CLIMATE CHANGE RESEARCH LANDSCAPE IN NUNAVUT

WHAT HAVE WE LEARNED? NAVIGATING THE CLIMATE CHANGE RESEARCH LANDSCAPE IN NUNAVUT (2004-2021)

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A brief note on the title

This project is titled, *What have we learned? Navigating the climate change research landscape in Nunavut (2004-2021)*. In the title, "we" refers to my research partners and myself since this project is based on collaboration (See Chapter 3: Methods). However, it also refers to the collective climate change research and adaptation work that has been conducted in Nunavut since 2004. As a result, the title encompasses broader climate change knowledge gleaned from academic and Nunavut communities as well as the lessons learned from this specific project in collaboration with the Government of Nunavut Climate Change Secretariat (CCS) and Nunavut Research Institute (NRI).

Lay Abstract

In Nunavut, climate change is impacting ice and weather patterns, wildlife, and Inuit travel on the land, water, and ice, which in turn affects Inuit health and well-being. In 2022, the Nunavut Research Institute (NRI) and Government of Nunavut Climate Change Secretariat (CCS) identified the need to understand: What climate change research has been done in Nunavut since the last review in 2004? Data analysis was conducted according to the CCS' seven priority areas. The results of this study highlight that: 1) climate change research has increased in Nunavut since 2004; 2) climate change research is led primarily by Canadian Universities, followed by the Government of Canada, and Nunavut Inuit Organizations; 3) most research projects relate to Healthy Environments, with predominant emphasis on physical/natural sciences; and, 4) Nunavut licensing, permitting, and funding agencies can enhance coordination and collaboration to reduce duplicated effort and streamline review processes.

Abstract

Climate change in Nunavut is rapidly impacting key wildlife, ice and weather patterns, and Inuit travel on land, water, and ice. This, in turn, affects Inuit livelihoods, culture, health, and well-being. In 2022, the Nunavut Research Institute (NRI) and Government of Nunavut Climate Change Secretariat (CCS) identified the need to understand the diversity of climate change projects that have taken place across the territory over the last two decades (2004-2021). Recognizing that not all climate change research conducted is published in academic literature, an analysis of climate change research in Nunavut was undertaken according to licensed and permitted research (from the NRI, Government of Nunavut Department of Environment, Fisheries and Oceans Canada, Parks Canada), as well as federal climate change funding programs targeted to support northern- and Indigenous-led initiatives (Climate Change Preparedness in the North Program, Indigenous Community-Based Climate Monitoring Program, Climate Change and Health Adaptation Program). CCS priority themes were used to analyze licensed/permitted/funded project summaries, including: Built Infrastructure & Services, Community & Connection; Food Sovereignty; Health, Safety & Wellness; Healthy Environment; Inuit Culture & Heritage; and, Livelihoods & Growth. Key findings highlight that: 1) climate change research has increased in Nunavut since 2004; 2) climate change research is led primarily by Canadian Universities, followed by the Government of Canada, and Nunavut Inuit Organizations; 3) most research projects relate to Healthy

Environments, with predominant emphasis on physical/natural sciences; and, 4) Nunavut licensing, permitting, and funding agencies can enhance coordination and collaboration to reduce duplicated effort and streamline review processes.

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I would also like to acknowledge the Nunavut Research Institute and territorial and federal agencies that have contributed data to this work, including Crown-Indigenous Relations and Northern Affairs Canada, Fisheries and Oceans Canada, Government of Nunavut – Department of Environment, Indigenous Services Canada, and Parks Canada. Thank you for your partnership!

Last but not least, I am so very grateful to all my lovely friends and family for cheering me on with their unwavering support throughout the highs and lows. I cherish all the virtual writing calls and every uplifting word of encouragement, especially in the very last stretch. Thank you all!

List of Abbreviations

Abbreviation	Explanation
CCHAP	Climate Change and Health Adaptation Program, Indigenous Services Canada
C-CIARN	Canadian Climate Impacts and Adaptation Research Network
CCPN	Climate Change Preparedness in the North Program, Crown-Indigenous Relations and Northern Affairs Canada
CCRRA	Climate Change Risk and Resiliency Assessment, Government of Nunavut
CCS	Climate Change Secretariat
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada, Government of Canada
CWS	Canadian Wildlife Service, Environment and Climate Change Canada
DCH	Department of Culture and Heritage, Government of Nunavut
DFO	Fisheries and Oceans Canada
DOE	Department of Environment, Government of Nunavut

ECCC	Environment and Climate Change Canada
GIS	Geographic Information System
GN	Government of Nunavut
HTO	Hunters and Trappers Organization
ICBCM	Indigenous Community-Based Climate Monitoring Program, Crown-Indigenous Relations and Northern Affairs Canada
ICC	Inuit Circumpolar Council
IQ	Inuit Qaujimajatuqangit (Inuit cultural knowledge, values, worldviews)
ISC	Indigenous Services Canada, Government of Canada
ITK	Inuit Tapiriit Kanatami (Non-profit organization representing Inuit across Canada)
MA	Master of Arts
NLCA	Nunavut Land Claims Agreement
NRI	Nunavut Research Institute
NTI	Nunavut Tunngavik Incorporated
PI	Principal investigator
RIA	Regional Inuit Association

SSHRC	Social Science and Humanities Research Council
SUN Team	StraightUpNorth Team
TCA	Thematic content analysis

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1.0 Introduction

1.1 Background

In Nunavut, accelerating climate change has drastically altered weather patterns, affected the timing of seasons, decreased ice thickness and extent, and increased extreme events (Box et al., 2019). This has been well-documented across a variety of physical science disciplines. However, climate change impacts do not only apply to weather patterns and ecosystems, especially within the context of the four regions of Inuit Nunangat (Inuit homelands in the Canadian Arctic): the territory of Nunavut, Nunavik in northern Quebec, Nunatsiavut in Labrador, and Inuvialuit in the northernmost regions of Yukon and Northwest Territories. Climate change impacts Inuit travel on the land, water, and ice, as well as key wildlife, which in turn affect Inuit health and well-being (Simonee et al., 2021a; K. J. Wilson et al., 2022).

In November 2022, the Nunavut Research Institute (NRI; the science division of Nunavut Arctic College) and Government of Nunavut (GN) Climate Change Secretariat (CCS) identified the need to undertake a situational analysis of climate change research conducted in Nunavut over recent decades. This Master of Arts (MA) thesis aims to identify recent trends in climate change research and explore new or emerging gaps across climate change adaptation initiatives as a whole.

1.2 Rationale

1.2.1 Previous Climate Change Gap Analyses

Twenty years ago, the NRI led its first climate change gap analysis through the Canadian Climate Impacts and Adaptation Research Network (C-CIARN): *Trends in Nunavut Climate Change Research: 1997 to 2004* (C-CIARN, 2005). This study, however, was based solely on research that was licensed in accordance with Nunavut's *Scientists Act*. Today, the NRI (as a part of the science division of Nunavut Arctic College) continues to grant Scientific Research Licenses under the same act for research pertaining to health, social, and physical/natural sciences, as well as Inuit knowledge research. This includes research that is based in or on Nunavut. As a result, the C-CIARN study excludes research projects that are licensed and/or permitted under alternative legislation by other federal or territorial agencies. In other words, the NRI research database alone does not capture the full breadth of climate change work, especially research that may be exempt from its licensing process. For example, other licenses and permits include the Wildlife Research Permit from the GN Department of Environment (DoE) for research on terrestrial wildlife, and the License to Fish for Scientific Purposes from Fisheries and Oceans Canada (DFO) for research on aquatic and marine wildlife, among others.

Seven years after the C-CIARN study, another climate change research gap analysis was conducted for Inuit Tapiriit Kanatami (ITK) (Bolton et al., 2011). As a

systematic literature review with a broader geographical scope, this project focused on Inuit Nunangat, rather than Nunavut specifically. The results are based on publicly available, peer-reviewed articles sourced from online academic search engines and databases (i.e. ISI Web of Science, PubMed, and GeoBase). However, published literature does not reflect climate change adaptation initiatives and projects that are not publicly available or based on academic scholarship.

Moreover, community-based climate change work and interdisciplinary research are not easily tracked with current licensing and permitting metrics and academic databases. The absence of university institutions in Inuit Nunangat also results in research projects that are largely led by or rely on partnerships with southern-based academic institutions. Thus, a review of targeted community climate change funding programs would also be critical.

1.2.2 Addressing the Gap

My MA research aims to address this gap by including climate change research and initiatives that are:

- Nunavut-specific;
- Updated (have taken place since the C-CIARN gap analysis, published in 2004);
- Inclusive of unpublished research;

- Inclusive of research licensed/permitted by federal/territorial agencies (in addition to the NRI); and
- Inclusive of community-based work.

As a result, three databases from federal climate change adaptation funding programs led by Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) and Indigenous Services Canada (ISC) are reviewed to include Indigenous-led, community-based projects.

1.2.3 Supporting CCS & NRI Priorities

This master's research aims to enhance the capacity of the CCS and NRI as both organizations carry out significant responsibilities for the territory and manage a wide variety of projects with relatively smaller teams. My project can provide insight into an existing research interest for my research partners at the CCS and NRI that may not be investigated otherwise. Contributing towards their organizational priorities will inform territorial climate change policy and adaptation planning, improve the accessibility and relevance of climate change research for decision-making, and contribute to climate change research consultation and engagement processes.

As of the writing of this thesis in September 2024, the GN is developing a Climate Change Risk and Resiliency Assessment (CCRRA) Methodology document to guide their governmental climate change approaches. This methodology represents the values of Nunavummiut (people of Nunavut) through seven key thematic areas that guide the

literature review (Chapter 2.5) and analysis (Chapter 4) of this MA thesis. By using these themes, my work can support the CCS by coming to a better understanding of whether the themes are adequately reflective of climate change research and initiatives across the territory.

The NRI is also interested in seeking opportunities to communicate and collaborate with other licensing and permitting agencies. Through this project, we can learn about other agencies' research licensing and permitting processes by examining the types of research metadata that are tracked and organized (e.g. principal investigator (PI) affiliation, research project duration, funding sources, etc.). A better understanding of other processes can lead to future cooperation where there may be duplication of work. This MA research is Nunavut's first situational analysis of climate change work in over a decade, aiming to benefit Nunavummiut, researchers, and decision-makers alike.

Finally, the years of study for this research, 2004-2021, were selected based on data availability from the NRI's licensing database, as they are a primary partner in this work and have one of the more comprehensive and consistent databases across years. This is because the digitization and standardization of the NRI's administrative database began with licensing data in 2004. Additionally, at the commencement of this master's research, 2021 was the most recent year with publicly available data. As such, although the NRI's licensing and information collection processes preceded 2004, this shift

created a consistent digital archive of license applications, which formed the basis of the years of study for this work.

1.3 Research Question & Objectives

My overarching research question is: What is the scope of climate change research in Nunavut, and how has it evolved since 2004? To address this question, I have four objectives, including to:

2. Identify who has been leading climate change research;
3. Examine the communities and field locations where climate change research has been taking place;
4. Investigate the trends in climate change research, focusing on the last two decades; and,
5. Explore opportunities to improve coordination for licensing and permitting of interdisciplinary climate change research.

However, prior to answering my research question, it is important that I first address the question(s) of where I see myself in the context of and in relation to Nunavut-specific research as a graduate student at McMaster University (Hamilton, Ontario).

1.4 Statement of Positionality

Our work is inextricably linked to who we are as professionals and, above all, as people. That is why Healey & Tagak (2014) posit that self-reflexivity is integral to

genuine and respectful relationship-building. They put forth the following critical questions:

> "Who are you? Where are you from? Who is your family? What are you looking at? Why do you want to know about it? What are the risks and benefits of pursuing this work? Who is it being conducted for? What will happen to the knowledge that is shared? How will we learn from each other?" (p. 5).

These are the kinds of questions that southern-based researchers are likely to be asked by northern community members (G. Healey & Tagak, 2014). In a way, these are also the guiding questions for my Statement of Positionality and, more broadly, the organization of my thesis chapters (See Chapter 1.6).

As a southern-based and non-Indigenous graduate student from the School of Earth, Environment & Society at McMaster University, I come to this work having benefitted from a Western and Southern education system for most of my life. As my views are largely informed by formal and structural education, it is essential to note that biases and assumptions may be embedded in my writing and rooted in my thinking. I understand that, as a woman of colour, different ethnic groups and cultures carry different privileges as well as assumptions and stigmas about other people and their cultures. As a result, self-reflexivity is a critical component of research, no matter the

stage we are in. In short, this section will highlight who I am, both as a person and researcher, as well as the ways in which this informs my research.

Who Am I: My Cultural Communities & Perspectives

As an East-Asian individual with a Canadian upbringing, I noticed the ways in which my Chinese-Canadian culture straddles the worlds of "Eastern and Western thinking," or in this case, "Northern and Southern thinking." Upon reading *Towards Braiding* by Jimmy et al. (2019), I have recognized that my cultural community stereotypically, yet habitually, values academic and workplace achievements with greater importance than areas of life that prioritize emotional, mental, and spiritual well-being. This is akin to what is conceptualized in the book as "brick sense and sensibilities" (Jimmy et al., 2019, p. 14), a metaphor for Western thinking "where the value of something is measured against its capacity, achievement or potentiality to 'move things forward'; and where self-worth is dependent on external validation" (Jimmy et al., 2019, p. 14). This emphasis on hierarchical and academic achievements can often be at odds with the circularity and interconnectivity of Indigenous and Inuit ways of thinking, doing, and knowing.

Within my community, I also recognize that there may be tendencies to be less aware of social issues impacting other cultures, which can lead to apathy, misunderstandings, and close-mindedness in cross-cultural interactions. Although this certainly remains a broad generalization, heightened awareness of such differences allows room for growth and enables me to actively take steps towards unlearning non-

generative thinking. Simultaneously, my cultural community strongly emphasizes respect, especially towards elders and within familial bonds. Through this cultural perspective, I bring a posture of respect for the research partners, mentors, and people I work with.

How Will I Move Forward: Weaving Perspectives

Both my Western and Eastern cultural communities inform my perspectives, beliefs, and actions. Parallels may be drawn to Two-Eyed Seeing, for instance, an Indigenous approach with Mi'kmaq roots that is encouraged in research because it aims to integrate the strengths of both Indigenous and Western ways of knowing in problem-solving (Wright et al., 2019). Similarly, although I cannot apply Two-Eyed Seeing through the perspectives of Indigenous ways of knowing, this is a concept that I can apply to my work through the lens of my Western- and Eastern-influenced upbringing. I can draw strengths from both knowledge systems and recognize the weaknesses and biases embedded within each.

Despite my efforts to learn about decolonization and unlearn biases and preconceived notions about the North, I would also like to acknowledge that it is impossible for me as a southern-based student, researcher, and individual to fully comprehend the ongoing and historical impact of the cultural genocide of Indigenous Peoples. While this is true, I will continue to imperfectly learn about Indigenous and northern ways of knowing, being, and doing; ways that collectively and continuously inform resilience.

What Am I Looking At: My Research

Although this work supports the priorities of my research partners in Nunavut, I acknowledge that it simultaneously fulfills the requirements of my MA degree. These structures are products of a Southern and Western education system that tells, retells, and manipulates history and knowledge from the perspective of settler colonialism and Southern and Western ways of thinking, being, and doing. As Smith (2012) wrote in her seminal work, *Decolonizing Methodologies*, "academic writing is a form of selecting, arranging and presenting knowledge […] [which can] render indigenous writers invisible or unimportant while reinforcing the validity of other writers" (p. 37).

Nevertheless, I want to engage in this work because I love learning. Since childhood, I have been interested in northern flora, fauna, landscapes, and culture. I am passionate about broadening my horizons and contributing meaningfully to something larger than myself. I wish to conduct research and produce work that does not manipulate knowledge to simply suit my needs and reinforce the validity of my knowledge, opinions, and perspectives. Instead, as discussed in the following chapters, I want to demonstrate appreciation and respect for the knowledge of my research partners throughout this entire process.

It is equally important to note, however, that my primary research partners work on behalf of Nunavummiut by representing organizations, the GN and NRI, which may bring another set of restrictions. For instance, although the GN consults with youth groups and Nunavummiut, governments are still strongly guided by structures and

systems that are inherently Southern and Western in concept. Additionally, there are limitations in what government employees can achieve due to policies, funding, and positionality. As such, my partners have objectives to fulfill that may not cater to specific Inuit communities because they strive to serve Nunavut as a whole.

Where Am I From: The Lands That Care for Us

I am thankful for the territories of the Haudenosaunee, Anishinabek, Mississaugas of the Credit First Nation, and Huron-Wendat in what is now known as North York, Toronto because it is the place that has raised me. I am thankful for the unique cultural perspectives that I now have as my family came here years ago from their motherland, Hong Kong. I am also grateful to the region that is now known as Hamilton, Ontario, which is on the lands of the Haudenosaunee, Mississaugas, Huron-Wendat, Neutral, and Erie nations. This is where I now live, study, work, write, and explore the many wonderful intricacies of nature around me. Finally, I want to recognize with immense gratitude the opportunity to support Nunavut-based work and to visit Iqaluit to meet with friends and northern partners on land that has been home to Inuit since time immemorial.

Even as I eventually grow out of the official title of being a student when I graduate from academia, I hope to continue to be a student of the land and cultural teachers for many years to come. I hope to continually learn, unlearn, and remember truths in gratitude, compassion, and what it means to engage in truly reciprocal relationships with other people no matter where I am in life.

1.5 Broader Research Project

My MA thesis is a part of the broader and existing StraightUpNorth Team (SUN Team) project at McMaster University: Making research work for Nunavummiut: Rethinking community consultation and engagement to enhance Inuit self-determination in research (2021-2026). This project, funded by Canada's Social Science and Humanities Research Council (SSHRC) and the Canada Research Chairs Program, is co-led by Gita Ljubicic (McMaster University), Jamal Shirley (Nunavut Research Institute), and Gwen Healey Akearok (Qaujigiartiit Health Research Centre). It aims to address community research fatigue in Nunavut, improve respectful community engagement and research relevance to northerners, and enhance accessibility of research results for Nunavummiut and other decision-makers. This thesis serves to support the final component by enhancing the availability and accessibility of information on overall climate change research and adaptation initiatives conducted across the territory.

1.6 Thesis Outline

I hope that, in my brief attempt to share my story and positionality above, I have partially answered the first three questions posed by Healey & Tagak (2014) and highlighted in Chapter 1.4. For example, the Rationale in Chapter 1.2 describes why I want to learn about climate change research in Nunavut.

The following chapters of this thesis aim to continue answering the proceeding questions:

- "What am I looking at?" (Chapter 2: Literature Review & Chapter 4: Results);
- "Who am I conducting it for?" and how the work will be conducted (Chapter 3: Methods);
- "What will happen to the knowledge that is shared?" and "How will we learn from each other?" (Chapter 5: Discussion & Chapter 6: Conclusion).

Chapter 2: Literature Review provides an overview of Nunavut and of existing literature on climate change research. Through planning and self-reflexivity, the Inuit research framework described in Chapter 3: Methods guides the work of this MA thesis. This chapter also delineates the roles of key partners and organizations and notable limitations. Chapter 4: Results & Analysis highlights key findings from this work. Next, Chapter 5: Discussion provides an analytical interpretation of trends in climate change initiatives across Nunavut and unravels research implications. Finally, Chapter 6: Conclusion summarizes key messages, as well as proposed recommendations for my research partners, permitting and funding agencies supporting Nunavut climate change research, and others interested in this work.

2.0 Literature Review

This literature review is a brief overview of climate change in Nunavut as well as an introduction to Nunavut more broadly (Chapter 2.1-2.3), aiming to provide contextual background for northern- and southern-based audiences alike. Next, it will highlight key regional and territorial organizations, policies, and plans in relation to climate change research and initiatives (Chapter 2.4). The literature review and analysis of this thesis will also be based upon seven of the Government of Nunavut's Climate Change Risk and Resiliency Assessment (CCRRA) thematic areas (also known as "themes"):

- Built Infrastructure & Services,
- Community & Connection,
- Food Sovereignty,
- Health, Safety & Wellness,
- Healthy Environment,
- Inuit Culture & Heritage, and
- Livelihoods & Growth (Government of Nunavut, 2023).

As a result, it is imperative that Chapter 2.5 summarizes existing literature on each of these key themes. Chapter 3: Methods (Chapter 3.6) and Appendix 2 better introduce and describe the themes with more context and detail.

2.1 Climate Change in Nunavut

Across the globe, present-day climate change is making waves in environmental, social, cultural, economic systems, and beyond. However, it is disproportionately affecting the world's circumpolar regions. Between 1971 and 2017, melting sea ice in the Arctic was reported to be the "largest global source of sea-level rise contribution, 48% of the global land ice contribution 2003-2010 and 30% of the total sea-level rise since 1992" (Box et al., 2019, p. 13). The geographically disproportionate distribution of climate change impacts may also be made apparent in terminology such as polar amplification, which refers to the way in which the circumpolar regions are warming more rapidly than others (Lo et al., 2023). This includes disruption of pollination systems and animal distributions as well as increased wildfires, organic matter, and carbon cycling (Box et al., 2019). In a 2020 systematic review of studies across 29 communities in Inuit Nunangat, 89% of communities observed later ice freeze-up, thinner ice, less snow, and unpredictable weather (Akhtar, 2020). Nunavut, Canada is no exception to these statistics.

In Nunavut, one of four regions of Inuit Nunangat (Inuit homeland) (Figure 2.1), and one of three Canadian territories, it is abundantly clear that climate change has made its mark in recent decades. Of the 18 studies examined in the Akhtar (2020) review, 10 focused on Nunavut communities from 2000-2015, 100% of which reported unpredictable weather, 90% identified later ice freeze-up, and 80% noted changes in ice thickness (Akhtar, 2020). Ice islands have been reported to be thinning across Baffin Bay

(Crawford et al., 2020), permafrost is shifting (LeBlanc et al., 2010), and glaciers are retreating across the entire territory (Cogley et al., 2011; Koerner, 2005; Van Wychen et al., 2014). Across Nunavut, sea ice has been freezing later and melting sooner, with longer ice-free seasons, less multi-year ice, and changes in floe edge (Kowal et al., 2023; Laidler et al., 2010). Key findings from Fisheries and Oceans Canada (DFO) similarly reveal that sea ice in the Arctic Ocean is thinning with shifts in freeze-up and breakup leading to longer periods of open water (DFO, 2019). Arctic Bay (Ikpiarjuk) and Iqaluit, for example, have also observed increased sea levels (Akhtar, 2020). Unfortunately, climate change is not restricted to the cryosphere. Nunavut is also experiencing shifting seasonal timing and length, instability in wind direction, precipitation, storm frequency, air temperature, and mudslides, and both flora (Panchen & Gorelick, 2017) and fauna (Poole et al., 2010) are experiencing drastic disturbances.

Figure 2.1 Map of Inuit Nunangat

Source: Inuit Tapiriit Kanatami, (n.d.)

Global present-day climate change has cascading effects on Nunavut ecosystems and Nunavummiut alike. It affects social, physical, mental, cultural, spiritual, and economic well-being. Ice and weather changes translate into subsistence hunting and travel safety challenges. Reduced sea ice, for instance, impacts existing ecosystem services such as habitat, provisioning of natural resources (e.g. harvesting, medicinal, etc.), climate regulation (e.g. as a carbon sink, etc.), and cultural and spiritual benefits (Steiner et al., 2021). It affects critical fauna in Nunavut, including caribou (Paquette et

al., 2023) and seabirds (Gutowsky et al., 2022). Local Nunavut communities, such as in Clyde River (Kanngiqtugaapik), Pangnirtung, and Qikiqtarjuaq, have observed reduced numbers of caribou and narwhal and increased southern species of birds, insects, and fish (Sansoulet et al., 2020). As a result, different food sources are required, in addition to changes in hunting technologies and habits (Sansoulet et al., 2020). However, climate change has also led to a variety of adaptations across Nunavut.

In (2017), Labbé et al. reported 700 different government-led climate change adaptation recommendations, out of which "Arviat, Cambridge Bay, Clyde River, Iqaluit, Kugluktuk, and Whale Cove emerge as the communities with the highest number of adaptations documented based on publicly available information" (p.15) with Iqaluit at the highest (235 initiatives). These top communities were involved in a 2010 GN and Canadian Institute of Planners adaptation program funded by CIRNAC (Labbé et al., 2017). While these initiatives are implemented at federal and territorial levels at 19% of all initiatives each, 62% of initiatives are at the municipal/community level (Labbé et al., 2017). Iqaluit, for example, has been in the lead with one of its primary adaptation initiatives being its Iqaluit Sustainable Community Plan (2014-2019) (Labbé et al., 2017). However, there has not been an updated plan in recent years. This may represent a recurring challenge in keeping plans up to date. Moreover, certain measures in the Labbé et al. (2017) study were not implemented due to challenges in capacity and a lack of resources (Office of the Auditor General of Canada, 2018).

2.2 Introduction to Nunavut

In 1999, the Territory of Nunavut was established following the signing of the Nunavut Land Claims Agreement (NLCA) and Nunavut Act, both of which passed six years prior in 1993 (Kikkert, 2023). The NLCA allows Inuit rights to the land (surface and subsurface) and rights to harvest country food across Nunavut (Kikkert, 2023).

As of 2022, Nunavut has a population of over 36 thousand residents (Statistics Canada, 2022) across 25 communities. According to the 2021 Census of Population from Statistics Canada, approximately 84% of the population is Inuit (Statistics Canada, 2022). As the capital, Iqaluit is the largest and only city, with a population of 7,429 based on 2021 numbers (Statistics Canada, 2022).

In Inuktitut, an Inuit dialect and one of the territory's four official languages (Inuktitut, Inuinnaqtun, English, and French), Nunavut means "Our Land." Spanning over two million square kilometres of land and water (Kikkert, 2023), the territory is home to three central regions: Kivalliq to the south, Kitikmeot to the west, and Qikiqtani to the east and north.

2.2.1 Inuit Organizations

Inuit voices and interests, including climate change concerns, are represented by a complex network of Inuit organizations in the north. While the Inuit Circumpolar Council (ICC) represents Inuit internationally from across the circumpolar north, Inuit Tapiriit Kanatami (ITK) works on behalf of Inuit in Canada.

Nunavut follows a government system that integrates both democracy and Inuit values of consensus without the division or distinction of political parties. Nunavut Tunngavik Incorporated (NTI) is an Inuit organization that ensures the implementation of the NLCA, representing Inuit in Nunavut and collaborating with the Government of Nunavut. Each region in the territory is also governed by their respective Regional Inuit Associations (RIAs), which strive to promote and protect Inuit rights, Inuit-owned land, and Inuit well-being, from cultural activities and heritage to socio-political and ecological activities at a more specific scale (Kikkert, 2023). NTI collaborates with and advocates on behalf of Nunavut's three RIAs, Inuit development and investment corporations, wildlife organizations, other land claims organizations, public government institutions, and territorial, national, and international groups.

Though these associations may not explicitly mention mitigating climate change or leading climate change research as a primary focus, this does not devalue its significance in the north. For example, other Nunavut organizations that support Nunavummiut, Inuit, and local environments, such as the Nunavut Wildlife Management Board or Kakivak Association, do not highlight climate change research on their websites but likely support projects related to climate change.

Kivalliq

The seven communities of Kivalliq are governed by the Kivalliq Inuit Association, which strives to protect Inuit culture, language, lands, and flora and fauna for present and future generations (Kivalliq Inuit Association, n.d.). Major hamlets include Rankin

Inlet (Kangiqliniq), Arviat, and Baker Lake (Qamani'tuaq). Additionally, the Kivalliq Wildlife Board consists of the chairperson from each Hunters and Trappers Organization (HTO) with the NLCA obligation to monitor harvesting activities across the region. Although climate change research is not displayed on their website, the Kivalliq Wildlife Board has initiated a community-based monitoring program in collaboration with ArcticConnexion to better understand the impacts of climate change on accessibility of country food in Kangiqliniq, including Arctic char, ringed seals, and polar bears, by prioritizing Elders' and hunters' knowledge (CIRNAC, 2022).

Qikiqtani

Qikiqtani, otherwise known as Qikiqtaaluk, is located to the east of the other two Nunavut regions and the northernmost region of Nunavut and Canada, with 13 communities and standing as the most populated region of all three regions. The largest communities include Iqaluit (Nunavut's capital and only city), Igloolik, and Pond Inlet (Mittimatalik) (Qikiqtani Inuit Association, n.d.-a). The region is also home to Grise Fiord (Aujuittuq), the northernmost community in the country. The Qikiqtani Inuit Association supports work in conservation and stewardship, education, cultural preservation, as well as management of Inuit-owned lands (Qikiqtani Inuit Association, n.d.-b). Their Annual Reports highlight a few research projects, though most of them do not explicitly highlight climate change, although the presence of such research indirectly and naturally contributes to climate change mitigation. For instance, this includes an iron mine research project in the 2021 report (Qikiqtani Inuit Association, 2021), a seismic testing

and shipping research project in the 2019 report (Qikiqtani Inuit Association, 2019), and an oil and gas development environmental assessment in the 2018 report (Qiqiktani Inuit Association, 2018).

Kitikmeot

Finally, Kitikmeot is the westernmost region of Nunavut, with seven communities and the largest hamlets being Cambridge Bay (Iqaluktuuttiaq), Kugluqtuk, and Gjoa Haven (Uqsuqtuuq) (Statistics Canada, 2022). Like the other Inuit Associations, the Kitikmeot Inuit Association aims to preserve the "social, cultural, political, and environmental well-being of the region" (KIA, n.d., second paragraph) and manages the land. However, there are currently no resources on any existing or previous climate change research efforts. Regional examples of community climate change projects are similar to those of Qikiqtani (see previous section).

2.2.2 Institutions of Public Government

In Nunavut, there are also Institutions of Public Government, which are territorial government-funded resource management boards jointly led by Inuit and the GN. These institutions include the Nunavut Impact Review Board, The Nunavut Planning Commission, Nunavut Surface Rights Tribunal, Nunavut Water Board, The Nunavut Wildlife Management Board, and Nunavut Marine Council. Each of these groups oversees different resource priorities and projects across the territory.

2.3 Introduction to Inuit Qaujimajatuqangit (IQ)

In Inuit communities across the northern circumpolar regions, people are guided by a worldview that prioritizes wellness and living a good life (Karetak et al., 2017). This Inuit worldview and ethical framework called Inuit Qaujimajatuqangit (IQ), which is greater than a list of rules. It is a set of eight existing principles that intertwine the beliefs, skills, attitudes, values, and knowledge of Inuit as identified by Inuit Elders (Karetak et al., 2017; Nunavut Department of Education, 2007). These values are informed by and continue to inform Inuit ways of knowing (epistemology), being (ontology), and doing (axiology) (Prete, 2019), but also guides Government of Nunavut climate change-related initiatives, plans, and policies, as discussed in the following chapters. The term Inuit Qaujimajatuqangit is used primarily in Nunavut as its principles were first described by Inuit Elders in collaboration with the Government of Nunavut in 1999 (Nunavut Department of Education, 2007). Thus, IQ may also be known as Inuit knowledge, Inuit traditional knowledge, or Inuit science across Inuit Nunangat and may not be used ubiquitously across the territory, nor Inuit Nunangat. The GN refers to the below-listed values as Inuit Societal Values (Government of Nunavut, n.d.-b).

Throughout this thesis, the term “Inuit Qaujimajatuqangit” or “IQ” will be used in the place of “traditional knowledge (TK),” which is commonly cited in academic literature, because Inuit Elders noted in Ferrazzi et al. (2019) that TK is a restrictive term that does not acknowledge the resilience and adaptability of their people.

According to Inuit Elders, and as published by the territorial government (Nunavut Department of Education, 2007), IQ primarily includes the following principles:

- *Inuuqatigiittiarniq* (respect and care),
- *Tunnganarniq* (openness and inclusivity),
- *Piliriqatigiinniq/ikajuqtigiinniq* (collaboration),
- *Avatimik kamattiarniq/avatittinnik kamatsiarniq* (environmental stewardship),
- *Pilimmaksarniq/pijariuqsarniq* (knowledge and skills development),
- *Qanuqtuurunnarniq* (resourcefulness),
- *Aajiiqatigiingniq* (consensus), and
- *Pijitsirniq* (serving and leadership).

However, despite these principles being expressed categorically for government policies, their application and perspectives are holistic and interdisciplinary (G. Healey & Tagak, 2014; Karetak et al., 2017) and transcend the temporal and geographical boundaries of Western science and thinking. More broadly, IQ considers the past, present, and future, as well as relationships with other people, environment, and good communication (G. Healey & Tagak, 2014; Karetak et al., 2017; Nunavut Department of Education, 2007).

2.4 Nunavut-relevant Policies & Plans

The following section highlights significant climate change goals, policies, plans, and organizations from the federal government, Inuit Nunangat, and Nunavut agencies and organizations. Federal climate goals and plans are relevant to Nunavut primarily because they guide Nunavut projects, territorial government-led or otherwise, and support projects in Nunavut through funding and grant allocations. These documents express agency and organization priorities, providing objectives and goals for researchers to follow. Funding programs associated with these plans allow existing projects to apply for financial support in climate change research and provide incentives for other research groups to apply and follow suit in achieving climate change research goals. Certain programs also bring together different levels of government, such as the *Pan-Territorial Adaptation Strategy* (Government of the Northwest Territories et al., 2011). This is also critical to guide future territorial and local adaptation and research plans, such as NTI's request for proposals to create a Nunavut-specific climate change strategy (NTI, 2022b). This may play a part in identifying critical topics of concern for researchers and funding applicants alike.

2.4.1 Federal Goals, Policies, and Plans

In 2016, Canada committed to the *2030 Paris Agreement*, which aims to achieve net-zero emissions by 2050 and to limit global temperature increases to a maximum of 1.5 degrees Celsius (United Nations, n.d.). To do so, and to advance Canada's broader climate change and socio-economic goals, the Government of Canada has implemented

a wide variety of plans and policies in recent years to mitigate climate change holistically. This includes adaptations, collaborations with Indigenous Peoples, greenhouse gas emissions reductions, building community capacity, tackling socio-economic climate change issues, funding aquatic climate change projects, and conducting climate change research (Government of Canada, 2024). Although many federal plans do not explicitly mention climate change research, such plans and policies inherently require research when implementing and funding climate change adaptation measures. As such, they are worth noting but do not only specifically relate to research.

Most notably, the *Climate Science 2050: Advancing Science and Knowledge on Climate Change (CS2050)*, published in July 2024, strives "to better understand the breadth of Canadian climate change science and knowledge gaps and to guide science and knowledge producers, holders and funders" (Environment and Climate Change Canada, 2020, p. 1). CS2050 acknowledges and emphasizes the imperative for Indigenous leadership to include social science disciplines rather than simply physical sciences (Environment and Climate Change Canada, 2020). Overall, this plan focuses on advancing climate change research in five key areas:

1. "Earth system climate science," including climate change prediction, ice melt (e.g., permafrost, glaciers, sea ice, etc.), and mitigation efforts;

2. "Healthy and resilient Canadians, communities, and built environments," including infrastructure, governance, migration, and trade;
3. "Carbon-neutral society," including energy decarbonization, carbon sinks, and best practices in socio-economic systems;
4. "Resilient terrestrial and aquatic ecosystems," including the "adaptive capacity of species and ecosystems," environmental stressors, and knowledge gaps and trade-offs in ecological mitigation strategies; and
5. "Sustainable natural resources," highlighting social science research on socio-economic and socio-cultural impacts and the role of natural resource sectors (Environment and Climate Change Canada, 2020, p. 1-2).

Furthermore, Canada's climate plan, *A Healthy Environment and a Healthy Economy* (ECCC, 2020a), updates the *Pan-Canadian Framework on Clean Growth and Climate Change* plan (ECCC, 2016) and prioritizes "clean air, clean water and long-term secure jobs"(Prime Minister of Canada, 2020). This plan highlights 64 new climate change measures with $15 billion in investments (Prime Minister of Canada, 2020). However, while the CS2050 plan prioritizes research, *A Healthy Environment and a Healthy Economy* does not. As a part of the *Healthy Environment* plan, the *National*

Adaptation Strategy: Building Resilient Communities and a Strong Economy was established to address the following risks:

- Physical infrastructure,
- Coastal communities,
- Northern communities,
- Human health and wellness,
- Ecosystems and species,
- Canada's economy,
- Fisheries and fish stocks,
- Canadian forestry, and
- Governance capacity. (ECCC, 2023)

The *Strategy* synthesizes the climate change adaptation goals and objectives of all levels of Canadian government, Indigenous communities, and Canadians, with guiding principles including Indigenous rights and systemic equity (ibid.). Many priorities overlap with the CCRRA thematic areas, and there is a northern focus on permafrost, sea ice, safe travel, and more (ibid.). Although this strategy aims to holistically address climate change adaptation rather than a specific research emphasis, examples of mitigation measures include significant financial support of wildfire research to enhance knowledge and create innovations for wildfire prevention (ibid.). Through this strategy, "the Government of Canada is committed to renewed nation-to-nation, Inuit-to-Crown and

government-to-government relationships with First Nations, Inuit, and Métis peoples, based on the recognition of rights, respect, cooperation, and partnership" (ECCC, 2021, Supporting Indigenous climate leadership section). This commitment to partnership in Indigenous climate leadership recognizes diverse Indigenous priorities, self-determination, collaboration in solutions, and Indigenous knowledge systems and ways of doing (ECCC, 2021). The federal government will also develop an *Indigenous Climate Leadership Agenda* together with First Nations, Métis, and Inuit (ibid.).

In March 2022, the Government of Canada published the *2030 Emissions Reduction Plan: Clean Air, Strong Economy* to further push for an ambitious reduction in greenhouse gas emissions by 40-45% below 2005 levels in less than a decade (ECCC, 2022). Through this *Plan*, the Government will provide $100 million in funding for climate change research on transitioning "to a net-zero economy for 2050" (ECCC, 2022, p. 7).

Under the *Clean Canada: Protecting the Environment and Growing our Economy* plan, the federal government is supporting research into plastic pollution solutions and innovations through *Canada's Plastics Science Agenda*, as well as funding northern climate change research on challenges in transportation systems.

Overall, climate change research is not explicitly stated in federal government plans and policies, as it is typically funded by different government departments and agencies. CS2050 is the primary plan for undertaking climate change research.

2.4.2 Pan-Territorial Strategy

In 2009, the governments of Nunavut, Northwest Territories, and Yukon began to collaborate on tackling climate change and in 2011, the *Pan-Territorial Adaptation Strategy: Moving Forward on Climate Change Adaptation in Canada's North* was created (Government of the Northwest Territories et al., 2011). The six approaches include funding, government collaboration, community support, adaptation, knowledge-sharing, and tool development (ibid.). The fifth approach encourages data to be shared among governments and partners, while the sixth promotes investing in climate change research (ibid.). These different areas were identified as critical to collective and synchronized adaptation in the North over a decade ago. However, there were no identifiable mentions of climate change research.

2.4.3 Inuit Nunangat Plans and Policies

In 2016*, Inuit Priorities for Canada's Climate Strategy* was published by Inuit Tapiriit Kanatami (ITK) (2016). The ITK is an organization representing the needs, priorities, and rights of Inuit across Canada and the 53 communities across Inuit Nunangat. This document shares long-term visions for the future, which include Inuit-led climate resiliency projects (ITK, 2016). More specifically, however, their short-term goals and recommendations advocated that funding be prioritized for Inuit-led climate change research and that climate change research should be evaluated against criteria

specifically pertaining to Inuit and their needs to assess the efficacy and necessity of research (2016).

Later, ITK established the *National Inuit Strategy on Research* (NISR) in 2018 to uphold "respectful and beneficial research for all Inuit" (ITK, 2018, p. 6) by asking researchers of all disciplinary backgrounds to seek and implement Inuit governance, ethics, priorities, access, ownership, control, and capacity in every stage of the research process (ibid.). This is critical because all research occurring in Inuit Nunangat inherently affects the lands and people that live there.

While NISR specifically advances Inuit interests in all areas of research, the 2019 *National Inuit Climate Change Strategy* (NICCS) specifically addresses all climate change actions in Inuit Nunangat (ITK, 2019). ITK's five main priorities include "1) knowledge and capacity-building; 2) health, well-being, and the environment; 3) food systems; 4) infrastructure; and 5) energy" (ITK, 2019, p. 4). Although all priority areas would benefit from climate change research, Priority 1 of the NICCS, "Knowledge and capacity building: advance Inuit capacity and knowledge in climate decision-making" (ITK, 2019, p. 7), is the most directly applicable to the topic of climate change research in Nunavut. This priority especially includes an objective to "promote Inuit-driven climate change research and monitoring" (ITK, 2019, p. 21), which not only pushes for including Inuit in research but strives to change the dialogue by encouraging Inuit-led projects. ITK aims to implement this objective by better communicating, disseminating, and improving

accessibility of climate change information among Inuit in Canada and the world's circumpolar regions (ITK, 2019).

2.4.4 Nunavut Plans, Policies, and Organizations

Nunavut Climate Change Strategy (2003)

Prior to the establishment of the Climate Change Secretariat, *the Nunavut Climate Change Strategy* was announced in 2003 and was led by the Government of Nunavut (Government of Nunavut, 2003). This Strategy, now published over two decades ago, set the foundation for the plans to follow. Broadly, its goals for the next decade were to "control and reduce greenhouse gas emissions; identify and monitor climate change impacts" and "develop adaptation strategies" (Government of Nunavut, 2003, p. 13) by raising awareness, including Nunavummiut in discussions, partnering with local and global communities, and conducting climate change research (ibid.). The *Strategy* was guided by Inuit principles of collaboration and leadership.

Upagiaqtavut (2011)

Upagiaqtavut – Setting the Course: Climate Change Impacts and Adaptation in Nunavut is a framework developed by the Government of Nunavut (GN) in 2011 to approach climate change based on IQ with the four components being: partnership building, research and monitoring, education and outreach, and government policy and planning (Government of Nunavut, 2011). The research and monitoring component states that research in Nunavut should be done in partnership with all communities (Inuit, scientific, and local and federal governments) (ibid.). Over the years, the GN has

partnered with different governmental and Canadian agencies to conduct climate change research, including the Canadian Institute of Planners, Natural Resources Canada, and what is now CIRNAC. *Upagiaqtavut* primarily led by eight Inuit guiding principles, two of which being *tunnganarniq* as "the government will take an inclusive and collaborative approach to climate change adaptation planning and research" (Government of Nunavut, 2011, p. 8). As in other federal and regional Inuit Nunangat documents, there is a clear desire to fully integrate IQ and Inuit ways of knowing into climate change research processes.

Nunavut Tunngavik Incorporated (NTI) Climate Change Strategy

More recently, in August 2022, NTI sent out a request for proposals to develop an updated Nunavut climate change strategy. This would build on existing climate change plans and recommendations and would be created in collaboration with different partners, involving Inuit knowledge and climate change strategy meetings and research (NTI, 2022b). As of August 2024, there do not seem to be any new developments to the strategy.

NTI's *Annual Report for 2021-2022* also emphasizes the need for Inuit-led research in climate change in Nunavut (NTI, 2022a). Established in 2021, NTI's Department of Research, Monitoring and Evaluation (RME) exists to advance NTI priorities by leading physical and social science research and monitoring projects and reviewing research applications (NTI, 2022a). For instance, RME conducted marine monitoring in Kimmirut and Clyde River using Automated Identification Systems "to

track vessels in near real-time" (NTI, 2022a, p. 73) and participatory research through a Research Capacity Needs Assessment at NTI. During the height of the COVID-19 pandemic, research methods continued virtually via online meetings and events, virtual document analyses, and data collection from local or virtual sources (ibid.). In addition, RME reviews research proposals from territorial, federal, and international programs such as social, physical, and health sciences research for the NRI and proposals for Polar Knowledge Canada, Northern Contaminants Programs, ArcticNet, and the Canadian-Inuit Nunangat-United Kingdom Research Program. Through these proposal reviews, they put forward their priorities for Inuit-led research, self-determination, Inuit knowledge, transparent and good communication, and an overarching respect of Inuit needs, rights, and values (ibid.). Once again, although climate change research is not explicitly mentioned in the NTI's *Annual Report*, RME leads research and reviews proposals that would inherently be climate change-relevant, explicitly stated or otherwise.

Nunavut Community Adaptation Plans

Across Nunavut, communities have also expressed the necessity for Inuit-led and climate change-focused research. Most 2010 Community Adaptation Plans listed on the GN website mention climate change research as a main goal and/or action, including Arviat (Nasmith & Sullivan, 2010), Cambridge Bay (Calihoo & Romaine, 2010), Clyde River (Hamlet of Clyde River & Ittaq Heritage and Research Centre, 2010), Hall Beach (Calihoo & Ohlson, 2008), and Iqaluit (Lewis & Miller, 2010). Climate change research were prioritized in different ways across these communities. However, it should be

noted that these plans are outdated and are likely no longer in place as it is challenging to maintain and update each one. Although, they provide good references as to different ongoing priorities and community values.

In Adaptation Plans from Arviat, Cambridge Bay, and Hall Beach, IQ and traditional community knowledge are cited as important aspects to consider in addition to scientific research when evaluating the impacts of climate change and potential methods of adaptation (Calihoo & Ohlson, 2008; Calihoo & Romaine, 2010). Clyde River, Hall Beach, and Iqaluit name Natural Resources Canada as the primary agency leading climate change research and they show support for climate change projects on shoreline erosion, infrastructure, and energy (Calihoo & Ohlson, 2008; Hamlet of Clyde River & Ittaq Heritage and Research Centre, 2010; Lewis & Miller, 2010). Hall Beach recognizes the role of research in climate change adaptation in every area of its action plan summary (Calihoo & Ohlson, 2008). Iqaluit explicitly notes the importance of climate change research for water-related issues such as stormwater management and changes in coastal environments. Although Kugluktuk's and Whale Cove's Community Adaptation Plans did not overtly identify research as an adaptation objective, other projects relating to infrastructure, for example, are the focus of their adaptation plans (Hayhurst & Zeeg, 2010; Johnson & Arnold, 2010).

2.5 Overview of Published Climate Change Research in Nunavut Based on CCRRA Themes

The following section of this chapter is based on seven of the GN's CCRRA themes: Inuit Culture & Heritage, Healthy Environment, Food Sovereignty, Health, Safety and Wellness, Built Infrastructure & Services, Community & Connection, and Livelihoods & Growth. These themes are derived from *The Government of Nunavut's Climate Change Risk and Resiliency Assessment – Methodology Draft* (Government of Nunavut, 2023). In using these themes to guide my literature review and analysis, the goal is to ensure that my research aligns with what the GN, and Nunavummiut, are most interested in knowing regarding climate change research.

2.5.1 Inuit Culture & Heritage

Within this CCRRA theme, IQ is listed as a sub-theme and is a significant component of Inuit culture and heritage as it comprises Inuit values, beliefs, and more. Within Nunavut, IQ is prioritized significantly within published climate change research, from knowledge of sea ice in Pond Inlet (Simonee et al., 2021; Wilson et al., 2021) to Clyde River (Gearheard et al., 2006, 2010) as well as Cape Dorset, Igloolik, and Pangnirtung (Laidler et al., 2010). Inuit knowledge is also expressed as experiences in noticing or understanding changes in weather (Fox et al., 2023; Gearheard et al., 2010; Weatherhead et al., 2010). In addition to physical changes, IQ is integral to "Traditional activities and practices" and "Access to land and resources," two additional sub-themes

within the Inuit Culture & Heritage CCRRA theme. Knowledge of weather and sea ice conditions is critical for climate change adaptation (Laidler et al., 2009), sea ice travel (K. Wilson et al., 2021), and hunting (Sansoulet et al., 2020). Inuit responses to climate change are also illustrated through artworks and artistic mediums to express themes that may not be expressed otherwise (Rathwell, 2020).

2.5.2 Healthy Environment

Although much of Nunavut-based climate change research in the physical sciences focuses on historic climate change, this sub-section emphasizes research that focuses on present-day anthropological climate change. Many of these studies in Nunavut are on glaciers and ice - both of which are connected to marine and terrestrial ecosystems. Glacier mass balance and change have been and continue to be studied widely across the territory and its islands, including Axel Heiberg Island (Cogley et al., 2011; Thomson et al., 2011), Bylot Island (Dowdeswell et al., 2007), Devon Island (Burgess & Sharp, 2004), Queen Elizabeth Islands (Koerner, 2005; Van Wychen et al., 2014), and Ellesmere Island (White & Copland, 2018; Woodward et al., 1997). Additional research on ice-related topics includes meltwater contributions from thinning ice islands in Baffin Bay (Crawford et al., 2020) and changes in firns at the Devon Ice Cap, which is compacted snow transitioning to glacial ice (Gascon et al., 2013). Studies have also shown shifts in sea ice breakup, freeze-up, thickness, floe edge, and multi-year ice near communities of Cape Dorset, Igloolik, and Pangnirtung (Laidler et al., 2010).

Within the scope of marine and aquatic ecosystems, there have been academic studies on greenhouse gas emissions from ponds and lakes on Bylot Island (Bouchard et al., 2015) as well as a Natural Resources Canada (NRCan) Geological Survey of Canada project that assessed sea-level projections across five communities in Nunavut (James et al., 2011). In terms of terrestrial ecosystems, the Geological Survey also studied permafrost conditions in Pangnirtung (LeBlanc et al., 2010) and, more recently, studies include permafrost temperature variability in Cape Bounty (Garibaldi et al., 2021). Moreover, there are studies on plant phenology, which highlight the role of climate change in affecting the timing of flowering plants (Panchen & Gorelick, 2017), impacts of sea ice shifts on caribou populations by Victoria Island (Poole et al., 2010), and climate change vulnerabilities for Arctic fox dens on Bylot Island (Poulin, 2021). In addition to studies on aquatic and terrestrial ecosystems, there is research prioritizing Inuit knowledge of changes in weather across Nunavut (Fox et al., 2023; Gearheard et al., 2010; Laidler et al., 2010; Pennesi et al., 2012; Simonee et al., 2021b; Weatherhead et al., 2010).

2.5.3 Food Sovereignty

Over the last twenty years, published literature has primarily explored climate change and food sovereignty through the lens of food insecurity, inaccessibility of country and culturally appropriate foods, as well as the affordability of commercial and country food for different communities in Nunavut. Food sovereignty, as described by

Caughey et al. (2022), is "the emphasis on Inuit-led solutions to food insecurity and the grounding of food within self-determination and Inuit rights to food" (p. 5). Food insecurity, on the other hand, "is largely transitory in nature and influenced by food affordability and budgeting; food knowledge; education and preferences; food quality and availability; absence of a full-time hunter in the household; cost of harvest; poverty; and addiction" (Beaumier et al., 2015, p. 196). Among this body of academic literature, there are clear connections between climate change and traditional food systems (e.g. harvesting and consumption of country food), compounding stresses to physical, social, and cultural well-being (Newell & Doubleday, 2020). Despite the "high level of adaptive capacity" (Ford, 2009, p. 83) of Inuit in the face of climate change-related food insecurity, extreme weather and environmental changes including reduced ice cover, for instance, have been reported to be associated with shifts in wildlife migration and decreased populations of wildlife (Gilbert et al., 2021). These occurrences exacerbate stressors to traditional Inuit food systems for country foods across the territory. According to Rosol et al. (2016), the following types of wildlife were commonly reported in the 2007–2008 Inuit Health Survey to have decreased in abundance: caribou in Qikiqtani, fish in Kivalliq, and seals in Kitikmeot. Subsequently, the study reported a “50% decline in consumption of fish, whale, ringed seals and birds” (Rosol et al., 2016, p. 1).

Extreme climatic conditions have been reported to augment food insecurity in Igloolik in 2006 (Ford, 2009), and Iqaluit in 2010-11 (Statham et al., 2015), for example.

In Kugluktuk, country foods such as fish and caribou have declined in population significantly (Panikkar & Lemmond, 2020), with Dolphin and Union caribou herds seeing reductions in population by 89% in the 23 years since 1997 (Hanke et al., 2024).

More specifically, studies emphasize socio-economic climate change stressors on food security both among Inuit women in Igloolik (Beaumier et al., 2015; Beaumier & Ford, 2010) and Inuit preschoolers across Nunavut, 70% of whom were reported in 2007-08 to be raised in food-insecure households (Egeland et al., 2010). Whereas most of these studies cite climate change as a contributing factor to food insecurity, not as many focus on climate change as a key stressor. Fewer still study food systems through an Inuit-led food sovereignty lens.

In addition to climate change, the main barriers to food availability, accessibility, and stability include challenges to financial well-being (e.g. unemployment, poor quality in housing, inadequate income support, unaffordability of commercial food, fuel, and commodities, etc.) (Ford, 2009; Guo et al., 2015; Lardeau et al., 2011) and social well-being (e.g. substance abuse, etc.) (Lardeau et al., 2011). In contrast, hunting flexibility (Ford, 2009), community food sharing, and support networks (e.g. sharing of country food, food banks, soup kitchens, etc.) (Gilbert et al., 2021; Lardeau et al., 2011) have proven to be effective coping strategies against food security vulnerabilities. Recommendations to combat the erosion of food sovereignty in Nunavut highlight preventative and long-term solutions rather than reactive and short-term ones (Beaumier & Ford, 2010). Examples of long-term solutions include increasing support for

"Hunters and Trappers Organizations to acquire country food for community distribution, as well as greater financial and equipment support for harvesters" (Gilbert et al., 2021, p. 157), improved food policies that look beyond market costs of commercial food (Newell et al., 2020), and traditional food systems adapting to harvesting land mammals due to changing sea ice (Beaumier et al., 2015).

Most importantly, food sovereignty in research should be meaningful and based on Inuit-identified priorities and Inuit research methodological principles and definitions of food security and climate change (Caughey et al., 2022). While the social and cultural value of country food in Nunavut are heavily discussed within the context of climate change, research on northern food policies (Ford et al., 2016; Wilson et al., 2020) and the nutritional value of foods (Warltier et al., 2021) do not often draw such strong connections as the primary focus of the work.

2.5.4 Health, Safety and Wellness

In Nunavut, most of the health research in existence thus far is primarily related to food sovereignty and security. Although many articles discuss the role of climate change in travel on land via sea ice and trail networks, few explicitly discuss the correlation between climate change and search and rescue incidents. Over the years, longer open-water seasons have led to increased ship traffic and greater marine and aquatic risks (Carter et al., 2019; J. Ford & Clark, 2019; Giles et al., 2013). Research has found that search and rescue accidents from being on the land are a primary cause of death in Nunavut due to changes in ambient temperature and ice thickness, among

other environmental factors (D. G. Clark et al., 2016). In recent years, unpredictable weather on the land has been researched in collaboration with the communities of Clyde River, Igloolik, Iqaluit, and Pond Inlet to investigate pathways towards improved climate change preparedness (Fox et al., 2023; Laidler et al., 2009; Pennesi et al., 2012; Simonee et al., 2021b). Inuit-led projects that incorporate IQ are also crucial to support safe travel on sea ice (K. Wilson et al., 2021). For example, to update existing aquatic risk prevention strategies, a study in Pangnirtung found that public safety promotion materials should include Inuit knowledge and translations into Inuktitut (Giles et al., 2013). These changes have been proven to be more effective because existing strategies may be southern-based and Euro-Canadian-centric (Giles et al., 2013).

Climate change-related health research relates to work beyond travel safety as well. Several Iqaluit- and community-based research projects have been led by Dr. Gwen Healey Akearok to examine the relationship between climate change and overall health in the north, tying together themes in ecological and population health (Akearok et al., 2019; Healey et al., 2011). Research has also been conducted relating to Nunavut youth, their resilience, and well-being (Kral et al., 2011, 2014); although the primary focus is not on climate change. One study, although there may be others, touches upon water security concerning community freshwater systems and vulnerabilities (Medeiros et al., 2017).

Based on existing and accessible published literature, it appears that there are few studies (little to none) on the impacts of climate change on mental health in

Nunavut. In contrast, many studies in the region of Nunatsiavut, Labrador explore the relationship between climate change and mental health (Lebel et al., n.d.; Middleton, 2021; Willox et al., 2013) as well as health more broadly (Harper, 2015; Ostapchuk et al., 2015; Willox et al., 2012). Published research in Nunavut does not venture as extensively into explicitly examining these relationships.

2.5.5 Built Infrastructure & Services

The majority of climate change-related research in Nunavut on built infrastructure and services focuses on shipping activities as the territory's marine systems are the most vulnerable to climate change of all the regions across Inuit Nunangat (Debortoli et al., 2019). Many studies also prioritize Inuit knowledge and perspectives on increased shipping due to lengthened open-water seasons during the warmer months (Andrews et al., 2018; Kelley & Ljubicic, n.d.; Van Luijk et al., 2021). Open waters also mean substantially increased marine tourism in Nunavut, namely expedition cruises and pleasure crafts (Johnston et al., 2012). Similarly, ice road and trail accessibility across the Arctic is also becoming increasingly unreliable due to climate change; a phenomenon reflected in literature within the geographical context of Inuit Nunangat and the pan-Arctic region, but not exclusively for Nunavut (Dong et al., 2022; J. D. Ford, 2019; J. D. Ford et al., 2023). Permafrost thaw has been a source of major concern for Iqaluit Airport (Ghias et al., 2017; Oldenborger & LeBlanc, 2015) as well as for landscape hazards to building and infrastructure safety in Arviat {Citation}(Forbes et al., 2011). These challenges, in addition to runoff and changes in sea level, are but a few

that are studied to augment community planning. In 2013, community perspectives from Iqaluit, Rankin Inlet, and Resolute Bay demonstrated their support for renewable energies such as wind and solar powers but were against the use of hydropower in Nunavut (McDonald & Pearce, 2013). A few studies also highlight the vulnerability of municipal drinking water and infrastructure in the territory (Bakaic, 2018; Hayward et al., 2021) in relation to environmental changes. Although published literature has focused significantly on marine transportation, academic research has yet to fully explore climate change adaptation in utilities, stormwater management, buildings, and waste management.

2.5.6 Community & Connection

Community & Connection is a cross-cutting theme that applies to all climate change research disciplines and intersects with the other six CCRRA themes. This CCRRA thematic area originally relates to the sub-themes of resource sharing, helping one another, and access to community services, to name a few. As this is quite a broad theme, I have expanded the definition to include community-led and -based research that stresses the importance of researcher-community relationships as well as intra- and inter-community collaboration.

Although there are no articles that only specifically relate to community, connection, and climate change as the primary theme, collaboration in climate change research is relatively prominent in health sciences regarding overall health and well-

being (Healey et al., 2011). Sub-themes such as resource sharing and helping one another are also quite evident within well-being and food sovereignty research. In Chesterfield Inlet, for example, researchers collaborated with the community to design the interview process relating to the ways in which the act of sharing country food is linked to cultural and physical well-being and environmental changes (Newell et al., 2020). In addition to community-based work, Caughey et al. (2022) developed a research program in Nunavut that delves into the relationships between food sovereignty and climate change by putting forth a community-led, NISR-guided project. Similarly, Kipp et al. (2019) assessed health-related climate change community-based monitoring programs for community-led components across Northern Canada, which includes Nunavut.

When it comes to the Arctic, Canadian North, and/or Inuit Nunangat, there does not seem to be a shortage of articles featuring community-based climate change adaptation initiatives, participatory research, and co-produced research. Fewer projects focus primarily on the intersection of research collaboration and climate change topics in Nunavut specifically. For instance, projects either discuss climate change collaboration across the North or general collaboration in Nunavut (Grimwood et al., 2012; Henri et al., 2020). Both foci are integral to the advancement of research. However, Fox et al. (2020)have conducted a long-term research project in Kangiqtugaapik (Clyde River) that prioritized co-production in environmental modelling.

2.5.7 Livelihoods & Growth

The effects of climate change on harvesting practices and tourism (Chanteloup, 2013) are also reflected in academic literature (Ford et al., 2013). This theme focuses on the effects of climate change on harvesting (Ford et al., 2007), but more specifically on fisheries (Galappaththi, 2023) and hunting (Laidler et al., 2009). Although additional climate change research projects exist, many projects focus on Inuit Nunangat and the Arctic as a whole rather than on Nunavut specifically. Policies and Inuit rights also play a major role in the discussion (Le Teno & Frison, 2021; Vogel & Bullock, 2021), as do economic adaptations (Leduc, 2006).

3.0 Methodology & Methods

3.1 Introduction

In Inuit communities across the northern circumpolar regions, people are guided by a worldview that prioritizes wellness and living a good life (Karetak et al., 2017; MacLachlan et al., 2022). Similarly, this research aims to be built upon an Inuit-developed ethical research framework because this MA research is Nunavut-based, which requires a contextually relevant approach. In this way, as a southern-based researcher, I can prioritize northern values to conduct Nunavut research that is grounded in respect, reciprocity, and relationships (See Section 1.4: Statement of Positionality).

In Inuit communities across the northern circumpolar regions, people are guided by a worldview that prioritizes wellness and living a good life (Karetak et al., 2017; MacLachlan et al., 2022). Similarly, this research aims to be built upon an Inuit-developed ethical research framework because this MA research is Nunavut-based, which requires a contextually relevant approach. As a southern-based researcher, I can prioritize northern values to conduct Nunavut research grounded in respect, reciprocity, and relationships (See Chapter 1.4: Statement of Positionality). The first sub-section of this chapter will provide an overview of the research framework used as a guideline for this master's research (Section 3.2), followed by the research stages of this work

(Section 3.3). Section 3.4 provides an overview of the limitations in the data collection and analysis process.

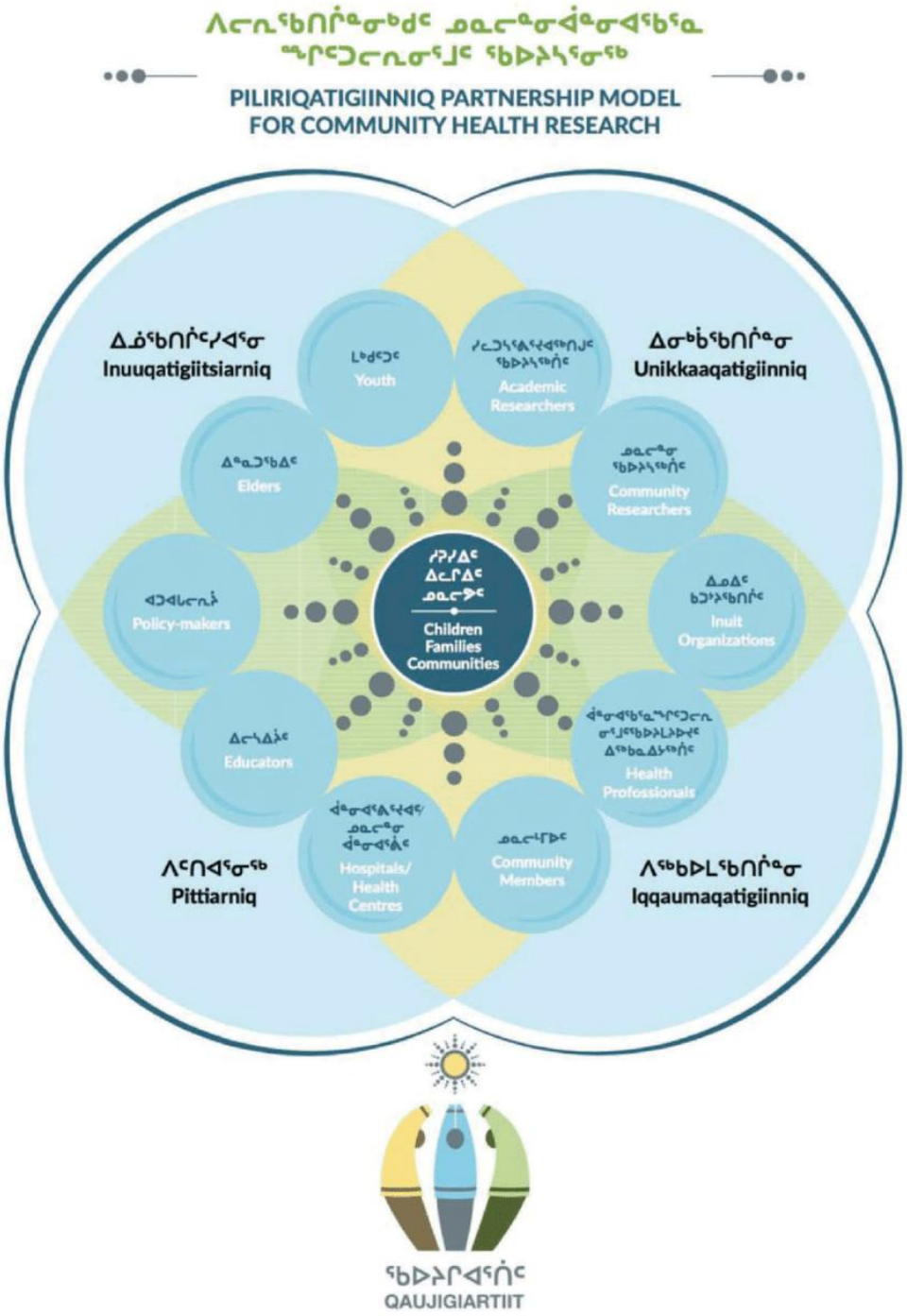
3.2 *Piliriqatigiinniq* in Practice: Research Framework

The theoretical framework of this research is guided by *piliriqatigiinniq*, one of the eight Inuit Qaujimajatuqangit principles (See Section 2.3 for an introduction to IQ) that emphasizes the importance of collaboration and healthy relationships for the good of all people, environments, and beings as a core aspect of wellness (Healey & Tagak, 2014). In other words, it prioritizes "working together for the common good" (Healey & Tagak, 2014, p. 1). This principle is the foundation of the Piliriqatigiinniq *Partnership Model for Community Health Research*, an Inuit research guideline developed by the Qaujigiartiit Health Research Centre (Figure 3.1) (ibid.). *Piliriqatigiinniq* intertwines ethics with relationships and methodology with understanding (ibid.) and encourages group needs to take precedence over individual needs (Nunavut Department of Education, 2007). In relation to the common good, Jimmy et al. (2019) similarly state that,

> "The focus on collective wellbeing invites the surrender of individual entitlements for a greater good and calls for a level of ongoing stretch-discomfort within a container of relational interdependence that is unconditional in its generosity over time, but not open to abuse" (p. 14).

Through this principle, good leadership is expressed through partnership and "sets expectations for […] strong relationship-building and consensus-building" (Nunavut Department of Education, 2007, p. 46).

Figure 3.1 Piliriqatigiinniq Partnership Model for Community Health Research



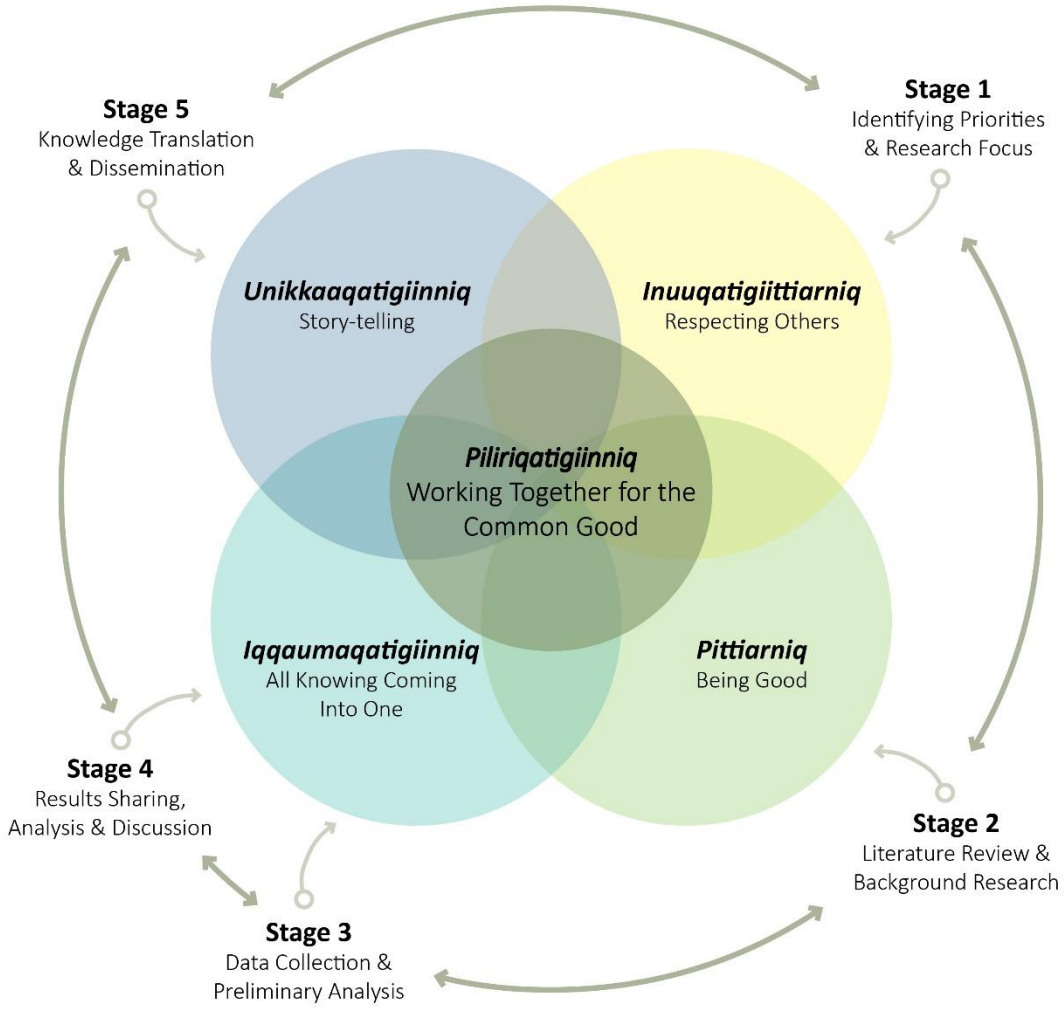
Source: QHRC, n.d.

The Piliriqatigiinniq *Partnership Model for Community Health Research* is comprised of four Inuit sub-principles, otherwise referred to in this plan as the four components of *piliriqatigiinniq*, for simplicity:

- *Inuuqatigiittiarniq* (respecting others),
- *Pittiarniq* (being good),
- *Iqqaumaqatigiinniq* (all knowing coming into one), and
- *Unikkaaqatigiinniq* (story-telling) (Healey & Tagak, 2014).

While the four components can be directly applied to my work, the different stages of my MA research do not fall neatly into separate Inuit principles and categories. Rather, there is overlap among all components because a research stage may draw from multiple Inuit principles. To better illustrate the relationships between the four *piliriqatigiinniq* principles and the five stages of my research, I have adapted Figure 3.2 to create my own research cycle diagram.

Figure 3.2 Climate change research stages and framework cycle diagram



The primary objective of Figure 3.2 is to achieve the common good through collaboration and partnership. Within the context of this work, the "common good" would be the priorities of the CCS and NRI, which are at the centre of this MA research. As a result, the research partner priorities would be the "common good," which is

located at the centre of the diagram. The four components and all five stages of this MA research are illustrated as circles and an outer cycle, respectively, to represent the relational and continuous nature of this work visually. The circles of the four components overlap one another because they work together to represent *piliriqatigiinniq.* The external MA research cycle employs double-ended arrows to demonstrate the way in which each of the stages informs one another rather than existing within a linear state. Overall, the research process is cyclical and iterative, as it is necessary to return to "previous" research phases as the research focus changes or as new information is provided. It is not a linear process, which allows for reflexivity, correction, and growth. In this way, the work also prioritizes Inuit research frameworks and ways of thinking and doing.

3.2.1 The Four Components of *Piliriqatigiinniq*

Inuuqatigiittiarniq – "Respecting Others"

The principle of ***inuuqatigiittiarniq*** prioritizes "respecting others" (Healey & Tagak, 2014, p. 5) through relationships with one another. To put this into practice, Healey & Tagak (2014)suggest that self-reflexivity and an understanding of the broader community context (e.g. history, culture, spirituality, worldviews, etc.) is crucial because researchers should work on creating a solid foundation of knowledge and of understanding themselves before attempting to work with others in such a space (Section 1.4). As the authors state, "[...] an awareness for and understanding of the

community context is part of acknowledging one's respect for it" (Healey & Tagak, 2014, p. 5).

Pittiarniq – "Being Good"

The principle of *pittiarniq* prioritizes "being good" (Healey & Tagak, 2014, p. 8). Since the definition of "being good" may be subjective depending on the individual, it is important to unpack this term within an Inuit context because non-Inuit (southerners and researchers, in particular) may justify or unknowingly continue harmful actions despite having good intentions (Tuck, 2009). Although southern- and academic-based measures such as ethics review boards and guidelines were created with good intentions to maintain ethical behaviour in research, they do not always translate appropriately in northern- and community-based work (Ljubicic et al., 2022). However, within the context of the Inuit principle, *pittiarniq* operates on the belief that researchers should be open to learning about broader community and cultural contexts, unlearning pre-existing notions and biases, and embarking on a potentially uncomfortable journey of personal growth. The researcher's behaviour should reflect respect for the land, people, and "relationships between and among the facets of the research" (Healey & Tagak, 2014, p. 9).

Iqqaumaqatigiinniq – "All knowing, coming into one"

The principle of *iqqaumaqatigiinniq* "is the Inuit concept of all thoughts, or all knowing, coming into one" (Healey & Tagak, 2014, p. 8). In this principle, the primary focus surrounds conducting meaning-making in true collaboration with research

partners. This would be an integration of perspectives, knowledge, and values to support a common goal or cause.

Unikkaaqatigiinniq – "Story-telling"

The principle of *unikkaaqatigiinniq* emphasizes the importance of "story-telling" (Healey & Tagak, 2014, p. 6). Since oral histories are the primary ways in which knowledge has been and continues to be shared in Inuit culture, storytelling applies to the ways in which research is shared. By including "stories and narratives by both the researcher and research participant" (Healey & Tagak, 2014, p. 6), research can be more holistic and not only reflect the biases and views of the researcher. In this way, the work would be more relevant to Inuit communities and research partners. *Unikkaaqatigiinniq* also prioritizes sharing research in the right way with the right audiences so that the research truly fulfills its potential and purpose in a positive, respectful, and useful way.

Within the context of this work, research will be primarily shared through written formats, which I recognize are very different from oral histories. As such, this principle can only be applied in limited ways since oral histories carry cultural and generational significance. In many ways, verbal storytelling is more accessible to a wider audience since storytellers can adjust the delivery and vocabulary to suit listeners of all ages. A written thesis is not as malleable. However, keeping *unikkaaqatigiinniq* in mind, Section 3.3 Research Stages in Practice, will be written as a narrative rather than a rigid list of methods.

3.2.5 Rationale for the Framework

The research methodologies and frameworks used in every project should pertain specifically to the cultural and geographical context in which the work occurs. Over the last few decades, many Indigenous research frameworks, protocols, and methodologies have begun to be shared by Indigenous scholars and knowledge holders internationally (ATSILIRN, 2012; Blue Quills, 2017; Prete, 2019; Union of BC Indian Chiefs, 2005). There have also been increasingly more northern- and Inuit-specific research models and guidelines (Ferrazzi et al., 2019; Healey & Tagak, 2014; Inuit Tapiriit Kanatami, 2018).

Since this project supports the work of the CCS and NRI, both of whom are based in Iqaluit and work to meet the needs and priorities of Nunavummiut, this work is guided by *piliriqatigiinniq*, an Inuit and Nunavut-based principle. Although the *Piliriqatigiinniq Partnership Model for Community Health Research* explicitly caters to research in health sciences, its values and impacts are holistic and relevant to a diversity of disciplines, including social science and human geography (Healey & Tagak, 2014). *Piliriqatigiinniq* is also an approach that has guided previous projects in collaboration with the NRI by fellow researchers in the StraightUpNorth Team (SUN Team), such as Alexis Polidoro, who conducted her MA research on social science-specific trends across Nunavut in collaboration with the NRI (Polidoro, 2022). Other qualitative studies

prioritizing Inuit worldviews also look to *piliriqatigiinniq* as an applicable and critical guiding principle (Lewthwaite & Renaud, 2009; MacLachlan et al., 2022).

Above all, as a southern-based, non-Indigenous researcher, it is important that I take time to critically reflect on myself, my research, and how I can tangibly and realistically conduct work that adheres to northern priorities (Section 1.4: Statement of Positionality). Since my research collaborators are the CCS and NRI (See Section 3.3.1: Developing Relationships & Identifying Priorities) rather than local community groups or individuals, the *piliriqatigiinniq* model suits the project because it focuses on "working together for the common good" (Healey & Tagak, 2014, p. 1). Despite my research being an analysis of research project summaries rather than speaking with communities directly, the concept of collaboration for a common goal is critical as I strive to contribute my skills and insight to the broader project. This model encompasses relationship building with northern research partners and includes southern-based researchers, such as myself, in accomplishing work that supports the common objective of our partners' priorities (ibid.). However, it is important to note that Inuit and, more generally, Indigenous frameworks and ways of thinking, being, and doing are typically interconnected in a holistic way, including physical, mental, and spiritual health well-being. Since the "common good" for this work is to analyze climate change research trends, this MA project is interdisciplinary and does not only focus on the physical sciences, for example.

3.2.6 Research Licensing & Ethics

Since this project is a part of the broader *Making research work for Nunavummiut* project, the existing NRI license was amended to include the new addition of my MA work (# 01 029 22R-M). As I am working primarily with secondary data in the form of project summaries from publicly available research licensing/permitting databases and funding databases rather than interviews, workshops, or focus groups, McMaster University Research Ethics Board confirmed that ethics clearance was not required in accordance with the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans – TCPS 2 (2022)*.

3.2.7 Terminology Definitions

Throughout this paper, "climate change research" relates primarily to academic research but also includes territorially and federally licensed, permitted, and funded research. In contrast, "climate change initiatives" and "climate change adaptation initiatives" refer to work that may not be directly affiliated with academic research or may not be considered research within a traditional Western science framework. To more effectively encompass both climate change research and non-research projects through the terminology of this work, the terms "climate change work" and "climate change projects" are used interchangeably. While a climate change project refers to entire unique projects, "climate change project summaries" refers to every document or instance of a project coded and added to the study under a different file name. This is

because certain projects may have multiple documents with different file names, especially if there is a different document for every year that a project applied for a license/permit. To simplify this complexity, references to "annual climate change project activities," or "annual activities," refer to the number of climate change projects that had an activity that year (regardless of whether it began that year or if their license/permit/funding had carried on from a previous year).

Additionally, the terms "licensing," "permitting," and "funding" are used frequently within similar contexts. Whereas "licensing" is a term typically used by the NRI to refer to their scientific research licensing processes, other agencies such as the GN Department of Environment (DoE), Parks Canada, and Fisheries and Oceans Canada (DFO) primarily deal with permits instead. Although licensing and permitting are similar, research permits specifically allow research to take place in national parks and handle certain types of wildlife in particular ways. Different agencies refer to their processes in different ways. The one exception to this is the DFO's "License to Fish for Scientific Purposes"; otherwise, their other processes involve permits. Where the term "permit" is used in this thesis, I am referring to non-NRI processes. The term "funding" is used for the three federal climate change funding programs included in this study.

Nunavut communities will be named in this paper according to their official place names, so while certain communities primarily use their Inuktut names, others are in English. By following the official names, I can hopefully standardize references to places

in other studies, papers, and according to CCS and other government documents. However, it is important to recognize the Inuktut, or original, place names, which is why I have included them in the first reference of a community.

3.3 Research Stages in Practice

The following sub-chapters will provide an overview of my five research stages, the methods in practice, and how the associated actions in each stage are guided by the *piliriqatigiinniq* principles. Appendix 3 summarizes the five stages of research and how they support the *piliriqatigiinniq* components and research partners.

3.3.1 Stage 1: Developing Relationships & Identifying Priorities

The first stage in this research is to identify the research focus. Since the goal from the start of my MA was to have this work serve the purposes of a community partner in Nunavut, the research focus, direction, and objectives were developed in collaboration with Sara and Jade. In Fall 2022 and early Winter 2023, a series of preliminary planning meetings and virtual communications were undertaken. I first connected with Jade via email in early November 2022, which was possible due to Gita's long-term relationships with Jamal at the NRI, and the existing SUN Team and NRI project, *Making research work for Nunavummiut*. Later that same month, Jade introduced Sara via email, who shared with us a research topic of interest to the CCS along with a list of research questions, which are listed in Appendix 1. Since then, Sara has continued to provide guidance on the direction of the research through virtual

communication to ensure that the work consistently aligns with CCS priorities. Jade Owen (and, occasionally, Jamal Shirley) from the NRI also provides guidance on refining the research focus through virtual and in-person meetings. In March 2023, Sara shared the seven CCRRA themes, which help to guide the literature review and data analysis (See Appendix 2 for a detailed list of themes and sub-themes):

- Built Infrastructure & Services;
- Community & Connection;
- Food Sovereignty;
- Health, Safety & Wellness;
- Healthy Environment;
- Inuit Culture & Heritage; and
- Livelihoods & Growth (Government of Nunavut, 2023).

Prior to the CCRRA themes, the themes for the literature review and analysis were to be based on existing themes from previous climate change research studies (Bolton et al., 2011). As the focus shifted to the CCRRA themes, the project could more accurately reflect the concerns of Nunavut government agencies as well as those of Nunavummiut (further discussed in Stage 2). This is because the CCRRA themes were created for a cross-departmental climate change risk and resiliency assessment, which was made possible through engagement with various GN departments and GN committees, including youth (Government of Nunavut, 2023). Since the GN's CCRRA

methodology document is currently in its draft stages, sub-themes may change to better reflect their priorities in the time following this project.

In Stage 1, *inuuqatigiittiarniq* is present in the way the research project was developed in collaboration with community partners from the onset of the work. This work supports *inuuqatigiittiarniq* because the intention behind the work seeks to support work chosen by community partners for the benefit of Nunavummiut. Since the research focus and themes were proposed by Sara, the work inherently acknowledges respect for her role as a primary partner and expert regarding the CCS' interests in supporting Nunavummiut.

The actions taken in this stage directly adhere to the CCS's goal of better understanding the different types of climate change research in Nunavut over the last two decades. They also support the NRI's interest in exploring opportunities to improve coordination and communication among fellow permitting and licensing agencies.

Key Organizations & Partners

This section outlines the key organizations and partners involved in this research. The roles of the primary MA project partners and co-leads are described first, followed by the program descriptions of the three federal climate change research funding programs, and concluding with descriptions of federal and territorial research licensing or permitting agencies and processes.

Nunavut Research Institute (NRI)

Established in 1995, the Nunavut Research Institute (NRI) receives physical/natural, social, and health science research proposed to take place in Nunavut and assigns them to local community review committees to issue mandatory research licenses as required by the territory's *Scientists Act* (NRI, 2024). An overarching priority of the NRI is to ensure that scientific research in Nunavut supports the well-being of Nunavummiut (NRI, 2024). However, the research licenses administered by the Science Advisor, currently appointed at the NRI, are not the only research permits in existence in Nunavut.

As per Nunavut's Scientists Act, the Science Advisor at the NRI grants research licenses to all physical science/natural science, social science and traditional knowledge, and health science research across the territory. Upon the submission of a research proposal, the department conducts an internal review of the application before forwarding it to external community reviewers such as local Hunters and Trappers Organizations (HTOs) and wildlife organizations (NRI, 2024).

Jade Owen – Manager of Research Design and Policy Development at the NRI

Jade Owen, also based in Iqaluit, Nunavut, is a manager at the NRI and is a primary research partner. In addition to this MA work, Jade provided support to other researchers and students at the SUN Team through the broader *Making research work for Nunavummiut* project. It was through Jade that we connected with the CCS. Jade

provided guidance and support relating to the NRI research licensing database and introduced Faith to relevant licensing and permitting agencies in Nunavut. More broadly, she provided invaluable insight into the overall themes, analysis, and direction of the project.

Climate Change Secretariat (CCS), Government of Nunavut

The Government of Nunavut (GN) Climate Change Secretariat (CCS) was established in 2016 to further support Nunavummiut leadership and resilience in navigating climate change through three primary areas: adaptation, mitigation, and knowledge mobilization (Government of Nunavut, n.d.-a). The CCS strives to coordinate between different governmental agencies throughout these projects by collaborating with Inuit organizations, GN and federal agencies, community and non-governmental organizations, and research institutes such as the NRI (ibid.). Above all, they support Nunavummiut in being prepared for local and broader regional impacts of climate change (ibid).

Sara Holzman – Climate Change Adaptation Manager at the CCS

Sara Holzman, who works on behalf of Nunavummiut as a manager for the GN Climate Change Secretariat, is a primary research partner for this MA work. In addition to proposing the research focus of this work, Sara has identified CCS priorities, research objectives, and the CCS' thematic areas of risk assessment for climate change. She provided feedback on these key themes, which informed the literature review of

published literature on climate change research as well as the following results and analysis chapter. More specifically, Sara provided invaluable direction to the project through collaboration in results interpretation and review of the analysis. Sara also connected Faith with contacts at the three primary federal climate change research funding programs led by CIRNAC and ISC (See Table 3.1 for contacts and roles). Following this thesis, Sara will also help determine and establish preferred research outputs to most effectively share results.

StraightUpNorth Team (SUN Team)

Faith Rahman – Master of Arts (MA) Student at McMaster University

Currently based in Hamilton, Ontario at McMaster University, I am the primary student researcher working on this project. Through this work, I will aim to support CCS and NRI priorities by:

- Conducting a literature review on climate change research in Nunavut since 2004;
- Conducting a thematic content analysis (TCA) of licensed and non-licensed climate change research in Nunavut since 2004;
- Producing an MA thesis and non-technical summary of results;
- Sharing results with partners and relevant agencies through summary documents and presentations; and, most importantly,
- Supporting decision-making for the CCS and NRI.

Gita Ljubicic – Professor at McMaster University

Gita, also based in Hamilton, Ontario, is a professor and the primary investigator and supervisor of this MA research. Over the last two decades, Gita has fostered relationships with northern community and organizational partners, continuing to collaborate with key individuals such as Jamal Shirley, Director of the NRI. Through these existing relationships, I was able to connect with Jade and then with Sara to develop the focus of this project as per their priorities. Throughout this work, Gita has provided and continues to provide academic guidance as well as support in learning to build respectful relationships in community-based northern research. In addition to supervising my MA and providing general academic support, Gita imparts guidance on refining the research focus and literature review (alongside feedback from Sara and Jade); developing coding themes for the TCA; learning to build respectful relationships in northern research; interpreting results; and creating summary products.

Funding Programs for Climate Change Work & Community-led Research

In Canada, there are a wide variety of climate change funding programs – from diverse governmental levels and agencies to Arctic organizations that fund all kinds of projects, climate change research across the country and in Nunavut can be funded by all sorts of programs.

Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) leads two climate change-related funding programs: the Climate Change Preparedness in the North Program (CCPN) and the Indigenous Community-Based Climate Monitoring

Program (ICBCM). Indigenous Services Canada (ISC) funds the Climate Change and Health Adaptation Program (CCHAP). The CCS was interested in including these three programs because they would include community-based and Indigenous-led climate change research/initiatives that may not be licensed or permitted by federal or territorial agencies. This allows for a more comprehensive look at the climate change research landscape. Additionally, all project summaries available through these programs are directly related to northern climate change issues, which provides a more curated database with which to work.

CCPN aims to support climate change adaptation projects across four regions of Inuit Nunangat, including Canada's three territories and the Nunavik and Nunatsiavut regions (CIRNAC, 2020). This program is led in collaboration with Indigenous groups, different governmental agencies, as well as additional relevant stakeholders (CIRNAC, 2020). Similarly, ICBCM consists of a two-phase program (CIRNAC, 2023). The first phase encourages Indigenous individuals and groups to submit initial project proposals prior to the full proposal process in the second phase (CIRNAC, 2023). While CCPN funds projects broadly relating to climate change adaptation measures, ICBCM specifically seeks community-based and -led projects that monitor changes in their own communities. CCHAP funds health-specific projects designed and led by Indigenous communities to develop region-specific adaptations and plans with the overarching goal of supporting communication and decision-making at all levels of government (ISC, 2024). This

includes food sovereignty, mental health, travel safety on land, extreme weather, for example.

MA Project Research Partners & Team Member Roles

The following table summarizes the roles and affiliations of the other team members and research partners involved in this MA research projects.

Table 3.1 Summary of Key Research Partners & Roles in MA Research

Name & Job Title	Organization	Role in MA Research
Additional MA Project Team Members & Supporters		
Jamal Shirley, Director of the NRI	Nunavut Research Institute (NRI)	• Co-lead of the broader project, *Making research work for Nunavummiut* • Works closely with Jade Owen at the Science Division of the NRI on scientific research projects in Nunavut • Provided insight on setting up the early stages of research at ArcticNet 2022
Regena Sinclair, MA Student & GIS Specialist	StraightUpNorth Team (SUN Team), McMaster University	• Provided GIS expertise on spatial mapping of where climate change research is happening across Nunavut • Worked closely with Maddy on data for mapping
Madeleine (Maddy) Lutes, Undergraduate Research Assistant	StraightUpNorth Team (SUN Team), McMaster University	• Supported organization of project summaries by location and GPS coordinates for mapping • Organized data by principal investigator affiliation • Organized data across all databases, except for Parks Canada data • Supported checking of results
Federal Climate Change Research Funding Programs		
Nicole Cerpnjak, Environmental Policy Analyst	Indigenous Community-Based Climate Monitoring	• Connected through Sara

(Previously)	Program (ICBCM), Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)	• Nicole was the previous contact for ICBCM, and provided database information on climate change-related project summaries
Merran Smith, Environmental Specialist	Climate Change and Health Adaptation Program (CCHAP), Indigenous Services Canada (ISC)	• Connected through Sara • Provided database information on climate change-related project summaries
Dennis Basudde, Environmental Policy Analyst	Climate Change Preparedness in the North Program (CCPN), Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)	• Connected through Sara • Provided database information on climate change-related project summaries
Federal & Territorial Research Licensing/Permitting Agencies		
Hayley Roberts, Ecologist Team Leader I	Nunavut Field Unit, Parks Canada	• Connected through Jade • Provided database information on protected areas- and climate change-related project summaries
Francis Piugattuk, Wildlife Technician I	Wildlife Research Chapter, Department of Environment, Government of Nunavut	• Connected through Jade • Provided database information on wildlife- and climate change-related project summaries
Colin Charles, Aquatic Science Biologist	Fisheries and Oceans Canada (DFO)	• Connected through Jade • Provided database information on fisheries-, aquatic-, and climate change-related project summaries

In summary, Sara and Jade helped identify and establish priorities for the work between September 2022 and January 2023. While Stage 1 was underway, I also began Stage 2 of the project by conducting research for my literature review starting in December 2022.

3.3.2 Stage 2: Literature Review & Background Research

As alluded to in the Stage 1 section of this chapter, the CCRRA themes were introduced later in the process of determining a research focus. As a result, background research conducted prior to March 2023 were initially based on existing themes from relevant published literature and previous government documents on climate change research gap analyses and assessments across Inuit Nunangat (Bolton et al., 2011; Ford et al., 2012). Since identifying themes used in other analyses and assessments remains useful as a consistent way to cross-reference between current and previous climate change research trends, Appendix 4 includes a table highlighting the themes used across multiple climate change research assessments and organizes them based on relationships and relevance to one another. As shown in the first column, the CCRRA themes were used as the baseline (e.g. the table highlights themes that overlap with CCRRA themes, includes themes not identified by CCRRA themes, etc.). This table was shared with Sara and Jade for their input and feedback, and it was determined and confirmed that the CCRRA themes best represented the interests of the CCS.

During this stage, I also worked on creating a *Community Engagement Plan* for GEOG 716: Community-Engaged Northern Research, a course with Dr. Ljubicic at McMaster University. Although I did not work directly with northern communities, the plan helped define the ways in which I could have my work be guided by Inuit principles for work that was in collaboration with northern organizations. Through this process, I have decided to use the *piliriqatigiinniq* model and created Figure 3.2 to tangibly apply the concepts to my work. This process also engages self-reflexivity to discuss positionality and intentions behind the work; employs critical thinking in how to follow an Inuit research framework respectfully and purposefully; and refines methodology to effectively improve organization of the work.

Throughout Stage 2, *pittiarniq* is present in the way I learn about the broader research context and unlearn biases and preconceived notions through conducting background research (Figure 3.2). Although this will be a continuous and ongoing process throughout my life, the personal work conducted for this project will hopefully serve as a solid foundation to be a good and respectful researcher and individual within an Inuit context. This is important because it is challenging to know how to demonstrate respect alongside the other four components of *piliriqatigiinniq* without first undertaking self-reflexivity and personal research. *Inuuqatigiittiarniq* is another critical principle in this stage because understanding such underlying contexts not only demonstrates greater awareness/understanding but also encourages a mindset of

entering work and relationships with respect for other cultures and their local communities.

This literature review will provide the CCS with a broad overview of existing and published climate change research with relevance to the CCRRA thematic areas of interest. As aforementioned, background research will also allow me to better understand the community context and roles of Nunavut's licensing and permitting agencies to support the CCS' and NRI's work. By planning to adhere to CCS and NRI priorities and creating a *Community Engagement Plan*, it is my aim to demonstrate respect for and dedication to their needs.

Once the CCRRA themes were shared in the spring of 2023, I connected with the different agency contacts (Table 3.1) to begin Stage 3 of my research. However, since the stages are iterative, I would consistently return to refine the focus of my research (Stage 1) and update my literature review (Stage 2) throughout the following stages.

3.3.3 Stage 3: Data Collection & Preliminary Analysis

Stage 3 primarily consists of connecting with various agencies to gather information on climate change-related project summaries and conducting qualitative data analysis. To do so in a more appropriate way, I relied on the support and existing relationships from Sara and Jade.

In December 2022, I met in person with Jade and Jamal for the first time at the ArcticNet Annual Scientific Meeting 2022 conference in Toronto. As previously

mentioned, it was then that Jade offered to introduce me to the different territorial and federal licensing and permitting agencies. As a manager at the NRI, she has existing relationships with a few of these agencies and introduced me via email. This was valuable because it was an additional way for Jade to reconnect or maintain contact with other agency representatives as a representative of the NRI. Since I would only be in touch for this master's, which is short-term by nature, Jade can use projects like this to help maintain long-term relationships with different licensing and permitting agencies. Through this project, opportunities could be created for the NRI to continue maintaining ongoing partnerships. Jade also identified the agencies that are most relevant and necessary to be contacted for this project, such as the Government of Nunavut Department of Environment (Wildlife Research) and Parks Canada (Table 3.1). Although there are research review processes led by other federal, territorial, and community organizations, projects reviewed by those agencies should already be included in the NRI database alongside those identified by Jade and Sara.

In late March 2023, Jade began sending introduction emails to different licensing and permitting agency contacts to make the initial request about their research application or project summary databases. In April, Sara sent similar introduction emails to her existing contacts managing the CCPN, CCHAP, and ICBCM funding programs. When personally following up with these emails, I would request documents in the form of Microsoft Excel spreadsheets, Word documents, PDFs, or any format they could provide to share climate change-related research in Nunavut since 2004. While most

agencies were able to share information, others, such as the Canadian Wildlife Service and GN Department of Culture and Heritage, were not able to due to temporal limitations and confidentiality (See Section 3.4 Methods Limitations). Parks Canada was the only agency to request the signing of a Data Sharing Agreement, which allowed them to share databases with names attached. All other databases have either omitted names or were able to share project summaries with me in their original formats. Although names may have been provided, they are not included in my results as this project is only concerned with principal investigator (PI) affiliations (e.g. whether a project is government- or university- led, etc.), rather than the PIs themselves.

Table 3.2 summarizes the types of licenses and permits granted by each agency and the research scope included for each one. Since every agency tracks and stores different types of information in different formats, I received project summaries from varying stages of agencies' processes. For instance, the GN Department of Environment was able to share its project summaries from permit applications, while the remaining agencies shared metadata spreadsheets or summary descriptions of projects that were confirmed to be licensed, permitted, or funded. This affects the way in which projects were coded (see the following sub-section on "Coding to Years, Locations & Primary Investigator (PI) Affiliations").

Table 3.2. Climate Change Research Licenses and Permits in Nunavut

Licensing/ Permitting Agency	License/ Permit	Government Act	Project Summary Type Received	Research Scope
Nunavut Research Institute (NRI), Nunavut Arctic College	Scientific Research License	Scientists Act	Individual project summary documents from projects with granted licenses	• For research conducted within the disciplines of physical/natural sciences, social sciences/traditional knowledge, and health sciences (NRI, 2024)
Government of Nunavut Department of Environment (DOE) – Wildlife Research	Wildlife Research Permit	Nunavut Wildlife Act	Individual project summaries from project applications	• For research relating to flora and fauna, including mammals, birds, insects, wildlife habitat (NRI, n.d.)
Parks Canada	National Parks Research Permits	Canada National Parks Act, Parks Canada Agency Act, Species at Risk Act, among others	Database of granted projects; no individual project summary documents	• For research conducted on National Parks and National Heritage Sites (Parks Canada, 2023)
Fisheries and Oceans Canada (DFO) Arctic Region	Fisheries Research Permits	Federal Fisheries Act	Database of granted projects; no individual project summary documents	• For researchers that would like to fish, sample, and/or handle fish and marine mammals for scientific research (DFO, 2024)
Environment and Climate	Scientific Permits	Migratory Birds	Database of granted projects;	• Allows researchers to band and handle

Change Canada (ECCC) – Canadian Wildlife Service (CWS)		Regulations, 2022	no individual project summary documents	migratory birds with minimal restriction for scientific purposes (CWS, 2024) • Project summaries from the CWS are important to include Nunavut research projects that include migratory birds, which may not be effectively captured in territorial wildlife research permits (ibid.)

Thematic Content Analysis (TCA) & Coding

In May, I began the data analysis process. Using NVivo qualitative analysis software, thematic content analysis (TCA) was conducted to effectively identify common themes across documents and group ideas (Vaismoradi et al., 2016). Broadly, the TCA or coding process in NVivo consists of tagging data on climate change-related research and/or work to relevant common themes, also known as codes. I manually assigned descriptive codes (Cope, 2010), or tags, to phrases in a text and entire project summaries to effectively identify salient themes across different documents (ibid.). A theme would include concepts, descriptors, or attributes selected by the researcher (Vaismoradi et al., 2016). The seven CCRRA themes were used as the high-level key themes in this case. Content would then be assigned to secondary themes (sub-themes), tertiary themes (second-level sub-themes), and quaternary themes (third-level sub-themes) (See tree diagrams in Appendix 2). Whereas previous studies in the broader

project referred to thematic levels as “Broad Codes” and “Detailed Codes” (Polidoro, 2022), the multiple levels of CCRRA thematic areas require specific terminology. For the purposes of this study, the terms “themes” and “codes” are used interchangeably.

Upon receiving research licensing and permitting database information from different agencies, files in the form of PDFs, Word documents, and Excel spreadsheets can all be input into NVivo for TCA. Table 3.2 highlights the format in which each database was shared with me for this study. **Appendix 5** displays types of metadata and information that is tracked and/or was shared with me for this study.

Each organization identified which projects were relevant to climate change prior to sharing them with me. When using data from the NRI database, project summaries have already been coded to “climate change” from 2004 to 2021 by other SUN Team students for the broader project. In this case, I can use NVivo to isolate summaries previously coded to “climate change” before continuing with my own coding for this MA research.

Rather than using a coding scheme or codebook based on themes that I personally identify and create as the investigator, the initial codes (Cope, 2010) I am using are based on the CCRRA themes and sub-themes. As a collaborative analysis process, Stage 3 is made possible through a recursive and reiterative process of communicating with Sara and Jade via email to clarify the meanings behind specific

CCRRA themes. As I continued to conduct TCA, new themes emerged that are not currently represented by the draft version of the CCRRA themes.

After a few emails and a virtual meeting, confirmation was received from Sara to create additional codes as they appeared in project summaries to complement existing CCRRA codes. This coding approach helped to better reflect the state of climate change research in Nunavut more effectively and comprehensively. The key CCRRA themes and sub-themes, nevertheless, have remained unaltered as the primary codes. As a result, projects that were not considered previously for newer codes were reviewed during a second and third round of coding to ensure that all projects were adequately considered for all themes. This MA research employs a combination of deductive coding, using pre-existing CCRRA themes, and inductive coding (Ferrazzi et al., 2019) by adding emerging themes.

While all projects were coded to broader primary themes, not all projects were coded to secondary, tertiary, and quaternary themes. Primary themes were coded when they were the leading theme(s) in a project, so one project could have multiple primary themes. For example, a project may be coded to “Food Sovereignty” and “Healthy Environments” simultaneously. Detailed sub-theme themes were only coded where relevant as a prominent component of a project. Where a project was coded to a sub-theme (e.g. Flora or Fauna), it would also be coded to the primary theme (e.g. Healthy Environments) (See Appendix 2 for tree diagrams).

Overall, the TCA approach blends the thematic analysis and content analysis approaches, wherein the former relies on the subjectivity of an individual investigator, and the latter relies on the objectivity of multiple investigators. Since I worked with a diverse range of data types and forms, new coding created for this project required my subjectivity as a researcher. In contrast, work that has already been coded to "climate change" by multiple researchers or organized by government agencies hinged upon assumed objectivity. This work, however, acknowledges the role that my biases and positionality may play as a part of the coding process. Therefore, it was important that I communicate with my community partners whenever I was unsure about whether a decision in the work may affect its direction.

Between March 2023 and 2024, projects were continuously coded as project summaries were shared with me from different contacts at different times. The challenges of working with various databases are described in the limitations section of this chapter (Section 3.4).

Coding to Years, Locations & Primary Investigator (PI) Affiliations

In addition to themes, coding the years, locations, and primary investigator (PI) affiliations helped to answer the questions of when and where research has been happening, as well as who has been leading it. In March 2024, I began to tag project summaries across all seven databases to their respective years and communities and/or field locations in which they took place. Databases from the funding programs concretely tracked the duration that a project was being funded. The years that the

project was funded would be displayed as a single row in a table (e.g. 2008-2010). However, the total number of years that the project was being led may be unknown. Contrastingly, the licensing and permitting databases display individual rows every time a project had applied for a new license/permit for the same project (e.g. 2008, 2009, 2010). To remain consistent with tagging projects to years, every project across all databases was coded to individual years regardless of the database formatting that I received.

As for the locations, Maddy Lutes (Table 3.1) joined the SUN Team in May 2024 as an undergraduate research assistant as a part of her IndigiNerds research training program at the McMaster Indigenous Research Institute. With the exception of the Parks Canada database (with whom a Data Sharing Agreement was signed), Maddy has assigned most project summaries to their PI affiliations, locations, and GIS coordinates for mapping. In May and June, I was able to collaborate with her so that I could complete any remaining databases on my own. Through her support, data can be graphed to PI affiliations and shared with Regena Sinclair, the SUN Team's GIS Specialist. Maddy also supported the process of double-checking data across the databases.

Stage 3 is primarily guided by *iqqaumaqatigiinniq* (Figure 3.2) because different types of knowledge came together to reveal themes in the TCA. Collaborative meaning-making with Sara and Jade through an iterative process of understanding and refining the coding scheme helped ensure that my work continued to align with their interests,

needs, and expectations. Sharing the work at its different stages with them also allowed them to gauge whether the TCA makes sense in the context of their organizations as northern-based professionals working on behalf of Nunavummiut. This work also increased connections and communication networks between the NRI and other licensing and permitting agencies, which also contributed to the intertwining of different knowledge. As with the previous stage, the work draws upon *inuuqatigiittiarniq* when my research partners helped to guide the direction of the analysis because I want to demonstrate respect for their expertise and priorities. These *piliriqatigiinniq* components were particularly relevant as I began creating and sharing preliminary results in Stage 4 of my work.

3.3.4 Stage 4: Results Sharing, Analysis & Discussion

The results of this study are based on 1410 annual climate change project activities from 736 unique project summary documents across four licensing/permitting agencies and three federal funding programs. “Annual climate change project activities” refers to projects represented by multiple documents, each one corresponding to annual applications for or renewals of licenses/permits. Alternatively, if a multiyear project was represented solely by one document, coding from this document was counted once per year that the project took place for the annual project activities count.

Following the TCA process in Stage 3, I exported data from NVivo to create drafts of bar graphs, charts, and tables in Microsoft Excel and visually summarize the data for

effective results sharing. I also reached out to Regena for support in spatial analysis and GIS mapping of the communities and field locations across which climate change-related research has been happening since 2004. Mapping was conducted by Regena concurrently with my Stages 3 and 4, both of which I have worked on iteratively.

Preliminary results, graphs, and visuals were shared digitally and in person with Sara, Jade, and other interested partners when I visited Iqaluit in November 2023. Through in-person meetings with key partners during this two-week-long period, we discussed early results interpretation and analysis of climate change research trends. In staying for two weeks rather than one, my goal was to better accommodate the busy schedules of those I was meeting. Meetings with Sara and Jade helped guide or re-direct the TCA and knowledge interpretation moving forward. We were able to verify that we are all on the same page, that the work continued to support their priorities, and I could receive input and in-depth feedback that I might not otherwise in a virtual environment. Organic discussions and conversations outside the meeting room also inspired new ideas and continued the ongoing process of building relationships.

While I was in Iqaluit, another main objective was to support the two-day NRI research licensing and permitting agency workshop (Nov. 15-16) by attending and note-taking. This event aimed to bring together these organizations that license and permit Nunavut research in general to promote collaboration and sharing of common challenges and solutions. Although this workshop was not directly affiliated with my MA

project, especially as it did not relate to the CCS or climate change-specific research, it provided real-life context behind the work led by each agency. This informed my contextual knowledge of the roles of different licensing/permitting agencies for my thesis and encouraged in-person connections with agency contacts. The workshop brought together all the agencies mentioned in this paper as well as several others (e.g. Nunavut Wildlife Management Board, Nunavut Water Board, Nunavut Impact Review Board, Nunavut Planning Commission, RIAs, etc.). My two-week stay in Iqaluit also allowed for flexibility to meet representatives from licensing/permitting agencies other than the NRI. This experience contributed to relationship-building and reciprocity, which is integral to *piliriqatigiinniq*, my growth as a researcher, and is embedded across the stages of my research (Figure 3.2). Being present in person also fosters natural opportunities to connect with the broader Iqaluit community when I planned for unscheduled time to participate in local events. Most figures were created following this visit to Iqaluit.

The rate of change (ROC) was automatically calculated within Excel by selecting options to display the trendline and its associated formula for the linear equation “y = mx+b”. The slope, or “m,” in this formula, would represent the ROC. This provides a consistent way to compare the average number of projects increased per year, per databases. To better analyze the thematic diversity of each database, Simpson’s Diversity Index was used for each database:

$$D = 1 - \frac{\sum n(n-1)}{N(N-1)}$$

Where “n” equals the total number of annual activities per theme and “N” equals the total number of annual activities across all themes, a 1.00 diversity would indicate high/infinite diversity. In contrast, 0.00 diversity would indicate complete thematic homogeneity. For example, a database that is dominated by Healthy Environment projects would have a diversity index closer to 0.00, which indicates low diversity. This formula provides a consistent way to compare each of the databases, despite each one having a different number of total annual activities.

Like the previous stage, Stage 4 is informed by *iqqaumaqatigiinniq* and *inuuqatigiittiarniq* (Figure 3.2). In Iqaluit, research partners helped guide the direction of the analysis and collaborated in interpreting the results. In-person meaning-making further promoted the alignment of goals and priorities during analysis and the NRI workshop.

3.3.5 Stage 5: Knowledge Translation & Dissemination

In this project, the research process does not end with my thesis. Rather, its completion marks the start of my knowledge translation and dissemination stage. Stage 5 of my research focuses on communicating results through various mediums: an MA thesis, research posters, non-technical and visual summary report, and any other preferred formats as requested by the CCS and NRI.

Prior to presenting my preliminary results at conferences, I shared a virtual copy of my research poster with Jade and Sara for their review. Later, during my visit to Iqaluit in November 2023, I brought and shared a physical copy of the poster, and they provided feedback to implement for my poster to be presented virtually at the ArcticNet Annual Scientific Meeting 2023 in Iqaluit. While an academic thesis can be used to summarize the literature review, methods, results, and discussion to fulfill a graduate degree and may contribute to academic publications, the primary goal of this work is to support my research partners. Whereas journal publications contribute to the broader academic community, summary reports and group presentations may be more effective to reach non-academic audiences since I can reduce language barriers. As such, it is critical to discuss with the CCS and NRI which written products most suit their needs and purposes. For instance, the non-technical and visual summary report should be engaging and suitable for audiences of all kinds, including government agencies and local community members. To do so effectively, the report may also be produced in multiple dialects of Inuktut, or whichever dialects and languages are requested by the CCS, in addition to English. This stage will take place in the Fall of 2024.

Stage 5 is largely informed by *unikkaaqatigiinniq* (Figure 3.2) because it is important for the climate change research trends "story" to be presented in mediums that accurately reflect the CCS' and NRI's needs and wants. The way in which these stories, or research results, are shared should be accessible to all audiences interested in understanding the results, and not limited to academic audiences. This is because the

impact of climate change research in Nunavut primarily affects northerners, Inuit, and Nunavummiut, not the majority of academics that may read about this work and are based outside of Nunavut.

For the CCS, prioritizing the Inuit principle of storytelling improves the accessibility and relevance of climate change research for decision-making and helps inform territorial climate change policy and adaption planning. For the NRI, this work introduces opportunities to improve coordination for the licensing and permitting of interdisciplinary climate change research. This research will be shared with partners and collaborators who have contributed data for this work. Digital and physical products should also be shared with anyone interested in knowing the results of the work.

Stories are narratives that tell the tale of their narrators; they are conscious of the voices and positionalities of those who are speaking. Likewise, this methods chapter aimed to outline the research process through a story-like narrative, with my voice and experiences clearly present throughout (Chapter 1.4: Statement of Positionality). The final section of this chapter will detail the relevant limitations encountered during coding and data analysis.

3.4 Methods Limitations

In this research project, there have been many challenges and limitations relating to the databases and information that form the basis of the research results. For this reason, improved coordination is required amongst different research licensing and

permitting agencies (See Chapter 5: Discussion). Since climate change research, work, and initiatives likely take place beyond the scope of the captured databases, the following results chapter does not fully encompass one hundred percent of climate change-related projects in Nunavut. This means that the results of this study underrepresent climate change work in Nunavut, and there is likely much more work completed, especially within non-academic and/or community-based work, that are not captured by the seven databases involved in this work. As such, this study aims to provide a snapshot of general themes and trends.

However, specific limitations must be acknowledged prior to the sharing of results as they are present in the data collected and coding process. Through communication and effort toward coding consistency, these limitations have been remediated to the extent possible.

3.4.1. Data Collected

Data Sharing

First, many organizations were unable to share their databases or specific data with me due to confidentiality, temporal limitations, and/or competing deadlines, compounded by relatively small teams. This project does not include Nunavut migratory bird research permitted by the Canadian Wildlife Service nor archeology research permitted by the GN Department of Culture and Heritage. As aforementioned, licensing and permitting organizations for Nunavut operate with relatively small teams for work

that occurs across the entire territory. Certain organizations may also prefer not to share their data with researchers external to their organization. Regarding the GN Department of Environment (Wildlife Research), there was insufficient time to provide data for the 2004-2008 years. This data limitation could be addressed and included in the summary report produced from this MA thesis. As a result, I have respected these agencies' existing tasks, deadlines, and preferences and continued my coding and analysis without these datasets. This means that the analysis of Nunavut climate change work is not as comprehensive as it could be, despite knowing that it is not an all-inclusive study.

Inconsistencies in Tracked Metadata

First, data received from each agency vary significantly in terms of the types of metadata included and excluded from their databases. Unlike Isirvik, the new online NRI database (isirvik.ca), the sets of information I received from every agency were unique because there is no standardized database set up, even within the same governmental departments (See Chapter 5: Discussion). For example, certain databases included principal investigator names while others could not.

Each agency also provided data for a distinct set of years. While the NRI has a digital database that stores data starting in 2004, other agencies have yet to convert their data into a digital format, especially for years earlier than 2016. Due to a lack of digital file organization, they may have also been unable to share information from years prior. Funding databases also only track the number of years a project was funded by the program but not the entire duration of the project. Other databases may or may not

include project funders and do not include funded amounts. Overall, inconsistencies in the categories of information shared do not accurately reflect the information tracked by each agency's database. They only reflect the information that was willingly shared with me (See Appendix 5 for a checklist of metadata that was shared with me).

Next, although Umingmaktok and Bathurst Inlet are no longer designated as communities or municipalities, certain databases have included these areas as locations of work rather than formal communities or field locations. As such, these two areas have been included in the maps as points representing community locations, rather than as field site points.

Inconsistencies in Format & Project Duplication

Moreover, accurately tracking the duplication of projects across databases is impossible. Project titles and applicant names for licensing, permitting, and funding differ amongst years and databases. The variation in database formats received also affects the types of information available. Whereas the NRI databases track and distinguish project durations because they consist of already licensed projects, other databases, such as the GN Department of Wildlife, can only share permit applications. It is not known whether all these projects have been approved and the exact duration of each project as permit applications have been missing for select years in between. In addition, the results of this MA research are based on project summaries of what applicants wanted to do, but it is not certain what they ended up doing. For example, did the project engage with community as described in their proposals? It is not clear

when applicants have opted for multi-year licenses and when they are re-applying annually. When reviewing permit applications, permit numbers do not exist. As such, there are no consistent variables (e.g. license/permit number, principal investigator name, title, etc.) to use as reliable unique identifiers to distinguish every project across databases. It is expected that projects will be duplicated within the dataset, however, I have opted to include more information rather than exclude potentially significant data.

3.4.2. Coding

Within thematic coding, there are limitations relating to the definition of themes and the process itself. First, in identifying emerging themes, certain themes are only introduced into the codebook once they have been identified as prominent through reoccurring appearances throughout the various databases. This means that certain project summaries at the start may not have been coded to newer, emerging themes. To rectify this, I re-coded certain databases a second or third time.

Climate Change Definition Inconsistencies

Additionally, it is challenging to precisely and rigidly define climate change-related research or work. For example, many environmental and socio-ecological projects, such as shifts in animal migration patterns, can be linked with climate change. As a result, for the NRI database, I have only worked with projects that were already coded to “climate change” by previous SUN Team students to remain consistent with previous projects for the NRI (Polidoro, 2022). As for the other databases, what qualifies

as “climate change-related” depends on what my research partners provided for the project. Different climate change initiative licensing, permitting, and funding agencies determine what is deemed relevant to climate change in their own ways.

CCRRA Thematic Area Definitions

Finally, as the CCRRA themes were introduced as the CCRRA Methodology document was in its infancy as a draft, the CCS does not have a confirmed list of themes yet. As certain themes may be quite broad (e.g. Community & Connection, Livelihoods & Growth, etc.) or similar (e.g. Food Availability vs. Food Accessibility; Transportation in the Built Infrastructure & Services theme vs. Transportation Industry in the Livelihoods & Growth theme), it is challenging to effectively and cleanly categorize interdisciplinary climate change research. As a southern-based researcher, I also do not have a full understanding of all the themes, which is why it was helpful to constantly communicate with Sara the definition of these themes via email, virtual meetings, and in person. Since the themes have yet to be confirmed, this study will also provide the CCS with insight into whether the CCRRA themes realistically reflect the climate change work taking place over the last two decades.

4.0 Results

4.1 Introduction

In Nunavut, climate change research and initiatives have taken place through the lenses of diverse disciplines by various organizations and institutions. In recent years, there has been a substantial increase in climate change-related discussions and outputs in academic and published literature. Based on the key objectives of this study, this chapter aims to examine climate change projects by addressing the following four areas:

1. The quantity of climate change projects that have been undertaken across Nunavut between 2004 and 2021;
2. The CCRRA themes that have been covered;
3. The types of organizations that lead climate change-related research and work across Nunavut; and
4. The communities and field locations across which climate change projects have occurred in Nunavut.

Considerations for Results

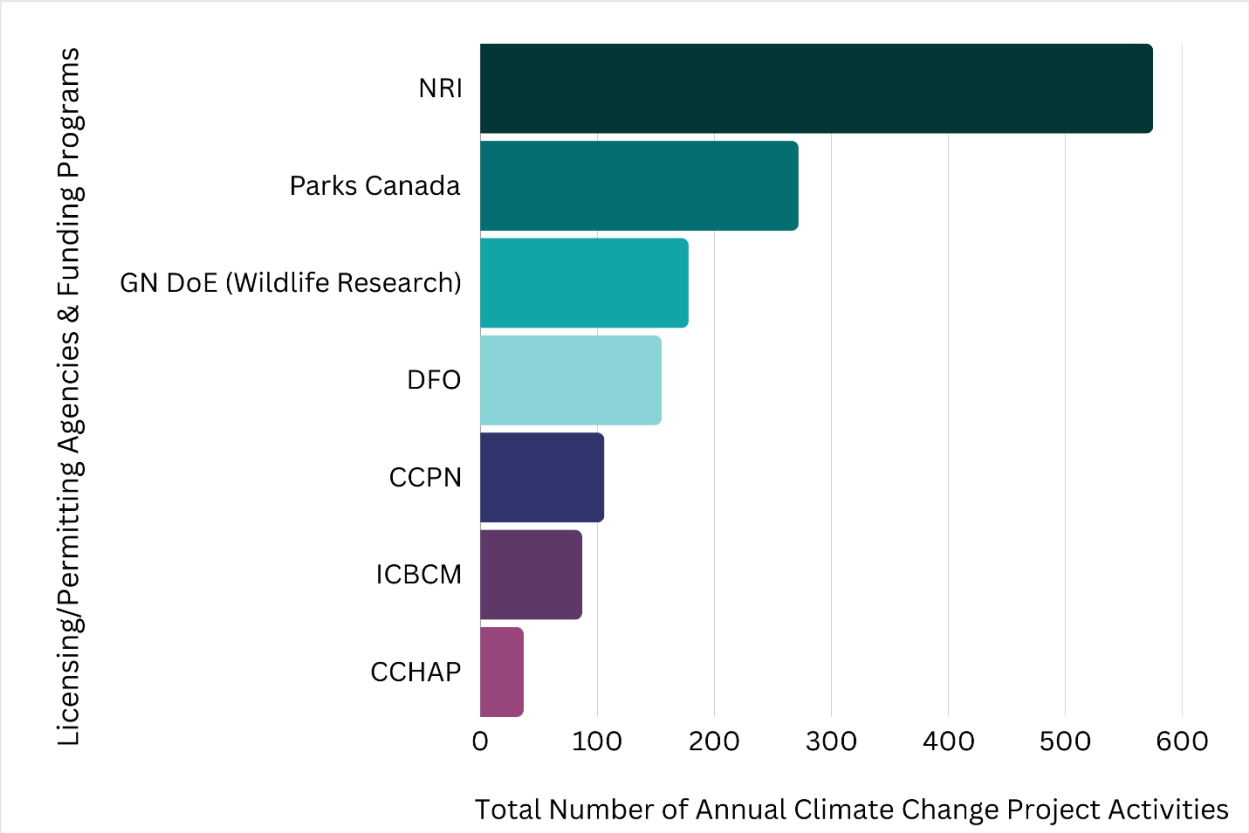
It should be noted that the results are expressed through a series of stacked bar graphs rather than pie charts or percentages as the data included is not an exhaustive list of all climate change projects conducted across the territory. Given the temporal scope of this work, and that not all climate change-related work is licensed, permitted,

or funded by territorial and federal agencies, there remain initiatives that may not be captured by this study. Where percentages are provided, totals are described in the text to be out of the total number of projects or documents included in this research.

4.2 How Much Climate Change Research and Work Have Been Done?

In Nunavut, the NRI licenses have the most climate change projects at 575 annual research activities, which is nearly 50% of the total number of annual activities coded for this research (1180) (Figure 4.1). Within the four licensing and permitting organizations, the NRI licensed over twice as much relevant research as Parks Canada (272 annual activities). The GN DoE contributed the second-most climate change projects at a record of 178 annual activities for 2008-2021, and the DFO was the third highest, contributing 155 annual activities for the full set of years (2004-2021).

Figure 4.1. Total number of annual climate change project activities in Nunavut by licensing/permitting agencies and funding programs (2004-2021)



Of the three funding programs, the CCPN (106) funds nearly three times as much climate change-related work as CCHAP (37). The DFO included the least number of projects for licensed/permitted research, and CCHAP included the least number of annual activities overall (52). While it seems that the data for this study is dominated by licensed and permitted research, this is evidently due to the availability of information for licensing/permitting agencies, with some providing data for a larger set of years than others. As the funding programs focus primarily on community-based projects rather than licensing and permitting all research, it is expected that CCPN, ICBCM, and CCHAP

would have lower numbers of projects within this study. However, when viewing a snapshot of all databases for 2016-2021 (Appendix 14), CCPN is second only to the NRI when it comes to the total number of annual activities licensed or funded in those years (106 and 238, respectively). This may be because many of the projects are funded by the program for multiple years and encompass a wider range of topics and activities compared to the GN, Parks Canada, and DFO databases, which review more niche subject matter within the climate change theme (e.g. parks, aquatic ecosystems, etc). Wildlife, in particular, is the primary topic of interest for many research projects reviewed by those agencies, which limits the projects included in their scope or jurisdiction between 2016 and 2021.

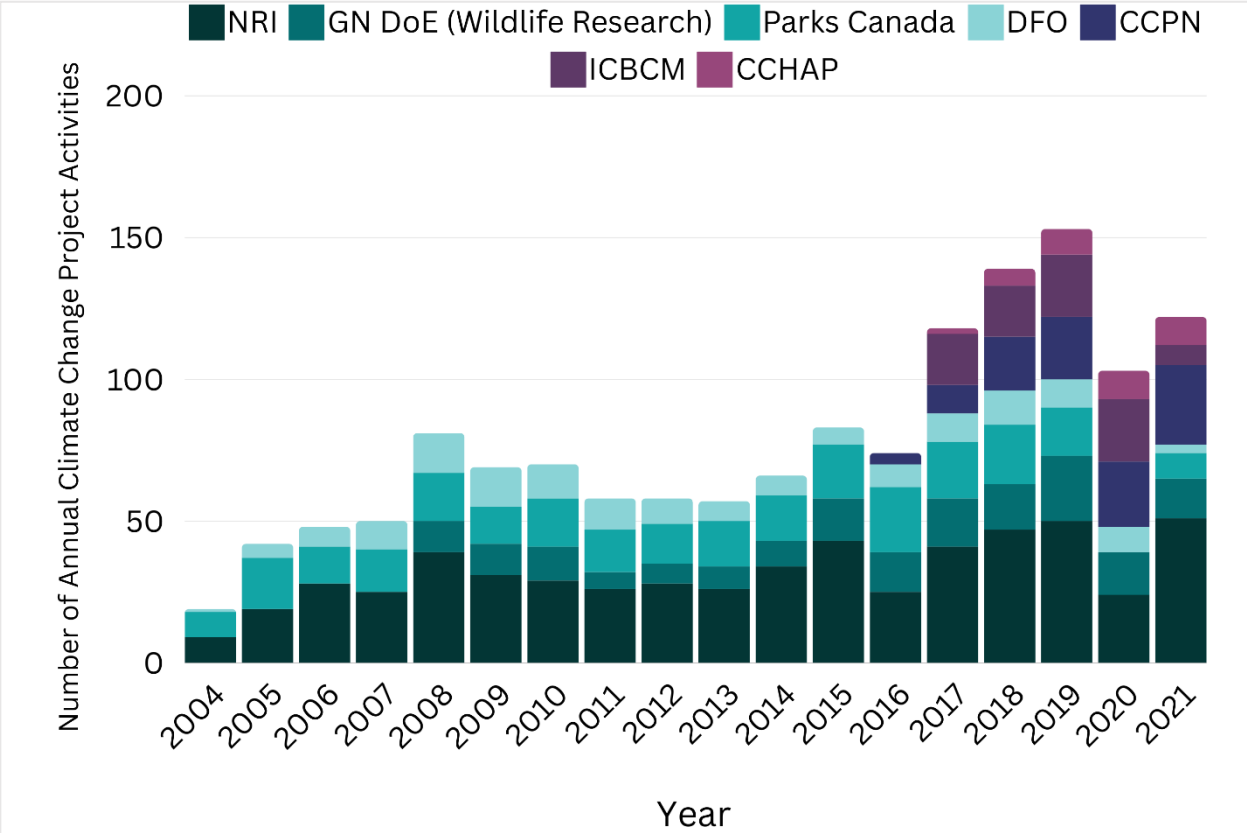
Given that the three funding programs have considerably lower annual activities since they began in 2016 and 2017, CCPN has a total of 106 annual activities. This may mean that the program funds more multiyear projects and/or for longer periods of time. However, it is also the program with the broadest theme, being preparedness in the north. ICBCM funded 87 annual activities across five years while CCHAP funded 37, a low number due to its health-specific focus.

4.2.1 Climate Change Project Activities Over the Years

Over the last two decades, research focused on climate change has increased in an overall positive trend. Figure 4.2 illustrates the total number of annual climate

change project activities between 2004 and 2021 across the seven databases included in this study.

Figure 4.2. Number of annual climate change project activities from 2004-2021, based on territorial and federal licensing, permitting, and funding data



Note. Data from the GN Department of Environment (Wildlife Research) is missing data for 2004-2007. Data for CCPN starts in 2016 and starts in 2017 for ICBCM and CCHAP.

Each shade of teal in Figure 4.2 indicates a different permitting or licensing agency, with the darker teals indicating organizations that have permitted more climate change-related research. While licensing and permitting agencies are represented at the base of each bar, the federal funding programs (CCHAP, CCPN, ICBCM) are shown in magenta,

indigo, and purple starting in 2016, which is when the databases begin. These colours remain representative of their respective organizations throughout the following figures.

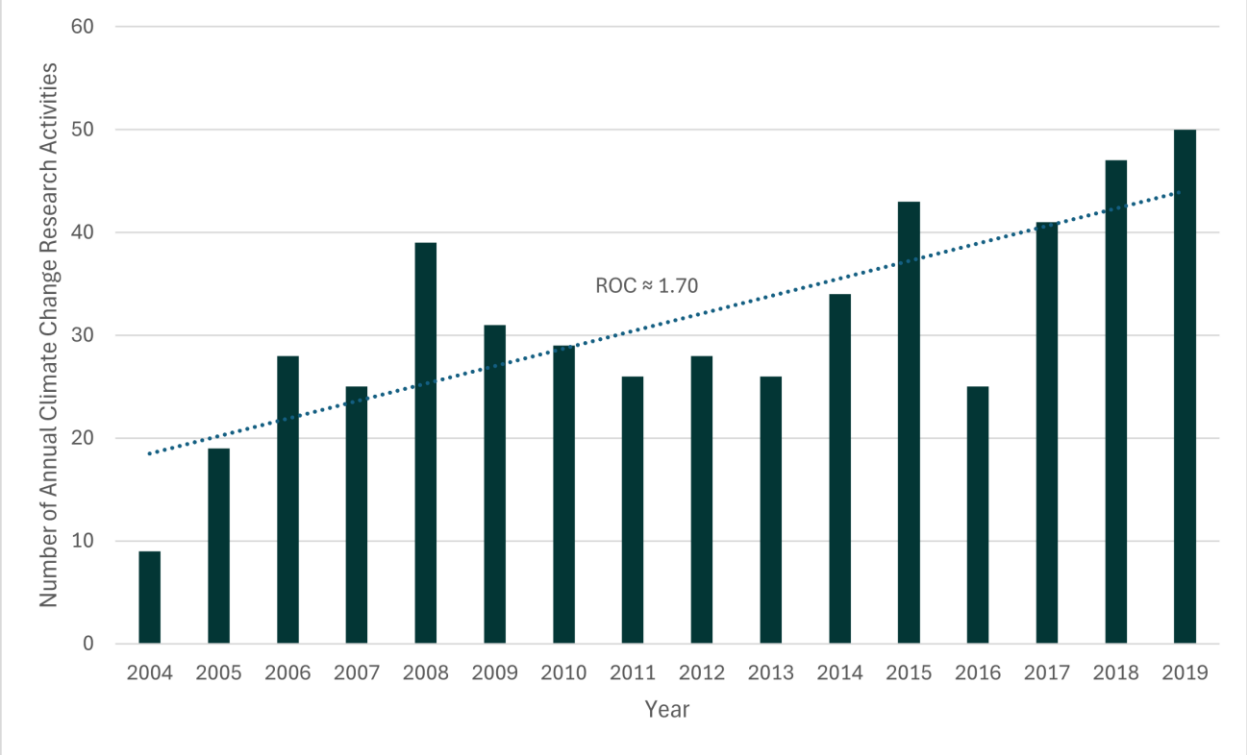
The number of annual climate change research activities peaked in 2019 at 153 annual activities or around 10.9% of the total number of annual activities (1410 activities). Prior to 2020, and within the four licensing/permitting agencies, 2013 had the least number of activities at 57 projects. Beginning in 2020, the prevalence of research licensed and permitted declined to 103 projects due to the COVID-19 pandemic, which is only 3.5% less than 2019. Many existing projects in 2020 and 2021 are represented by multiyear projects from previous years rather than projects that were directly licensed, permitted, or funded in those years. Much of the work tracked for those two years was permitted by the NRI or funded by CCPN or ICBCM, which maintained similar numbers to years prior. Among the three funding programs, CCPN has consistently funded the most climate change work. Compared to other regions globally, the discrepancy in work continuing to be licensed, permitted, or funded may be due to a delay in COVID-19 restrictions in Nunavut during the first year of the pandemic (Government of Nunavut, 2020).

4.2.2 Rates of Change

Since Figure 4.2 combines data from all seven databases, some of which do not have complete datasets for 2004-2021, it does not accurately display the positive trend in climate change-related work and research. To address this, Figures 4.3 - 4.9 display trendlines for each of the seven databases to highlight the rate at which climate change

activities increased over the years, otherwise known as the rate of change (ROC), for their respective years of available data. All the following graphs have a positive ROC to varying degrees. Each of these figures includes data until 2019 to better demonstrate the positive trend prior to the pandemic. As climate change project activities increase in 2021 following 2020 in Figure 4.2, it can be extrapolated that similar positive trends would have continued otherwise.

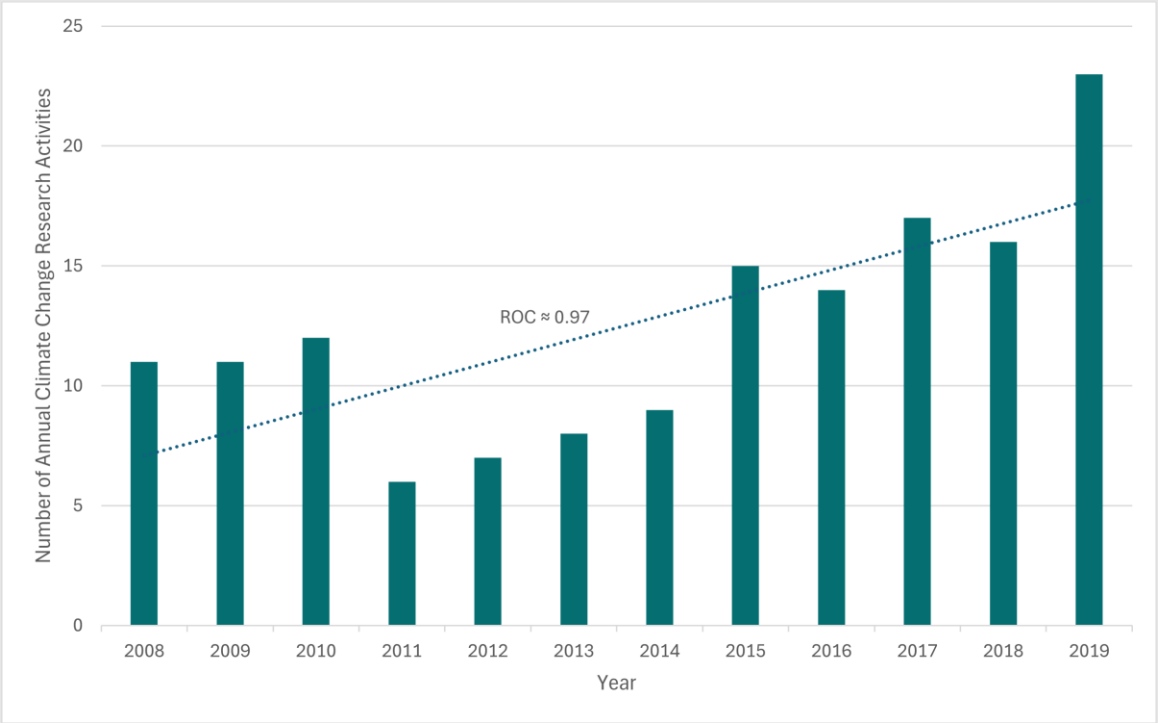
Figure 4.3. The rate of change for annual climate change research activities licensed by the NRI



As shown in Figure 4.3, although there are a varying number of annual projects licensed by the NRI, there is a positive ROC at about 1.7 annual activities per year, with

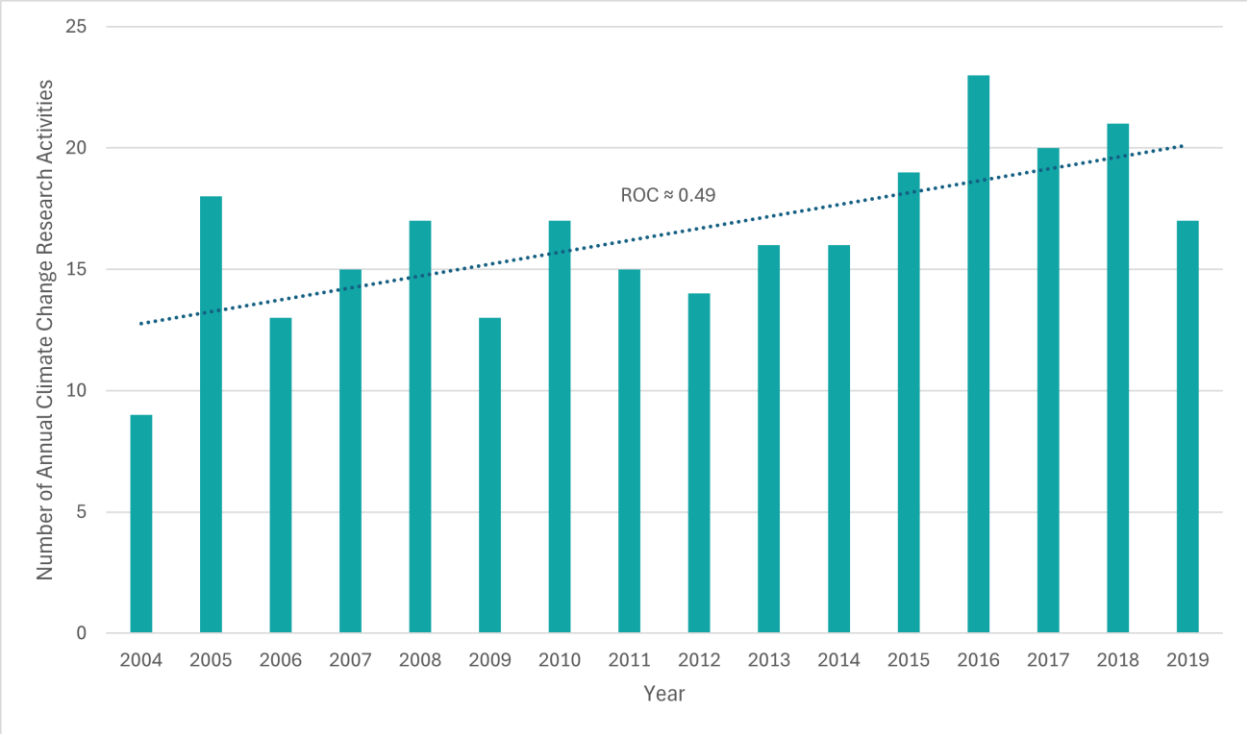
the most research taking place in 2019 (50 annual activities). The first year included, 2004, had the least number of annual activities (9 total).

Figure 4.4 The rate of change for annual climate change research activities licensed by the GN Department of Environment



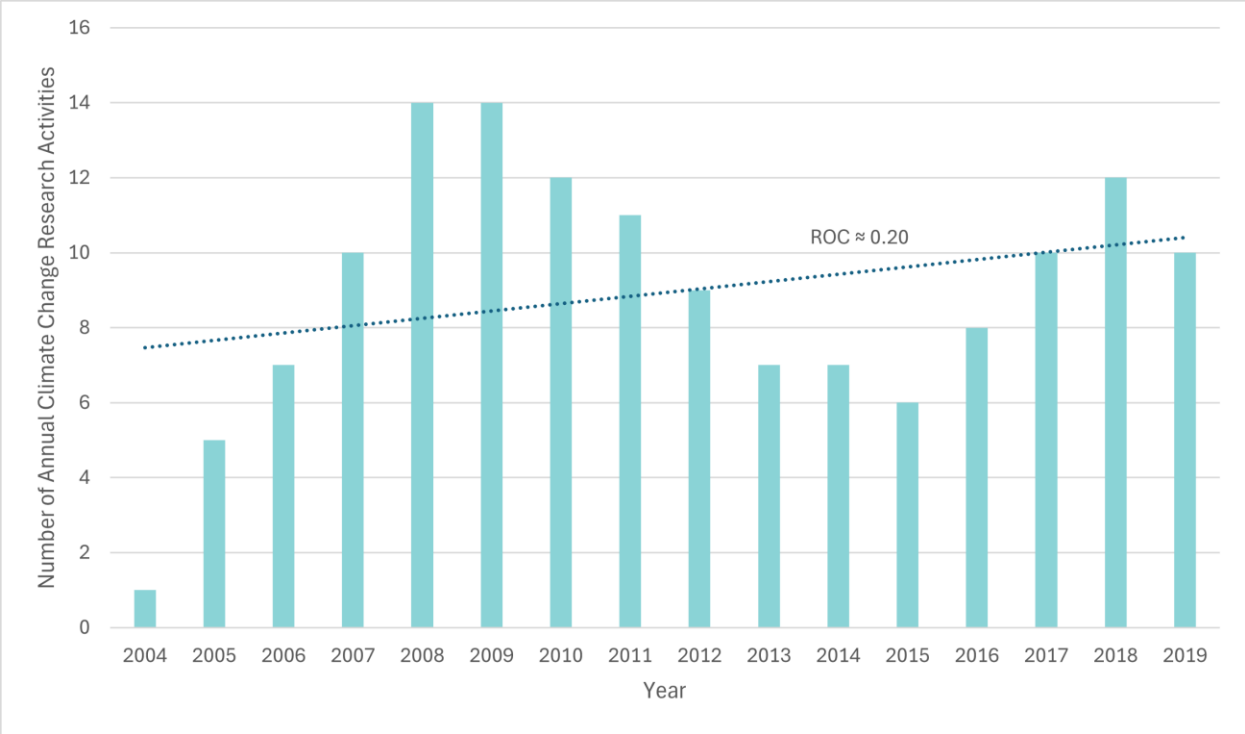
As demonstrated by Figure 4.4, there is a positive trend of approximately 0.97 annual activities per year. For the GN, climate change-related wildlife research occurred the least in 2011 at 6 annual activities. Projects between 2011 and 2014 remained solely in the single digits. By 2019, however, this number nearly multiplied four times at 23 annual activities.

Figure 4.5. The rate of change for annual climate change research activities permitted by Parks Canada



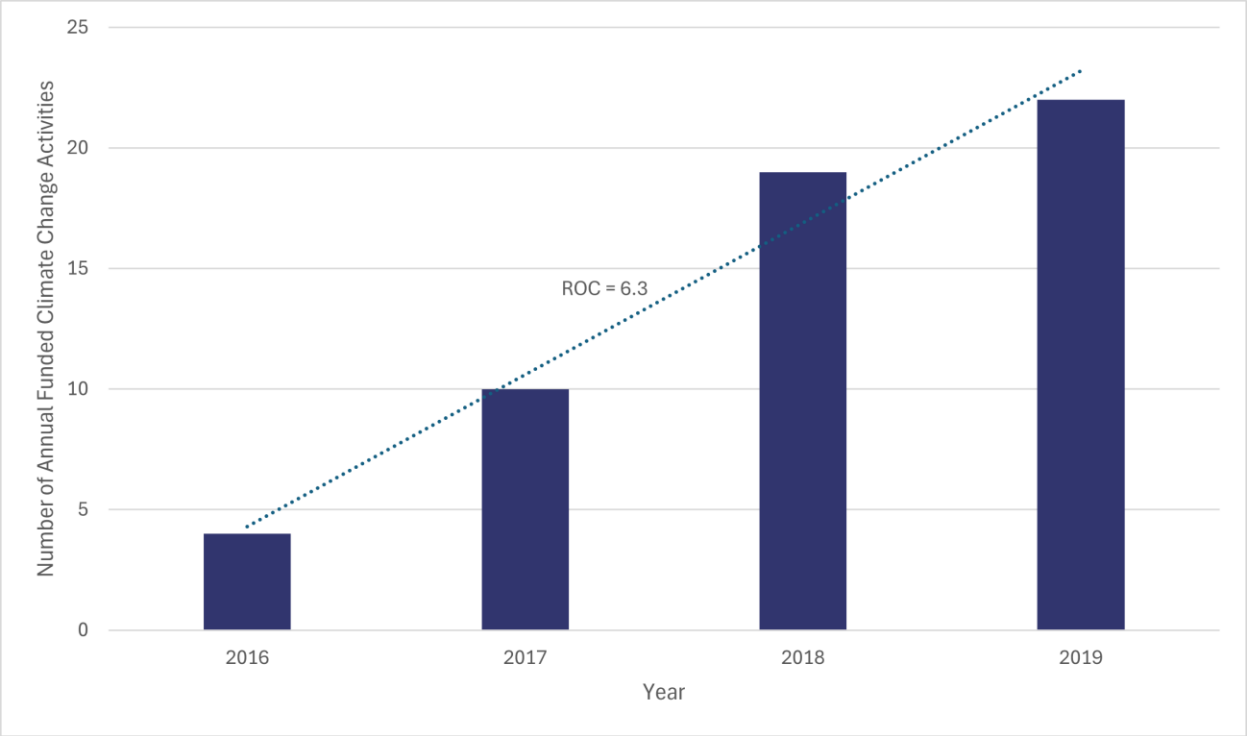
Annual activities for Parks Canada also increased by an ROC of 0.49 annual activities across the 15-year period (Figure 4.5). In 2004, there were nine activities in contrast to 2016, which recorded a high of 23.

Figure 4.6. The rate of change for annual climate change research activities permitted by Fisheries and Oceans Canada (DFO)



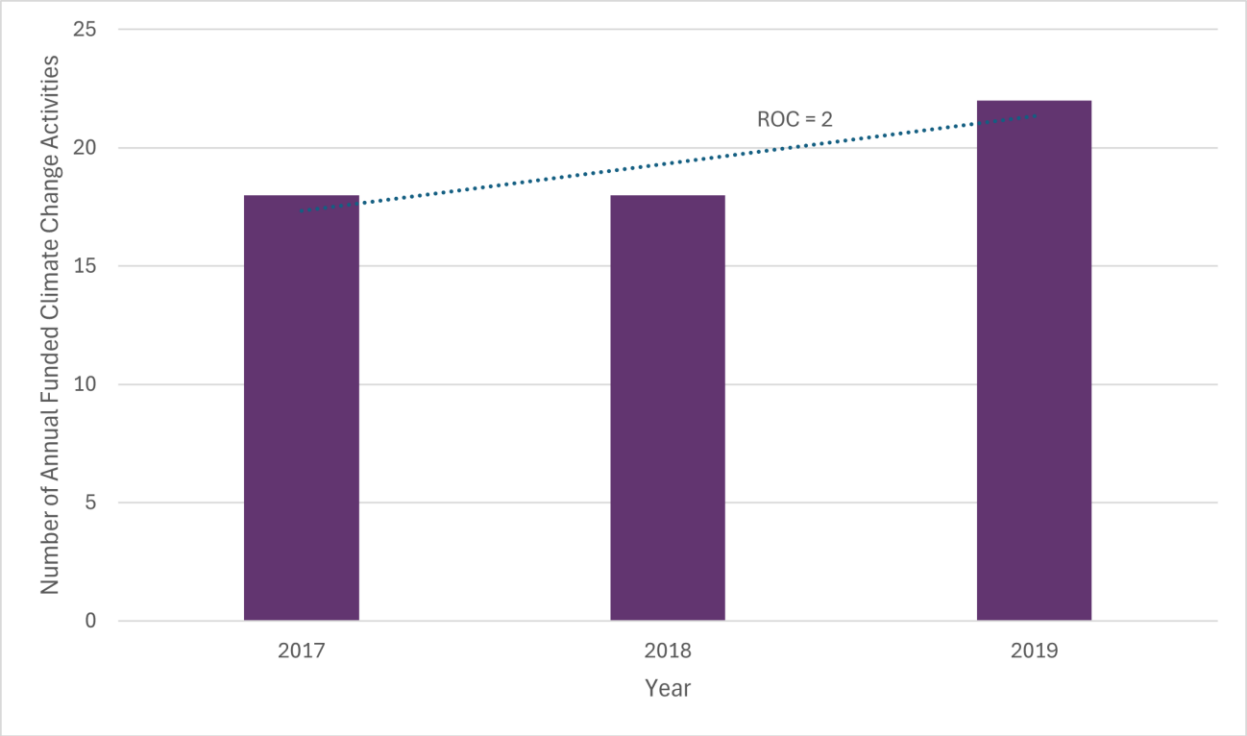
The DFO database had the lowest ROC of all seven databases at 0.20 annual activities per year (Figure 4.6). Besides the GN DoE database, which does not currently include data for the full range of years, the DFO has the lowest number of climate change projects permitted in 2004 among the licensing/permitting agencies. According to their database, the most climate change-related work was permitted in 2008 and 2009, with 14 annual activities per year.

Figure 4.7. The rate of change for annual climate change project activities funded by the Climate Change Preparedness in the North Program (CCPN)



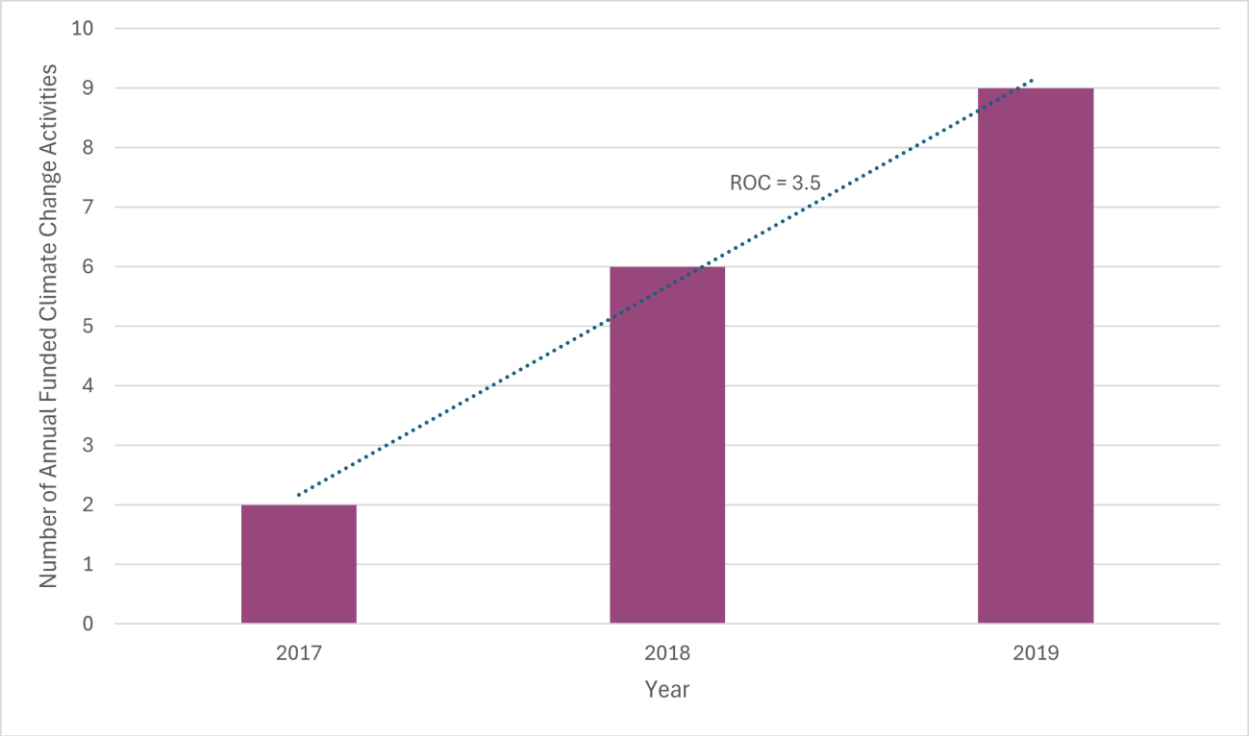
The CCPN program is the only one of the three funding programs with data beginning in 2016 rather than 2017 (Figure 4.7). The CCPN database has the highest ROC of all databases at a rate of 6.3 activities per year. In 2019, the program funded a high of 28 annual activities compared to a low of 4 in 2016, increasing seven times within the span of four years.

Figure 4.8. The rate of change for annual climate change project activities funded by the Indigenous Community-Based Climate Monitoring Program (ICBCM)



The ICBCM database had an ROC of 2 annual activities per year between 2017 and 2019 since the earliest year with data available is 2017 (Figure 4.8). Although this database has a low of 18 annual activities in 2017 and 2018, with a high of 22 in 2019, this is not indicative of key findings due to the significantly lower subset of years included in this study. Many of the projects included in this figure are repeated across the years as they are typically funded for multiple years.

Figure 4.9. The rate of change for annual climate change research activities permitted by the Climate Change and Health Adaptation Program (CCHAP)



As shown in Figure 4.9, CCHAP funded two activities in 2017 compared to nine in 2019, leading to a 3.5 rate of change. Although the number of annual activities tripled between 2017 and 2019, the total number of annual activities funded is low in contrast to the other databases.

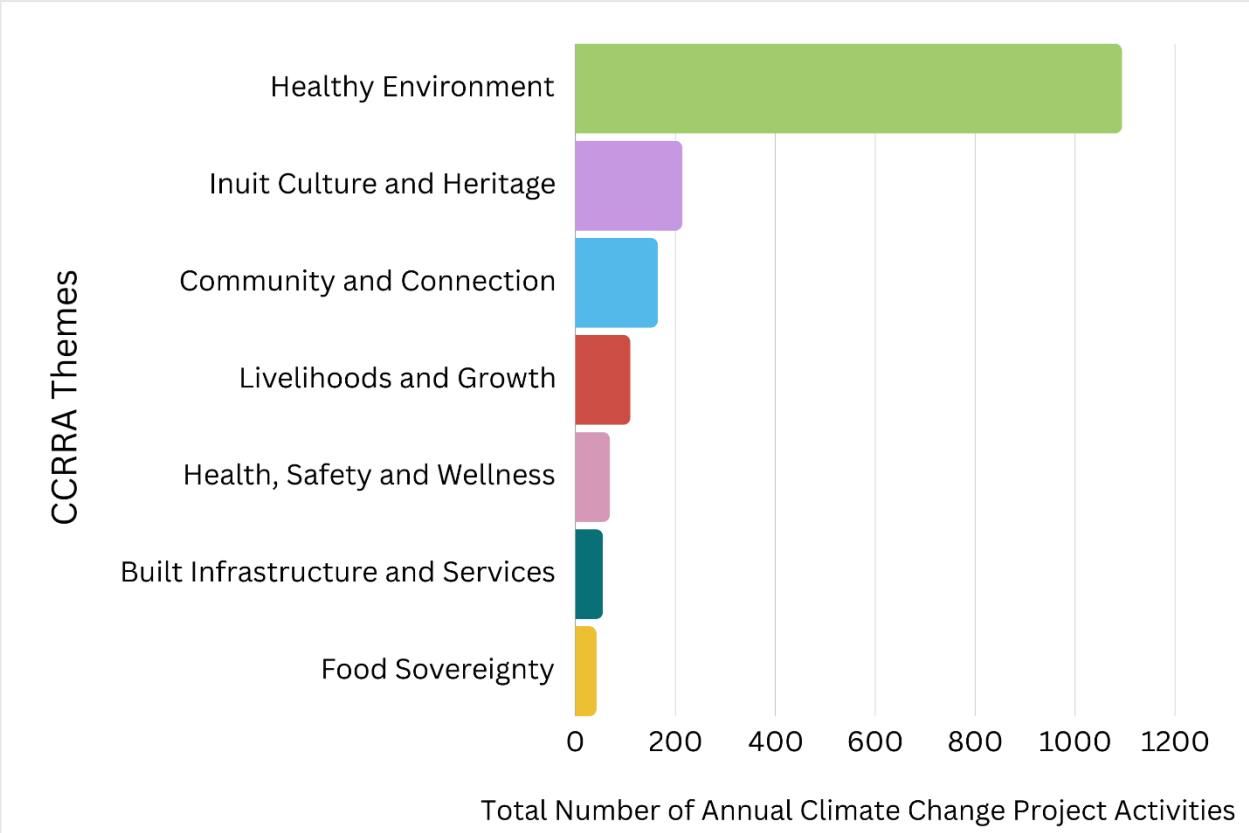
Overall, the CCPN database has the highest ROC (6.3 annual activities per year), while the DFO has the lowest (0.2). However, this discrepancy in trendlines is significantly due to the limited subset of years provided for this research; three years (CCPN) compared to 16 (DFO) for these figures. This remains true for all funding agencies. Although the funding databases all have substantially higher rates of change

when compared to the licensing/permitting agencies, they are based on data from much fewer years, yielding results with limited reliability. Nevertheless, this indicates that the CCPN, ICBCM, and CCHAP programs have increasingly funded more annual activities every year, which is to be expected as they actively seek climate-related projects.

4.3 Which Climate Change Themes Have Been Covered?

This sub-section presents the results according to relative coverage of the seven CCRRA themes (Figure 4.10). First, I will provide an overview of all themes, followed by a topical breakdown of each of the themes' sub-themes (secondary-, tertiary-, and quaternary-level themes).

Figure 4.10. Total number of annual climate change project activities relating to each of the seven CCRRA thematic areas from 2004-2021

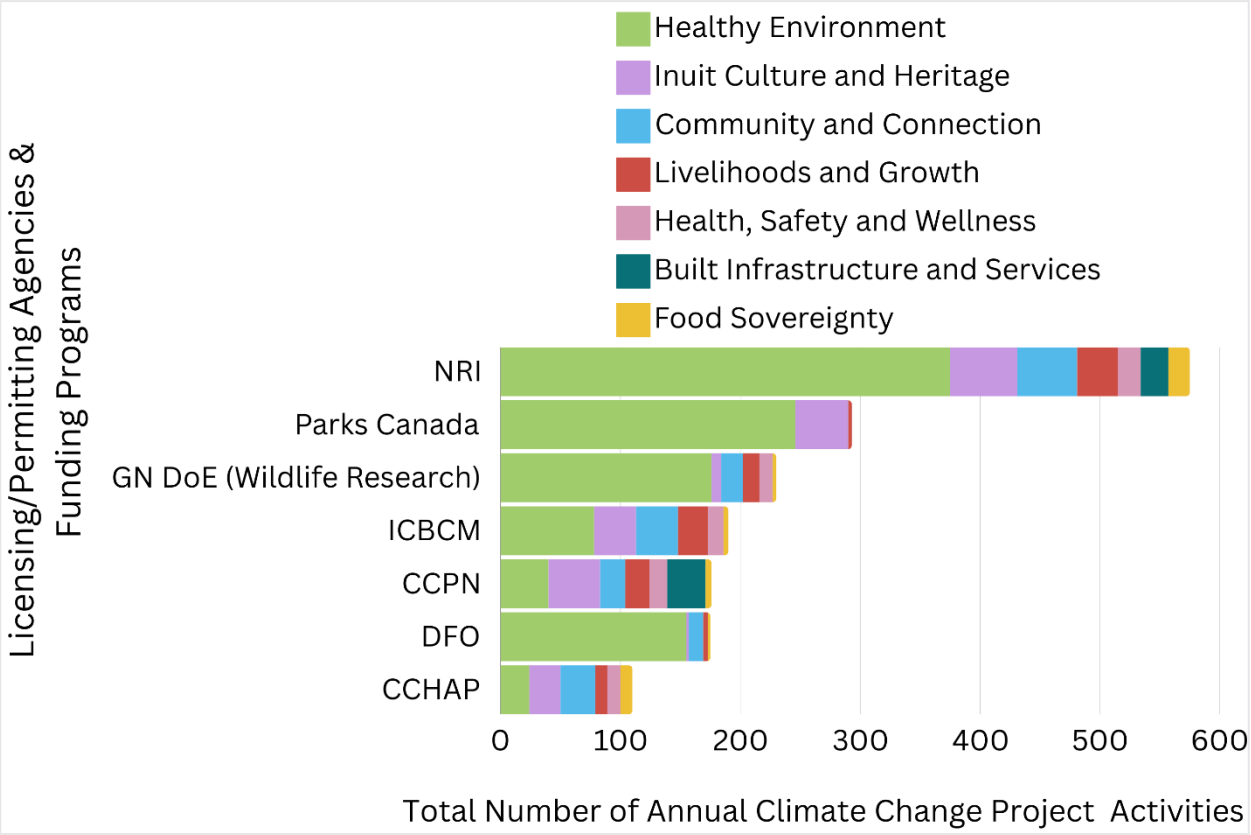


Note. If a project has more than one prominent theme, it has been coded to more than one CCRRA theme, once per year. As such, the numerical totals in this figure will differ from previous figures.

The Healthy Environment theme accounts for approximately 62.6% of all annual climate change project activities over the last two decades. This includes 1095 annual activities for Healthy Environments, the majority of which are physical and natural sciences projects from wildlife-related databases (GN DoE, Parks Canada, DFO). This is due to the size of wildlife databases, which consist of more project summaries than

funding databases, which are limited in temporal scope. However, social sciences projects are included in the Healthy Environment theme as well. Healthy Environments also includes approximately five times more projects than the second-most prominent theme: Inuit Culture & Heritage (213). Food Sovereignty is the least dominant theme (42).

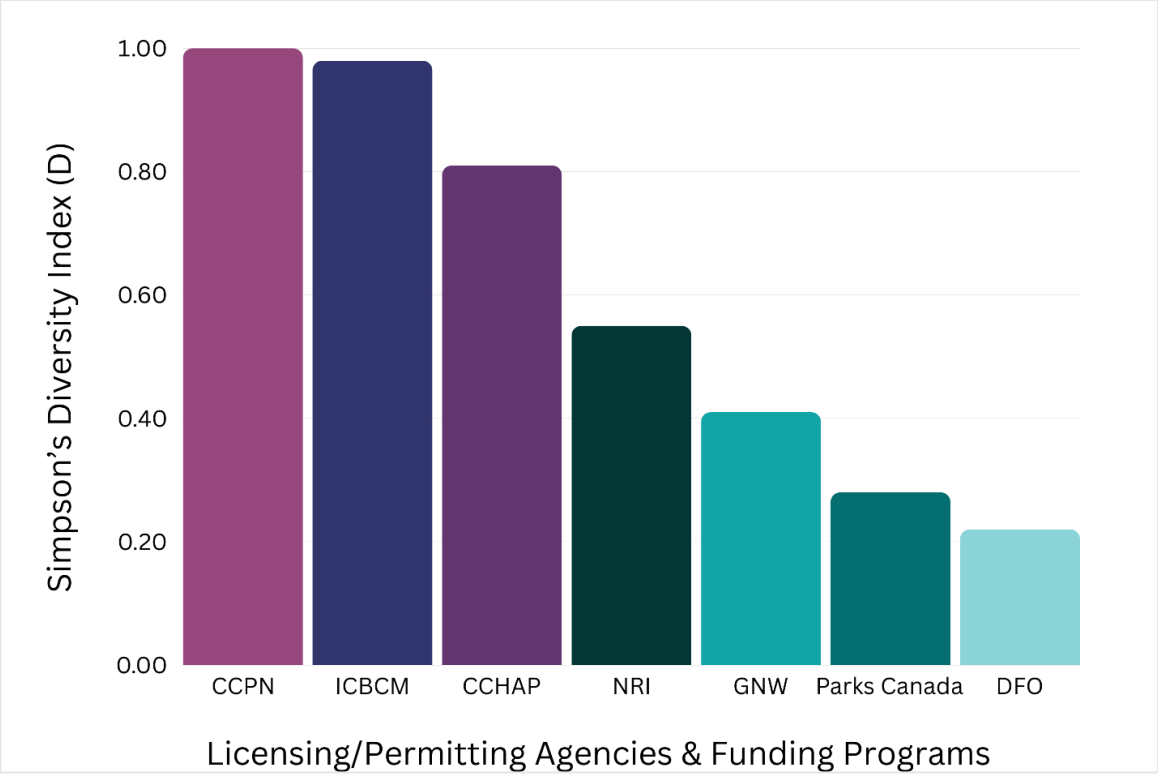
Figure 4.11. Total number of annual climate change project activities per licensing/permitting agency and funding program by CCRRA themes



As illustrated in Figure 4.11, only two databases included climate change projects from all seven CCRRA themes: the NRI and CCPN. As the most established database with a process that licenses multiple disciplines of scientific research, the NRI has been

leading in the number of annual activities for all themes except for Built Infrastructure and Services (23). In fact, despite only recording a total of 176 annual activities, the CCPN has had the greatest number of annual activities in the Built Infrastructure theme (32). As seen in the top four bars of Figure 4.11, much of the research licensing and permitting agencies are dominated by the Healthy Environment theme, which includes flora, fauna, and ecosystems. With a total of 1094 annual activities, this theme will be further examined in the following subsections of this chapter. Contrastingly, Food Sovereignty was the least present among most databases at a total of 42 annual activities. While the NRI and CCPN databases were the only two to involve all seven CCRRA themes, the Parks Canada database had the lowest number of themes (3), along with the DFO (4). This is due to the specificity of their research permits, which relate to National Parks and National Historic Sites, as well as aquatic ecosystems, respectively. Figure 4.12 further examines this through Simpson's Diversity Index.

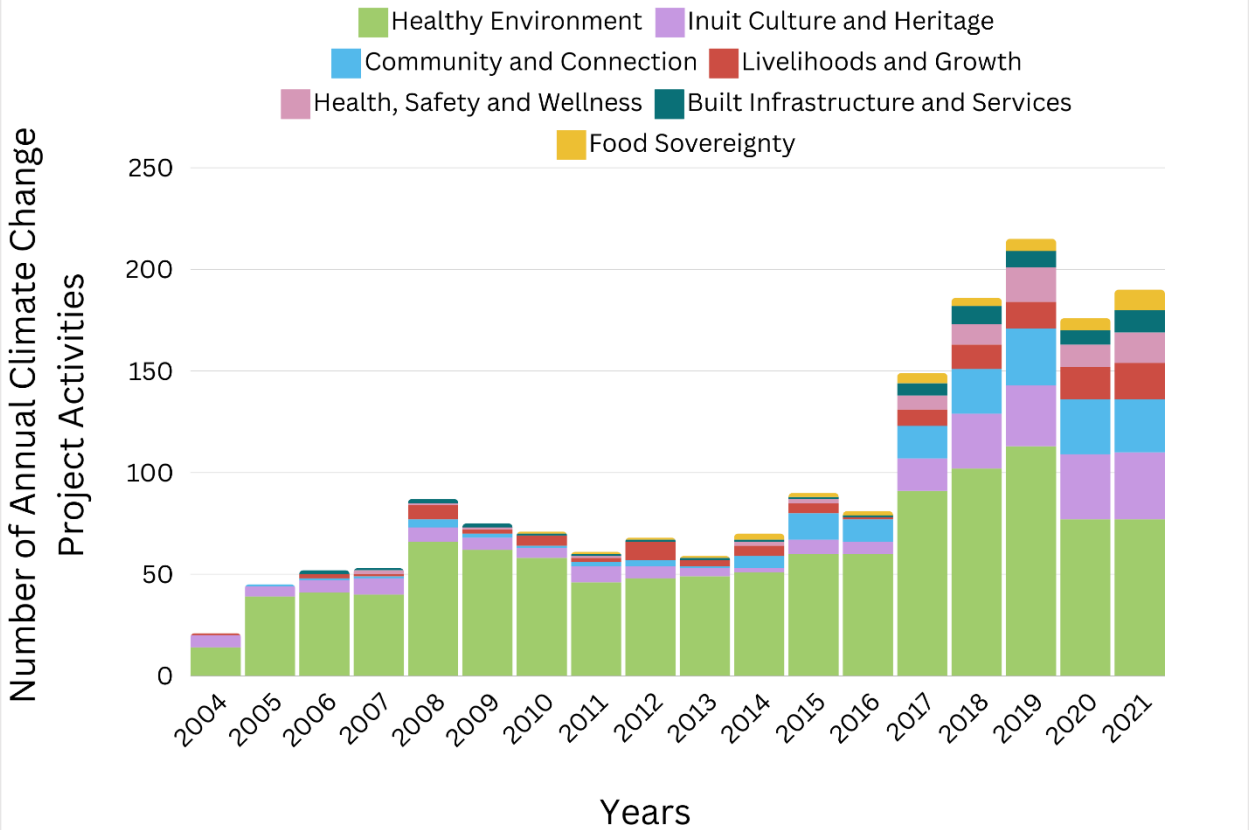
Figure 4.12. Simpson's Diversity Index for each of the databases



Where 1.00 on the diversity scale represents high diversity of the seven themes, and 0.00 represents a complete lack of diversity, CCPN is the most thematically diverse as its score of 0.999 was rounded up to 1.00. All funding programs are in the top three positions for being very heterogeneous as they each involve projects that simultaneously support multiple themes. At the other end of the spectrum, the DFO features the lowest diversity at an index of 0.21 as the most homogenous database. DFO projects relate primarily to the Marine & Aquatic Ecosystems secondary theme under the Healthy Environment theme, which leads to projects that were often only coded to solitary themes. This is further analyzed in the subsection below. The databases with the

greatest number of annual activities in Figure 4.12 are also those with the lowest thematic diversity.

Figure 4.13. Number of annual climate change project activities per year by CCRRA themes



Next, Figure 4.13 clearly indicates the addition of funding data from 2016 onwards due to the increased thematic heterogeneity. While Healthy Environment remained a dominant theme across all 18 years, with Inuit Culture and Heritage present, the first Food Sovereignty theme was first recorded in 2010. Similarly, although the first few Health, Safety and Wellness projects emerged in 2007, these two health-related

themes are barely distinguishable until 2017, or the addition of funded climate change work.

If Healthy Environments primarily represents physical and natural sciences, Inuit Culture and Heritage, Community and Connection, and Livelihoods and Growth consist mostly of Inuit knowledge and social sciences research. Critically, these three themes have also significantly increased since 2017.

4.3.1 Breakdown by CCRRA Thematic Areas

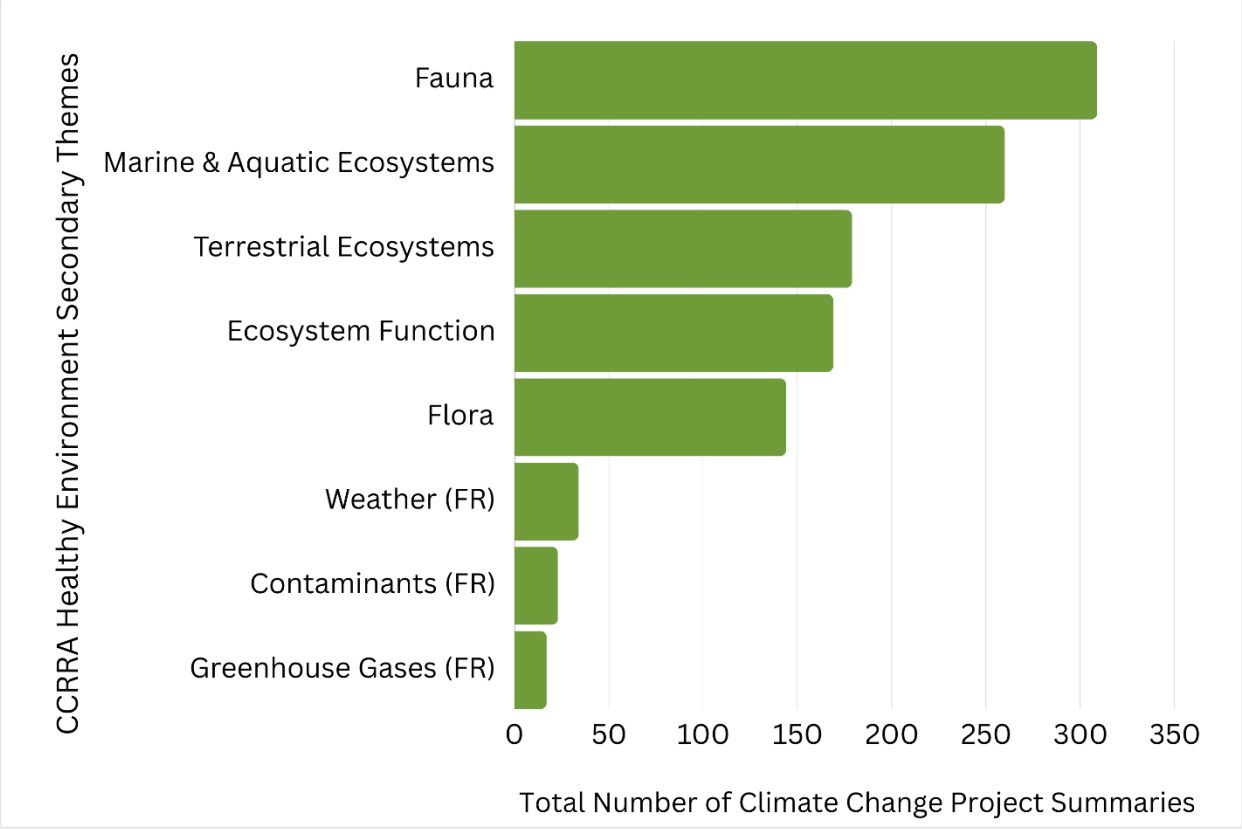
The following sections provide more insight into the diversity of each of the seven themes' sub-themes. See Appendix 6 for a comprehensive list of the total number of project summary documents coded to every key theme and sub-theme. Where I have contributed new themes to the original CCRRA themes, I have indicated with my initials, "FR," in brackets following the theme name. Projects coded to newer and/or more detailed themes are captured by additional figures, which include breakdowns of secondary, tertiary, and quaternary themes. While the previous figures are based on the total number of annual activities, the following figures are based on counts for unique project summary documents (e.g. database files), representing lower numbers than annual project activities. Although all projects are coded to a minimum of one of the seven key themes, they are not necessarily coded to secondary, tertiary, or quaternary themes, especially depending on the level of detail available or provided by each database. Sub-themes are only coded when identified as predominant or reoccurring in

the project summary. As a result, the total sum of counts for sub-themes are not equivalent to totals for each of the key themes.

Healthy Environment (625 Project Summaries)

Data sourced from the following databases all contributed primarily, if not only, to the Healthy Environment theme: GN Department of Environment (Wildlife Research), DFO, and Parks Canada.

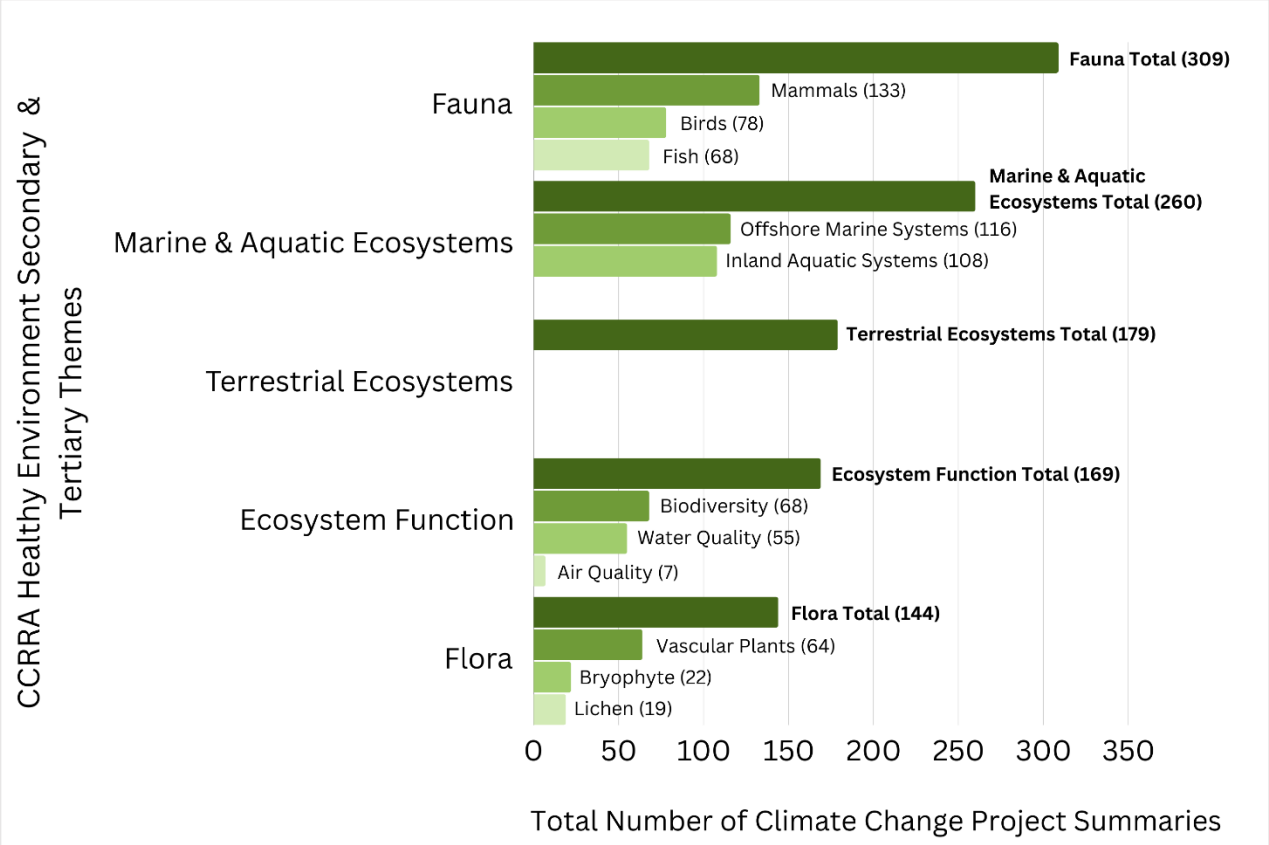
Figure 4.14. Healthy Environment – Secondary themes



As displayed in Figure 4.14, much climate change work is included in Fauna (309), which is over a third of the total number of documents coded to Healthy Environments

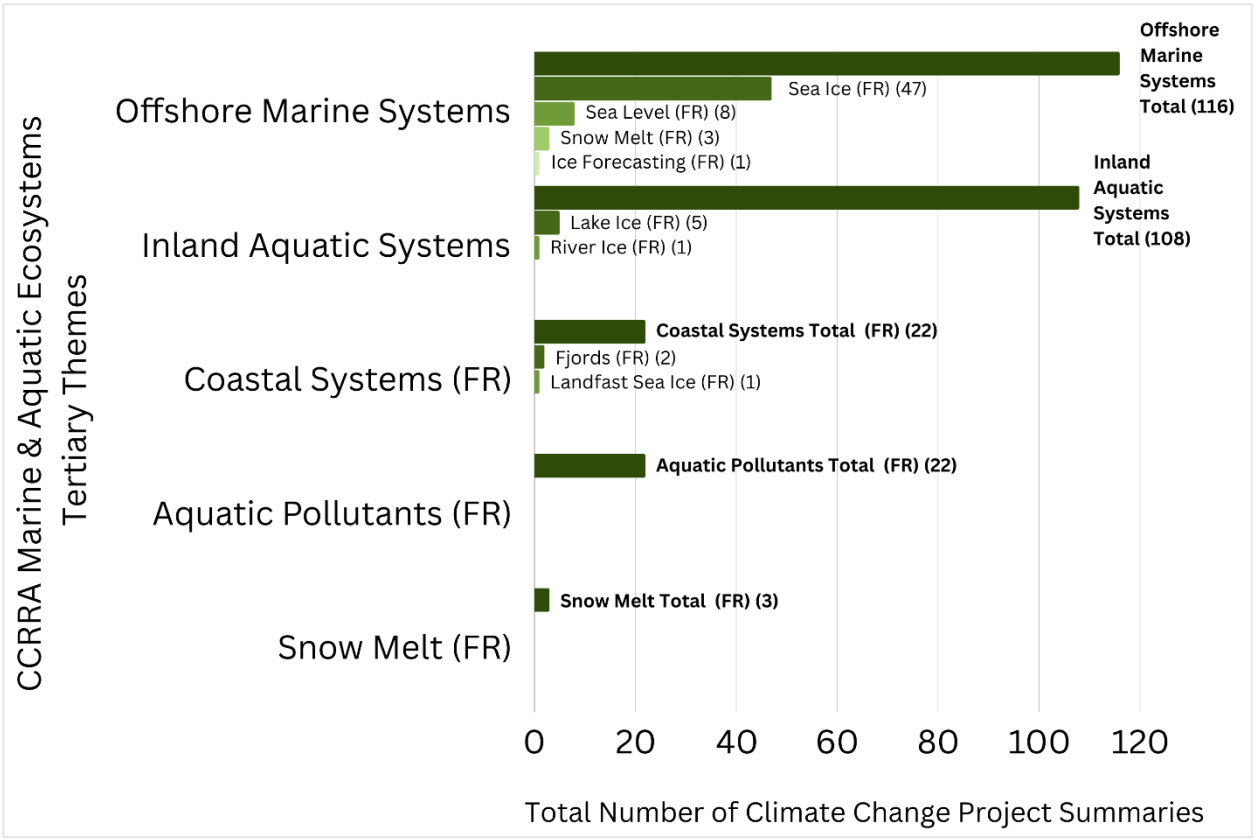
(625). As aforementioned, this result is to be expected as many Nunavut licenses and permits are related to the protection of wildlife and safety or ethics in handling them. The secondary themes within the Fauna sub-theme feature projects on mammals (133) as the most common wildlife focus in Nunavut climate change research, followed by Birds (78) and Fish (68) (Figure 4.14). The darkest bars in Figure 4.15 have "Total" in their bar labels to indicate that they are the secondary themes. Lighter coloured bars underneath represent tertiary-level themes. This remains true for the following rigures related to Healthy Environment, as well as other CCRRA themes.

Figure 4.15. Healthy Environment – Secondary theme totals with tertiary themes



Since the DFO exclusively permits projects relevant to aquatic environments, the Marine & Aquatic Ecosystems secondary theme evidently has the second-most project summaries coded (260). In Figure 4.16, the number of projects that have explicitly indicated saltwater (Offshore Marine Systems, 116) or freshwater (Inland Aquatic Systems, 108) ecosystems do not differ drastically. Flora (144), the secondary theme with the lowest number of unique documents coded, is less than half the total number of projects in Fauna.

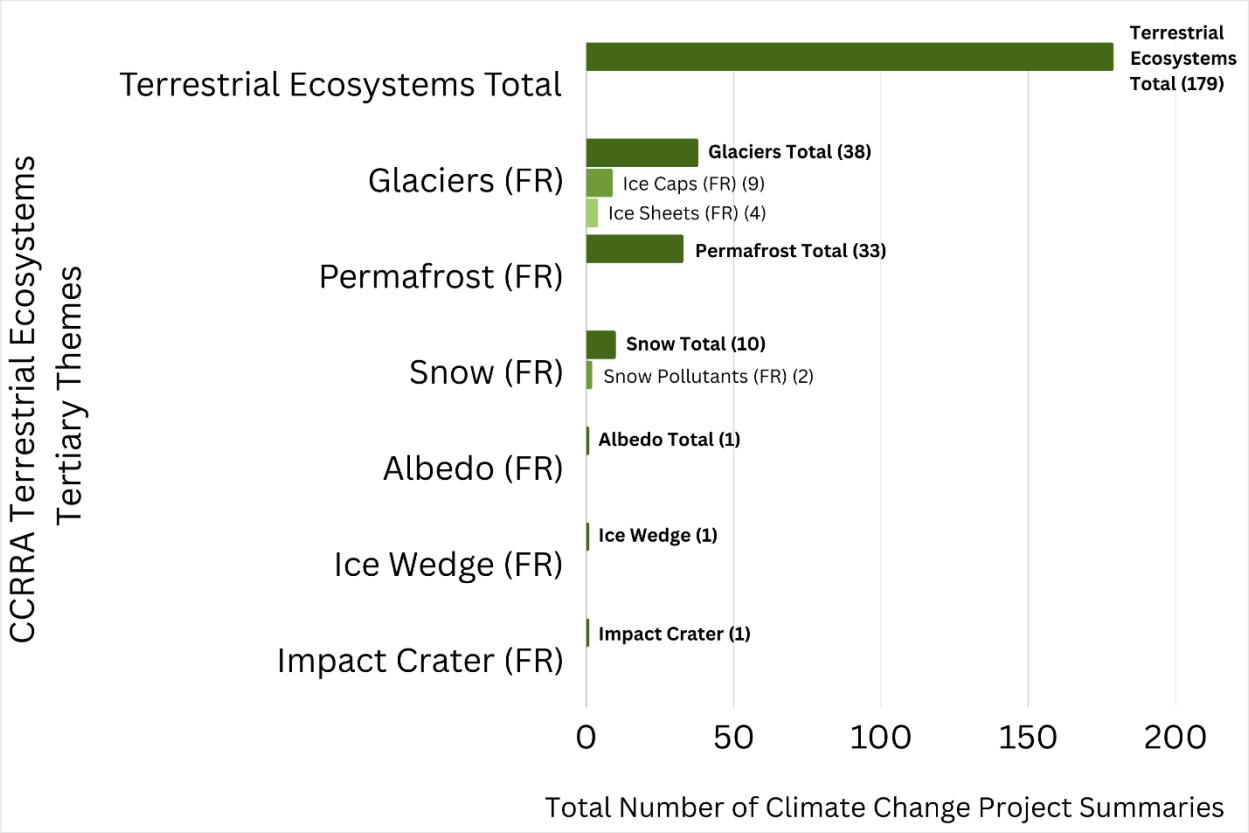
Figure 4.16. Healthy Environment – Tertiary theme totals with quaternary themes



Due to identified thematic gaps in the existing CCRRA themes during the coding process, the most significant additions of new themes are within the Healthy Environment category (See Section 5.3 in Discussion). Most notably, many new themes were added to Marine & Aquatic Ecosystems, such as Sea Ice (47 project summaries), Coastal Systems (22), Aquatic Pollutants (22), and Sea Level (8) (Figure 4.16). Although sea ice is a significant theme in climate change in the North, this number would be greater if other project summaries not coded to Sea Ice were more explicit in identifying the topic as a primary area of study.

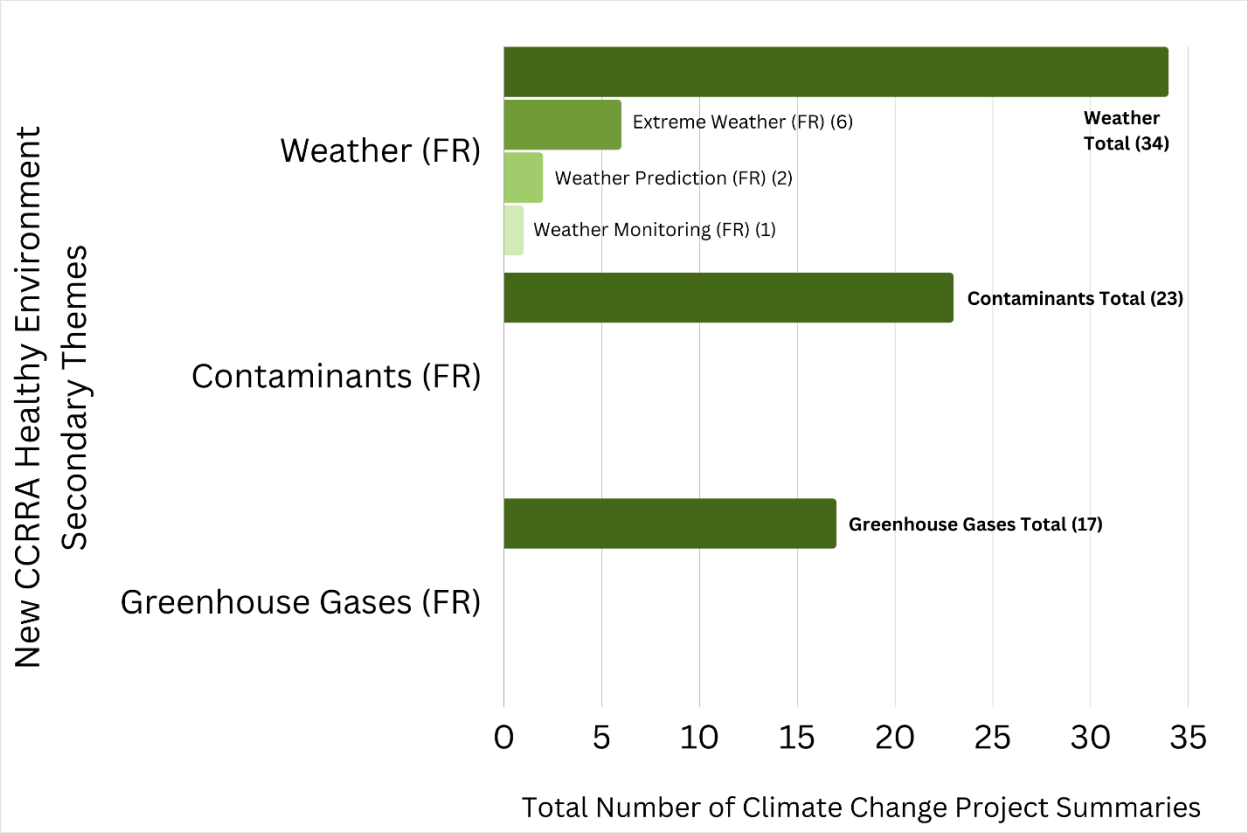
New tertiary themes were also added across all secondary themes. Examples of a Healthy Environment project include a 2008-2009 government-led study on the effects of global warming on narwhal and beluga whales in the Hudson Bay, based on samples from local Inuit hunters from Arviat, Repulse Bay, and Sanikiluaq (*Global Warming and Arctic Marine Mammals*, 2008). This project, permitted by DFO, is at the intersection of the Marine & Aquatic Ecosystems and Fauna sub-themes.

Figure 4.17. Healthy Environment – Terrestrial Ecosystems tertiary themes



The GC, DFO, and Parks Canada also contributed considerably to this theme. Within the Terrestrial Ecosystems secondary theme, prominent new themes include Glaciers (38), Permafrost (33), and Snow (10) (Figure 4.17).

Figure 4.18. Healthy Environment – New secondary and tertiary themes



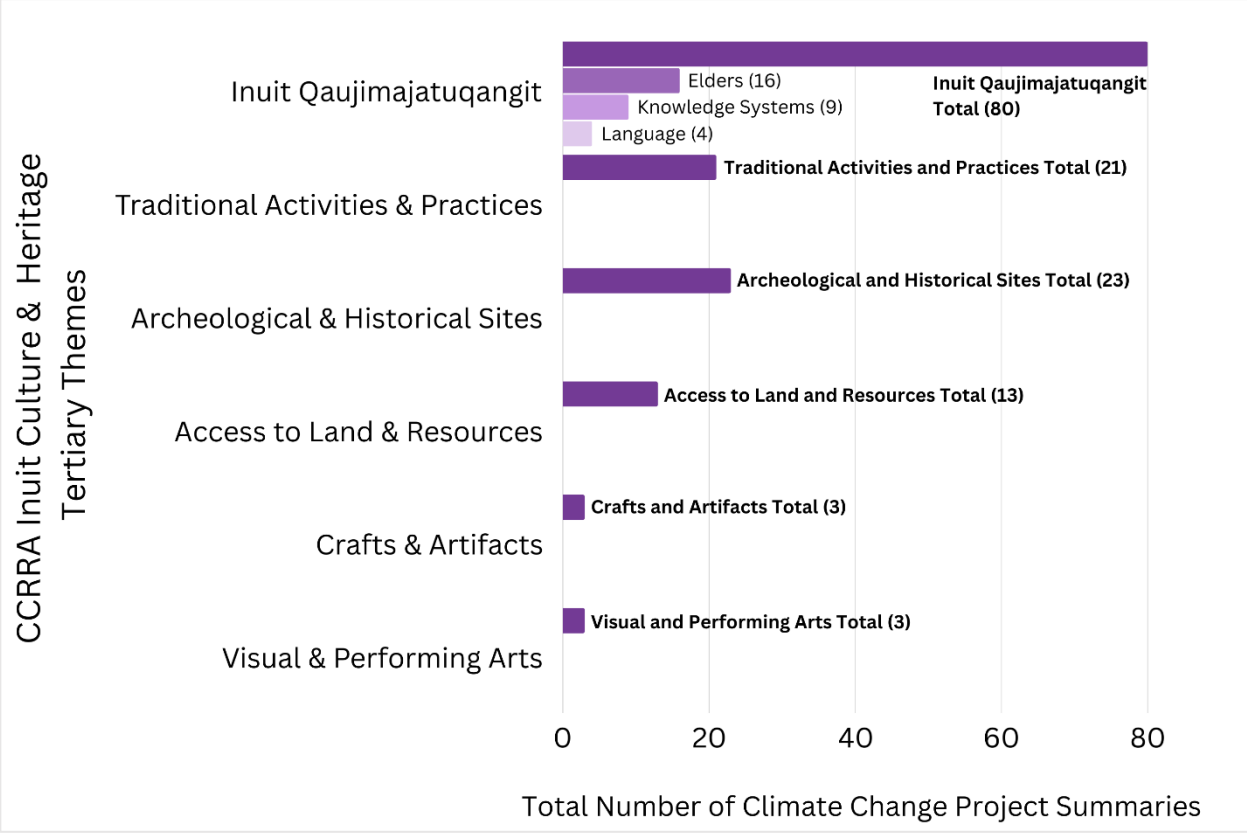
Finally, Figure 4.18 highlights three secondary-level sub-themes that were not represented in original CCRRA themes: Weather (34), Contaminants (23), and Greenhouse Gases (17). Since weather patterns are also critical both in understanding climate change and daily travel on the land, this was added as a secondary theme with more specific tertiary themes as well. Additional examples of Healthy Environment include a water quality assessment in Quttinirpaaq National Park (St. Louis, 2019), study of climate change and arctic tundra berry ecology (Levesque et al., 2011), and a research program near Clyde River investigating shifts in glaciers and evidence of historic climate

change (Anderson, 2006). This theme encompasses the widest variety of research projects.

Inuit Culture & Heritage (121 Project Summaries)

Inuit Culture & Heritage is the CCRRA theme with the second highest number of project summaries (121) but is much less than Healthy Environments. Within this theme (Figure 4.19), most climate change work relates to Inuit Qaujimajatuqangit (80) at approximately 66% of the entire primary theme.

Figure 4.19. Inuit Culture & Heritage – secondary themes



Within the context of this work, “Inuit Qaujimajatuqangit” is used as a code inclusive of projects that mention Inuit local and cultural knowledge or traditional knowledge (80

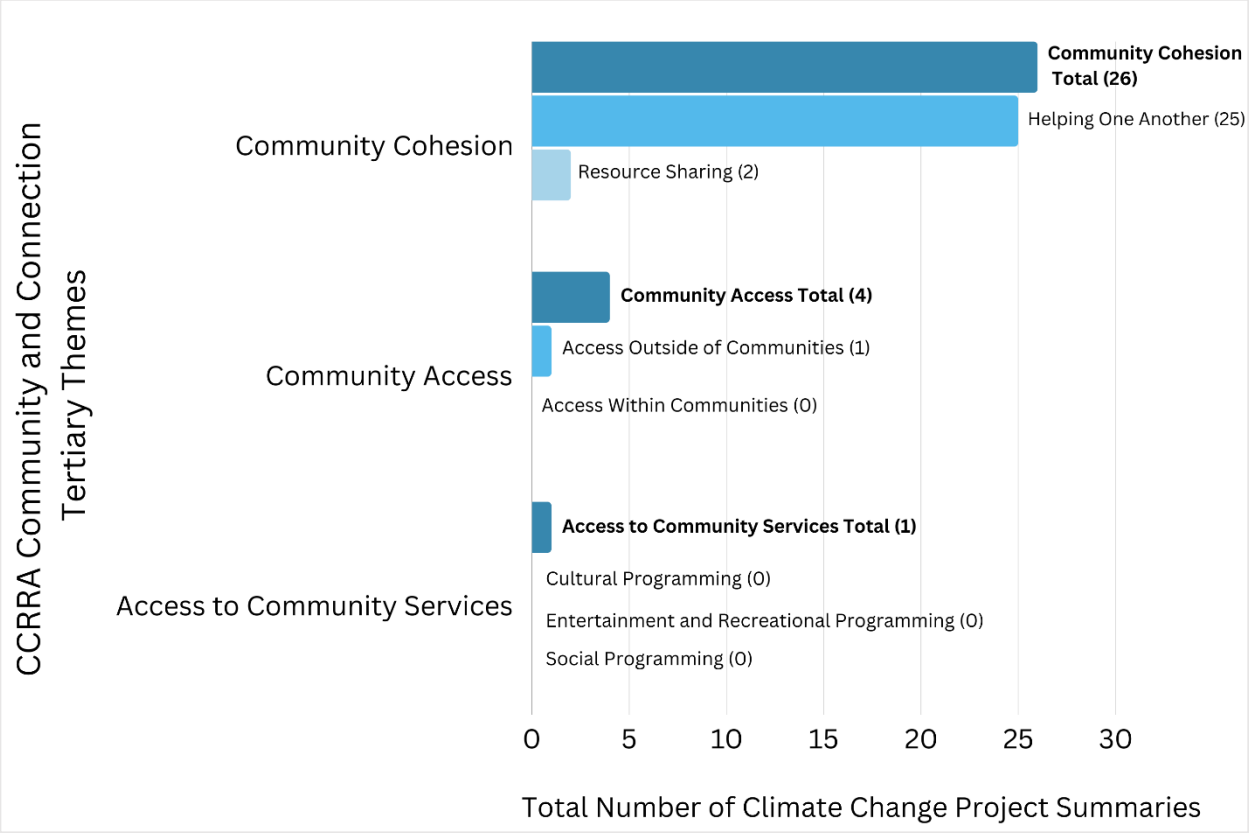
projects) (Figure 4.19). This theme is followed by Archeological and Historical Sites (23), Traditional Activities and Practices (21), and Access to Lands & Resources (13). In this category, there were the least number of projects in the Visual & Performing Arts and Crafts & Artifacts themes, with three projects in each. Overall, Inuit Qaujimajatuqangit was the most prominent secondary theme as it is nearly four times greater than the second-most prominent theme. More specifically, it is comprised of three tertiary themes: Elders (16), Knowledge Systems (9), and Language (4).

Examples of Inuit Qaujimajatuqangit projects include a study compiling existing IQ relating to snow geese and arctic foxes in Sirmilik National Park (Berteaux, 2005), a community-led caribou and muskoxen monitoring program spearheaded by a local Hunters and Trappers Organization (HTO) on Victoria Island (Ekaluktutiak Hunters & Trappers Organization, 2020), and a university-led documentary film on Pangnirtung Inuit knowledge relating to climate change (Mauro, 2009). Within this sub-theme, there was only one project from the DFO database: a DFO-led study on Hudson Bay marine forage fish that strived to include traditional knowledge (DFO, 2007). One of the few Crafts & Artifacts projects include a CCHAP-funded and hamlet-led land-based art program focused on the role of art in discussing climate change issues and resiliency in Kinngait and Pangnirtung (Hamlet of Pangnirtung, 2019).

Community & Connection (105 Project Summaries)

Most projects in this theme fell within the Community Cohesion theme (26), which is comprised of secondary themes including, Helping One Another (25) and Resource Sharing (2) (Figure 4.20).

Figure 4.20. Community & Connection – Secondary theme totals with tertiary themes



Most notably, many projects within the Community & Connection broad theme belonged to the Community-Based Research sub-theme, which is a secondary theme I added retroactively to the broader theme (85). Project summaries were coded to this sub-theme if there were direct mentions or strong implications to the following concepts: community-led and community-based work and/or work that benefits the

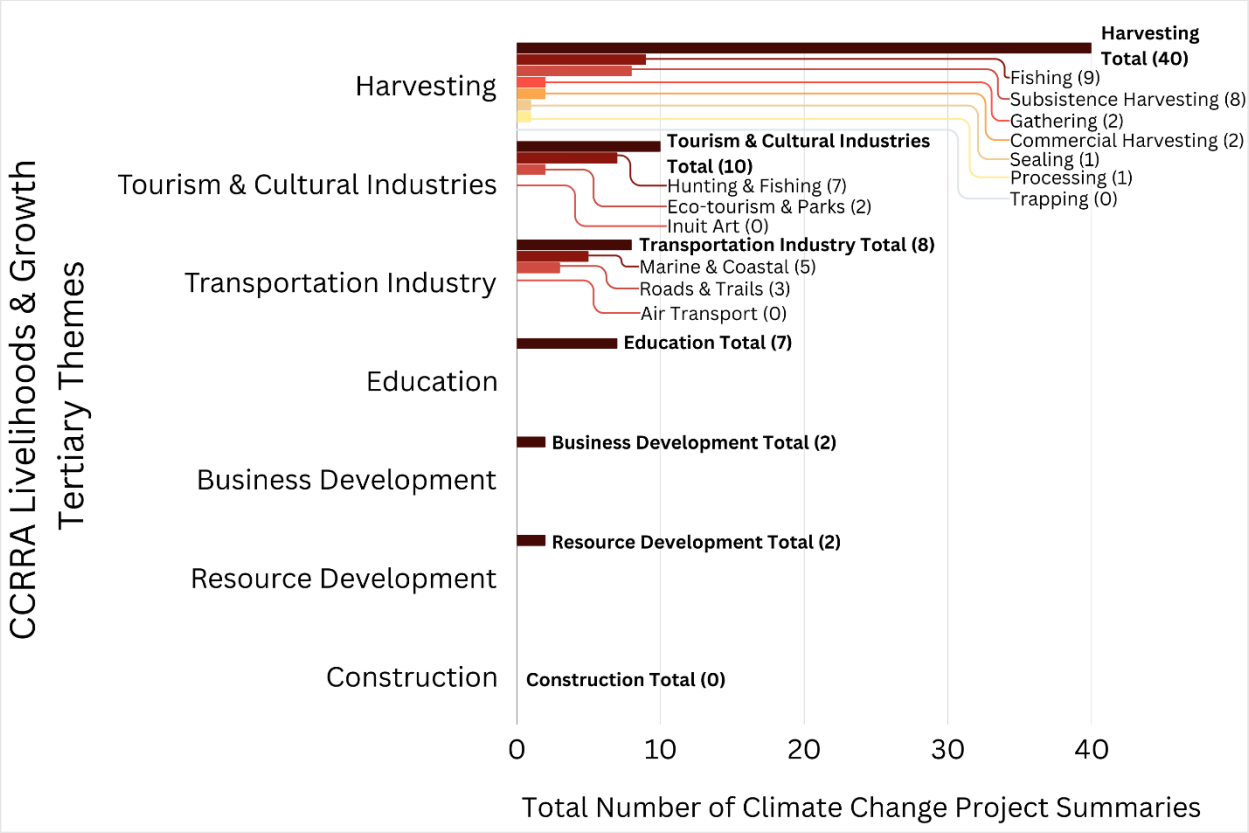
community or each other. Regarding Community Access (3), there is only one project in the Access Outside of Communities tertiary theme and none for Access Within Communities. No project summaries in this research were found to be relevant to the following tertiary themes for Access to Community Services: Cultural Programming, Entertainment and Recreational Programming, and Social Programming. Since the broader theme is not as well-defined, it was challenging to determine whether projects prioritized Community & Connection as a primary theme and leading force in the execution of their work. Hence, there are significantly fewer projects within this thematic area.

Community & Connection projects include a community-based study on experiences of Inuit women in Iqaluit on adapting to climate change (Bunce, 2014) and a community-based fish habitat adaptation project aiming to connect people and generations within and between Baker Lake and Taloyoak (ArctiConnexion et al., 2020). Additionally, funded climate change-related work includes examples such as a CCPN-funded initiative to fund a Climate Change Community Research Coordinator for the Qaujigiartiit Health Research Centre (Qaujigiartiit Health Research Centre, 2017).

Livelihoods & Growth (65 Project Summaries)

This next theme, Livelihoods & Growth is represented in Figure 4.21 primarily by the Harvesting tertiary theme (40), followed by Tourism & Cultural Industries (10), Transportation Industry (8), Education (7), Business Development (2), Resource Development (2), and none in the theme of Construction.

Figure 4.21. Livelihoods & Growth – Secondary theme totals with tertiary themes



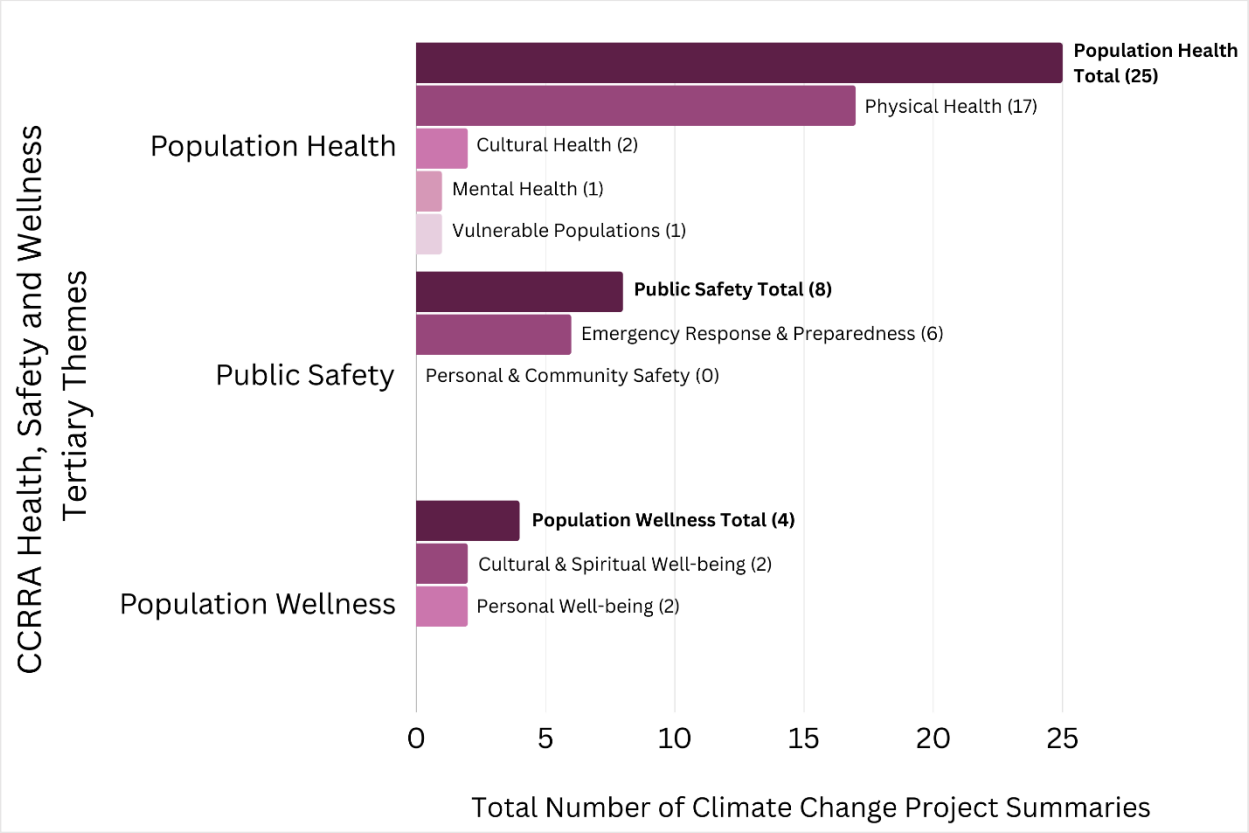
Representation in climate change databases for Harvesting is four times greater than Tourism & Cultural Industries as the former is comprised of a wide range of harvesting activities, such as Fishing (9), Subsistence Harvesting (8), Gathering (2), Commercial Harvesting (2), Processing (1), and Sealing (1), although there were none in the theme of Trapping. Similarly to the last theme, Community & Connection, ambiguity within certain sub-themes (secondary and tertiary) rendered it challenging to determine whether themes were adequately prominent in a project summary to be coded.

For instance, a hamlet-led project in Gjoa Haven and Taloyoak focused on monitoring sea ice conditions to support safety in travel for subsistence harvesting and cultural practices on the land (Hamlet of Gjoa Haven, 2019). A CCPN-funded project supports the Ujjiqsuiniq Young Hunters Program to further support youth in harvesting and stewardship practices (Aqqiumavvik Society, 2016).

Health, Safety & Wellness (50 Project Summaries)

Fifty projects were coded to Health, Safety and Wellness; half of which are related to Population Health (25), as shown in Figure 4.22. Most projects within the Population Health theme fell under the Physical Health tertiary theme (12) as opposed to Cultural Health (2), Mental Health (1), or Vulnerable Populations (1).

Figure 4.22. Health, Safety & Wellness – Secondary themes with tertiary sub-themes



Although the intersection of climate change and mental health appears to be a rising theme across Inuit Nunangat, such research priorities have yet to emerge to the same degree in Nunavut, as evidenced by existing databases. Physical Health has over 8 times as many projects as Cultural and Mental Health projects combined. Public Safety projects (8) are primarily concerned with Emergency Response & Preparedness (6) rather than Personal & Community Safety (0). Finally, Population Wellness (5) only consists of two projects each in Cultural & Spiritual Well-being and Personal Well-being. In general, few projects across all seven databases relate to the Health, Safety & Wellness key theme, despite being a critical component to climate adaptation, its

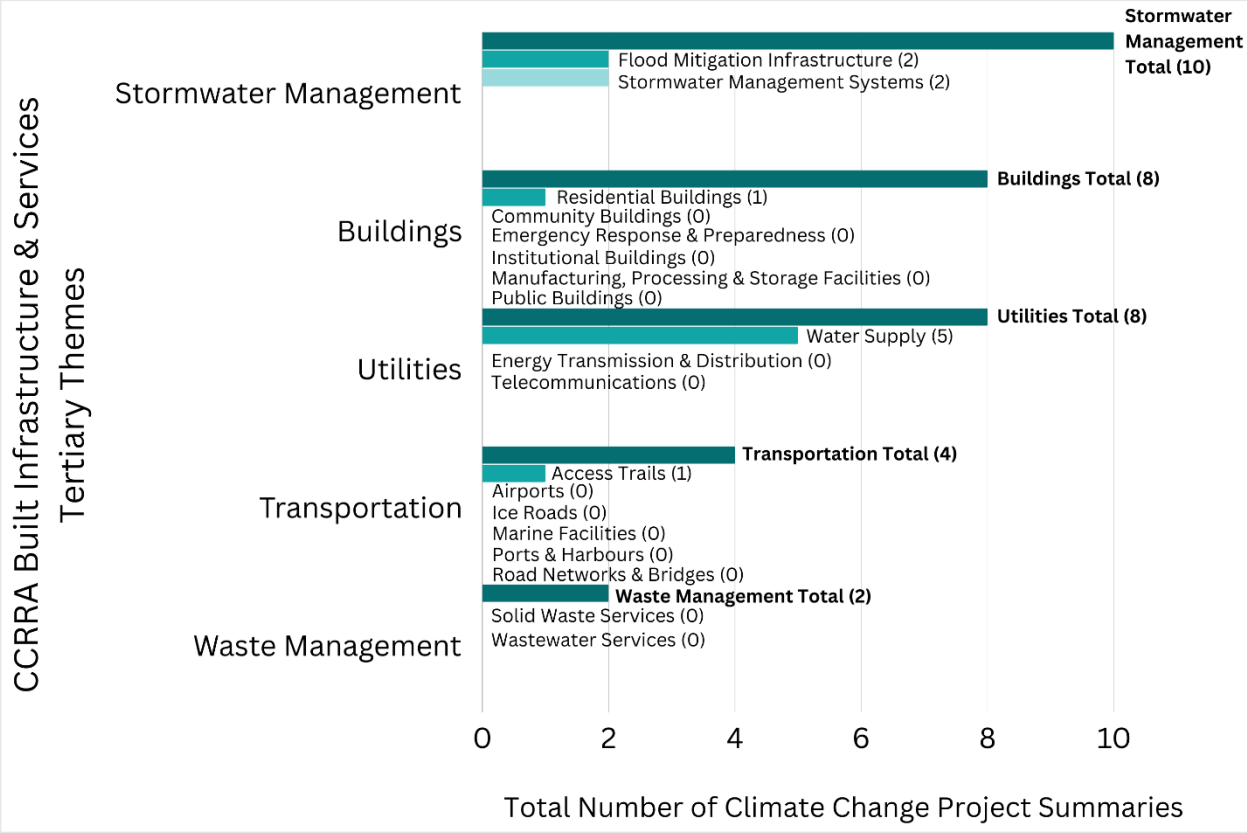
relevance to all northern communities, and broad sub-themes. Health-related projects lag behind physical/natural and social sciences projects primarily in the Healthy Environments and Inuit Culture & Heritage key themes.

In Baker Lake, CCHAP has funded the Qamani'tuaq Young Hunter's Program to foster knowledge transfer of IQ and traditional skills and practices among youth (Baker Lake Hunter's and Trapper's Organization, 2021). Health and well-being were cited as components of and benefits from the project. Another health-related research project led by a researcher at McGill University focused on injury patterns from search and rescue incidents on the land (Clark, 2015).

Built Infrastructure & Services (33 Project Summaries)

Within the Built Infrastructure & Services theme (Figure 4.23), most projects belong to Stormwater Management (10), followed by Buildings (8), Utilities (8), Transportation (4), with the least number of projects in Waste Management (2). Whereas the Stormwater Management theme included two projects in both Flood Mitigation Infrastructure and Stormwater Management Systems tertiary themes, Buildings only consisted of one project relating to the Residential Buildings sub-theme (Figure 4.23). The additional tertiary themes included in the CCRRA thematic areas of Buildings, Utilities, Transportation and Waste Management were too specific for projects to be considered during the coding process, and so no projects were coded to any of these (Figure 4.23).

Figure 4.23. Built Infrastructure & Services – Secondary and tertiary sub-themes



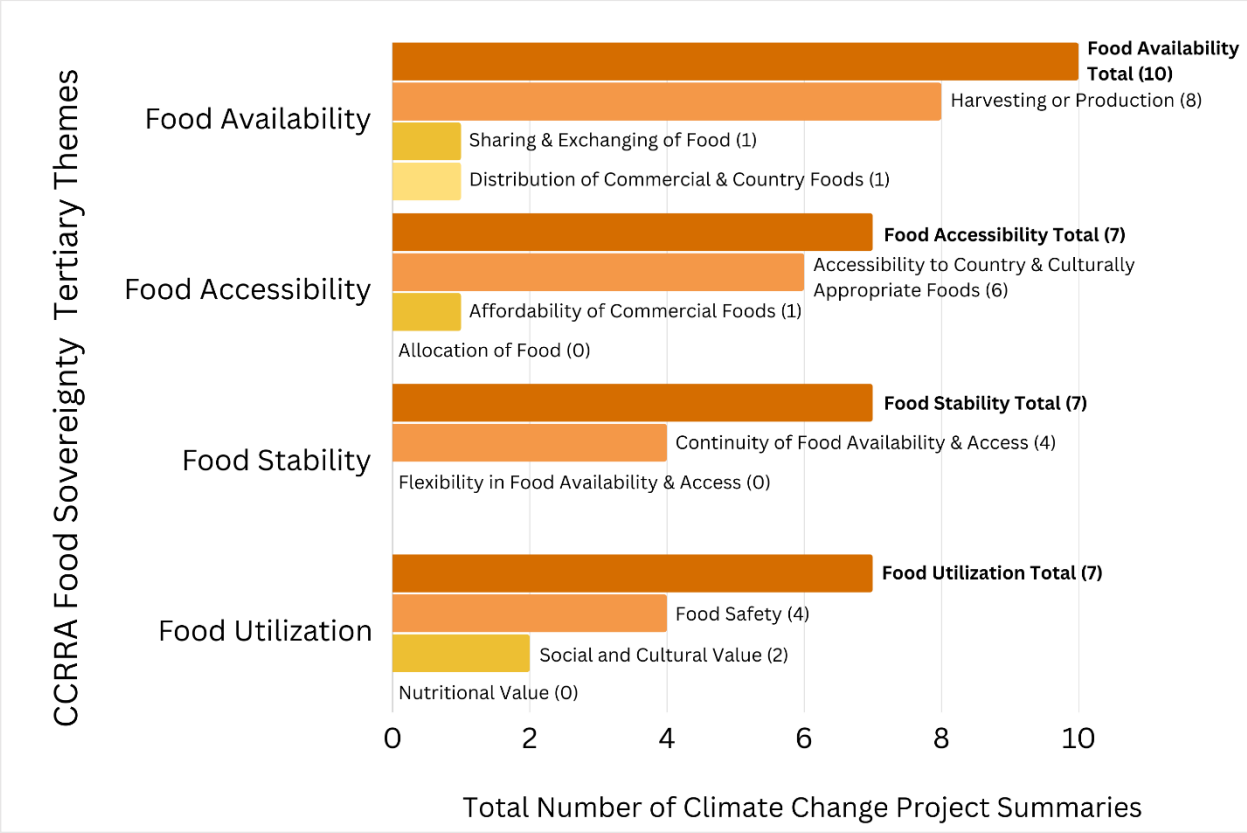
Built Infrastructure & Services projects include a CCPN-funded City of Iqaluit initiative to increase efficiency in reducing water loss (City of Iqaluit, 2017) and a joint territorial-federal government project to map landscape hazards across Nunavut that may be detrimental to infrastructure and resources (Mate, 2009). More specifically, hamlet-led CCPN-funded projects include ones that aim to reduce risks of flooding by improving drainage (Hamlet of Arviat, 2018) and installing culverts (Hamlet of Hall Beach, 2018).

Most notably, many tertiary-level themes in this CCS priority area are not commonly addressed by traditional western or southern research priorities. Instead, community-based projects and hamlet- or municipality-led work are more common as they are invested in areas that are linked with the overall well-being of their communities and reflect their priorities. These projects also tend to lead to tangible implementations of environmental and infrastructure improvements rather than traditional research documents (publications and reports). As a result, the funding databases capture a unique aspect of community-led research that is not well reflected in research licensing and permitting databases. For example, if a project does not fit the definition of research, a research license would not be required.

Food Sovereignty (28 Project Summaries)

As the most specific primary theme, projects within Food Sovereignty (Figure 4.24) are distributed relatively evenly across its four secondary themes: Food Availability (10), Food Accessibility (7), Food Stability (7), and Food Utilization (7). The tertiary themes in Food Availability consist primarily of Harvesting or Production (8), followed by Sharing & Exchanging of Food (1), and Distribution of Commercial & Country Foods (1).

Figure 4.24. Food Sovereignty – Secondary and tertiary sub-themes



Food Accessibility mainly refers to Accessibility to Country & Culturally Appropriate Foods (6). There is one project in Affordability of Commercial Foods and none in Allocation of Food. While Food Stability primarily refers to Continuity of Food Availability & Access (4) and not as much to Flexibility in Food Availability & Access (0), Food Utilization relates to both Food Safety (4) and Social and Cultural Value (2) but did non appear to be associated with Nutritional Value (0). Like other primary themes in this study, the four secondary themes in Food Sovereignty are quite similar, and they often overlap with one another. Similar to Built Infrastructure & Services, Food Sovereignty

tertiary themes may be less prominent due to their specificity as well as the inherently community-based nature of the work.

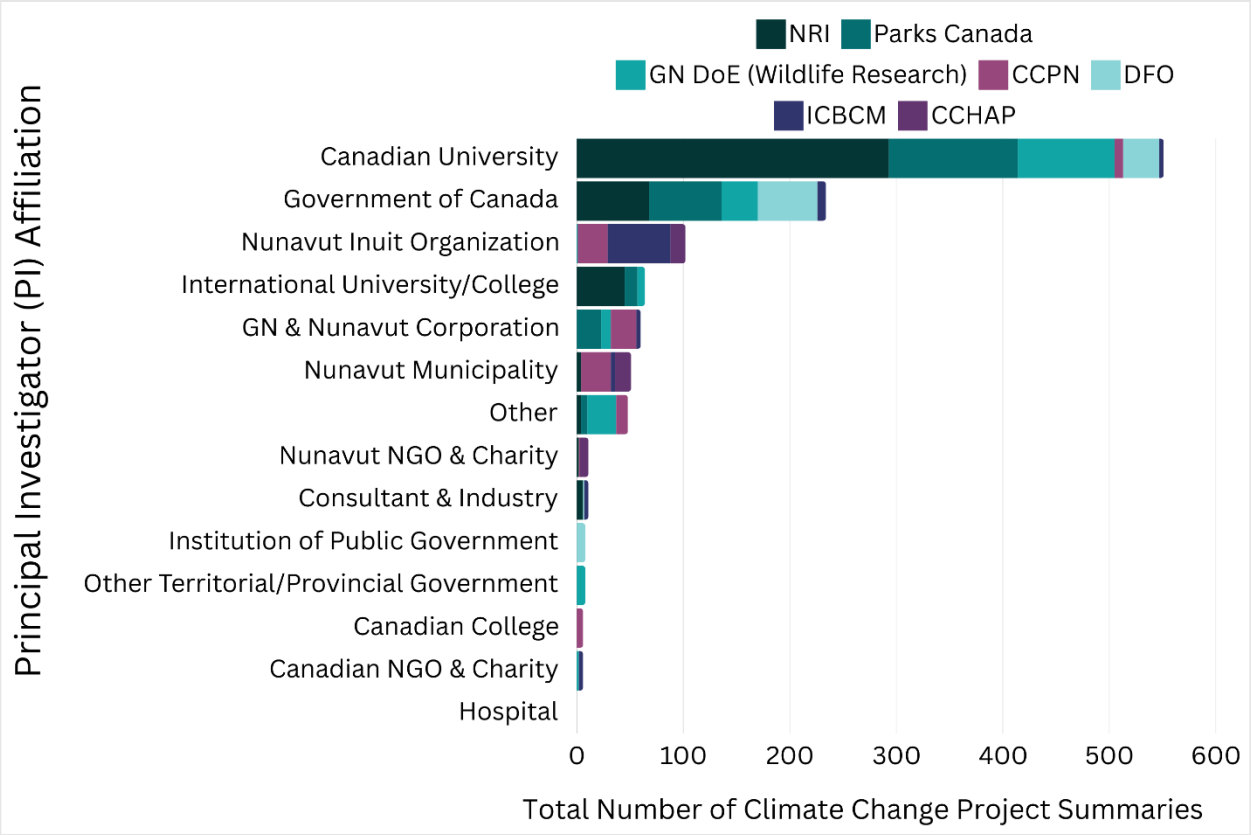
Although many wildlife-related projects can be linked to food sovereignty, project summaries were only coded to Food Sovereignty if the document clearly and explicitly indicated it as a component of their climate change-related work. For example, this includes a university-led project focused on climate change-related assessments for food security and sustainable harvest practices in Qikiqtarjuaq (Chan et al., n.d.).

4.4 Who Has Been Leading Climate Change-related Work?

Over the last two decades, climate change-related initiatives have been led by various territorial, federal, and international PIs. In this study, one PI affiliation was tracked per project summary, rather than annually. It is clear that climate change-related research is predominantly led by Canadian Universities (551 project summaries), followed by the Government of Canada (234), which led half as many projects (Figure 4.25). However, PIs affiliated with Nunavut Inuit Organizations led the third highest amount of climate change-related research (102). Canadian University and Government of Canada projects are primarily reflected in the licensing and permitting databases, while Nunavut Inuit Organization is almost exclusively represented in the funding databases (Figure 4.25). Since the federal funding programs purposefully fund northern-,

community-, and Indigenous-led work, Figure 4.25 highlights that investments are reaching the targeted northern leadership.

Figure 4.25. Number of annual climate change project activities by PI affiliation



While the first two PI affiliations were identified predominantly in research licensing and permitting databases, Canadian Universities are 9 times as prevalent as International Universities or Colleges (60). For example, many Nunavut climate change research projects are led by Quebec universities, such as McGill University and Laval University, but also by universities across the country, from the University of British Columbia to University of Saskatchewan, University of Manitoba, University of Toronto, and Memorial University of Newfoundland. Although provincially diverse, these are

primarily southern-based institutions. Academic institutions, including international and domestic universities and colleges combined, make up approximately 54% of overall PI affiliations. Government affiliations, federal and territorial alike (including Nunavut Municipality and Institutions of Public Government), represent 14% of PI affiliations in climate change-related work. Beyond academia and the federal government, projects are significantly less prevalent. However, it is notable that Nunavut Inuit Organization is the third-highest PI affiliation category, making up 8.8% of all project affiliations as 99.99% of these affiliations are from the federal funding databases.

While colleges, international or local, lead a few climate change projects, national and territorial NGOs, charities, and private sector companies lead the least number of projects. It should be recognized, however, that many government- and academic-led projects are conducted in collaboration with other academic/government partners, as well as communities and other organizations. No climate change projects were recorded to have been led by a hospital over the last two decades. This remains in accordance with the lack of health sciences research and health-related climate change work.

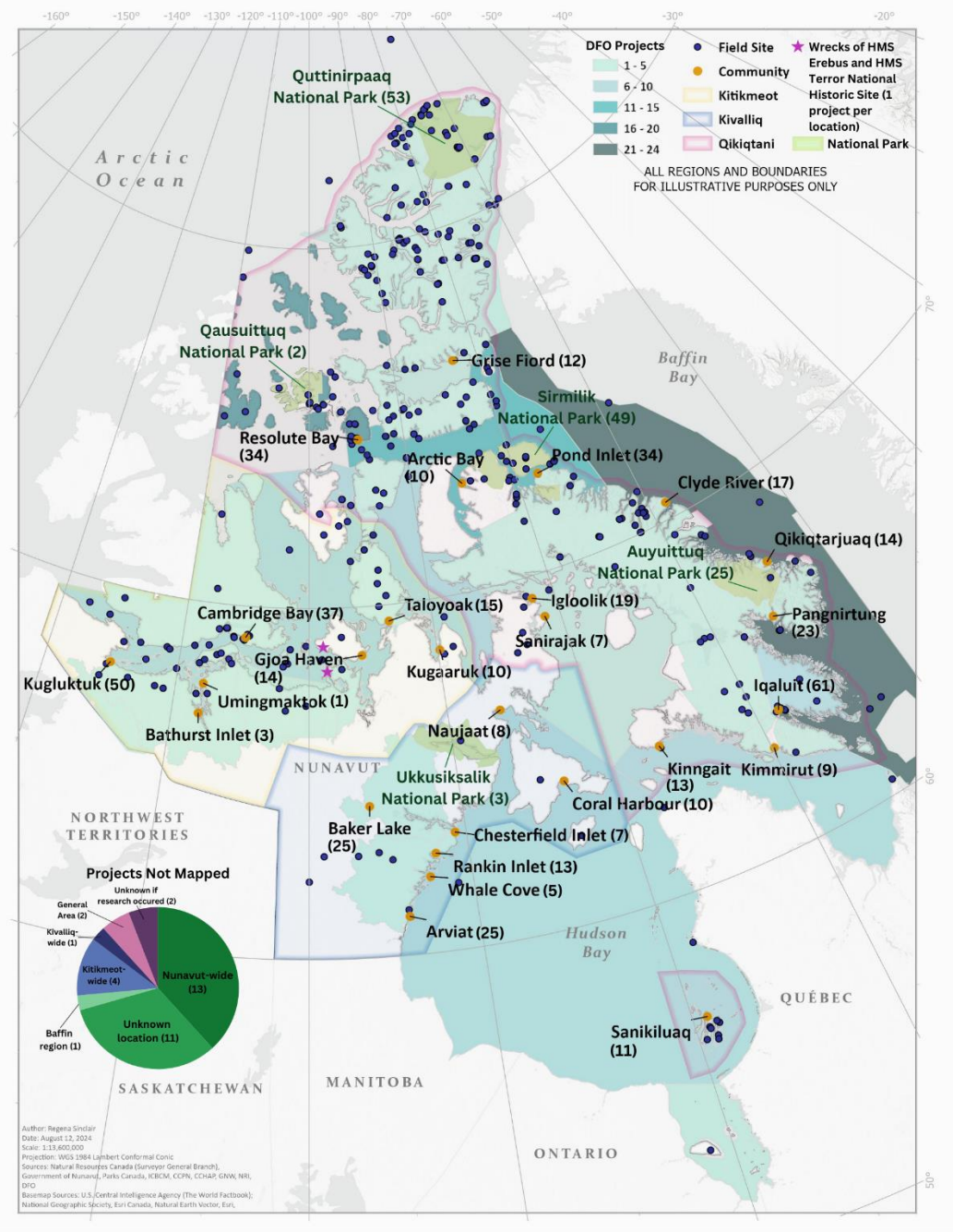
4.5 Where Has Climate Change Work Taken Place?

To provide a spatial overview of where climate change research is taking place, unique locations associated with each project are used rather than representing

locations of annual activities. Figure 4.26 summarizes locations for all seven databases.

For clarity, each of the databases has an individualized mapfi in the Appendices.

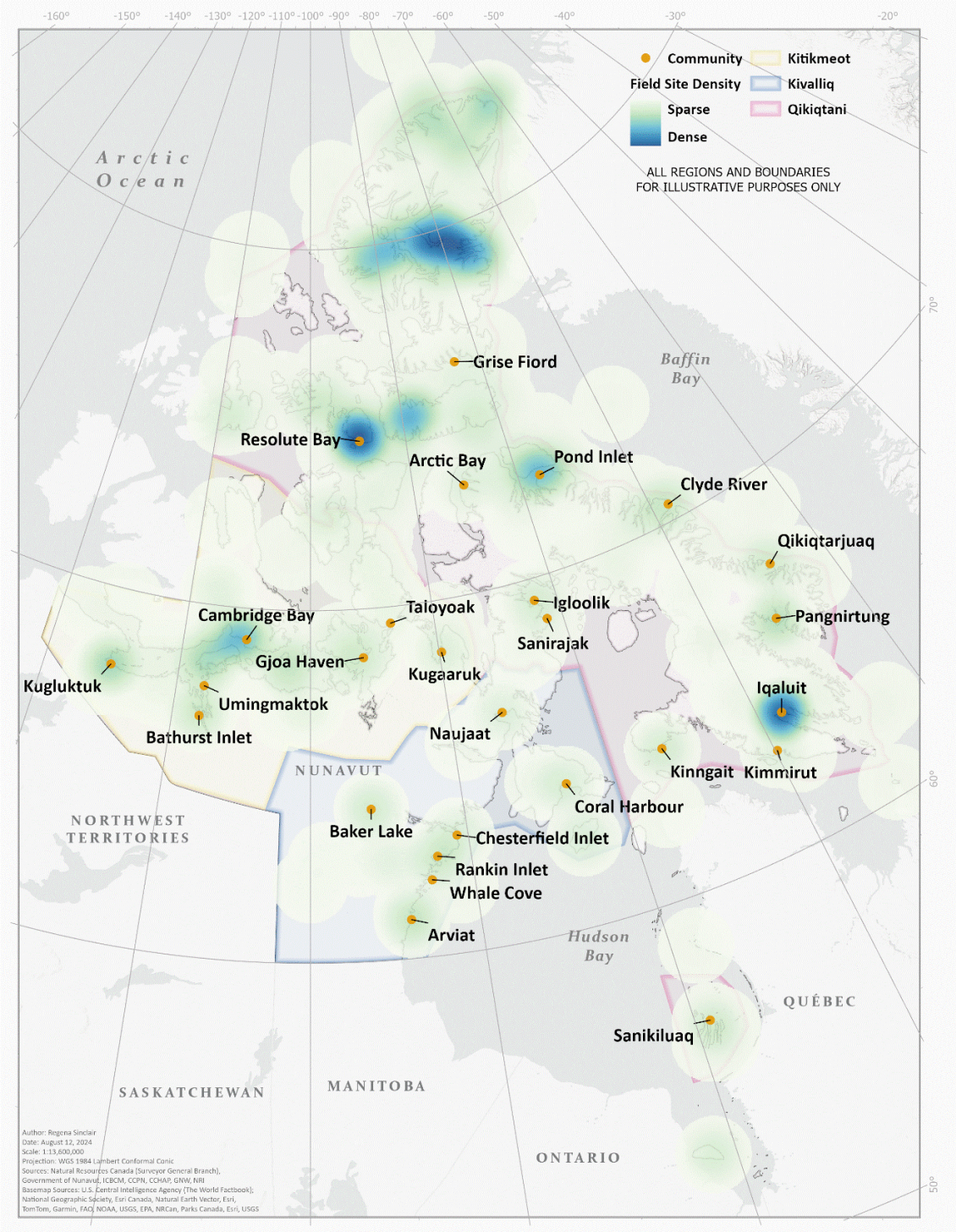
Figure 4.26. Number of climate change projects by community, marine area, National Park, and unique field site locations



As seen in the map above, most projects with unique field sites were in Qikiqtani, given the larger area and presence of glaciers, followed by Kitikmeot and Kivalliq. There are also more National Parks in Qikiqtani, resulting in a greater number of projects there as well. A similar pattern can be observed when looking at the number of projects by community. Over the last two decades, there have been 264 climate change projects in Qikiqtani communities, 130 in Kitikmeot communities, and 93 in Kivalliq communities. The top three communities with the most climate change projects are Iqaluit (61), Kugluktuk (50), and Cambridge Bay (37). Resolute Bay was a close fourth at 34 projects. In the latter three communities, projects primarily come from the GN DoE database, as it makes up approximately 86.8%, 57.9%, and 90% of projects in each community, respectively. The fewest number of projects exist in Umingmaktok (1 project), Bathurst Inlet (3), and Naujaat (8). In terms of marine areas, the Baffin Bay region along the northeastern coast of Baffin Island is the most saturated in colour, with a range of 21-24 projects.

Since Figure 4.26 does not indicate the number of projects for field sites, Figure 4.27 is a heat map illustrating the concentration of projects for field sites specifically. This excludes communities across all databases, as well as the DFO and Parks Canada databases, which deal with marine areas and National Parks, respectively.

Figure 4.27. Number of climate change projects by field sites



Note. This map does not include the Parks Canada or DFO databases.

In this map, most projects also took place in the Qikiqtani region. The highest concentration of climate change projects in terms of field site density would be Ellesmere Island in northern Nunavut. This is followed by sites near Resolute Bay, then coordinates near Iqaluit. Other notable areas include a moderate increase in field site density near Pond Inlet and Cambridge Bay. Since field site projects often relate to flora and fauna, they are more likely to be physical/natural science projects rather than community-based work. These areas often overlap with the habitats of wildlife species, such as caribou calving grounds.

4.6 In Summary

Since 2004, climate change-related initiatives have been increasing, although the COVID-19 pandemic impacted this trajectory in 2020. Nevertheless, there is evidence from the number of climate change projects in 2021 to suggest that it will again reach pre-pandemic levels in the coming years. Climate change work has increased greatly due to the addition of climate change-targeted federal funding programs, along with associated thematic diversity. Most projects were led by Canadian universities or the Government of Canada, whose institutional headquarters and PIs are mostly based in southern, urban centres in Provinces across Canada. Of the seven databases included, the NRI has licensed the most climate change research, particularly in Healthy Environment, but overall, the greatest diversity of research is occurring within the targeted federal funding program of CCPN (diversity index rounded to 1.00 out of 1.00). In contrast, the NRI database had an average thematic diversity of 0.55.

At an aggregate level, gaps in climate change research and initiatives exist most prominently within the health sector, as exemplified by a complete lack of hospital PI affiliations and a weak thematic presence across all years and databases (both for the Food Sovereignty and Health, Safety and Wellness CCRRA themes). CCHAP, the only database with a health-related climate change focus, is the third most diverse thematically but is the smallest database quantitatively. While social science-dominant themes such as Inuit Culture and Heritage, Community and Connection, Livelihoods and Growth, and Built Infrastructure and Services have been on the rise since 2017, much work is needed to balance out thematic representation, to better reflect the diversity of Nunavut climate change priorities. These results reflect the climate change foci of each agency presented, but also of the organizations, principal investigators, researchers, and leaders behind the work. Such gaps reveal potential discrepancies in the research interests and values of PIs from southern-based institutions, compared to those of northern- and community-based organizations.

5.0 Discussion

5.1 Introduction

Climate change work is a cross-cutting topic, requiring an interdisciplinary lens to draw linkages between diverse projects. Likewise, this chapter aims to draw conclusions based on a variety of relationships and connections between the data, prior studies, and published literature in alignment with the *piliriqatigiinniq* model (Chapter 2: Methods). Faced with the challenge of interpreting and representing the many relationships between data for the partners involved in this work, I was reminded to return to the guiding principle of *iqqaumaqatigiinniq* (Figure 3.2). Results presented in Chapter 4 are based on project summaries, but *iqqaumaqatigiinniq* encourages and advocates for "all knowing coming into one" (Figure 3.2) by weaving together different kinds of knowledge to help find meaning in the research and numbers. As Healey & Tagak (2014) state,

> "In essence [the Piliriqatigiinniq Partnership Model for Community Health Research] is a model for an Inuit epistemology in action because it arises from the relational perspective and is built on what was known, what is known, and what will come to be known in Inuit communities. Its development is predicated on the past, present and future experiences of Nunavummiut. From this epistemological perspective, ethics, accountability, methodology, knowledge,

> understanding and our relationships with each other as human beings, as well as our environments are part of the same space." (p. 11-12)

This model inspires how I approach the discussion – by working to recognize "what was known, what is known, and what will come to be known" (Healey & Tagak 2014, p. 11) in relation to climate change in Nunavut. In each section, I aim to highlight and discuss key results in the context of CCS and NRI priorities, emphasizing considerations for decisions and challenges they have identified.

As per the epistemological perspective of *piliriqatigiinniq*, this discussion will be organized according to past, present, and future by way of three key sections:

1. **Past**: How has climate change work evolved over the last two decades?
2. **Present**: How can this study inform the development of CCRRA thematic areas?
3. **Future**: How can these findings contribute to improved climate change collaboration between licensing/permitting/funding in the future?

The third question will, in part, also be addressed in Chapter 6: Conclusions. Each of the following three sections (Sections 5.2-5.4) will begin by identifying the questions and interests that the CCS and NRI may have relating to the past, present, and future of climate change initiatives. I will also consider the interests of the additional territorial and federal agencies involved in providing data for this work. This helps ensure that I am clearly framing the analysis and results with my collaborators in mind, aiming to position the work in a way that would benefit them.

5.2 Past: How has climate change work evolved over the last two decades?

Several literature reviews and gap analyses have previously been conducted to assess the scope of climate change research in the Canadian Arctic. However, the latest one concluded in 2010 (Bolton et al., 2011), so my analysis enables an evaluation of how things have evolved in the last two decades. Furthermore, this study is framed according to CCS thematic priorities, enabling an investigation of gaps and overlaps in climate change work more relevant to territorial priorities. Simultaneously, this analysis informs the NRI of how climate change research has evolved since the last climate change research trends report based on their licensing data (C-CIARN, 2005). The following sub-sections will highlight the gaps and overlaps in themes, locations, and PI affiliations for climate change work.

5.2.1 Gaps & Overlaps in Themes

Overlaps in Physical Sciences

Based on the 2004-2021 data in this study, there is considerable overlap in research trends with the 1997-2004 C-CIARN (2005) and 2000-2010 Bolton et al. (2011) studies. As emphasized in Chapter 4, Healthy Environment comprises 62.6% of all climate change annual activities as a theme consisting of many projects relating to physical and natural sciences, including a strong focus on fauna, marine, and terrestrial

ecosystems. Similarly, in the C-CIARN review (2005), most research was associated with themes in glaciology and paleolimnology, which would have been coded to Healthy Environment. This MA research also recorded 29 paleolimnological projects involving lake sediments. Both the C-CIARN review and this study also reveal high numbers of projects related to Marine and Aquatic Ecosystems. While the C-CIARN (2005) study found that 11.3% of all climate change research belonged to the Marine Systems category at the time, approximately 18% of all included climate change project summaries in the present study belong to Marine and Aquatic Ecosystems. A substantial number of this percentage is derived from the DFO database. Most of the themes in Bolton et al. (2011) were interdisciplinary or related to social sciences; none isolated physical/natural sciences as a separate theme (Appendix 2).

In Cueva et al. (2021), a study assessing the representation of "resilience" in Arctic research based on published literature from 2000 to 2019 similarly found that much of the overrepresentation was from climate change and environmental sciences research. This is relevant as "resilience" is a term whose uses by non-Indigenous researchers have been critiqued (Cueva et al., 2021) and is typically used in conjunction with themes of change in the North, climate change in particular. For instance, limitations of the term include using it to describe individualistic rather than collective adaptive capacities (Thomas et al., 2016), insufficiency in describing "modern Indigeneity" by Indigenous scholars in health sciences (Wilbur & Gone, 2023), and its use is based on traditional Western understandings of adaptation (Usher et al., 2021).

Within health science, for instance, Wilbur & Gone (2023) have identified “survivance” as an emerging term. However, further discussions would be necessary to determine the contextually appropriate use of and alternatives to the term “resilience” regarding climate change in Nunavut.

Gaps in Health Sciences

In contrast, only approximately 4.1% of unique project summaries were coded to Food Sovereignty, and about 6.4% discussed Health, Safety and Wellness, with only 1 project explicitly mentioning Mental Health and 2 projects for Cultural Health. Contributing factors include the thematic definitions of the secondary and tertiary themes, which may be general. Findings and challenges with thematic definitions will be discussed in the following sub-section. Since the seven CCRRA themes were established in collaboration with different GN departments and youth in an effort to describe and capture Nunavummiut values, the fact that Food Sovereignty is a separate theme indicates that it is a priority that is of significant value to be a theme independent of Health, Safety and Wellness and Livelihoods. However, it also draws from multiple themes, so anything coded to Food Sovereignty would also be coded to Health, Safety and Wellness. It is also due to this specificity that there are more projects coded to Health than Food Sovereignty since it is broader and more encompassing. Thematic clarity could also be more defined for Food Sovereignty sub-themes to more accurately code projects.

Unfortunately, this gap in climate change-related health research is not unique to this study. C-CIARN (2004) also reported that no research was conducted on Community Health in relation to climate change within an eight-year period. Likewise, the Bolton (2011) gap analysis found that "little is known regarding the mental health impacts of changing livelihoods and climate" (p. 37). While the authors classified food insecurity as being "understudied," especially for groups with elevated risk (women, children, elderly), contaminants research was "emerging." Moreover, there were a few references to search and rescue, but emergency response assessments were "absent" across Inuit Nunangat, particularly in relation to weather events (Bolton, 2011). Although a few more health-related climate change projects have emerged since 2011 in contaminants, for example, these areas are still relatively understudied, especially in comparison with Healthy Environment projects. The Cueva et al. (2021) review of published literature also found "underrepresentation" of "resilience" in categories relating to "health, medicine, wellness, or well-being" (p. 1). Nevertheless, while the C-CIARN (2005) study only focuses on NRI-licensed research and the Bolton et al. (2011) study on published literature on all four regions of Inuit Nunangat, this one includes unpublished climate change projects, from four different licensing and permitting agencies, as well as three funding programs in the latter years of the study. This provides a unique angle and opportunity. As such, we may isolate the last five years of the study to examine trends

between 2017-2021; when data from all seven databases are fully present (See Appendix 14 for all databases between 2016 and 2021).

Gaps in Social Sciences

Upon examination of Appendix 14, the addition and presence of the three funding programs have greatly increased and improved references to social and health sciences projects. This demonstrates their efficacy in addressing health-related priorities from community perspectives. However, there is still a gap in social sciences, although not as drastic as health sciences. The gap encompasses projects on Built Infrastructure & Services (55 annual activities) and the Transportation sub-theme (4 annual activities), though these numbers have increased slightly since 2004. For instance, Built Infrastructure & Services has about 95% fewer annual activities than Healthy Environment. Likewise, the C-CIARN study found that research in the categories of Infrastructure, Transportation, and Waste Management were all equally null, which are 100% less than any of the categories in the Natural System (2005). In 2011, Bolton et al. identified a rise in permafrost degradation projects (which has built infrastructure applications/impacts) as well as the need for academic research to focus on resource extraction and its resulting impacts on infrastructure and communities. This was an elevation compared to the C-CIARN report, although Bolton et al. (2011) included all four regions of Inuit Nunangat. Despite the nominal growth in social sciences since 2004, more themes have been populated since then.

The C-CIARN report highlights the 14 NCE categories used in the analysis, each one belonging to either Natural, Economic, or Community System distinctions (See Appendix 4 for a comparison of themes across different studies). According to the C-CIARN (2005) study, there was only one project in the Hunting/Trapping category populating Economic Systems, two projects in Community Systems, with the top four categories all belonging to Natural Systems. There were none in the other Economics and Community System categories (See Appendix 4 for categories). While there was only one project in the Hunting/Trapping category between 1997 and 2004 (C-CIARN, 2005), this MA research reveals in the Livelihoods & Growth theme that there have been 40 annual activities in the Hunting sub-theme since then. Notably, Culture & Heritage was not a theme in the 2004 report, other than Traditional Knowledge, and IQ had yet to be used primarily by the GN as the preferred term and approach. According to Bolton et al. (2011), improvement in TK integration is "widely cited," which is mimicked in the Inuit Culture & and Heritage theme as the Inuit Qaujimajatuqangit tertiary theme has the most annual activities in that category (80 annual activities).

Challenges in Interdisciplinary Representation

Overall, there are major gaps in climate change work in social sciences, interdisciplinary research, and projects with more tangible applications, such as in health. Across all climate change research studies, research and projects are heavily concentrated in the physical and natural sciences, especially on fauna and aquatic ecosystems. Many opportunities exist in interdisciplinary collaboration, however, many

barriers exist when striving to achieve a working understanding of a field different than your own, such as technical jargon, unfamiliarity with local community context, lengthier timelines (Lanterman & Blithe, 2019), and foreign research methods or ways of doing (ibid.). These issues may be further accentuated in academia when publishing becomes an additional factor of consideration. Lanterman & Blithe (2019) cite editorial critiques of preferences in the use of different methods and researchers challenged to publish in journals beyond their discipline as disincentives of interdisciplinary work. Although publication may not necessarily be a major factor in non-academic climate change work, lengthier timelines and barriers in reaching a mutual understanding and working knowledge of diverse fields are certainly relevant when it comes to collaboration.

5.2.2 Gaps & Overlaps in Locations

Based on the mapping of projects we were able to locate, research was primarily concentrated in the Qikiqtani region (264 projects), with Iqaluit as the community with the most projects (61). The area with the highest density of projects from field sites of research was Ellesmere Island, which is also in Qikiqtani. This represents an oversaturation of all disciplines of climate change work – both community- and field-based. This regional trend is even more pronounced when examining geographical maps for the DFO (Appendix 9) and Parks Canada (Appendix 10). Areas that are the darkest in the shade gradient belong to Qikiqtani, especially in Baffin Bay, Western Queen Elizabeth Islands, and Tallurutiup Imanga National Marine Conservation Area – all of

which are in the Qikiqtani region. When surveying Parks Canada research, four of the six National Parks on the map are found in Qikiqtani. Such a trend may not come as a surprise because Iqaluit is the territorial capital as Nunavut's only official city, but additionally, as C-CIARN (2005) notes, the region is also home to the most glaciers and ice caps in the territory. C-CIARN (2005) similarly found that Qikiqtani "hosted by far the most research projects from all the categories" (p. 5). The region was dominated by Natural Systems or biophysical research. Most notably, Tundra dominated all categories of research as the only category in all three regions. However, there were 73 in Qikiqtani compared to four in Kivalliq and Kitikmeot. Bolton et al. (2011) focus on Inuit Nunangat, and do not have specific insights on climate change research distribution within Nunavut's three administrative regions based on published research. It remains challenging to gather substantial, region-specific data on climate change research.

5.2.3 Gaps & Overlaps in PI Affiliations

The majority of climate change work in Nunavut is predominantly led by PIs from Canadian Universities, followed by the Government of Canada, and Nunavut Inuit Organizations (Figure 4.25). Since this data is based on annual activities, there is a greater abundance of projects led by universities and governments because these researcher-led projects are multiyear and long in their duration, most of which are represented in the licensing/permitting databases within the given years. However, while funded projects may be longer in duration, they began in 2016/2017, and project

years past 2021 were not included in this study due to the years of study. When it comes to work led by governments, the smaller the scale of government, the greater the likelihood of that project being represented by a funding program rather than licensing/permitting agency. This is because lower levels of government are more likely to work closely with or directly represent communities. For example, much of the Government of Canada-led work derives from the DFO database, which are primarily offshore marine projects, likely with less community input than a project led by the Government of Nunavut. In contrast, as seen in Figure 4.25, nearly half of the projects led by the Government of Nunavut and Nunavut Corporation PI affiliation are from one of the three federal funding databases. Many recipients of the three federal funding projects are represented by Nunavut's municipalities, otherwise known as the Hamlets, who initiate projects based on their community needs. As a result, hamlets are represented under those programs rather than captured in research licensing/permitting databases because they involve projects such as stormwater management infrastructure improvements rather than academic research outputs. All in all, based on the present study, there is a distinct oversaturation of climate change work led by Canadian Universities and the Government of Canada, which are mostly southern-based institutions, with southern researchers that abide by southern methods of research. There are significant gaps in work by NGOs and Consultants & Industry, but this may be because the included databases do not adequately capture that work. Furthermore, it should be noted that consultants and industry likely work in partnership

with governments (federal, territorial, and municipal), as well as with universities, but are not listed in the application as the primary PIs, which means that their involvement may not be accurately tracked in that way. Projects led by hospitals are absent, which is in line with gaps in health-related climate change work mentioned previously. As climate change can be viewed one-dimensionally by health practitioners as primarily environmental issues, outside of approaches similar to One Health (World Health Organization, 2017), health projects by hospitals perhaps have yet to emphasize climate change as an explicit focus or contributor to their work.

The C-CIARN (2005) and Bolton et al. (2011) studies do not examine relationships between PI affiliations and climate change work. Nevertheless, the NRI co-led a research study on social sciences research trends in Nunavut (2004-2019), based on their research licensing database (Polidoro et al., 2024). Despite not being a climate change-specific study, there are parallels in that 65.7% of social sciences research was also led by Canadian Universities, which reveals that it is not only a pattern found in physical and natural sciences climate change research, but that it is a common trend in Nunavut more generally. While Polidoro et al. (2024) found that the second leading PI affiliation was international colleges/universities (12%) in social sciences, this is only the fourth highest affiliation. This discrepancy is understandable as international institutions are not eligible for the funding programs. The Polidoro et al. (2024) study also recorded quite a significant number of projects by consultants and industry, which is not found here. Finally, there is a lack of work from Institutions of Public Governments – the only

projects with this PI affiliation are from the DFO database. This is because these institutions do not typically lead research.

5.3 Present: How can the present study inform the development of CCRRA thematic areas?

As discussed in Chapter 3, thematic content analysis (TCA) undertaken in this MA research is guided by the CCRRA themes. Through tree diagram visuals, the CCRRA thematic areas have a tiered approach that allows for very specific themes to fall under larger, broader, more encompassing themes. In general, while Healthy Environment is the largest theme with the most associated climate change projects, two themes relate primarily to health sciences, and the remaining five themes can be identified as primarily relating to the social sciences. However, beyond these generalized categorizations, all climate change disciplines may fall into each of the CCRRA themes and work to inform one another. Contrastingly, the C-CIARN (2005) study, based on the NCE's 14 categories identified under 3 Systems (Natural, Economic, Community) – four categories were physical sciences, three were economic, with the remaining seven being community or social sciences. Although the document cites 15 themes, only 14 were listed in Table 2 of the document. Despite including more community categories, climate change research in the late 1990s and early 2000s almost exclusively focused on physical sciences themes. The Bolton et al. (2011) study is organized into "six sector categories" (p. 5),

which do not include a theme directly or only based on physical sciences, although it is a systematic review of interdisciplinary published research.

As the thematic areas were shared by the CCS in their infancy (draft stage) and the work is designed to address future GN adaptation efforts, this section will highlight gaps, overlaps, and areas that may require more clarity in future iterations of CCRRA themes. These observations were noted during the coding process, discussion of themes with Sara and Jade, and during data analysis as new and reoccurring themes emerged from the data. The following sub-sections will summarize findings for each primary theme in alphabetical order.

5.3.1 Built Infrastructure & Services

This was a critical theme reflected across all three studies in this Discussion. Climate change research, in particular, rather than climate change adaptation initiatives are not one of the least represented in this theme because many of the categories require direct applications that are undertaken by governments, community groups, or individuals rather than research institutions.

First, the Buildings secondary theme includes specific types of buildings in terms of areas assessed for risk and resiliency. However, for the purpose of a situational analysis of climate change work, while it may encompass solutions such as retrofits, it does not provide a category specific to reduction of energy consumption and/or greenhouse gases, energy efficiency or alternative sustainable energy solutions. These

are tertiary themes I added under the new secondary theme, Reducing Emissions. These are or could potentially also be connected to the Energy Transmission & Distribution tertiary theme under Utilities. Next, while Transportation is largely in regard to transport infrastructure, there are not secondary or tertiary themes that adequately include modes of transport (land, water, air) such as vehicles, ships, or planes. A potential overlap would be the Transportation Industry secondary theme under the Livelihoods & Growth primary theme. However, the tertiary themes are Air Transport, Marine & Coastal, and Roads & Trails, which are in relation to industry and livelihoods. As a result, greater clarity and reduced duplication is needed to distinguish between Transportation in Built Infrastructure & Services and Transportation Industry in Livelihoods since projects were occasionally coded to one or the other, but not both, and may not have belonged to either.

5.3.2 Community & Connection

This theme is a critical value at the heart of many community-based initiatives. Among all seven themes, Community & Connection was the least defined. More detail is required to appropriately determine the kinds of projects that would belong to climate change research or risks related to "Access to Community Services," such as Social Programming and Entertainment and Recreational Programming, both of which are tertiary themes. The next secondary theme, Community Access, is also related to access. However, it would be useful to detail specific answers to some of the following

questions for additional context: Is this primarily referring to access to places (e.g. other communities and within the community) or access to resources (e.g. harvesting, education, financial, etc.)? Who is doing the access (e.g. community members, other communities, etc.)? In the CCRRA document, activities are included to practice climate change risk analysis, one of which is "Determining Severity of Impacts" (p. 170) through several rubrics per theme for impact scoring. As a southern-based researcher who does not have a complete understanding of the Nunavut context, questions I may pose include whether it would be challenging to quantify the "amount" of community and connection that exists (e.g. in terms of access to resources or "helping one another") through such proposed activities. As every community has its own context for connection, would rubrics be assessing risk for a community compared to "historical connection" or to other communities and examples of "best practices," whatever that may be? What's the benchmark, and who holds the knowledge to determine the score of climate change risk to community and connection? As I was classifying climate change projects and research, it was useful to add Capacity Building and Community-Based Research (Methods) (with Community-Led docked underneath) as new sub-themes to help code projects to this theme, since these are terms and concepts that more commonly arise in project summaries. More projects can also relate to Helping One Another, whether it's within a community or between a few.

5.3.3 Food Sovereignty

As one of the more specific primary themes, Food Sovereignty as a theme separate from Health, Safety and Wellness, indicates the level of significance that it poses for climate change risk and Nunavummiut values. Though the specificity of the tertiary themes is good, the secondary themes (Food Accessibility, Food Availability, Food Stability, and Food Utilization) may appear to be quite similar, resulting in projects being coded to multiple secondary themes due to thematic overlap or lack of clarity. This is evident, particularly for the following tertiary theme comparisons:

- Accessibility to Country and Culturally Appropriate Foods (under Food Accessibility) vs. Continuity of Food Availability & Access/Flexibility in Food Availability & Access (both under Food Stability);
- Allocation of Food (Food Accessibility) vs. Distribution of Commercial & Country Foods (Food Availability).

The secondary theme, Marine Food Use or Harvest, was also added to address a common type of food utilization that I noted from project summaries.

5.3.4 Health, Safety and Wellness

This theme effectively highlights the various aspects of well-being, including cultural, mental, and physical health, as well as emergency response. However, it would be beneficial to define the differences between the Population Health and Population

Wellness secondary themes. More specifically, what distinguishes Cultural Health (under Population Health) from Cultural & Spiritual Well-being (under Population Wellness)? What do those themes mean and entail? What falls into Personal Well-being (under Population Wellness), compared to Mental Health and Physical Health (both Population Health)? Improved understanding of these themes would help reduce unwanted overlap in project summaries. Moreover, since primary themes such as Built Infrastructure & Services have more situation-specific tertiary themes, would this theme also benefit from additions of more specific themes? For example, tertiary themes relating to travel on the land, search and rescue, and health education (physical, mental, emergency response, etc.) could have been added to the Public Safety secondary theme. In terms of cultural wellness, contributions of specificity in tertiary themes, and potential quaternary themes, could be beneficial as well.

5.3.5 Healthy Environment

Healthy Environment was one of the thematic areas with secondary and tertiary themes that are more specific, resulting in themes that are well-defined for the categorization of climate change research. However, this is also because detailed terms such as biodiversity, flora, and fauna are better understood by physical and natural sciences, which make up a significant portion of climate change work. As such, Healthy Environment also includes the most additional emerging themes as the larger sample

size of physical/natural science research revealed more patterns in the types of topics covered.

First, a significant number of tertiary themes were added to existing secondary themes, such as:

- Invasive Species to Ecosystem Function;
- Insects/Invertebrates/Zooplankton to Fauna; and
- Algae/Phytoplankton to Flora, among others.

Although flora and fauna were largely covered by broad categories, many projects assessed water quality through benthic invertebrates and the presence of other key indicator species of insects. As for Marine and Aquatic Ecosystems, tertiary and quaternary themes were added relating to coastal systems. Since paleolimnological studies examining historical climate change often used lake sediment cores in their methods, Lake Sediment was added as well. Most notably, however, this theme lacked mentions of sea ice, sea levels, snow melt, and lake ice, all of which were added to the codebook. Although Sea Ice is the only one of those themes that yielded a higher count of projects when themes were added, these are common topics often discussed when examining climate change. Similarly, within the Terrestrial Ecosystems secondary theme, sub-themes relating to glaciers and permafrost are often studied, so they were also added as codes. Finally, prominent themes that were added as independent secondary codes, include Contaminants, Greenhouse Gases, and Weather (including the tertiary

themes, Extreme Weather, Weather Monitoring, Weather Prediction). The Contaminants theme, especially in relation to the effects of contaminants in harvested species, could also be included in Health, Safety & Wellness.

5.3.6 Inuit Culture & Heritage

All in all, this theme was well-defined and effective in categorizing social science research and land-based climate change programming. For the purposes of this present study, projects that strongly highlighted traditional and/or Inuit knowledge were included in the Inuit Qaujimajatuqangit secondary theme, since certain projects, especially from earlier years, have yet to make the shift in terminology. Although only a single project was coded to this new theme, Working Dogs was added under the Traditional Activities and Practices secondary theme because it is specific in the way that it relates to Inuit Culture & Heritage and livelihoods.

5.3.7 Livelihoods & Growth

The Livelihoods & Growth theme is also highly specific, particularly for the Harvesting secondary theme, which effectively differentiated between commercial harvesting, subsistence harvesting, fishing, sealing, trapping, gathering, and processing. Themes that could benefit from an inclusion of tertiary themes and more detail include Business Development and Resource Development. As aforementioned in Section 5.3.1: Built Infrastructure & Services, greater clarity and detail would be useful in identifying what belongs in that theme compared to the Transportation Industry sub-theme here.

New secondary themes regarding livelihoods were added, including energy security, food production, and mining. Although these are not critical themes to be added to the CCRRA thematic areas, mining and its associated infrastructure may be considered as an addition to the Resource Development sub-theme and/or Built Infrastructure sub-theme.

5.4 Future: How can these findings contribute to improved collaboration between licensing/permitting/funding agencies in the future?

5.4.1 How can collaboration be enhanced between research licensing and permitting agencies?

In approaching the ambitious task of climate change research data management in tandem with working to address Nunavut-wide climate change goals, I identified two key emerging considerations, including: 1) Approaches in how information about climate change projects is sought, stored, and shared; and 2) approaches in cross-organizational communication and collaboration.

First, through the process of data organization and cleaning from licensing/permitting and funding agencies, it became evident that each organization uses different formats and management processes. Challenges identified include the lack of consistency in the types and quality of project information tracked, both within

and across organizations. Challenges arise over time due to the transition from hard copy to digital files, and some organizations expressed limited data management capacity due to insufficient human and financial resources. For example, while certain databases track PI affiliations, others do not, and the categories of information provided vary in type and level of detail. Recognizing these challenges, licensing/permitting application forms or portals from each agency would ideally request a standardized set of metadata; resulting in databases that are more consistent in tracking similar types of information across the board. Since the NRI database has the most comprehensive set of metadata categories, it covers more specific topics such as Affiliation Type (not just the PI affiliation on its own), Roles (in a research team), and administrative team members, in addition to categories covered by the other databases. Since the NRI also has its database publicly available on its Isirvik online platform, it could be beneficial to use the NRI metadata categories as a baseline of categories to include in licensing/permitting applications. For a list of metadata tracked by the NRI and the rest of the databases included in this study, see Appendix 5.

To effectively share data among organizations, some possibilities for improvement include:

- Expanding an existing licensing/permitting application portal to include options to apply for multiple kinds of approvals (i.e. a central portal);

- Coordinating amongst licensing/permitting organizations to agree on a standardized set of information that all would request, track, and share for ease of facilitating regular assessment of climate change (or other topical) research trends over time; and/or,
- Creating an application screening portal where researchers provide all key information needed for consistent tracking across organizations, and can select the permits/licenses needed (which could be shared amongst organizations). The applicant would then be directed to additional specific forms needed for each kind of permit.

Opportunities for researchers to apply simultaneously for multiple licenses or permits would aid applicants as well as review organizations by minimizing duplication of project applications, reducing review fatigue, and simplifying administrative processes. It would also help applicants to identify all the licenses or permits that they would need, based on their project type and scope. This way, agencies can ensure that all metadata is tracked and that the involved agencies would have access to the shared information, where there are no restrictions in confidentiality.

Additionally, a dropdown list could allow applicants to classify the topic and discipline of their projects, such as climate change. Although this may appear to be a goal reserved for the distant future, it would be a major undertaking founded on a base of effective cross-organizational communication and collaboration that can be honed in

the present. This would require cooperation between multiple levels of governance in the public sector, from the territorial to the federal level.

In a study on governmental climate action in British Columbia, Dale et al. (2020) indicated that "transformational change" necessitates an understanding of mutual benefits in implementing a particular initiative toward a shared goal. Similarly, this concept and practice ties back into the *piliriqatigiinniq* model, which supports the notion that the collective good should be clearly defined for appropriate collaboration. According to Diacu (2009), in-person activities and establishing working groups with defined mandates would support good communication across public sector organizations. The authors acknowledge, however, that "implementation will require a commitment to change as well as human and financial resources…" (p. ii). This MA research contributes to the emerging and existing discourse of collaboration in research licensing and permitting agencies. Continued in-person activities like the two-day licensing/permitting agency workshop hosted by the NRI in November 2023 are useful in identifying ongoing gaps and opportunities, as well as knowledge sharing of potential implementation for the future.

5.4.2 How does funding affect the types of climate change research conducted?

Topics covered within climate change work in Nunavut are affected by funding (or lack thereof) for both academic research and community-based work. Project size is

not necessarily indicative of its significance because groups that are unable to secure sufficient funding due to ineligibility relating to topics, do not have as significant of a reach.

Research funding, while available, only temporarily increases research within a given topic of interest as it has been found to immediately decrease following the termination of the funding period (Checchi et al., 2019). However, based on a study reviewing funding for the sciences and engineering disciplines in Canada, the greater the quantity and quality of funding, the greater the quantity and quality of academic publications resulting from the work (Ebadi & Schiffauerova, 2016). The study also identified that those who already secured funding are more likely to acquire more funding, while the reverse is also true. Based on over 240,000 European research papers, increased funding variety has also been shown to augment citation impact (Gok et al., 2015).

However, more specifically, climate change research funding focuses primarily on physical and natural sciences rather than social sciences. While the results of this MA research reflect this reality, a study based on international research grants between 1990 and 2018 found that "natural and technical sciences received 770% more funding than social sciences for issues on climate change" (Overland & Sovacool, 2020, p. 1). In contrast, relevant funding received by social sciences projects made up 0.12% of the 333 total grants (Overland & Sovacool, 2020). Similar funding trends are reflected in Arctic

research across Canada, Europe, and the United States (Ibarguchi et al., 2018). In this study, "less than 3% of total budget the funding agencies considered is allocated in any given year to Arctic-related research" between 2003 and 2014 (ibid.). As a result, financial resources and priorities should match the priorities of Indigenous partners, researchers, rights holders, and communities (ibid.). This is not a novel idea. However, present-day trends have yet to catch up to decades-long patterns.

6.0 Conclusions

What have we learned? While certain trends in Nunavut climate change work have evolved tremendously over the last two decades, others have seemingly stayed the same. It is why we must look to the past to help determine a way forward, particularly when collaborating with climate change research licensing, permitting, and funding agencies. This chapter will highlight key takeaways (Section 6.1) and recognizes that research can never be fully objective as Section 6.2 is a narrative presented from the perspective of the author. As Wilson (2008) espoused and demonstrated in *Research is Ceremony*, personal written narratives can be effective and necessary in fostering relationships between the researcher, the research project, and the reader to genuinely portray a dedication to relationality in research. Hence, this thesis includes a dialogue surrounding my personal lessons from the work regarding what I have learned from "past" stages in the MA process, "present" commitments to accountability in research rigour, and goals for the research and data in the immediate "future" and beyond (Section 6.3). As peer-reviewed publications are traditionally Western and Southern by nature, they do not typically allow for the flexibility to include "non-scientific" learnings and reflections. This is why I begin (Section 1.4) and end (Section 6.3) my thesis with reflexivity; following the circularity of *piliriqatigiinniq* throughout my research cycle.

This chapter concludes with a summary of future considerations for the CCS (Section 6.3.1), licensing/permitting/funding agencies (Section 6.3.2), and researchers (Section 6.3.3). Visions for next steps in future work can be found in Section 6.4.

6.1 Key Takeaways

- At an aggregate level, climate change-related work in Nunavut increased by approximately 6.22 project activities per year from 2004 to 2021.
- Between 2017 and 2019, annual climate change project activities significantly augmented due to the addition of the three federal funding programs (CCPN, ICBCM, and CCHAP).
- Projects peaked in 2019 (153 annual climate change project activities) and decreased by 32.7% in 2020 (103 activities) due to the COVID-19 pandemic.
- Nearly 50% of climate change research analyzed in this study received Scientific Research Licenses from the Nunavut Research Institute Scientific.
- The Healthy Environment theme accounts for approximately 62.6% of all annual climate change project activities included in this study (1095 activities).
- Food Sovereignty is the least dominant theme (2.4% - 42 activities).
- The funding databases, particularly the CCPN (1.00 diversity), feature the highest amount of thematic diversity among all seven databases.

- Annual climate change activities are led primarily by Canadian Universities, followed by the Government of Canada, and Nunavut Inuit Organizations.
- When including all seven databases, most projects take place in the Qikiqtani region, followed by the Kitikmeot region and the Kivalliq region (across marine areas, National Parks, field sites, and communities).
- The communities with the most climate change projects have been Iqaluit (61 projects), Kugluktuk (50), and Cambridge Bay (34).

6.2 Lessons Learned

Who we are as people intricately informs what we do as researchers and how we undertake research. In the circular nature that is my MA research cycle, guided by *piliriqatigiinniq*, I began this work with a reflection on who I am and what needed to be done. Like the title of this paper, it begs the question, what has been done, and what have I learned? In the eyes and language of academia, a thesis traditionally signals finality – the end of a degree. However, as Yunkaporta (2020), an Indigenous scholar from the Apalech Clan (Queensland, Australia) wrote, "The song itself is not as important as the communal knowledge process that produces it" (p. 88). This was written in the context of "cultural innovations" in Indigenous knowledge and practices that undergo many generations of trial and error. Social science methods and processes, like Indigenous science, also undergo patterns of trial and error – albeit in much shorter

timescales and a more academic context. As a result, the thesis itself is not as important as the "communal knowledge process" shared with my research partners, along with the lessons learned and the ongoing discussion of the ways in which results of this thesis will be shared in formats that are accessible and beneficial for Nunavummiut. Rather than being the end of a metaphorical chapter, this is the start of my journey in northern community-engaged work, and these are the lessons that will be brought forth with me. In the same vein as the overall past, present, and future structure of the rest of this chapter, the following sub-sections will discuss my "past" research stages and lessons (Section 5.5.1), present commitments to accountability in research rigour (Section 5.5.2), and future goals for research and data (Section 5.5.3).

6.2.1 "Past" Stages & Research Lessons

As cliched as it is to "expect the unexpected," I have learned that doing so helps to encourage flexibility in research, potentially avoiding non-generative research practices or habits that may crop up despite our best intentions. It is easy to make grand gestures and commitments to ethics and transparency in communication and collaboration at the start, but when push comes to shove, how well do those promises stand? It was within unexpected circumstances that my systems were challenged to withstand the downpour that was the corruption, missing, and crashing of files during my data analysis. The NVivo software that I was using and trusted to manage my data encountered issues with seemingly no possible fix except for a last-minute reversion to

manual entry. With invaluable help from Maddy Lutes, we double- and triple-checked the counts and totals for climate change work coded to each of the seven databases and seven CCRRA themes. Although this lengthy process took place over two to three months, it was the only way I could confidently move forward with data analysis to ensure representative results to the best of my ability. I learned through this process to simply accept that there may always be unknown errors and to move forward. Despite good intentions, researchers can easily seek to forego the "communal knowledge process" out of ease and convenience, viewing ethics as another checkbox or speed bump on the road to publication. Although challenging at times, my commitment to *pittiarniq* (being good) helped to resist this temptation and prioritize ethics and rigour. I was also strongly supported in this process through partnership and communication with Sara, Jade, and Gita. Sharing iterations of my results and learning from their feedback, I was buoyed through challenging times with new insights and strengthened relationships.

In the data analysis of my research, the data challenges I faced were isolation, but in trying my best to communicate deadlines with Sara and Jade, we could shift our deadlines and provide more time for their review of draft results and copies of this work. Expecting a longer timeline than assumed could better prevent future instances of unintentional disregard of good intentions and allow for even more time for my partners to review the work, better respecting their time. Due to this iterative process, flexibility, correction, and communication, we could be aware of wrongs that could be righted and

see what Sara and Jade would like at each stage. As we all have our own individual roles in the work, it is a balance of not burdening those involved with what is considered my task, while keeping them informed and in the loop. I have also continued to learn about the need to balance open-mindedness in shifts in research focus and flexibility with realistic expectations of tangible outcomes within a given scope and deadlines. For example, at the start, the CCS shared a list of potential questions for MA research, including a wide variety of priorities in learning about climate change research. Together, we identified what was possible within the scope of a master's project. Additionally, the project focus had shifted within the first four months of the work, while working to meet expectations.

In summary, these lessons I learned from "past" stages in this MA research are, in fact, ongoing stages that will be consistently improved upon and returned to when the occasion arises. This is particularly true, especially in finalizing data, maps, and graphs for results sharing and publication in the time following the submission of this thesis, as described in the next two sub-sections.

6.2.2 Present Commitments to Accountability in Research Rigour

Throughout the MA research process, I have continued to seek direction for the work whenever questions or challenges arose. This is an ongoing practice that I still carry with me as I have committed to checking data, with the support of a second researcher, if difficulties with files and numbers persist. I want to uphold, to the best of my ability,

rigorous research by continuing to anticipate additional time required to rectify any potential inaccuracies in my work. As per usual, I will also ask questions and remain open to correction for increased accountability. As Smith (2012) wrote, "In Indigenous frameworks, relationships matter" (p. 125), which is why I aim to continue in *pittiarniq* (being good) by building relationships with people and partners, but also with the data and new information around me. To do so, I strive to demonstrate this commitment to research rigour by reading beyond what is required for my research. These components all worked to inform my present efforts in working with others in an Inuit and northern context that is uniquely different from my own.

6.2.3 Future Goals for Research & Data

According to Yunkaporta (2019), "If people are laughing, they are learning. True learning is a joy because it is an act of creation" (p. 137). My future goal for this work is to continue to learn in the spirit of joy. However, it does not mean that it will be easy. In the same way that I was and am presently committed to *pittiarniq* (being good), as well as the other *piliriqatigiinniq* principles, I hope to focus specifically on *iqqaumaqatigiinniq* (all knowing coming into one) and *unikkaaqatigiinniq* (story-telling) in the time following thesis submission. I will continue to work with Sara and Jade on the kinds of formats, language, and visuals most relevant to reach diverse community, academic, and decision-maker audiences. We will continue to make decisions together, and we will collectively work to reach these different audiences. Furthermore, in reciprocity for the

data shared by each of the licensing/permitting agencies and funding programs included in this thesis, I will provide them with individualized graphs and results summaries to display climate change research trends for their respective databases. They remain the data owners, but they can use the results of my analysis as they see fit to support their organizational goals and mandates. Ultimately, I want to contribute to improved climate change research outcomes for Nunavummiut.

6.3 Future Considerations

6.3.1. For the CCS

Overall, the CCRRA thematic areas, or themes, were very useful in organizing climate change work according to the Government of Nunavut's risk and resiliency assessment areas. When it comes to the potential restructuring of CCRRA thematic areas, certain themes and/or sub-themes may be added and further defined for improved clarity and specificity of climate change risk and resiliency areas. This may account for nuances in climate change risks that may be quite broad. Furthermore, climate change work is underrepresented relating to built infrastructure and health-related themes. As a result, it may be beneficial to connect with hamlets to help support their strategic priorities in climate change adaptation and with hospitals and key health organizations to refine health sub-themes as well. Below are summary points of key findings and considerations.

- Healthy Environment is the most populated CCRRA theme as it effectively captures physical sciences climate change research, especially in the Fauna sub-theme from the following databases: GN DoE (Wildlife Research), Parks Canada, and DFO. It also includes relevant Inuit and social science projects from the CCPN, ICBCM, and CCHAP. Inclusion of sub-themes such as sea ice, snow melt, permafrost, glaciers, sea level, insects, invasive species, contaminants, and greenhouse gases would be useful in further specifying climate change impacts and implications.
- Built Infrastructure & Services and Livelihoods & Growth themes are most effective in capturing Inuit and social science and climate change adaptation projects as they are among the most detailed key themes. The Transportation and Transportation Industry sub-themes within each primary theme, respectively, are quite similar, so it may be worth considering more specific terms and definitions to further differentiate the two.
- Health, Safety and Wellness and Food Sovereignty are important themes that highlight health science research yet have the fewest projects across all years and databases. Differences between the Cultural Health and Cultural & Spiritual Well-being sub-themes can be further clarified.
- Community & Connection is the broadest theme and can be more specific in definition.

- Inuit Culture & Heritage is effective in application to this study and could benefit from the inclusion of a Youth sub-theme.
- Increased climate change adaptation funding between 2017 and 2019 is positively related to an increase in interdisciplinary and Nunavut Inuit Organization-led work that supports a greater diversity of CCRRA themes.

6.3.2. For Licensing, Permitting, and Funding Agencies

- When considering annual climate change project activities, the NRI licenses the most research, followed by the GN DoE, Parks Canada, and DFO. Within funding, CCPN funds most projects, followed by ICBCM and CCHAP. It is understood that licenses/permits and funding programs with more specific topical scopes, according to the appropriate Acts, would license, permit, and fund fewer climate change projects.
- Healthy Environment is the dominant, or largest, theme in all databases, except for CCPN (in which Inuit Culture & Heritage is dominant) and CCHAP (in which Community & Connection is dominant).
- The licensing/permitting agency databases are less thematically diverse, and they experience lower rates of change (the number of climate change projects increased per year) than federal funding programs.
- Most projects from the NRI, Parks Canada, GN DoE, and DFO databases are led by Canadian Universities. Funding projects are primarily led by Nunavut Inuit

Organizations and Nunavut Municipalities. Would health-specific funding programs encourage more climate change research from hospitals?

6.3.3. For Researchers

- Based on the present study, C-CIARN (2005) study, and Bolton et al. (2011) study, there is an overrepresentation of climate change research in the Healthy Environment theme and physical/natural science disciplines across Nunavut. Topics in Fauna and Marine & Aquatic Ecosystems are particularly saturated.
- More research can be done in social and Inuit sciences relating to the following themes: Built Infrastructure & Services, Community & Connection, Inuit Culture & Heritage, and Livelihoods & Growth.
- The greatest disparity in climate change work exists in the Health, Safety & Wellness and Food Sovereignty themes. Topics in Mental Health and Cultural Health are particularly underrepresented.
- Geographically, more research can be conducted in the Kitikmeot and Kivalliq regions.
- Most climate change research is led by Canadian Universities. Academic researchers should collaborate more with Nunavut Inuit Organizations in particular, as well as NGOs, Institutions of Public Government, and Hospitals. It is important to prioritize Inuit-led climate change research.
- All CCRRA themes are interconnected, and climate change research projects would benefit from involving and considering a greater diversity of themes.

6.4 What's Next: Future Work

Identifying Nunavut climate change research trends across seven licensing/permitting and funding agencies is only the metaphorical the tip of the iceberg. It is a beginning, that helps to identify challenges and opportunities, and raises many new questions about the underlying causes of these trends. It would be beneficial for future research to:

- Examine impacts of the COVID-19 pandemic on climate change research post-2021;
- Investigate different aspects of climate change research, such as research methods employed, youth involvement, as well as connections to policy, governance, and Inuit sovereignty;
- Explore the impacts of climate change funding (e.g. Who funds the work? How much funding is available? Which types of projects receive the most funding, and for how long?); and,
- Analyze additional variables such as project duration and the size of research teams in relation to the scale and impact of climate change projects.

CCS had also identified a number of other questions that I was not able to address in this thesis due to MA timelines and resources (Appendix 1) and would be important points of investigation in future studies. For example, what are the key recommendations from climate change research, and were they disseminated to

communities in Nunavut? How have recommendations been implemented, if at all, and what was the level of community engagement? These additional investigations may present their own challenges in data collection and analysis but would expand our understanding of climate change work in terms of topical depth, temporal scope, and available human and financial resources.

This study only scratches the surface of what is possible in such a short-term situational analysis, and yet demonstrates the benefits of collaborative and cross-organizational cooperation. When it comes to climate change work, there remain many questions left to be asked and much to be done. Often, it can be overwhelming to know where to start – for researchers and agencies alike. However, it is in looking to our partners and their priorities that we can work together in *piliriqatigiinniq* and move towards achieving our climate change goals in communities, across Nunavut, and throughout the country.

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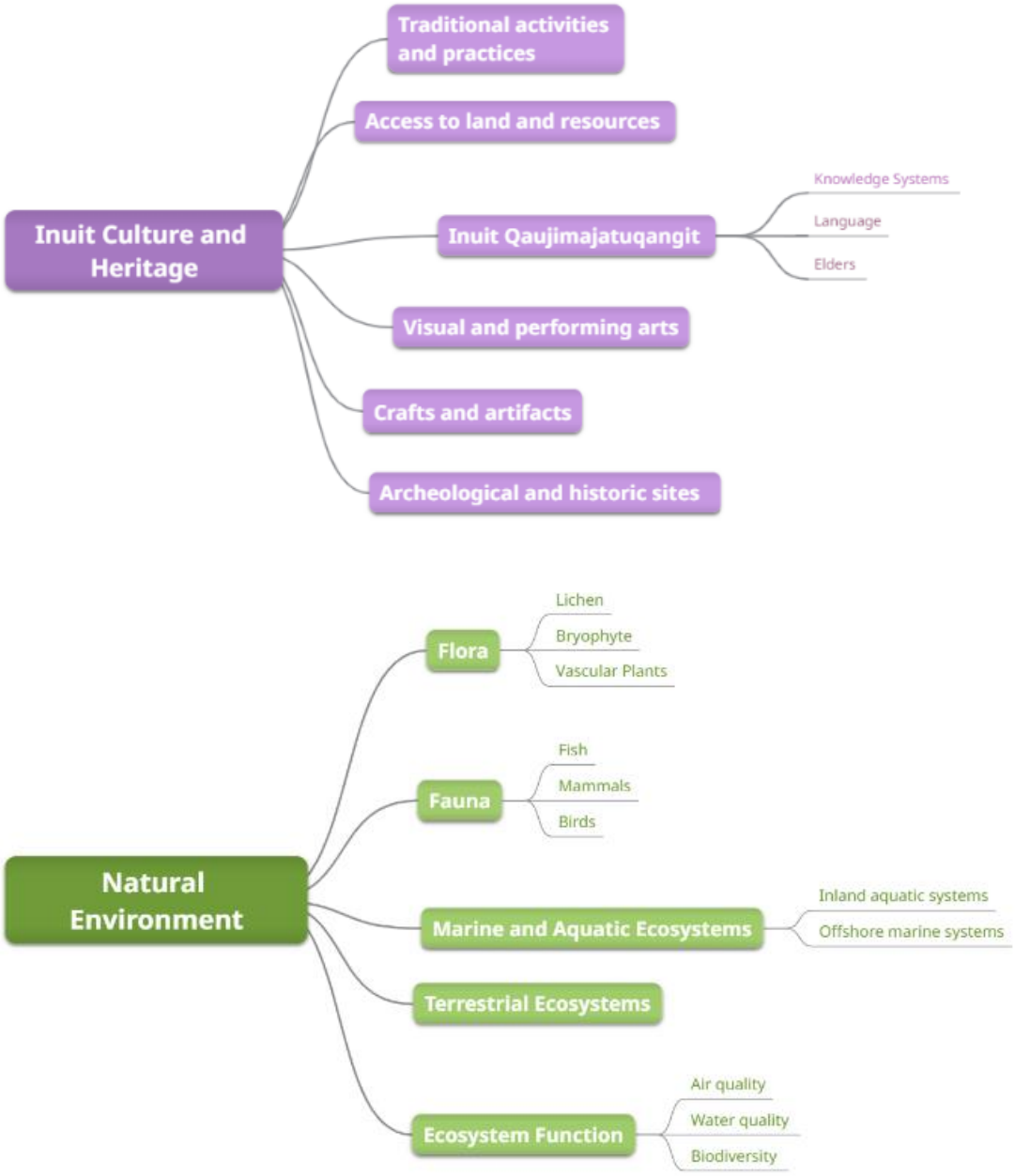
Appendices

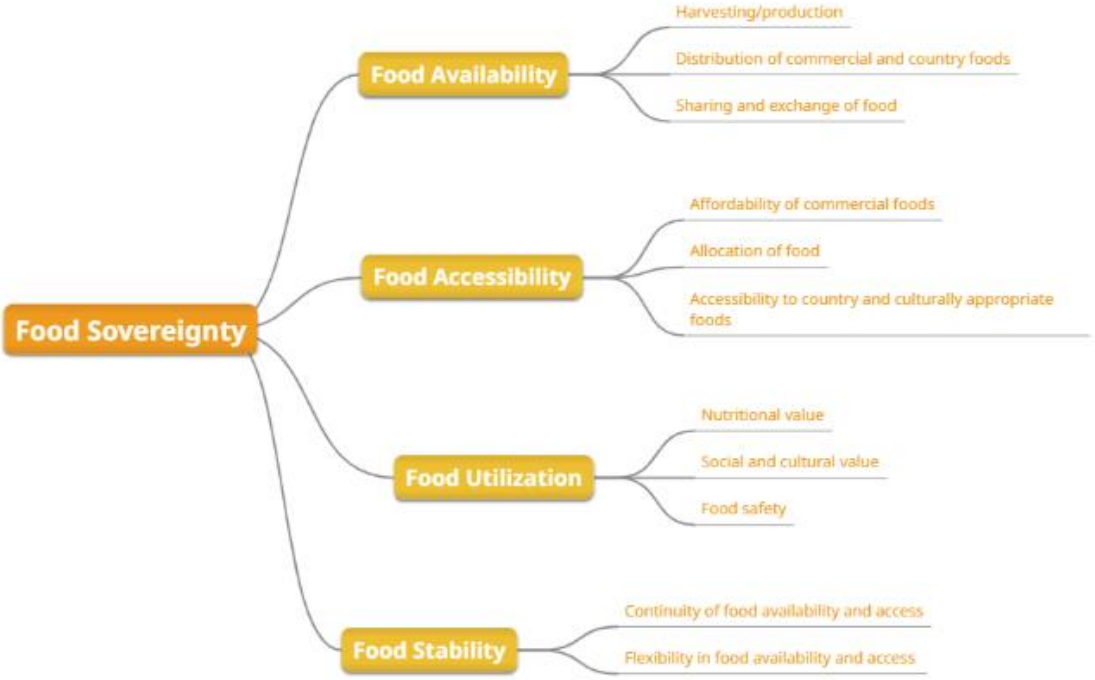
Appendix 1. *CCS questions for MA climate change research*

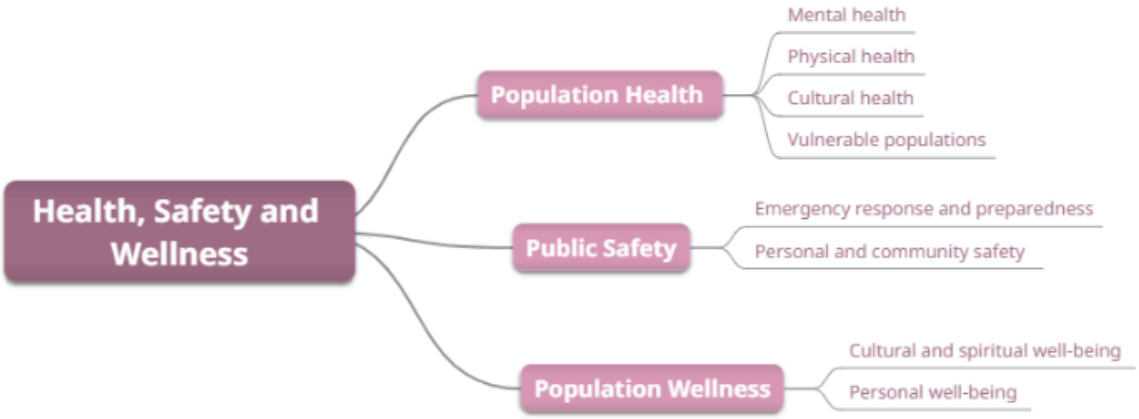
Primary questions	**Secondary questions (Beyond the scope of this MA research)**
• Out of all the licensed research in NU, which ones are climate change related? • Which regions is the research being done? • Which communities? • Which institutions did the work? (academic/government/community/other). • Which CC impacts/hazards was it connected to?	• Who funded it? • Do we have contact information for the researcher and funders? • What were the recommendations coming out of the work? • Who were these recommendations shared with? (How much research is actually making it to NU decision-makers?) • Did any action/change come from the recommendations? • Which partners did the work? • What level of engagement was initiated in the community? With whom (hamlet, residents, elders, youth)? • Were any local opportunities identified to help the community continue to lobby for continued investigation into addressing the research topic, if required?

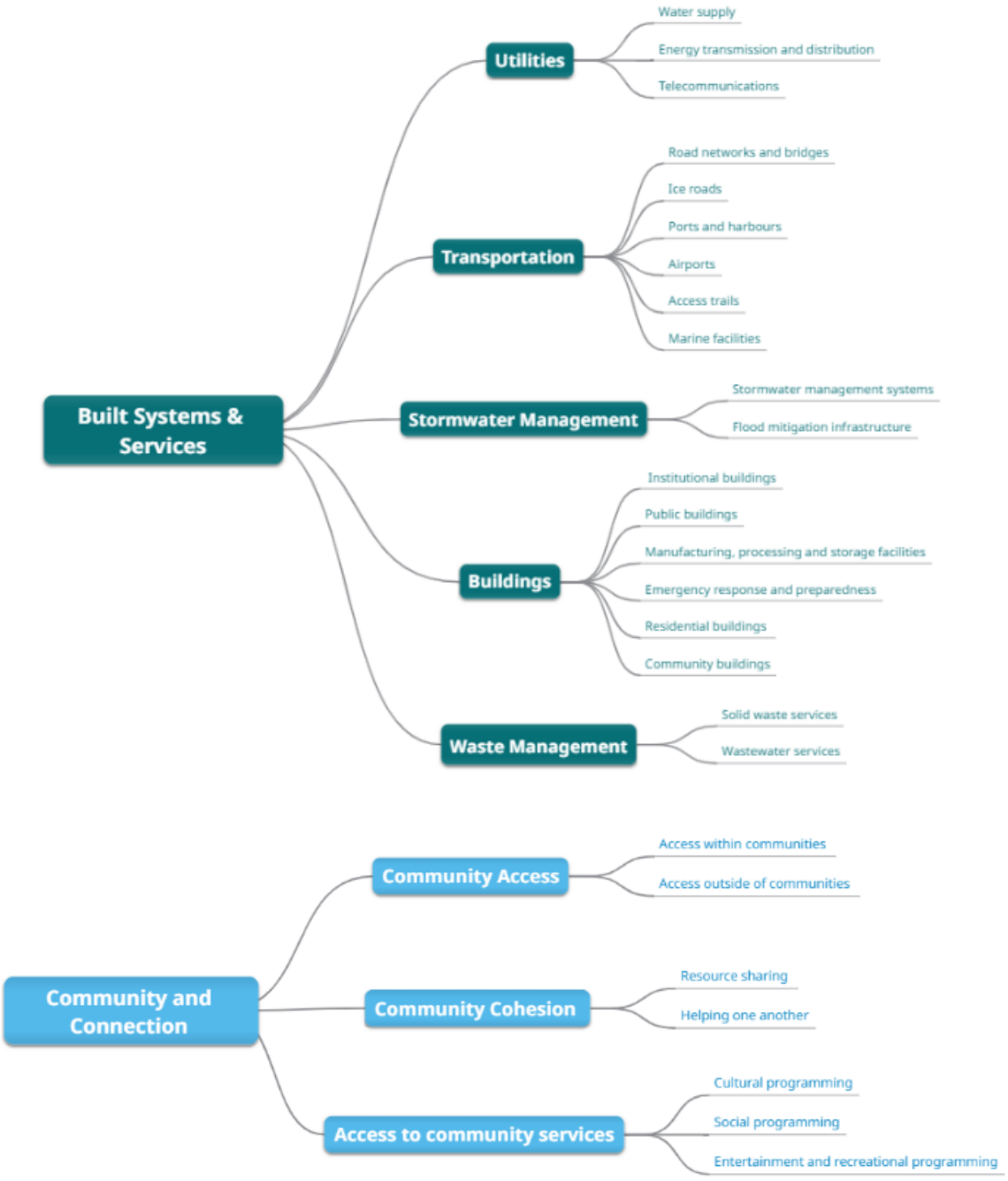
	• Do we have contact information for researcher and funders? • Were any of the research findings disseminated back to the community? If so, in what format? Was any material translated for dissemination within the community? • Were any additional resources or continued learning opportunities presented/left in the community?

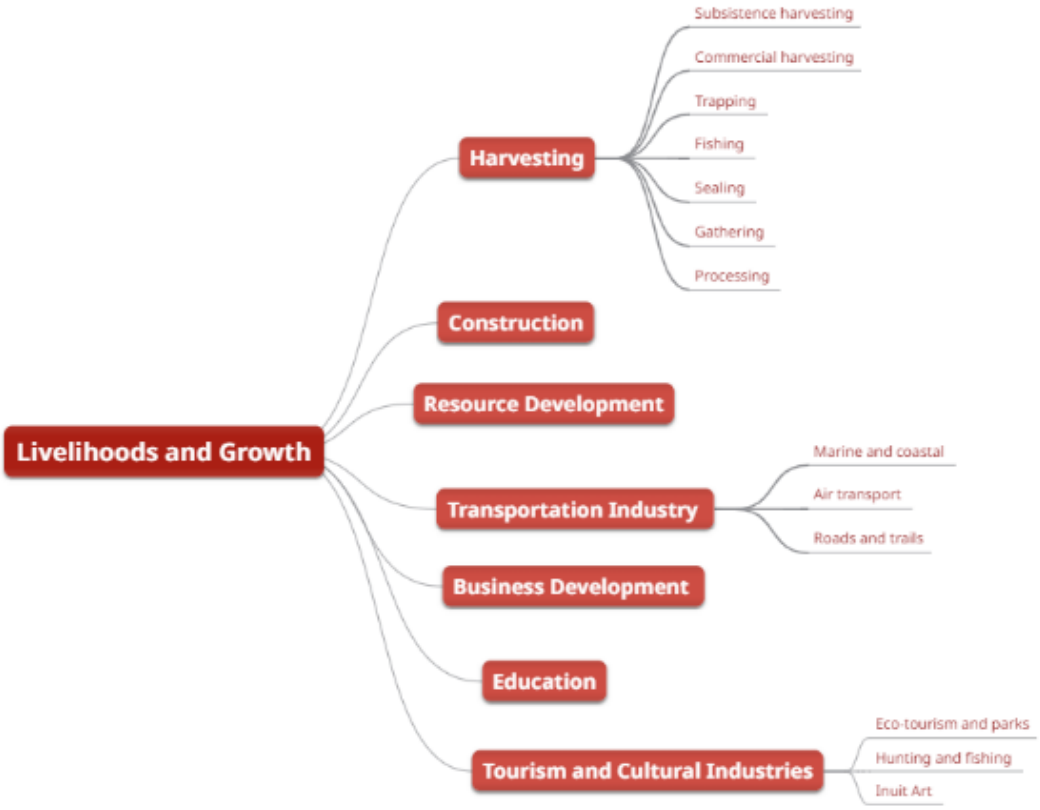
***Appendix 2**. Government of Nunavut's seven CCRRA value-based themes*




Food Sovereignty
Food Availability
Harvesting/production
Distribution of commercial and country foods
Sharing and exchange of food
Food Accessibility
Affordability of commercial foods
Allocation of food
Accessibility to country and culturally appropriate foods
Food Utilization
Nutritional value
Social and cultural value
Food safety
Food Stability
Continuity of food availability and access
Flexibility in food availability and access


Health, Safety and Wellness
Population Health
Mental health
Physical health
Cultural health
Vulnerable populations
Public Safety
Emergency response and preparedness
Personal and community safety
Population Wellness
Cultural and spiritual well-being
Personal well-being


Built Systems & Services
Utilities
Water supply
Energy transmission and distribution
Telecommunications
Transportation
Road networks and bridges
Ice roads
Ports and harbours
Airports
Access trails
Marine facilities
Stormwater Management
Stormwater management systems
Flood mitigation infrastructure
Buildings
Institutional buildings
Public buildings
Manufacturing, processing and storage facilities
Emergency response and preparedness
Residential buildings
Community buildings
Waste Management
Solid waste services
Wastewater services
Community and Connection
Community Access
Access within communities
Access outside of communities
Community Cohesion
Resource sharing
Helping one another
Access to community services
Cultural programming
Social programming
Entertainment and recreational programming



Source: Government of Nunavut, 2023, p. 75-81

Appendix 3. *The five stages of the MA research project*

Stage	Action	How Action is Guided by Piliriqatigiinniq Principles	How Action Supports CCS & NRI Priorities
Stage 1: Identifying Priorities & Research Focus	• Connected with community partners via email to identify priorities and research focus • Sara Holzman, Government of Nunavut Climate Change Secretariat (CCS) - Identified CCS priorities, interests, questions • Jade Owen & Jamal Shirley, Nunavut Research Institute (NRI) - Provided guidance on refining research focus • Organized and participated in virtual and in-person meetings • Asking for guidance from Sara and Jade will remain ongoing throughout the process	• Supports *inuuqatigiittiarniq*, "respecting others" (Healey & Tagak, 2014, p. 5) • Intentions - To support work chosen by community partners • Research focus was proposed by Sara, which acknowledges respect of her role as a primary partner and what the CCS currently needs to support Nunavummiut • Working towards the common good respects the needs of community partners as well as the broader context of Nunavut communities • Consistently asking for guidance and implementing feedback respects and acknowledges the expertise and priorities of partners	CCS • MA work directly benefits CCS' goals and priorities of understanding the types of climate change research conducted in Nunavut across the last two decades NRI • MA work will support the NRI's goal of and interest in exploring opportunities to improve coordination and communication among permitting/licensing agencies
Stage 2: Literature Review and Background Research	• Conducting personal background research on: • The Inuit community context in Nunavut • Decolonizing research	• Supports *pittiarniq*, "being good" (Healey & Tagak, 2014, p. 8) • Personal Growth - Learning and un-learning through background research	CCS • The literature review will provide CCS with a broad overview of published literature on climate change research with

	• Indigenous-led research methods, principles, and frameworks • Conducting literature review on: • Published literature on the climate change research context in Nunavut (including the current impacts of climate change and types of climate change research) - Using CCS climate change risk assessment thematic areas (themes/priority areas) to guide organization of this section • Existing climate change gap analyses for Nunavut • Climate change policies across Nunavut and Canada • Federal funding programs for climate change research • Researching & creating a community engagement plan • Drafting a plan based on an Inuit framework, background research, and self-reflexivity	provides community and topic context to "be good" • Supports *inuuqatigiittiarniq*, "respecting others" (Healey & Tagak, 2014, p. 5) • Community Context - Better understanding underlying contexts before the data analysis and results interpretation stages demonstrates awareness • Encourages a mindset of entering the work with respect for other cultures and the local community • Intentions & Self-reflexivity - Reflections on positionality and significance of decolonizing research and the work through personal readings and coursework support building respectful relationships	relevance to CCS' thematic areas of interest • Background research will help me understand the climate change research and community context to better support the CCS' work • By planning to adhere to CCS priorities, creating a community engagement plan demonstrates respect of and dedication to their needs • Promotes organization, efficiency, and critical thinking in the work NRI • Background research will help me understand the different roles of Nunavut's licensing and permitting agencies, which will better support the NRI's work • By planning to adhere to NRI priorities, creating a community-engagement plan demonstrates

			respect of and dedication to their needs • Promotes organization, efficiency, and critical thinking in the work
Stage 3: Data Collection & Preliminary Analysis	• Reaching out to territorial and federal licensing/permitting agencies • Jade identified permitting agencies that are most relevant and necessary to the project • Requesting databases and documents with project summaries including climate change-related research • Reaching out to federal climate change funding programs • Requesting databases and documents with project summaries including climate change-related research • Conducting qualitative data analysis • Thematic content analysis (TCA) using NVivo computer	• Supports *iqqaumaqatigiinniq*, "all knowing, coming into one" (Healey & Tagak, 2014, p. 8) • Finding Meaning - Collaborative meaning-making with Sara and Jade through an iterative process of understanding and refining the coding scheme will ensure that our ideas align and that the analysis makes sense in the context of their communities and perspectives (as northern-based professionals working on behalf of Nunavummiut) • Increasing connections and communication networks between the NRI and licensing/permitting agencies support different types of knowing coming into one • Supports *inuuqatigiittiarniq*,	CCS • Communication throughout this stage will ensure the TCA codes adequately reflect the themes represented by the CCS' climate change risk assessment thematic areas • Continues to benefit the CCS NRI • Communication throughout this stage will ensure that I am reaching out to permitting agencies directly relevant and necessary to the project and to the NRI (as identified by Jade herself) • Continues to benefit the NRI

	software & secondary sources (e.g. Project summaries) • Using CCS climate change risk assessment thematic areas (themes/priority areas) as codes in the TCA • CCS themes will also guide following results interpretation (and also guides literature review) • Preliminary analysis of common climate change research trends • Will create draft summary tables and graphs to share with community partners	"respecting others" (Healey & Tagak, 2014, p. 5) • Community partners are guiding the direction of the analysis, which demonstrates respect of expertise and priorities	
Stage 4: Results Sharing, Analysis & Discussion	• Meet with community partners in Iqaluit, Nunavut (October) • Early results sharing & interpretation • Discuss preliminary results and research trends with Sara and Jade to guide/re-direct TCA and overarching analysis • Receive & implement feedback and input from Sara and Jade • Connect with other permitting agencies	• Supports iqqaumaqatigiinniq, "all knowing, coming into one" (Healey & Tagak, 2014, p. 8) • Finding Meaning - In-person meaning-making will further promote the alignment of goals and priorities during analysis and the NRI workshop • Supports *inuuqatigiittiarniq*, "respecting others"	CCS • CCS can ensure that early results align with expectations as well as present and future needs and expectations NRI • NRI can ensure that early results align with expectations as well as present and future needs and expectations

	(e.g. Government of Nunavut wildlife and archaeology departments, etc.) • Support licensing/permitting agency workshop (Not a direct contribution to MA research***) • Workshop to facilitate increased communication between different agencies • Providing support, wherever possible, to running the workshop (e.g. Notetaking, logistics, etc.) • Conduct spatial analysis • GIS Mapping - With the help of Regena Sinclair, maps can be created with GIS to visually represent where climate change research has taken place in Nunavut	(Healey & Tagak, 2014, p. 5) • Community partners are guiding the direction of the analysis and are collaborators in results interpretation, which demonstrate respect of expertise and priorities	

Stage 5: Knowledge Translation & Dissemination	• Write MA thesis • Summarize literature review, methods, results, discussion • Discuss with community partners preferred methods of knowledge translation • Discuss with CCS and NRI appropriate formats for research dissemination as well as for their needs and purposes • Discuss with CCS and NRI ways to reach diverse audiences • Create a non-technical, visual summary report • Produced in English and three regional dialects of Inuktut and/or whichever dialects and languages requested by the CCS • Other forms of knowledge mobilization as necessary or where possible • E.g. Group presentations, academic publications, etc.	• Supports *unikkaaqatigiinniq*, "story-telling" (Healey & Tagak, 2014, p. 6) • The climate change research trends "story" will be presented in mediums that reflects the CCS' and NRI's needs and wants • The way in which these stories, or research results, are shared will be visual and accessible to all audiences, not limited to academic audiences	CCS • Improves the accessibility and relevance of climate change research for decision-making • Informs territorial climate change policy and adaption planning • Research will be shared in a format most useful to them NRI • Introduces opportunities to improve coordination for licensing and permitting of interdisciplinary climate change research • Research will be shared in a format most useful to them
Notes	*Stage 1 is considered officially complete because CCS priorities and a research focus were identified and determined in November 2022. However, due to the nature of updated information provided by community partners, the climate		

	change research themes prioritized in the literature review and data analysis will consistently be updated to best match the areas of interest of the CCS. ** It should be noted that these stages, although labelled as such, do not only begin when the previous stage ends. Due to the iterative nature of this work and the reality of working on multiple stages at the same time, there are overlaps between the "start" and "end" dates of each of these stages. *** Although this workshop is not a contribution to the MA research, my anticipated contribution to assisting its facilitation supports NRI priorities, which in turn supports building respectful relationships. See Chapter 3.

Appendix 4. *Climate change research topics and themes as compared to topics in published literature*

GN CCRRA Thematic Areas (7 Themes)	**ITK Climate Change Strategy (2019) Themes (5 Themes)**	**C-CIARN (2005) Themes (14 Themes)**	**Bolton et al. (2011) Themes (6 Themes)**
Built Infrastructure and Services	**Infrastructure** • Close the infrastructure gap with climate resilient new builds, retrofits to existing builds, and Inuit adaptations to changing natural infrastructure	**Infrastructure (Community System)** • Zero projects in this category across all regions from 1997-2004 (C-CIARN, 2004) **Transportation (Community System)** • Zero projects in this category across all regions from 1997-2004 (C-CIARN, 2004)	**Infrastructure and transportation**
Food Sovereignty	**Food Systems** • Reduce the climate vulnerability of Inuit and market food systems	**Community Health (Community System)** • 3 projects (1.8% of all climate change research) in this category across all regions from 1997-2004 (C-CIARN, 2004)	**Health and wellbeing**
Health, Safety, and Wellbeing	**Health, Well-being and the Environment** • Improve Inuit and environmental health and wellness outcomes		

	through integrated Inuit health, education and climate policies and initiatives		
Inuit Culture and Heritage		**Traditional Knowledge (Community System)** • 10 projects (5.9% of all climate change research) in this category across all regions from 1997-2004 (C-CIARN, 2004)	**Culture and education**
Livelihood and Growth		**Hunting/Trapping (Economic System)** • 1 project (0.6% of all climate change research) in this category across all regions from 1997-2004 (C-CIARN, 2004)	**Hunting and subsistence harvesting**
		Tourism/Recreation (Community System) • Zero projects in this category across all regions from 1997-2004 (C-CIARN, 2004)	**Business and economy**
		Mining (Economic System) • Zero projects in this category across all regions from 1997-	**Institutional and Resource Management**

		2004 (C-CIARN, 2004)	
		Fisheries • Zero projects in this category across all regions from 1997-2004 (C-CIARN, 2004)	
Healthy Environment		**Freshwater** • 46 projects (27.3% of all climate change research) in this category across all regions from 1997-2004 (C-CIARN, 2004)	
		Tundra • 81 projects (48.2% of all climate change research) in this category across all regions from 1997-2004 (C-CIARN, 2004)	
		Coastal Areas • 8 projects (4.7% of all climate change research) in this category across all regions from 1997-2004 (C-CIARN, 2004)	
		Marine Systems • 19 projects (11.3% of all climate change research) in	

		this category across all regions from 1997-2004 (C-CIARN, 2004)	
Community and Connection	**Knowledge and Capacity** • Advance Inuit capacity and knowledge use in climate decision-making		
	Energy • Support regional and community-driven energy solutions leading to Inuit energy independence	**Energy Development** • Zero projects in this category across all regions from 1997-2004 (C-CIARN, 2004)	
		Waste Management • Zero projects in this category across all regions from 1997-2004 (C-CIARN, 2004)	

***Appendix 5**. Nunavut climate change research database metadata tracked and shared for this MA project*

	NRI	GN Wildlife	DFO	Parks Canada	ICBCM	CCPN	CCHAP
Project Title	✓	✓	✓	✓	✓	✓	✓
License Number	✓	✓	✓	?			
License Year	✓	✓	✓	✓			
Summary	✓	✓	✓	✓	✓	✓	✓
Rationale	✓	✓	✓	✓	?	?	?
Objectives	✓	✓	✓	✓	✓	✓	✓
Methods	✓	✓	✓	✓	✓	✓	✓
Community Consultation Plan	✓	✓	✓	?	?	?	?
Proposed Use of Local Knowledge	✓	✓	✓	?	?	?	?
Opportunities for Local Participation	✓	✓	✓	?	?	?	?
Applicant	✓	✓	✓	✓	✓	✓	✓
Principle Investigator (PI)/Lead Researcher Name	✓	✓	?	✓	?	?	?
Department	✓	?	?	✓	✓	✓	✓
Affiliation	✓	?	?	✓	×	×	×
Affiliation Type	✓	×	×	✓	×	×	×
Contact	✓	✓	✓	✓	✓	✓	✓
Email	✓	✓	✓	✓	✓	✓	✓
Roles	✓	×	✓	✓	?	?	?
Field Researchers	✓	?	×	?	×	×	×
Team Members	✓	✓	×	?	×	×	×
Team Members (Administrative)	✓	?	×	?	×	×	×

	NRI	GN Wildlife	DFO	Parks Canada	ICBCM	CCPN	CCHAP
Project Title	✓	✓	✓	✓	✓	✓	✓
License Number	✓	✓	✓	?			
License Year	✓	✓	✓	✓			
Summary	✓	✓	✓	✓	✓	✓	✓
Rationale	✓	✓	✓	✓	?	?	?
Objectives	✓	✓	✓	✓	✓	✓	✓
Methods	✓	✓	✓	✓	✓	✓	✓
Community Consultation Plan	✓	✓	✓	?	?	?	?
Proposed Use of Local Knowledge	✓	✓	✓	?	?	?	?
Opportunities for Local Participation	✓	✓	✓	?	?	?	?
Applicant	✓	✓	✓	✓	✓	✓	✓
Principle Investigator (PI)/Lead Researcher Name	✓	✓	?	✓	?	?	?
Department	✓	?	?	✓	✓	✓	✓
Affiliation	✓	?	?	✓	✗	✗	✗
Affiliation Type	✓	✗	✗	✓	✗	✗	✗
Contact	✓	✓	✓	✓	✓	✓	✓
Email	✓	✓	✓	✓	✓	✓	✓
Roles	✓	✗	✓	✓	?	?	?
Field Researchers	✓	?	✗	?	✗	✗	✗
Team Members	✓	✓	✗	?	✗	✗	✗
Team Members (Administrative)	✓	?	✗	?	✗	✗	✗

Note. The blue check marks confirm that the metadata type is tracked and was shared with me for this study. Purple question marks indicate that it was not shared, although it is likely that the type of information may be tracked but was not shared with me. The orange crosses indicate that it is relatively uncertain whether that type of metadata is tracked by the database.

***Appendix 6**. Total Number of Project Summaries Coded per CCRRA Theme (Primary, Secondary, Tertiary, and Quaternary)*

Built Infrastructure and Services	**37**
Buildings	**8**
Community Buildings	0
Emergency Response & Preparedness	0
Institutional Buildings	0
Manufacturing, Processing & Storage Facilities	0
Public Buildings	0
Residential Buildings	1
Reducing Emissions (FR)	**1**
Alternative Energy	1
Energy Efficiency	1
Greenhouse Gas Reduction	1
Stormwater Management	**10**
Flood Mitigation Infrastructure	2
Stormwater Management Systems	2
Transportation	**4**
Access Trails	1
Airports	0
Ice Roads	0
Marine Facilities	0
Ports & Harbours	0
Road Networks & Bridges	0
Utilities	**8**
Energy Transmission & Distribution	0
Telecommunications	0
Water Supply	5
Waste Management	**2**
Solid Waste Services	0
Wastewater Services	0
Community and Connection	**105**
Access to Community Services	**1**

Cultural Programming	0
Entertainment & Recreational Programming	0
Social Programming	0
Capacity Building (FR)	**14**
Community Access	**4**
Access Outside of Communities	1
Access Within Communities	0
Community Cohesion	**26**
Helping One Another	25
Resource Sharing	2
Community-Based Research (METHODS) (FR)	**85**
Community-Led	25
Food Sovereignty	**32**
Food Accessibility	**7**
Accessibility to Country and Culturally Appropriate Foods	6
Affordability of Commercial Foods	1
Allocation of Food	0
Food Availability	**10**
Distribution of Commercial & Country Foods	1
Harvesting or Production	8
Sharing & Exchanging of Food	1
Food Stability	**7**
Continuity of Food Availability & Access	4
Flexibility in Food Availability & Access	0
Food Utilization	**7**
Food Safety	4
Nutritional Value	0
Social & Cultural Value	2
Marine Food Use or Harvest (FR)	**6**
Health, Safety and Wellness	**50**
Population Health	**25**

Cultural Health	2
Mental Health	1
Physical Health	17
Vulnerable Populations	1
Population Wellness	**4**
Cultural & Spiritual Well-being	2
Personal Well-being	2
Public Safety	**8**
Emergency Response & Preparedness	6
Personal & Community Safety	0
Healthy Environment	**625**
Contaminants (FR)	**23**
Ecosystem Function	**169**
Air Quality	7
Biodiversity	68
Invasive Species (FR)	5
Water Quality	55
Fauna	**309**
Birds	78
Fish	68
Insects (FR)	58
Invertebrates (FR)	66
Mammals	133
Zooplankton (FR)	24
Flora	**144**
Algae (FR)	29
Bryophyte	22
Lichen	19
Phytoplankton (FR)	10
Vascular Plants	64
Greenhouse Gases (FR)	**17**
Marine and Aquatic Ecosystems	**260**
Aquatic Pollutants (FR)	**22**

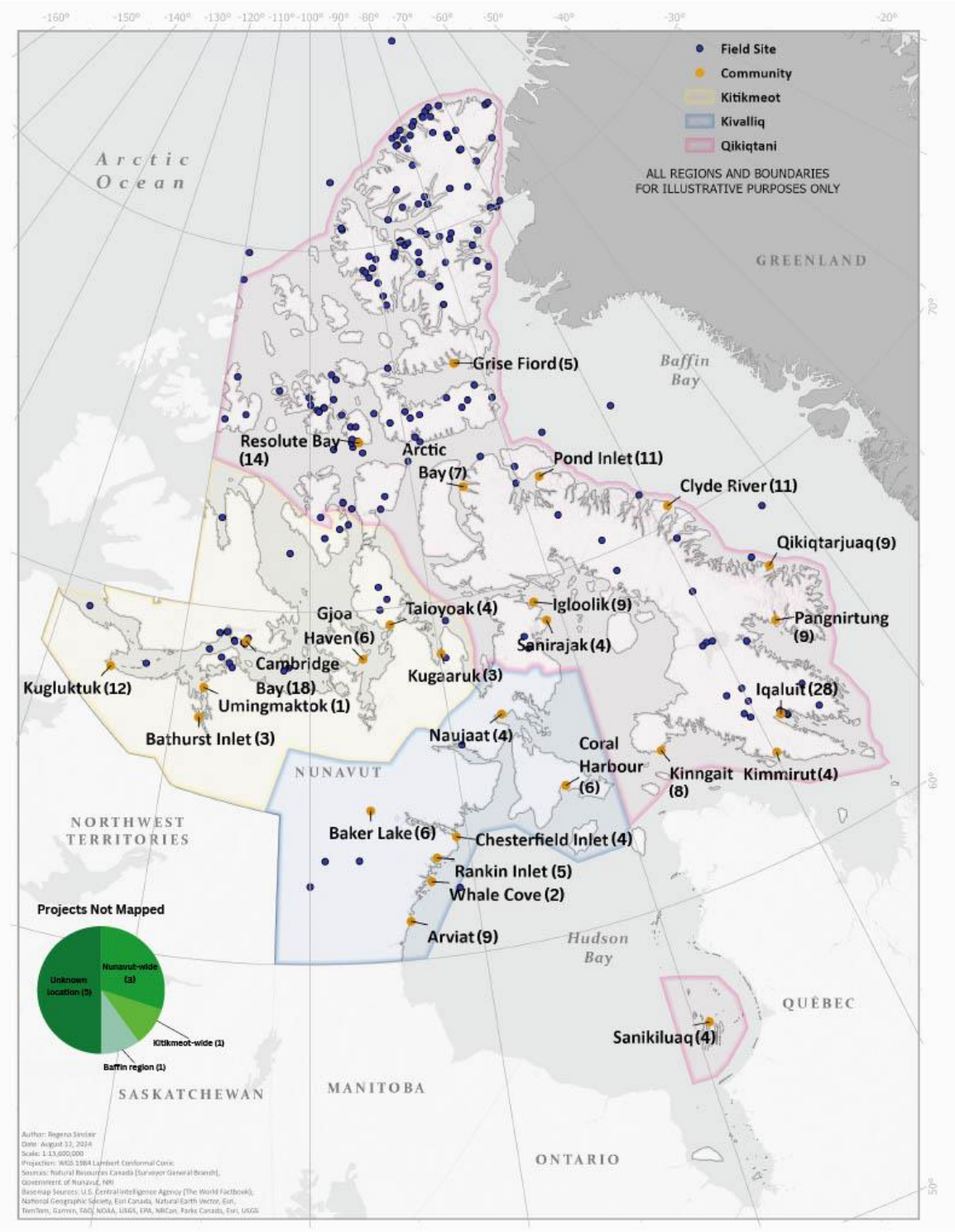
Coastal Systems (FR)	**22**
Fjord (FR)	2
Landfast Sea Ice (FR)	1
Inland Aquatic Systems	**108**
Lake Ice (FR)	5
Lake Sediment (METHODS) (FR)	29
River Ice (FR)	1
Offshore Marine Systems	**116**
Ice Forecasting (FR)	1
Ocean Currents (FR)	3
Sea Ice (FR)	47
Ice Islands (FR)	2
Ice Shelves (FR)	7
Ice Tongues (FR)	1
Icebergs (FR)	2
Multiyear Ice (FR)	2
Sea Level (FR)	8
Sediment (METHODS)	8
Snow Melt (FR)	**3**
Microbes (FR)	**18**
Terrestrial Ecosystems	**179**
Glaciers (FR)	38
Ice Caps (FR)	9
Ice Sheet (FR)	4
Ice Wedge (FR)	1
Impact Crater (FR)	1
Permafrost (FR)	33
Rocks and Minerals (METHODS) (FR)	14
Sediment (METHODS FR)	15
Snow (FR)	10
Snow Pollutants (FR)	2
Weather (FR)	**34**
Extreme Weather	6
Weather Monitoring	1
Weather Prediction	2

Inuit Culture and Heritage	**121**
Access to Land and Resources	**13**
Archeological and Historical Sites	**23**
Crafts and Artifacts	**3**
Knowledge Transfer (FR)	10
Inuit Qaujimajatuqangit	**80**
Elders	16
Knowledge Systems	9
Language	4
Oral Histories (FR)	**6**
Traditional Activities and Practices	**21**
Working Dogs (FR)	1
Visual and Performing Arts	**3**
Livelihoods and Growth	**65**
Business Development	**2**
Construction	**0**
Education	**7**
Energy Security (FR)	**2**
Food Production (FR)	**1**
Harvesting	**40**
Commercial Harvesting	2
Fishing	9
Gathering	2
Processing	1
Sealing	1
Subsistence Harvesting	8
Trapping	0
Mining (FR)	**2**
Resource Development	**2**
Tourism and Cultural Industries	**10**
Eco-tourism & Parks	2

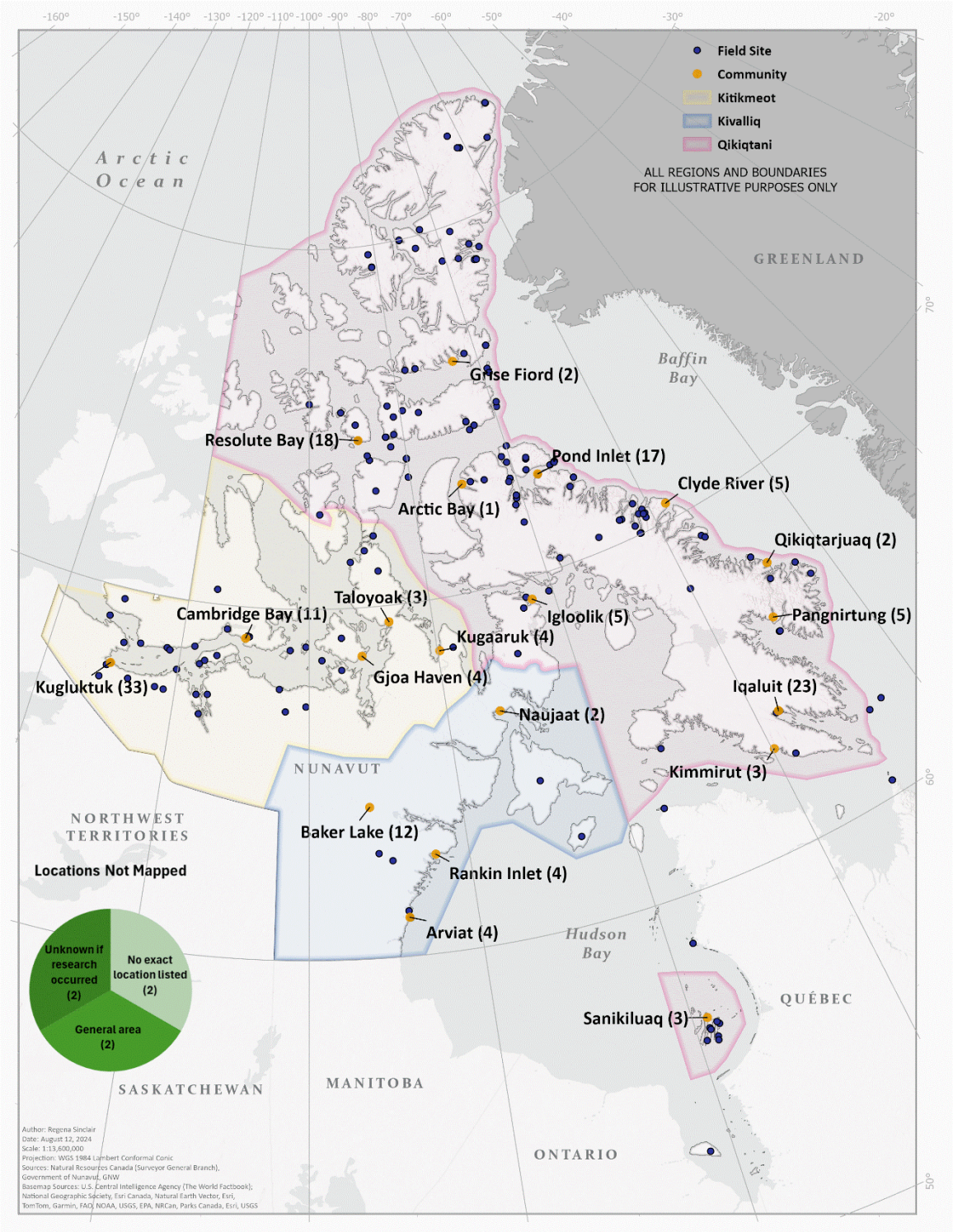
Hunting & Fishing	7
Inuit Art	0
Transportation Industry	**8**
Air Transport	0
Marine & Coastal	5
Water Security (FR)	1
Roads & Trails	3

Note. Codes with the initials, "FR," indicate that they were added and are not in the original CCRRA themes.

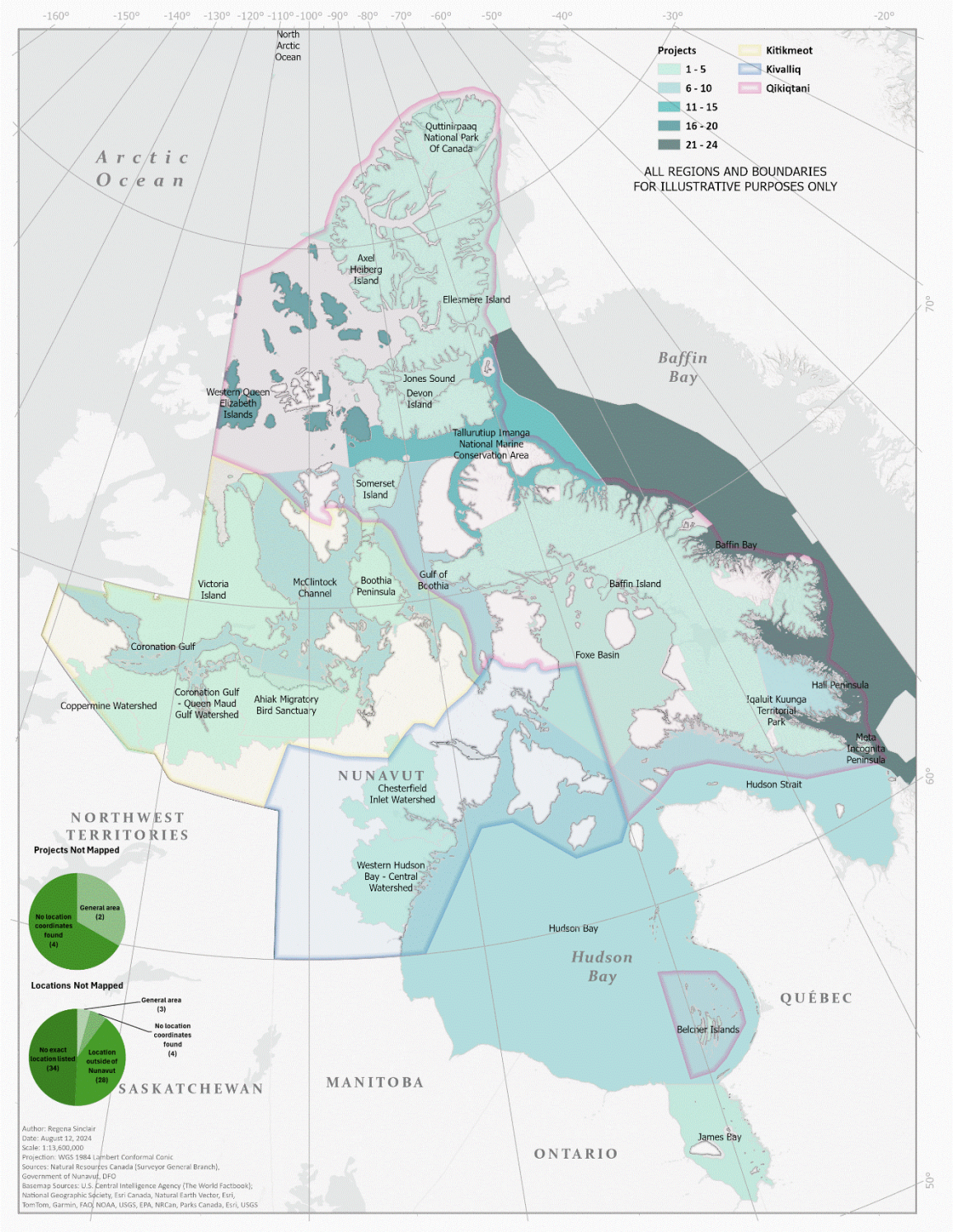
Appendix 7. *Map of NRI database climate change projects*



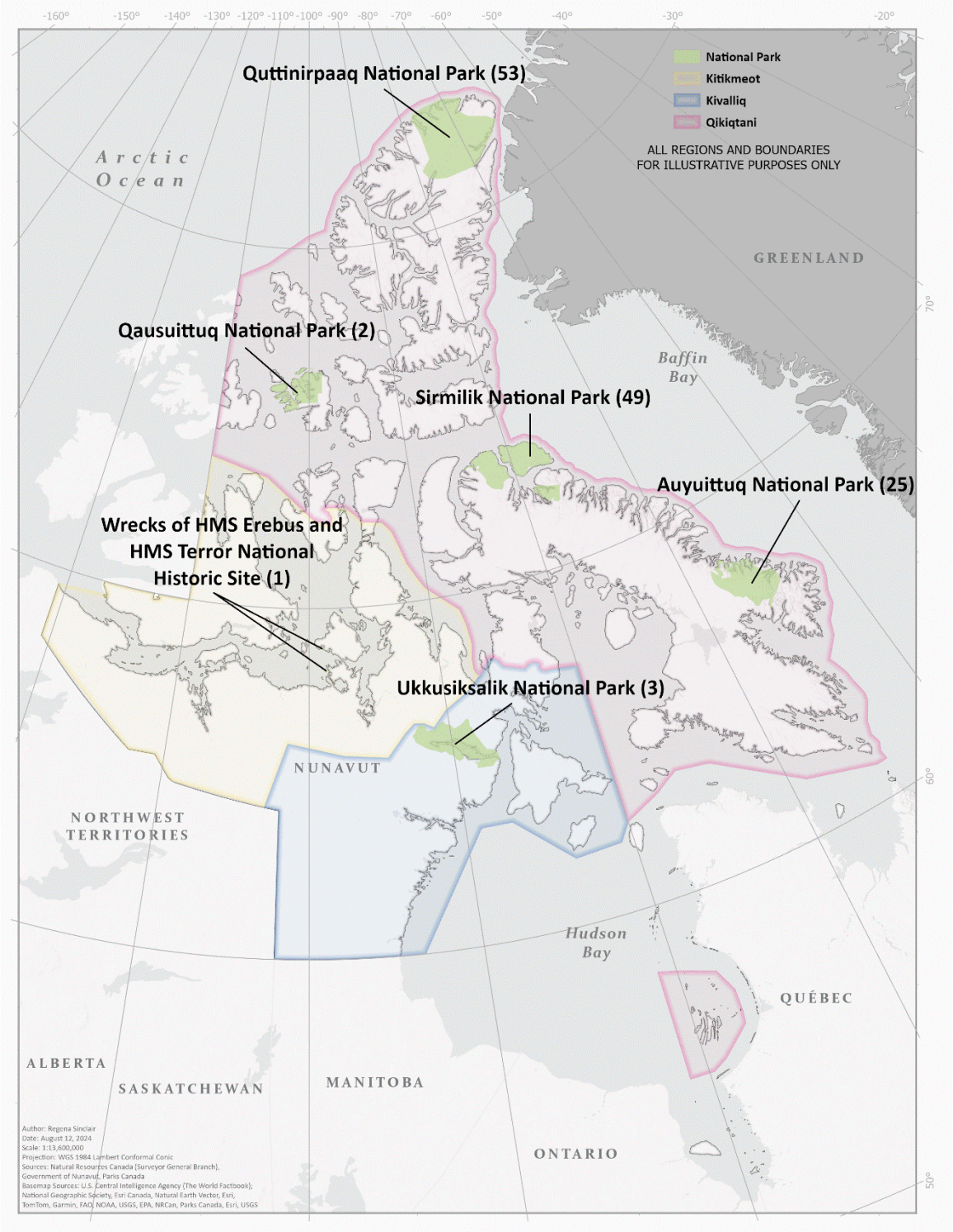
Appendix 8. *Map of Government of Nunavut Department of Environment (Wildlife Research) database climate change projects*



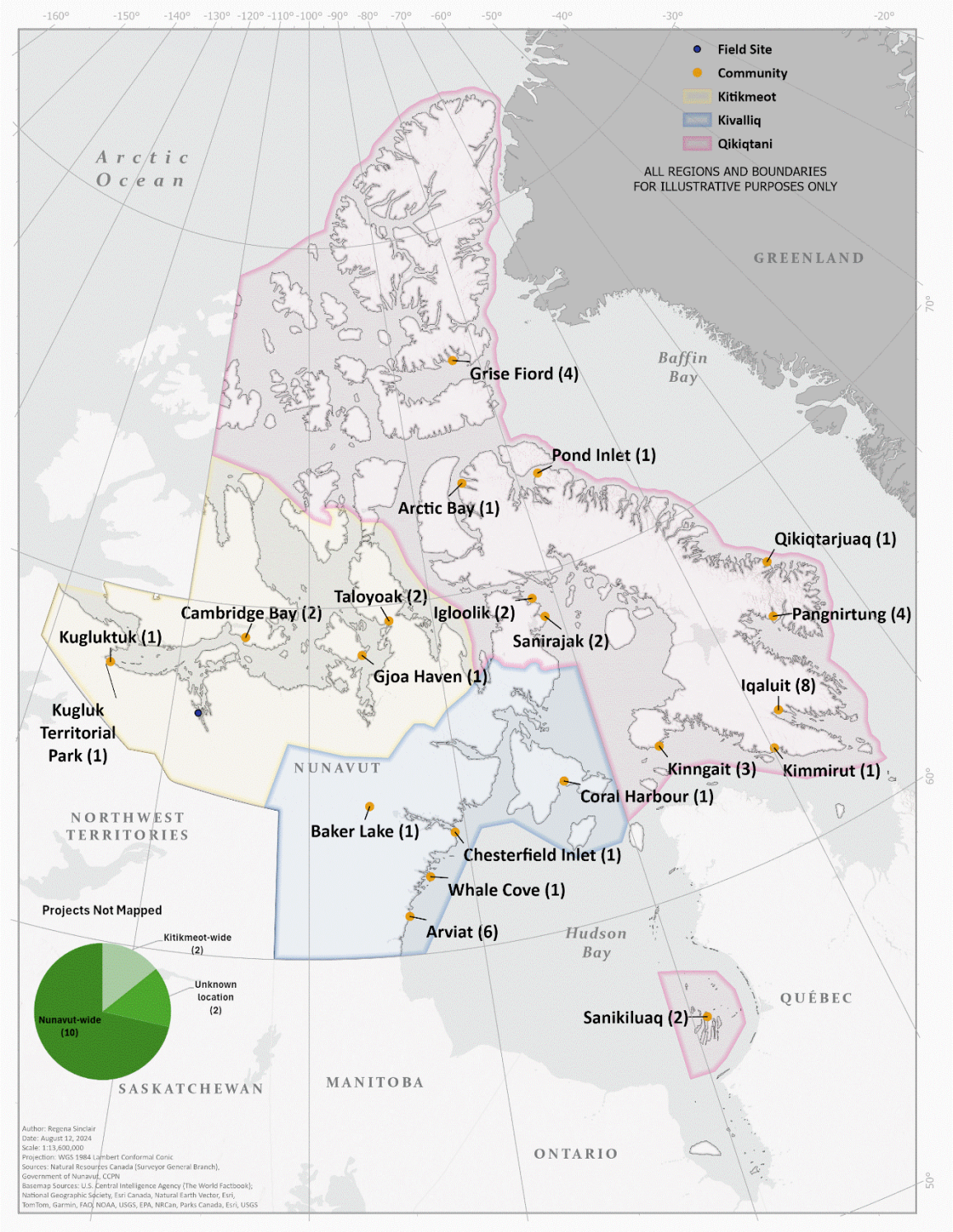
Appendix 9. *Map of Fisheries and Oceans Canada database climate change projects*



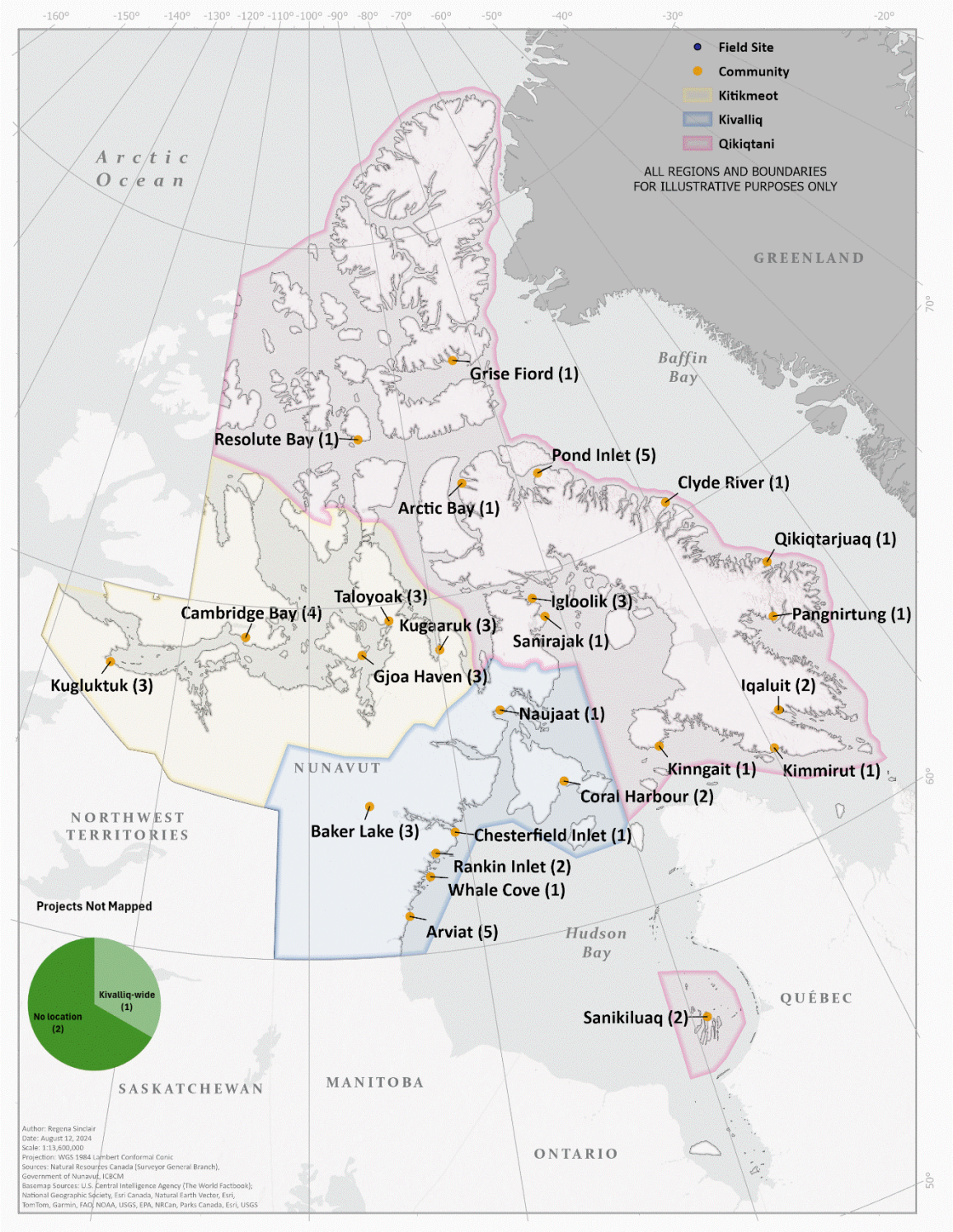
Appendix 10. *Map of Parks Canada database climate change projects*



Appendix 11. *Map of CCPN database climate change projects*

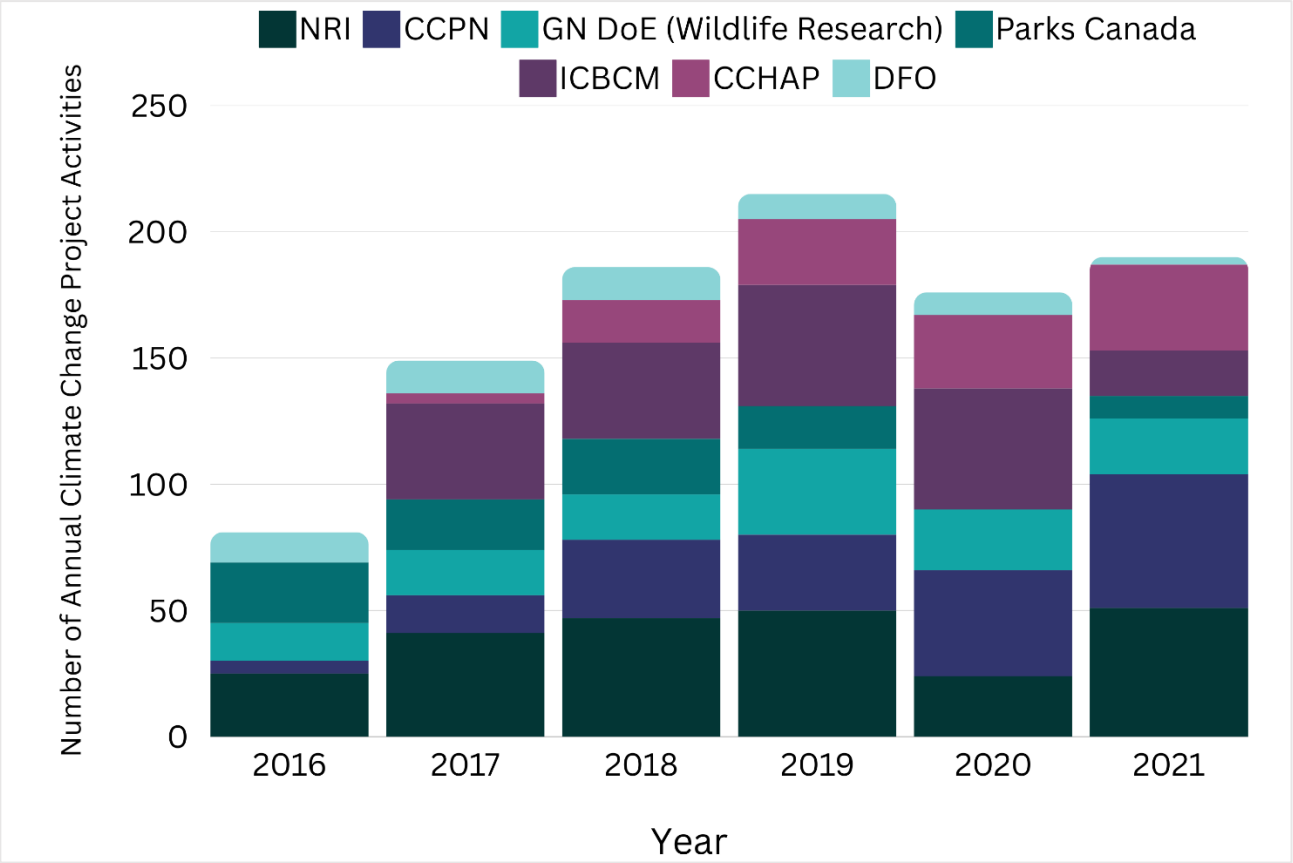


Appendix 12. *Map of ICBCM database climate change projects*

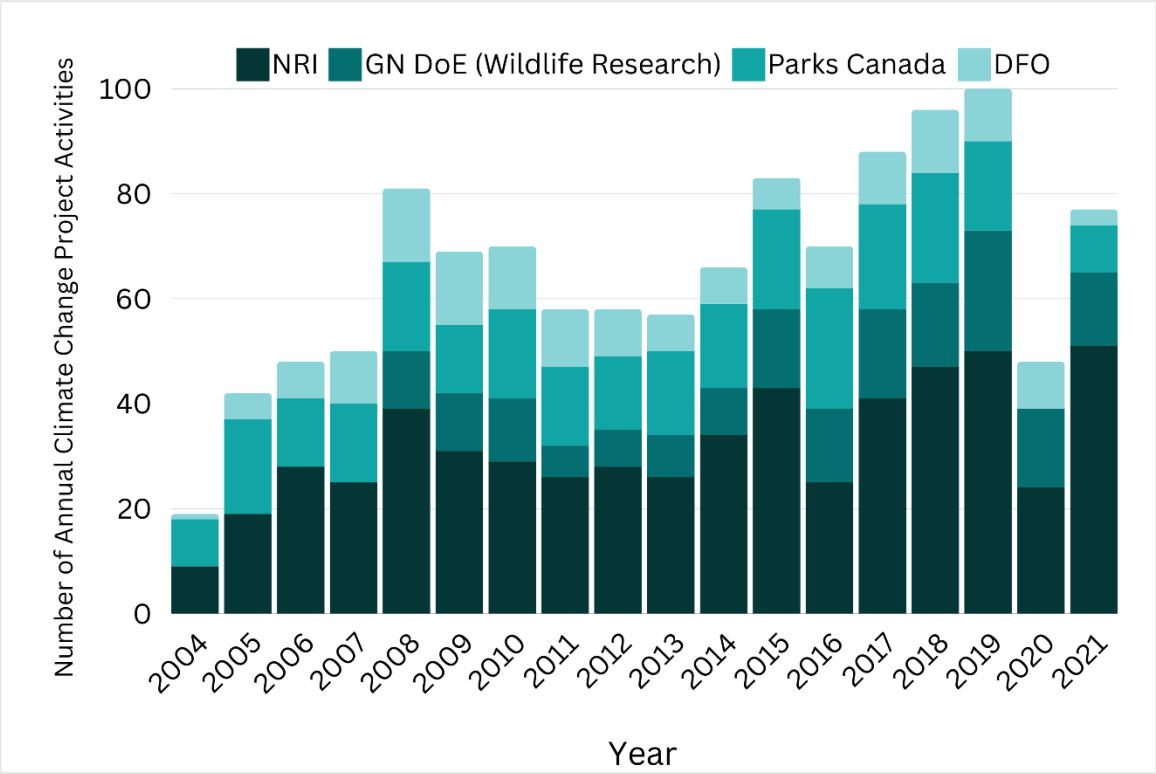


Appendix 13. *Map of CCHAP database climate change projects*

Appendix 14. *Total number of annual climate change project activities in Nunavut (2016-2021)*



***Appendix 15**. Total number of annual activities by licensing/permitting agency (2004-2021)*



Appendix 16. *Total number of annual activities by funding agency (2016-2021)*