

**On Thin Ice:**

**Perils of a changing climate for communities  
in the Canadian Arctic**

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Todavía no es tarde para construir la utopía que nos merecemos.

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## Introduction

On May 2019, the Canadian House of Commons heard motions to declare a climate emergency. As the capital region recovered from record-breaking floods, residents in Alberta fought forest fires. Scientists predict these aberrant weather events are the proverbial tip of the iceberg. This past decade has seen tropical storms, forest fires, droughts, coral bleaching, floods, and heat waves. Animal migration patterns have changed, food production is compromised, and freshwater resources are dwindling. The evidence is clear — the effects of climate change are widespread, and are expected to increase in the coming years. These effects will impact life in unprecedented ways.

In October 2018, the Intergovernmental Panel on Climate Change published a Special Report outlining the potential consequences of a global temperature rise of 1.5°C. These consequences could include: 0.26-0.77 metres of sea-level rise, or potentially multi-metre sea level rise if the Antarctic and Greenland ice sheets are lost (medium confidence); increasing average temperatures in most land and ocean regions, hot extremes in most inhabited locations, heavier precipitations, and droughts in different regions around the world. These factors will also influence the intensity and duration of natural disasters such as tropical cyclones, hurricanes, flash floods, and forest fires (IPCC, 2018). Indigenous knowledge corroborates these observations, and provides illustrative examples of the link between ecosystems, biological diversity, and potential consequences including global food shortages, reduced availability of fresh water, and loss of habitat for plants and animals (Baer and Singer, 2014).

The United Nations Framework Convention on Climate Change (UNFCCC) is the leading international body for policy and negotiation on climate change. It brings together policy makers, academics, non-governmental organizations, Indigenous groups, scientists, and civil society. The Paris Agreement, approved at the UNFCCC meeting in France on December 2015, has been ratified by 197 countries. It is an ambitious document, advocating for limiting temperature rise to 2 °C above pre-industrial levels, and to make efforts that limit warming to 1.5 °C. Besides serving as a tool for policy makers, it provides an overview of the international community's understanding of the climate issue. To this effect, it stipulates that while climate change effects are global, disadvantaged communities are more likely to be significantly impacted (UNFCCC, 2015). This is because climate change is not only an environmental issue, but has deep-rooted connections to our social, political, economic, and cultural spheres.

Climate change is a multifaceted problem. While natural sciences provide evidence of our changing climate — for example, by providing data on increased incidents of drought and warmer sea temperatures — there are social implications as well. For example, increased drought leads to food shortages, and warmer sea temperatures mean natural infrastructure is no longer reliable. These environmental changes will affect disadvantaged populations more acutely due to their social circumstances.

The Intergovernmental Panel on Climate Change (IPCC) notes:

Populations at disproportionately higher risks of adverse consequences include disadvantaged and vulnerable populations, some Indigenous peoples, and local

communities dependent on agricultural or coastal livelihoods. Regions at disproportionately higher risks include Arctic ecosystems, dry land regions, small island developing states, and Least Developed Countries. Poverty and disadvantage are expected to increase in some populations as global warming increases. Limiting global warming... could reduce the number of people both exposed to climate-related risks and susceptible to poverty by up to several hundred million by the year 2050 (IPCC, 9, 2018).

The poorest and most vulnerable will bear the brunt of the adverse impacts of climate change. This heightened susceptibility is not due to a single natural cause, but is rather a product of intersecting economic, cultural, historical, and social inequalities.

## Research problem

This Major Research Paper (MRP) focuses on the social impacts of climate change on Indigenous Peoples in Canada's Arctic region in a case study of climate impacts in this region conducted through an environmental justice lens. As a marginalized group, Indigenous populations are more likely to be disproportionately impacted by the effects of climate change than other populations within Canada. While First Nations and Metis populations are also impacted by climate change, this paper focuses on Inuit residing in Inuit Nunangat.

The main research question driving this study is: How are the Inuit currently impacted (and likely to be continued to be impacted) by climate change, and how are these impacts influenced by and impacting social circumstances? Focusing on these climate impacts, this research strives to demonstrate that while climate change will affect all Canadians, the Inuit are more vulnerable due to a series of structural disparities between settlers and Indigenous Canadians. This analysis will incorporate research on socio-economic characteristics of the Inuit homeland, as well as the Inuit's

relationship with the land. After identifying the main impacts of climate change on Inuit communities, the paper discusses how Inuit are involved in citizen science, community-driven projects that can help address concerns related to a changing climate.

This research draws on insights from across disparate bodies of academic and grey literature, notably the Indigenous studies literature from the disciplines of environmental studies, Indigenous studies, science and technology studies, epistemology, geography, and health research. The MRP is divided into three parts. Section 1 elaborates on the rationale for the project, its theoretical framework, methodology, and provides a discussion on western science and Indigenous knowledge. Section 2 provides a summary of findings from the literature, including from Indigenous resources on the unique effects of climate change on Inuit population. Section 3 discusses how citizen science and community-led approaches are helping the Inuit mitigate climate change, and adapt to its effects. The conclusion summarizes the findings, discusses their implications, and provides closing remarks.

## SECTION 1: Rationale, Methodology, and Epistemic underpinnings

In the Speech from the Throne on December 5, 2019, as well as Mandate Letters to Cabinet, Prime Minister Justin Trudeau stated that no relationship is more important to the Government of Canada than the one with Indigenous Peoples. However, 2020 has so far been marked by a series of civil actions by Indigenous Peoples with regard to pipelines and energy projects, as well as a global pandemic – all of which have highlighted the inadequacies of socioeconomic differences including health access for Indigenous Peoples in Canada. Canadian society is still grappling with a history of colonialism and ingrained inequalities that disproportionately impact Indigenous Peoples, including Inuit in the Canadian Arctic.

In addition, the past year has also been marked by reinvigorated civil society engagement with regard to climate change, and climate action. Internationally, there have been global calls to action ranging from the September 2019 climate strikes, to Greta Thunberg's recent nomination for the Nobel Peace Prize in recognition of her efforts to combat climate change. Domestically, the global climate strike paralyzed major cities such as Montreal, Toronto, and Vancouver. Civil society is engaged, and made this a focus of the 2019 federal election.

This project is situated at the intersection of domestic climate policies and Indigenous relations in Canada. Given that climate change will disproportionately impact Inuit communities, it is pertinent to understand why and how they will be impacted. What is more, it is imperative to understand how these communities are demonstrating

climate leadership by using citizen-science to contribute to climate action, and how these events are related to broader social issues affecting Indigenous communities and progress towards reconciliation.

## Theoretical Framework

In order to understand the complexity of climate change, and its influence on the social aspects of the climate experience, I use an environmental justice framework, drawing on a variety of data, reports, journal articles, and policy documents. Sources include findings from the Intergovernmental Panel on Climate Change, academic studies analyzing climate effects, and data and statistics generated by the Government of Canada and Inuit organizations as they pertain to economic standards, Inuit experiences, and institutions. My study examines climate change through an environmental justice and intersectionality perspective. Before delving into these theoretical perspectives, it is important to acknowledge the wide range of theories that have influenced the scholarship on environmental issues such as climate change.

For many sociologists, environmental issues such as climate change are traditionally understood through two theoretical lenses: environmental realism and social constructivism. Environmental realists argue that nature and humans are linked, but are not controlled by one another. Nature is an independent variable that interacts with and affects human decision-making and vice versa. As such, changes in the environment can affect people, regardless of how people perceive or understand the concept of nature. Often within this scholarship, the environment is placed at the centre,

and societies are seen to be limited by what they can do, and how they can react based on natural limit constraints. In a sense, humans are constrained by natural factors and limits in nature; but they cannot and do not control the outcomes, but rather react to what is given to them by the natural world. Humans mold their actions and their reactions to correspond to what is “out there” in nature. With an issue like climate change, humans have upset the natural balance, and must now adapt to the changing climate and strive towards sustainability, or face dire consequences (Young, 2014) (Murphy, 2015). Realists therefore argue that a problem such as climate change must be resolved because “improving our relationship to the environment will help alleviate social ills” as using less resources would allow for a more sustainable, less resource-driven, less wasteful lifestyle (Young, 2014, 4). As such, for realists, the main climate issue is how to limit greenhouse gas emissions to mitigate climate change, and avoid a disequilibrium that would upset the natural dynamic.

At the other end of the spectrum is social constructionism. The main tenet of this theory argues that nature is understood but only by how humans interpret it. For social constructivists, human actions relative to the environment are patterned by how nature is perceived, the values we attribute to it, and our ideas in how its impacts manifest. “Individuals seek understanding of the world in which they live and work...and develop subjective meanings of their experiences, directed toward certain objects or things. These meanings are varied and multiple, leading researchers to look for the complexity of views rather than narrow the meanings into a few categories or ideas” (Creswell and Poth, 2018, 24). Constructivists still rely on observations of environment, but argue that

these interpretations of the natural world are shaped by culture. In admiring an orchid, we are not merely observing a plant's reproductive structure, but also attributing many other characteristics that have been assigned to it - as an economic good or a sentimental object imbued with meaning. As such, constructivists are not merely interested in observing something but in understanding how our culture, experiences, and viewpoints, will affect how we interpret these manifestations.

In discussing the tenants of social constructivism, Maarten Hajer and Wytse Versteeg argue that because reality is seen as socially constructed, the "analysis of meaning becomes central; for interpretative environmental policy research, it is not an environmental phenomenon in itself that is important, but the way in which society makes sense of this phenomenon ...[environmental issues like dying forests] do not contain in themselves the reason for the public attention...but from the symbols and experiences that govern the way people think and act " (Hajer and Versteeg, 2005, 176). In this sense, understanding what has caused climate change, what climate change represents and means to our society, and how it will affect humanity is at the crux of the issue. The realist-constructivist debate embodies the range of theoretical perspectives in sociology. However, given that climate change is a problem that intersects with every aspect of human life, it is best examined through the theoretical framework of intersectionality and environmental justice.

Scholars recognize that the effects of climate change are mediated through social, cultural, and economic structures and processes; and that there is a need to

pursue this social analysis. While natural scientists focus on the natural aspects of climate change, including its causes and potential effects, sociologists must focus on both the social effects of climate change, and also why these occurrences are disproportionately felt across the globe. Intersectionality is an analytical tool that can help us understand the role of power structures and knowledge production on producing issues like climate change. Kathy Davis defines intersectionality as “the interaction between gender, race and other categories of difference in individual lives, social practices, institutional arrangements, and cultural ideologies and the outcomes of these interactions in terms of power” (Davis, 2008, 68).

As social beings, we belong to diverse social categories – but these often overlap and are interdependent on one another. An Inuit woman, for example, fits into several categories at once, given her nationality, gender identity, culture, education, and age. All of these factors, as well as others in her social and political environment, will determine how the climate change phenomenon will impact her. In her discussion on gender and environmental security, Nicole Detraz encapsulates how these are relevant to climate change: “There are several factors that affect people’s ability to adapt to climate change including access to assets, protection of their economic livelihood, access to services political participation, in decision-making, access to information and enhanced leadership” (Detraz, 2017, 211).

When analyzing climate change, it is important to recognize the interconnectedness of climate change with how our societies are structured, and the

relationships between humans, nature, power structures, and other dynamics. Anna Kaijser and Annica Kronsell state that “as climate change has gradually become a more recognised and apparent threat, the issue has gained prominence on the political agenda...since [its] effects are mediated through social, cultural, and economic structures and processes, the need for social analyses in relation to the issue have become more recognised” (Kaijser and Kronsell, 2013, 417). If we agree that climate change is not merely a scientific phenomenon, but one that touches on so many of society’s spheres, then academic analysis of climate change requires an intersectional and environmental justice approach. These lenses will help us understand the social, political, cultural, and economic factors that influence Inuit in Canada’s North, how and why climate change affects them disproportionately, and how to eventually address the gaps that exacerbate climate change impacts for Inuit.

In a discussion on gender, security, and climate change, Annica Kronsell argues that concepts like climate change and vulnerability to natural crises are rooted in “political phenomena that can and should not be thought of as outside relations of power” as climate change affects everyone differently not due to a natural cause, but a social multiplicity of reasons (Kronsell, 2019, 727). Conceptions of environmental problems such as climate change must include reflections on intersectionality, and of how power relations make some more vulnerable than others. For example, scientists estimate that climate change will increase flash floods. However, some communities are more vulnerable not by natural causes, but due to social constructs. For example, an Inuk living on a fixed income, who is impacted by higher global food prices while

droughts limit his food production, will be put in a more precarious situation given his underlying social and economic position in comparison to his Southern counterpart. This will be discussed in more detail on Section II.

In addition to intersectionality, climate change and its effects on Inuit, must also be examined through the theoretical framework of environmental justice. Environmental justice (EJ) gained prominence in the literature in the 1980s. An exemplary early text in EJ was the work *Dumping in Dixie: Race, class, and Environmental Quality* by sociologist Robert Bullard. Bullard studied the effects of solid waste sites among African-American and other disadvantaged communities in Houston, Texas, concluding that “all Americans, white or black, rich or poor, are entitled to equal protection under the law...including to one’s physical environment” (1990, 5). Bullard brought to the forefront studies that reflected on the linkages between the natural environment, and existing social constructs and inequalities. Bullard also defined environmental discrimination as “disparate treatment of a group or community based on race, class, or some other distinguishing characteristic” (1990, 7). Since the 1980s, the concept of environmental justice has evolved beyond issues of pollution. It now encompasses issues ranging from hazardous waste to nuclear testing, military occupation, mining, and most relevant to this paper, climate change (Holifield, Chakraborty and Walker, 2017).

Environmental justice exists at the nexus of social sciences, natural sciences, ethics and law and the framework espouses the principle that all people and

communities are entitled to a safe and clean environment. EJ is dominantly as the “fair treatment and meaningful involvement of all people regardless of race, colour, national origin, or income, with respect to the development, implementation and enforcement of environmental laws, regulations and policies” (US EPA, 2017, 2). Using EJ as a theoretical perspective allows for a consideration of the costs of climate change, how they are distributed, and how sustainable society’s needs are in relation to how resources are allocated.

Environmental problems have the potential to affect us all. For example, the recent wildfires in California have led to decreased air quality across the United States and Canada, reaching Southern Ontario. However, how we experience those effects will hinge on our particular social circumstances. Poor air quality as a result of these wildfires will impact agricultural workers more readily than those who work in an office building for a number of reasons: they are performing manually, intensive work outdoors and for an extended period of time, some may not have adequate equipment to protect their airways, and they may not have access to adequate health care. Environmental justice theory illustrates these disparities by analysis the “unequal and differentiated positioning...that typically places the heaviest environmental burdens upon the marginalized, disadvantaged, and less powerful populations” ((Holifield, Chakraborty and Walker, 2017, 1).

Environmental justice is not only applicable but necessary to understand the sociological underpinnings of the disproportionate effect that climate change has on Indigenous Peoples. Understanding climate science can only provide a partial perspective on the issue. By engaging with the literature from a critical perspective that

asks why Indigenous Peoples are more severely impacted, we can delve into the root causes that exacerbate these impacts for certain people over others. An environmental justice lens can serve to illustrate the disproportionate distribution of risks and impacts between Inuit versus their southern neighbours living in urban centres like Toronto and Ottawa. It can also elucidate the pre-existing inequities and socio-economic circumstances that compound differences in climate risk (e.g. costs of food in Indigenous communities) and how jarring these are given that traditionally Inuit are among the least polluting communities in the entire country (and also internationally).

## Epistemology and Power

Before delving into the specific circumstances of the Arctic, it is important to first understand that knowledge, power, and environmental justice are intertwined. Knowledge is power – experts have the power to influence our understanding of issues, their urgency, and how we act on them. Our understanding of climate change is plagued by two issues – the disproportionate knowledge hierarchy of western science over Indigenous knowledge; as well as the embedded inequalities in knowledge structures and institutions that are at the forefront of the issue (e.g., the Intergovernmental Panel on Climate Change). With regard to this imbalance, Alana Shaw argues that a “defining feature of environmental justice activism and scholarship...is the realization that the nature-culture dichotomy has been linked to a long history of environmental racism and colonial oppression” (Shaw, 2017, 506). While not denying the importance of engaging with facts when discussing climate science, it is important to ascertain how certain knowledge and expertise are often founded on systems of oppression.

## Western Science and Indigenous Knowledge

As with many global issues, narratives about climate change are often presented through a western (i.e., global North) perspective. In a review of how scientific assessments of environmental health risks overlook minorities, Maria Powell and Jim Powell state: “Institutional risk-assessment and communication approaches, typically embedded in western European-based scientific cultures, are often blind to race, class, and cultural risk contexts and inequities, thereby rendering them invisible” (2011, 149). Some of these narratives – complementing the power structures, economic structures, and government policies designed to sustain those structures - tend to both maintain and underpin capitalist and colonial legacies. This is important because, as Powell and Powell say: “Scientific and government institutions play important roles in constructing what we know and do not know about environmental risk disparities, and the ways these “knowns” and “unknowns” in turn shape scientific, political, and public attention to environmental injustices” (Powell and Powell, 2011, 149).

One of the main criticisms regarding mainstream understandings and representations of climate change relates to the issue of how scientific knowledge and data<sup>1</sup> are collected and the relation between these practices and colonialism and injustice. Power structures and knowledge hierarchies plague our understanding of the world, including of climate change. In *Indigenous Knowledges in Global Contexts*, George Sefa Dei argues:

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<sup>1</sup> This is a separate debate from climate skeptics. The scope of the paper does not include these positions.

Under the colonial influence, the biological and intellectual heritage of non-Western societies was devalued. The priorities of scientific development and R&D efforts, guided by a Western bias, transformed the plurality of knowledge systems in a *hierarchy* of knowledge systems. When knowledge plurality mutated into knowledge hierarchy, the horizontal ordering of diverse but equally valid systems was converted into a *vertical* ordering of *unequal* systems, and the epistemological foundations of Western knowledge were imposed on non-Western knowledge systems with the result that the latter were invalidated (2000, vii).

In this process of colonization – one which lay the foundation for our modern institutions - western knowledge is often lauded as the *only* scientifically valid knowledge system, which relegated traditional knowledge illegitimate as it was deemed inferior and unscientific.

In *Metaphors and Models: Indigenous Knowledge and Evolutionary Ecology*, Raymond Pierotti delves into the issues of knowledge hierarchies. He argues that western science tends to discredit or undermine the legitimacy of Indigenous knowledge, and that this discrimination is embedded within our academic and scientific institutions. Indeed, contrasting western and Indigenous knowledge often itself works for the benefit of western Science, as traditional knowledge is relegated to the realm of “folksy” and “unsophisticated” ways of understanding the world. An example of distinctions between western science and Indigenous knowledge is reflected in how knowledge is transmitted. For instance, Inuit Elders share knowledge orally. Other Indigenous groups (such as the Lakota) employ metaphors to transmit their understanding of the environment (Pierotti, 2011). These methods are often denigrated as lacking precision or accuracy. Comparing the way in which knowledge is conveyed, the literary tools used to present facts, and whether data is recorded manually or not,

have often been demonstrative of the tension between Indigenous knowledge and western science<sup>2</sup>. However, these comparisons are often unhelpful as they juxtapose both sets of knowledge in order to ascertain the superiority of one over the other.

Another problematic characteristic in the western interpretation of Indigenous knowledge is how non-Indigenous thinkers try to integrate both epistemologies to solve global issues like climate change. On the issue of how knowledge exchanges can occur between Indigenous knowledge, and the “fields of climate, environmental, and sustainability science”, Kyle Whyte argues that the value of Indigenous knowledge “rests on [its] capacities to fill in gaps in certain scientific methods, such as a lack of historical data” (2016, 63). He cites the example of Clyde River, Nunavut. Climate scientists disagreed with Inuit hunters when they compared data observations. The discrepancy was due to the weather stations that the scientists were using - they were stationary and in a flat area, which skewed their results. While the conclusion that climate scientists and Inuit hunters working together does lead to more accurate and comprehensive results, the premise that Indigenous knowledge has “value” only to “fill in gaps” is very problematic. This is an example of how current western research undermines Indigenous knowledge by attributing a value to it which limits it to a complementary sidekick to the main epistemic body – western science.

Whyte also creates a false dichotomy by separating Indigenous knowledge from climate and environmental science, creating an artificial barrier that devalues Indigenous knowledge, as though both epistemologies cannot exist in the same academic space to

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<sup>2</sup> The use of science here is a choice of nomenclature. It does not imply western science is more valid, objective, or rigorous than Indigenous knowledge.

yield comparable findings. Lastly, while Indigenous (often local and experiential knowledge) provides a more in-depth understanding of certain issues (such as the Clyde River example), it goes beyond filling the gaps and is a legitimate epistemology.

The tensions created by scholars in describing western science and Indigenous knowledge described above are rooted in historic and unjust power dynamics. George Dei explains that colonialism has from the very beginning been a power struggle, which is reflected in institutions. He argued that who determines what will count as knowledge, who is considered an expert, or who is an innovator is rooted power dynamics (Dei, 2000,vii). These questions have been foundational in the colonizing project. In *Indigenous Knowledge and pedagogy in First Nations Education*, Marie Battiste argues that comparisons between western science and traditional knowledge are illogical. For example, conducting a literature review (a widespread and accepted practice within the academy) can be problematic in leaving out Indigenous knowledge, as “Indigenous knowledge comprises the complex set of technologies developed and sustained by Indigenous civilizations...a literature review is an oxymoron because Indigenous knowledge is typically embedded in the cumulative experiences and teachings of Indigenous Peoples...rather than in a library” (2002, 2). Using tools established by western academy to gather or to assess the validity of Indigenous knowledge is akin to measuring temperature with a telescope — nonsensical.

Since first contact, western perspectives and ideologies have disparaged Indigenous approaches and knowledge. In *Decolonizing methodologies: research and Indigenous people*, Linda Tuhiwai Smith argues that the Enlightenment period and the

beginning of modernity are founded on the legitimization of colonial practices. “The globalization of knowledge and western culture constantly reaffirms the West’s view of itself as the centre of legitimate knowledge, the arbiter of what counts as knowledge, and the source of “civilized” knowledge. This form of global knowledge is generally referred to as “universal” knowledge, available to all...until non-western scholars make claims to it” (2012, 125). Non-western sources of knowledge have historically been ignored, misrepresented, or simply appropriated while at the same time the project of colonialism has and continues to propagate the narrative of Eurocentric superiority, using the teachings of western philosophical tradition and Christian concepts for its foundation. In this conquest, Indigenous knowledge has been “systematically usurped and then destroyed in their own cultures by the colonizing West” (Dei, 2000, vii). Whyte’s views on TEK (examined below) is one example of the ongoing formations of colonialism in the way environmental science is conducted, and how widespread and ingrained these views are within the field.

Colonization is grounded in the notion of white man<sup>3</sup> as a rational (and thus superior) being. Man exists at the top of the natural world pyramid, in which animals, plants, resources, as well as other *irrational* and *unenlightened* beings (like, historically, women and non-whites) reside at the bottom. With this powerful narrative of man as a “superior being” responsible for all others, western civilizations justified and carried out the genocide of Indigenous Peoples in North and South America, Australia, Asia, and

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<sup>3</sup> In Eurocentric views, this ideal being and central figure is understood to be a Caucasian, Christian, heteronormative, and able-bodied man.

Africa<sup>4</sup>. They were able to subvert political organizations, rewrite frontiers, enslave communities, and exploit and plunder natural resources in many continents. By labelling traditional ecological knowledge, along with political, religious, social, and cultural practices as *primitive* (or worse barbaric, backwards, heathen, etc.), western powers were able to defend their actions. By couching their colonizing project in terms of “rationality”, “progress”, and “modernity”, they were able to rationalize the genocide perpetrated on Indigenous Peoples for centuries. Discussing Indigenous knowledge, anticolonialism, and empowerment, Waziyatawin Angela Wilson states:

We were taught that the conquest and “civilizing” of our people was inevitable; that we too must give way to “progress”. It was hammered into our heads that our Indigenous cultural traditions were inferior to those of Euro-Americans and Euro-Canadians, that there was nothing of value in our old ways, and that those ways were incompatible with modernity and civilization. But they really meant something different (Waziyatawin, 2013, 19).

This slant towards western superiority is still prevalent in many of our political, cultural, and scientific institutions. As Marie Battiste puts it:

For as long as Europeans have sought to colonize Indigenous Peoples, Indigenous knowledge has been understood as being in binary opposition to “scientific”, “western”, “Eurocentric” or “modern” knowledge. Eurocentric thinkers dismissed Indigenous knowledge in the same way they dismissed any socio-political cultural life they did not understand: they found it to be unsystematic and incapable of meeting the productivity needs of the modern world (Battiste, 5, 2002).

The colonizing project underlying the superiority of the western tradition helped to cement the first western schools and universities as the arbitrating institutions of knowledge. Waziyatawin Angela Wilson argues that the process of colonization

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<sup>4</sup> For example, in W. Hegel’s Lectures on the Philosophy of World History, Europe is the subject of progressive development of world history. Any other country, or its culture, is subservient to the *Continent*.

“required the complete subjugation of [Indigenous] minds and spirits, in addition to physical subjugation, so that lands and resources could be robbed from underneath [Indigenous] bodies” (Waziyatawin, 2013, 20). In Canada, this colonizing project was perpetuated through the combined efforts of government institutions and Christian workers, which led to federal boarding and residential schools.

Through these institutions and teachings, this superiority myth has been promulgated for centuries, as the notion of superior western thinking entailed the abnegation of Indigenous knowledge, and was essential to justifying Europe’s colonization project (Waziyatawin, 2013, 19). While conditions are improving, and universities and governments alike include more Indigenous perspectives in their bodies of literature and policy formulations, there is still a noticeable gap between western science and Indigenous knowledge in the conduct and communication of academic knowledge and scholarship contributing to understandings of climate change is no exception. As such, Waziyatawin argues that “Indigenous knowledge recovery is an anti-colonial project” (Waziyatawin, 2013, 19). Therefore, as we move towards reconciliation, and towards greater inclusion for Indigenous Peoples in Canada and elsewhere, it is important to recognize that the academy (along with many of other institutions) are still plagued by colonial and political legacies.

Embedded colonial and relations are continuously reproduced through forms of domination that are racialized and often gendered. In the study of climate change, the IPCC – lauded as the leading organization on climate change - mirrors the social and

power inequities of the world, given the majority of IPCC contributors are predominantly Caucasian, male, and native English-speakers (IPCC, 2019, 15).

In recognition of these disparities, the Panel decided to establish the Task Group on Gender to develop a framework of goals and actions to improve gender balance and address gender-related issues within the IPCC. Established at its 47th Session in March 2018, the IPCC Task Group on Gender found embedded inequalities throughout the organization. For example, the proportion of women authors of IPCC reports has increased from below 10% to around 30% today. While incremental progress, 33% of contributors for the Sixth Assessment Cycle (from 2018-2022) are women, compared with 67% male contributors (IPCC, 2019, 15). The IPCC is not unique as an institution in its gender disparity. It “has been well documented that men outnumber women in research at all professional levels” (IPCC, 2019, 6). Research by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) which studies Women in Science paints a grim picture of the current state of such bias in knowledge production:

Men outnumber women in research at all professional levels, and that women are on average 28% of all scientific researchers worldwide. Women are underrepresented in research, and continue to face multiple barriers and discriminations along their career path, and gender often intersects with other factors that influence participation including race, ethnicity, language, disability, age or nationality (UNESCO, 2018).

The IPCC also identified that for many scientists “gender was only one factor affecting their participation and race, nationality, English proficiency, and disciplinary training also influenced their inclusion or exclusion from IPCC processes” (2019, 7).

These biases in knowledge production also highlight the importance of intersectionality.

The Task Group report found that scientists also face multiple barriers to participation “associated with their social categorization and identifiers, including gender, race, ethnicity, language, age or nationality...gender is but one way in which someone’s social category can affect their experience within the IPCC” (2019, 15). The report highlights not only the composition of this international body, but also outlines ways in which this structure influences content, including decreased opportunities to lead chapters and working groups, opportunities to speak in meetings and shape content, and be nominated to lead Chapters (IPCC, 2019, 18-21).

Findings demonstrate there are inherent biases in how the IPCC works and produces its reports. When asking respondents on their views on challenges to intersectional experiences, participants reported the following as barriers for non-western scientists:

It is still a huge challenge for people that are not from an English-speaking country to fully participate in all the discussions and on the writing process for the IPCC. The discussions and writing process were still centrally led by scientists from Europe and US (also Australia and other development nations). Although the IPCC has impressively opened the door to developing countries scientists...their engagement is very much determined by the [Chapter Lead Author]...I believe it is the cultural process of scientific expertise dominated by Northern countries scientists and these have a hard time accepting and/or opening the door to different worldviews and participations (IPCC, 2018, 21).

Another participant responded:

The biases against women, non-English speakers and developing countries are more subconscious than deliberate. Everyone wants to do the right thing. But it is difficult because of cultural issues. Some white men just like to talk, and feel very free to do so, without thinking of impacts on more shy, or less able to speak in English folks, especially from developing countries (IPCC, 2018, 21).

While the IPCC is striving towards greater inclusion by establishing the Task Force and acting on its suggestions, the findings demonstrate that the institution has western biases. These ingrained and institutionalized disparities sometimes complicate addressing and understanding the social aspects of climate change.

The IPCC is an institution that leads on climate science and solutions. Their scientific understanding of climate change is at the root of our understanding of the issue. IPCC reports are the founding basis for most evidence-based reports and policy formulations in governments throughout the world. As experts, their body of work and their scientists are the knowledge-keepers in the issue. And while the organization is an international body; its scientists, Secretariat, and governing structure is not representative of the world population. It is still heavily influenced by western bias, leaving little space for scientists of different backgrounds and intersecting identities. This is particularly important to address in an Arctic context, where it is crucial to privilege Inuit experiences when we discuss the effects of climate change in the Arctic. By incorporating Indigenous voices through citizen science, we can “challenge the powerful institutions of colonization which have routinely dismissed alternative knowledges and ways of being as irrelevant to the modern world. As Indigenous Peoples and other advocates of Indigenous knowledge have typically been denied access to the academic power structures which legitimize knowledge production, those of us with access to those structures must work to support Indigenous knowledge recovery efforts for our own purposes” (Waziyatawin, 2013, 19).

This paper focuses on climate impacts for the Inuit, and in so doing includes data from the IPCC, but also incorporates sources of knowledge such as Indigenous literature and data produced by Inuit organizations. Recognizing that climate change will have potential implications for populations often excluded from dominant narratives, I engage marginalized perspectives to provide a lens through which equitable and sustainable solutions to the climate crisis could emerge. Indigenous knowledge has been frequently underutilized in decision-making and policy (Cuerrier, 2015). In order to make Indigenous knowledge more relevant, I include a variety of data to ensure it yields results that are inclusive and useful, and that this research speaks to and reflects Inuit experiences in an authentic and direct way. In Section III, this research paper will also expand on the ways citizen and community science can complement established approaches to provide a more fulsome understanding of the world - and environmental phenomena like climate change.

### Indigenous Knowledge, Traditional Ecological Knowledge, and Inuit Qaujimajatuqangit

In order to work against colonial practices in western environmental and social science, in this research paper I strive to highlight the importance of Indigenous knowledge in understanding the Inuit's plight against climate change. The terminology in the literature often conflates Indigenous knowledge with Traditional Knowledge, Traditional Ecological Knowledge (TEK), and to a lesser degree with Inuit Qaujimajatuqangit (IQ). Broadly, these are all distinct epistemologies – with TEK and IQ belonging to the comprehensive body of Indigenous knowledge (Berkes, 1998) (Watt-Cloutier, 2005) (Christie et al, 2018).

Indigenous knowledge comprises all knowledge “pertaining to a particular people and its territory, the nature or use of which has been transmitted from generation to generation” (Battiste, 2002, 6). It encompasses the unique experiences, capabilities, priorities, and value systems of local peoples and communities. It is varied, as it reflects and coexists within diverse situations and contexts. Indigenous knowledge relies on oral traditions, on historical and ancestral knowledge, and on cultural resources used to understand the world and the cosmologies that explain its workings (Dei, 2000). It was a term first developed in “the late 1980s by Indigenous scholars and representatives to the United Nations Working Group on Indigenous Populations to cover the diverse knowledge systems of Indigenous Peoples. Traditional knowledge was part of the ethnoscience field within anthropology in the 1950s” (Battiste, 2002, 62). This paper uses Indigenous knowledge instead of Traditional knowledge as the former is the more accurate and culturally sensitive term.

Traditional Ecological Knowledge (TEK) may be considered as a sub-set of Indigenous knowledge, defined “as local knowledge held by Indigenous peoples or local knowledge unique to a given culture or society” which focuses on the relationship between people and the land or environment they inhabit. The term TEK first originated in ethnoscience and human ecology (Berkes, 1646-1649) (Polfus, 2014). Often used interchangeable with TEK, Inuit Qaujimagatutqangit reflects Inuit traditional knowledge and societal values, based on the close relationship with the land and environment (Upagiatavut, 2015). IQ provides detailed insight into climate change (reflecting Elders

and hunters' observations of sea ice thickness for example). In addition to empirical observations, IQ also provides the “context to help understand how climate change will impact Inuit culture, communities, and individuals” (Upagiaqtavut, 2015, 13). IQ, like TEK, is transmitted through “participation and experience in an environment...generally transmitted among Inuit through hands-on education on the land and by listening and learning from Elders and other experienced individuals” (Pearce et al., 2015, 241). This paper reflects findings from all three of these knowledge systems when referring to Indigenous knowledge.

## Methodological Approach

Given the broad theoretical approach to knowledge that I take in this project, as well as the focus on Indigenous communities, the main sources of information are from Indigenous scholars and organizations. This method also furthers my main objective to answer questions regarding Inuit communities, as well as further the broader reconciliation project. My method includes a document analysis of policies and reports by the Inuit Tapiriit Kanatami – the national representational organization protecting and advancing the rights and interests of Inuit in Canada. Additional sources include, case studies relevant to the Arctic, Inuit Elder narratives, and reports from citizen-driven community-led projects in the Arctic.

To provide a wider literature review and incorporate more perspectives, the research also includes data from the Intergovernmental Panel on Climate Change, and other international organizations such as the United Nations and its associated programs. The theoretical components are supported by peer-reviewed articles and

scholarly sources from diverse backgrounds. Sources were collected from academic journals, policy papers, web searches (for information on community-led projects), as well as media reports.

## Literature Review

A systematic literature review of published scholarly articles was conducted to ascertain the impacts of climate change on Inuit in Canada's North. Although climate change impacts have been well documented in many regions, the search was limited to the past decade given that climate impacts and their effects are evolving rapidly so recent sources provide the latest findings. Based on discussions with the University of Ottawa Librarian and my supervisor, I began with an overview of two key social science databases: ProQuest social science and JSTOR. In order to narrow the dataset to relate to those articles, which dealt with impacts of climate change, the following key terms were used: ((“Climate change”)OR(“ global warming”)OR(“greenhouse effect”)OR(“climate”)). In ProQuest social science, this search yielded 1,424,732 results. In JSTOR, the search for climate change sources (using the key terms) yielded 662,114 results.

To conduct an advanced search, and refined to target the Inuit case study, the following key words were employed: ((“Inuit”<sup>5</sup>)OR(“Inuk”)OR(“Indigenous”)). Given there are Inuit in other parts of the Circumpolar region, the scope was further limited by

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<sup>5</sup> In using Inuit and Inuk, the research also yielded articles that also included *eskimo*. The term Eskimo is not only outdated but largely considered a derogatory term for Inuit. The ITK has been clear on the subject, and refers to it as a “relic of colonial power”. While it is being phased out in the current literature, it is still included in databases and in subject topics, which is why it is noted here for full disclosure.

adding the terms: ((“Canada”)OR(“Canadian”)OR(“North”)OR(“Arctic”)). Articles were identified based upon their abstracts, subject matter and also geographic location—only those articles which dealt with a Canadian context were included. Articles that cited Indigenous groups in the United States, and Greenland were excluded from the research, as were articles dealing exclusively with First Nations or Metis groups as they extended beyond the scope of the paper. The search was further refined to exclude (as mentioned above), non-Canadian sources, sources that extended beyond the time period, and those Indigenous groups not included in this study. In order to capture interdisciplinary scholarship, I conducted a separate search using Academic Search Complete database. The search yielded sources from multidisciplinary fields, including environmental sociology, natural sciences, health, political science, and geography.

Through ProQuest, the initial search on the climate change, Indigenous, and Canadian terms yielded over 140,000 results. Given the need to provide updated information on a field that evolves quickly, I limited the publication date from 2009 to 2019. This culled results to approximately 50,000 hits. Additional filters were applied, including language (only English resources were examined) and document types (scholarly journals, books, newspapers, reports). This excluded sources such as conference papers and proceedings, trade journals, and magazines. This choice was made given the academic nature of this research. After applying two additional filters - peer-reviewed sources and those that were full-text resources - the search yielded 4,427 results. Given the geographic focus, the location filter was applied, constraining the search to Canada. This further reduced results to 131 articles.

Based on these initial results, I prioritized multidisciplinary approaches relevant to the study. While understanding the research would require a broader approach, there were some categories that were excluded as they would not be relevant to the final product. I excluded sources from communications, anthropology, ethnic studies, criminology, aging, nursing scholarship, immigrant and minority studies, peace and conflict, and sexuality. This selection yielded approximately 45 results. From here, I discarded an additional 38 articles that were not pertinent. After reading the abstracts, only two were used in the research.

On JSTOR, the initial search (Indigenous, climate change, Canada) yielded 54,743 results. Using the same parameters as for ProQuest to ensure comparable results - further refining by timeframe, language, and document types - yielded 11,550 results. Based on these results, I focused on subjects including environmental studies, sociology, and public health, further limiting the results to about 687 sources. Based on research guidance, I refined the advanced search. While the keyword terms were the same, I modified the parameters to search the database captions, rather than all the fields including author, item title, caption and abstract. This yielded 13 results. By modifying the search once again, I looked for all journals that included the terms in the abstract. This yielded 39 results. Of these, only twelve journals were reviewed. Exclusions were made given the subject matter (journals dealt with other groups of Indigenous peoples, or dealt with other environmental issues including conservation, or pollution). Focusing on the particular challenges of Inuit, the results were refined to three main categories: food security, health, and safety and mobility. These categories

are all interlinked – there can be no safety or comfort if one is going hungry, nor can one feel safe if one is ill. However, there are distinct effects that fall into these categories and splitting them in these groupings allows for a more rigorous understanding of the challenges they pose.

While this investigation yielded some resources that involved Indigenous scholars, there was a disproportionate slant towards those produced by settlers and according to western knowledge or science. Library and journal searches did not yield a significant amount of Indigenous literature or data produced by Inuit organizations. In order to yield a more comprehensive final product according to this study's aims - that is, informed by Indigenous knowledge - the scope and methods evolved. After conducting a review of the literature, the search was expanded to analyzing publications by the Inuit Tapirit Kanatami website. This provided an entry point into Inuit-relevant research, and was used to “snowball” sample from the bibliographic information contained in initial readings which generated 15 documents including publications, opinion pieces, and social media texts. Finally, the policy material that informs this study was generated using Google Search web searches for policy documents, including federal government reports, and community-led initiatives presented in Section III. These searches were targeted based on information I gathered previously while researching various topics for course work for my Master level courses in sociology, international relations, and gender studies. These policy documents provide statistics and policy perspectives, which in turn provide context and information on how government programs are formulated and delivered.

## SECTION 2: Effects of a changing climate on the Inuit

### Inuit Nunangat

Inuit in Canada's Arctic region are particularly vulnerable to the effects of climate change. To understand the magnitude of the problem, it is important to understand the historical and social context of the Inuit Nunangat, the traditional Inuit homeland. Spanning from the Northwest Territories to Labrador, it includes 53 communities and encompasses roughly 35 percent of Canada's landmass and 50 percent of its coastline. This homeland includes the four Inuit land claim regions and its surrounding water and ice: the Inuvialuit Settlement Region (northern Northwest Territories), Nunavut, Nunavik (northern Quebec) and Nunatsiavut (northern Labrador) (ITK, 2019).

The majority of the 65,000 Inuit in Canada live in Inuit Nunangat, with one-quarter of their population living outside its borders. Of those living outside Inuit Nunangat, about half live in towns or cities. Inuit co-manage their homelands with the federal, provincial and territorial governments through constitutionally protected land claims agreements. More than a third of the communities in Inuit Nunangat have populations under 500 people and most can only be reached by air year-round and by air and sea during the summer. These are considered off-grid communities. They are "neither connected to the North American electrical grid; nor to the piped natural gas network; nor are permanent or long-term (5 years or more) settlements" (Indigenous and Northern Affairs Canada, 2012). Since most Inuit live in off-grid communities, they face unique environmental, health, and economic concerns. Environmentally, off-grid communities rely on diesel for electricity generation. Given that they are in remote

areas, diesel must be transported by airplane, truck, or barge, leading to a greater risk of fuel spills. Diesel must also be stored near communities so it remains accessible, which can lead to soil and groundwater contamination (this will be discussed in more detail in the infrastructure section). Moreover, diesel can be unreliable, leading to precarious conditions for Inuit as black outs can lead to lack of heating sources in extreme cold conditions. Emissions from diesel generators have been linked to health problems in Inuit communities, and are noisy and disruptive. Economically, a reliance on diesel is very expensive. It is a non-renewable resource, so diesel prices continuously fluctuate especially given the high costs of transportation (INAC, 2012). To keep energy affordable in the North, large subsidies are required<sup>6</sup>. These subsidies can add up to a considerable cost. In fact, the Government of Nunavut reported that it pays almost 80 percent of Nunavut's energy costs just to keep the cost of energy affordable (Canada Energy Regulator, 2018). These funds are redirected from other health and social initiatives.

The Inuit Taparit Kanatami has conducted extensive research on the Inuit's health and well-being. Figure 1 (below) illustrates the vastly different outlook between Inuit and their southern counterparts, comparing well-being factors such as education, health care, housing, employment, mortality rate. It illustrates a stark difference between those in Inuit Nunangat and all Canadians.

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<sup>6</sup> For example, all communities in Nunavut have electricity costs subsidized at 28.4 cents per kilowatt hour (kW.h) for the first 1 000 kW.h per month in the winter or the first 700 kW.h per month in the summer. If electricity consumption exceeds these amounts, the consumer is charged the unsubsidized rate. The unsubsidized rate varies by community, from 56.7 cents per kW.h in Iqaluit to 112.3 cents per kW.h in Kugaaruk (CER).

## Social and Economic Inequity in Inuit Nunangat

Many Inuit face social and economic inequities that impact our health and wellbeing

### Inuit Nunangat

**52%** of Inuit in Inuit Nunangat live in crowded homes\*<sup>1</sup>

**34%** of Inuit aged 25 to 64 in Inuit Nunangat have earned a high school diploma<sup>1</sup>

**70%** of Inuit households in Nunavut are food insecure<sup>2</sup>

**\$23,485** The median before tax individual income for Inuit in Inuit Nunangat<sup>1</sup>

**30** The number of physicians per 100,000 population in Nunavut<sup>4</sup>

**47.5%** of Inuit in Inuit Nunangat are employed<sup>1</sup>

**72.4 years** The projected life expectancy for Inuit in Canada<sup>5</sup>

**12.3** The infant mortality rate per 1,000 for Inuit infants in Canada.<sup>6</sup>



**IMR**

### All Canadians

**9%** of all Canadians live in crowded homes\*<sup>1</sup>

**86%** of all Canadians aged 25 to 64 have earned a high school diploma<sup>1</sup>

**8%** of all households in Canada are food insecure<sup>3</sup>

**\$92,011** The median before tax individual income for non-Indigenous people in Inuit Nunangat<sup>1</sup>

**119** The number of physicians per 100,000 population in Urban Health Authorities<sup>4</sup>

**60.2%** of all Canadians are employed<sup>1</sup>

**82.9 years** The projected life expectancy for non-Indigenous people in Canada<sup>5</sup>

**4.4** The non-indigenous infant mortality rate per 1,000 for Canada.<sup>6</sup>

\* Should not be compared with crowding data for previous years. Based on the suitability definition (whether the dwelling has enough bedrooms for the size and composition of the household). The previous figure was based on the number of persons per room definition.

† Should not be compared with previous life expectancy data. The figure is a national 2017 projection of life expectancy for Inuit. Previous figures were for 2004-2008 for all residents of Inuit Nunangat, including non-Inuit.

1 Statistics Canada, 2016 Census. (crowded homes: 98-400-X2016163; high school diploma 98-400-X2016265; income: unpublished custom table provided to ITK; employment: 98-400-X2016266)

2 Grace M. Egeland, Inuit Health Survey 2007-2008: Nunavut (Ste-Anne-de-Bellevue, QC: Centre for Indigenous Peoples' Nutrition and Environment, May 2010), 12.

3 Shirin Roshanafshar and Emma Hawkins. Health at a Glance: Food Insecurity in Canada (Ottawa, ON: Statistics Canada, March 25, 2015).

4 Canadian Institute for Health Information, Supply, Distribution and Migration of Physicians in Canada, 2014 (Ottawa, ON: Canadian Institute for Health Information, September 2015).

5 Custom table based on Statistics Canada's Projections of the Aboriginal Population and Households in Canada, 2011 to 2036.

6 Sheppard et al 2017. "Birth outcomes among First Nations, Inuit and Metis populations." Health Reports Vol. 28. No. 11

Figure 1: Social and Economic Inequity in Inuit Nunangat (ITK, 11, 2019)

## Climate change in the Arctic

In the Environment and Climate Change Canada report, *Canada in a Changing Climate*, scientists found that the Arctic is warming at three times the rate of average

global climate change. These changes will result in summer sea ice loss, reduced sea ice in the winter, and an increase of coastal erosion and extreme weather events (ECCC, 2019). The report explains that due to its geographic location, Inuit Nunangat is one of the most vulnerable regions to the effects of climate change in the world, as the Arctic is now experiencing some of the most rapid and severe climate change on earth. Over the next 100 years, climate change is expected to accelerate, contributing to major physical, ecological, social, and economic changes, many of which have already begun.

The *Arctic Climate Change Update of 2019* conducted by scientists from the Canada, the United States, Norway, Iceland, Sweden, Finland and Russia offers a stark warning: “The Arctic air temperatures from 2014 to 2018 exceeded those of any year since 1900. The pace of change in the Arctic is so rapid that new records are being set annually, and each additional year of data strengthens the already compelling evidence of a rapidly changing Arctic” (AMAP, 2-3). By many assessments, the Arctic summertime ice cap could completely vanish by 2050 – even under ambitious emissions reductions. As temperatures rise and ice caps recede, ocean waters rise leading to erosion in coastal lines, which threaten the livelihood and safety of communities (AMAP, 3).

Another unique effect of climate change in the Arctic is the melting of permafrost. Permafrost, at its most basic, is permanently frozen land – soil or rock that remains frozen from one year to the next. In the Arctic, it is the foundation of the land. Permafrost underlies 35 to 50 percent of the Canadian land surface - as it covers the

vast majority of the northern Canadian landscape (Natural Resources Canada, 2017). Climate change is affecting permafrost – as warmer temperatures increase, permafrost thaws. As permafrost thaws, it weakens the structure of the ground, leading to ground instability, different drainage patterns, accelerated erosion, and ultimately causes damage to human-built infrastructure. Reports demonstrate that changing permafrost has already caused damage to buildings, roads, airports and other crucial community infrastructure. (NRCan, 2017, Upagiaqtavut, 2015).

Culturally for Inuit, a changing climate poses dire consequences in many facets of life. The Inuit have a deep connection with their ancestral lands through their subsistence practices, and these relations have shaped their collective culture and identity a people (Shaw, 2017). In a petition to the Inter-American Commission on Human Rights, Nobel Prize nominee Sheila Watt-Cloutier argued that for Indigenous communities, climate change is a human rights issue. “The future of the Inuit is the future of the rest of the world — our home is a barometer for what is happening to our entire planet” (Watt-Cloutier, 2005). Watt-Cloutier’s argument in this petition, and throughout her work, extends beyond the Inuit being the proverbial canary in the mine. Yes, the Inuit are the first impacted in Canada, and seeing this evidence should be a call to urgent climate action. However, what is most notable here is that these tangible effects are not only disruptive in a material sense, but also will affect the Inuit’s pursuit of their culture, tradition, and way of life. “Because Inuit culture is inseparable from the condition of their physical surroundings, the widespread environmental upheaval resulting from climate change violates the Inuit’s right to practice and enjoy the benefits

of their culture. The subsistence culture central to Inuit cultural identity has been damaged by climate change, and may cease to exist if action is not taken by the United States in concert with the community of nations” (Watt-Cloutier, 2015, 5).

## Food security

Climate change induced events such as unpredictable precipitation and droughts have highlighted the link between food security<sup>7</sup> and environmental, social, and economic issues. This is particularly problematic in rural areas where families rely on subsistence agriculture. In its 2016 *State of Agriculture Report*, the Food and Agriculture Organization of the United Nations (FAO) declared that:

Agricultural production is already being adversely affected by rising temperature variability, greater frequency of dryer spells and droughts, salinization of arable land and fresh water. As climate change impacts on agriculture intensify, it will become increasingly difficult to grow crops, raise animals, manage forests, and catch fish in the same ways and in the same places as we have done in the past (FAO, 2016).

The ramifications of climate change extend beyond crops, as livestock and fisheries are projected to decline. These food sources and are already under multiple stresses including overfishing, habitat loss, and water pollution. This affects the economic livelihood of impacted peoples, as scarcity could limit their abilities to attain traditional food sources which have been declared a basic human need and right (FAO, 2016).

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<sup>7</sup> Food security is interpreted through the Food and Agriculture Organization of the United Nations (FAO) definition as a condition in which “all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (FAO, 2016).

Food security is precarious in the Arctic. As discussed at the beginning of this chapter, the majority of Inuit communities in the Arctic live off-grid. These circumstances make the cost of living for Inuit twice or three times that of southern Canadians. The lack of infrastructure in northern and remote communities also leads to a lack of affordable and readily available nutritious foods. Given that 70 percent of Inuit households in Nunavut do not have enough to eat (compared to 8.3 percent in the rest of Canada), a decline in wild food access could have catastrophic implications for the food security and livelihoods of Inuit. (Canada's Arctic and Northern Policy Framework, 2018). It is when we recognize these inequalities, that the nexus of environmental justice and climate change become apparent.

Specifically for food security, the Inuit have already begun to experience climate change related effects in their wild food systems. Elders have reported dwindling access to Arctic char and seal, contaminated fish stocks, and a sharp decline in caribou populations (Cunsolo Willox, 2012) (Unikkaaqatigiit, 2005). Studies have found trichinella<sup>8</sup> in walrus and polar bear meat, and brucellosis<sup>9</sup> in caribou. The transmission of these and other diseases may increase when previously isolated wildlife populations come in contact with one another as natural barriers decrease (Upagiatavut, 15). To explore the implications of climate change for health and well-being, a multidisciplinary team of Indigenous and non-Indigenous researchers from the

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<sup>8</sup> Trichinella is a parasitic roundworm. When consumed, it can cause gastrointestinal symptoms, and when severe can cause neurologic and cardiac complications that may be fatal if severe (Public Health Agency of Canada).

<sup>9</sup> Brucellosis is a bacterial infection that can cause undulant fever, organ infection, and respiratory complications (Government of Manitoba Public Health Factsheet).

natural, social, and health sciences from the University of Guelph and from the Ringolet Inuit community government came together to carry out a large case study. The multi-year, community-based research yielded interesting findings on food security, physical health and mental health. Participants reported that “local and regional wildlife and vegetation patterns and the decreased access to wild meat and wild berries due to local variations in weather, snow, and ice” (Cunsolo Willox, 2012, 543). Furthermore, warmer temperatures have caused changes in sea ice thickness, which reduces possibilities for hunting and harvesting activities. One participant (an avid hunter) explained: “the changes experienced in her migration patterns and in the quality, stability, and extent of ice were decreasing opportunities for people to hunt for wild meat, and shifted diets” (Cunsolo Willox, 2012, 543).

Fluctuating temperatures also represent changes in wild food preparation and preservation techniques. For example, warmer temperatures are currently jeopardizing community permafrost-based freezers and infrastructure that Inuit have relied on for decades for sustenance (ITK, 2016). Community members have reported that outdoor meat caches now spoil, whereas before they remained fresh and preserved in the constantly cold environment of the Arctic (Upagiaqtavut, 15).

This decline in country food<sup>10</sup> available has also led to a shift in food sources. As Inuit face barriers hunting and harvesting country food, there has been a marked increase in their reliance on market (store-bought) foods which are shipped from

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<sup>10</sup> Country food describes traditional Inuit food. The Inuit Tapiriit Kanatami uses country food in its reports and research, which is why I have chosen to use the term in this paper.

southern areas. (ITK, 2019). According to surveys conducted for the Government of Canada in Kugaaruk and Labrador, market food in the Arctic is unaffordable, often of poor quality, and of very limited variety. Perishable food is often prone to spoilage because of the shipping required to bring it to remote communities. Given that the food has to travel longer distance, fresh produce and fruit is often prohibitive in cost and lacking in quality.

Although [Inuit] may prefer healthier choices, such as fruits and vegetables or whole wheat products, either they are not available, or the differences in quality and costs can make convenience/confectionary foods a more sensible choice in terms of cost, quality and ability to “fill kids up”...A female hunter explained “Doctors in the south are wondering why health is so bad in the North. The kids have bad teeth, bad health in families. Now they are finally looking at diet? I usually buy pop, chocolate to fill them up. It’s cheaper than other foods, cheaper than fruits and milk...I would rather use real potatoes, prefer the taste but they cost more and partly rotten. You can get more out of instant potatoes (Chan, 425).

These pre-existing environmental and economic pressures combined with wild food shortages due to climate change represent for the Inuit a drastic decrease in revenue from hunting opportunities, additional expenses in fuel costs to travel within communities, and an overall increasing dependency on southern Canada. By adopting an intersectional approach, we recognize that these pressures threaten the cultural, and physical well-being of all Inuit (ITK, 2019), and a lack of resources and food security also exacerbates impacts on Inuit health.

## Health

The provision and access to health care services has been an ongoing challenge in the Canadian Arctic. Life expectancy is considered a universal indicator of overall

health and wellness in a population given it reflects access to health care, nutrition, and living conditions. “Gaps are stark and striking. For instance, life expectancy for Inuit in Canada is 72.4 years versus 82.9 years for Canada's non-Indigenous population” (Arctic Policy Framework, 2018).

In its *Social Determinants of Inuit Health in Canada* report, the Inuit Tapiriit Kanatami reported troubling statistics. In comparison to other Canadians, Inuit have much lower life expectancies, have higher infant mortality rates, the highest suicide rates of any group in Canada, and suffer disproportionately higher rates of infectious diseases (ITK, 2014). The most troubling aspect of these circumstances is that “in many respects, [this health gap], is a symptom of poor socio-economic conditions in Inuit communities which are characterized by high poverty rates, low levels of education, limited employment opportunities, and inadequate housing conditions<sup>11</sup>” (ITK, 2014, 7).

Further compounding these circumstances, Inuit face additional barriers to receiving adequate health care including lack of medical infrastructure, a dearth of trained medical professionals that remain in communities for a significant period of time, and a small population that is spread out over vast and remote geographic areas. Socially, there are also gaps in providing inclusive, culturally appropriate and responsive care in the North (Arctic Policy Framework, 2018).

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<sup>11</sup> 52% of Inuit in Inuit Nunangat live in crowded homes, which are associated with high rates of communicable disease such as tuberculosis, as well as other challenges, compared to 9% of Canadians overall (Arctic Policy Framework, 2018).

## **Impacts of climate change on Inuit's physical health<sup>12</sup>:**

Since the impacts of climate change are widespread change, all populations are and will experience negative health effects. The IPCC states, “global warming is projected to affect human health, with primarily negative consequences (including) heat-related morbidity and mortality, ozone-related mortality, heat waves, and vector borne diseases” (IPCC, 2018, 2). The Inuit are disproportionately impacted due to a combination of factors.

Given the extreme temperatures in the Arctic, fluctuations can cause severe consequences. Based on the determinants of health vulnerability to climate change in Canada, James Ford argues that Inuit are already and will continue to be disproportionately impacted due to their geographic location: “For Inuit who live in small, remote, mostly coastal communities...numerous health implications from climate change have already been documented. Changing precipitation and temperature are projected to increase the probability, duration, and severity of extreme weather events and their outcomes (e.g., flooding, erosion) with implications for water quality” (Ford, 2014, 9).

Since the Canadian Arctic is widely regarded as a global hotspot of the effects of current and future climate change, Inuit are also more likely to be exposed to new “encroaching or introduced pathogens. Warmer temperatures and melting permafrost

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<sup>12</sup> Health is a holistic concept, encompassing physical, mental and spiritual well-being. Differentiating between physical health and mental health here is an editorial choice for clarity.

are also more likely to increase exposure to vector-borne diseases, as rising temperatures have the potential to increase the risk and incidence of waterborne, food-borne, zoonotic, and vector-borne disease (e.g., coli, giardiasis, etc.)” (Ford, 2014, 9). This will be particularly problematic, given that the novelty of these pathogens will mean delays in treatment.

In a report on climate change and infectious diseases in the Arctic, a multidisciplinary team also found that invasive bacterial infections are of special concern in the Arctic, as rising temperatures “may allow reservoir animals species such as rodents to survive winters in larger numbers, increase in population size, and expand their habitat range. Such shifts can favour the transmission of *Brucella spp*, *Toxoplasma gondii*, *Trichinella spp.*, *Coxiella burnetti* and *Puumala hantavirus* to humans in more northern locations” (Parkinson et al, 2014, 73). Since these are emerging conditions, communities are not always prepared to contain and deal with infestations. Another important consideration is that due to their cultural practices, Inuit are dependent on the land, sea, ice and local environment, which means they spend a significant amount of time outdoors, making them more vulnerable to pathogenic exposure.

### **Impacts of climate change on Inuit’s mental health:**

In a preamble to the Inuit Tapiriit Kanatami’s *Climate Change Strategy*, President Natan Obed argued that the Inuit’s “relationship with the environment is steeped with meaning. It shapes our identity, values, and world view...we must be prepared to take exceptional actions to adapt and remain resilient” (ITK, 2016). Given the holistic

integration of Inuit culture, the environment and its wellbeing are linked to the Inuit's wellbeing as well. Having seen the ramifications on their physical health, it is important to also examine the role that a changing climate has on Inuit life.

Mental health research has increased over the last two decades, and so have the efforts to understand how climate change impacts affect it. Drawing on research in Northern Canada, Ashlee Cunsolo and Neville Ellis posit that climate-related events and environmental changes,

Have been linked to a wide variety of acute and chronic mental health experiences, including: strong emotional responses, such as sadness, distress, despair, anger, fear, helplessness, hopelessness and stress; elevated rates of mood disorders, such as depression, anxiety, and pre- and post-traumatic stress; increased drug and alcohol usage; increased suicide ideation, attempts and death by suicide; threats and disruptions to sense of place and place attachment; and loss of personal or cultural identity and ways of knowing (2018, 275).

This emerging phenomenon is recognized in the literature as *ecological grief*, a natural response to “ecological losses, particularly for people who retain close living, working and cultural relationships to the natural environment, and one that has the potential to be felt more strongly and by a growing number of people as we move deeper into the Anthropocene” (Cunsolo and Ellis, 2018, 275). This term is one which illustrates the necessity of incorporating environmental justice, constructivism, and realism. While we can measure and record incidences of drug and alcohol use, or suicide attempts, we need to understand the immaterial causes of these occurrences. It is where sociologists need to recognize the relative importance of cultural identity, emotional responses to natural weather events, and how place-based instances can have broader ramifications for (in this case) the Inuit way of life.

In a study on climate change and health in Nunatsiavut, participants “shared with the researchers that they felt *mad, upset, pissed off, angry, helpless, frustrated and sad*” (Cunsolo Willox, 543). Climatic and environmental changes have placed a unique toll on daily Inuit life. In the documentary *Lament for the Land*, 24 Inuit leaders, elders, and community members from Nunatsiavut (Labrador), discuss the effects of climate change on their communities. While their perspectives are unique, these individuals are experiencing a very similar sense of loss for their way of life. These are compounded in a variety of ways. First, there is grief associated with physical ecological losses – including changing weather patterns or natural infrastructure. Second, there is grief associated with loss of environmental knowledge. Climate change is affecting how to predict weather events, the ability to gather country foods, and pass on cultural skills to future generations. Research suggests that this inability to access the land also has repercussions on culture, transmitting IQ, and other cultural teachings:

The loss and weakening of TEK among some younger Inuit are linked to a gradual disengagement of younger generations from the land and subsistence activities...unlike their parents and grandparents, young Inuit today are generally spending less time involved in subsistence activities beyond organized land-camps and occasional hunting trips. As a result, some have fewer opportunities to learn the knowledge and skills necessary for safe and successful travel and hunting under changing climatic conditions (Pearce et al, 2015, 240).

Lastly, there is grief associated with anticipated future losses. This is the case for Inuit who fear a further degradation of their land, future food shortages, and more precarious situations as the effects of climate change continue to unfold before their eyes (*Lament for the Land*, 2014).

Research has also found that intersecting challenges – such as issues in obtaining sufficient country food (as discussed in the food security section), as well as the inability to hunt (which will be examined in detail in the following section), are causing complex mental health issues for Inuit hunters. Changing climate conditions “reflect not only the decreased ability to provide food for the family, but also a loss of cultural identity, and livelihood practices” which lead to further mental health decline (Ford, 2014, 12).

## Infrastructure, mobility, and safety

Arctic communities are often remotely located, the majority of the infrastructure is built on permafrost, and materials are often expensive and hard to come by. Traditionally Indigenous communities were not confined to live in a single location but moved as necessary when they could not support their needs in a particular location. However, the transition away from a nomadic lifestyle due to government decisions in the 1950s required infrastructure that has not been made readily available to Inuit (Warren, 487). Through a study on small remote Arctic communities, a multidisciplinary team lead by Dr. John Warren found that while communities have tried their best to adapt to their relatively new lifestyle, infrastructure has not always kept up with their needs.

One of these infrastructure needs includes availability of sanitation facilities (including movement of water and waste) such as piped utility systems, potable water availability, water treatment and water distribution (Warren, 490-494). The study found that many remote Arctic communities lack adequate sanitation systems. This makes

Indigenous communities more vulnerable to diseases, as melting permafrost can disrupt pipes leading to a lack of access to water for sanitation and food preparation purposes. Flooding and erosion can damage infrastructure leading to waste contaminating community water supplies, or cross-contamination from diesel pipes. In warmer temperatures, solid waste material can thaw and release dangerous contaminants near communities, and contaminants can leach into drinking water (Warren, 494).

Changes in ice conditions also affect natural infrastructure, changing or lengthening travel routes, and making them more unpredictable, resulting in hunters being more prone to increased incidents of falling through ice. Elders are now unable to accurately predict the weather even though they have been doing so with accuracy for generations. This leads to potential fatalities and safety hazards for Inuit, given that there is an increased risk while on the ice.

In a collaboration between Inuit Tapiriit Kanatami, the Nasivvik Centre for Inuit Health at Laval University, and the Ajunnginiq Centre at the National Aboriginal Health Organization, organizers conducted series of workshops focused on environmental change and what it means for communities in the four Inuit regions of Canada. With regard to safety and mobility, participants flagged that harvesting and land-based activities have become difficult, unpredictable, and increasingly dangerous. “We need to be more careful when pursuing animals because of thinner ice and changing ice conditions” (Unikkaaqatigiit, 2005, 73). These environmental changes have made travel challenging, which not only affect harvest activities, but also recreation and social time,

as Inuit families are unable to visit relatives in neighboring communities. The loss of natural infrastructure is further compounded by high living costs, reducing mobility. “The costs of diesel affect us because places we could reach before cannot be reached because of melting snow and thinning ice in the winter in this warmer weather” (Unikkaaqatigiit, 2005, 73). Higher costs of diesel, longer distances due to changes in routes, and increased wear for vehicles also add to the economic barriers faced by Inuit.

As the environment becomes more unpredictable, Inuit are forced into more precarious situations, often being stranded on land for indefinite amounts of time and often in hazardous weather. As ice quality becomes unpredictable, there have been increasing reports of hunters falling through the ice leading to injury, or in some cases, death. Even in less dangerous incidents, hunters lose their equipment, which is often quite costly to replace (ITK, 2016).

While climate change will affect weather patterns, Inuit will be more acutely impacted by these changes than other Canadians due to their reliance on the land for their survival, and the entanglement of environmental change with socio-economic factors that are beyond their control (for example, rising fuel prices). Moreover, given the Inuit’s holistic relationship with the environment and Inuit links between environment, culture, and community, it is no surprise that they are at the forefront of climate action.

## SECTION 3: Self-determination, citizen science, and case study

### Inuit Self-Determination and Climate Action

Inuit have a deep connection to the land. As the president of the Inuit Tapiriit Kanatami, Natan Obed, puts it: “Our rich culture, values, and language have thrived because we have embraced our interconnectedness with the land, sea and ice that is our home” (ITK, 2019, 10). At the same time, Inuit have been leaders in climate action for decades whose leadership must be respected when developing climate action and policies. Given their particular circumstances in a harsh environment, removed from electricity grids and other infrastructure powering the majority of southern Canada, Inuit action is guided by different principles. It is important here to deviate from environmental considerations to note some institutional and legal aspects of Inuit in Canada.

Section 35 of the *Constitution Act of 1982* recognizes and affirms Indigenous Rights in Canada. Section 35 of the Constitution Act states:

35. (1) The existing aboriginal and treaty rights of the aboriginal peoples of Canada are hereby recognized and affirmed.
- (2) In this Act, “aboriginal peoples of Canada” includes the Indian, Inuit and Métis peoples of Canada.
- (3) For greater certainty, in subsection (1) “treaty rights” includes rights that now exist by way of land claims agreements or may be so acquired.
- (4) Notwithstanding any other provision of this Act, the aboriginal and treaty rights referred to in subsection (1) are guaranteed equally to male and female persons.

To note, section 35 did not create Rights for Indigenous Peoples, but reaffirmed them after Indigenous leaders fought to have their rights enshrined and protected. Despite having this legal protection under the Canadian system, Inuit organizations are often

inadequately engaged in policy formulations and research. This includes policies directed at preservation of Indigenous knowledge, access to health and social services, access to housing, and many other rights that have either been denied or underprovided in the Inuit Nunangat (Kipp et al, 2019, 2).

As rights holders, Inuit should be at the forefront of climate action that affects them. As rights holders, actions and policies should be formulated using a “rights-based approach premised on partnerships with representatives of Inuit and governments. Inuit democracy is grounded in land claims agreements that provide the foundation for self-determined climate decision-making where Inuit lead and develop partnerships for outcomes that address Inuit priorities” (ITK, 2019, 14). As such, climate policies must respect Inuit self-determination, and include all relevant actors - Inuit, federal, provincial, territorial governments, civil society, industry, and the academic community. This is not always the case. Often, due to the privileging of Western science, and a lack of access to “decision-making processes and social structures that allow decisions to be made without involvement of those most intimately concerned”, Inuit are often left on the margins of actions that impact their communities (Shaw, 2017, 6).

As we saw at the beginning of this paper, informed climate action is often a tricky balance of negotiating knowledge hierarchies, incorporating different types of knowledge, building capacity, and fomenting relationships that are based on trust and mutual respect. In the next section, I will present the argument that climate action can be a conduit for reconciliation. This can be the case through citizen science, as this process meaningfully engages Indigenous communities in knowledge production.

## Citizen Science

By understanding the context of the changing climate in the Arctic, and its unique impacts on the Inuit, researchers can help provide solutions to the climate crisis. However, using an environmental justice lens also highlights the need to incorporate community-based engagement from outside mainstream academic and government institutions. Democratizing science movements work to encourage the critical analysis of research findings to reveal their political context, and by legitimizing citizen knowledge in scientific processes, policies and public discourse. Often rooted in environmental justice, these movements intend to “change the value structure underlying science, drawing attention to the biased nature of research trajectories” (McCormick, 4). While western science and institutions like the IPCC collect and provide climate data, citizen science can help to dismantle the West’s monopoly on climate change science and its place in policy solutions. Given the importance of incorporating Indigenous knowledge, citizen science can help bridge the gap between western science and Indigenous knowledge, given that “the value of TEK does not often translate into its use in science and decision making where scientific knowledge, measurements, and projection are privileged” (Cuerrier, 2015, 380).

Citizen science, and specifically community-based monitoring, involves different actors in a community, including local residents, governments, industry, groups and academics, to work together to observe and record common community concerns like climate change. Unlike top-down monitoring, this type of research is community-driven, and relies on community knowledge in the design, development and implementation of

monitoring initiatives. It is increasing in prevalence in Arctic and Subarctic regions of North America, as it empowers communities, fosters self-determination, creates social capital, develops research skills amongst local people, and strengthens partnerships between community members, government agencies, and other like-minded institutions. Based on observations and discussions over the course of five workshops with communities in the Arctic, Katherine Christie and a team of researchers found that participatory approaches at the local level have a higher chance of success than top-down policy interventions. These “local level approaches that examine [climate change] adaptation challenges on a case-by-case basis are more likely to be consistent with the purposes and norms of local cultures. As a result, these initiatives have a greater probability of being embraced by individuals and communities” (Christie et al, 2018, 1). By emphasizing a sense of ownership and self-determination, these community-led, culturally-appropriate initiatives to environmental monitoring and climate action are more likely to produce lasting and more fruitful results.

The benefits of citizen science have been observed in other environment issues. Citizen science has been seminal in developing more sustainable and inclusive resource management and risk assessment practices, as the alternative has led to various gaps and challenges in coverage, data quality and relevance (Kipp et al, 2019, 3). Alternately, in examining risk assessments conducted without ample community involvement, researchers have found that outcomes do not “protect cultural minorities very well for a variety of reasons – one of the key reasons being that some cultural minorities access resources in the environment differently than both the mainstream

culture and the scientists and policy makers doing the risk assessments” (Johnson and Ranco, 2011, 179). By recognizing that there has been a lack of inclusion in environmental consultation, researchers and policymakers alike are now shifting their protocols to conduct studies and formulate policies in *partnership* with local communities. In addition, climate activists are leveraging these lessons learned to bring practices that are more inclusive to the Arctic.

Based on one scholarly review of community-based monitoring practices in the Arctic, researchers found that “Indigenous communities across the North are increasingly involved in the design, development and implementation of monitoring programmes in order to observe, record, and respond to climate change” (Kipp et al, 2019, 12). These Inuit-led partnerships are helping to catalyze self-determination, carry out research that is culturally relevant, and disseminate findings in more culturally relevant, and therefore in a more useful, manner. One of these community-based, Indigenous-led projects is SIKU.

### Case Study: SIKU

SIKU<sup>13</sup> (sea ice in Inuktitut), is an Indigenous knowledge social network. It is an online platform for Inuit by Inuit, serving to provide real-time information on ice safety and weather. The Arctic Eider Society (AES) and Inuit communities created this social

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<sup>13</sup> There is another collaborative project titled SIKU “Sea Ice Knowledge and Use: Assessing Arctic Environmental and Social Change” that was launched in the International Polar Year (2007-2008). The project involved 5 nations and more than 30 communities spread around the Arctic, from Greenland to Siberia. The projects have a similar focus but are not connected.

media/open encyclopedia smart phone application or “app”. The AES, an Inuit-driven charity based in Sanikiluaq, aims to empower local people to take charge of research, education, and stewardship of the environment (UNESCO Courier, 2019). Working together with Inuit and First nations communities, the AES was awarded the 2017 Google Impact Challenge in Canada. With this funding, AES brought together Inuit hunters, elders, and youth, and software partners and sponsors including Google to collaborate in this groundbreaking project (SIKU Press Release, 2019).

Launched in December 2019, the SIKU app provides “open-source tools to help Inuit communities map changing sea ice, and build a living archive of Inuit knowledge to help inform decision making for stewardship and sustainability” (SIKU, 2019). SIKU is an interesting example of citizen science and community-based monitoring, because it unites a remarkably wide-ranging variety of stakeholders on the climate issue, ranging from Inuit hunters, universities, non-profit organizations, territory officials, the federal government and private industry and technology partners like Google. The development of SIKU was led through a series of workshops that were held “across Inuit Nunangat. For example, the [Arctic Eider] society worked with Ikaarvik programs in Pond Inlet, Cambridge Bay and Gjoa Haven; hunters and youth in Sanikiluaq, Inukjuak, Umiujaq and Kuujjuaraapik; various organizations like SmartICE and Canadian Ice Service; community research programs; and Nunavut Sivuniksavut in Ottawa” (Nunatsiaq, 2019).

To overcome accessibility and technology barrier issues, Inuit youth, hunters, elders and organizations across Inuit Nunangat were involved in the creation and

development of features on SIKU. This ensured that the app would be culturally relevant, and user-friendly for stakeholders. Additional workshops and training were offered by the Eider society, so users could create profiles, access information, learned how to use the SIKU GPS and maps, create and post hunting stories, and ice conditions. These broader consultations ensure that the platform remains an accessible tool for community-driven research (SIKU Press Release, 2019).

SIKU operates under four guiding principles: Respect (providing a safe space for sharing and mobilizing Indigenous knowledge); Self-determination (documenting data that has formed the basis for Indigenous knowledge, and mobilizing it for research, education and environmental stewardship); Intellectual Property (preserving integrity of the data, through an informed data stewardship framework); and Integrity (requiring real names and real data, understanding the importance of authentic information for safe travel, knowledge transfer, and cultural preservation) (SIKU, 2019). Content is organized by four types of posts – social, wildlife, sea ice, and tools. The app is unique, insofar as it incorporates aspects of social media platforms like Facebook like timelines, profiles, and allows for commenting and sharing of posts. However, it goes beyond this to support GPS tracking, reporting on weather, tides, satellite imagery, and ice safety. Through the *sea ice* category, users can undertake a range of activities, including profiling sea ice types through posts and pictures of ice conditions by tagging Inuktitut sea ice terminology. Under *wildlife*, there are 80 Arctic species including fish, marine species, and land animals and birds. Users can tag the species, and provide observations, including tracks, nests, dens, as well as habitat, diet, body condition, and

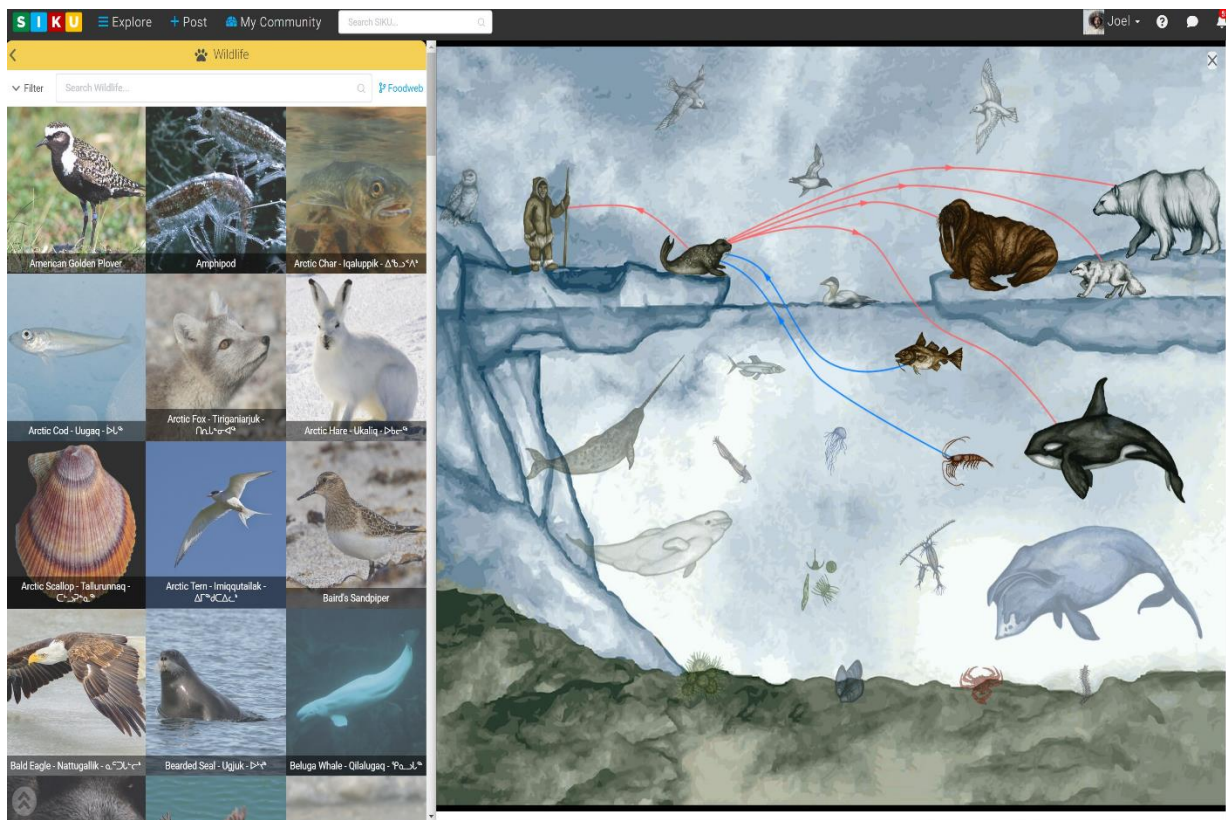
flag unusual or rare events. The *social* posts include hunting trips and excursions on ice. Users share photos, and geo-tagging to share relevant information. Under *tools*, users feature data collected with scientific instruments like ice core and water samples. All four types of post allow for documenting traditional place names and recording local knowledge (SIKU Press Release, 2019).



Screenshot: Dangerous Ice post near Sanikiluaq (SIKU Press Release)

SIKU gathers different actors online in order to leverage diverse knowledge. Since it is an open platform, anyone can contribute, which circumvents knowledge hierarchies. The open platform allows Inuit to access, and directly benefit from the results of the research (rather than ending up locked in university archives far from the community). It also prevents organizations or government departments from appropriating the traditional knowledge that is collected and used in the study; as

summarized earlier, such appropriation has been a point of contention for the academy in its interactions with Indigenous groups. SIKU's guiding principles also advocate for self-determination, ensuring that no one can use data without the author's permission, and boasts customizable privacy settings. The application is also not-for-profit and always free. "Unlike other areas of the internet, where someone's online content can be used without permission, a SIKU user owns their data. People and organizations will need consent before using someone's content. Not even SIKU or the Arctic Eider Society can compete for content ownership—the society wrote itself out of the privacy policy" (Nunatsiaq, 2019, 1). This unique approach to privacy and data stewardship puts Indigenous self-determination and rights at the forefront of the project (SIKU Press Release, 2019).



Screenshot: Wildlife Species Profile and Interactive Food Web (SIKU Press Release, 2019)

Information is recorded in English, as well as in Inuktitut, which is helping to preserve this traditional language for the next generation. The platform supports language and knowledge transfer, as it can be used in multiple Inuktitut languages and dialects. While Inuit have traditionally relied on oral history, SIKU provides an opportunity to use cutting-edge technology (including 360 degree street view imagery on the ice, underwater video, and timelapses) to document and preserve their data. By using technology with traditional practices, SIKU is becoming a tool to bridge intergeneration gaps. SIKU is providing a tool to preserve traditional languages, and “it is hoped that this [terminology] will one day be integrated into machine learning approaches (artificial intelligence), so that Indigenous communities can access relevant information remotely — in real time and in their own language” (UNESCO Courier, 2019, 1). While Elders are able to share information, the app is also boosting Inuit youth engagement in traditional activities. “To involve youth, [the AES’s Research Network] has partnered with Kativik Ilisarniliriniq, the Nunavik School Board, to develop a holistic Inuit-centred approach to training and education in the sciences. This has resulted in the Arctic Sea Ice Educational Package. Using interactive multimedia tools, it allows young people to partner with hunters and to become directly involved in local research” (UNESCO Courier, 2019, 1).

As a web platform by and for Inuit, SIKU is providing didactic learning resources in a culturally relevant format to engage Inuit students and overcome some of the socioeconomic barriers that affect Inuit households. In an interview on the importance of SIKU, Lisa Kavik, an Elder for the region, explained that not all students have an

opportunity to get out on the land due to a lack of transportation or economic resources. SIKU provides young Inuit with an opportunity to see Inuit Nunangat and further their scientific knowledge in an interactive way, while also learning Inuktitut terminology for wildlife species and ice types (SIKU, 2019).

SIKU is illustrative of the partnerships that Inuit, governments, and civil societies can participate in to further inclusive and effective climate action. SIKU is producing tangible results such as providing real-time climate data, advocating for ice safety, and providing the tools to carry out traditional activities using available technological solutions. More importantly, SIKU incorporates many of the best practices that make community-led monitoring programmes successful. It is community-led and community-based, it makes use of innovative technologies that are locally appropriate and usable, and it combines cultural knowledge on climate change with environmental observations, leading to the development of community adaptation and emergency response strategies (Kipp et al, 2019, 12). The platform is also putting Inuit leadership and rights at the centre of this experience, allowing Inuit to control their own research, preserve their traditional knowledge in a more permanent way, and share it across the Inuit Nunangat and for the rest of Canada. It is a modern-day example that leverages traditional knowledge, Inuit experiences, and technology to provide a culturally relevant solution to adapt to a changing climate.

## Conclusion

Citizen science and community-led projects such as SIKU are paramount to addressing climate issues in a way that is inclusive and effective; such projects bring Inuit knowledge and western science together, to provide appropriate, culturally relevant, and autonomous solutions. They are also an excellent example of how necessary the decolonization of environmental knowledge is for achieving reconciliation. Citizen science is not just a tool for mitigating the effects of climate change, but a way towards reconciliation by engaging Indigenous communities as expert members of society with legitimate knowledge. Citizen science methods can serve to decolonize and dismantle western forms of knowledge hierarchies, and expand the definition of who is a recognized “expert” in the field of science – notably of climate change. Addressing issues of knowledge hierarchies and reconciliation requires a deeper understanding of the theoretical tools used to understand environmental issues such as climate change.

Climate change remains one of the biggest threats to our current way of life. As policy makers, industry, and civil society representatives meet to discuss progress on the Paris Agreement at the next UNFCCC Conference of Parties in 2021, they will explore ways to mitigate greenhouse gases and adapt to a changing climate. Sociologists have a part to play in this debate as well. It is our duty to remind the international community that complex problems require inclusive solutions. These are only effective if all actors are invited to the table. This is why it is essential to recognize the intersectionality of climate change — and how it will affect those most vulnerable due to social, cultural, economic, and political factors.

If governments and decision-makers are to have all the pertinent information available to produce effective policies, it is important for the academy and institutions like the IPCC to become more inclusive and recognize their own inherent biases towards Indigenous knowledge and other intersecting aspects, like gender. In the introduction of *Global Challenges for Sociology*, Bhambra and Santos argue that “if the injustices of the past continue into the present and are in need of repair, that reparative work must also be extended to the disciplinary structures that obscure as much as illuminate the paths ahead” (2017, 9). This is why Indigenous knowledge, manifested through community-led projects, needs to be brought to the forefront of climate action.

Inuit have suffered for centuries under colonial and capitalist policies that have left them disenfranchised, unable to access social services that most Canadians enjoy, and they are now more vulnerable to a shifting natural environment. Policies to mitigate and adapt to a changing climate will be misdirected if socio-economic factors, colonial legacies, and power imbalances are not addressed. As we face this climate crisis, we must also pledge our support to dismantle the power struggles that led us to this issue in the first place. With programs like SIKU, Inuit continue to demonstrate climate leadership and display their knowledge of the Arctic. SIKU is a model of partnership that is needed if we are to solve the climate crisis.

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