Living with Ice: Climate Adaptation Practices from Greenlandic Communities

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Introduction

Greenland’s ice is a constant presence—shaping coasts, seasons, livelihoods, and stories. It is also changing at a pace that people can feel underfoot and at sea: permafrost softens, shorelines retreat, and familiar travel routes across sea ice become unpredictable. For many outside observers, these shifts are captured in satellite images and climate models. For Greenlandic communities, they are measured in the distance to safe harbor, the depth of pilings beneath a home, the soundness of a trail, and the reliability of food shared at the communal table. This book starts there—at the scale of everyday decisions—because climate adaptation succeeds or fails where people live.

Living with Ice brings together case studies of community-led initiatives in housing design, food security, coastal protection, and intergenerational knowledge transfer. Each chapter highlights a practical model rooted in local knowledge and culture, then distills lessons that can travel—carefully—from one context to another. The goal is not to prescribe a single blueprint but to show how principles like co-design, long-term stewardship, and design-for-repair can generate solutions that fit Arctic realities. While the settings are Greenlandic, the insights matter far beyond the Arctic: many coastal and cold-region communities face parallel challenges of volatile weather, costly infrastructure, and limited maintenance capacity.

The book is intentionally practitioner-focused. Development practitioners, municipal planners, engineers, school administrators, and community leaders will find checklists, decision frameworks, and implementation details tied to real projects. The chapters examine how a community freezer stays reliable through power outages; how a hybrid microgrid reduces diesel use while keeping critical services online; how pile foundations and adjustable skirting protect homes on thawing ground; how nature-based coastal defenses can complement rock revetments; and how youth programs that blend classroom learning with time on the ice sustain both safety and identity. These examples are not isolated innovations but parts of broader systems—governance, finance, supply chains, and cultural life—that determine what endures.

Equally important is how adaptation work is done. Many effective projects in Greenland begin with relationships: time invested in listening, consent processes that respect local authority, and research designs that return value to the community. Throughout this book, co-authored cases and practitioner sidebars illuminate the agreements, data-sharing protocols, and maintenance plans that underpin trust. By making these “backstage” elements visible, we invite readers to consider ethics and accountability as core components of technical success.

Methodologically, the case studies draw on mixed sources: interviews with elders, hunters, teachers, and municipal staff; technical documentation; monitoring data; and site observations across multiple seasons. We foreground Indigenous knowledge because it is both empirical—grounded in long practice—and adaptive, evolving with conditions. At the same time, we examine the limits of transferability. What works in one fjord may not fit another. Accordingly, each chapter ends with clearly stated boundary conditions, cost ranges, staffing needs, and maintenance requirements to help readers judge applicability in their own context.

Finally, Living with Ice frames adaptation as an ongoing practice rather than a destination. Infrastructure must be designed for repair, supply chains for delay, and governance for learning. Culture—language, stories, celebrations—is not an “add-on” but a foundational asset that sustains motivation, cohesion, and mental health through prolonged change. The chapters that follow offer tools and narratives to help communities align technical choices with cultural values, and to move from vulnerable dependence to capable interdependence.

As you turn to the table of case studies, we invite you to read for patterns: partnerships that endure, designs that anticipate maintenance, financing that privileges local control, and educational programs that keep knowledge alive by putting it into practice. These are the threads that, woven together, make adaptation more than a reaction—they make it a way of living with ice.

Chapter One: Greenland in a Warming World: Climate Signals and Local Realities

Greenland, a vast island largely cloaked in ice, stands at the forefront of a rapidly warming Arctic. This region experiences climate change at a pace significantly faster than the global average, with temperatures rising as much as four times faster. For Greenlanders, particularly the Indigenous Inuit population who comprise about 88% of the island's inhabitants, these aren't abstract scientific projections but tangible shifts that redefine daily life, traditional practices, and the very landscape beneath their feet. The pervasive ice, once a steadfast element shaping every aspect of existence, is now a dynamic indicator of profound environmental upheaval.

The most striking climate signal in Greenland is the accelerating melt of its colossal ice sheet. Covering roughly 80% of the island's surface, this ice sheet, if completely melted, holds enough water to raise global sea levels by approximately seven meters. While a complete melt won't happen overnight, the current rate of ice loss contributes significantly to global sea-level rise. Beyond its global implications, the influx of freshwater from melting glaciers and ice sheets also affects local and regional ocean circulation and nutrient levels in marine food webs, impacting the delicate balance of the Arctic ecosystem.

Greenlanders are acutely aware of these changes. Surveys indicate that a remarkable 76% of residents have personally experienced the effects of climate change, a figure that is more than double that of other Arctic nations. This lived experience translates into a deep, firsthand understanding of environmental shifts, even if the understanding of anthropogenic causes for these changes varies among the population, particularly in more rural, subsistence-based communities.

One of the most immediate and disruptive local realities stemming from a warming world is the thawing of permafrost. Permafrost, or permanently frozen ground, is widespread across Greenland's margins, though beneath a seasonal "active layer" of soil. As temperatures rise, this active layer deepens, and the underlying permafrost thaws, compromising the stability of the ground. This has direct and often expensive consequences for infrastructure. Buildings, roads, and bridges, historically constructed on stable frozen ground, now face instability, leading to damage and the potential for collapse. Research in Northwest Greenland, for instance, has identified numerous areas at risk of permafrost thaw leading to rock slope instability, with eighteen of these near human settlements.

The changing state of sea ice presents another critical challenge. Sea ice is not merely

a frozen surface; it is an integral part of Greenlandic culture, economy, and travel. For generations, traditional hunting with dog sleds relied on predictable and stable sea ice conditions. However, the period of sea ice cover is decreasing, and the ice itself is becoming thinner and more unpredictable. This makes traditional travel routes dangerous and, at times, impassable, posing risks to hunters and travelers. The implications extend to food security, as changes in sea ice directly affect the populations and migration patterns of marine mammals like seals and walruses, which are staples of the traditional diet.

Beyond the ice, the very waters surrounding Greenland are telling a story of change. Rising sea temperatures are altering marine ecosystems, leading to the appearance of unfamiliar fish and shellfish in local catches. While some of these changes might present new economic opportunities, they also disrupt established fishing practices and introduce uncertainty into a livelihood deeply intertwined with the marine environment. The melting of glaciers that terminate in the sea also contributes to localized impacts, as meltwater can influence ocean currents and marine life in fjords.

The physical landscape is not the only thing undergoing transformation. The impacts of these environmental shifts ripple through the social and cultural fabric of Greenlandic communities. The challenges to traditional hunting and fishing practices can lead to food insecurity and, perhaps more profoundly, a sense of disconnection from long-held cultural identities. This "ecological grief" can manifest as stress and anxiety, as people grapple with reconciling the rapid changes to their environment with their traditional way of life. The loss of reliable ice, for example, makes the ancient practice of dog sledding more difficult, impacting not only transportation but also a vital cultural connection to the land and animals.

Even the simple act of getting from one place to another is impacted. The melting of glaciers and increased rainfall can lead to heightened water flow in rivers, sometimes destroying roads and bridges. More intense precipitation events, a signal of a warming climate, also increase the risk of landslides on steep slopes, further threatening settlements and infrastructure. The implications for remote communities are particularly severe, as disrupted transportation networks can exacerbate isolation and limit access to essential supplies and services.

It's not all doom and gloom, however. While many aspects of climate change present formidable challenges, some shifts bring new considerations. The retreat of ice, for example, is revealing previously inaccessible mineral resources, attracting interest from both local and foreign investors. This presents potential for new industries and job opportunities, though it also raises complex questions about sustainable development and the environmental impact of extraction in a fragile Arctic environment. Shallowing harbors due to sediment accumulation, a consequence of increased meltwater, also complicates shipping and transportation, highlighting the need for adaptive solutions in coastal infrastructure.

In eastern Greenland, communities face concerns about increased remoteness and isolation as climate change alters travel routes and access. In the more populated mid-region, around Nuuk, there are concerns about national security as new sea routes open in the Arctic, potentially increasing the presence of other nations in Greenlandic waters. These geopolitical shifts add another layer of complexity to the climate challenges, demonstrating how environmental changes can have far-reaching political and economic consequences.

The signals are clear, and the realities are local and deeply felt. Greenlanders are witnessing and experiencing climate change on an unprecedented scale. Their responses, born out of generations of living with ice, offer invaluable insights into how communities can navigate a rapidly changing world. These local experiences, from adapting homes to shifting ground to developing new ways to navigate altered sea ice, form the foundation of the case studies presented in this book. They are not merely coping mechanisms but active, often ingenious, strategies for living with ice in a new and uncertain era.

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