctuating commodity prices, continued climate change and technological advancement gradually increase the accessibility of these valuable resources and transportation corridors. Canada's Arctic's strategic economic value only increases as its geographic position open up for access to development, improving its role within global supply chains for energy security and critical mineral production. These increasing international economic opportunities require corresponding investments in domestic governance, regulation,

and strategic planning to ensure that expanding activity supports Canada's long-term sovereignty objectives. Economic interests are framed as commercial growth opportunities with strategic considerations that positively influence Canada's relationships with allies, competitors, northern communities, and international institutions.

Therefore, resource competition and economic interests have become integral components of Canada's contemporary Arctic strategy. Climate change forces Canada to redefine its strategic importance within the global economy where economic competition is increasingly intertwined with questions of sovereignty, security, and governance, reinforcing the need for Canada to manage development in ways that support both national interests and the long-term stability of the circumpolar North.

6.2.3. Defence Modernization and Operational Readiness

As the Arctic region becomes increasingly accessible and strategically significant, Canada's defence priorities are evolving to address a more complex operational environment. Across the three primary policy documents, it is clear that maintaining Arctic sovereignty requires more than legal authority over northern territory; it also depends upon the ability to operate effectively within that territory. Contemporary Canadian defence policy increasingly emphasizes modernization, sustained operational presence, enhanced surveillance, and improved domain awareness as essential components of Arctic sovereignty.

Our North, Strong and Free provides the most comprehensive discussion of Canada's evolving defence position within the Arctic. The policy argues that climate change, technological advancement, and increasing geopolitical competition have fundamentally altered Canada's

northern security environment, requiring a renewed approach to Arctic defence (Department of National Defence, 2024). Rather than preparing exclusively for conventional military threats, the Canadian Armed Forces must be capable of operating across a wider range of missions, including surveillance, sovereignty patrols, search and rescue support, disaster response, and cooperation with domestic and international partners. This broader operational readiness reflects the realities of Arctic security that is increasingly shaped by environmental change as well as geopolitical developments.

A central aspect of the current defence plan is the modernization of Canada's Arctic capabilities. The policy identifies continued investments in North American Aerospace Defence Command (NORAD) modernization, Arctic and Offshore Patrol Ships (AOPS), enhanced surveillance systems, and domain awareness technologies as critical to maintaining Canada's ability to monitor and respond to activities throughout its territory (Department of National Defence, 2024). The emphasis placed on persistent situational awareness demonstrates an important shift in Canadian defence planning. As the natural barriers historically provided by extensive sea ice diminish, sovereignty increasingly depends upon Canada's capacity to detect, assess, and respond to activity occurring within its territorial boundaries. Operational readiness for these situations extends beyond military capability alone to include the ability to maintain continuous awareness across a geographically vast and environmentally challenging region.

Canada's Arctic Foreign Policy complements this perspective by emphasizing that effective defence contributes to sovereignty, diplomacy, and international stability (Global Affairs Canada, 2024). Canada's ability to exercise sovereignty requires operational capabilities to support international commitments, protect northern communities, and respond to changing

regional conditions. Continued cooperation with Canada's Arctic and non-Arctic allies, Indigenous partners, and local governments is seen as the key to strengthen Canada's Arctic presence, demonstrating that defence modernization is only one component of a broader 'whole-of-government' approach to Arctic governance.

Arctic Security Under Threat argues that Canada's current defence capabilities must continue to evolve alongside the changing Arctic environment. While climate change increases operational demands across the region, it also highlights capability gaps related to surveillance, mobility, communications, and emergency response. Rather than recommending militarization as the sole solution, the report emphasizes the importance of ensuring that Canada's defence institutions possess the flexibility and capacity necessary to respond effectively to a range of Arctic incidents (Canadian Senate Committee on National Security, Defence and Veterans Affairs, 2023). Defence modernization is not solely a response to increasing geopolitical competition but also an adaptation to the operational realities created by climate change.

Canada must no longer rely on geography alone to ensure northern security. National security and sovereignty are strengthened through the use of governmental authority with the ability to monitor, patrol, and respond to the entire national territory. Canada's approach to Arctic defence must move past environmental isolation towards prioritizing sustained operational readiness within the region. Defence modernization is only one adaptive response to changing environmental and geopolitical conditions and requires Canada to maintain the capacity to monitor, operate, and respond. This development indicates that Arctic security is no longer defined by remoteness, but by Canada's ability to actively exercise sovereignty within an increasingly dynamic and internationally significant region.

6.3. Infrastructure Vulnerability and Adaptation

The strategic implications of Arctic climate change extend beyond increased accessibility and geopolitical competition to the resilience of physical infrastructure. Rising temperatures, permafrost degradation, changing precipitation patterns, coastal erosion, and increasing environmental variability are fundamentally altering the conditions for which typical northern infrastructure was originally designed and constructed. Climate change not only creates new demands for Arctic governance and defence but also challenges Canada's ability to maintain the infrastructure necessary to support government operations, military presence, transportation, emergency response, and northern communities.

Infrastructure has become an increasingly important component of Arctic sovereignty because the effectiveness of governmental authority depends on the capacity to operate throughout Canada's northern territory. Airfields, transportation corridors, ports, communications systems, military facilities, and community infrastructure enable surveillance, emergency response, regulatory enforcement, and the delivery of essential public services. As climate change accelerates environmental transformation across the Canadian Arctic, these systems are vulnerable to damage, disruption, and rising maintenance costs. The resilience of northern infrastructure is not only an engineering challenge but also a strategic governance issue with direct implications for Canada's long-term sovereignty.

This strategic analysis uses an adaptive governance framework as its primary function to examine how Canada's contemporary Arctic policy documents address the relationship between climate change and infrastructure resilience. The analysis is organized around three interconnected components: the impacts of permafrost degradation on northern infrastructure, the

need for climate adaptation and resilient infrastructure planning, and the capacity of governmental institutions to support northern communities. Together, these components establish that maintaining Arctic sovereignty requires more than responding to external geopolitical pressures; it also depends on Canada's ability to adapt its domestic infrastructure and governance systems to a rapidly changing physical environment.

6.3.1. Permafrost Degradation and Infrastructure Risk

Among the many physical consequences of Arctic climate change, permafrost degradation represents one of the most immediate and consequential challenges for Canada's northern infrastructure. Unlike declining sea ice, which primarily alters accessibility and maritime activity, thawing permafrost directly affects the stability of the built environment where government operations, transportation networks, and defence activities are based. Throughout the three primary policy documents, infrastructure resilience is increasingly recognized as a strategic requirement for maintaining Canada's sovereignty and continued operational effectiveness.

Our North, Strong and Free identifies climate change as fundamentally altering the operational environment where Canada's defence capabilities must function. Although this policy focuses primarily on modernization and operational readiness, it acknowledges that northern infrastructure must remain capable of supporting military operations (Department of National Defence, 2024). Reliable runways, transportation corridors, communications systems, and support facilities are essential components of Canada's ability to maintain a sustained operational presence throughout the Arctic. As permafrost degradation accelerates, these assets face increasing risks associated with ground instability, structural deformation, and higher

maintenance requirements, creating challenges for accurate defence planning and operational effectiveness.

Canada's Arctic Foreign Policy similarly recognizes the importance of resilient infrastructure to Canada's broader governance objectives. The policy emphasizes that climate change threatens the infrastructure supporting northern communities, transportation, economic development, and public services while simultaneously increasing the need for sustained government presence (Global Affairs Canada, 2024). Resilient infrastructure is a requirement for effective governance, environmental stewardship, and long-term sustainable development outside of its demands for effective defence planning. Canada's ability to exercise sovereignty depends not only on legal authority but also maintaining functional systems capable of supporting governance across a geographically vast and environmentally challenging region.

Arctic Security Under Threat provides the most direct assessment of the risks associated with deteriorating northern infrastructure arguing that thawing permafrost, coastal erosion, and increasing environmental variability are threatening the long-term viability of transportation networks, military facilities, ports, airports, and community infrastructure (Canadian Senate Committee on National Security, Defence and Veterans Affairs, 2023). These vulnerabilities have implications extending beyond infrastructure management alone. Damage to runways may reduce the ability to deploy personnel or conduct emergency response operations, while deteriorating roads and marine facilities may limit access to remote communities and increase costs associated with maintaining government services. Infrastructure resilience is an essential component of Canada's Arctic security strategy outside of a technical engineering concern.

Permafrost functions as the structural foundation for much of the infrastructure across northern Canada, where rising ground temperatures can produce uneven settlement, foundation instability, road deformation, and damage to buildings, pipelines, airports, and other critical infrastructure (Romanovsky et al., 2017; Hjort et al., 2022). Recent studies estimate that large portions of Arctic infrastructure are located within regions experiencing increasing permafrost vulnerability, with projected climate change expected to substantially increase maintenance costs and infrastructure failures throughout the next 50 years (Hjort et al., 2022). These risks are particularly significant for northern transportation systems because reliable runways, roads, and ports are vital for the movement of military personnel, emergency responders, essential goods, and community services throughout the Canadian Arctic.

Infrastructure vulnerability is becoming an increasingly important determinant of Canada's capacity to exercise effective sovereignty. While infrastructure has generally been viewed as supporting government operations, climate change is transforming it into a strategic asset where resilience of critical infrastructure directly influences Canada's ability to maintain presence, provide services, and respond to emerging security challenges. Permafrost degradation is not simply an environmental consequence of Arctic warming but a fundamental challenge to the long-term operational capacity to execute northern Canadian sovereignty properly.

6.3.2. Climate Adaptation and Resilient Infrastructure

Recognizing the growing vulnerability of northern infrastructure, the three primary policy documents emphasize the importance of adaptation and long-term resilience rather than simply repairing infrastructure damaged by climate change. As Arctic warming continues to alter

environmental conditions, infrastructure planning is shifting from maintaining systems designed for historical climatic conditions toward developing new infrastructure capable of functioning within an increasingly dynamic and uncertain environment. Resilient infrastructure is presented not only as an engineering objective but as a strategic investment supporting Canada's long-term governance, defence, and sovereignty objectives.

Our North, Strong and Free places particular emphasis on ensuring that Canada's defence infrastructure is capable of supporting operations within a changing Arctic. The policy recognizes that military installations, communications networks, transportation infrastructure, and operational facilities must remain effective despite accelerating environmental change (Department of National Defence, 2024). Rather than solely replacing aging infrastructure, investments to improve resilience, operational flexibility, and long-term sustainability need to be prioritized for permanent sovereignty. Defence modernization is required as both a security priority and a climate adaptation strategy, where operational readiness depends on infrastructure capable of withstanding future deteriorating environmental conditions rather than historical climate norms.

Canada's Arctic Foreign Policy similarly identifies climate adaptation as a central component of Arctic governance. The policy emphasizes that resilient infrastructure supports sustainable economic development, community well-being, environmental stewardship, and Canada's broader sovereignty objectives (Global Affairs Canada, 2024). Climate adaptation requires coordinated planning across multiple sectors, integrating scientific research, environmental monitoring, and long-term investment into proper infrastructure design. Resilient infrastructure is not an isolated environmental initiative, but an essential component of

responsible governance to support northern communities and maintain Canada's presence throughout the Arctic.

Arctic Security Under Threat reinforces the importance of proactive adaptation by arguing that Canada's existing infrastructure must evolve alongside the changing Arctic environment (Canadian Senate Committee on National Security, Defence and Veterans Affairs, 2023). Delayed investment will increase future costs while reducing Canada's operational flexibility to respond to emerging challenges. To continue strengthening northern infrastructure, coordinated planning, sustained funding, and improved collaboration are essential between civilian and defence organizations. Infrastructure resilience is important to the contribution of Canada's ability to exercise sovereignty and enable continuous government operations to support emergency response capabilities across remote northern regions.

Permafrost degradation requires infrastructure systems designed with changing environmental conditions in mind rather than relying upon historical engineering assumptions (Hjort et al. 2022). New adaptation strategies should integrate climate projections, monitoring programs, and long-term planning to reduce future infrastructure risks (Arctic Monitoring and Assessment Programme, 2021). Though, infrastructure resilience cannot be achieved solely through technological improvements, it requires governance systems capable of anticipating environmental change and adjusting policies accordingly.

Infrastructure adaptation has become a strategic priority within Canada's Arctic policy landscape. Rather than responding to infrastructure failures after they occur, contemporary Canadian policy increasingly emphasizes proactive planning, climate resilience, and long-term investment. These findings determine that maintaining Arctic sovereignty depends not only on

expanding Canada's operational capabilities but also ensuring that the infrastructure supporting those capabilities remains functional.

6.3.3. Government Capacity and Northern Communities

While resilient infrastructure provides the physical foundation for Canada's Arctic presence, effective sovereignty also depends on the capacity of government institutions to deliver services, coordinate emergency responses, and support northern communities. Increasing accessibility, infrastructure vulnerability, and more frequent environmental hazards have expanded the responsibilities of federal, territorial, and local governments, requiring greater institutional coordination than has been historically necessary. The three primary policy documents discuss community resilience, emergency preparedness, search and rescue, and intergovernmental cooperation as essential components of Canada's long-term Arctic governance strategy.

Canada's Arctic Foreign Policy focuses on strengthening northern communities as a central objective of Arctic governance. The policy recognizes that climate change is affecting transportation, food security, public services, and community infrastructure while also increasing the frequency of environmental hazards which require coordinated governmental responses (Global Affairs Canada, 2024). These resilient communities are responsible for contributing directly to Canada's sovereignty by supporting year-round habitation, local governance, environmental stewardship, and sustained Canadian presence throughout the Arctic. This perspective broadens the concept of sovereignty beyond military capabilities where effective governance depends on the well-being and resilience of northern populations.

Our North, Strong and Free approaches the issue primarily through a defence lens which recognizes that Arctic security depends on cooperation between military and civilian organizations. The policy identifies search and rescue, disaster response, and support to civil authorities as examples of these increasingly important operational responsibilities (Department of National Defence, 2024). As climate change contributes to greater maritime activity, more frequent extreme weather events, and increasing operational demands, the Canadian Armed Forces are expected to work alongside federal departments, territorial governments, Indigenous organizations, and local communities to ensure effective responses to emergencies across Canada's North. This reflects an understanding that defence institutions form just one component of an integrated 'whole-of-government' approach to Arctic security.

Arctic Security Under Threat provides the most comprehensive discussion of institutional capacity. Canada's ability to exercise sovereignty increasingly depends on the effectiveness of coordination among departments responsible for transportation, emergency management, environmental protection, public safety, defence, and Indigenous relations (Canadian Senate Committee on National Security, Defence and Veterans Affairs, 2023). The report highlights the growing importance of search and rescue capabilities as maritime traffic expands while also emphasizing that emergency response systems must remain capable of supporting year-round northern communities.

Maintaining Canadian sovereignty requires more than resilient infrastructure or enhanced defence capabilities. Climate change requires institutions capable of collaboration across multiple jurisdictions, continuous learning, and flexible decision-making to respond to evolving environmental conditions (Folke et al., 2005). Effective Arctic governance must depend on

coordination of governments, Indigenous organizations, scientific institutions, and local communities rather than centralized decision-making alone. As environmental conditions become less predictable, institutional capacity becomes an important determinant of resilience and long-term governance effectiveness. Community resilience, institutional coordination, and effective government capacity reinforce Canadian sovereignty not only through territorial control but through the continued ability to govern, support, and respond to Canada's northern regions.

6.4. Indigenous Sovereignty and Co-Management in the Arctic

Climate change is transforming the Canadian Arctic through increased accessibility, growing geopolitical competition, and expanding infrastructure challenges. However, these developments also reveal a broader conversation in how sovereignty itself is understood and exercised throughout the Arctic. Contemporary Arctic governance officially recognizes that effective sovereignty extends beyond territorial control, military capability, and physical infrastructure to include meaningful partnerships with Indigenous peoples who have lived throughout the circumpolar North for millennia. Indigenous governance is no longer viewed as separate from Canada's sovereignty objectives but as an essential component of maintaining a stable, resilient, and effectively governed Arctic.

The significance of Indigenous governance has become increasingly apparent as climate change accelerates environmental devastation across the North. Indigenous communities possess extensive knowledge of Arctic ecosystems, sea ice conditions, wildlife movements, and environmental variability that has developed through generations of lived experience. This invaluable knowledge provides insight into rapidly changing Arctic conditions while supporting

adaptive approaches to environmental monitoring, resource management, and community resilience. Modern treaties, land claim agreements, and evolving co-management institutions have expanded Indigenous participation within Arctic decision-making, reflecting a required shift toward collaborative governance and management of the environment.

This final strategic analysis uses the adaptive governance framework to examine how Canada's contemporary Arctic policies incorporate Indigenous knowledge and governance into discussions of sovereignty and climate adaptation. The analysis is discussed in three interconnected components: the role of Indigenous knowledge within Arctic governance; the expansion of co-management and shared decision-making; and the contribution of reconciliation to Canada's long-term sovereignty objectives. Together, these components demonstrate that the future of Canadian Arctic sovereignty depends on governance systems that integrate Indigenous leadership alongside federal, territorial, and international institutions.

6.4.1. Indigenous Knowledge and Arctic Governance

One of the strongest areas of connection across the primary policy documents is the recognition that Indigenous knowledge is an essential component of contemporary Arctic governance. While each document approaches the issue from a different institutional perspective, all acknowledge that Indigenous peoples possess unique environmental knowledge and longstanding relationships with Arctic ecosystems that contribute directly to Canada's ability to understand and respond to climate change. Rather than treating Indigenous knowledge as secondary to scientific research, Canada's modern policies finally recognize it as an important source of evidence informing governance, environmental monitoring, and policy development.

Canada's Arctic Foreign Policy places the greatest emphasis on Indigenous leadership within Arctic governance. The policy recognizes Inuit, First Nations, and Métis peoples as land rights holders whose knowledge, governance systems, and lived experiences are fundamental to Canada's approach to Arctic policy (Global Affairs Canada, 2024). The document further emphasizes that Indigenous knowledge strengthens environmental stewardship by providing observations of changing sea ice conditions, wildlife distributions, ecosystem health, and seasonal variability to complement modern scientific monitoring programs. Instead of separating Indigenous knowledge from broader governance processes, Canada's Arctic Foreign Policy presents it as integral to evidence-based decision-making capable of improving Canada's responses to climate change.

Our North, Strong and Free also discusses how effective Arctic governance requires meaningful collaboration with Indigenous communities. While defence policy is the primary focus of this report, it recognizes that Canada's long-term presence within the Arctic relies on partnerships with northern populations whose knowledge of the region vastly outweighs the federal government to contribute to situational awareness, emergency response, and operational effectiveness (Department of National Defence, 2024). Indigenous engagement is integral to supporting broader defence objectives while reinforcing Canada's commitment to reconciliation and inclusive governance. Arctic security is strengthened not only through military capability but also through sustained relationships with the communities most directly affected by environmental and geopolitical change in the region.

Arctic Security Under Threat reinforces these observations by arguing that Indigenous knowledge should play a greater role in Canada's Arctic governance and security planning. The

report discusses how northern communities often experience the impacts of climate change before they become apparent to southern populations or even within conventional monitoring systems, making Indigenous observations particularly valuable for understanding emerging environmental risks (Canadian Senate Committee on National Security, Defence and Veterans Affairs, 2023). Strengthening collaboration with Indigenous governments and organizations to improve policy development, environmental monitoring, and emergency preparedness throughout the Arctic is an important relationship to combat the impacts of Arctic climate change and contribute to effective governance and national security.

Indigenous knowledge represents a cumulative system of environmental understanding developed through long-term interactions between communities and their surrounding ecosystems (Berkes, 2018). Within rapidly changing Arctic environments, this knowledge provides valuable insight into local environmental conditions, wildlife behaviour, seasonal variability, and ecosystem change that may not be captured through scientific monitoring alone. The Arctic Council (2021) and the Intergovernmental Panel on Climate Change (2022) emphasize that combining Indigenous knowledge with scientific research improves climate adaptation planning while supporting a more balanced and comprehensive environmental governance plan. Indigenous knowledge and scientific knowledge are not competing sources of comprehension but work as complementary approaches to strengthen evidence-based decision-making within complex socio-ecological systems.

Indigenous knowledge has become an increasingly important component of Canada's Arctic governance framework. Climate change has heightened the value of local environmental knowledge by increasing uncertainty throughout the Arctic, making adaptive decision-making

dependent on local sources for evidence and experience. Indigenous knowledge contributes not only to environmental stewardship but also Canada's broader sovereignty objectives to strengthen governance, improve situational awareness, and enhance the long-term resilience of Arctic institutions. Effective sovereignty within a rapidly changing Arctic increasingly depends on governance systems capable of integrating multiple knowledge systems rather than relying exclusively on federal or territorial institutions.

6.4.2. Co-Management and Shared Decision Making

Building on the recognition of Indigenous knowledge within Arctic governance, the policy documents further appreciate that effective governance requires meaningful Indigenous participation in decision-making processes. Contemporary Arctic governance gradually extends beyond consultation with Indigenous governments, organizations, and communities toward collaborative approaches to participate directly in the development, implementation, and evaluation of policies affecting the Canadian Arctic. Co-management is an increasingly important governance tool to strengthen environmental stewardship while supporting Canada's broader sovereignty objectives.

Canada's Arctic Foreign Policy emphasizes partnerships with Indigenous peoples as an essential component of Canada's Arctic governance framework. The policy recognizes that modern treaties, land claim agreements, and Indigenous self-government have fundamentally reshaped governance throughout the Canadian Arctic, requiring federal decision-making to occur through collaborative relationships rather than unilateral action (Global Affairs Canada, 2024). Indigenous organizations play a central role within Arctic diplomacy, environmental

management, and sustainable development, reflecting Canada's commitment to advancing reconciliation alongside Arctic sovereignty. Rather than viewing Indigenous participation as supplementary to federal governance, the policy presents co-management as an integral component of effective decision-making within the North.

Our North, Strong and Free similarly recognizes that strengthening Canada's Arctic security requires sustained collaboration with Indigenous governments and northern communities. The defence policy appreciates that successful defence planning depends on long-term partnerships capable of supporting situational awareness, community resilience, and regional cooperation (Department of National Defence, 2024). This reflects an understanding that security and governance are increasingly interconnected and that meaningful engagement with Indigenous partners enhances Canada's ability to operate effective defence practices.

Arctic Security Under Threat reinforces these observations by recommending stronger collaboration between federal institutions and Indigenous governments across multiple areas of Arctic governance. The report argues that Indigenous organizations should be more fully integrated into emergency management, environmental monitoring, infrastructure planning, and Arctic security discussions because they possess unique regional expertise while representing communities most directly affected by environmental change (Canadian Senate Committee on National Security, Defence and Veterans Affairs, 2023). Co-management is not simply a matter of reconciliation but a practical governance strategy to improve institutional effectiveness and policy outcomes.

Collaborative governance enables governments and Indigenous communities to combine scientific expertise, Indigenous knowledge, and local decision-making to improve the

management of complex socio-ecological systems (Berkes, 2018). The Arctic Council has long recognized Indigenous participants as essential contributors to circumpolar governance, demonstrating that collaborative decision-making has become a defining quality of Arctic cooperation (Arctic Council, 2021). These governance arrangements are particularly valuable under conditions of rapid environmental change because they facilitate knowledge sharing, institutional learning, and adaptive decision-making across multiple jurisdictions.

Co-management has become an increasingly important mechanism for Canada to govern its Arctic territory and strengthen Canada's capacity to exercise authority by improving policy effectiveness, enhancing environmental stewardship, and increasing the legitimacy of governance institutions throughout the North. Co-management represents both a practical response to climate change and an important condition of Canada's Arctic sovereignty.

6.4.3. Reconciliation as Sovereignty

Throughout the primary policy documents, reconciliation is demonstrated not only as a domestic policy objective but also as a strategic component of Canada's long-term Arctic sovereignty. While historical approaches to sovereignty often emphasized territorial control, military presence, and federal or territorial authority, contemporary Arctic policy has recognized that effective sovereignty depends on legitimacy governance partnerships, and shared responsibility. Reconciliation and Arctic sovereignty are presented not as competing priorities but mutually reinforcing objectives.

Canada's Arctic Foreign Policy most clearly reflects this shift by positioning reconciliation as a foundational principle guiding Canada's Arctic policy. The policy recognizes

that respecting Indigenous rights, implementing modern treaties, and supporting Indigenous self-determination strengthen Canada's governance framework while contributing to more effective environmental stewardship and international credibility (Global Affairs Canada, 2024). Reconciliation enhances Canada's capacity to govern rather than limiting federal authority.

Our North, Strong and Free acknowledges that Canada's future security depends on maintaining trusted relationships with northern communities whose continued presence and participation contribute to the stability and sovereignty of the Arctic. Long-term defence objectives are strengthened through these partnerships where national security depends on resilient communities and inclusive governance rather than military capability alone (Department of National Defence, 2024).

Arctic Security Under Threat highlights that Indigenous communities need to be viewed as long-term partners in shaping Canada's Arctic future. Strengthening Indigenous governance, emergency management, infrastructure planning, and security policy improves Canada's overall ability to respond to climate change while reinforcing Arctic governance (Canadian Senate Committee on National Security, Defence and Veterans Affairs, 2023). Effective governance depends on meaningful collaboration between federal institutions and Indigenous governments rather than treating reconciliation as separate from Arctic security.

Collaborative governance and Indigenous participation improve institutional resilience while strengthening the adaptive capacity of socio-ecological systems facing rapid environmental change (Berkes, 2018). Within the Canadian Arctic, where Indigenous peoples have maintained relationships with northern lands and waters for millennia, reconciliation contributes directly to governance legitimacy, environmental stewardship, and long-term institutional resilience.

Reconciliation is an important component of Canada's contemporary approach to Arctic sovereignty where climate change has exposed the limitations of governance models based solely on centralized decision-making, highlighting the importance of collaborative institutions capable of responding to rapidly evolving environmental and geopolitical conditions. Reconciliation strengthens Canada's sovereignty by enhancing the effectiveness, legitimacy, and resilience of the governance systems where those claims are made.

This strategic sovereignty analysis advocates that the future of Canadian Arctic sovereignty will depend not only on military capability, infrastructure investment, or international diplomatic engagement but also on governance frameworks that recognize local Indigenous peoples as full partners in the stewardship and governance of the Canadian Arctic.

7. Conclusion: Canada's Arctic Sovereignty in a Changing Climate

Climate change is structurally changing the Canadian Arctic in ways that extend beyond the physical transformation. Accelerated Arctic warming has been shown to alter the physical geography of the region through Arctic amplification leading to declining sea ice extent and thickness, permafrost degradation, changing ocean circulation, and increasing climatic variability. These interconnected physical processes are impacting accessibility and infrastructure stability while simultaneously transforming the global geopolitical environment. As a result, climate change has power on Canada's future governance, defence, and environmental policy within the North.

My research focus was on how accelerated temperature rise in the Canadian Arctic is understood to impact Canada's geopolitical sovereignty in key policy documents. Through an

interdisciplinary analysis integrating Arctic geography, climate science, environmental governance, defence policy, and international relations, this research determines that climate change is structurally transforming the environment that Canadian sovereignty relied on. Accelerated Arctic warming is not simply an environmental phenomenon but a geopolitical catalyst to change accessibility, infrastructure, governance, defence planning, and international strategic interests throughout the circumpolar North. Sovereignty within the Canadian Arctic can no longer be understood solely through legal jurisdiction or territorial possession but through Canada's capacity to govern, monitor, adapt to, and maintain an effective presence in the changing environment.

The application of adaptive governance, climate security, and world-systems theory frameworks demonstrate the value of an interdisciplinary approach to understanding Arctic sovereignty. Rather than viewing climate change as only an environmental issue or sovereignty as only a defence issue, these complementary theoretical perspectives illustrate the interconnectedness of environmental transformation, institutional adaptation, geopolitical competition, and global economic systems. Together, they provide a more comprehensive understanding of how climate change is reshaping Canada's Arctic policy landscape and create an analytical framework for evaluating future governance challenges within rapidly changing socio-ecological systems.

While previous research in Arctic climate change and sovereignty has often examined climate change, defence policy, or environmental governance independently, my research demonstrates that environmental transformation influences sovereignty through multiple interconnected pathways, including accessibility, geopolitical competition, infrastructure

resilience, and collaborative governance. By integrating these dimensions into a single analytical framework, this research perspective showcases the evolving nature of Canadian Arctic sovereignty under climate change.

My review of key policy documents shows that the future of Canadian Arctic sovereignty will not be determined only by the intensity of climate change, but by Canada's ability to respond and adapt to the new realities created from the change. Historically, Canada's Arctic sovereignty benefited from the region's geographic isolation and environmental inaccessibility. Extensive sea ice, extreme weather, and remote geography acted as natural barriers that limited maritime traffic, resource development, and sustained foreign activity throughout much of the year. While Canada has always exercised sovereignty through legal authority, governance, and occupation, these environmental conditions gave Canada the ability to govern its northern territory with limited operational demands. Climate change is now altering these historical assumptions. The Arctic is becoming increasingly accessible, more economically valuable, and more strategically significant, requiring sovereignty to be exercised through active governance rather than passive geographic advantage.

Arctic sovereignty can no longer be demonstrated through territorial possession or military presence alone. Sovereignty today depends on Canada's capacity to effectively govern, monitor, protect, and steward its territory under continuous environmental degradation. Through the strategic analysis, sovereignty is no longer a fixed concept, but a challenge requiring continuous adaptation. Canada's future capacity to exercise sovereignty will now depend on maintaining and responding to changing environmental conditions while balancing

environmental protection, economic development, national security, and international cooperation.

Climate change processes in the Arctic further increase the region's geopolitical importance. Continued reductions in sea ice extent will lengthen seasonal shipping windows, improve access to natural resources, and increase scientific, commercial, and military activity. While the Canadian Arctic will remain a challenging operating environment, its strategic significance will grow as Arctic and non-Arctic states pursue interests in maritime transportation, critical minerals, fisheries, and economic opportunities. Climate change will continue to act as a threat multiplier, amplifying existing strategic interests while creating new governance challenges associated with increased accessibility and international interest.

The growing strategic importance of the Arctic reinforces the need for Canada to continue modernizing its defence and governance institutions. However, effective Arctic security cannot be achieved exclusively through military presence. Defence modernization must be integrated with broader governance objectives to include resilient infrastructure, environmental monitoring, scientific research, emergency preparedness, and long-term adaptation planning. Investments in surveillance technologies, Arctic transportation infrastructure, communications systems, and search and rescue capacities will contribute to Canada's ability to govern its northern territory. Future defence policy will require interdisciplinary approaches that recognize climate change as both an environmental and security issue.

Climate adaptation is recognized as the defining principle of any future Arctic policy. The future of Canadian Arctic sovereignty depends on collaborative governance that extends beyond territorial control to encompass the relationships, institutions, and governance systems of

Indigenous communities. Indigenous peoples possess extensive environmental knowledge, longstanding relationships with Arctic ecosystems, and governance institutions that strengthen Canada's capacity to understand and respond to environmental change. Strengthening Indigenous participation in environmental stewardship, policy development, emergency management, and Arctic governance enhances both the legitimacy and effectiveness of Canadian sovereignty while supporting an adaptive and resilient governance system.

No single policy can adequately respond to the interconnected challenges presented by climate change. Environmental science, defence policy, international relations, infrastructure planning, Indigenous governance, and economic development are all linked in the Arctic. Successful Arctic governance will require policy approaches from multiple disciplines to addressing environmental changes and evolving geopolitical tensions. Adaptive governance provides a relevant framework for managing this unpredictability by focusing on flexibility, learning, and collaboration across multiple levels of governance.

Ultimately, my research shows that climate change is redefining how Canadian Arctic sovereignty is portrayed. Canada's ability to maintain sovereignty will depend on its willingness to move beyond governance approaches developed for a historically stable Arctic and embrace adaptive policies capable of responding to continuous environmental change. The future of Canadian Arctic sovereignty will not be determined solely by the pace of Arctic warming but by Canada's capacity to evolve alongside it.

As with all research, my study has several limitations. The analysis focused on a selected group of contemporary Canadian policy documents and only reflects the priorities and perspectives contained within those sources. Furthermore, these documents were created in 2023

and 2024, and climate change processes continue to alter the Arctic region at a speed likely exceeding policy implementation. While the qualitative document analysis provided valuable insight into Canada's current Arctic governance and defence strategies, future research could expand into other Arctic nations, interview policymakers and Indigenous leaders, or quantitative assessments of infrastructure vulnerability and defence capabilities.

Ultimately, my research demonstrates that climate change is redefining how Canadian Arctic sovereignty is implemented. The Arctic of the twenty-first century is increasingly accessible, strategically significant, and environmentally dynamic, requiring governance systems capable of adapting to continuous change. Canada's future sovereignty not only depends on defending its northern territory but on the ability to govern through resilient institutions, collaborative partnerships, scientific understanding, environmental stewardship, and adaptive policies. As the Arctic continues to warm, the question is no longer whether climate change influences Canadian sovereignty, it already does.

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