Università
di Genova

DIPARTIMENTO DI SCIENZE POLITICHE
E INTERNAZIONALI

Corso di Laurea Magistrale in:

Security and International Relations

THE ARCTIC FROM FROZEN FRONTIER TO STRATEGIC SPACE: CLIMATE CHANGE, STRATEGIC COMPETITION AND THE CENTRALITY OF GREENLAND

Geography of Conflicts

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ANNO ACCADEMICO

2025-2026

Table of Contents

ABSTRACT (EN) **5**

ABSTRACT (IT) **6**

LIST OF ABBREVIATIONS **11**

LIST OF FIGURES **13**

LIST OF TABLES **14**

INTRODUCTION **16**

CHAPTER 1: THE ARCTIC ENVIRONMENT **18**

1.1 Defining the Arctic *19*

1.2 Climate Change: Trends and Empirical Evidence *22*

1.3 Environmental Change and Socio-Economic Impacts *27*

1.3.1 Environmental Transformations *27*

1.3.2 Socio-Economic Impacts *32*

1.4 Resource Exploitation and Accessibility in the Arctic *37*

1.4.1 Undiscovered Oil and Gas Resources *37*

1.4.2 The Shift to Critical Minerals and Strategic Reserves *39*

1.4.3 Renewable Energy Potential *40*

1.4.4 Agriculture: An Emerging Northern Frontier *41*

1.5 Arctic Sea Routes and Transformation of Maritime Space *42*

1.5.1 Main Arctic Shipping Routes: NSR, NWP and TSR *43*

1.5.2 Climate Change and Navigability *45*

1.5.3 Opportunities and Risks *47*

CHAPTER 2: INFRASTRUCTURE, CONNECTIVITY AND HYBRID COMPETITION **49**

2.1 Infrastructure as a Vector of Power *49*

2.2 Arctic Connectivity *50*

2.2.1 Maritime Infrastructure *51*

2.2.2 Submarine Cables *58*

2.3 Hybrid Conflict and Militarization Dynamics *65*

2.3.1 Defining the terrain: hybrid conflict, the gray zone, and militarization *65*

2.3.2 Militarization: the return of hard power to the High North *67*

2.3.3 Hybrid conflict in practice: gray-zone operations (2024–2026 case studies) *70*

2.4 Strategic Alignments: The Sino-Russian Axis *74*

CHAPTER 3: GREENLAND AT THE CENTRE OF GEOPOLITICS **78**

3.1 Greenland as an Emerging Arctic Pivot *78*

3.2 A Geographical Profile of Greenland *80*

3.2.1 Physical Geography: Extent, Climate and Environment *80*

3.2.2 Human Geography: Population, Settlements and Economy *85*

3.3 The Stakes: Resources, Infrastructure and Strategic Location *87*

3.3.1 Mineral Wealth: Rare Earths, Critical Minerals and Hydrocarbons *88*
3.3.2 Infrastructure and Accessibility *94*
3.3.3 Military Geography: the Pituffik (Thule) Air Base *97*

3.4 The Greenland Question: Sovereignty, Independence and Identity *100*
3.4.1 The Danish Realm and the 2009 Self-Government Act *101*
3.4.2 Economic Dependence and the Independence Debate *103*
3.4.3 Greenland between Great Powers: the US-EU Dispute *105*
3.4.4 The View From Within: Inuit Identity and the Greenlandic Sense of Belonging *107*
3.4.5 A View from Copenhagen: Danish Perspectives on the Greenland Question and a personal interpretation based on a traineeship in Denmark *109*

CONCLUSION **112**

REFERENCES **115**

Bibliography (Academic Sources) *115*

Sitography (Online sources) *125*

Primary sources (Interview) *135*

Figure sources *135*

ABSTRACT (EN)

The Arctic is rapidly shifting from the margins of the world map to one of its strategic centres. As climate change accelerates the retreat of the ice, the region's physical geography – its distances, its buried resources and its location – is being converted into strategic assets, opening the far North to mineral extraction, new shipping routes and renewed great-power competition. This thesis examines that transformation through the lens of the geography of conflict, taking Greenland as a paradigmatic case study. It asks how Greenland comes to occupy the paradoxical position of both an object of external ambitions – from the United States, Europe, Russia and China – and a subject asserting its own territorial agency, and what this tension reveals about who holds power over contested space in the twenty-first century. Drawing on academic and institutional sources, an original interview and first-hand Greenlandic voices, it argues that power over Arctic territory is no longer the preserve of the great powers alone: legitimacy, identity and self-determination have themselves become decisive forces in contemporary geopolitics.

KEYWORDS

Arctic geopolitics; Greenland; climate change; great-power competition; resource exploitation; self-determination; Inuit identity; Arctic amplification; Arctic sea routes; critical minerals; sovereignty games; infrastructure.

ABSTRACT (IT)

Per gran parte dell'età moderna l'Artico ha occupato i margini della carta geografica: una distesa gelata e scarsamente abitata, considerata importante – quando lo era – proprio per la sua lontananza. Nel giro di una sola generazione questa immagine si è rovesciata. Con il ritiro dei ghiacciai, la regione un tempo percepita come periferia del mondo è tornata al centro della politica internazionale, in un punto in cui cambiamento climatico, risorse naturali, nuove rotte marittime e sicurezza militare si intrecciano. Nulla ha reso questo rovesciamento più evidente dell'improvvisa attenzione mondiale sulla Groenlandia – un territorio di circa 57.000 abitanti che, nel giro di pochi anni, è passato dalla periferia della politica internazionale al cuore di una contesa fra le grandi potenze.

Questa tesi analizza tale trasformazione attraverso la lente della geografia dei conflitti e assume la Groenlandia come caso di studio paradigmatico, ponendo una domanda di fondo: come la Groenlandia arrivi a occupare la posizione paradossale di oggetto delle ambizioni altrui e, insieme, di soggetto che rivendica una propria capacità di agire sul proprio territorio, e cosa questa tensione riveli su chi detenga davvero il potere sullo spazio conteso nel XXI secolo. Il lavoro combina fonti accademiche e istituzionali, documenti ufficiali e stampa con due elementi che gli danno voce propria: un'intervista condotta in prima persona a Copenaghen e una serie di fonti groenlandesi di prima mano pubblicate da Osservatorio Artico.

Il primo capitolo stabilisce le fondamenta fisiche e ambientali del discorso. Vi si mostra che il cambiamento climatico non è soltanto un processo ecologico, ma un fatto geopolitico: con l'arretramento del ghiaccio, la geografia fisica dell'Artico – le sue distanze, la sua inaccessibilità, le sue risorse sepolte – si converte in un insieme di asset strategici. Il riscaldamento procede qui a un ritmo molto superiore alla media globale, il fenomeno noto come amplificazione artica: le alte latitudini settentrionali si scaldano più rapidamente del resto del pianeta, con effetti a catena sul ghiaccio marino, sul permafrost e sugli ecosistemi costieri. Il capitolo documenta come queste trasformazioni – la riduzione della banchisa, l'erosione delle coste rese fragili dal disgelo del permafrost, il progressivo "greening" delle terre emerse – non siano soltanto fenomeni ambientali, ma ridefiniscano il valore economico e strategico della regione. Il ritiro del ghiaccio, in particolare, apre alla navigazione rotte a lungo impraticabili e rende più raggiungibili giacimenti prima inaccessibili: l'Artico diventa così una potenziale frontiera di idrocarburi e, sempre più, di minerali critici e terre rare, indispensabili alla transizione verde e alle tecnologie

avanzate. Il capitolo passa poi in rassegna le tre principali vie di navigazione – la Northern Sea Route lungo la costa russa, il Northwest Passage attraverso l'arcipelago canadese e la Transpolar Sea Route attraverso il Polo – analizzando come il cambiamento climatico ne stia allungando le finestre di percorribilità e quali opportunità e rischi ne derivino, dai vantaggi di distanza rispetto alle rotte tradizionali (Suez, Panama) alle incognite ambientali, assicurative e di sicurezza. La tesi che ne emerge è che il clima agisce meno come sfondo che come motore: non si limita ad alterare l'ambiente artico, ma cambia ciò che l'Artico vale, e per chi. Uno spazio un tempo apprezzato per il suo vuoto è oggi conteso per ciò che quel vuoto nasconde.

Il secondo capitolo mostra come questa trasformazione si traduca in competizione concreta. Argomenta che le infrastrutture e la connettività – porti, aeroporti e, soprattutto, i cavi sottomarini che trasportano i dati della regione – sono diventate veri e propri vettori di potere. Poiché circa il 99% delle comunicazioni intercontinentali viaggia sotto la superficie del mare, il controllo di questa rete "invisibile" è insieme un fattore di sviluppo e una vulnerabilità strategica. Il capitolo mostra che la rivalità intorno a queste infrastrutture assume in misura crescente forme ibride, di "zona grigia", che restano al di sotto della soglia della guerra aperta e giocano sull'ambiguità tra incidente e attacco deliberato. Se ne analizzano casi concreti del biennio 2024-2026: il taglio ripetuto di cavi sottomarini nel Mar Baltico, in cui la distinzione tra sabotaggio e semplice negligenza resta volutamente incerta; il disturbo e la falsificazione dei segnali satellitari (jamming e spoofing di GPS e GNSS), che colpiscono l'aviazione civile e la navigazione; e il ricorso a una "flotta ombra" di navi dal profilo opaco, come nel caso del tanker Eagle S. Il capitolo ricostruisce inoltre la militarizzazione dell'Alto Nord – con la modernizzazione delle basi russe sulla Penisola di Kola – e il consolidamento, per quanto asimmetrico, dell'asse sino-russo, in cui la Russia fornisce il territorio e il controllo della Northern Sea Route, mentre la Cina fornisce i capitali, la tecnologia e il mercato. Su questo punto il capitolo approfondisce la controversa autodefinizione cinese di "Stato quasi-artico" – fondata su una relativa vicinanza geografica, sull'esposizione agli effetti del cambiamento climatico e sul suo status di grande potenza commerciale – e la reazione scettica degli Stati artici, che hanno ammesso Pechino solo come osservatore del Consiglio Artico. La conclusione è che l'Artico non è più uno spazio "eccezionale", isolato dalle tensioni globali, ma un'arena in cui queste vengono provate, proiettate e, a volte, deliberatamente rese ambigue: la connettività è insieme la promessa e la vulnerabilità della regione.

Il terzo capitolo fa convergere questi fili in un unico luogo. La Groenlandia emerge come punto focale della contesa artica proprio perché, su una sola isola, si concentrano la sua geografia fisica, la sua ricchezza di risorse, le sue infrastrutture e la sua posizione strategica. Il capitolo si apre con un profilo geografico dell'isola. Sul piano fisico, la Groenlandia è l'isola più grande del mondo, con una calotta glaciale che ne copre circa l'80% e lascia libera dai ghiacci soltanto una stretta fascia costiera – meno di un quinto del territorio – dove si concentrano insediamenti, attività economiche e giacimenti noti; un clima che varia dall'alto-artico del nord al sub-artico dei fiordi meridionali; e un ambiente in rapida trasformazione, con il raddoppio della copertura vegetale negli ultimi decenni e la perdita continua di massa della calotta. Sul piano umano, l'isola ospita una popolazione piccola, per circa l'88% inuit (Kalaallit), dispersa lungo le coste, senza strade che colleghino le città, e legata alla Danimarca da un'economia fondata su due soli pilastri: la pesca – che da sola vale circa il 98% delle esportazioni di beni – e il trasferimento annuale danese (block grant), il cui peso sul PIL è sceso dal 30% circa del 2003 al 19% circa del 2021 ma resta decisivo.

Definito il quadro, il capitolo analizza la posta in gioco. La Groenlandia ospita 25 dei 34 materiali che l'Unione europea classifica come critici, oltre a grandi giacimenti di terre rare – in particolare nel complesso di Ilímaussaq, con i depositi di Kvanefjeld e Tanbreez, tra i maggiori al mondo – e a un rilevante potenziale di idrocarburi, stimato dallo USGS in circa 31 miliardi di barili di petrolio equivalente nei bacini della Groenlandia orientale. A ciò si aggiunge il valore militare della posizione: l'isola giace sulla traiettoria polare più breve fra Nord America e Russia, e la base di Pituffik (l'ex Thule) – dotata di un radar di allerta precoce erede del BMEWS e oggi affidata alla U.S. Space Force – funge da "torre di avvistamento" per la difesa missilistica statunitense, secondo una logica che risale all'accordo di difesa del 1951 e che l'accordo trilaterale di Igaliku del 2004 ha aggiornato dando voce anche alla Groenlandia.

Su queste basi materiali si innesta la "questione groenlandese", che il capitolo affronta in tutte le sue dimensioni. Sul piano giuridico, l'Atto sull'autogoverno del 2009 riconosce i groenlandesi come popolo con diritto all'autodeterminazione e traccia una via legale all'indipendenza; sul piano economico, tuttavia, quella via resta condizionata dalla dipendenza dai sussidi danesi, sicché il dibattito interno verte non tanto sul "se" quanto sul "quando e come" – come confermano le elezioni del marzo 2025, vinte dai Democratici, favorevoli a un'indipendenza graduale, davanti a Naleraq, che la vorrebbe rapida. Sul

piano geopolitico, il capitolo mette a fuoco un elemento inedito: la contesa principale non è tra l'Occidente e un rivale, ma tra due alleati, gli Stati Uniti e l'Europa. La pressione statunitense, avanzata da Trump nel 2019 e drasticamente intensificata dal 2025 fino a definire "inaccettabile" tutto ciò che non sia il pieno controllo dell'isola, ha provocato una reazione europea di solidarietà con Danimarca e Groenlandia e ha incrinato il legame transatlantico; al tempo stesso, paradossalmente, Stati Uniti ed Europa continuano a cooperare sui minerali critici, segno che la disputa è un intreccio di conflitto e interesse comune.

L'ultima parte del capitolo dà spazio alla voce "dall'interno". Il lavoro mostra che, per i groenlandesi, l'autodeterminazione non è solo questione di statualità o di conti economici, ma di appartenenza, dignità e diritto di decidere del proprio futuro: un popolo inuit che rifiuta di essere trattato come merce, sia da Washington sia da Copenaghen. Questa prospettiva è documentata attraverso fonti dirette – tra cui le lettere che comuni cittadini groenlandesi hanno indirizzato a Donald Trump, in cui alla logica dell'acquisto rispondono con l'ironia di "we are already Great" e con l'ormai iconico "Greenland is not for sale", e in cui l'etica Kalaallit del prendere dalla natura solo il necessario si contrappone al desiderio di possesso. A questa voce fa da contraltare quella danese, raccolta attraverso l'intervista condotta in prima persona a Copenaghen con uno studioso di studi strategici: ne emerge lo spostamento dell'opinione pubblica danese – da paese tra i più filoamericani d'Europa a paese diffidente verso gli Stati Uniti – e la lettura della mossa statunitense come un "autogol" strategico, dato che Washington ottiene già, con gli accordi esistenti, ciò che le serve davvero. La tesi arricchisce questa lettura osservando che, anche quando è irrazionale come politica, la sola evocazione della pretesa ha già cambiato la realtà: ha incrinato l'alleanza atlantica, accelerato la spesa per la difesa nel Nord Europa e spinto l'indipendenza groenlandese in cima all'agenda.

Proprio la Groenlandia consente allora di rispondere alla domanda di ricerca. L'isola è al tempo stesso oggetto e soggetto perché la geografia del conflitto del XXI secolo opera su scale diverse: lo stesso territorio può essere una pedina sulla mappa delle grandi potenze e, insieme, la patria di un popolo che rivendica il diritto di parlare per sé. Ciò che il caso groenlandese rivela è che il potere sullo spazio conteso non appartiene più soltanto a chi dispone degli eserciti o delle economie più grandi: la legittimità, l'identità e l'autodeterminazione – condensate nel principio "nothing about us without us" – sono diventate a loro volta fonti di agency, capaci di complicare, rallentare e persino resistere

ai disegni di attori ben più forti. In un'epoca in cui il cambiamento climatico rimescola il valore strategico dei territori, chi controlla lo spazio è sempre più inseparabile da chi vi appartiene.

Da qui discende una lezione più ampia per lo studio della geopolitica, che il lavoro affida alla conclusione: una carta geografica non è mai soltanto una superficie da spartire fra i potenti, ma è anche vissuta dal basso, da chi vi ha la propria casa. L'aspetto più istruttivo della questione groenlandese non è l'ambizione di Washington, Pechino o Mosca, bensì il fatto che una nazione di poche decine di migliaia di abitanti sia riuscita a porre la propria voce al centro di una contesa fra giganti. La tesi riconosce anche i limiti della propria indagine – l'appoggio prevalente su fonti occidentali e in lingua inglese (con l'eccezione dell'intervista e delle voci groenlandesi raccolte), la scelta di un caso singolo e la rapidità con cui gli eventi del 2025-2026 continuano a evolvere – e li legge non come debolezze, ma come aperture verso possibili sviluppi comparativi, ad esempio con le Fær Øer, le Svalbard o il Nord canadese. Ne emerge, in definitiva, che l'Artico non è più il bordo ghiacciato del mondo ma uno dei suoi centri emergenti, e che la Groenlandia è il luogo in cui questo spostamento si legge con maggiore chiarezza: dietro ogni mappa strategica dell'isola – ogni zona ombreggiata di minerali, ogni arco di una traiettoria missilistica, ogni rotta marittima proiettata – c'è una costa dove un popolo continua a prendere dal mare solo ciò di cui ha bisogno, e che non intende più essere semplicemente disegnato sulla carta, anziché ascoltato.

PAROLE CHIAVE

Geopolitica artica; Groenlandia; cambiamento climatico; competizione tra grandi potenze; sfruttamento delle risorse; autodeterminazione; identità inuit; amplificazione artica; rotte marittime artiche; minerali critici; giochi di sovranità; infrastrutture.

LIST OF ABBREVIATIONS

AMAP	Arctic Monitoring and Assessment Programme
CARA	Circum-Arctic Resource Appraisal
CBAM	Carbon Border Adjustment Mechanism
CCCC	China Communications Construction Company
CRMs	Critical Raw Materials
CSIS	Center for Strategic and International Studies
DMI	Danish Meteorological Institute
EEC	European Economic Community
EEZ	Exclusive Economic Zone
EU	European Union
GDP	Gross Domestic Product
GEI	Global Energy Interconnection
GEUS	Geological Survey of Denmark and Greenland
GISTEMP	NASA Goddard Institute for Space Studies Surface Temperature Analysis
GIUK	Greenland–Iceland–United Kingdom (gap)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GRACE	Gravity Recovery and Climate Experiment
IMO	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
LNG	Liquefied Natural Gas
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NOAA	National Oceanic and Atmospheric Administration
NORAD	North American Aerospace Defense Command
NSIDC	National Snow and Ice Data Center
NSR	Northern Sea Route
NWP	Northwest Passage

REEs	Rare Earth Elements
REOs	Rare Earth Oxides
ROTACS	Russian Optical Trans-Arctic Cable System
TSR	Transpolar Sea Route
UHV	Ultra High Voltage
UNCLOS	United Nations Convention on the Law of the Sea
USGS	U.S. Geological Survey

LIST OF FIGURES

Figure 1: Global surface temperature anomalies, 1980–2024 22
Figure 2: Zonal mean temperature anomalies and Arctic amplification, 1980–2024. 23
Figure 3: Spatial distribution of global surface temperature anomalies. 24
Figure 4: Projections of Arctic sea-ice extent under different emissions scenarios. 24
Figure 5: Backshore height, ground-ice content and shoreline change along the coast. 28
Figure 6: Physical processes along permafrost coasts. 29
Figure 7:Impacts of climate warming on Arctic coastal environments. 29
Figure 8:The Atlantis ecosystem model. 32
Figure 9: The Arctic divided into four sub-regions 33
Figure 10:Petroleum potential of assessment units and provinces in the Circum-Arctic 38
Figure 11: Arctic topography, key locations and main maritime routes 43
Figure 12: Arctic surface air temperature under 2 °C and 3 °C warming scenarios. 46
Figure 13:Area where the NSR is the shortest route from Rotterdam to the Pacific. 52
Figure 14: The NSR within the wider transport-infrastructure network. 55
Figure 15: The global submarine cable network, ... 59
Figure 16:Planned route of ROTACS 60
Figure 17:Planned route of Arctic Fibre through the Northwest Passage 60
Figure 18:Planned route of the Ivaluk Network 61
Figure 19: Modernization of Severomorsk-1 air base (2012 vs 2019) 69
Figure 20:Greenland Physical Map 80
Figure 21:Population of Greenland and the Northeast Greenland National Park. 83
Figure 22:Land-ice mass change in Greenland and Antarctica, 2002–2023 84
Figure 23:Total mass balance of the Greenland ice sheet to 31 August 2025 84
Figure 24:Greenland's strategic and critical raw material resource potential. 89
Figure 25:The East Greenland Rift Basins Province and its assessment units. 91
Figure 26:Geology and structural setting of the East Greenland Rift Basins Province 92
Figure 27:The five healthcare regions of Greenland 96
Figure 28: Location of the Pituffik (Thule) Air Base 97
Figure 29:"We are not for sale": protests in Greenland, 2025 108

LIST OF TABLES

Table 1: Development outcomes in the Delphi exercise 35
Table 2:Cargo and transit traffic on the NSR 53
Table 3:Physical characteristics of selected NSR ports 53
Table 4:Evaluation of NSR ports 54
Table 5:Principal port investment and development projects along the NSR. 56
Table 6: Principal Arctic submarine cable projects 62

INTRODUCTION

For most of modern history, the Arctic occupied the margins of the world map: a frozen, sparsely inhabited expanse, valued – when it was valued at all – precisely for its remoteness. Within a single generation, that image has been overturned. As the ice retreats faster than almost anywhere on the planet, the region once seen as the edge of the habitable world is being redrawn as one of its strategic centres, a space where climate change, natural resources, new shipping lanes and hard security now intersect. Nothing has captured this reversal more sharply than the sudden global attention on Greenland – a territory of only about fifty-seven thousand people that, in the space of a few years, has moved from the periphery of international politics to the heart of a contest between the world's great powers.

This transformation raises a problem that is, at its core, geographical. When a warming climate changes what a territory is worth, it also changes who wants it, how they compete for it, and on what terms – and it raises a fundamental question: not simply who owns a space, but who ultimately holds power over it. The Arctic is frequently read from above, as a chessboard on which the United States, Russia and China manoeuvre. Far less attention is paid to the fact that these spaces are also homelands, inhabited by peoples – many of them Indigenous – who are increasingly unwilling to be treated as the passive scenery of other states' ambitions. It is in the tension between these two ways of seeing the same territory that this thesis situates itself.

Accordingly, the central question it seeks to answer is the following: in an Arctic increasingly shaped by great-power rivalry, how does Greenland come to occupy the paradoxical position of both an object of external ambitions and a subject asserting its own territorial agency — and what does this tension reveal about who holds power over contested space in the twenty-first century? Underlying this is a prior, more physical question: in what ways does climate change turn the Arctic's physical geography into strategic assets, thereby driving the competition over the region? Answering the second is the condition for understanding the first.

The approach adopted in the thesis is qualitative and interpretive, drawing on the tools of political and human geography. It combines academic literature, institutional and think-tank analysis, official documents and press reporting with two elements that give the study its own voice: a semi-structured interview I had the opportunity to conduct in

Copenhagen with a Danish scholar of strategic studies, complemented by first-hand Greenlandic sources published by Osservatorio Artico, including open letters written by ordinary citizens, which allow the view from within to be heard rather than merely described. Greenland is treated not as an exhaustive survey but as a paradigmatic case study: an island small enough to be grasped as a whole, yet dense enough, in resources, location and history, to concentrate in one place the forces reshaping the entire Arctic.

The thesis unfolds in three movements. The first chapter establishes the physical and environmental foundation, examining how climate change is transforming the Arctic – its temperatures, its ice, its coasts – and how this transformation turns geography itself into a strategic resource, opening the region to mineral extraction and to new maritime routes. The second chapter moves from the environment to power, analysing how this newly accessible space becomes an arena of competition: how infrastructure and connectivity, from ports to submarine cables, are turned into instruments of influence, and how rivalry in the region increasingly takes hybrid, "*grey-zone*" forms, against the background of militarisation and a deepening Sino-Russian alignment. The third chapter narrows the focus to Greenland, where all of these dynamics converge, and where the *"Greenland question*" – legal, economic, geopolitical and, above all, identitarian – allows the paradox of object and subject to be examined in its fullest form.

With this approach, this study aims to make a modest contribution on two fronts. Empirically, it brings together a fast-moving and still-unfolding sequence of events – culminating in the renewed pressure on Greenland in 2025-2026 – into a single, structured account. Conceptually, it argues that the Arctic cannot be understood through the logic of great-power competition alone, and that the agency of small and Indigenous actors has itself become a factor in the geography of contemporary conflict. If the pages that follow succeed, it will be in showing that the future of the Arctic is being decided not only on the maps of distant capitals, but also, and increasingly, at the point where the ice meets the sea.

CHAPTER 1: THE ARCTIC ENVIRONMENT

The Arctic has long occupied a unique position in the human imagination, oscillating between the myth of an unreachable "*ultima Thule*" and its current reality as a central node of global change. The origin of the term, derived from the Greek *Arktika*, signifying the "*Land of the Bear*" in reference to the celestial constellation *Arktos*, reflects a history of navigation since centuries and orientation where the North was a fixed, albeit distant, anchor for the known world.

For ages, the region was defined by its strong physical barriers, a frozen area that set the limits of human ambition and, particularly, state power. However, in the modern world, this frontier has unfrozen dramatically, turning the Arctic from a static geographic boundary into a dynamic stage for economic and strategic competition.

In August 2007, the shift from a remote, frozen desert to a global political arena was at its most symbolic. During a well-known Russian expedition, two submersibles went down 4,261 meters below the North Pole to plant a titanium Russian flag on the seabed of the Lomonosov Ridge. This event did more than simply assert a claim to land; it changed the conventional view of the Arctic as a place apart from normal power politics. It was a sign of a geopolitical awakening, showing that as the sea ice melts, the sub-seabed and the waters above it, are becoming places of intense sovereign scrutiny and commercial interest.

In order to comprehend this change, it is essential to glance at the Arctic environment from many angles. The physical changes happening in the High North are what make it strategically important now. The area is currently going through the famous argued *"Arctic Amplification*", which suggests it is warming more than twice as fast as the rest of the world, having a huge effect on the cryosphere.

What the whole world is discussing nowadays, does not regard to a merely environmental crisis; it is referring to a structural change that is going to change the way humans think about distance and accessibility. The melting of sea ice and the thawing of permafrost are destroying traditional indigenous ways of life and infrastructure at the same time that they are creating *"windows of opportunity*" for mineral extraction and global logistics. As the ice melts, the story of the Arctic is being told more and more through the lens of resource security. The huge amounts of hydrocarbons that have not yet been found, which were

once thought to be out of reach technologically, are now being joined by an even more important resource: a huge amount of strategic minerals that now, more than ever, are necessary for the global green transition. The shift from fossil fuels to "green minerals" like cobalt, nickel, and Rare Earth Elements (REEs) is putting Arctic countries in a key position in the future global energy hierarchy.

Along with this rush for resources, new shipping routes are as well opening their way up. The Northern Sea Route (NSR), the Northwest Passage (NWP), and the future Transpolar Sea Route (TSR) are now real shipping lanes that will change the way goods are traded around the globe by making the distance between the Atlantic and Pacific oceans considerably shorter. Nonetheless, this increased navigability is producing an ambivalent view; on one side it will bring economic potential, but, on the other side, will also introduce unprecedented operational risks, heightening the likelihood of overlapping territorial claims.

Ultimately, this chapter seeks to bridge the gap between the physical reality of a changing climate and the strategic reality of a changing maritime space. By exploring the interplay between environmental volatility and human agency, it is possible to observe how the Arctic is being integrated into the global system not as a passive victim of warming, but as a contested frontier where the future of global energy, trade, and security will be negotiated.

1.1 Defining the Arctic

The Arctic is often perceived as a clearly delimited geographical space located at the northernmost part of the globe. However, the Arctic can be defined in different patterns, since is not a self-evident geographical entity. Rather, it is described through multiple and overlapping criteria – astronomical, climatic, ecological and political – each producing a different spatial delineation.

The most widely recognized and used definition concerns to the astronomical one, that corresponds to the area of the Arctic Circle (66° 33′ N). The latitude assesses the southernmost point in which the sun remains constantly above the horizon for a minimum of 24 hours during the summer solstice and below it during the winter one. Whereas the geometrically precision of the definition, this boundary helps to capture merely a solar phenomenon rather than environmental or socio-economic realities (Arctic Portal, n.d.).

A second definition regards to the climatic sphere, where the Arctic is commonly based on the 10°C July isotherm, basically where the average temperature of the warmest month of the year (July) does not exceed 10°C (EUMETSAT, 2020). This threshold is consistent to the physiological limit for the three growth and overlaps with the northern treeline. Far apart from the Arctic Circle, the 10°C July isotherm is not a fixed parameter: in fact, it changes in response to long-term warming trends. According to the Intergovernmental Panel on Climate Change (IPCC), assessments of polar climate systems rely on comparable climatic criteria and emphasize the phenomenon of Arctic amplification, whereby regional temperatures are increasing more than twice the global average (IPCC, 2021).

Another definition should be assessed as the ecological one, that in contrast with the astronomical and climatic ones, defines the regional delineation. In this sense, the Arctic can be described as the north region of the boreal forest, characterized by tundra ecosystems, low biodiversity, permafrost soils and short growing seasons – boundary that can vary in according to the ocean currents, topography and continentality. In accordance with the Arctic Biodiversity Assessment produced by the Arctic Council, identifies the tundra biome and associated species distribution as central markers of the Arctic ecological zone (CAFF, 2013).

Lastly, another criterion, in order to have a full evaluation of the Arctic, is the cryospheric one. In fact, the Arctic may be defined by the presence of sea ice, permafrost, glaciers and seasonal snow cover. Institutions such as the National Snow and Ice Data Center (NSIDC) highlight that Arctic processes are fundamentally shaped by sea ice extent and permafrost distribution. Nonetheless, rapid sea ice decline and widespread permafrost thaw are progressively altering the physical contours of the region, providing cryospheric definitions increasingly unstable (Windnagel, A., Stafford, T., Fetterer, F., Meier, W., 2025*).*

The scientific definitions, despite their diversity, play an important role in demonstrating the even apparently objective geographical criteria produce multiple “Arctics”, depending on the variables selected. So, the region is therefore not a singular natural container but a space whose boundaries shift according to the metric employed.

Moreover, the Arctic can also be regarded through a political definition, that does not coincide perfectly with any of the scientific delimitations explained above. Instead, it is structured through institutional arrangements, sovereignty claims and governance mechanisms.

Contemporary Arctic governance is centered on the Arctic Council, established by the Ottawa Declaration in 1996. The Council brings together eight member states – Canada, the Kingdom of Denmark, Finland, Iceland, Norway, the Russian Federation, Sweden and the United States – commonly referred as the "Arctic Eight". Naturally, membership is given due to the territorial presence within the Arctic region rather than a strict adherence to the Arctic Circle boundary (Arctic Council, 1996).

Within this division, a distinction is often drawn between the Arctic Eight and the Arctic Five: Canada, Denmark (via Greenland), Norway, Russia and the United States, whose coastlines border the Arctic Ocean. Their status as littoral states give them specific rights under the United Nations Convention on the Law of the Sea (UNCLOS), particularly concerning continental shelf claims and maritime jurisdiction. Hence, the political geography of the Arctic is closely intertwined with questions of sovereignty, maritime delimitation, and resource control (Byers, 2013; Young, 2005; Malik, et al 2025).

As a result, the political Arctic is not merely a cartographic space, but a governance framework shaped by diplomatic recognition and legal authority, where its boundaries reflect state interests and institutional practises rather than purely environmental parameters.

The variety of Arctic definitions reveals that the region cannot be understood as a self-evident geographical entity. Astronomical latitude, climatic thresholds, ecological transitions, and cryospheric conditions each generate distinct spatial imaginations and interpretations of the Arctic. Meanwhile, political definitions create an additional layer by making certain lines official for the sake of governance and sovereignty.

Thus, defining the Arctic is not a neutral scientific procedure; it is a spatial practice with real-world effects. The selection of a boundary affects resource rights, environmental duties, and strategic placement. To understand how environmental change affects the region's strategic frontier, it is crucial to recognize that Arctic space is layered and built up.

1.2 Climate Change: Trends and Empirical Evidence

Analysing the Arctic, one of the first thing that come into mind straightforward it's correlated to the phenomenon of climate change. Over the past four decades, the region has experienced a unprecedent environmental shift that exceeded the global averages. In this sense, one of the most distinctive features of contemporary climate change is the phenomenon known as "Arctic amplification", referred to the accelerated warming observed in the Arctic compared to the global average. According to the IPCC (2021), temperatures in the Arctic have increased at a rate more than twice the global average over the past decades. Particularly, some regions of the Arctic have experienced warming at rates three to four times higher than the global mean, becoming one of the most rapidly changing climatic systems on Earth (Serreze and Barry, 2011).

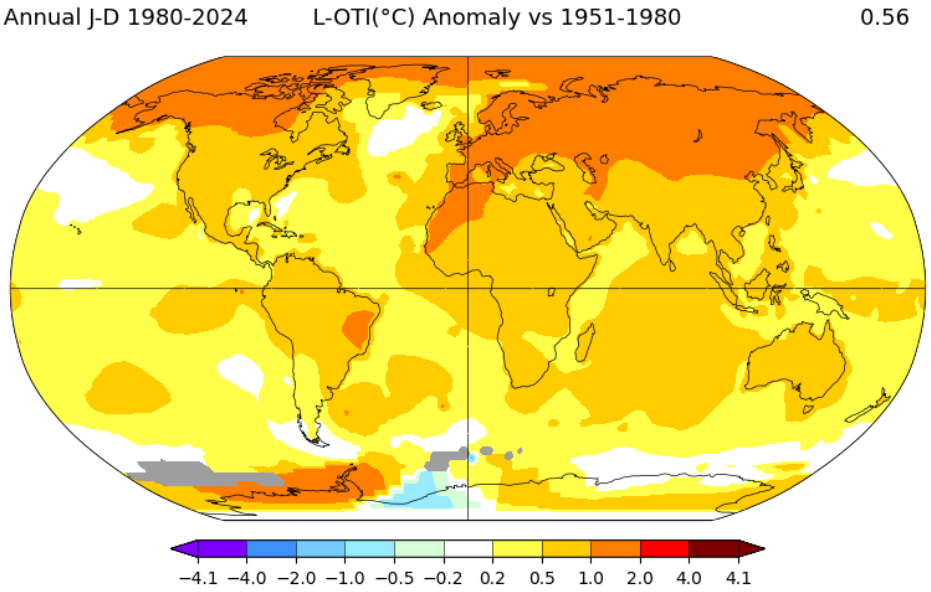


Figure 1: Global surface temperature anomalies, 1980–2024
The map highlights the concentration of warming trends in the Arctic region. Source: NASA GISS (2024).

The accelerated warming in the area is primarily driven by a series of interconnected feedback mechanism within the Arctic climate system. Among the most relevant is the ice-albedo feedback, through which the reduction of highly reflective snow and ice surfaces exposes darker ocean and land areas that absorb a greater amount of solar radiation. As a consequence, more heat is retained within the regional climate system, further intensifying warming and contributing to the decline of sea ice and snow cover (Serreze and Barry, 2011). Further processes, such as changes in the atmospheric circulation,

increased concentrations of water vapour, and variations in cloud cover, additionally amplify regional warming trends (Screen and Simmonds, 2010).

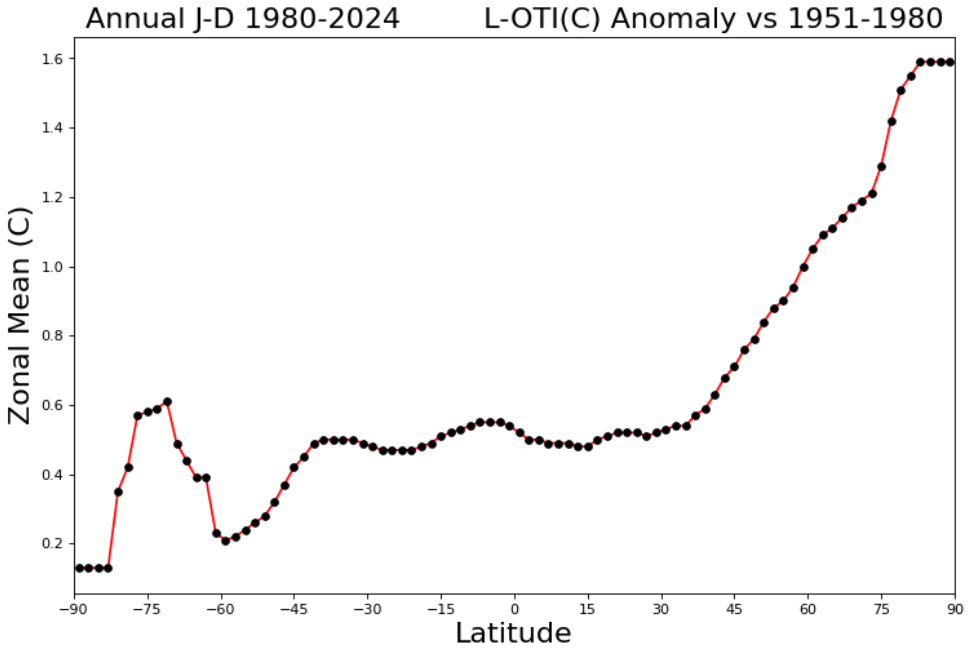


Figure 2: Zonal mean temperature anomalies and Arctic amplification, 1980–2024.
The graph clearly illustrates "Arctic Amplification," with temperatures in the high northern latitudes (60°N-90°N) rising significantly faster than the global average. Source: NASA GISS (n.d.).

The spatial distribution of temperature anomalies highlights the disproportionate warming affecting the Arctic, pattern widely recognized in the scientific literature as Arctic amplification.

Empirical observations collected thought satellite monitoring, climate models and long-term meteorological records tend to confirm the magnitude of these transformations. Since the late twentieth century, the Arctic has experienced an increase in average temperatures of approximately 3°C, a rate considerably higher than the global average (IPCC, 2021). The rapidity of changes has led many scholars to describe the Arctic as a "*sentinel region*" of climate change, where environmental transformations emerge earlier and with greater intensity than in most other parts of the world (Serreze and Barry, 2011).

As illustrated in Figure 3, this geographical disparity in warming creates a new geography of opportunity and risk, where receding ice opens contested maritime routes while destabilizing the environmental basis of regional security.

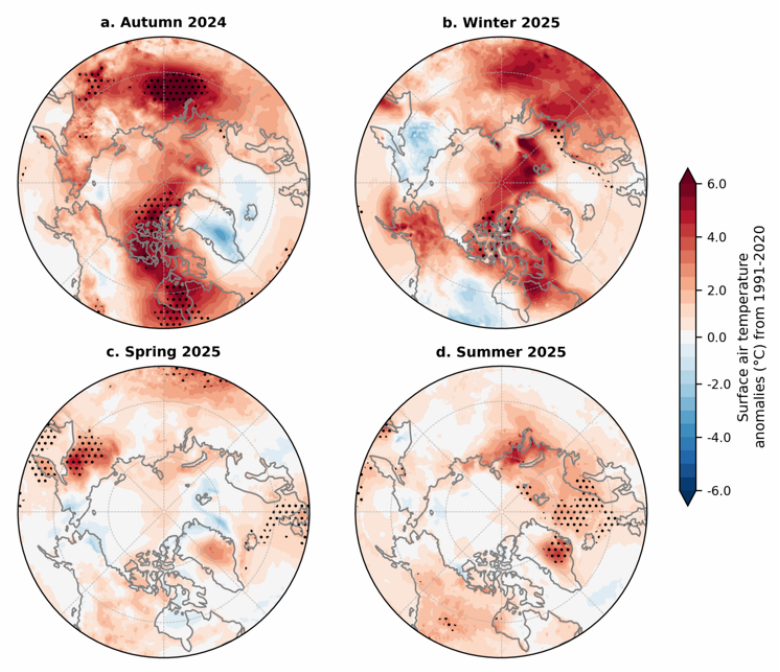


Figure 3: Spatial distribution of global surface temperature anomalies. Highlighting the phenomenon of Arctic amplification. Source: AMAP (2024, p. 12).

The implications of Arctic Amplification exceed beyond regional environmental dynamics. In fact, accelerated global warming is reshaping the physical structure of the Arctic environment, influencing sea ice aspects, permafrost stability and ecosystem functioning. Apart from arctic amplification, when analysing the sensible thematic of climate change, it is appropriate to refer also to another phenomenon – sea ice decline – defined as one of the most visible and widely documented consequences of Arctic warming.

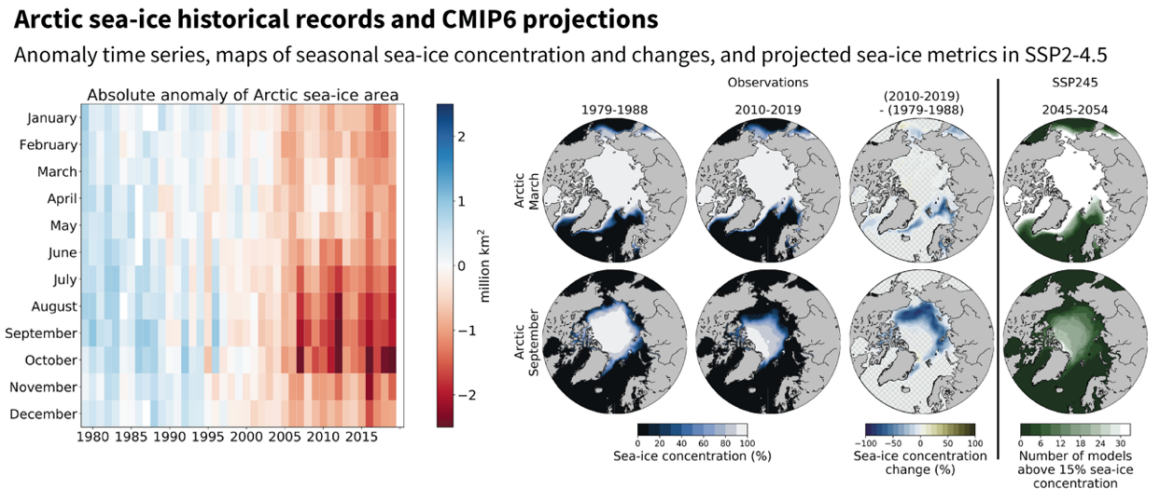


Figure 4: Projections of Arctic sea-ice extent under different emissions scenarios. Source: reproduced from Fox-Kemper et al. (2021, p. 1272, Fig. 9.13).

According to the IPCC (2021), Arctic sea ice extent has decreased in every month of the years since the beginning of satellite observations in 1979, with the most relevant reductions occurring during summer.

The most noteworthy changes can be observed in the month of September, when the Arctic sea ice reaches its annual minimum extent. Alongside this period, the sea ice cover has declined by approximately 12-13% per decade since 1979, a trend that represents one of the clearest indicators of contemporary climate change (Meredith et al., 2019).

In addition to the decline in overall extent, the structural composition of Arctic sea ice has undergone a notable transformation. The multi-year ice – thicker and more resilient ice that survives several melting seasons – has dramatically decreased, while thinner seasonal ice has become increasingly dominant. This change has made the Arctic ice more vulnerable and exposed to the rapid melting and greater seasonal variability (Meredith et al., 2019).

These alterations, despite being environmentally relevant, play also an important role in the big field of geopolitics: as it is possible to imagine, the retreat of sea ice progressively give access to the opening of previously inaccessible maritime corridors across the Arctic Ocean.

Furthermore, another critical dimension regards to the thawing of permafrost, intended as the layer of permanently frozen ground that underlies large portions of the Arctic landmass. Permafrost has historically played a fundamental role in maintaining the stability of Arctic ecosystems, landscapes and human infrastructure. However, rising temperature across the Arctic are accelerating the degradation of permafrost at an unprecedent rate (NSIDC, 2020; European Environment Agency, 2024).

According to the assessments by the AMAP (2024) and IPCC (2021), permafrost temperature has increased across most Arctic regions over the past decades, leading to widespread thaw and ground destabilization. As frozen soils begin to thaw, the organic matter tend to decompose, releasing huge amounts of greenhouse gases such as carbon dioxide and methane into the atmosphere, creating further feedback mechanisms that will make global warming even worse. The thaw of permafrost additionally has major geophysical and socio-economic consequences. Increasingly, ground subsidence, coastal erosion and greater landslide activity are observed throughout Arctic regions, notably Siberia, Alaska and northern Canada. These processes threaten critical infrastructure, including roads,

pipelines, settlements and industrial facilities built on previously stable frozen ground. As a title of example, in Russia, where large segments of Arctic infrastructure rely on permafrost stability, these environmental transformations pose significant economic and strategic challenges (Arctic Council, n.d.).

Beyond infrastructure vulnerability, permafrost thaw also has broader implications for what concerns both the fields of environmental security and regional development. As Arctic landscapes become increasingly unstable, governments and local communities face growing challenges related to infrastructure maintenance, resource extraction, and environmental management. Consequently, permafrost degradation represents not only an environmental phenomenon but also a strategic issue intersecting climate change, economic development, and regional governance in the Arctic.

Moreover, to long-term warming trends, the Arctic is increasingly experiencing a rise as well in extreme climatic events and profound ecological transformations, which illustrate the systemic nature of environmental change in the region. These phenomena, which include the growing frequency of wildfires, coastal erosion, ocean acidification, and shifts in biodiversity, are closely linked to rising temperatures and changing environmental conditions (IPCC, 2021; AMAP, 2024).

One of the most striking developments in recent years has been the increase in Arctic wildfires, particularly in Siberia region. Traditionally rare in high-latitude environments, wildfires have become more frequent and intense due to higher temperatures and drier conditions. In some cases, so-called "*zombie fires*" can persist beneath the snow during winter and reignite in the following season, further contributing to environmental instability (Borunda, 2021). At the same time, coastal erosion is intensifying across many Arctic regions as a result of diminishing sea ice, rising sea levels, and increased storm activity. The loss of protective sea ice exposes coastlines to wave action, leading to rapid land loss and posing serious risks to Arctic communities and infrastructure, particularly in Alaska and parts of northern Russia (IPCC, 2019). Marine ecosystems are also undergoing significant changes. The Arctic Ocean is experiencing increasing levels of ocean acidification, caused by the absorption of atmospheric carbon dioxide. This process has critical implications for marine biodiversity, particularly for calcifying organisms such as shellfish, which form the base of many Arctic food webs (IPCC, 2021). At the same time,

rising temperatures are driving species redistribution, with southern species migrating northward and disrupting existing ecological balances.

These ecological transformations have far-reaching consequences not only for the natural environment but also for human activities and governance in the region. Changes in biodiversity affect fisheries, food security, and traditional livelihoods, particularly for Indigenous communities. More broadly, the intensification of extreme events and ecological shifts reinforces the perception of the Arctic as a region undergoing rapid and multidimensional transformation.

Taken together, these developments highlight that climate change in the Arctic is not limited to gradual environmental variation but increasingly manifests through non-linear processes and abrupt changes, with significant implications for both regional stability and global climate systems

1.3 Environmental Change and Socio-Economic Impacts

Following the environmental trends discussed in the previous section, it is important to look at how these changes are affecting both ecological systems and human activities in the Arctic. The effects of climate change in the area go beyond just rising temperatures, melting sea ice, and thawing permafrost. They are also showing up in bigger changes to the environment that affect landscapes, ecosystems, and the stability of natural processes. These changes, in turn, set the stage for a wide range of socio-economic effects, connecting environmental changes to problems regarding development, governance, and regional security.

1.3.1 Environmental Transformations

The Arctic coastal system is currently defined by a high degree of geomorphic variability and a profound sensitivity to anthropogenic warming, which is occurring at a rate approximately 2.4 times faster than the Northern Hemisphere average (Irrgang et al., 2022).

This environmental transformation is primarily driven by the interplay of local coastal settings – such as lithology and ground-ice distribution – with intensifying environmental drivers such as rising air and water temperatures, sea-ice loss, and increasing storminess (Irrgang et al., 2022). Approximately 65% of Arctic coasts are composed of unlithified, ice-bonded sediments, making them particularly susceptible to rapid morphological changes compared to lithified, rocky shorelines where erosion is limited to mechanical

weathering (Overduin, P. P. et al, 2014). The presence of ground ice, which can reach volumes exceeding 90% in certain Siberian and Alaskan zones, significantly lowers the coast's resistance to erosion once thawing is initiated (Couture, 2018).

The relationship between coastal characteristics and erosion can be clearly illustrated in Figure 5, which demonstrates that unlithified permafrost coasts characterized by low backshore heights and high ground-ice content, such as those along the Laptev and Beaufort seas, experience the most rapid shoreline retreat (Irrgang et al., 2022). Conversely, regions undergoing postglacial isostatic uplift, like the Canadian Archipelago, may exhibit stable or even protruding shorelines despite high ice content (Strzelecki et al, 2020; Bendixen et al, 2017).

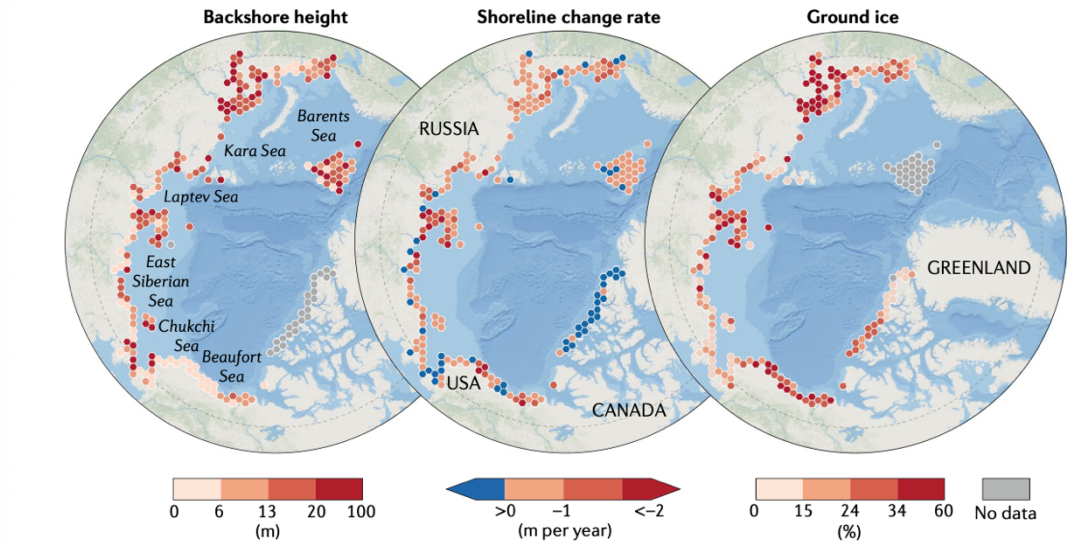


Figure 5: Backshore height, ground-ice content and shoreline change along the coast. Variability of these parameters along the Arctic coast. Source: Lantuit et al. (2011).

The dynamics of these coastal changes are governed by complex physical processes that integrate terrestrial and marine influences. For instance, thermal denudation occurs when warm air and solar radiation cause exposed ground ice to melt, leading to the loss of sediment cohesion and downslope movement, while thermal abrasion involves the combined effect of seawater's thermal energy and mechanical wave action (Baranskaya, A. et al, 2018). These processes often work interdependently; in fact, the formation of a thermo-erosional niche at the base of a bluff can lead to episodic block failure, where entire blocks topple into the ocean.

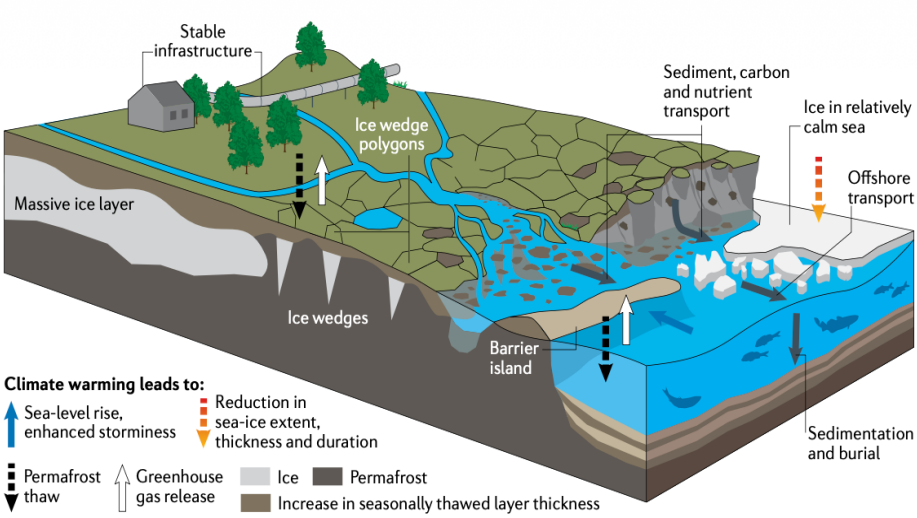


Figure 6: Physical processes along permafrost coasts.
Physical processes contributing to changes along permafrost coasts. Source: Irrgang et al. (2022).

Figure 6 provides a comprehensive schematic of these physical processes, highlighting how climate warming facilitates permafrost thaw, reduces sea-ice thickness, and increases significant wave heights, all of which contribute to accelerating shoreline retreat. The reduction in sea ice is particularly critical as it lengthens the open-water season and increases fetch, allowing for the development of more powerful waves and higher wind sea states that strike the coast with greater frequency and intensity (Irrgang et al., 2022).

The impacts of these intensifying drivers and dynamics extend across the marine, terrestrial, and built environments, as depicted in the schematic overview in Figure 7.

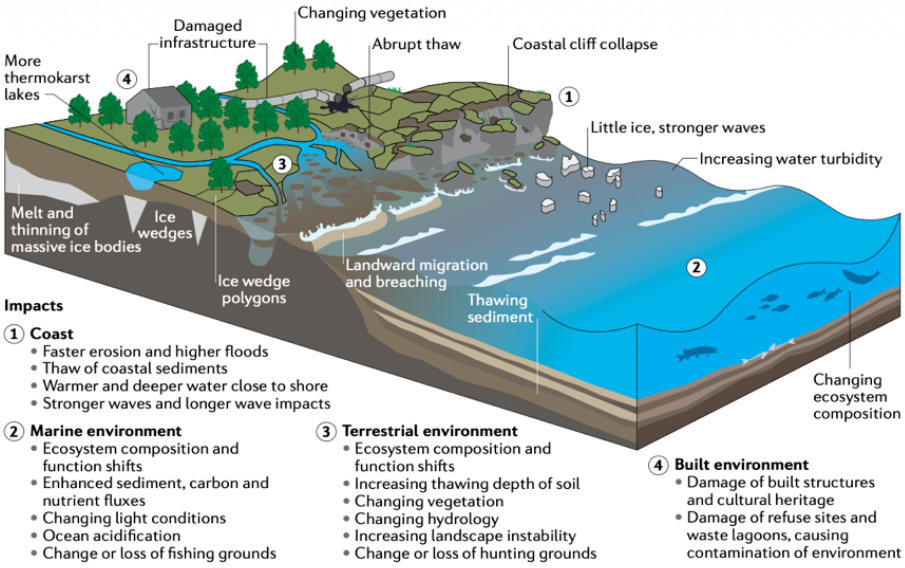


Figure 7:Impacts of climate warming on Arctic coastal environments.
Source: Irrgang et al., (2022)

Environmentally, the erosion of permafrost coasts releases massive quantities of organic carbon, nutrients, and contaminants into the nearshore zone (Irrgang et al., 2022). The annual input of organic carbon from coastal erosion is estimated at 14.0 Tg, a figure higher than the particulate organic carbon delivered by all Arctic rivers combined (Wegner et al., 2015). This flux not only modifies marine food webs, by increasing water turbidity and affecting primary production, but also creates a global climate feedback loop, as the mobilised organic matter is released as greenhouse gases such as CO_2 and CH_4 (Abbott and Jones, 2015).

Meanwhile, on land, permafrost degradation destabilises the landscape and alters hydrology. For the region's Indigenous and local communities, it also entails the loss of traditional hunting grounds, as shifting terrain and changing wildlife distributions undermine subsistence practices. The built environment faces equally severe challenges, as thawing ground and eroding shorelines destabilise infrastructure and threaten coastal settlements (Irrgang et al., 2022). Communities such as Kaktovik, Kivalina, and Shishmaref have already faced relocation or costly mitigation efforts due to repeated flooding and land loss (Bronen and Chapin, 2013). Cultural heritage is at risk as well: it is estimated that 26% of the archaeological remains along the Canadian Beaufort coast were destroyed by erosion between the 1950s and 2011 (Irrgang et al., 2019).

As warming continues, the combination of permafrost degradation and increased storminess will inevitably lead to further intensification of these multifaceted impacts across the Arctic.

Simultaneosly, the marine ecosystems of the Sub-Arctic, particularly those around Iceland, are currently confronting the dual challenges of ocean acidification and global warming, both of which are progressing at rates significantly higher than the global average (Oostdijk, Sturludóttir and Santos, 2022).

This vulnerability is compounded by the region’s specific oceanographic conditions, where colder temperatures enhance the absorption of anthropogenic CO2 and increased freshwater input further reduces the calcium carbonate saturation state (IPCC, 2022). Understanding the response of these complex trophic networks to such stressors requires an integrated approach that considers both biological sensitivities and the socio-economic framework of the communities that depend on these resources. In this sense, the

assessment of these impacts is facilitated through the use of the Atlantis ecosystem model, an end-to-end framework that simulates the interaction between oceanographic processes and all major marine functional group (Oostdijk, Sturludóttir and Santos, 2022).

To parameterize this model in the most correct and effective way possible, fish species are first evaluated based on their socio-economic importance – determined by catch value and the number of participants in the fishery – and their ecological status as keystone groups. This categorization allows researchers to focus on social-ecological keystones, such as Atlantic cod (*Gadus morhua*) and capelin (*Mallotus villosus*), while also accounting for species whose value is primarily economic, such as mackerel, or primarily ecological, such as various zooplanktonic and benthic groups (Oostdijk, Sturludóttir and Santos, 2022).

Furthermore, ecological importance within the Sub-Arctic food web is quantified using network indicators that measure feeding interactions and biomass flow. According to the research conducted by Oostdijk, Sturludóttir and Santos (2022), these metrics reveal that lower trophic levels, specifically zooplanktonic groups (micro-, meso-, macro-, and gelatinous zooplankton), function as primary keystones because fluctuations in their biomass have the most extensive direct and indirect impacts throughout the entire trophic network. In addition, it is possible to encounter other functional groups, such as flatfish, large pelagic fish, and Greenland halibut, that serve as fundamental conduits for biomass flow between diverse parts of the ecosystem. Moreover, species like capelin and sandeel are classified as critical prey groups that support a wide selection of higher-level predators. Projections of the ecosystem's response to isolated warming scenarios indicate a profound re-shaping of biomass across different trophic levels. In fact, lower trophic level groups, including diatoms and certain planktonic functional groups, generally show positive responses to warming, that are likely due to the increased primary productivity. Forage fish such as herring and capelin are also expected to increase in biomass under higher temperature scenarios, although the increase in capelin is mainly attributed to the bottom-up effects rather than its specific thermal niche. On the other hand, in contrast, higher trophic level predatory fish and benthic groups – including haddock, mackerel, flatfish, and lobsters – display consistent declines with increasing temperatures (Oostdijk, Sturludóttir e Santos, 2022).

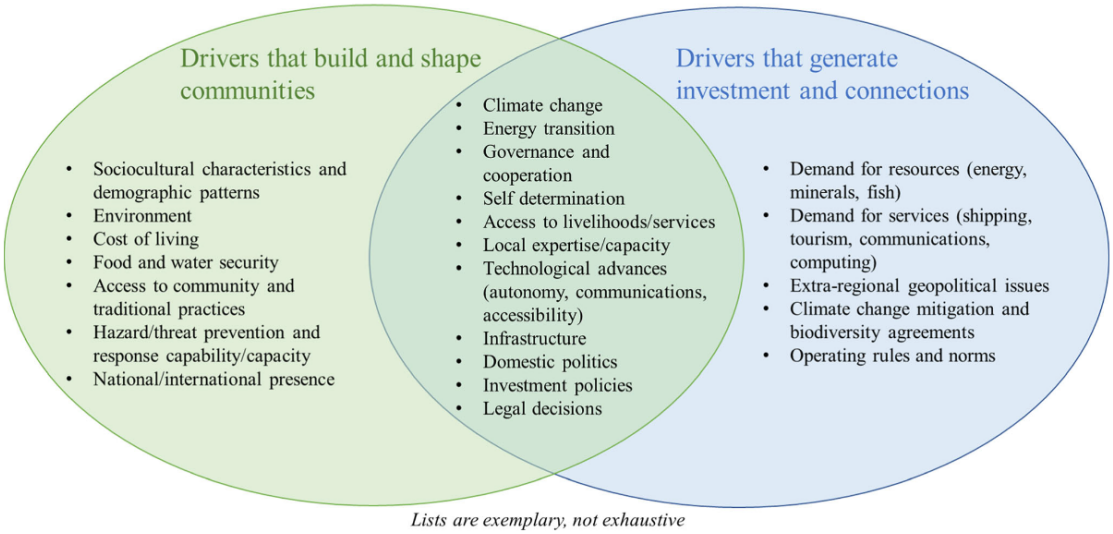


Figure 8:The Atlantis ecosystem model.
Source: Oostdijk, Sturludóttir e Santos, (2022)

In conclusion, when ocean acidification is introduced as a combined stressor, the Atlantis model can suggest that temperature remains the principal driver of biomass change, though acidification introduces cumulative and, sometimes, synergistic adverse impacts.

1.3.2 Socio-Economic Impacts

The socio-economic landscape, as well as other spheres of the Arctic, is undergoing a profound transformation, driven by the acceleration of environmental changes and a shifting geopolitical climate. As argued by Tingstad et al. (2024), these impacts are not homogeneous; rather, they follow "*divergent trajectories*" that redefine regional stabilities. The majority of recent research highlight the socio-economic impacts identifying drivers of change by 2050.

In particular, the research conducted by Tingstad et al. (2024), analyse and divide the drivers in three different categories: drivers that shape activities in and characteristics of local communities; drivers that drive attention toward the pan-Arctic from the outside; and the drivers that impacts at the community level and also drive global interest in the Arctic. Additionally, their research was based also in considering the change of both drivers from local "*inside looking out*" and global "*outside looking out*" views.

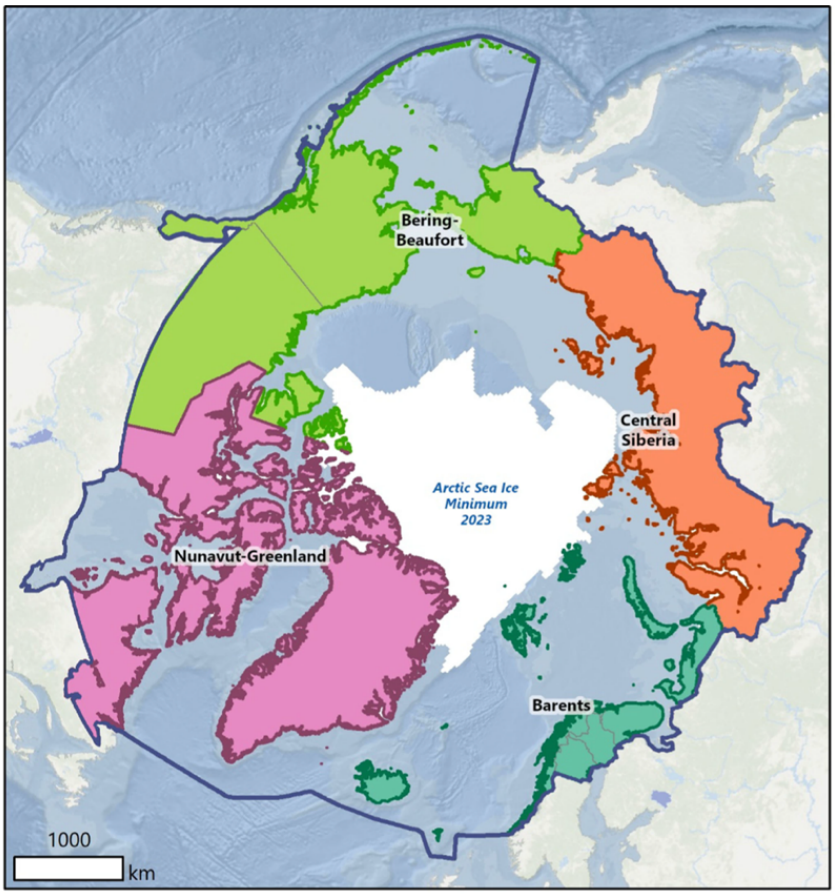


Figure 9: The Arctic divided into four sub-regions
Source: Tingstad et al., (2024)

As it is likely to observe, Image 9 highlights how sociocultural traits and the environment, which are intrinsically local and impact community land and marine use as well as people's perceptions of the world and their role in it, are change drivers that create and shape communities. For instance, women are more likely to move from tiny villages to big cities in Greenland and Alaska due to demographic and cultural trends, more likely to pursue job and educational possibilities away from home, particularly university degrees, even though opportunities for hunting and fishing are liable to attract men to stay (Hamilton, 1996).

As they attract the outside world to the Arctic, change drivers that create linkages and investments from the outside are global in scope. As a title of example, interest in current and prospective extractive activities in the far north has increased due to the worldwide demand for resources and services. This is mostly due to economic considerations outside of the Arctic, such as the emergence of China and India as significant resource users (Keil 2017). These two categories are overlapped by a number of causes, especially those portrayed in the diagram's centre, like governance concerns and climate change. Depending

on the scale and context, these drivers have different outcomes. Local conflicts over renewable energy projects and the green shift are being shaped by the global energy transition, which is also raising interest in the importance of minerals of the Arctic on a global scale (McCauley et al. 2022). Indigenous self-determination levels also influence trajectories in a number of areas, such as resource and infrastructure development and subsistence practices (Nuttall 2019).

Following this pathway, another essential distinction, needed to fully understand the socio-economic sphere, concerns the subdivision of the Arctic into four main areas: Barents, Bering-Beaufort, Central Siberia, and Nunavut-Greenland (Tingstad et al., 2024). This partition is not arbitrary; rather, it reflects the deep heterogeneity of the Arctic across biophysical, socio-economic, and political-governance conditions, so that the same driver can produce very different outcomes depending on whether it unfolds in the Barents or in Central Siberia.If Figure 9 refers to the cultural and economic dimensions, Figure 10 reflects a more specific analysis, focused mainly on areas of interests.

For instance, it is noteworthy to note that there is a long history of international cooperation between the nations and Indigenous Peoples in the Barents subregion. The subregion has a wide range of political philosophies and governmental systems, but collaboration has been made possible by shared objectives based on similar cultural and economic values. Many aspects of Barents sub-region collaboration across borders with Russia based on economic objectives and cultural history, have slowed or stopped after the full-scale invasion of Ukraine in 2022, demonstrating that notions of cohesions and links within the Arctic are necessarily persistent (Tingstad et al, 2024).

To better understand the socio-economic landscape, this section draws upon the empirical findings of Tingstad et al. (2024). Their research, based on a Delphi exercise involving a diverse pool of Arctic experts, identifies ten key outcomes that are instrumental in shaping the region's future by 2050. These outcomes, categorized into economic sectors and sovereignty/governance issues (see table 11), provide a framework for analysing how environmental change translates into localized socio-economic shifts.

Table 1: Development outcomes in the Delphi exercise
Source: Reproduced from Tingstad et al. (2024)

Outcome	Description of outcome	Type: Economic or Sovereignty/Governance
Food	Growth in ocean and land-based production	Economic
Oil and natural gas	Accelerated hydrocarbon extraction	Economic
Mining	Expansion of mining options	Economic
Tourism	Rise in demand for eco- and other tourism	Economic
Technology	Expansion of technology sector	Economic
Arctic residency	Increased public desire to establish or maintain residency in the Arctic	Sovereignty/Governance
Indigenous self-determination	Increased collaboration between Indigenous populations and state/federal and/or private companies	Sovereignty/Governance
Multi-stakeholder cooperation	Decline in cooperation over development issues (growing control over decision making at the national level)	Sovereignty/Governance
Protected areas	Reduced access to land and coastal/maritime areas associated with climate change mitigation (e.g., expansion of renewable energy production; decarbonization; ecological conservation)	Sovereignty/Governance
Military operations	Expansion and persistence of military operations	Sovereignty/Governance

A central tension lies in the dual nature of resource extraction: oil and gas activities are receiving increasing attention, while – despite *"governmental pressures to act on climate change"* in the Western Arctic (Tingstad et al., 2024) – they still remain a crucial component of the Russian Federation's economy. On the other hand, the world's need for a shift to green energy has made Arctic mining a strategic need for getting important minerals. This creates a complicated conflict of stories: the mining of minerals, which is often seen as a way to help the environment, often competes directly with local conservation efforts and traditional Indigenous land-use practices.

Indigenous self-determination is becoming a key part of Arctic governance, but it is not being used evenly across the region. Recent legal advancements, including the devolution agreement with Nunavut (Government of Canda, 2024), the draft constitution in Greenland (Wehmeyer J, 2023), and significant Supreme Court decisions for the Sámi people

in Norway and Finland, underscore an increasing trend towards local governance (Tingstad et al., 2024). From a conflict point of view, this empowerment undermines centralized state authority and creates new legal and institutional tensions in the oversight of nascent economic enterprises, including aquaculture and "*high-tech*" sectors such as data centres, mainly situated in the North area of the Arctic.

The geopolitical split that happened after Russia's invasion of Ukraine in 2022 has also changed the region's social and economic geography in a full-sized way. The end of the "*Arctic Exceptionalism*" era is marked by the end of joint commercial projects, like Russian European cruise tourism, and the end of multilateral cooperation within the Arctic Council (Chuffart, Devyatkin and Raspotnik, 2025). This fragmentation is becoming more evident with the creation of "*no-go zones*" and the growth of military-restricted areas, which Tingstad et al. (2024) say make it harder for people to move around and use commercial space. These military infrastructures not only regulate physical movement but also represent a "*Bipolar Arctic*," where socio-economic development is increasingly referred to national security priorities and strategic rivalry.

Moreover, the divergence identified by Tingstad et al. (2024) is particularly evident when comparing the Russian Arctic with the North American and Nordic sectors, revealing a mosaic of competing governance models and strategic priorities. In the Central Siberian region, the socio-economic framework remains strictly anchored to a state-driven extractive paradigm, where the Arctic is conceptualized as a vital resource base for national economic survival. This model, heavily reliant on oil, gas, and mineral production to satisfy Asian markets, notably China, offers almost no space for local agency or the inclusion of Indigenous perspectives in national policymaking. From a conflict perspective, this creates tensions, where equity is marginalized in favour of large-scale industrial exploitation, often resulting in environmental degradation that further threatens local food security and non-permanent population stability (Tingstad et al, 2024).

By contrast, the sub-regions of North America and Greenland are on a trajectory increasingly marked by decolonization and consolidation of Indigenous self-governance. In these territories, powerful Indigenous voices have resisted hydrocarbon extraction, prioritizing conservation and preservation of traditional livelihoods over industrial growth (Nuttall, 2019; Bronen and Chapin, 2013). This shift, yet indicative of a greater level of

human agency, also results in new socio-economic uncertainties regarding the viability of long-term services and the cost of living in remote communities (Tingstad et al., 2024).

The regional contrast is further accentuated in the Barents region, which experts call a military "*seam*" between Russia and Western Europe. Here, the expansion of hard security infrastructure and military footprint is beginning to overshadow historical multilateral cooperation, turning the geographical space into a site of strategic competition (Young, 2005; Kakışım, 2025). At the same time, the Nordic countries are still at the forefront of technological innovation and "*high-tech*" clusters, which is creating a digital gap and reinforcing the unevenness of Arctic development (Tingstad et al., 2024; Dmitrieva and Solovyova, 2023).

Ultimately, as Tingstad et al. (2024) illustrate in their synthesis of expert insights, the Arctic is no longer a single geopolitical entity but a collection of "*many Arctics*," where the competition between extractive survivalism, Indigenous sovereignty, and military securitization defines the new borders of regional conflict. The findings by Tingstad et al. (2024) highlight a significant "*double fragmentation*" in the Arctic, characterized by localized socio-economic transformations and a rigid geopolitical bipolarity. The invasion of Ukraine in 2022 sped up this two-layered rift, which ended the time of "*Arctic Exceptionalism*" and replaced cooperation between countries with strategic friction.

From this standpoint, the "*Many Arctics*" concept goes beyond just different regions; it is a structural barrier to pan-Arctic governance. As sub-regions diverge – from the Russian state-centric extractive model to North American and Greenlandic indigenous-led sovereignty – the capacity to cultivate shared knowledge and collective security diminishes.

1.4 Resource Exploitation and Accessibility in the Arctic

One of the main reasons why the Arctic has become a state's attraction point regards unavoidably to its resources. In a special manner, not merely to the ones already discovered but the ones, that according to a multiple selection of researches, are supposed to be there and are going emerge in the next decades.

1.4.1 Undiscovered Oil and Gas Resources

According to the findings of the Circum-Arctic Resource Appraisal (CARA), conducted by the U.S. Geological Survey (2008), periodically updated, it is possible to have a clearer

view about the undiscovered resource situation in the Arctic, specifically regarding the oil and gas ones.

Actually, based on the data of the USGS (2008), the Arctic should be home of a huge frontier containing approximately 90 billion barrels of oil, 1,669 trillion cubic feet of natural gas, and 44 billion barrels of natural gas liquids (NGL). Remarkable is the fact that merely and roughly 84 % of these undiscovered resources are expected to be located in offshore areas, referring to the hydrocarbons located beneath the seabed of the continental shelf. The reserves constitute a great portion of the global energy landscape, specifically when considering that the Arctic already accounts for about 10% of the world's known conventional petroleum resources (USGS, 2008).

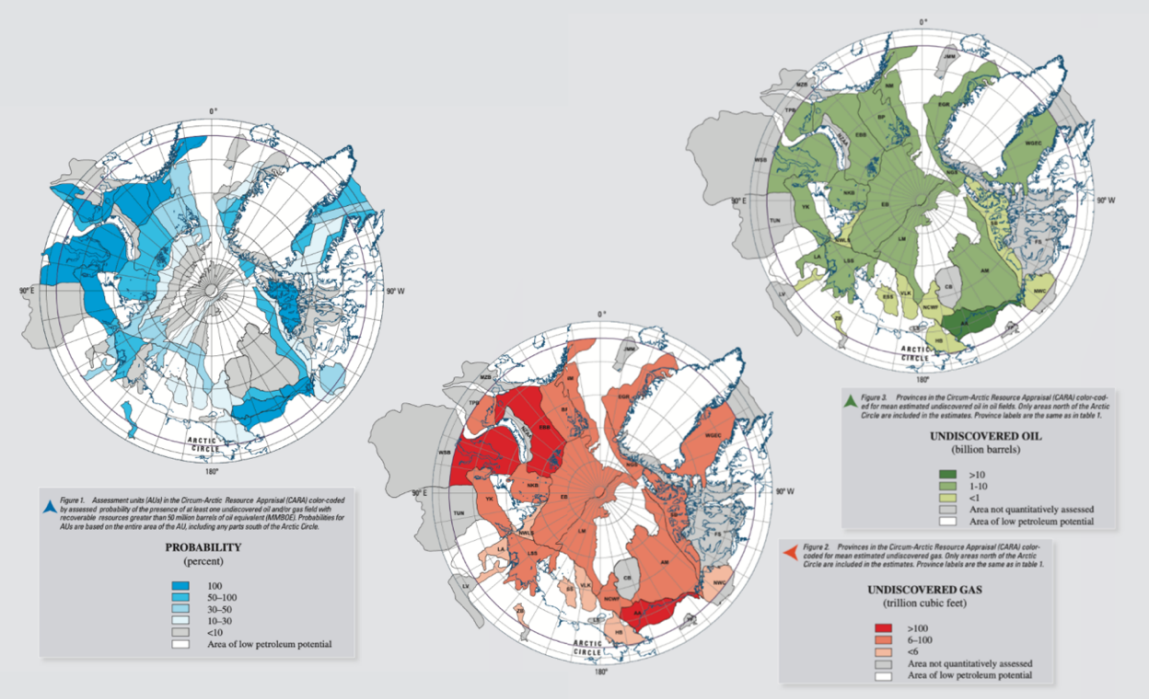


Figure 10:Petroleum potential of assessment units and provinces in the Circum-Arctic
Source: CARA and USGS (2008)

Furthermore, the USGS assessment (2008) provides a quantitative analysis of 25 out of 33 identified geological regions, particularly those presenting a probability higher than 10% of containing significant resource accumulations. Given to the data scarcity in many remote sectors, this appraisal relies on geological analysis and analogue modelling to offer a comprehensive estimate of the region's potential. It is crucial to clarify that these figures pertain exclusively to conventional resources; therefore, unconventional sources – such as coalbed methane, gas hydrates, oil shales, and tar sands – are explicitly excluded from the total estimates. Still, the USGS appraisal remains strictly geological in nature,

focusing on the presence of resources without incorporating economic feasibility, technological constraints, or potential extraction costs (USGS, 2008).

The spatial distribution of this potential is notably uneven across the region. In reference to oil resources, over 70% of the estimated reserves are concentrated within five specific provinces: the Arctic Alaska, the Amerasia Basin, the East Greenland Rift Basins, the East Barents Basins, and West Greenland-East Canada. Similarly. Additionally, more than 70% of the undiscovered natural gas is concentrated in just three provinces, namely the West Siberian Basin, the East Barents Basins, and Arctic Alaska. The extensive Arctic continental shelves likely constitute the largest unexplored geographical area with remaining petroleum potential on Earth (USGS, 2008).

1.4.2 The Shift to Critical Minerals and Strategic Reserves

Despite the lens of fossil fuel extractions, in which the Arctic has traditionally been viewed through, the global momentum toward a green economy is driving a significant paradigm shift. As noted by Kakışım (2025), mechanisms such as the Carbon Border Adjustment Mechanism (CBAM) and Emissions Trading Systems (ETS) are accelerating the transition away from fossil fuels, making the Arctic's critical mineral potential strategically more important than its oil and gas reserves. In addition, the region is supposed to hold mineral resources capable of supporting global critical mineral security (Dmitrieva & Solovyova, 2023).

Nevertheless, the distribution of the resources is highly concentrated: in fact, geological surveys indicate that Rare Earth Oxides (REOs) in the Arctic amount to approximately 126.76 million metric tonnes (mmt), where the Russian sector is holding 72.26 mmt, followed by Greenland (41.69 mmt) and Canada (14.31 mmt) (Mered, 2019). Beyond REEs, the Russian territories of the Komi Republic and Yakutia contain vast reserves of Platinum and Palladium (94.6% of Russian reserves), Cobalt (75%), and Nickel (70.5%) (Dmitrieva & Solovyova, 2023). Notwithstanding Russia's significance in the Arctic – where it controls over 50% of the region's territory – other Arctic nations are positioning themselves as key suppliers in order to reduce dependence on Chinese imports. As a title of example, Finland stands out as the only European country currently producing cobalt on a significant scale, while Norway recently announced a massive discovery of seabed minerals in 2023, including an estimated 3.1 million tonnes of cobalt and 24 million tonnes of magnesium (Adomaitis, 2023). Norway's 2024 decision to initiate licensing for

deep-sea mining in its Exclusive Economic Zone (EEZ) marked a pivotal shift in Arctic resource management, underscoring the strategic urgency of securing green minerals for the renewable energy sector. Similarly, the United States has continued to refocus on Alaska – which ranks sixth in the U.S. non-fossil fuel mineral economy – rebating the region as a critical asset for long-term supply chain resilience (Kraska, 2024).

This "*mineral rush*" has clearly direct geopolitical consequences, as the need to secure sub-seabed resources has triggered a surge in claims for the extension of the Continental Shelf under UNCLOS. In 2023, the Commission on the Limits of the Continental Shelf accepted Russia's request to expand its Arctic shelf by 1.7 million km2, while Canada, Denmark (via Greenland), and Norway have submitted similar claims for millions of square kilometres (Kraska, 2024). This overlap of sovereign claims creates a fertile ground for international tension as states compete to formalize their control over the Arctic's hidden wealth (Kakışım, 2025).

1.4.3 Renewable Energy Potential

Beyond extractive industries, the Arctic is as well emerging as a powerhouse for renewable energy. The region's production potential is estimated to be more than twice the global average (Liu et al., 2023). Wind energy represents the most abundant resource, with average wind speeds reaching 11 m/s in Greenland and 10 m/s in the Norwegian Sea (Mered, 2019). According to the World Energy Council, the Arctic’s annual theoretical wind energy production accounts for roughly 18.5% of the total global capacity (Liu et al., 2023).

Moreover, the melting of glacial masses is also paradoxically increasing hydroelectric capacity, which rose from 80 GW in 2013 to 510 GW in 2021 (Liu et al., 2023). The excess capacity is being leveraged for innovative projects, such as the Hyper Project, a collaboration between Norway, Switzerland, and Japan aimed at establishing an international green hydrogen supply chain by 2030, transporting hydrogen from Norway to Japan via Arctic maritime routes (Mered, 2019).

Furthermore, the region's asymmetric distribution of geothermal energy – highly concentrated in Iceland and Western Alaska – and the increased efficiency of solar panels in low temperatures add to the Arctic’s strategic value in the global energy transition. This potential has attracted non-Arctic actors, most notably China, which incorporates "*Arctic energy hubs*" into its Global Energy Interconnection (GEI) project. By utilizing Ultra High Voltage (UHV) cable technology, China aims to connect giant Arctic wind farms to

continental grids, potentially providing 600 TWh of wind energy annually to a global network (Mered, 2019).

Consequently, the Arctic is no longer seen just as a source of raw materials, rather it is referred as a central node in the future of global renewable energy connectivity.

1.4.4 Agriculture: An Emerging Northern Frontier

Among the economic opportunities that a warming climate is opening in the North, one is easy to overlook: agriculture. As global temperatures rise, the agro-climatic zones suitable for farming are shifting steadily northward, and this shift is projected to be greatest at high latitudes, above 50°N (King et al., 2018). For a region long considered too cold to farm, this turns the Arctic and sub-Arctic into a potential new agricultural frontier – and it gives concrete meaning to the *'land-based production'* side of the *'Food'* development outcome identified by Tingstad et al. (2024).

The opportunity rests on more than warmth alone, in fact, a longer and milder growing season, together with the very long daylight of the midnight-sun period, can accelerate crop growth and, in some places, allow more than one harvest and the cultivation of new and more productive species (Unc et al., 2021). The potential is uneven but, for several northern countries, it could be transformational for local land use (King et al., 2018). However, national approaches already diverge: Canada and Russia lean towards the northward expansion of commercial agriculture, whereas Finland and Sweden emphasise more resilient models such as agroecology and organic farming (Klöffel et al., 2022).

What can actually be grown remains limited, but it is expanding. The hardiest crops dominate: barley, cultivated mainly as animal feed, together with cold-tolerant root vegetables and brassicas such as potatoes, turnips, carrots, cabbage, kale and cauliflower, and hardy fruits like rhubarb and strawberries (Klöffel et al., 2022, The New Humanitarian, 2016). In this particular and underdeveloped field, Greenland represents the clearest illustration: potatoes and cabbages have proved especially successful, and an increasing range of vegetables is now cultivated in its milder south. Where the open-field season is too short, greenhouses fill the gap – in Iceland, abundant geothermal and hydroelectric power sustains the year-round production of tomatoes, cucumbers and peppers that could not otherwise grow at these latitudes (NIBIO, 2023).

These prospects, however, come with serious caveats. Northern soils are often thin, poor and highly variable; the growing window is still short; and much depends on seasonal

conditions that are not yet well understood (Klöffel et al., 2022). Most importantly, expansion is not free of environmental cost. Converting northern natural lands to farmland risks releasing a large share of the carbon they store – by one estimate up to 76% of the carbon held in their vegetation and soils – which would partly offset the very climate benefits sought elsewhere (Klöffel et al., 2022). For this reason, the scope and consequences of northern agriculture remain genuinely uncertain, and it is best understood as an emerging niche rather than a future economic engine, still marginal beside fisheries and resource extraction.

The Arctic's place in the global food system, moreover, is not only a matter of what can be grown there. On the Svalbard archipelago, the *Svalbard Global Seed Vault* – opened in 2008 and carved some 120 metres into the permafrost of a mountain near Longyearbyen – serves as a global backup for agricultural biodiversity, holding duplicate samples of more than 1.3 million seed varieties gathered from gene banks across the world as a safeguard against natural or human catastrophe (Parigi, 2019). The choice of the Arctic was deliberate: its cold and its remoteness were meant to keep the seeds frozen and secure without artificial refrigeration. Yet the vault also embodies the very tension that runs through this section, since the warming that is opening the region to farming has begun to test the permafrost on which the facility depends – a reminder that even the Arctic's role as guardian of the world's crops is not immune to climate change.

Ultimately, the issue is not just whether food can be grown in the Arctic, but for whom and under whose control: climate change may enable agricultural expansion, but its governance will determine whether it supports local food sovereignty or reinforces external claims on the region.

1.5 Arctic Sea Routes and Transformation of Maritime Space

As analysed and explained in the previous sections, the interplay between accelerating climate change and increased accessibility is reshaping the Arctic's spatial dynamics. This process is giving rise to a new geography of access, where the strategic control of shipping lanes and the exploitation of critical resources are becoming the primary drivers of mutually regional cooperation and systemic competition.

1.5.1 Main Arctic Shipping Routes: NSR, NWP and TSR

The Arctic environment is constantly evolving, which has turned the area from a mostly unreachable maritime space into a growing network of central shipping routes. The Arctic Ocean was once thought of as a static and unchanging mass of water due to the thick and long-lasting sea ice that covered it. Currently, it is becoming increasingly as a dynamic and changing maritime area. In this scenario, three main sea routes have become crucial to both academic and policy discussions: the Northern Sea Route (NSR), the Northwest Passage (NWP), and the Transpolar Sea Route (TSR). These routes differ significantly in terms of geographical features, navigability, and governance frameworks, reflecting the uneven and complex nature of Arctic accessibility (Chen et al., 2023).

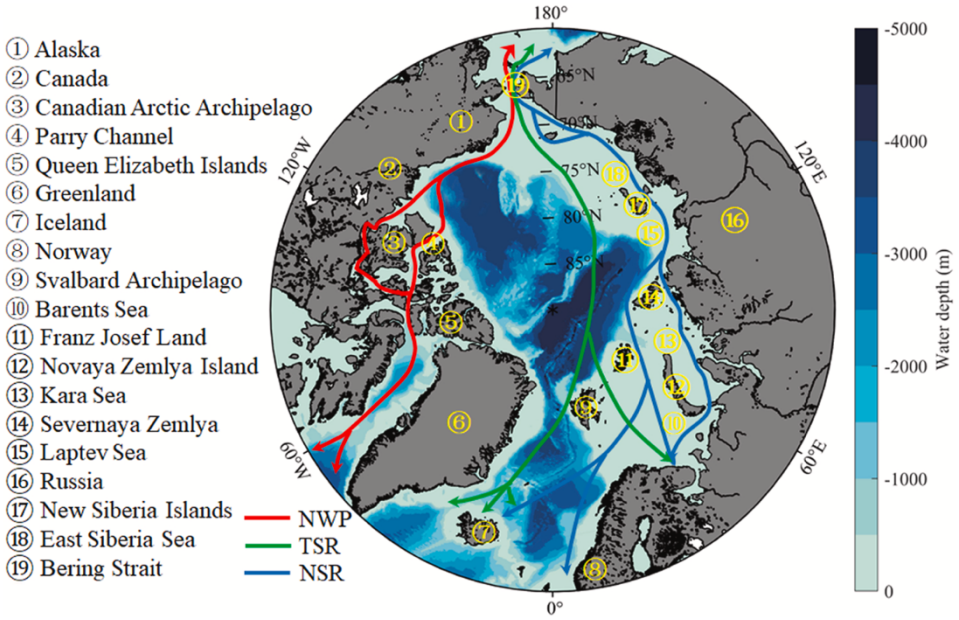


Figure 11: Arctic topography, key locations and main maritime routes
Distribution of Arctic topography, key geographical locations and the main maritime routes – the Northwest Passage (NWP), the Northern Sea Route (NSR) and the Transpolar Sea Route (TSR). Source: Chen et al. (2023).

The NSR is the most developed and operationally viable Arctic corridor at the present time. It passes across the Russian Arctic coast across the Kara Sea up to the Bering Strait. Its relative accessibility is due to both the gradual decrease in sea ice extent and the presence of extensive state-owned infrastructure, such as icebreaker fleets, navigational support systems, and port facilities. In light of these factors, the NSR has slowly become more popular for commercial purposes, especially for exporting energy such as liquefied natural gas (Meza et al, 2023). Nevertheless, regardless of these improvements, navigating the NSR is still very sensitive to changes in the environment. Sea ice conditions

continue to impact the best route, the speed of the ship, and safety while the ship is in operation, illustrating how puzzling it can be to navigate in the Arctic. (Shu et al., 2023).

On the other hand, the Northwest Passage (NWP), which goes through the Canadian Arctic Archipelago, is much more complex and unpredictable to navigate. The route has a rough geography with narrow straits, shallow waters, and ice conditions which vary frequently, making it not optimal for large-scale commercial shipping. Furthermore, the NWP is part of ongoing legal and political discussions about whether it corresponds to internal waters or an international strait. This represents an important difference because it affects control, regulation, and freedom of navigation. The absence of clear laws, along with the lack of supporting infrastructure and limited search and rescue capabilities, makes it even harder for the NWP to become a stable and predictable maritime corridor (Li and Lynch, 2023).

Finally, the Transpolar Sea Route (TSR) is the most transformative part of the Arctic maritime system we may observe in the future. The TSR would pass through the central Arctic Ocean, unlike the NSR and NWP. This would make the Atlantic and Pacific Oceans more directly connected and cut down on the distance between major global exchanges. Recent forecasts suggest that ongoing warming trends could facilitate seasonal navigation along this route before the mid-21st century, despite its current inaccessibility due to persistent ice cover (Zhang et al., 2023). If the TSR took place, it would be an enormous shift in the way global shipping is regulated and perceived: it would make coastal routes less important and change the way maritime hierarchies work.

Taken together, these three routes demonstrate that the opening of the Arctic does not translate into a uniform expansion of navigability. Rather, it creates a varied maritime space where access is not evenly spread out and is affected by a mix of environmental factors, technological advancements, and geopolitical concerns. The NSR is becoming more institutionalized and controlled by the government, but the NWP is still limited by both physical and legal uncertainties. The TSR, on the other hand, is still mostly just a possibility for the future. This variety shows the need to think of Arctic Sea routes not just as other shipping lanes, but as parts of a bigger change in worldwide maritime space that is happening over time.

1.5.2 Climate Change and Navigability

Climate change represents the primary driver behind the increasing navigability of the Arctic maritime domain. Over the past decades, the region has experienced a marked reduction in sea ice extent, thickness, and seasonal persistence, fundamentally altering the physical conditions that have historically constrained the access to sea. The transformation is not only accelerating but also showing strong seasonal and regional variability, making the Arctic an increasingly dynamic – yet still unpredictable –navigation environment.

One of the most significant consequences of Arctic warming is the progressive lengthening of the navigation season. Routes that were once accessible only for a few weeks during late summer are now open for extended periods, particularly along the NSR. Ideal and model projections suggest that under continued warming scenarios, navigability across key Arctic passages will expand significantly, especially under global temperature increases of 2°C and 3°C (Chen et al., 2023). These changes are expected to reduce transit barriers and enhance the operational likelihood of Arctic shipping, although not uniformly across all routes.

Concurrently, declining sea ice does not necessarily translate into safer or more predictable navigation conditions. In fact, the transition from multi-year ice to thinner and more mobile "*first-year ice*" introduces a variety of new operational risks. Increased ice drift, the presence of unpredictable ice floes, and rapidly changing weather conditions are all factors that can significantly affect route planning and vessel performance as well. Even in scenarios of reduced ice coverage, these factors continue to impose restrictions on speed, routing efficiency, and general safety (Shu et al., 2023). Consequently, Arctic navigation seems to remain highly dependent on real-time environmental monitoring and advanced forecasting capabilities.

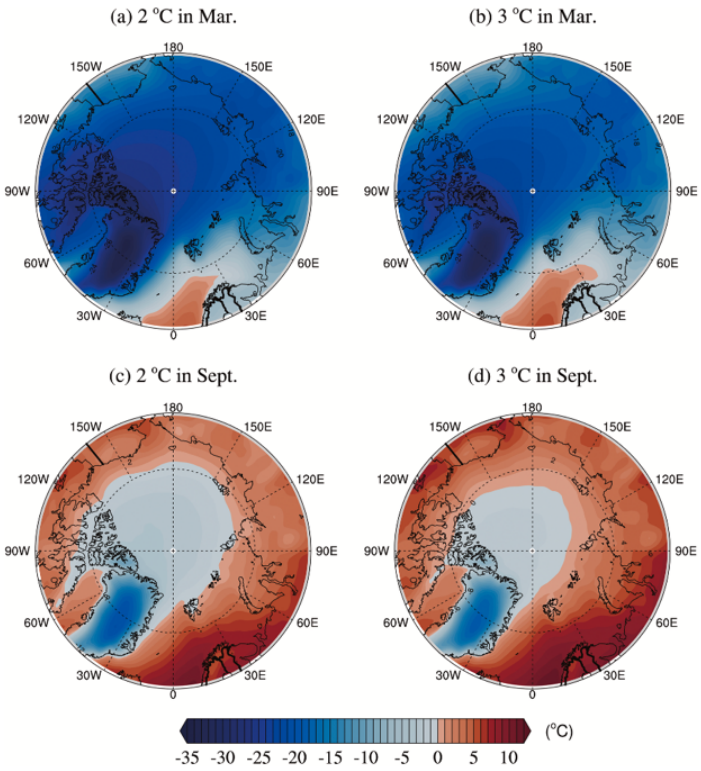


Figure 12: Arctic surface air temperature under 2 °C and 3 °C warming scenarios. Distribution in March and September under 2 °C and 3 °C global warming, based on SSP2–4.5, SSP3–7.0 and SSP5–8.5 ensemble averages. Source: Chen et al. (2023).

Looking toward the future, projections indicate the possible emergence of a seasonally ice-free Arctic Ocean, particularly during late summer months. This scenario would represent a structural shift in global maritime accessibility, enabling not only the consolidation of existing routes such as the NSR, but also the potential opening of new corridors, including the TSR (Zhang et al., 2023). More recent studies further suggest that, by the end of the century, certain segments of Arctic routes – especially along the NSR– could become navigable on a near year-round basis, depending on emission trajectories and technological adaptation (Zhao et al., 2024).

However, the expansion of navigability must be understood as a non-linear and uneven process. Regional disparities in ice retreat, combined with interannual variability, mean that accessibility will remain fragmented and uncertain. In addition, climatic changes interact with other environmental factors, such as ocean currents, wind patterns, and visibility conditions, further complicating navigation dynamics. Thus, while climate change is undoubtedly lowering the physical barriers to Arctic shipping, it is simultaneously generating a more complex and risk-prone operational environment.

In this sense, the liaison between climate change and Arctic navigability is intrinsically ambivalent. On one side, it opens new opportunities for maritime connectivity and

economic activity; on the other, it introduces new layers of uncertainty and risk that challenge the assumption of a straightforward opening of the Arctic.

1.5.3 Opportunities and Risks

The progressive opening of Arctic Sea routes presents a complex combination of economic opportunities and strategic risks, reflecting the inherently ambivalent nature of climate-driven transformations in the region. While increasing navigability is often framed as a gateway to new commercial and logistical possibilities, it concurrently introduces noteworthy environmental, operational, and geopolitical challenges that complicate the development of Arctic maritime corridors.

From an economic standpoint, one of the most relevant opportunities besides in the potential reduction of world shipping routes and the cut of transit times. Arctic routes, as explained before, could considerably shorten connections between major markets in Asia and Europe if compared to the traditional passages, such as the Suez Canal. It is a matter of fact that the use of the Arctic routes, especially the NSR, has direct impacts on fuel consumption, transportation costs and the efficiency of global supply chain. Furthermore, the development of Arctic navigation is closely linked to the advance of resource-based firms, particularly in the energy sector. The growing use of Arctic routes for the export of Liquefied Natural Gas (LNG) illustrates how maritime accessibility and resource exploitation are increasingly interconnected (Meza et al., 2023). More recent studies also suggest that the expansion of Arctic shipping could reshape global emission patterns, potentially reducing distances but also redistributing environmental impacts across regions (Zhao et al., 2025). Nonetheless, these opportunities are counterbalanced by persistent and, in some cases, intensifying risks.

Besides the economic view, from an operational perspective, Arctic shipping and navigation remains pretty uncertain and vulnerable. Even under circumstances of sea ice reduction, in theory easier to navigate, in practice vessels are always exposed to rapidly changing weather patterns, limited hydrographic data, and insufficient infrastructure, including ports, search and rescue capabilities, and emergency response systems. These elements, put together, increase the likelihood of accidents and complicate large-scale commercial expansion. Moreover, the presence of mobile ice, low visibility, and extreme conditions continues to pose significant challenges for route optimization and safety as well (Li & Lynch, 2023).

Another relevant pattern to take into consideration regards to the environmental risk: in fact, the Arctic could be easily described as an exceptionally fragile ecosystem, highly sensitive to external disorders. Properly in this particular situation, the increment of shipping activities raises the probability of oil spills, pollution and disturbances to marine biodiversity, that can leave the room for irreversible consequences. In this light, the paradox of Arctic navigability becomes clear: the processes that enable increased access, such as climate change and ice melt, are at the same time exacerbated by the expansion of human activity in the region (AMAP, 2024; IPCC, 2021).

In accordance with the economic and environmental ponderations, the navigability of Arctic Sea routes, carries as well profound geopolitical complications. Improvement in accessibility help define the Arctic as more strategic space, in which states seek to assert control over emerging corridors and associated resources (Tingstad et al., 2024). In particular, the NSR, seems to be subject to strong regulatory control by the Russian Federation, which recognizes the route as a national transport artery rather than an international shipping lane (Li & Lynch, 2023). Nonetheless, the situation of unresolved legal disputes – such those surrounding the status of the NWP – underline the potential tensions regarding sovereignty and freedom of navigation principles.

Hence, it is clear that the Arctic, and in this sense its routes, cannot be analysed sorely in terms of economic efficiency or technological practicability. Fairly, it is necessary to consider and interpret them as components of an emerging and contested maritime space, shaped by the interaction of environmental change, market dynamics, and geopolitical interests. The opportunities associated with increased accessibility are therefore inseparable from the risks they generate, reinforcing the idea that the transformation of the Arctic does not simply open new routes, but reconfigures the balance between cooperation, competition, and vulnerability in the global maritime system.

CHAPTER 2: INFRASTRUCTURE, CONNECTIVITY AND HYBRID COMPETITION

2.1 Infrastructure as a Vector of Power

As discussed in the previous chapter, the progressive retreat of Arctic sea ice is reshaping patterns of access, making resources and maritime routes increasingly reachable. However, physical accessibility alone does not translate into effective use: routes require ports, logistics, communication systems, and search-and-rescue capabilities in order to become operational and functional. Infrastructure, therefore, constitutes the critical link between geographic possibility and strategic reality.

In this sense, infrastructure cannot be understood as a merely technical or economic domain, but rather as a fundamental *vector of power*. In his seminal work, Michael Mann (1984) theorizes infrastructural power as the capacity of the state to penetrate and coordinate activities across its territory through logistical and administrative means. Roads, communication systems, and networks are thus not neutral tools, but the material channels through which sovereignty is exercised and maintained. This perspective is particularly relevant in the Arctic, a region historically resistant to state penetration due to extreme environmental constraints. As these constraints weaken, the expansion of infrastructural networks becomes the primary mechanism through which states transform their presence into authority.

What makes infrastructure strategically significant is not the existence of it but, more specifically, the control of the critical nodes in larger connectivity networks. In interconnected systems, power, according to Farrell and Newman (2019), originates from the ability to hold central positions in networks. They point out two main mechanisms: the *panopticon effect,* which enables actors to monitor flows thru strategic hubs, and the *chokepoint effect,* which enables them to restrict or deny access to those flows. Originally developed in the context of financial and informational networks, this framework can directly be applied to the Arctic, where ports, icebreakers, and communication systems function as critical nodes in emerging routes, where having control over these nodes automatically translates into the ability to regulate access, shape usage conditions, and influence the behaviour of other actors.

This dynamic is further intensified by the structural characteristics of the Arctic environment. On one hand, the infrastructure in the region is very expensive, technically complicated and slow in development; in contrast, at the same time, environmental factors such as permafrost thaw and extreme climatic conditions reduce long-term stability and increase maintenance costs (Povoroznyuk et al., 2022). This results in infrastructure being scarce and difficult to manage. This scarcity makes it all the more strategically valuable. Unlike more developed areas, each piece of infrastructure in the Arctic is a highly visible and irreplaceable node that gives those who control it disproportionate power.

Furthermore, Arctic infrastructure is dual-use in nature, with the same assets that enable economic activity, such as ports, icebreakers and communication systems, also supporting military operations and strategic surveillance. This overlap blurs the distinction between civilian and security domains, and infrastructure investment becomes a key instrument of geopolitical positioning. Therefore, infrastructure development in the Arctic is rarely politically neutral but rather reflects wider strategic goals and power projections.

Taken together, these elements highlight how infrastructure structures competition in the Arctic rather than merely supporting it. States that are able to build, control, and maintain key infrastructural nodes gain a decisive advantage in shaping emerging connectivity networks, dynamic particularly visible in the development of Arctic maritime routes, where infrastructural capacity determines not only access, but also governance and control.

2.2 Arctic Connectivity

Connectivity refers to the networks that link societies, states and global systems across multiple dimensions. In the Arctic, connectivity assumes a particularly tactical importance: this is not due to a greater quantity of infrastructure, but rather to the region's structural constraints, including extreme environmental conditions, sparse population, limited workforce and historically low levels of investment compared to other regions.

Hence, infrastructure in the Arctic acquires a disproportionate significance: depending on the type of infrastructure considered, it can fundamentally shape both regional development and global dynamics.

In order to have a full image and a better comprehension of the field, this section is intended to focus on two key dimensions: maritime infrastructure and submarine cables. While these systems are deeply interconnected, they differ in their functions, implications and the ways in which they are perceived.

2.2.1 Maritime Infrastructure

Alongside the broader question of Arctic transport, marine infrastructure occupies a unique position: it embraces the seaports, the specialised terminals for LNG, crude oil, dry bulk and, prospectively, containers, and the ancillary services – icebreaker escort, search-and-rescue capability, and hydrometeorological and ice monitoring – without which commercial navigation of the NSR cannot take place. Although scholars have always posed their attention and consideration on the navigability and the economy behind the route itself, in recent years, ports have increasingly been recognised as the decisive node. As Wang et al. (2020) illustrate, a port performs functions such as ship maintenance, replenishment and cargo distribution that make it indispensable to the route, however the underdevelopment of these facilities is simultaneously one of the principal barriers to the growth of the NSR. The route's commercial appeal rests on geography: between north-western Europe and north-eastern Asia the NSR is roughly 30–40% shorter than the Suez Canal route (Rivas Hermann et al., 2022). Such distance advantages can only be realised if a functional port infrastructure is available both at the endpoints and along the route.

A useful conceptual distinction frames the discussion on maritime infrastructure. Rivas Hermann et al. (2022) separate two different notions, that often are confused as the same: *the gateway,* an intermodal point at which goods pass from one mode of transport to another; *the hub*, a transmodal point at which transfer occurs between vessels of the same type. Their research shows that the viability of the NSR as an intercontinental corridor is less dependent on the ability of individual ships to travel the entire route than on the emergence of transshipment hubs at its ends: Ice-classed vessels will serve the central ice-covered section between two hubs and conventional feeder ships will serve open-water approaches. This is one of a number of operational models described in the literature reviewed (notably Milaković et al.) all of which place dedicated port infrastructure at the heart of any year-round commercial use of the route.

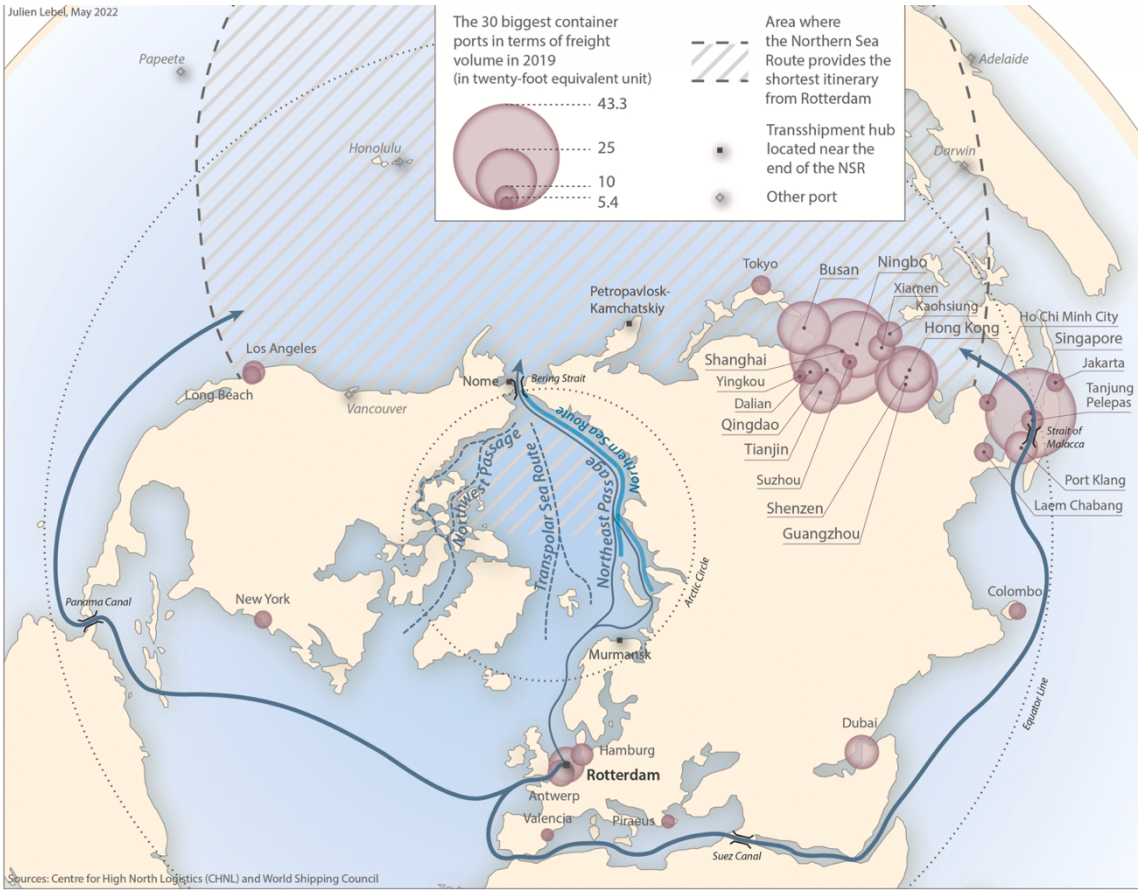


Figure 13:Area where the NSR is the shortest route from Rotterdam to the Pacific.
Shown against the world's major container ports (azimuthal projection centred on the North Pole). Source: Rivas Hermann et al. (2022).

The scale and composition of current traffic explain why this remains a prospective rather than a complete accomplished system. Total cargo on the NSR rose from about 3.1 million tonnes in 2011 to 31.5 million in 2019 and roughly 34.9 million in 2021; yet international transit – cargo merely passing through – has remained small and volatile, collapsing after the 2014 sanctions and never regaining its 2013 level (Wang et al., 2020; Rivas Hermann et al., 2022). The overwhelming share of movement is destination shipping tied to the export of Russian hydrocarbons and minerals: liquid bulk accounted for roughly 70% of cargo in the early 2010s, most of it moving westbound to eastbound, and dry bulk (chiefly iron ore) dominated the modest transit flow of 2021, with containers barely 1.5% (Wang et al., 2020; Rivas Hermann et al., 2022). Projections that predict traffic approaching 100 million tonnes by 2030 rest almost entirely on planned energy projects rather than on container trade (Wang et al., 2020). Marine infrastructure on the NSR, in other words, is being built for resources first and for containers only distantly (Table 2).

Table 2:Cargo and transit traffic on the NSR.
Author's elaboration from Wang et al. (2020, Table 1) for 2011–2019 and Rivas Hermann et al. (2022) for 2021.

Year	Total cargo (Mt)	Transit voyages	Transit cargo (Mt)
2011	3.11	41	0.82
2013	3.91	71	1.36
2014	3.98	31	0.27
2016	7.48	19	0.21
2018	19.7	27	–
2019	31.5	37	0.70
2021	34.85	86	–

Drawing on the reviewed literature, Rivas Hermann et al. (2022) note that the siting of a hub is governed by a series of considerations: fuel efficiency and emissions over the route; the ability to connect with shipping lanes other than the NSR, particularly the Northwest Passage and the Transpolar Sea Route at the Bering Strait; and proximity to industrial activity and settlements. The ability to handle deep water – infrastructure that can cope with vessels carrying cargo and drawing about twelve meters of water – is often regarded as a threshold, and the dredging of seventy million tons of material at Sabetta's port is a case in point. But that review also takes a more cautious view. Projected traffic may not support ports of this size. Demand is driven largely by resource extraction and local re-supply, not large container shipping . Planning port capacity is inherently challenging, as the volume a hub must handle depends on traffic flows originating at the endpoints of the route and must account for both destination and transit traffic. The current condition of Arctic ports (Table 3) highlights a highly uneven starting point: only a few combine sufficient depth with extensive berthing capacity, and seasonal accessibility varies significantly – from Murmansk's year-round ice-free operation to the limited two-month window at Dikson and Tiksi (Wang et al., 2020).

Table 3:Physical characteristics of selected NSR ports
Author's elaboration from Wang et al. (2020, Table 4). Only Murmansk is ice-free year-round; most other ports operate for two to nine months

Port	Max depth (m)	Berths (no.)	Total berth length (m)
Vanino	20.0	26	3,948

Port	Max depth (m)	Berths (no.)	Total berth length (m)
Vostochny	19.8	34	2,369
Sabetta	16.0	6	n.a.
Murmansk	15.7	130	14,441
Vladivostok	15.0	66	11,098
Dudinka	11.8	32	4,142
St. Petersburg	11.5	102	17,124
Arkhangelsk	10.4	146	16,250

Geography also plays a key role in determining where viable port systems can develop, and the literature consistently points to a markedly uneven pattern of development.

Wang et al. (2020) evaluate twenty-five ports along two dimensions – *present situation* and *future potential* – and find that only Murmansk scores highly on both. Its advantages are decisive and real: it is ice-free throughout the year and well connected by rail to Moscow and St Petersburg, which is why both the reviewed studies and Russian planning documents treat it as the natural western hub (Wang et al., 2020; Rivas Hermann et al., 2022). Arkhangelsk complements it in the west. At the eastern end, Petropavlovsk-Kamchatsky is attractive as a transshipment point but lacks land connections and depends on air transport, whereas Vladivostok enjoys rail links. Between these poles, several ports function less as hubs than as gateways to the hinterland: Dudinka and Tiksi, connected to the interior by the Yenisei and Lena rivers, link the route to Krasnoyarsk and Yakutsk (Rivas Hermann et al., 2022). The broader pattern is a west-east asymmetry, in which the western ports serve mainly as loading points for resources and the eastern ports as unloading points, while the eastern sector remains poorly served by rail and, in Wang's assessment, generally weaker in both infrastructure and potential (Wang et al., 2020).

Table 4:Evaluation of NSR ports
Top scores: author's elaboration from Wang et al. (2020, Table 10). Sabetta's low present score but high potential reflects its recent construction as a dedicated LNG terminal.

Port	Present situation	Future potential	Total score
Murmansk	9.4	7.6	17.0
Sabetta	4.3	8.4	12.7

Port	Present situation	Future potential	Total score
Vostochny	7.2	4.2	11.4
Vanino	6.6	4.8	11.4
St. Petersburg	7.0	4.0	11.0
Vitino	5.0	5.8	10.8
Dudinka	4.6	6.2	10.8

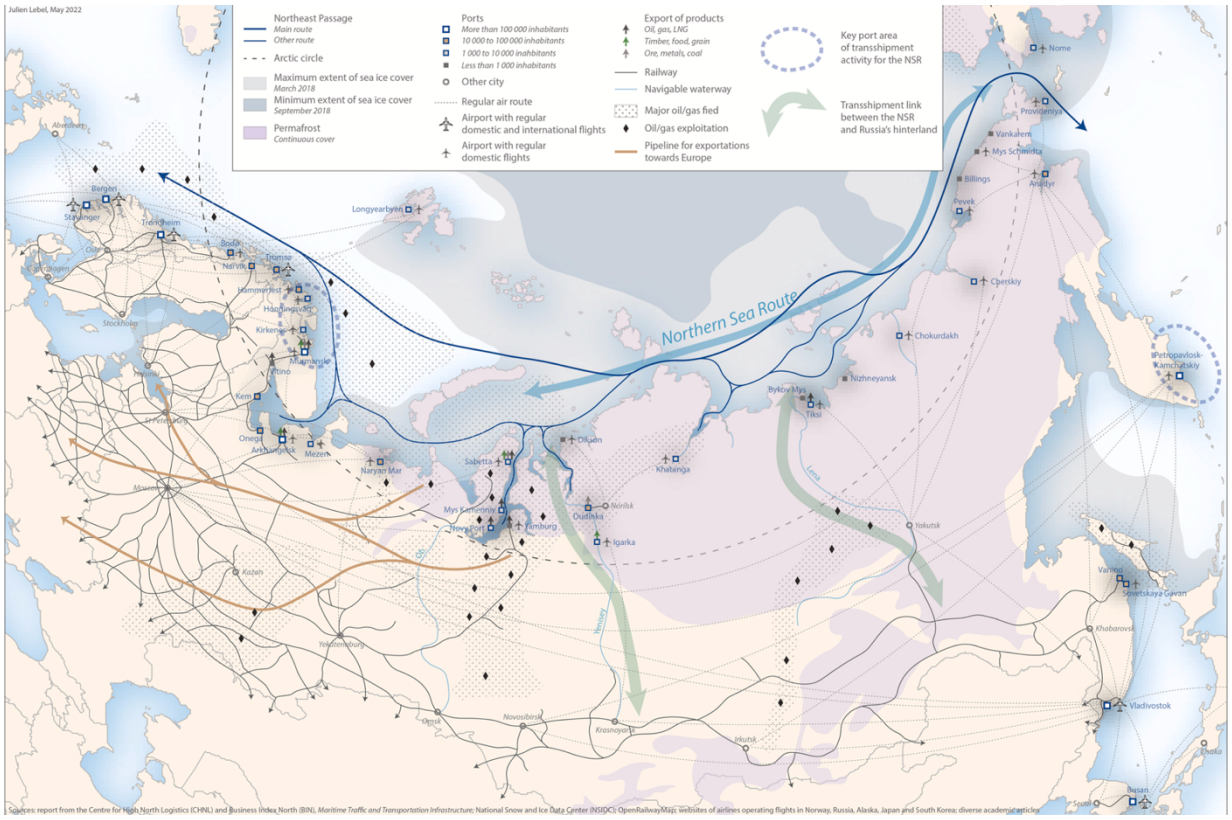


Figure 14: The NSR within the wider transport-infrastructure network.
The NSR as a transcontinental waterway, showing the uneven distribution of existing facilities. Source: Rivas Hermann et al. (2022, Fig. 9).

Since the NSR runs almost entirely through Russian waters, the development of its marine infrastructure is inseparable from state policy and geopolitics. Institutional responsibility must be shared: Rosatom[1] holds authority over the development and operational control of shipping and infrastructure, the Ministry of Transport governs regulation and safety, and the Northern Sea Route Administration issues navigation permits and monitors ice conditions (Rivas Hermann et al., 2022). In addition, ambition is codified in the Strategy

[1] The largest electricity producer in Russia

for Developing the Russian Arctic Zone to 2035, which targets 90 million tonnes of cargo by 2030 and 130 million by 2035, and in Rosatom's Northern Maritime Transit Corridor project; a 2022 infrastructure plan envisages logistics and transshipment hubs at Murmansk, Petropavlovsk-Kamchatsky and Vladivostok by 2026 (Rivas Hermann et al., 2022). These plans are entangled with sovereignty claims – Russia invokes Article 234 of UNCLOS[2], which permits coastal states to regulate navigation in ice-covered waters – and with the contested prospect of internationalising the polar routes, which Moscow resists. The sanctions of 2014 and, more acutely, of 2022 bear directly on this picture, jeopardising the very LNG investments that drive hub development and prompting a reorientation of expected demand towards China and India (Rivas Hermann et al., 2022).

Financing is arguably the most exposed link in the chain, and the scholars treats it with scepticism. Rivas Hermann et al. (2022) report three plausible scenarios: a *market* scenario, in which the Russian state struggles to cover the full costs; a *geopolitical* scenario, in which investment is sustained by a combination of defence and extractive interests; and a *defence* scenario, in which infrastructure primarily serves military needs. The experience of Sabetta highlights several challenges: port dues are insufficient to recover capital costs, total expenditure reached approximately 69.6 billion roubles – largely driven by dredging – and federal funding was necessary (Rivas Hermann et al., 2022). History, as well, offers a cautionary parallel in the "*ice dues*" once imposed to cover icebreaker escort, which made timber shipment uneconomic and contributed to the decline of Igarka as a transshipment point — a reminder that a tariff mechanism can undo a port as surely as it can sustain one (Rivas Hermann et al., 2022). Much of the actual investment is therefore carried by resource companies operating in public–private partnership, as Table 4 indicates.

Table 5:Principal port investment and development projects along the NSR.
Author's elaboration from Rivas Hermann et al. (2022).

Port / project	Actor	Function	Capacity	Cost / notes
Sabetta	State and Novatek	LNG (Yamal)	–	RUB 69.6 bn (dredging); dues below cost

[2]Coastal States have the right to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution from vessels in ice-covered areas within the limits of the exclusive economic zone, where particularly severe climatic conditions and the presence of ice covering such areas for most of the year create obstructions or exceptional hazards to navigation, and pollution of the marine environment could cause major harm to or irreversible disturbance of the ecological balance. Such laws and regulations shall have due regard to navigation and the protection and preservation of the marine environment based on the best available scientific evidence

Port / project	Actor	Function	Capacity	Cost / notes
Ura Bay (Murmansk)	Novatek	LNG transshipment	41.4 Mt/yr	~RUB 70 bn; launch 2023
Murmansk	Rusatom Cargo	Container terminal	up to 4 m TEU/yr	pilot 2024
Petropavlovsk-K.	Novatek	LNG transshipment	22 Mt/yr	delayed
Murmansk (expansion)	Sevneft	Universal port	up to 200 Mt/yr	RUB 150 bn
Dudinka	Norilsk Nickel	Metals / container	–	15 Arctic carriers (ice 1.5 m)
Vladivostok	DP World	Intermodal container	–	2021 proposal; rail to Asia

In their work Makarova et al. (2023) catalogue the principal pressures of port activity: *dredging*, which raises turbidity and resuspends contaminated sediment while destroying benthic habitat; ballast water, which introduces invasive species; oil pollution from run-off, bilge discharge and accidents; sewage and oily bilge water; nitrogen loading and the eutrophication it drives; and emissions from diesel vessels and equipment.

What makes these otherwise ordinary hazards acute in the Arctic is the fragility of the ecosystems and the near-absence of waste-reception and spill-response facilities in remote ports, meaning that a spill in cold water under adverse weather conditions can have multiplied consequences. Regulation has started to respond: in fact, since 2020 the IMO has required the sulphur content of marine fuel to fall from 3.5% to 0.5%, alongside pressure to curb black carbon and to phase out heavy fuel oil (Makarova et al., 2023). Furthermore, Makarova et al. situate port development within the paradigms of the *"*blue economy" and the "smart port*";* yet these sit in obvious tension with the parallel plan to deploy some fifteen floating nuclear power plants along the route and with the fundamentally extractive and strategic character of the enterprise – a tension the analysis should not smooth over.

Finally, marine infrastructure cannot be assessed in isolation from the land behind it or from the wider Arctic. A port without hinterland connections cannot be defined, in practice, a hub: the planned rail extension from Bovanenkovo to Sabetta and the associated Northern Latitudinal Railway illustrate how a specialised marine terminal depends on terrestrial links to become multifunctional, and how the social and environmental costs

of such linear infrastructure – borne heavily by Indigenous communities – are routinely underestimated in impact assessment (Povoroznyuk et al., 2022). Nonetheless, Rivas Hermann et al. (2022) at the ending of their review called for a port system conceived for the whole Arctic rather than the NSR alone, identifying persistent gaps: the absence of an agreed definition of deep-water hubs, of a comprehensive geospatial database of projects, of empirical evidence on financing, and of scenario analysis linking future ice conditions to operational models.

2.2.2 Submarine Cables

Almost all global digital communication relies on infrastructure that lies beneath the ocean surface. Approximately 99% of intercontinental data flows – including financial transactions, video calls, and cloud services – are transmitted not via satellites, but through a vast network of more than 500 fibre-optic cables spanning roughly 1.4 million kilometres of seabed (Figure 16)(Wasiuta, 2023; Bueger and Liebetrau, 2021). In particular, one ocean has so far been left off this map. The Arctic is among the last seas without a cable running across it, and two very different ambitions are now converging to change that. The first looks inward, to the scattered communities of the North that still depend on slow and costly satellite links and stand, at last, to be joined to the rest of the world (Delaunay, 2014). The second looks outward, to a shorter fibre route between Europe, Asia and North America over the top of the globe (Shvets, 2021). Connectivity for the North and a shortcut between continents: these twin motives run through every Arctic cable ever proposed.

The case for an Arctic route begins with a map. As the summer ice pulls back, it opens the NSR and the NWP to work that was long impossible, cable laying among it (Delaunay, 2014). Cross the top of the world and the distance between north-western Europe and north-eastern Asia shrinks to its shortest possible length. For data, that means speed: an Arctic cable could shave roughly 30% off transmission latency – tens of milliseconds that mean little to most of us but a fortune to a high-frequency trader (Delaunay, 2014).

Moreover, there is a second appeal to the route. This bypasses the congested and politically sensitive bottlenecks that the current network depends on, especially the Suez Canal and the Red Sea, whose vulnerability was highlighted when a break in the AAE-1 cable in 2022 resulted in outages in several countries (Wasiuta, 2023). And the Arctic seabed is so little traveled that it has been spared the trawling and anchoring that cause most cable faults elsewhere – an advantage that will shrink as Arctic shipping grows. For all its

promise, the Arctic has kept cables out for good reason. Laying one here is hard; repairing one is harder still. The work demands ships built to operate in ice, it can proceed only during a brief ice-free window, and the cable itself is vulnerable to *'ice scour'* where the seabed runs shallow (Shvets, 2021; Delaunay, 2014). Faults are not a possibility but a certainty – more than a hundred occur worldwide every year, most of them caused by human hands (Wasiuta, 2023). In the Arctic the logic of repairing is unforgiving: a vessel may need days simply to reach a remote break, and the fix itself can take a fortnight. Small wonder that resilience and backup planning sit at the centre of the debate, and that the Arctic Council has returned to them again and again (Shvets, 2021).

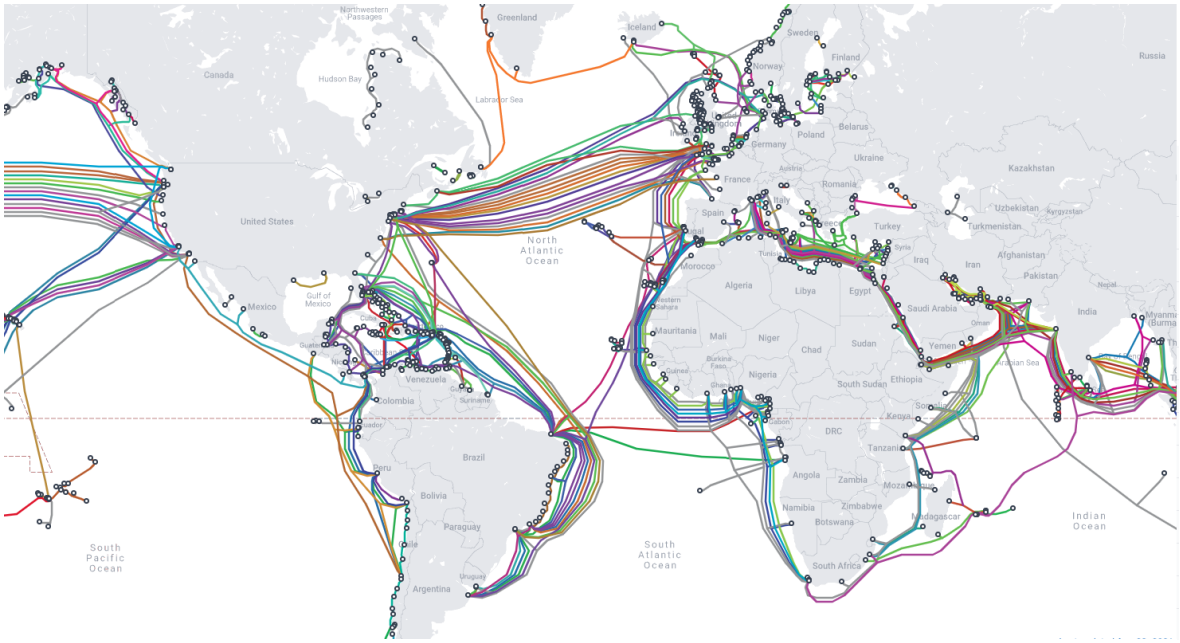


Figure 15: The global submarine cable network,
Showing the dense routes around the main hubs. Each coloured line represents a distinct submarine cable and each point a landing station; colours are used only to distinguish individual cables and carry no categorical meaning. Source: TeleGeography, Submarine Cable Map (submarinecablemap.com).

The first generation of Arctic cable projects, hatched between the early 2000s and the mid-2010s, was long on ambition and short on cable actually reaching the seabed. From the Russian side came *ROTACS*, the Russian Optical Trans-Arctic Cable System, promoted by the Polarnet company: some 15,000 kilometres meant to tie Tokyo to London along the NSR for an estimated US$1.9 billion (Figure 17). Its planned route ran along the Russian coast, through Teriberka, Anadyr and Vladivostok, and it was meant to be built in stages. It won official blessing and then went nowhere, defeated by the very obstacles that would frustrate every early scheme – the high cost, the difficulty of laying and repairing cable in ice, and the absence of the anchor customers needed to justify so large an investment (Delaunay, 2014; Shvets, 2023).

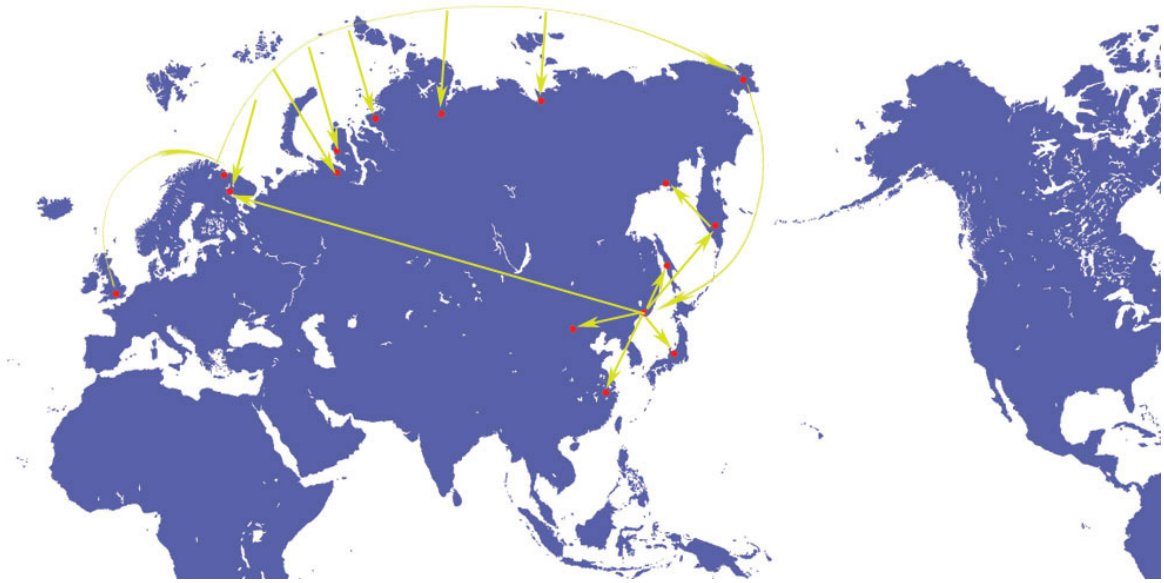


Figure 16:Planned route of ROTACS
ROTACS along the north coast of Scandinavia and Russia, linking London and Tokyo. The yellow lines show the cable's main trunk and its branch connections (spurs) to the landing points serving Arctic coastal communities along the route. Source: ExtremeTech (Anthony, 2012).

From North America came *Arctic Fibre*, a Canadian plan to thread the NWP and connect London, Tokyo and Seattle for around US$650 million, with spurs to communities in Nunavut and Alaska; in the event only the Alaskan stretch was built, under its successor Quintillion (Figure 18) (Delaunay, 2014; Shvets, 2023).

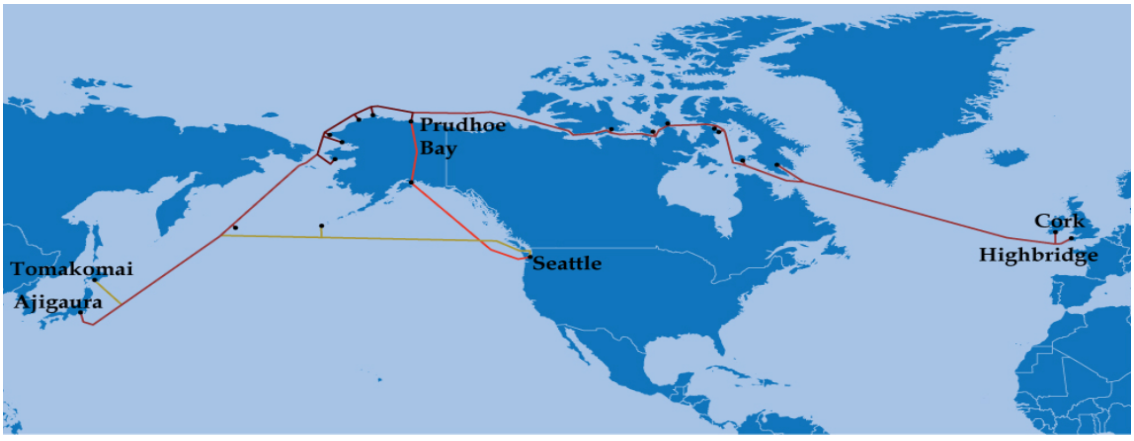


Figure 17:Planned route of Arctic Fibre through the Northwest Passage
Linking London, Tokyo and Seattle, with branches to Nunavut and Alaska. Source: Delaunay (2014).

A third scheme, the purely regional *Ivaluk Network*, imagined an 8,000-kilometre loop serving Nunavut and Nunavik – but with so few customers to pay for it, it leaned on public money that never came (Figure 19) (Delaunay, 2014)



Figure 18:Planned route of the Ivaluk Network
A regional loop serving communities in Nunavut and Nunavik. Source: TeleGeography, 2014.

Last, the *Arctic Connect project*, a joint venture between Finland's Cinia and Russia's MegaFon, got as far as surveying the route before being shelved in 2021. A pattern emerges from these false starts: grand transcontinental visions repeatedly foundered on cost, on ice, and on the plain fact that a cable cannot pay its way on a handful of small northern towns alone (Figures 17-19).

Two later projects broke the deadlock, and they are best read as rival tracks. The first is *Russia's Polar Express* – the only trans-Arctic cable so far to leave the drawing board for the seabed. Stretching roughly 12,650 kilometres from Murmansk to Vladivostok along the NSR, it is a state undertaking through and through. Its customers are the Ministry of Transport and the Federal Agency for Maritime and River Transport; Rosmorport operates it and Morsviazsputnik lays it, so that ownership and the right to maintain it rest squarely with the Russian state (Shvets, 2023). It is as well written into the Russian Arctic Strategy to 2035, whose aims include building up NSR port infrastructure and knitting a Russian *'digital ecosystem'* across the North (Shvets, 2023). The cable is going down section by section: Teriberka to Amderma in 2022, a coastal station at Dikson in 2023, and work pressing eastward since, with completion set for 2026 at a cost near 65 billion roubles and a designed capacity of 52–104 Tbit/s (DataCenterDynamics, 2025; Submarine Networks, n.d.).

The second track is the Western Far North Fiber (FNF), which rose from the wreckage of Arctic Connect once its Russian partner was cut loose. At around 17,000 kilometres it would join Europe to Japan through the Northwest Passage, coming ashore in Ireland, Norway, Finland, Arctic Canada and Alaska. Behind it stands a consortium of Finland's Cinia, America's Far North Digital and Japan's Arteria Networks, incorporated as Far North Fiber Inc.; a full route survey opened in 2024 with Alcatel Submarine Networks as technical partner, and the system is now expected to go live in 2027 (Submarine Networks, n.d.; Cinia, 2023). The contrast with the Polar Express is the analytical heart of this part: a private consortium of allied states building a Western-controlled route, set against a single-state, vertically integrated Russian one.

Table 6: Principal Arctic submarine cable projects.
Author's elaboration from Delaunay (2014), Shvets (2023), Submarine Networks (n.d.), Cinia (2023) and DataCenterDynamics (2025).

Project	Route	Length	Est. cost	Ownership	Status
ROTACS / Polarnet	Tokyo–London (via NSR)	~15,000 km	~US$1.9 bn	Russian (private)	Not built; stalled
Arctic Fibre (later Quintillion)	London–Tokyo–Seattle (via NWP)	~15,700 km	~US$650 m	Canadian, later US	Only the Alaska segment built
Ivaluk Network	Regional loop (Nunavut/Nunavik)	~8,000 km	~US$800 m (CAD)	Canadian (Nuvitik)	Not built
Arctic Connect	Europe–Asia (via NSR)	~10,000+ km	Not disclosed	Cinia (Finland) and MegaFon (Russia)	Suspended in 2021
Polar Express	Murmansk–Vladivostok (via NSR)	12,650 km	~RUB 65 bn	Russian state	Under construction (target 2026)
Far North Fiber	Europe–Japan (via NWP)	~17,000 km	Not disclosed	Cinia, Far North Digital and Arteria	In development (planned 2027)

The rules governing these cables are surprisingly thin. In principle they fall under the UNCLOS, which guarantees the freedom to lay cables on the high seas while reserving certain rights to coastal states within their territorial sea and EEZ. Every Arctic state except for the United States has signed it, and even Washington is bound by the customary rules it reflects (Shvets, 2021). UNCLOS treats the Arctic much like any other ocean,

with one exception: Article 234 lets coastal states tighten the rules in ice-covered waters. That clause bears directly on the Polar Express, which hugs the Russian coast and so falls largely under Russian control (Shvets, 2023). Beyond this loose frame the picture fragments into national law – Finland, Sweden and Norway each demanding their own assessments and permits – while regional coordination remains weak. The Arctic Council's task forces on connectivity and telecommunications labelled the issue as a priority; yet, as Shvets (2021) observes, they have never turned that priority into a fair, region-wide system of governance.

However, in comparison with other Arctic industries, submarine cables exert a relatively low environmental impact. They are slim, they barely graze the seabed, and they are usually left unburied except close to shore and at their landing points. A break spills nothing, unlike a ruptured pipeline, and the harm it does remains local (Shvets, 2021). Cable laying can therefore be understood as one of the least environmentally invasive forms of development in the region – an argument that aligns with the principle of intergenerational justice, namely preserving the Arctic for future generations (Shvets, 2021). Yet '*light'* does not equal to '*weightless'*… Burying and installing a cable disturbs the seabed; the noise and vibration of laying and repair can unsettle marine life and coastal birds; and a cable ship threading its way through ice runs a real risk of collision, with the environmental fallout that would bring (Shvets, 2021).

Concerning the social views and aspects in the large field of submarine cables, is harder to find a balance, and it is here that the promise of '*connectivity for the North*' meets its test. On one side lie real gains: swap a satellite link for high-capacity fibre and a remote community gains telemedicine, online schooling that can be integrated around reindeer herding, well-paid remote work that gives the young a reason to stay, and fresh markets for local goods and tourism (Shvets, 2021; Delaunay, 2014). On the other side lie real costs: the same connection can deepen a dependence on technology and thin out traditional and Indigenous ways of living; it can pit local producers against online giants able to undercut them even in the furthest village; and it can leave a community badly stuck when the system goes down (Shvets, 2023). Shvets reads these tensions through several ideas of justice – distributive, procedural and, above all, recognition – and insists that unless Indigenous peoples share genuinely in the planning, the upkeep and the rewards, a cable will serve the North in his name only, passing beneath it rather than belonging to it.

Moreover, there is one concern that has come to overshadow all the rest – the security question. As is it possible to achieve, the useful way to see a cable is as "*dual-use"* critical infrastructure: at once a lever of state power and a target for it (Bueger and Liebetrau, 2021). As a lever, the Polar Express is instructive. A cable owned outright by one state and running through its own waters concentrates control in a single pair of hands: because the line sits under Russian jurisdiction, the state can, in principle, throttle, watch or copy whatever crosses it – a capability that fits neatly with Moscow's push for "*digital sovereignty"* and a self-contained Russian internet (Shvets, 2023). As a target, the network is alarmingly open. Its routes are published, its faults number in the hundreds each year, and it passes through a few chokepoints and landing sites (Wasiuta, 2023). What was once a theoretical worry is now front-page news. Since October 2023 a string of incidents in the Baltic Sea has shown just how easily a merchant ship dragging its anchor can sever the infrastructure beneath it – and how stubbornly hard it is to prove who meant to. The tally peaked with some seven cable and pipeline cuts between November 2024 and January 2025, pinned on vessels of a Russian "*shadow fleet"* such as the Yi Peng 3 and the Eagle S, the latter boarded and held by Finland after the Estlink 2 link went dark (Atlantic Council, 2025; gCaptain, 2025). The reaction was swift: the North Atlantic Treaty Organization (NATO) stood up Operation Baltic Sentry in January 2025, the Joint Expeditionary Force switched on the AI-driven Nordic Warden monitoring system, and in February 2026 the European Commission put €347 million and a Cable Security Toolbox behind the problem (Atlantic Council, 2025; Bulletin of the Atomic Scientists, 2026; SIPRI, 2025).

These anxieties are quietly redrawing the Arctic cable map. The sweeping transcontinental schemes of the 2000s are yielding to shorter regional lines built with security in mind: in October 2025 Denmark announced funding for a cable binding Denmark, the Faroe Islands and Greenland, and analysts now read Arctic connectivity through the language of digital sovereignty, critical-infrastructure protection and unease at China's widening footprint in the region (ArcticToday, 2025; The Arctic Institute, 2025; SubTel Forum, 2025). The submarine cable, in the end, rehearses the very tension that runs through the North's ports and railways. It is a single strand of infrastructure that offers northern communities a place in the wider world, yet, held by a state, hardens into an instrument of sovereignty, surveillance and rivalry. It is precisely here – where connectivity meets security, and where the region still wants for both a coherent system of governance and

fresh research into what cabling the North will mean for its people and its seas – that this analysis takes its place.

2.3 Hybrid Conflict and Militarization Dynamics

2.3.1 Defining the terrain: hybrid conflict, the gray zone, and militarization

Before examining how competition is unfolding in the High North, it is worth pausing on the vocabulary itself. Terms such as '*militarization'*, '*hybrid conflict'* and the '*gray zone'* now appear routinely in analyses of the Arctic, yet they are often used loosely and almost interchangeably. Each, however, points to a different phenomenon, and keeping them apart is essential if the dynamics described in this chapter are to be understood rather than merely labelled.

Militarization is the oldest and, at first sight, the most straightforward of the three ideas. In its narrowest sense it refers to military build-up: measurable increases in armed forces, weapons, bases and defence spending (Stavrianakis, 2015). Yet the concept is broader than hardware. Anthropologists describe militarization as the *"cultural, symbolic, and material preparation for war"* and stress that it is an intentional, state-driven process rather than a natural or inevitable one (Bickford, 2015). A frequently cited formulation defines it as "*the degree to which a society's institutions, policies, behaviours, thought, and values are devoted to military power and shaped by war"* (Kohn, cited in Bickford, 2015), while more sociological accounts frame it as the growing penetration of social relations by military ones (Shaw, cited in Stavrianakis, 2015). For the purposes of this chapter, militarization is best understood as the visible, deliberate expansion of military capacity and of the weight the military carries in a region's affairs. It is, crucially, an activity conducted above the threshold of open conflict: bases, fleets and exercises are meant to be seen, because their purpose is deterrence. This matters in the Arctic because, for most of the post-Cold War period, the region's security was conceived in far broader terms. Environmental threats were widely considered as significant as military ones (Halašková, 2025), and the region was long governed by the Norwegian watchword *"High North, low tension"* (Brimmer, 2023). The re-emergence of hard military power in the North therefore represents not simply an increase in capabilities but a change in how the region is imagined and governed.

If militarization can be associated to visible force, **hybrid conflict** is about combining force with everything else. The concept was popularised by Frank Hoffman, who argued

that it is too simplistic to divide war into *"big and conventional"* versus "*small and irregular",* because tomorrow's adversaries would instead blend these forms together (Hoffman, 2007). He described hybrid threats as those that combine a variety of forms of warfare – conventional capabilities, irregular tactics, terrorism and criminal disorder – that tend to be used concurrently and are tailored to take advantage of an adversary's vulnerabilities (Hoffman, 2007). The defining characteristic is that of blurring: hybrid conflict blurs the neat distinctions between war and peace, and between combatant and non-combatant, on which conventional strategy relies (Hoffman, 2007). Since 2007 the term has evolved considerably, particularly following Russia's 2014 annexation of Crimea, which Western analysts widely interpreted through the lens of hybrid warfare and of Valery Gerasimov – Chief of the General Staff of the Russian Armed Forces and Deputy Minister of Defence – who in 2013 argued that modern conflicts are won through the integrated use of political, economic, informational, and other non-military means supported by military force (Andrassy and Ondruš, 2024). Its popularity, however, has made the concept slippery. Because it can be stretched to cover almost anything, critics warn that hybrid warfare risks *"saying everything and nothing at the same time"* (Andrassy and Ondruš, 2024). For clarity, this section treats hybrid conflict as the coordinated use of military and non-military instruments – economic, informational, cyber, legal and criminal – to achieve strategic aims while remaining deliberately ambiguous.

The **gray zone** is the terrain on which hybrid conflict is fought. It denotes the space *"between peace and war"*: a domain of intense political, economic and informational competition that is sharper than ordinary diplomacy but stops short of open warfare (Andrassy and Ondruš, 2024). The logic of the gray zone is to secure one's objectives without crossing the threshold that would trigger a decisive response – whether Article 5 of the NATO treaty, the United Nations' definition of aggression, or severe economic sanctions (Andrassy and Ondruš, 2024). Its essential qualities are ambiguity and deniability: actions are calibrated to stay below that threshold and, often, to obscure who is responsible, so that the target may not even realise at first that it is under attack (Andrassy and Ondruš, 2024). The Russian military theorist Alexander Bartosh captures the relationship neatly when he calls the gray zone *"the battlefield of hybrid warfare"* (Bartosh, cited in Andrassy and Ondruš, 2024). So, it is possible to achieve the zone, as a space exploited above all by the major powers – the United States, Russia and China – precisely because it is not clearly

defined in international law and is therefore difficult to address (Andrassy and Ondruš, 2024).

The three concepts are best conceived of as layers, not synonyms. Militarization is the backdrop and the leverage, the visible build-up of forces that makes coercion credible. The method: hybrid conflict, the combination of military and non-military tools. The arena is the gray zone: the ambiguous space beneath the threshold of war, where that method is applied. The same actor can be overtly militarized and covertly engage in gray zone activity, and the two reinforce each other: a strong military posture lends credibility to deniable pressure, while gray zone activity advances goals that overt force could not achieve without risking escalation. The Arctic is unusually well suited to all three dynamics. Its remoteness, harsh climate and vast distances make activity hard to monitor and to attribute, which is precisely the condition on which gray-zone operations depend. Rapid digitalisation, meanwhile, has extended a new layer of vulnerability across the region: as communities and infrastructure come to rely on cyber technology, they become exposed to disruption in ways that implicate individual and community security, and not only that of the state (Klein and Hossain, 2020). The dual-use infrastructure of the region, as discussed in the previous section, further complicates the differentiation between civilian and military assets. The political ground has shifted decisively with Russia's 2022 invasion of Ukraine transforming the security calculations of the Nordic states, drawing Finland and Sweden into NATO and leaving seven of the eight Arctic states inside the alliance facing Russia and stalling cooperation in the Arctic Council (Brimmer, 2023). The long-held idea of *"Arctic exceptionalism"* – the belief that the region could remain insulated from great-power rivalry – has come under serious strain (Halašková, 2025). It should be stressed, however, that this rivalry has so far not produced armed conflict in the Arctic itself; the more immediate dangers to the people who live there remain environmental degradation and rapid climate change (Heininen, 2022). It is in this setting – militarized, digitally exposed and increasingly contested below the threshold of war – that the specific dynamics examined in the rest of this chapter unfold.

2.3.2 Militarization: the return of hard power to the High North

If the previous part helped to draw the conceptual map, this one turns to its most visible feature: the return of hard military power to a region that had, for three decades, prided itself on its calm. The retreat of the sea ice had already reframed the Arctic from a space of mainly scientific interest into a contested arena of overlapping commercial, security

and environmental concerns (Sariak, 2015). Yet the region was still widely governed by the Norwegian formula of *"High North, low tension"*(Brimmer, 2023), which described a genuine reality: an Arctic largely walled off from the confrontations playing out elsewhere. That wall has now fallen. Russia's war of aggression against Ukraine has sent ripples far beyond its borders, and the Arctic – long treated as a low-tension zone insulated from Russia–West relations – has not been spared (Kertysova and Gricius, 2023). Militarization, in the sense defined above (the deliberate, visible expansion of military capacity), is once again a defining feature of the North, and it is unfolding on two sides at once.

The Russian build-up is not, in the first instance, about the Arctic itself. Its logic must be understood as nuclear. The Kola Peninsula, on Russia's north-western edge, hosts the country's single most important strategic asset: the Northern Fleet and the ballistic-missile submarines that form the sea-based leg of its nuclear deterrent (Stensrud and Østhagen, 2023). To protect these forces, Russia maintains what analysts call a *"bastion"* defence – a layered posture designed to keep adversaries away from the waters around Kola and to guarantee that its nuclear capabilities remain usable (Stensrud and Østhagen, 2023; Østhagen, 2025). Military activity across the Barents Sea and the wider North Atlantic is therefore best read not as an offer to seize territory but as a way of shielding this bastion and of signalling resolve to NATO and the United States (Stensrud and Østhagen, 2023). Much of the hardware is defensive in that specific sense, even as it makes the region measurably more militarized.

Around this nuclear core, Russia has spent the past decade modernizing its northern military infrastructure – refurbishing airfields, radar and bases along its Arctic coast in what one detailed study described as the raising of an *"*ice curtain*"* on the Kola Peninsula (Melino, Conley and Bermudez, 2020). This effort overlaps directly with the civilian infrastructure examined before. The ports, airstrips and monitoring systems that serve the Northern Sea Route and its energy projects are, in many cases, dual-use assets that also support the fleet; the same corridor that promises commercial shipping doubles as a militarized frontier. Economic development and military build-up in the Russian Arctic are thus difficult to separate – a point Russia itself exploits, since its commercial stakes in the region give it a strong reason to avoid open confrontation even as it expands its forces (Kertysova and Gricius, 2023).

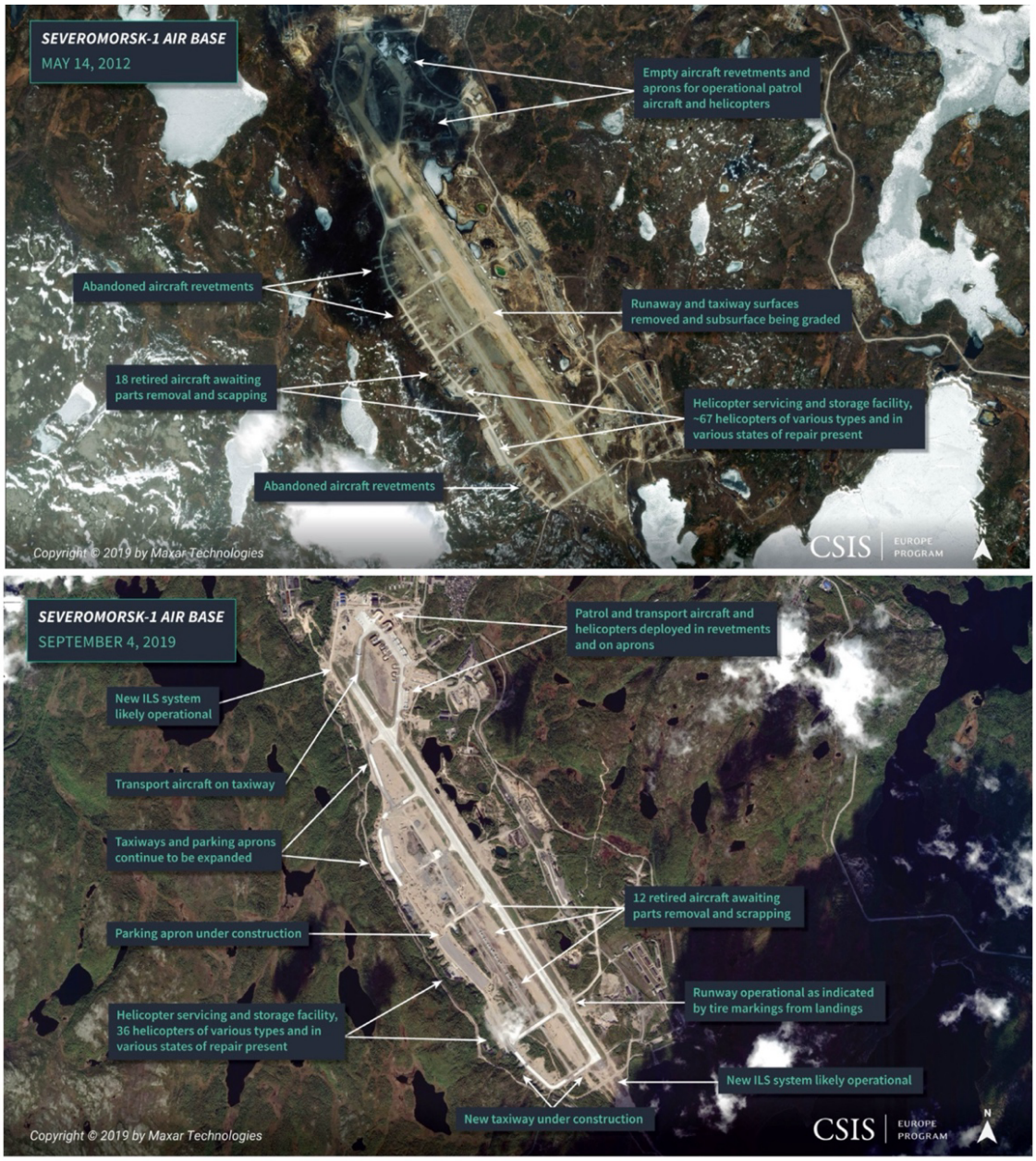


Figure 19: Modernization of Severomorsk-1 air base (2012 vs 2019)
Kola Peninsula: satellite imagery of May 2012 (before) and September 2019 (after). Source: Melino, Conley and Bermudez (2020); satellite imagery © 2012, 2019 Maxar Technologies.

The second side of the build-up is the Western response, and here the change has been just as dramatic. Russia's invasion transformed the security calculations of two long-neutral states: Finland, neutral since 1948, and Sweden, neutral since the Napoleonic era, both abandoned that status to join NATO (Brimmer, 2023). Their accession recalibrated the strategic map of the North. Where the Arctic had once counted five NATO members, two neutral states and Russia, it now contains seven NATO allies facing a single Russian one, and Finland's membership alone added a 1340 km land border between the alliance and Russia. Just as importantly, the High North has climbed NATO's agenda: the region now figures more prominently in the alliance's planning, exercises and command

structures, from large manoeuvres such as Trident Juncture and Cold Response to closer Nordic cooperation through NORDEFCO and the Joint Expeditionary Force (Kertysova and Gricius, 2023; Brimmer, 2023).

These two elements feed on each other in a pattern familiar in the field of international relations, known as the "*security dilemma"*: measures each side takes for its own defence are read by the other as aggression, prompting further countermeasures. Russian state media routinely portrays Western exercises such as Trident Juncture and Cold Response as provocations, while alternately presenting Russia's own build-up as purely defensive or dismissing it as weak (Kertysova and Gricius, 2023). NATO, for its part, treats the modernization of the Kola bastion and the growth of the Northern Fleet as reasons to reinforce its northern flank. Each move is defensive in intent and threatening in effect – and the stalling of the Arctic Council, frozen as a venue for cooperation since 2022 (Brimmer, 2023), has removed one of the few channels that might have helped manage the resulting mistrust.

Two qualifications keep this picture in proportion. First, for all the hardware, the Arctic has so far not seen armed conflict; the rivalry remains one of posture and signalling, and the gravest dangers to the region's inhabitants continue to be environmental rather than military (Heininen, 2022; Halašková, 2025). Second, and crucially for what follows, open war does not appear to be Moscow's preferred instrument in the North. A direct clash with NATO would jeopardize the very economic development Russia is pursuing there, and experts broadly agree that hybrid interference through non-military means is the more likely Russian strategy going forward (Kertysova and Gricius, 2023). Militarization, in other words, sets the stage: it raises the stakes and supplies the leverage. But the action most likely to unfold on that stage belongs to the gray zone.

2.3.3 Hybrid conflict in practice: gray-zone operations (2024–2026 case studies)

The concepts examined earlier become far clearer when placed against real events. The period between late 2024 and 2026 – the aftermath of Russia's full-scale invasion of Ukraine – produced a cluster of incidents in and around the European Arctic and the Baltic that show, in concrete terms, what gray-zone competition looks like. As argued before, the gray zone is defined by three qualities: activity that stays below the threshold of open war, that is deliberately ambiguous, and that is hard to attribute to any single culprit. The three cases that are going to be analysed in this section – the cutting of undersea cables,

the jamming of navigation signals, and the use of a 'shadow fleet' of tankers – display all three qualities almost perfectly.

Before turning to them, two points of method are worth stating. First, geography: several of these episodes took place in the Baltic Sea rather than in the Arctic proper. They are included here because, as Østhagen (2025) argues, the security debates of the Arctic and the North Atlantic have become a single continuum – the same actors, vessels and tactics move between the two theatres, so that what happens in the Baltic is a preview of what could happen further north. Second, vocabulary: to avoid the loose usage criticised in the previous section, this one follows Stensrud and Østhagen's (2023) distinction between hybrid threats, hybrid operations and hybrid warfare, treating most of what follows as operations and threats rather than warfare. Each case is then examined through the same four questions: what happened, why it counts as a gray-zone operation, why attribution is so difficult, and how the West has responded.

Severed cables in the Baltic Sea

On 17–18 November 2024 two telecommunications cables were cut off within hours of each other: the BCS East-West Interlink between Lithuania and Sweden, and C-Lion1, the Finland–Germany line (DataCenterDynamics, 2024; CNN, 2024). Investigators concluded that a Chinese bulk carrier, the Yi Peng 3 – which had left the Russian port of St Petersburg – had dragged its anchor across the seabed for many miles, cutting first one cable and then the other; both were restored within about ten days (DataCenterDynamics, 2024). One month later, on 25 December 2024, the Estlink 2 power cable and several telecommunications lines linking Finland and Estonia were cut in turn. Finnish police seized a tanker, the Eagle S, the following day, accusing its crew of dragging an anchor for roughly ninety kilometres and later charging the captain and two officers; the repairs alone cost the cable owners around €60 million (Euronews, 2025; Lloyd's List, 2025). These were not isolated events: since October 2023 at least eleven cables and pipelines have been damaged in the Baltic region, with seven of the cuts concentrated in the two months between November 2024 and January 2025 (Atlantic Council, 2025).

Two features make these episodes textbook gray-zone operations. The first is deniability. In each case the damage was done not by a warship or an explosive but by an ordinary commercial vessel dragging its anchor – an act that can always be presented as an accident of seamanship. Western officials themselves were initially divided over whether the cuts

were deliberate (CNN, 2024), and China declined a Swedish request to let prosecutors investigate the Yi Peng 3 (ASPI, 2025). No isolated event can be definitively shown to be sabotage; however, the numerous occurrences of these '*incidents'* in the same area make the innocent rationale increasingly difficult to uphold. That accumulated uncertainty embodies the core of the gray zone. The second aspect is the objective: cables serve as dual-use essential infrastructure – unprotected, unobserved, and readily accessible – whose damage leads to disturbance and concern without resulting in fatalities or violating any clear boundary of conflict. The reaction has been similarly responsive. In January 2025, NATO initiated Operation Baltic Sentry to prevent assaults on underwater infrastructure, and in February 2026, the European Commission responded with a €347 million initiative and a Cable Security Toolbox (Atlantic Council, 2025; Bulletin of the Atomic Scientists, 2026). However, the confiscated Eagle S was returned in a few months, and no individuals have faced prosecution – a trend that illustrates both the susceptibility and the lack of accountability central to gray-zone operations.

Jamming and spoofing of navigation signals

The second case is quieter but more pervasive: the jamming and spoofing of satellite-navigation (GNSS) signals across the High North and the Baltic. Since 2024 the number of interference incidents has risen sharply, with equipment concentrated in Russia's Kaliningrad exclave and along its western border in the Leningrad and Pskov regions (GPS World, 2025; Defense News, 2025). Jamming drowns out the satellite signal, while spoofing feeds receivers a false position; both degrade the systems on which modern aviation and shipping depend. The effects reach deep into civilian life. Finnair suspended flights to Tartu, in Estonia, in the spring of 2024 because of GPS interference, and Lithuania has reported hundreds of incidents a week (GPS World, 2025; AeroTime, 2025). By 2025 disruption over parts of the region had become almost a permanent background condition, and in October 2025 Finland and Estonia used the assembly of the International Civil Aviation Organization to blame Russia publicly for it (AeroTime, 2025).

Jamming is inherently a gray-zone activity. It occurs constantly instead of in a sudden manner, it undermines safety and trust without causing outright destruction, and it is incredibly difficult to pinpoint with the level of certainty that a legal or military reaction would necessitate – a transmitter in Kaliningrad does not leave any traces on an aircraft diverted over Finnmark. The imbalance is clear: it is impossible to intercept a radio signal, and attacking the origin within Russian borders would be considered an act of war. States

are therefore pushed towards resilience rather than retaliation. Thirteen European Union (EU) members have demanded action (GPS World, 2025), and a group of Baltic and Nordic countries – Germany, Poland, Sweden, Norway, Finland and Estonia – is currently developing the R-Mode Baltic project, a land-based back-up to satellite navigation (GPS World, 2025). This is precisely the pattern that Kertysova and Gricius (2023) identify as one of Russia's four principal lines of hybrid activity in the Arctic, alongside cyber-attacks, infrastructure interference and disinformation.

The Russian 'shadow fleet' as a hybrid instrument

The third case is less an event than an instrument, and it ties the others together: the Russian *"shadow fleet"*. This is the fleet of ageing, opaquely owned and often obscurely flagged tankers that Russia uses to move oil while evading Western sanctions (Kertysova and Gricius, 2023). The Eagle S, which cut the Estlink 2 cable, was one such vessel, sailing under a Cook Islands flag while carrying Russian oil from Ust-Luga; some seized ships have reportedly been found to carry surveillance equipment (Lloyd's List, 2025).

The shadow fleet illustrates how one mechanism can combine activities that were previously separate: evading sanctions (both economic and criminal), possible sabotage (military), and intelligence collection, all cloaked in the deniability of a supposedly civilian merchant vessel flying a flag of convenience. As a countermeasure, the European Union and the United Kingdom have started to impose sanctions on specific shadow-fleet tankers by name, despite the fleet's size and ability to be easily reflagged (Atlantic Council, 2025).

This combination is precisely what renders the shadow fleet a hybrid tool in Hoffman's (2007) definition – a merging of civilian and military, state and criminal, creating confusion for an opponent as to whether it is facing an accident, a crime, or an assault. It also reveals the constraints of the current legal system. Due to their freedom of navigation on the high seas and their foreign flags, coastal states possess limited authority to halt, board, or prosecute these vessels, and any connection to the Russian state is intentionally kept one step distant. The device is designed to occupy the space between what the law can encompass and what a government can realistically refute.

Common threads

Read together, the three cases reveal a consistent logic. Each targets the seams of an open society – the undersea cables, the navigation signals and the merchant shipping on which

modern life quietly depends – rather than its armies. Each is calibrated to stay below the threshold that would trigger a collective military response. And each exploits the ambiguity of attribution that the Arctic and Baltic environments, with their remoteness and dense civilian traffic, make possible. The Western response has been real but reactive: new patrols, monitoring systems, funding and targeted sanctions, yet few convictions and no settled means of deterrence. This is the "*response gap"* that gray-zone actors are designed to exploit, and it rests on a basic asymmetry – the attacker chooses the time, the place and the deniable method, while the defender must protect thousands of kilometres of exposed infrastructure and, to act, must first prove intent. The real danger, on this reading, is less a single dramatic attack than the slow normalisation of pressure below the threshold of war. Finally, the cases point beyond Russia. The involvement of a Chinese vessel in the November 2024 cable cuts serves as a reminder that gray-zone pressure in the North increasingly involves more than one state, highlighting the strategic alignment between Russia and China.

2.4 Strategic Alignments: The Sino-Russian Axis

The previous part ended on a telling detail: the vessel most closely linked to the November 2024 Baltic cable cuts was not Russian but Chinese. This coincidence introduces the main focus of this topic. The pressures reshaping the Arctic are no longer the work of Russia alone; increasingly they involve a second power that has no Arctic coastline at all. Among the various alignments emerging in the region, this analysis focuses on one – the partnership between Russia and China – and it is important to clarify from the outset why this pairing, rather than any other, merits dedicated attention.

Currently, the Arctic includes multiple alignments. The most apparent is the unification of the Western bloc: seven out of the eight Arctic nations are now members of NATO, united by Russia's conflict. Beyond the eight, a growing group of external players – Japan, South Korea, India, Singapore, the European Union – possess observer status in the Council and seek commercial or scientific objectives. In this context, why consider the Russia-China relationship as the strategic alliance of the Arctic – the one that largely shapes the region's future?

Three characteristics distinguish it. Initially, its composition. It is the sole alliance that connects the region's leading coastal nation with a major non-Arctic power. Russia manages about fifty percent of the Arctic shoreline and all of the Northern Sea Route; China,

despite being located far to the south, has proclaimed itself a "*near-Arctic state*" and provides the investment, technology, and market that Russia needs (Lee, 2025; Türker, 2024). This self-designation, set out in China's 2018 Arctic Policy white paper, rests on its relative geographic proximity to the Arctic Circle, on the fact that it is directly affected by the region's environmental changes, and on its status as a major trading power and stakeholder in Arctic shipping, resources and science (State Council of the People's Republic of China, 2018). The Arctic states, however, have received the claim with scepticism: admitted only as an observer to the Arctic Council in 2013, China has been granted no special status, and the United States has rejected the notion outright, insisting that no category exists between Arctic and non-Arctic states (Kauppila and Kopra, 2022; Türker, 2024). No other combination unites regional influence and worldwide economic strength in this manner. Secondly, its result. Since Russia possesses the land and China provides the funds, together they can sustain the progress of Russian Arctic development even after the exit of Western companies and investment – a capability unmatched by any other external player. Third, timing: the 2022 conflict did not establish the axis but reinforced it, transforming a voluntary partnership into one of necessity for Moscow and rendering the alliance crucial for the region's future (Kauppila and Kopra, 2022).

The argument is emphasized by China’s stance in other regions of the North. Throughout the democratic Arctic, China's influence has waned as governments have considered Beijing’s human-rights practices and its aggressiveness in the South China Sea and toward Taiwan; *“wolf-warrior”* diplomacy has increased scepticism (Lajeunesse et al., 2023). In contrast, Russia has stayed a receptive ally, making it China's most crucial gateway to the region. Nonetheless, there is also a definitional point. Unlike the Western bloc, which is a formal alliance bound by treaty, the Sino-Russian axis is not an alliance at all. It carries no mutual-defence commitment and rests on a transactional and often mistrustful footing (Lajeunesse et al., 2023). Precisely because it is looser, more asymmetric and more ambiguous than a formal bloc, it fits the gray-zone and the dual-use logic – and it is the alignment that most directly challenges the Western-led Arctic order rather than defending it. For all these reasons the axis is treated here on its own terms.

At its core the partnership is a marriage of complementary needs. Russia has the world’s longest Arctic coastline and vast reserves of gas, oil and minerals, but after the 2014 annexation of Crimea and the sanctions that followed it lacked the capital and technology to develop them; it responded with a *“pivot to the East”* (Lee, 2025). China, for its part,

is energy-hungry and ambitious but geographically excluded from the region. In January 2018 it set out its position in a white paper, China's Arctic Policy, which named four priorities – shipping, resource development, governance and science – and framed China as a *"near-Arctic state"* entitled to a role in the North (State Council, 2018; Lajeunesse et al., 2023). The economic vehicle for that role is the Polar Silk Road, the Arctic arm of China's Belt and Road Initiative, through which Beijing seeks new shipping lanes and energy supplies while presenting the whole enterprise in the language of *"win-win"* co-operation (Türker, 2024; Chu and Alekseenko, 2025).

The clearest fruit of this complementarity is energy. The flagship project, Yamal LNG, was kept alive by Chinese money after Western financing dried up: Chinese state entities hold close to a third of it – the China National Petroleum Corporation twenty per cent and the Silk Road Fund 9.9 per cent – and the model was repeated in the follow-on Arctic LNG-2 (Wang et al., 2020; Lee, 2025). What Russia gains is investment and a market; what China gains is a stake in Arctic energy and a foothold in the region. The same pattern extends to shipping, where China treats the Northern Sea Route as the northern leg of its trade network, and to science, where joint research ranges, as one study puts it, *"from deep sea to deep space"* – work whose dual-use potential is never far from the surface (Kirchberger, Sinjen and Wörmer, 2022).

If complementarity explains why the two powers cooperate, the war in Ukraine explains why they have been driven closer. Kauppila and Kopra (2022) describe February 2022 as a *"critical juncture"* and a watershed in Arctic politics: within weeks the Arctic Council, the region's central forum, had suspended its work, and its seven Western members had frozen cooperation with Moscow. Cut off from Western capital, technology and markets, Russia became markedly more dependent on China – and the balance within the partnership tilted accordingly. Where the relationship had once been closer to equal, Russia now increasingly plays the junior role: the supplier of discounted resources to a partner it cannot easily replace (Lee, 2025; Lajeunesse et al., 2023).

China's own posture has been more cautious than the *'no limits'* friendship proclaimed by Xi Jinping and Vladimir Putin in February 2022 might suggest. Beijing has been careful not to fall foul of Western secondary sanctions and has kept a studied *"neutrality"* in the war, even as it quietly reaps the strategic benefits of a weakened, more flexible neighbour (Kauppila and Kopra, 2022). The result is an alignment that is at once tighter and more disproportionate than before – closer, but on terms that increasingly favour Beijing.

It would be a mistake, however, to read the axis as a settled or seamless bloc. Beneath the public warmth lies what one study calls a "*highly transactional partnership*", underpinned by deep and abiding suspicion (Lajeunesse et al., 2023). Russia has long been cautious of Chinese ambitions in a region it regards as its own, and its deepening reliance on Beijing revives an old fear: that of becoming a mere *"resource appendage"* to a stronger neighbour. Analysts identify three recurring points of friction – over navigation on the Northern Sea Route, over the terms of resource development, and over infrastructure – each of which exposes the limits of the relationship (Lajeunesse et al., 2023). Russia guards its sovereignty over the NSR jealously, while China would prefer freer access; the dual-use character of joint scientific work feeds Russian security suspicions; and China's push for a formal say in Arctic governance runs against Russia's reluctance to admit outsiders to a region it treats as its own preserve.

This is why several scholars prefer the language of "*frenemies"* and describe the relationship as a friendship as fragile as glaciers (Lavdari and Lavdari, 2025). The two governments have strong reasons to cooperate and equally strong reasons to distrust one another, and the balance between the two can shift. For Western observers an important implication follows: Russia and China are best understood not as a single, inherently unified front but as two distinct actors whose partnership contains exploitable seams (Lajeunesse et al., 2023).

The Sino-Russian axis is not the united bloc frequently depicted in Western accounts, nor is it merely the rhetorical idea of a "*no-limits* "partnership. It serves as an unequal axis of convenience: significant due to its support for Russian Arctic growth, its invitation to a global superpower into the area, and its revival of great-power rivalry in the far North, although constrained by scepticism and unlikely, for the time being, to solidify into a formal alliance. This unique combination – substantial enough to transform the Arctic, yet vague enough to maintain uncertainty – is what renders it the strategic alliance most deserving of scrutiny, distinguishing it from all other power arrangements in the area.

CHAPTER 3: GREENLAND AT THE CENTRE OF GEOPOLITICS

3.1 Greenland as an Emerging Arctic Pivot

"Nothing about us, without us"

Government of Greenland, Foreign, Security and Defense Policy 2024-2033

How can the entire world talk about Greenland without taking the Greenlandic perspective into account? And how can the press, the governments and the politicians assume that the only reason Greenland matters is the expansionist aim of what may be called, without exaggeration, one of the greatest powers of all time? Here, one of the most important phrases voiced by the Government of Greenland captures what states, peoples and the wider world do not always see at first glance. So, why has Greenland become one of the most talked-about territories in recent geopolitics? A country of only about 57,000 people – most of them of Inuit descent – and one of the least populated on Earth, in fact has a great deal to be talked about.

The reason is not one, but many at once. In only a few years, climate change, natural resources, new shipping routes and hard security have come together on this single island, turning it into a focus of competition between the world's major powers: the United States, Russia and China (European Parliament, 2025; Saalbach, 2024). Despite its small population, its limited infrastructure and its harsh climate, Greenland now sits at the centre of the Arctic and global contest (European Parliament, 2025).

Its first and oldest value regards to its geography, specifically its position. Greenland lies between North America and Eurasia, and this location has made it strategically important since the Second World War (Mortensgaard and Barse, 2026). For the United States it works as a kind of '*watchtower'*, a place from which to detect and respond to long-range weapons heading towards North America; for the same reason the United States has kept a military presence there for decades, today at Pituffik Space Base, formerly Thule Air Base (Belfer Center, 2025; Mortensgaard and Barse, 2026). In addition, Greenland also forms the 'G' in the so-called GIUK gap – the maritime chokepoint between Greenland, Iceland and the United Kingdom – which matters for protecting the sea routes across the Atlantic and, therefore, for NATO (Mortensgaard and Barse, 2026). As Danish

researchers point out, it is above all this geography, and these Cold War dynamics, that make Greenland relevant, more than climate change in itself (Mortensgaard and Barse, 2026).

Climate change, however, changes the cards on the table in another manner: it makes the island's resources easier to reach and more valuable. Greenland holds critical minerals – including REEs needed both for modern weapons and for the green transition – as well as oil, gas and fresh water (Belfer Center, 2025; Mortensgaard and Barse, 2026). These deposits lie along the coast rather than under the ice sheet, so they are not as easy to extract as is often assumed; yet their potential is real, and the Greenlandic government welcomes the development of its resource sector (Mortensgaard and Barse, 2026). For some, these resources could even provide the income that would one day make independence possible (Saalbach, 2024).

It is this mix – location, resources and a warming, more accessible Arctic – that has drawn in the great powers. The United States has shown the most open interest: President Trump proposed buying Greenland in 2019 and returned to the idea, with far greater pressure, starting from 2025 (Belfer Center, 2025; Council on Foreign Relations, 2025). China has become heavily involved in the Greenlandic economy and presents itself as a '*near-Arctic'* actor, while Russia's militarisation of its own Arctic has raised tensions across the whole region (European Parliament, 2025; Saalbach, 2024). Greenland, in brief, has become a place that the entire world discusses – often, as the opening of this chapter suggested, as if it were only a prize to be won.

And yet this is exactly the point that the phrase "*nothing about us without us"* is meant to correct. Greenland is not an object of other states' ambitions, instead, it is a subject, with a voice and a growing agency of its own (Basile, 2025). It has been self-governing since 1979, and the 2009 Self-Government Act gave Greenlanders a legal pathway to independence, which most of them support – even if their continued reliance on Danish subsidies makes that goal complicated (Belfer Center, 2025; GIS Reports, 2025). Moreover, in the last years Greenland has learned to use its position. As Jacobsen (2020) argues, Greenlandic representatives play what he calls "*sovereignty games"*: they turn their "*Arctic advantage"* and circumpolar events into arenas for widening their own room for manoeuvre, above all in relation to Denmark. The 2024 Foreign, Security and Defence Policy – tellingly titled Greenland in the World: Nothing About Us Without Us – is the

clearest expression of this: a small nation insisting on being treated as a protagonist on the international stage, and no longer as a mere periphery of the Kingdom of Denmark (Government of Greenland, 2024; Belfer Center, 2025).

This double character – Greenland as both an object of great-power competition and a subject asserting its own self-determination – is the thread that will run through the rest of this chapter.

3.2 A Geographical Profile of Greenland

3.2.1 Physical Geography: Extent, Climate and Environment

In order to have a better understanding of the big picture it is essential to have a look at the small one before. To achieve all the knowledge about the situation in Greenland the starting point has to be Geography.



Figure 20:Greenland Physical Map

Source: Gaba, E. (Sting), Wikimedia Commons.

Greenland is the largest island on the planet according to the total surface – about 2.2 million km² – by which about 1.7 million covered by the arctic ice sheet. The distances in the area help to explain its particular condition: north to south are 2670 km; east to west are 1050 km and the coastline is about 44,087 km (Greenland in Figures, 2026). These distances, in the world's least densely populated country, make its situation particularly complex. A further peculiarity concerns where Greenland actually belongs. Geographically and geologically, it is part of North America: its ancient bedrock once formed part of the Laurentian (North American) Shield, and the island broke away from the North American landmass only when sea-floor spreading opened the Labrador Sea and Baffin Bay, while the widening of the North Atlantic set it apart from Europe (Henriksen, 2008). Its Inuit population, too, is culturally part of the wider circumpolar Inuit world of Arctic Canada and Alaska (Gad, 2017). In political and administrative terms, however, Greenland is European: a self-governing territory within the Kingdom of Denmark, generally regarded as geopolitically part of Europe (Greenland in Figures, 2026).

Greenland's geology is as remarkable as its ice. Its rocks record an unusually long and varied history stretching back some four billion years (Paul, 2026): very few places on Earth have been shaped by all three of the great geological processes — mountain building, rifting and volcanic activity — yet Greenland has experienced them all (Paul, 2026). Long episodes of mountain building fractured its crust and left gold, gems and graphite in the cracks; episodes of rifting, most recently the opening of the North Atlantic around 200 million years ago, created the sedimentary basins that can hold oil and gas; and repeated volcanic activity produced the unusual, mineral-rich rocks in which rare earth elements are concentrated (Paul, 2026). The result is a geological "treasure chest" that also holds some of the oldest rocks on the planet, truck-sized lumps of natural iron, and even diamond-bearing formations discovered in the 1970s but never mined, given the difficulty of reaching them (Paul, 2026).

However, the defining feature of the island is characterized by the ice sheet – that covers nearly 80% of the Greenland’s surface– and it is the second ice sheet most extended in the world after the Antarctic one (Greenland in Figures, 2026; NSIDC, 2026). It has an average thickness of about 1,670 meters, that overclass of 3,000 meters in its most central zone – according to NSIDC (2026), if the entire Greenland ice sheet would melt in a hypothetic – but not so hypothetic – future, sea level would rise nearly 7.4 meters globally.

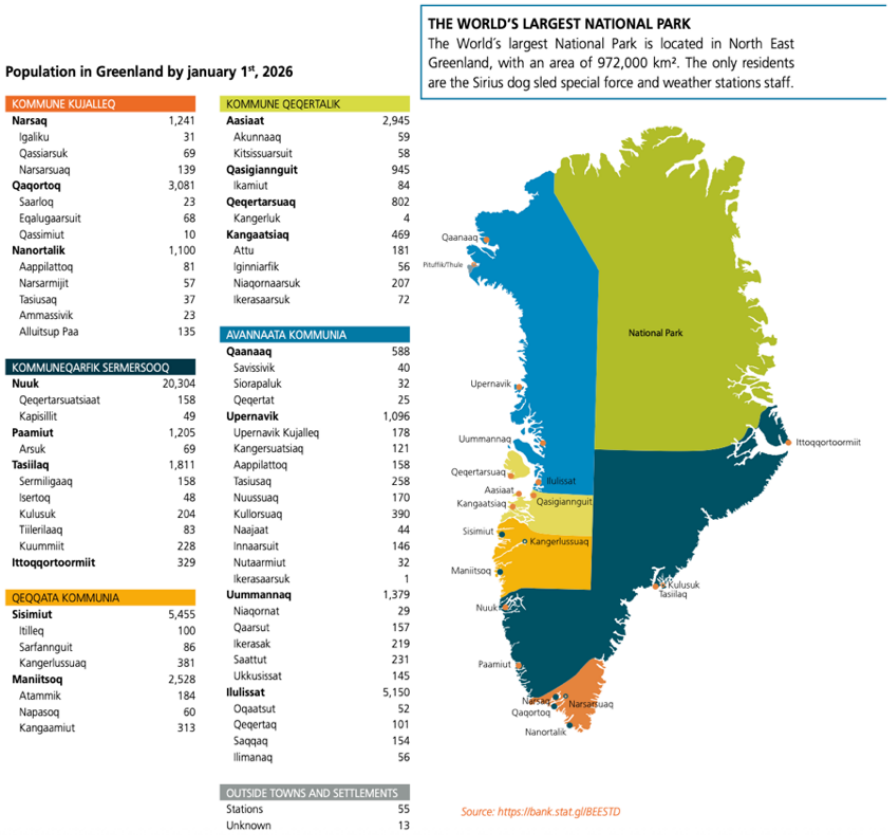
Another surprising fact about Greenland is that, with the passing of the years, the enormous weight of the ice has compressed the underlying rock in such way that the majority of the rock floor is currently beneath the sea level (Encyclopaedia Britannica, 2026). Notwithstanding, one of the main important geographic consequences regards to the fact that the ice-free portion is just 19% of the territory – about 410,000 km² – acknowledging the presence of a narrow coastal strip where it is possible to find a concentration of all the settlements, the economic activities and the mineral deposits known to the world (Greenland in Figures, 2026).

Despite the ice sheet, another relevant and essential field refers to the climate: in fact, Greenland is positioned in the north polar region, having cold winters and mild summers, despite some strong local variations across the entire island (Greenland in Figures, 2026). To have a look at the climate in details it is convenient to describe it as gradient from north to south: in the north, the climate in high-arctic, with fresh summers highlighted by the midnight sun followed by harsh winters in which the polar night can last from one to five month; in the centre and south of the island, the climate can be associated as low-arctic; only in the deep fiords of South Greenland, the climate became Sub Arctic, allowing the growth of a few trees (Greenland in Figures, 2026).

In addition, turning to actual temperatures, the extremes are striking: the highest ever recorded in Greenland was 25.9 °C, on the west coast in July 2013, and the lowest −69.6 °C, on the ice sheet (Greenland in Figures, 2026). Average values, however, better convey the north–south and coast–interior gradient. In the capital Nuuk, on the milder south-west coast, the mean temperature ranges from about −5.2 °C in January to 7.9 °C in July; further north, at Ilulissat (above the Arctic Circle), it falls to around −8.5 °C in January while summers remain similar (7.6 °C in July); in the interior, at Kangerlussuaq, the continental climate brings both colder winters (−15.3 °C in January) and warmer summers (10.7 °C in July) (Greenland in Figures, 2026); and in the far north, at Pituffik (Thule), around 76 °N, the July mean reaches only about 4.6 °C, while the coldest month averages roughly −24.6 °C (DMI, 1991–2020 normals). These figures confirm that there is no single Greenlandic climate, but a range of conditions – which helps explain why settlement and the island's limited agriculture are concentrated in the milder south.

Furthermore, as stated by Greenland in Figures (2026), most of the Greenlandic landscape outside the ice cap is pristine tundra – unforested. The absence of linking infrastructure

can be highlighted as a distinctive mark: the country does not have streets that connect one city to another and the easiest way to move are by sea of air.



Population in Greenland by january 1st, 2026

KOMMUNE KUJALLEQ	
Narsaq	1,241
Igaliku	31
Qassiarsuk	69
Narsarsuaq	139
Qaqortoq	3,081
Saarloq	23
Eqalugaarsuit	68
Qassimiut	10
Nanortalik	1,100
Aappilattoq	81
Narsarmijit	57
Tasiusaq	37
Ammassivik	23
Alluitsup Paa	135

KOMMUNEQARFIK SERMERSOOQ	
Nuuk	20,304
Qeqertarsuatsiaat	158
Kapisillit	49
Paamiut	1,205
Arsuk	69
Tasiilaq	1,811
Sermiligaaq	158
Isertoq	48
Kulusuk	204
Tiilerilaaq	83
Kuummiit	228
Ittoqqortoormiit	329

QEQQATA KOMMUNIA	
Sisimiut	5,455
Itilleq	100
Sarfannguit	86
Kangerlussuaq	381
Maniitsoq	2,528
Atammik	184
Napasoq	60
Kangaamiut	313

KOMMUNE QEQERTALIK	
Aasiaat	2,945
Akunnaaq	59
Kitsissuarsuit	58
Qasigiannguit	945
Ikamiut	84
Qeqertarsuaq	802
Kangerluk	4
Kangaatsiaq	469
Attu	181
Iginniarfik	56
Niaqornaarsuk	207
Ikerasaarsuk	72

AVANNAATA KOMMUNIA	
Qaanaaq	588
Savissivik	40
Siorapaluk	32
Qeqertat	25
Upernavik	1,096
Upernavik Kujalleq	178
Kangersuatsiaq	121
Aappilattoq	158
Tasiusaq	258
Nuussuaq	170
Kullorsuaq	390
Naajaat	44
Innaarsuit	146
Nutaarmiut	32
Ikerasaarsuk	1
Uummannaq	1,379
Niaqornat	29
Qaarsut	157
Ikerasak	219
Saattut	231
Ukkusissat	145
Ilulissat	5,150
Oqaatsut	52
Qeqertaq	101
Saqqaq	154
Ilimanaq	56

OUTSIDE TOWNS AND SETTLEMENTS	
Stations	55
Unknown	13

THE WORLD'S LARGEST NATIONAL PARK

The World's largest National Park is located in North East Greenland, with an area of 972,000 km². The only residents are the Sirius dog sled special force and weather stations staff.

Source: https://bank.stat.gl/BEESTD

Figure 21:Population of Greenland and the Northeast Greenland National Park.
Population by municipality and locality (1 January 2026), and the Northeast Greenland National Park, the largest national park in the world. Source: Statistics Greenland (2026), Greenland in Figures 2026.

To have a better understanding of the field, it is noteworthy to cite the Greenland National Park, actually the largest in the world, that equals to 972,000 km² (Greenland in Figures, 2026). Productive land use is therefore very small and limited to the southern strip, signalling that the land cover is changing rapidly – according to a satellite analysis of the last three decades it is possible to observe a doubling of the land cover by vegetation (+111%), a quadruplication of the wetlands (+380%) and a net reduction of the ice cover of about 28,700 km² (Grimes et al., 2024).

As stated in the first chapter, the phenomenon known as "*Arctic Amplification*" is especially relevant in Greenland – being the motor of all changes. The ice sheet has been losing mass for 27 straight years, every year since 1998 (NOAA, 2025). On average, between 2002 and 2025, Greenland has lost about 264 gigatons of ice per year, contributing alone to a global sea level rise of about 0.8 mm per year (NOAA, 2025).

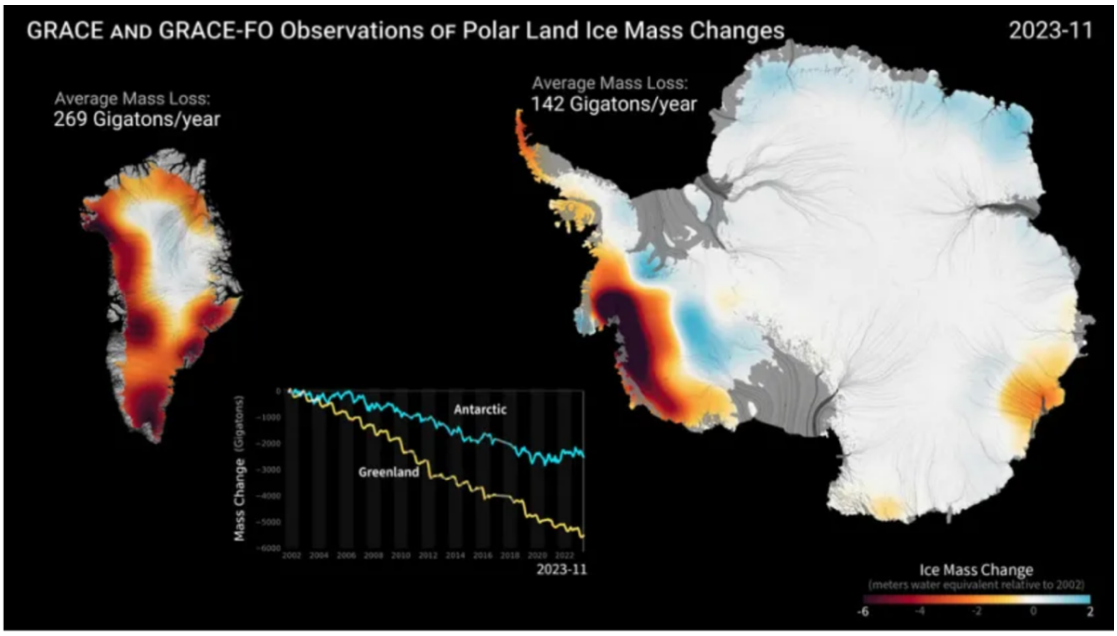


Figure 22:Land-ice mass change in Greenland and Antarctica, 2002–2023
From the GRACE and GRACE-FO satellite missions; Greenland loses on average about 269 gigatonnes of ice per year. Source: NASA (2023), GRACE and GRACE-FO observations of polar land ice mass changes.

Here, the relevant factor to take into consideration, regards to the variability year by year: in 2025 the loss was about –129 Gt, a number below the average 2003-2024 (about –219 Gt), thanks to superior snowfall and inferior fusion in the norm (Carbon Brief, 2025).

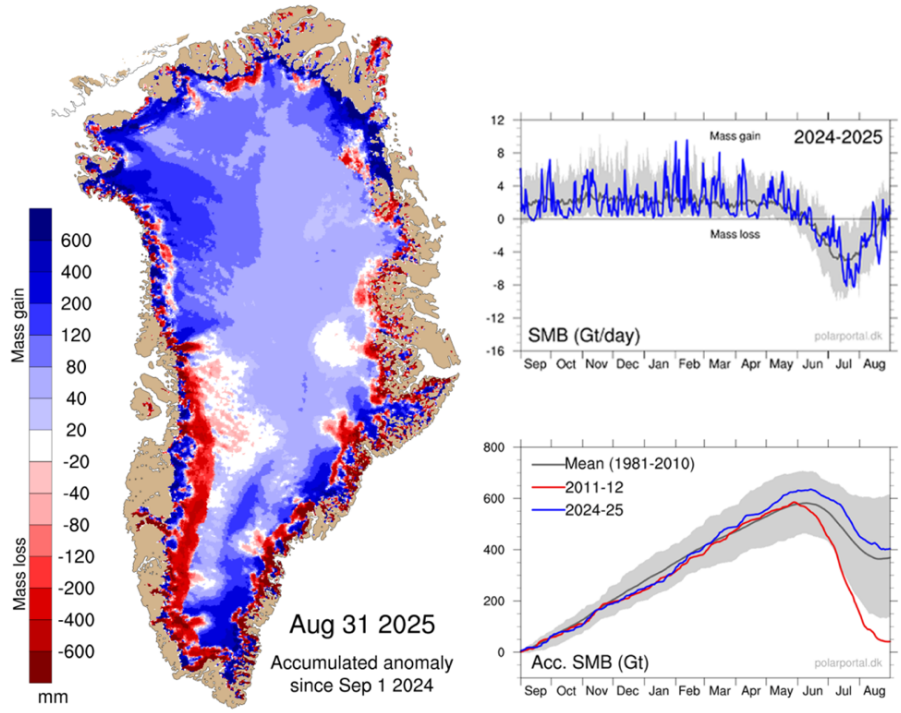


Figure 23:Total mass balance of the Greenland ice sheet to 31 August 2025
129 ± 50 Gt, shown against the 2003–2024 range. Source: Carbon Brief (2025), 'Guest post: how the Greenland ice sheet fared in 2025'.

The interesting fact is that the loss does not happen only for the superficial fusion but also for the calving of icebergs from glaciers, that rests higher also in years with fewer fusion (Carbon Brief, 2024). Moreover, climate change is not limited to the reduction of glaciers, but it tends to transform the territory – it extends the thermal growing season and promotes the so-called "*greening*" of the island: over the past three decades, the area covered by vegetation has doubled and wetlands have quadrupled, while ice continues to retreat (Grimes et al., 2024; Silva et al., 2025). At the same time, permafrost degradation – the thawing of permanently frozen ground – releases greenhouse gases previously trapped in the soil and threatens the stability of buildings and infrastructure constructed on top of it (Carbon Brief, 2025).

In light of these developments, the profound physical transformations of Greenland, together with the parallel human and socio-economic changes, help explain why the island has become far more contested today than in the past.

3.2.2 Human Geography: Population, Settlements and Economy

The strategic weight of a territory does not merely depend on its territory or resources, but on the people who live inside: how many persons, where they live, how they maintain themselves. In particular way – in the Greenlandic scenario – what is defined as human geography is also part of the geopolitical question: little population, Inuit's majority, concentration on the coast and economic dependence on the Kingdom of Denmark. Acknowledging that the human dimension is inseparable from the geopolitical question.

According to Statistics Greenland (2026), the official population dated on 1st January 2026 is 57,000 inhabitants, making Greenland one of the least densely populated areas in the world – with 0.3 inhabitants per km², considering the area free from glaciers. As well stated by Statistics Greenland (2026), inside the 57,000 people living in Greenland, one of the most interesting data refers to the composition populations' percentage: 88% belong to the Inuit (*Kalaallit*) and 12% is mostly Danish, with Greenlandic birth certificate. This demographic picture, however, is neither ancient nor natural – it is a result of a recent and remarkable transformation in the country. As Hamilton and Rasmussen (2010) point out in their work, over the course of the twentieth century Greenland shifted, in only a few generations, from a society of scattered settlements, based on hunting and sealing to an urbanised, post-industrial economy – a change largely driven by Danish post-war modernisation policies, which tended to concentrate the population in the main town and moved the economic base from hunting towards commercial fishing.

Nowadays, the past influence the future, and the most evident consequence regards to populations' urbanisation and concentration in the central city of Nuuk. Moreover, another element to take into consideration, concerns to the imbalance between sexes, analysed by Hamilton and Rasmussen (2010): an initial excess of women recently transformed into an excess of men. The reason refers to the migration pattern, in fact, women tend to leave settlements and to migrate more than men. In addition, the effects are also visible in patterns of internal migration to Nuuk that lasts since decades and to a progressive aging, calculating a projection of decrease in the total population under 50,000 inhabitants by 2050 (Statistics Greenland, 2026; Danmarks Nationalbank, 2025).

Indeed, the common thread here is that geography influences the way of living: more than 65% of the population lives in the five major centres – Nuuk, Sisimiut, Ilulissat, Aasiaat and Qaqortoq – and only Nuuk, with its 20,300 inhabitants, collects nearly a third of them. This, connected to the dispersion element along the coasts, especially in the southwestern area, in a territory deprived of streets between cities, where mobilisation is possible only via sea or air, is something that has great impacts on the island (Statistics Greenland, 2026). This settlement pattern is not accidental: it is rooted in the country's history, in particular in the mid-twentieth-century Danish policies that moved a lot of families from the smallest periphery to larger towns (Hamilton and Rasmussen, 2010).

Its main consequence is above all economic: when a very small population is scattered across dozens of isolated communities, with no roads between them and goods moving only by sea or air, the provision of basic services – such as healthcare, energy and transport – becomes something extremely difficult and expensive. Hendriksen and Hoffmann (2025) describe this situation as an "island operation economy", in which each settlement works almost as a separate unit that must be supplied and run on its own. Geography, therefore, does not only decide where Greenlanders live: it also shapes how much their society costs to sustain – leading directly to the question of the island's economy.

Greenland's' economy is mainly sustained by fishing, which dominates its exports, arriving to a total of 98% of goods (European Parliament, 2025); meanwhile the block grant[3] – four billion crowns, equivalent to a significant share of the public budget – from the Danish government remain decisive, even if its weight on GDP has fallen from around 30% in 2003 to about 19% in 2021 (European Parliament, 2025; Danmarks Nationalbank,

[3] A block grant is a fixed sum transferred by a central to a regional or local government to fund public services

2025). Beyond the block grant, Denmark is also responsible for the cover of areas such as defence, policing, justice and foreign affairs, which make Nuuk even more closely and connected to Copenhagen (European Parliament, 2025). In recent times the economy has slowed down: GDP's growth was only about 1% per year since 2023, while a growing shortage of labour – increasingly filled by foreign workers – and an ageing population are putting pressure on public finances (Danmarks Nationalbank, 2025). However, one of the main structural weaknesses is therefore the narrowness of the economic base, which rests almost entirely on fishing – the single export factor– and on Danish transfers. For what concerns other sectors, these are still underdeveloped: mining remains more potential rather than an actual source of income, while tourism is growing, helps by the opening of Nuuk's new International airport in 2024 and by the growing presence of summer cruise tourism (Danmarks Nationalbank, 2025; Statistics Greenland, 2026).

Taken together – small, ageing and largely Inuit population, dispersed settlements and an economy dependent on fish exports and Danish subsidies – these elements, help to explain both Greenland's vulnerability and its ambitions. Because genuine independence would require replacing the block grant with income generated by the island itself, the debate over Greenland's future increasingly turns on what the territory actually possesses. It is precisely these assets – its mineral wealth, its infrastructure and its strategic location – that the following section will examine.

3.3 The Stakes: Resources, Infrastructure and Strategic Location

Before looking at the ambitions that other powers have for Greenland, it is worth pausing on a simpler question: what is it, exactly, that makes this island so valuable?

The attention Greenland receives today does not rest on a single feature, but on the way several different assets come together in one place. Beneath its rock and ice lies an extraordinary concentration of natural resources, from REEs and other critical minerals to large reserves of oil and gas. Around and across the island run the sea routes, ports and communication links that are slowly making the Arctic more accessible, and that determine whether these resources can actually be reached and moved. And above all there is Greenland's position itself – a location that has given it military and strategic importance since the Second World War, and that keeps it at the centre of the security calculations of the great powers.

These three dimensions – resources, infrastructure and accessibility, and military geography – are the concrete stakes of the Greenland question. They are also closely connected: the value of the resources depends on the infrastructure that can reach them, and both are shaped by the geography that makes the island so strategically sensitive. The sections that follow will examine each of these assets in turn, beginning with the one that has drawn the most attention in recent years: Greenland's mineral and energy wealth.

3.3.1 Mineral Wealth: Rare Earths, Critical Minerals and Hydrocarbons

If Greenland has become a prize, it is first of all because of what lies in and beneath its rock. Nowadays, it is a matter of fact that the island holds some of the richest stores of natural resources on Earth: Critical Raw Materials (CRMs) such as REEs and lithium, a long list of other metals, and a very large volume of oil and gas (Paul, 2026). The objective of this section sets out three things in turn – why these resources matter, what is actually there (including what still lies hidden under the ice), and a single fact that runs through the whole story: there is a very wide gap between what Greenland holds in the ground and what it currently produces.

The materials found in Greenland are not ordinary commodities. REEs and other so-called CRMs are the building blocks of the technologies that define the twenty-first century. They are used in the powerful magnets inside wind turbines and the electric motors of clean vehicles, in rechargeable batteries, in electronics, and in advanced weapons systems from fighter jets to guided missiles (CSIS, 2025). Two forces have pushed them to the centre of world politics. The first regards to the green transition: as economies move away from fossil fuels, demand for these minerals is rising quickly, and the European Union has responded with a formal list of CRMs and a Critical Raw Materials Act meant to secure its supply (European Parliament, 2025; Pachytel 2025). The second concerns to dependence. The mining and, above all, the processing of rare earths are today dominated by a single country, China, which leaves Western economies exposed to shortages, price shocks and political pressure whenever supply is disrupted (CSIS, 2025).

It is against this background that Greenland acquires its value. For Europe and the United States, an island that holds large deposits of exactly these materials, and that sits within the Western sphere rather than the Russian or Chinese ones, seems like a rare opportunity to build an alternative and more secure supply (CSIS, 2025; European Parliament, 2025).

The interest in Greenland's minerals, in other words, is not only about the minerals themselves; it is about reducing a strategic dependence.

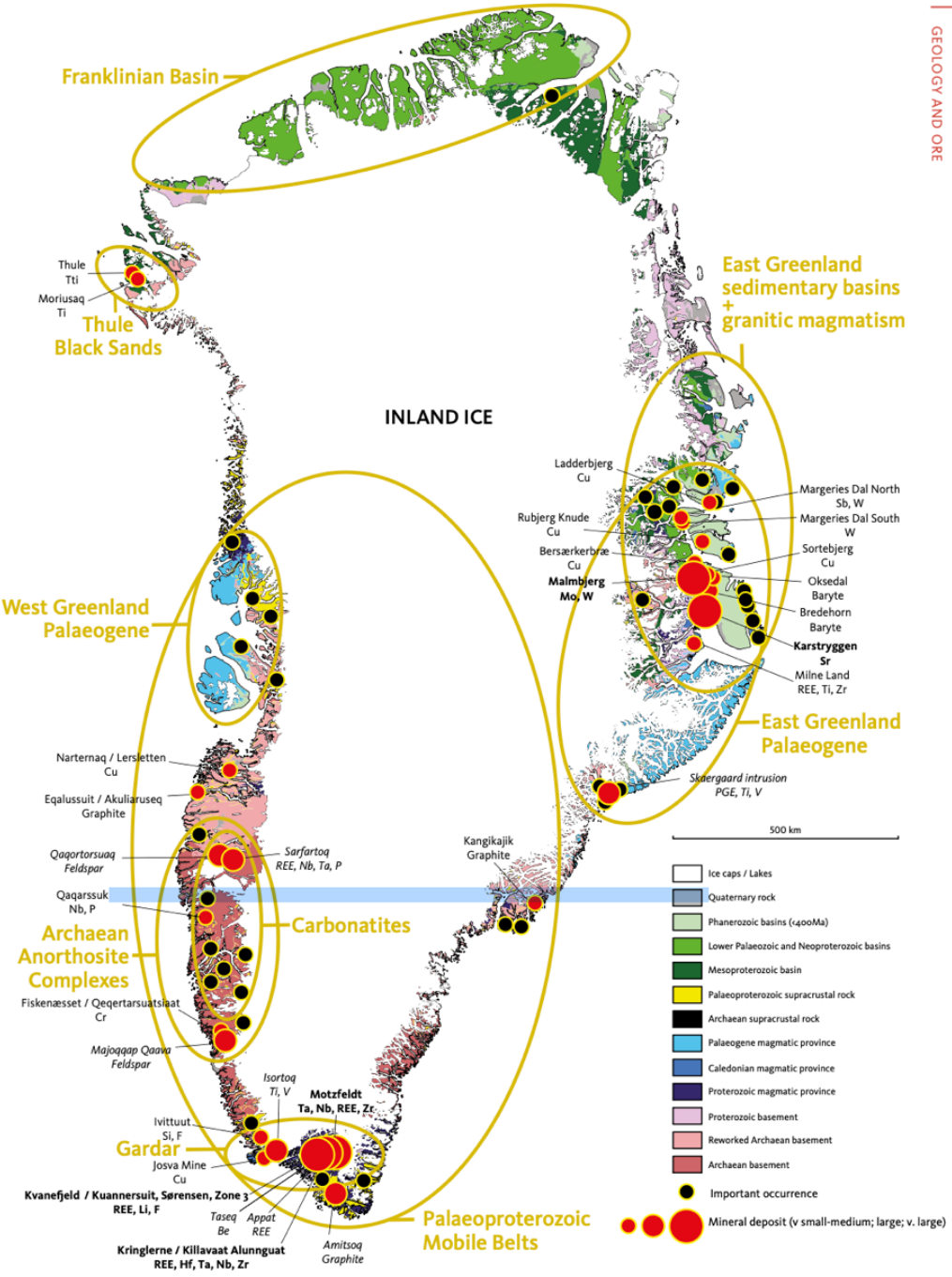


Figure 24:Greenland's strategic and critical raw material resource potential.
Source: Rosa et al. (2023), Geological Survey of Denmark and Greenland (GEUS)

Built on the ancient and varied geology outlined in the previous section, Greenland's ice-free coasts hold a remarkably concentrated mineral wealth. It is worth looking, then, at what is actually there. The heart of Greenland's critical-mineral wealth lies in the south, in the Gardar province, which the Geological Survey of Denmark and Greenland describes as an exceptional concentration of CRMs (Rosa et al., 2023). At its centre is the Ilímaussaq complex, one of the most mineralogically diverse places on Earth, which hosts several very large deposits. Kvanefjeld (in Greenlandic, *Kuannersuit*) contains rare earths together with uranium and zinc; the nearby Kringlerne (*Killavaat Alannguat*) is rich in tantalum, niobium, rare earths and zirconium; and other deposits such as Motzfeldt add further reserves (Rosa et al., 2023; GEUS, 2023). A short distance away lies Tanbreez, which may be one of the largest single rare-earth resources in the world and is unusual for its high proportion of the heavy rare earths – the sub-group that is both the most valuable and the hardest to obtain outside China, because of their use in high-strength, heat-resistant magnets (CSIS, 2025). Taken together, Kvanefjeld and Tanbreez rank among the largest rare-earth deposits anywhere on the planet (CSIS, 2025).

However, rare earths are only a part of the whole picture. According to the Geological Survey, Greenland hosts 25 of the 34 raw materials that the European Union classifies as critical (Rosa et al., 2023; Pachytel, 2025). East Greenland adds the very large Malmbjerg deposit of molybdenum – a metal used to harden steel – and the Skaergaard deposit, rich in platinum-group metals, gold, titanium and vanadium (Rosa et al., 2023; GEUS, 2023). Graphite, which is essential for lithium-ion batteries and which Europe must import almost entirely, is present in several deposits but remains, in the Survey's own words, "*underexplored"* compared with major producers such as China (Paul, 2026; Pachytel, 2025). Base metals such as lead, copper, iron and above all zinc occur in the ice-free coastal basins, some worked on a small scale since as far back as 1780, and the far-northern Citronen Fjord is one of the world's largest undeveloped zinc deposits (Paul, 2026; GEUS, 2023). This breadth is what makes Greenland strategically interesting: unlike a country rich in a single commodity, it could in principle supply the whole or part of Europe's needs across a wide range of critical materials at once (European Parliament, 2025).

Greenland's mineral wealth is matched as well by a large hydrocarbon potential. The United States Geological Survey estimates that the East Greenland Rift Basins Province, in the north-east of the island, holds a mean of about 31 billion barrels of oil-equivalent in undiscovered oil, gas and natural-gas liquids – a figure comparable to the entire proven

crude-oil reserves of the United States (USGS, 2007; Paul, 2026). That assessment divided the province into several distinct basins, including the Danmarkshavn, Thetis and Liverpool Land basins, and assumed that the sea ice which now covers the area would no longer be an obstacle (USGS, 2007; USGS, 2008).

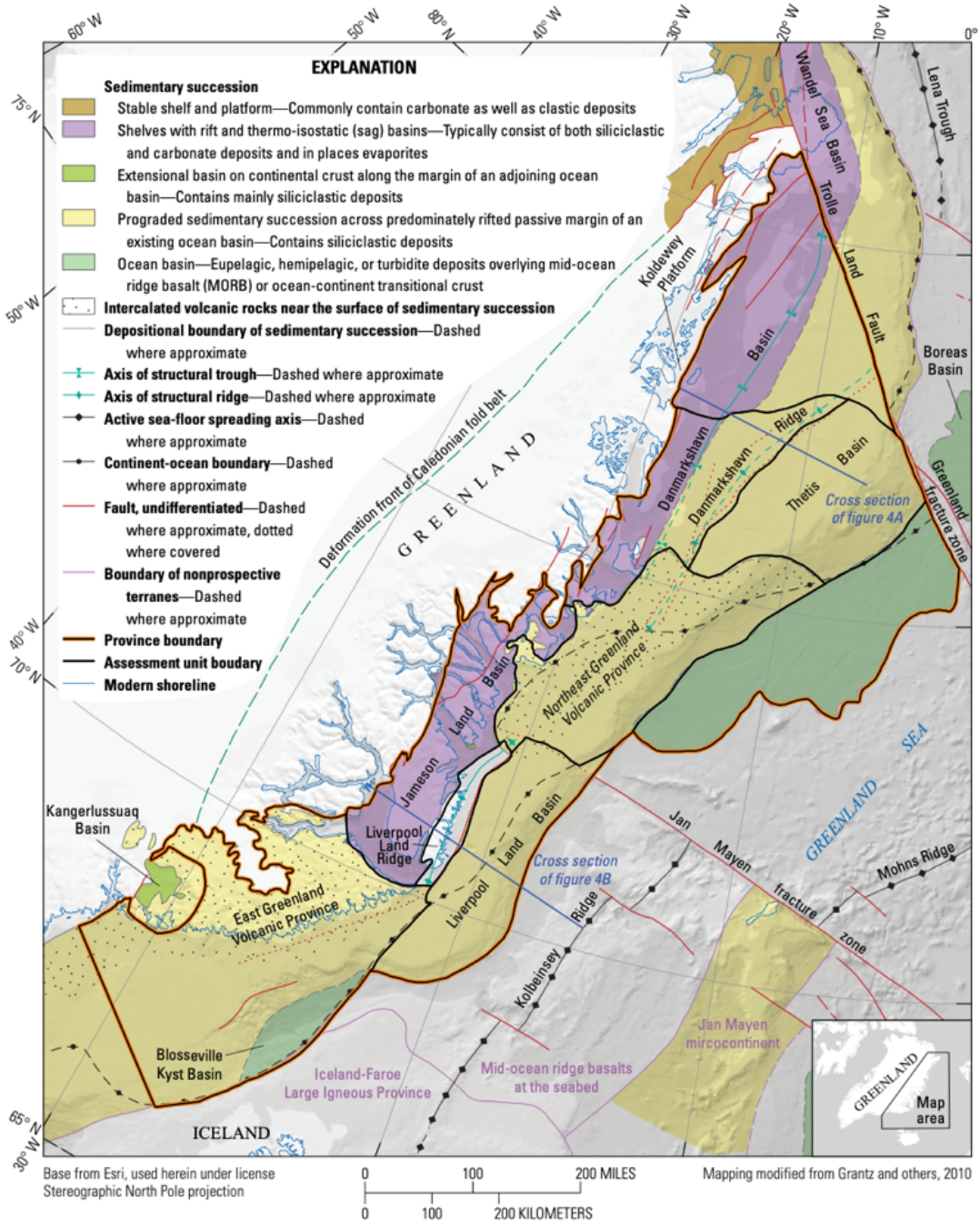


Figure 25:The East Greenland Rift Basins Province and its assessment units.
Source: USGS (2008), Geology and Assessment of Undiscovered Oil and Gas Resources of the East Greenland Rift Basins Province

The onshore Jameson Land Basin is thought to resemble Norway's oil-rich continental shelf, and further petroleum systems are believed to ring much of Greenland's offshore area (Paul, 2026). Despite that, these numbers come with a decisive caveat, because they

describe pretty well what might be found, but not what is actually being produced – and Greenland has chosen not to pursue it. On environmental grounds, the government suspended new oil and gas exploration in 2021, so this vast potential remains, for the moment, deliberately untouched (Paul, 2026).

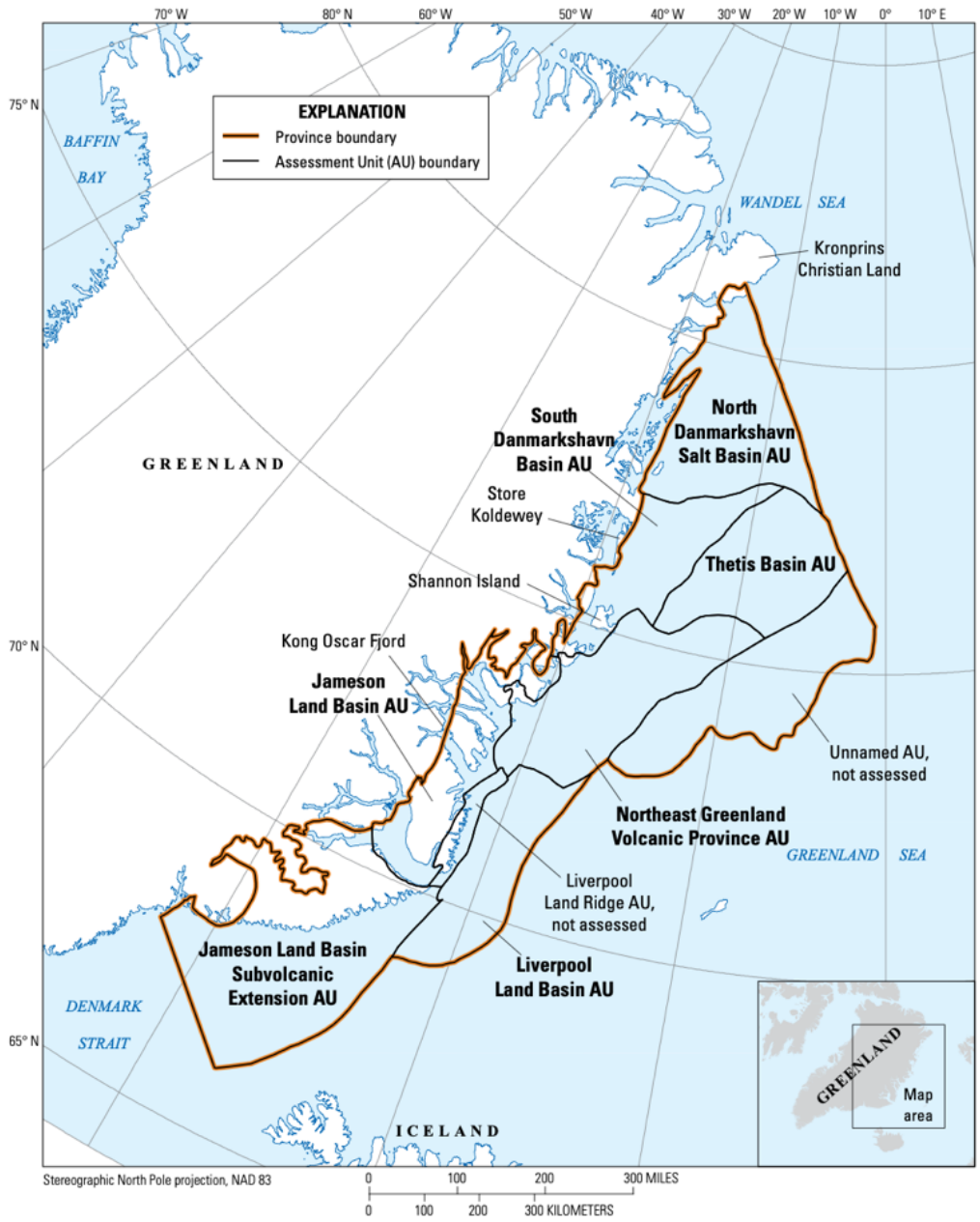


Figure 26:Geology and structural setting of the East Greenland Rift Basins Province
Source: USGS (2008), Geology and Assessment of Undiscovered Oil and Gas Resources of the East Greenland Rift Basins Province

Furthermore, what makes Greenland exceptional and distinctive is not only what has been mapped, but how much has not. The ice sheet covers more than four-fifths of the island; the ice-free land where mining is possible, though nearly twice the size of the United Kingdom, amounts to less than a fifth of the total surface (Paul, 2026). Almost everything

described above lies on that narrow coastal fringe, simply because that is where geologists can reach the rock (Mortensgaard and Barse, 2026). Beneath the ice, much of the island remains genuinely unexplored. Geologists believe that three of Greenland's rare-earth-bearing deposits, buried deep under the ice, may be among the largest in the world by volume, and that the island could hold enough sub-ice dysprosium and neodymium – two of the most valuable and hardest to source rare earths – to meet more than a quarter of predicted future global demand, a combined total approaching 40 million tonnes (Paul, 2026).

Here climate change enters the story again. An area of ice the size of Albania has melted since 1995, slowly uncovering new ground, while new survey techniques such as ground-penetrating radar are beginning to reveal the bedrock beneath up to two kilometres of ice (Paul, 2026). It would be a mistake, however, to overstate this effect. The known and workable deposits lie along the coast, not under the thickest interior of the ice sheet, so it is Greenland's geography and geology, more than the melting itself, that decide what can actually be reached (Mortensgaard and Barse, 2026). The honest picture is therefore mixed: Greenland's true mineral wealth is partly proven, partly estimated and partly still locked beneath the ice – a resource frontier whose full extent no one yet knows (Saalbach, 2024).

In addition, experts found a paradox that runs through the whole field. For all its riches, Greenland is at present rich in the ground but poor in output: not a single rare-earth mine is operating there at scale (CSIS, 2025). Some of the obstacles are those that frustrate every Arctic project – remoteness, extreme cost, a tiny workforce and a short working season. But despite the structural limits, the real ones are instead political and environmental. The flagship Kvanefjeld project stalled after Greenland passed a law in 2021 banning uranium mining, following strong local opposition; because the deposit's rare earths are chemically bound up with uranium, the ban effectively froze the project (CSIS, 2025). All resource activity, moreover, is tightly regulated by the Government of Greenland under legal frameworks that reach back to the 1970s, and any decision to loosen them is Greenland's to make (Paul, 2026). The gap between promise and production is thus not only a matter of geology and money, but of choice.

At this point, it is possible to state that this is precisely what gives the resources their political charge: because China dominates the mining and, above all, the processing of rare earths worldwide, every large deposit outside China is strategically valuable – and

Greenland's are among the most promising (CSIS, 2025). This strategic value is already reflected in the growing involvement of both Chinese and US actors in Greenland's mining sector. Chinese company *Shenghe Resources* is the largest shareholder in the Kvanefjeld project, while in 2025 the United States *Export-Import Bank* signalled its willingness to help finance the rival Tanbreez mine, marking the first move of its kind by the institution in the Arctic (CSIS, 2025). These developments illustrate that Greenland's minerals matter not only for what they can produce, but also for the strategic leverage that control over future supply chains could provide. The question is therefore increasingly not simply whether Greenland's resources will be developed, but who will develop them and under whose terms.

3.3.2 Infrastructure and Accessibility

Resources and infrastructure are closely interconnected: resources have value only when they can be accessed, extracted and transported. Infrastructure therefore represents the link between potential and actual use. In Greenland's particular case, this process is shaped by two complementary forces: what is being built, such as airports and ports, and what climate change is opening up, such as the retreat of sea ice.

The starting condition is that the settlements are scattered along the coast, with no roads between towns and with movement possible only by sea or air (Statistics Greenland, 2026). This, however, is not merely a geographical constraint — ice, fjords and enormous distances — but also a historical inheritance. In their analysis of three hundred years of infrastructure, Abildgaard and Gad (2026) show that Greenland's networks have followed a succession of imperial and post-colonial logics, connecting places according to the aims of the coloniser — trade, extraction and administration — rather than local mobility. A telling example is that, until only two years ago, the main international gateway was Kangerlussuaq, a former American military airport in the interior, which forced most flights through a single hub and often via Copenhagen (Greenland Airports, 2026).

Against this background, the recent transformation of the country's airports marks a turning point for Greenlandic infrastructure. Kalaallit Airports — the company created in 2016 and merged in 2024 into the new Greenland Airports — has built three airports: Nuuk (opened on 28 November 2024, with a 2,200-metre runway), Ilulissat (expected in October 2026, also with a 2,200-metre runway) and Qaqortoq, in the south, with a 1,500-metre runway (Greenland Airports, 2026). Here the benefits clearly outweigh the

drawbacks: direct international flights that bypass Kangerlussuaq and Denmark, shorter and safer journeys, new opportunities for tourism, and the prospect of economic diversification. Yet the drawbacks do not disappear. As Vanek (2026) argues, the length of the runway – the "2,200 metres" of his title – becomes the symbol of a promised future, but the new arrangement also reorganises the entire transport network, strengthening the main hubs (Nuuk, Ilulissat) at the risk of isolating or marginalising smaller communities. Infrastructure is thus bound up with a politics of belonging: choosing who is connected also means deciding who is left out (Vanek, 2026; Abildgaard and Gad, 2026).

A further point deserves attention: who builds and finances infrastructure matters as much as the infrastructure itself. The emblematic case dates from 2018, when the Chinese state-owned company China Communications Construction Company (CCCC) offered to fund and build Greenland's airports. The offer alarmed both Copenhagen and Washington, which feared strategic dependence and possible military access — so much so that the project was ultimately financed within the Western sphere (European Parliament, 2025).

Beyond the infrastructure built by human hand, accessibility is also changing through natural forces. The retreat of the sea ice is lengthening the windows of navigation and gradually making the shipping routes more usable. As Melia et al. (2016) argue, the ice loss expected over the course of the twenty-first century will increase opportunities for transit and shorten the distances between the Atlantic and the Pacific, making Greenland's coasts and resources more reachable as well. Even so, the picture remains largely prospective: the routes are still seasonal and require reinforced, ice-class ships.

Infrastructure, finally, also concerns the healthcare system, which is organised into five regions and strongly centralised. The national hospital is Dronning Ingrids Hospital in Nuuk, and for specialised care patients are often flown to Nuuk or to Denmark, while telemedicine helps to bridge the distances (Statistics Greenland, 2026). This very dependence exposes the fragility of healthcare access in the most isolated villages, which, tied so closely to transport links, now find themselves at the centre of a serious crisis (France 24, 2026)

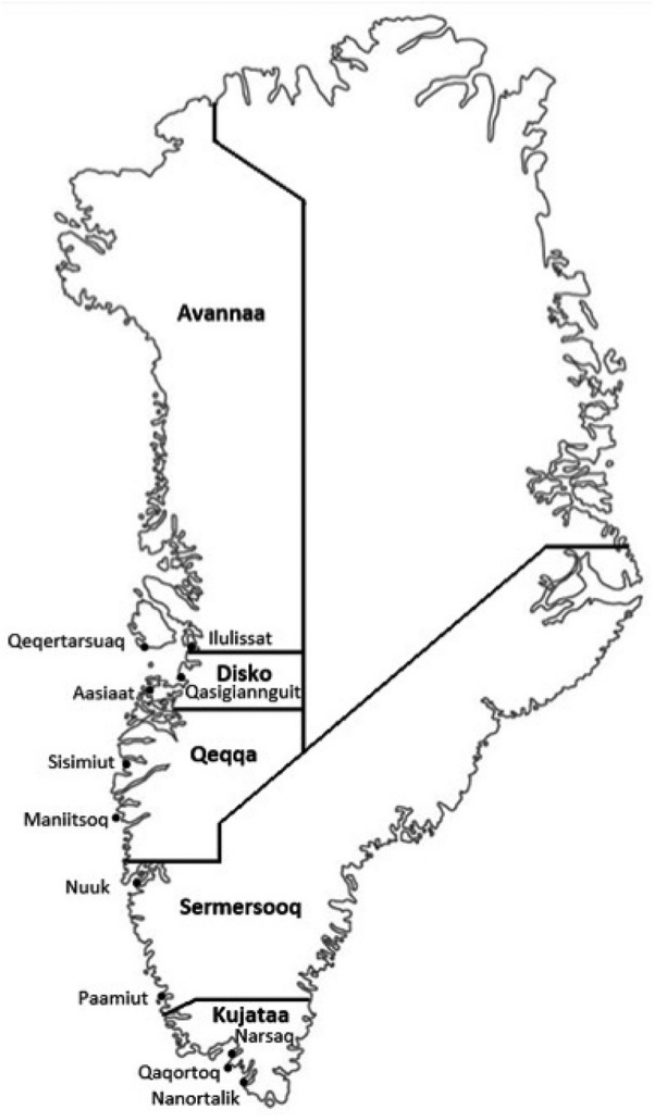


Figure 27:The five healthcare regions of Greenland
The five healthcare regions (Avannaa, Disko, Qeqqa, Sermersooq and Kujataa) and the towns hosting the regional hospitals. Source: Meklenborg, Pedersen and Bonefeld-Jørgensen (2018).

Accessibility, however, is never only a civilian matter. The same runways, ports and opening sea routes that bring Greenland closer to the world also make the island easier to reach – and therefore easier to defend, or to threaten. In a territory whose position has attracted military interest since the Second World War, every improvement in access inevitably feeds into questions of security and control. It is this dimension that the following section takes up, moving from the infrastructure of everyday life to Greenland's military geography and, above all, to the role of the Pituffik Space Base.

3.3.3 Military Geography: the Pituffik (Thule) Air Base

If resources explain what Greenland has, and infrastructure how it can be reached, its military importance rests on something even more basic: where it sits. Ever since the Second World War, when the United States first took over the island's defence, Greenland has mattered above all for its position on the map – a geography that makes it one of the most strategically sensitive places in the entire Arctic.

Greenland rests on the shortest path – the polar one – between North America and Russia: in the missile's era, whoever controls that point can detect and raise the alarm of a trans-polar attack before it reaches the American continent. Starting from this point, the island through the passing of years was seen as watchtower on the Arctic routes (Belfer Center, 2025). Besides the aerial and spatial functions, the maritime one matter as well: Greenland – together with Iceland and United Kingdom – forms the "G" in the GIUK Gap, a strategic chokepoint through which Russian submarines and vessels pass into the Atlantic, making it crucial to NATO (Belfer Center, 2025; European Parliament, 2025).

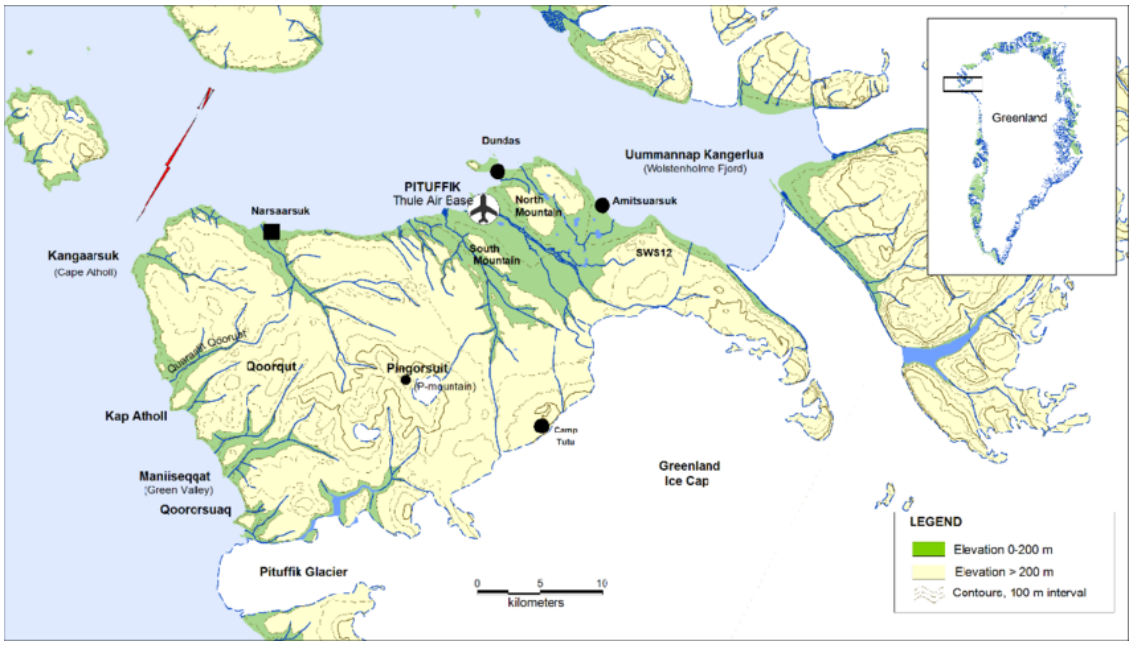


Figure 28: Location of the Pituffik (Thule) Air Base
Source: Cuyler et al. (2022), Greenland Institute of Natural Resources, Technical Report No. 104.

The American presence in Greenland dates back to the Second World War. After Nazi Germany occupied Denmark in 1940, the United States and the Danish ambassador Henrik Kauffmann signed an agreement in 1941 that placed the island under American protection and allowed the construction of the first military airfields (National Security

Archive, 2025). What began as a wartime arrangement became permanent with the Defense of Greenland Agreement of 27 April 1951, signed within the framework of NATO, which gave the United States the right to maintain and expand a lasting military presence on the island (Ackrén, 2019; National Security Archive, 2025). It was under this agreement that Thule Air Base was built, initially in secret, between 1951 and 1953. The base was designed as a forward station for the bombers of the Strategic Air Command, which from this position could reach targets inside the Soviet Union within a few hours (National Security Archive, 2025). Its construction, however, came at a human cost: in 1953 the local *Inughuit* community was forcibly relocated further north, to Qaanaaq, to make room for the base – an episode that still weighs on Greenlandic memory today (National Security Archive, 2025).

The strategic – and nuclear – role of the base became dramatically clear in 1968, when an American B-52 bomber carrying hydrogen bombs crashed near Thule. The accident, known as the '*Thule affair*', revealed the presence of United States nuclear weapons on Greenlandic soil, in open contradiction with Denmark's official anti-nuclear policy (National Security Archive, 2025). This long-standing tension between security commitments and Denmark's non-nuclear tradition has resurfaced in the current debate on nuclear deterrence and the country's future role in European security (Basile, 2026).

In the following decades the arrangement was gradually updated. The Igaliku Agreement of 2004 modernised the 1951 framework and, crucially, made it trilateral, giving Greenland itself a formal place at the table alongside Denmark and the United States (Ackrén, 2019). Finally, in April 2023, Thule Air Base was renamed Pituffik Space Base and placed under the United States Space Force – a change of name that reflects the shift of its mission from air power to space and missile early-warning operations (Air & Space Forces Magazine, 2025).

Today the base's mission is no longer about bombers, but instead about detection and surveillance. Indeed, the geographic logic that made Thule valuable during the Cold War still holds: because the shortest trajectory of a missile fired between Russia and North America passes over the pole, a sensor placed in northern Greenland can see such a threat earlier than almost anywhere else. For this reason, Pituffik operates an Upgraded Early Warning Radar – the successor of the Ballistic Missile Early Warning System first installed in 1961 – run by the 12th Space Warning Squadron. This radar detects

intercontinental and submarine-launched ballistic missiles along the polar routes and passes its data to the North American Aerospace Defense Command (NORAD), the body responsible for warning of and defending against an attack on North America (Air & Space Forces Magazine, 2025). The base's tasks, however, now reach beyond missile warning. It also contributes to the control of military satellites, through the 23rd Space Operations Squadron, and to '*space domain awareness*' – the tracking and identification of objects in orbit around the Earth – which is why, in 2023, it was placed under the United States Space Force (Air & Space Forces Magazine, 2025).

Pituffik is the northernmost installation of the United States armed forces, located roughly 1,500 kilometres from the North Pole. Although it is a small base, hosting only around 150 permanent personnel, its deep-water port and its airfield make it a unique platform: it is the only site from which the United States can sustain military operations this far into the high Arctic. Its role, moreover, is not fixed but is being actively reassessed. As missile technology evolves, some analysts warn that fixed radars such as the one at Pituffik may be increasingly vulnerable to the new generation of hypersonic weapons, which fly lower and manoeuvre in ways that are harder to track; this has fuelled current debates about how the base's sensors should be modernised and integrated into wider missile-defence plans (Defense News, 2025).

Notwithstanding, the base is not only an American asset: it stands on Greenlandic soil, and over time its governance has become an arena in which Greenland asserts its own agency. The evolution of the agreements makes this clear. What began in 1951 as a purely bilateral arrangement between the United States and Denmark – one in which Greenlanders had no formal voice – was transformed by the Igaliku Agreement of 2004, which modernised the old framework and, crucially, made it trilateral, giving Greenland a seat at the table alongside Copenhagen and Washington (Ackrén, 2019). This trend continued with the negotiations of 2020, when Greenland pushed to recover local economic benefits after the lucrative service contracts for the base had been awarded to a United States company, depriving the island of revenue and jobs. The episode is a telling example of Greenland behaving as a party in its own right, rather than as a mere object of great-power arrangements (Olsvig, 2024).

To this Greenlandic dimension is added a Danish one. Denmark has long combined its NATO commitments with an official rejection of nuclear weapons on its territory – a

tension first exposed by the Thule affair and one that has resurfaced today, as the reopened debate on nuclear deterrence forces Denmark to reconsider its role in European security, a question that bears directly on the meaning of a base such as Pituffik (Basile, 2026). The base therefore sits at the intersection of three sets of interests – American, Danish and Greenlandic – and the way they are balanced has become inseparable from the wider question of Greenland's self-determination, the principle of "*nothing about us without us*" applied to the field of security. It is also, in large part, this military value that explains why Greenland attracts such persistent external attention, and why the United States in particular has repeatedly signalled that it regards control over the island as a strategic priority (European Parliament, 2025).

Taken together, the history and the present role of Pituffik show that Greenland's importance does not stem only from what lies beneath its ice, but from where the island sits on the map. Its position turns it into a watchtower over the polar approaches to North America, and it is precisely this value – at once military and symbolic – that has drawn the attention of the great powers for more than seventy years.

3.4 The Greenland Question: Sovereignty, Independence and Identity

The previous sections have shown what makes Greenland valuable – its resources, its infrastructure and its strategic position. Yet all of these ultimately raise a single, deeper question: who has the right to decide Greenland's future?

This is what may be called the "*Greenland question"*, and it is at once legal, economic, political and profoundly identitarian. In legal terms, Greenland is still part of the Kingdom of Denmark, even though the 2009 Self-Government Act granted it a formal path towards independence. In economic terms, that path remains constrained by the island's dependence on Danish subsidies, which keeps full sovereignty a distant and contested goal. Politically, the question has been amplified by the renewed interest of the great powers, and in particular by the dispute between the United States and Europe over the island's future. Beneath all of this lies a question of identity: for a population that is overwhelmingly Inuit, self-determination is not only a matter of statehood but of belonging, culture and the right to speak for oneself – the meaning captured by the phrase *"nothing about us without us".* The following sections are supposed to examine these dimensions in turn – the constitutional framework, the economic debate, the pressure of external powers and

the Greenlandic sense of belonging – before turning, finally, to how the whole question appears from Copenhagen.

3.4.1 The Danish Realm and the 2009 Self-Government Act

To understand the debate over Greenland's future, one has to start from its present legal status – from what Greenland actually is under constitutional law. Today Greenland is neither a fully independent state nor an ordinary province: it is a self-governing territory within the Kingdom of Denmark, endowed with wide autonomy but still part of a single sovereign state. This peculiar position is the result of a long process, which moved from colonial rule to Home Rule in 1979 and, finally, to the Self-Government Act of 2009 – the law that today defines both the extent of Greenland's autonomy and its legal path towards independence.

Here the translation of the Danish Realm detains a huge importance: Greenland is not an independent state, but part of the Kingdom, alongside with Denmark and Fær Øer Islands. Basically, a unique sovereign state lead by the 1953's Danish Constitution, with a monarch as head of state (Prime Minister's Office of Denmark, n.d). Thus, the key-concept is well explained in Jakobsen and Larsen (2024) paper, where the words *"unitary state"* plays an important role: formal sovereignty rests to the Danish state, meanwhile, at the same time, it coexists with Greenlandic autonomy. The relationship stands on two elements: the first one regards to the fact that Greenland has the power to elect two deputies at the *Folketinget*[4]; the second one points out that, even if part of the Reign, Greenland rests outside European Union from 1985, after joining it with Denmark in 1973 and voting to leave in the 1982 referendum, subsequently becoming an *"Overseas Country and Territory"* associated with the EU (The Danish Parliament, n.d.).

Hence, the historical context requires some clarification, and a slightly wider frame. Denmark's colonial presence in Greenland dates back to 1721, when the missionary Hans Egede founded the first colony; for more than two centuries the island remained a Danish colony, until the constitutional reform of 1953 integrated it into the Kingdom as a county, formally ending its colonial status and granting Danish citizenship – though within a policy of modernisation and "Danisation" that generated growing discontent (Greenland in Figures, 2026). The decisive turn came with the European question. Greenland had been brought into the European Economic Community (EEC) together with Denmark in 1973,

[4] The Danish Parliament

against the will of most of its people, and this resentment fuelled the push for greater autonomy: as Jakobsen and Larsen (2024) argue, it was this "*critical juncture*" that triggered the establishment of Home Rule. The Home Rule Act of 1979 created a Greenlandic Parliament (*Landsting*) and Government (*Landsstyre*) and transferred competences such as education, health and taxation; and the newly autonomous Greenland soon put its voice to use, holding a referendum in 1982 that led it to leave the EEC in 1985 – the first territory ever to do so (Greenland in Figures, 2026). Self-government, in other words, was a push from within rather than a mere concession from above (Jakobsen and Larsen, 2024).

Building on this Home Rule framework, the decisive step came three decades later. After a referendum held in 2008, in which around 75% of voters expressed their support, the Self-Government Act[5] entered into force on 21 June 2009, Greenland's national day. Compared with the 1979 arrangement, the new Act marked a clear qualitative jump. Its most important provision is symbolic as well as legal: it explicitly recognises that *"the people of Greenland is a people pursuant to international law with the right of self-determination"* (Act on Greenland Self-Government, 2009). Alongside this recognition, the Act made Greenlandic the official language of the country, and allowed the Self-Government authorities to take over, at their own pace, a wide range of new fields of responsibility, such as policing, the administration of justice and company law (Act on Greenland Self-Government, 2009; Jakobsen and Larsen, 2024).

The Act also reshaped the economic relationship between Greenland and Denmark. It established that the revenues from Greenland's subsoil resources belong to Greenland, while introducing a mechanism by which the annual Danish block grant is gradually reduced as this resource income grows (Act on Greenland Self-Government, 2009). Above all – and this is the point that matters most for the debate on the island's future – the Act set out, for the first time, a concrete legal path towards independence: it can be achieved through a decision of the Greenlandic people, negotiated with the Danish government, formalised in an agreement, and finally approved both by a referendum in Greenland and by the Danish parliament (Act on Greenland Self-Government, 2009). Certain core competences, however, remain with Copenhagen, including the constitution, citizenship, foreign, security and defence policy, monetary policy and the Supreme Court.

[5] Act No. 473 of 12 June 2009

Despite these important gains, ultimate sovereignty still rests with the Danish state, and Greenland's self-determination continues to operate, in the words of Jakobsen and Larsen (2024), *"in the shadow"* of the unitary state. The road to independence is real, but it is conditional: it requires mutual negotiation and the consent of the Danish parliament, and, most importantly, it remains constrained by economic dependence, since the block grant still covers a significant share of Greenland's public budget. The 2009 Act can therefore be read as a compromise – the widest possible autonomy short of full statehood – a framework that formally acknowledges Greenland's right to independence while, for the time being, keeping the island firmly within the Kingdom. It is precisely this gap between the legal right to independence and the economic capacity to exercise it that the following section examines.

3.4.2 Economic Dependence and the Independence Debate

The 2009 Act grants Greenland the right to become independent, but the concrete question is a different one: can the island afford it?

As anticipated, Greenland's economy rests on two main pillars: fishing, which alone accounts for about 98% of goods exports, and the Danish block grant, which covers a large share of the public budget. In addition, Denmark bears the cost of areas such as defence, foreign affairs and justice (European Parliament, 2025). This dependence is the chain that holds back the prospect of independence. The weight of the block grant on GDP has fallen over time – from around 30% in 2003 to roughly 19% in 2021 – yet it remains decisive (Danmarks Nationalbank, 2025). As Andersen (2015) argues, Greenland's real challenge is to build a "*self-sustaining*" economy, one able to stand on its own resources without external transfers.

This raises a crucial question: why is it so difficult to overcome dependence on the Kingdom?

Different factors combine here: a small and ageing population, a labour shortage, a narrow economic base, and the high cost of delivering services across dispersed settlements – what Hendriksen and Hoffmann (2025) call an *"island operation economy*", meaning that, because the settlements are isolated and not connected by roads, each one has to be supplied and run almost as a separate, self-contained unit, which duplicates infrastructure and makes public services extremely expensive.

In order to become independent, it would be necessary to replace the block grant with new sources of income, mostly from resources like mining and hydrocarbons or from the growth of fishing and tourism, but these industries are unpredictable and require time to develop (Andersen, 2015; Danmarks Nationalbank, 2025). A sudden withdrawal of the Danish grant would result in a drastic decline in living standards since, although the right to independence exists, there are now insufficient financial resources to implement it.

The debate over independence therefore turns on how and when. On one side, support for independence is high in public opinion; on the other, caution prevails about achieving it immediately or at the cost of a decline in living standards (GIS Reports, 2025). The elections of 11 March 2025 clearly reflected this tension: Demokraatit, which favours gradual independence, emerged as the winner, while Naleraq, which calls for rapid independence, came second, and a majority of the parties opposed holding an immediate referendum (Pequeño IV and Ray, 2025; France 24, 2026). The debate, in short, is not so much about whether to become independent as about when and how – and about how to achieve economic sustainability first.

Since 2025, Trump's pressure over the Greenland question has complicated the debate on independence. On the one hand, it has pushed independence to the top of Greenland's political agenda; on the other, it has made Greenlanders wary of simply replacing dependence on Copenhagen with dependence on Washington (France 24, 2026; European Parliament, 2025). In light of this, a significant number of Greenlanders encourage adopting a careful approach, which includes strengthening the island's economy, broadening its alliances, and, most importantly, not rushing. Renewed American pressure has strengthened the desire for more political and economic autonomy on Greenland's terms rather than speeding up the independence movement. The Greenlandic situation ultimately highlights a striking paradox. Although the Greenlanders have a legal right to independence and a strong desire to attain it, they do not currently have the financial resources to do so.

Independence thus remains suspended between a genuine national aspiration and an economic reality that keeps full sovereignty conditional. It is precisely this vulnerability – a small, resource-rich territory that cannot yet stand on its own – that turns Greenland's future into a question reaching far beyond its own shores, drawing in the great powers whose competing ambitions are examined in the following section.

3.4.3 Greenland between Great Powers: the US-EU Dispute

Rarely has a single island managed to set two allies against each other. Yet this is precisely what Greenland has done: for the first time in decades, the sharpest dispute over its future is not between the West and a rival power, but between the United States and Europe themselves.

The American position, in the current scenario, first drew attention in 2019, during Trump's first administration, and intensified sharply from 2025, when he went so far as to describe anything short of full control over the island as "*unacceptable*", justifying it on grounds of "*national security*" and backing it with pressure and tariffs on Denmark, while not explicitly ruling out the use of force (European Parliament, 2025; Fix and Harris, 2026). The motives can be summarised in four: military geography (the Pituffik base), the presence of critical minerals, the wish to compete with and keep China out of the Arctic, and an ideological factor – in particular the logic of "*America First*", a vision centred on the Western Hemisphere and impatient with dependence on allies (Belfer Center, 2025; CSIS, 2025). For this reason, several scholars and analysts read the move as a strategic own goal: the United States already obtains what truly matters – military access to Pituffik and Greenland's openness to mineral extraction – through existing agreements, so that a direct takeover would bring only a modest gain at an enormous cost (CSIS, 2025; Fix and Harris, 2026).

On the other side, the European reaction was one of firm solidarity with Denmark and Greenland, with an explicit refusal to be blackmailed, emergency diplomatic meetings, the threat of suspending the trade agreement with Washington, and even the symbolic deployment of small contingents by France, Germany, Norway and Sweden (Liboreiro, 2026; Fix and Harris, 2026). From this an analytical dilemma emerges: Europe depends on the United States for its security, yet the threat now comes from that very ally – in Martin's (2026) words, a *"situation with no way out*" for European security. The point is reinforced by the widespread perception among European leaders that the transatlantic relationship "*as we have known it*" has now been broken (Fleck and Batchik, 2026).

Hence, the real paradox is not merely a US vs EU, as the European Union also has a direct interest in Greenland's resources: in 2023, it signed a strategic partnership on CRMs with Greenland, and in 2025, it designated the Amitsoq graphite project as a *"strategic project"* under the Critical Raw Materials Act (European Commission, 2023). Brussels is therefore competing for access to the same minerals, but through partnership rather than

control. The paradox worth highlighting is that, precisely in the field of critical minerals, the United States and Europe continue to cooperate even as they clash over Greenland (Lu, 2026): a sign that the dispute is not one of total rivalry, but rather an intricate combination of conflict and shared interests.

Furthermore, one of the most unusual aspects, is that the clash is between allies rather than against an external enemy. China is often invoked – keeping it out is one of the American justifications – yet its real presence in Greenland is limited (CSIS, 2025). The true elephant in the room, in security terms, is Russia's militarisation of the Arctic; and yet attention is absorbed by the intra-Western dispute, which risks distracting from the region's real security challenges (Mortensgaard and Barse, 2026; Saalbach, 2024).

Indeed, Greenland, however, is not simply a "*prize to be won*". The island is not a passive actor: it uses the competition to widen its room for manoeuvre, demands to be consulted, diversifies its partnerships and remains wary of replacing dependence on Copenhagen with subordination to Washington (France 24, 2026; European Parliament, 2025; Government of Greenland, 2024). Its preferences, in short, shape the outcome of the contest.

At the time of writing, this dispute appears to have reached a provisional resolution. In September 2026, the United States, Denmark and Greenland announced a security agreement – expected to be signed at the United Nations General Assembly and still subject to parliamentary approval – granting Washington a lasting, "permanent" role over Greenland's security and providing for an expanded US military presence, while barring any non-NATO (and, explicitly, Chinese or Russian) base or sensitive investment without American consent (O'Connell, Matza and Murray, 2026; Rennolds, 2026). Crucially, the deal stops well short of Trump's original ambition of purchasing or annexing the island: Denmark retains its sovereignty and territorial integrity, and it explicitly recognises Greenlanders' right to self-determination (O'Connell, Matza and Murray, 2026). The outcome is telling: the United States obtained the security control and the exclusion of rivals it had always sought – much of which, as this chapter has argued, it already enjoyed – without acquiring the territory or its costs, while Greenland preserved its status as a subject rather than being reduced to a purchase. The compromise thus embodies, almost literally, the object–subject tension that runs through this chapter.

And yet, for all the noise of tariffs, troop deployments and emergency summits, the voice that matters most is often the one least heard. Throughout the dispute, both Washington

and Brussels have treated Greenland as a prize to be seized or defended – an object of strategy rather than a subject with a will of its own. But an island is never only a point on a map or a deposit of rare earths: it is the home of a people. And this shifts the real question away from what Greenland is worth to others, and towards what it means to those who actually live there.

3.4.4 The View From Within: Inuit Identity and the Greenlandic Sense of Belonging

After governments, analysts and foreign powers have all spoken about the island's future, attention must now turn to those who actually live there. For behind the maps, the minerals and the military bases, Greenland is above all the home of a people – the *Kalaallit* – and their sense of identity is essential to understanding the question in its entirety.

The starting point is simple but decisive: Greenland is an Inuit country. Around 88% of its roughly 57,000 inhabitants are Inuit, and the island's own name, *Kalaallit Nunaat – "the land of the Kalaallit"* – places identity before geography (Hamilton and Rasmussen, 2010). It is a population with its own official language, *Kalaallisut*, and a deep relationship with the land, the sea and the practice of hunting and fishing, which still shapes everyday values. This identity is not folklore: it is the political and legal foundation of Greenland's claims, since the 2009 Self-Government Act recognises Greenlanders as *"a people pursuant to international law with the right of self-determination"* (Government of Greenland, 2024; Gad, 2017). From this point on, the island can no longer be read as a mere territory, but must be understood as the homeland of a people.

This identity, however, is not fixed but continually shaped by the colonial past and by an ongoing process of decolonisation. As Gad (2017) explains, Greenlandic national identity combines elements of traditional Inuit culture with elements of colonial modernity: it is negotiated rather than given. That process also has a painful side. Under the Danish crown, Greenlanders experienced a forced "Danisation" of their lives and culture, which left wounds that are still open *"on Inuit bodies and minds"* (Gianoli, 2026a) and that now feed a search for what many call mental decolonisation. On a more theoretical level, Østergaard and Arnaut (2023) show how the "*Inuit myth*" – the idea of the Inuit as natural stewards of the Arctic – is reworked to claim a distinct model of governance and rights grounded in cultural and political identity. For Greenlanders, in other words, asserting who they are is at once an act of healing and the basis of their sovereignty.

It is this identity that turns into a political voice, captured by the phrase that runs through the whole debate: *"nothing about us without us"*. The motto is now institutional – it gives its title to Greenland's 2024 Foreign, Security and Defence Policy (Government of Greenland, 2024; Constantin, 2026; Nyberget, 2025) – but its sharpest expression came in response to American pressure. On 9 January, the leaders of Greenland's five parties signed a joint declaration built on a principle both simple and radical: *"we do not want to be American, we do not want to be Danish, we want to be Greenlandic"*, adding that *"we must decide the future of our country ourselves, without pressure […] or interference from other countries"* (Gianoli, 2026a). Significantly, this was a message not only to Washington but also to Copenhagen, since foreign policy still remains a Danish competence. It echoes what Jacobsen (2020) calls Greenland's *"sovereignty games*", in which Greenlanders turn their position into agency: Greenland, as they insist, *"is a political subject, not an empty strategic space"* (Gianoli, 2026a).



Figure 29:"We are not for sale": protests in Greenland, 2025
Demonstrators hold placards reading "We are not for sale" and "No means no" during protests against United States pressure to acquire the island. Source: Reuters (via BBC).

Nowhere is this voice clearer than in the letters that ordinary Greenlanders addressed to Donald Trump, collected together with the Greenlandic newspaper *Sermitsiaq*. Their reaction to the threat of annexation was not fear but pride and irony. Faced with the prospect of a cash incentive of tens of thousands of dollars per citizen, a young Inuit woman replied to Sky News with a smile*: "We are already Great! We won't get any greater by giving us McDonald's"* – and, like many others*, "we are already rich*" and the now iconic *"Greenland is not for sale"* (Gianoli, 2026a). Beneath the humour lies a serious point: the wealth

many Greenlanders truly seek is not economic, but freedom from the burden of a colonial past (Gianoli, 2026a).

The individual letters make this even more powerful. That of Lena Pedersen, an activist of the *Urani? Naamik* –"*Uranium? No thanks"* – movement, speaks to Trump not in the language of geopolitics but in that of *Kalaallit* ethics (Gianoli, 2026e). *"Many of us gather directly from nature what we need, without taking more than necessary*", she writes, recalling the myth of *Sassuma Arnaa*, the mother of the sea, whose hair becomes tangled and who withholds the animals whenever hunters take too much – an ancient warning against excess. She closes with words that overturn the very logic of possession: *"it is inner restlessness and dissatisfaction that make one always want more […] you will not find what you need outside yourself: you already possess it*" (Gianoli, 2026e). The same spirit runs through the rest of the series, in which Greenlanders remind their reader that friendship rests on respect, not on acquisition (Gianoli, 2026d). Taken together, these voices shift the whole question from the plane of strategy to that of the dignity of a people speaking for itself.

Seen from within, then, self-determination means far more than statehood or economics. For Greenlanders it is a matter of belonging, dignity and the right to decide their own future – which is precisely why they refuse to be treated as a commodity, whether by Washington or by Copenhagen (Basile, 2025; Gianoli, 2026a; Gad, 2017). Identity, in this sense, is the moral core of the entire Greenland question, the very thing that legal, economic and geopolitical analyses, on their own, risk failing to see. Having listened to this voice from within, it remains to be seen how the same question looks from the other side of the relationship – from Copenhagen.

3.4.5 A View from Copenhagen: Danish Perspectives on the Greenland Question and a personal interpretation based on a traineeship in Denmark

The Greenland question would not be complete without the last view: the one from Copenhagen. At the beginning of 2026, during a traineeship at the Italian Embassy in the Kingdom of Denmark, I had the opportunity to interview a Danish scholar of strategic studies and great-power competition at the Royal Danish Defence College, about how the whole matter looks from the Danish side (interview, Copenhagen, 12 March 2026). What follows draws on that conversation, a view from within Danish strategic thinking, to show how the events examined so far appear from the other shore of the Kingdom – and how quietly they are reshaping Denmark's sense of itself.

The first and most striking point concerns the shift in Danish public opinion. At first, the interviewee recalled, most Danes treated Trump's proposal as almost a joke; it was only after the 2024 election that it became clear *"he was serious about taking over the island"*. What followed was a genuine reversal: a country that had long been *"one of the most pro-American countries in Europe"* turned into one that is now *"increasingly wary of the United States"*. Yet he was careful to stress the ambivalence of this shift, since Denmark remains deeply dependent on Washington for its security and still wishes to preserve that partnership, especially in the Arctic. This is where the Danish and Greenlandic perspectives quietly converge: the Danish government, he noted, has been reluctant to decide Greenland's fate, holding that *"it is for the Greenlanders to define their own position"* – in effect, a Danish echo of the principle *"nothing about us without us"* that runs through this whole chapter.

A second theme is how far Greenland has moved, in Danish eyes, from the margins to the centre. The scholar illustrated this with a telling detail: whereas Arctic affairs once received little coverage, the Danish national broadcaster DR – *"the Danish equivalent of the BBC"* – now devotes a daily segment to events in Greenland, including its election campaigns. *"Two years ago"*, he observed, *"there simply would not have been that level of interest."* I would add that this sudden attention is revealing in itself: that Denmark should be discovering the strategic weight of Greenland only now says a great deal about the historic asymmetry of the relationship, in which the island was long governed without being truly seen.

The third and most provocative point is his overall verdict on Trump's ambition, which he judged *"mainly a misstep"*. His argument is coldly strategic: the United States, he explained, already obtains what it needs from Greenland – military access through Pituffik and an island that is *"open for business*" on minerals – so that formal control would add little while costing enormously, given the price of running Greenlandic society. Under the present arrangement, in his memorable phrase, Washington gets *"to have their cake and eat it"*. Worse, he argued, the affair is a distraction from the more serious Arctic security challenge posed by Russia, and it forfeits the moral high ground the United States once held: having criticised others for *"going around conquering other countries*", it is now "*doing something similar",* which he summed up as *"a massive own goal*". The deeper driver, in his view, is ideological – an *"America First"* outlook that resents dependence

on allies and is drawn to the idea of simply seizing *"this big island*" without weighing whether it truly serves American interests.

Here, however, I would personally add a note of caution to his otherwise persuasive reading. Even a strategic "own goal" leaves marks on the field. Whether or not annexation ever makes sense for Washington, the mere raising of the idea has already reshaped the region's politics: it has strained the transatlantic alliance, prompted Denmark and its Nordic partners to accelerate Arctic defence spending, pushed the question of Greenlandic independence to the top of the island's own agenda, and revived Europe's debate about its strategic autonomy. Above all, it has begun to erode the long-held norm of Arctic "exceptionalism" – the assumption that the region could remain a zone of low tension, insulated from great-power rivalry. Seen through this lens, this is the deeper point: a claim over territory does not need to be carried out to be consequential. The very act of naming Greenland as a prize has redrawn the mental map of the Arctic – and it is this shift, more than any coherent American plan, that has placed the island at the centre of a new phase of Arctic competition.

To conclude, if I had to distil what I carried away from Copenhagen, it would be this. Seen from the Danish side, the Greenland question turns out to be less about ice, minerals or missiles than about relationships – Denmark's fraying trust in its oldest ally, and its uneasy bond with a people it has long counted as its own yet never fully listened to. What struck me most during the interview was how a matter almost always framed in the cold vocabulary of geopolitics rests, at its core, on a question of recognition: who is entitled to speak for a territory, and who is merely spoken about. This is precisely where the whole of this thesis has been heading. Approached through law, economics, strategy or identity, the Greenland question keeps returning to the same answer – that a homeland cannot be reduced to a point on someone else's map. The measure of the coming Arctic order will not be only which power secures the island's resources or its radar sites, but whether the smallest actor in the contest, the Greenlanders themselves, is at last treated as a subject rather than an object. For all the great-power noise that surrounds it, the future of *Kalaallit Nunaat* is not for others to decide, but for the people who call it home. Nothing about them, without them.

CONCLUSION

The objective of the thesis was to understand how climate change is redrawing the political geography of the Arctic, and why Greenland, in particular, has come to occupy the paradoxical position of an object of external ambitions and, at the same time, a subject asserting its own territorial agency. Read and examined through the lens of the Geography of Conflict, the Arctic has proved to be a space whose strategic meaning is being rewritten before our eyes – and Greenland the point at which that rewriting becomes most visible.

The first chapter answered the underlying climatic question. It showed that environmental change is not merely an ecological process but a geopolitical one: as the ice retreats, the Arctic's physical geography – its frozen distances, its inaccessibility, its buried resources – is being converted into strategic assets. Warming has turned the region into a potential frontier of critical minerals and hydrocarbons and has begun to open maritime routes that were long closed, so that ice, location and access have themselves become objects of power. In this sense, climate change acts less as a backdrop than as a driver: it does not simply alter the Arctic environment, it changes what the Arctic is worth, and to whom. A space once valued for its emptiness is now valued for what that emptiness conceals.

The second chapter traced how this transformation translates into concrete rivalry. It argued that infrastructure and connectivity – ports, airports, and above all the submarine cables that carry the region's data – have become vectors of power, and that competition over them increasingly takes hybrid, *"grey-zone"* forms below the threshold of open war: severed cables, jammed signals, a shadow fleet operating in the ambiguity between accident and attack. The militarisation of the High North and the tightening, if uneven, Sino-Russian alignment confirmed that the Arctic is no longer an exceptional space insulated from global tensions, but one where those tensions are rehearsed, projected and, at times, deliberately blurred. Connectivity, in other words, has become both the region's promise and its vulnerability.

The third chapter brought these threads together in a single place. Greenland emerged as the focal point of the Arctic contest precisely because, on one island, its physical geography, its resource wealth, its infrastructure and its strategic position all converge. Its rare earths and hydrocarbons, its opening coasts, and above all the polar location that makes

the Pituffik base a watchtower over North America, explain why the great powers – and, unusually, two allies, the United States and Europe – now compete over it. Yet the same chapter revealed the other half of the story: that Greenland is not an empty stage. From the 2009 Self-Government Act, which recognised the Greenlanders as a people with the right of self-determination, to the response of ordinary citizens who answered the offer to be bought with the words "*we are already Great*", and as confirmed from the Danish side in the interview I had the possibility to conduct for this work, the island has behaved as a political subject, insisting that its future be decided by Greenlanders themselves.

Here lies the answer to the central question. Greenland is at once an object and a subject because Geography in the twenty-first century operates across scales: the same territory can be a pawn on the great powers' map and a homeland whose people claim the right to speak for it. What the Greenlandic case reveals is that power over contested space is no longer held only by those with the largest militaries or economies. Legitimacy, identity and the principle captured in the phrase *"nothing about us without us*" have become sources of agency in their own right – capable of complicating, delaying and even resisting the designs of far stronger actors. In an age when climate change reshuffles the strategic value of territory, who controls space has become inseparable from who belongs to it.

This carries a wider lesson for the study of geopolitics. The Arctic shows that a map is never only a surface to be divided among the powerful; it is also lived from below, by those whose home it is. The most instructive feature of the Greenland question is not the ambition of Washington, Beijing or Moscow, but the fact that a nation of some fifty-seven thousand people has been able to place its own voice at the centre of a contest between giants. If the twentieth century taught that geography could be seized, the Greenlandic case suggests that, in the twenty-first, it can also answer back.

Notwithstanding, these findings, of course, carry some limits. The events at the heart of this study are still unfolding, and a subject moving as quickly as the Greenland question in 2025–2026 resists any final word; some conclusions may be overtaken by developments after the time of writing. The analysis has also relied largely on Western and English-language sources – with the notable exceptions of the interview and the Greenlandic voices gathered here – and it examines a single, if paradigmatic, case, which invites

further comparative work, for instance with the Fær Øer Islands, Svalbard or the Canadian North. These are not weaknesses so much as openings: the Arctic is changing too fast, and matters too much, for any single study to close the question. Indeed, as this thesis was being completed, the September 2026 security agreement between the United States, Denmark and Greenland – granting Washington a lasting security role while preserving Danish sovereignty and Greenlandic self-determination – offered a striking confirmation of its central argument: Greenland emerged from the contest neither annexed nor silenced, but as a subject whose voice still counted.

In the end, the image that remains is a simple one. Behind every strategic map of Greenland – every shaded zone of minerals, every arc of a missile's trajectory, every projected shipping lane – there is a coastline where people still take from the sea only what they need, and a cardboard sign, raised against the cold, that reads: *we are not for sale*. The Arctic is no longer the frozen edge of the world; it has become one of its centres. And Greenland stands as a reminder that the Geography of Conflict is decided not only by those who look at the map from above, but by those who live at the point where the ice meets the sea – and who have grown tired of being drawn upon it, rather than asked.

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