UiT The Arctic University of Norway

Faculty of Health Sciences

Indigenous Health and Climate Change

- A scoping review on climate-health outcomes for First Nations in Canada

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Table of Contents

Abstract

Indigenous populations in Canada are generally categorized as vulnerable to the impacts of climate change. Despite this, research is lacking in terms of location- and populations-specific data on how climate change affects their health. To address this gap, we conducted a scoping review to explore the impact of climate change on the health of First Nations communities in Canada. Our study also investigated how climate change influences the Inverse Care Law (ICL) in relation to First Nations' health.

We utilized a scoping review methodology, searching 4 databases to explore the theme of this thesis. Our approach to understanding health was framed through an "Indigenous lens," encompassing not only physical and mental health perspectives but also spiritual and community health considerations. The generated literature was numerically and thematically analyzed. Our findings reveal that climate change exacerbates existing health disparities among First Nations, impacting traditional activities, diet, finances, cultural identity, and mental well-being. This exacerbation deepens the burden of lifestyle-related diseases exacerbates health disparities through perpetuating and/or exacerbating the Inverse Care Law (ICL). The analysis also looks at the importance of incorporating Indigenous-specific health indicators for understanding and addressing these multifaceted impacts.

We also recognize the dual characterization of First Nations as vulnerable yet resilient. While climate change poses significant threats, communities demonstrate adaptive capacity and

resilience. However, the label of vulnerability can have negative connotations, potentially undermining autonomy and self-determination.

Our research identifies significant knowledge gaps, particularly regarding gendered perspectives. Additionally, research on First Nations in the Prairie region remains limited, emphasizing the need for more inclusive studies. The small number of eligible studies also highlight the need for continued focus on the theme of this thesis.

In conclusion, our study underscores the complex and interconnected impacts of climate change on First Nations' health. Holistic and culturally sensitive approaches to health measurement and intervention are essential. Addressing knowledge gaps and including diverse perspectives are crucial for mitigating the health impacts of climate change on Indigenous populations and supporting their journey towards greater health equity and self-determination.

1 Background

This thesis concerns the theme of how climate change impacts Indigenous health in Canada, with specific focus in the First Nation population. In the background section, we shall look at the context of this theme, and the reasons for why this theme should be explored.

1.1 Indigenous health – worldwide and in Canada

It is widely recognized that Indigenous health is a global health problem. As presented in WHO's fact sheet from 2007 on the health of Indigenous peoples; "Indigenous peoples remain on the margins of society: they are poorer, less educated, die at a younger age, are much more likely to commit suicide, and are generally in worse health than the rest of the population."(1). More than a decade later, a substantial health gap persists between Indigenous and non-Indigenous populations at global scale. Some attribute the state of Indigenous health to a collective history of oppression and discrimination. Unfortunately, discrimination of these peoples still exists in today's healthcare (as well as society in general) and remains an obstacle for improving the situation (2). Canada is one of the countries rich in Indigenous people. The Indigenous population amounts to about 4% of the country's population and consists of three main groups: Métis, Inuit, and First Nations. Though Canada is considered a well-developed country with a strong healthcare system, the health of the Indigenous population, mirrors that of the global perspective – the Indigenous population generally has poorer health and a lower life-expectancy than their non-Indigenous counterparts (3). Though the reason for this is of course multifaceted, one prominent contributor is the fact that they remain among the most medically underserved groups in the country. In later years, the focus on Indigenous health has increased, and some measures have been taken to mitigate the disparities – for instance, health reforms have created a shift towards Indigenous community control of primary care (4). Also, in 2015, the Truth and Reconciliation Commission released 94 calls to action, elicited from the harm done by the history of residential schools, in which the importance of closing the health gap is highlighted (5). The health gap is, however, far from closed (3, 4).

1.1.1 Social determinants of Indigenous health – the underlying causes of the health gap

As established, there is little doubt that there exists a health gap between Indigenous populations and non-Indigenous populations. This is evident because of the high rates of certain diseases, poor access to healthcare etc., as previously mentioned. But how did it come

to be like this? In 2009, Professor Malcom King et al. published an extensive study on this particular theme, or as they called it: "Indigenous health part 2: the underlying causes of the health gap." In this study, they analyzed literature to find the social determinants of Indigenous health. Though they generalized the findings to Indigenous people all over the world, their data was largely based on the Canadian setting. In this, they stated that social determinants of health are the root causes of everyone's health problems, but that they play a particularly big role in the state of Indigenous health. Not only did they emphasize the importance of these determinants, but they also found the situation to be considerably more complex for Indigenous populations. The 1986 Ottawa Charter for Health Promotion defined classic socioeconomic indicators of health to be: income, education, employment, living conditions, social support, and access to health services. These are indeed applicable to Indigenous populations. Indigenous people are however additionally affected by a history of colonization and racism, and Indigenous-specific factors such as disconnection from their land and cultural identity (3). One of the social determinants of Indigenous health that is often highlighted is their relationship to the land. For instance, Durkalec et al. found that traditional utilization of sea ice – for transportation, fishing etc., had positive health outcomes (mainly emotional/mental) for an Inuit group in Canada (6). As such, the loss of this ice would lead to loss of cultural practices and be detrimental to the wellbeing of this group. The destruction of land has been perpetuated by globalization and commercial exploitation. In recent times, however, the additional threat of climate change could exacerbate the situation (3, 6). It is this intersection between climate change and Indigenous health that we want to explore in this thesis. In the following background sections, elected research pertaining to this, as well as some necessary definitions will be presented.

1.1.2 The Indigenous definition of health and Indigenous Knowledge

As touched upon in the previous section, social determinants of health are more complicated for Indigenous peoples. Among other already mentioned factors (like the legacy of colonialism), the Indigenous definition of health is one of the reasons for this. Health is generally understood in a holistic manner in Indigenous cultures. In their article, King et al. describe it as: "[…] At the personal level this means each member [of the community/First Nation] enjoys health and wellness in body, mind, heart, and spirit. Within the family context, this means mutual support of each other. From a community perspective it means leadership committed to whole health, empowerment, sensitivity to interrelatedness of past, present, and

future possibilities, and connected between cultures." (3). From this, we see that, to get the full picture of Indigenous health, one must explore outside of physical health.

An important part of Indigenous culture, as well as Indigenous health, is traditional knowledge/traditional ecological knowledge (TEK). TEK is knowledge generated about the local environment over generations, based on experience and observations of the local environment. The Inuit Circumpolar Council defined it as such: "a systematic way of thinking applied to phenomenon across biological, physical, cultural and spiritual systems. It includes insights based on evidence acquired through direct and long-term experiences and extensive and multigenerational observations, lessons and skills. It has developed over millennia and is still developing in a living process, including knowledge acquired today and in the future, … [as] passed on from generation to generation." (7). As the environment changes, it is likely that TEK/the generation of TEK will be impacted. This shall be further explored in our project.

1.2 Climate change and health

As emphasized in WHO's COP26 special report on climate change and health: the health argument for climate action, climate change will inevitably create large health challenges. In fact, this report states that climate change is "the single biggest health threat facing humanity." Among other hazards, increasingly frequent extreme weather events lead not only to acute illness and deaths, but food insecurity, vector borne diseases and zoonoses and mental illness. Also, social determinants of health, like livelihoods and access to healthcare, are negatively impacted. The situation is predicted to become more severe with increasing global temperatures, though some effects are already seen today (8, 9). Generally, climate change unevenly affects disadvantaged and marginalized populations. – Be that because of poverty, poor social support systems, vulnerable food systems, discrimination, or other indicators of vulnerability. In terms of health, climate change is likely to amplify the so called "Inverse Care Law" if action is not taken to adapt current health – and support systems (8, 9). We shall look more into this in section 1.3.2.

1.2.1 Climate change and Indigenous health

Indigenous people are largely characterized as vulnerable to climate change(6). Rhys Jones (2019) summarizes this to be due to "a range of factors including unique relationships with the natural environment, socioeconomic deprivation, a greater existing burden of disease, poorer access to and quality of health care, and political marginalization." Consequently,

climate change will probably lead to negative health outcomes for these populations if strategies are not implemented to mitigate the harm. Looking to Canada, we have already seen the example of how the melting of sea ice may affect the health of Inuit (see section 1.1.1). Many Indigenous peoples do, however, show a great adaptive capacity. There are several examples of Indigenous peoples initiating community-based action to increase awareness and surveillance of climate-related health outcomes and benefiting from their cultural knowledge and traditions in doing so. In other words, climate change adaptation could be an opportunity for community strengthening (10).

1.3 The Inverse Care Law

In 1971, The Lancet published an article by Julian Tudor Hart which has become widely known by most social health scientists. In his study, Hart looked at the distribution and accessibility of healthcare in Britain, and how socioeconomic factors, such as social class and localization, affected the situation. By his findings, he theorized that "The availability of good medical care tends to vary inversely with the need for it in the population served." This theory is known as 'The Inverse Care Law'(11). Though Hart was looking at Great Britain specifically, as well as social and geographical disparities in health, The Inverse Care Law (ICL) has been applicable for various localizations and health fields. Though it may be most prominent in low resource settings (11, 12), a version of it is seen in upper-middle and high-income countries – a so-called disproportionate care law' or 'incomplete Inverse Care Law'. This version is defined as "an increase in health-care use with social disadvantage but not in proportion to need." (11).

Research unfortunately shows that the ICL has stood the test of time(11). As previously mentioned, it may be perpetuated, and indeed exacerbated, by climate change. As stated in the COP26 special report on climate change and health; "While no one is safe from these [health] risks, the people whose health is being harmed first and worst by the climate crisis are the people who contribute least to its causes, and who are least able to protect themselves and their families against it - people in low-income and disadvantaged countries and communities."(8) As per the previous section, Indigenous populations will likely be particularly affected by climate change, which could exacerbate their already disproportionate access to healthcare

1.4 Thesis motivation – Indigenous health, climate change and current research

As the background section shows, Indigenous health outcomes from climate change is an important research field to prepare, adapt and improve existing health systems to what may come. Because of the history of marginalization of these peoples, this also represents an opportunity for reconciliation, and one can arguably say that Indigenous health should be a priority in the adaptation to climate change(5). In 2012, James D Ford reviewed research on Indigenous health and climate change to "capture place-based dimensions of vulnerability and broader determining factors." In this, he found that there is a rich body of research dedicated to vulnerability of Indigenous peoples to climate change – studies that identify specific factors that make them vulnerable. However, he found that population-specific understanding on the nature of vulnerabilities and determinants is lacking, and that few studies focused on differential vulnerability at a community level, examined high-risk groups or looked at urban Indigenous populations. He argues that the local diversity in how climate change will play out "reinforces the importance of place-based and population-specific studies"(10). Of course, research is an everchanging field, and in 2024 one could maybe expect that the knowledge gaps from 2012 had been filled. Harper et al. published a scoping review in 2021 identifying trends and gaps in climate change and health research in North America. Though one of the highlighted findings was that climate-health research had increased over time, they also identified many knowledge gaps– specific topics and geographics were underrepresented in the literature. Among other things they found that research considering Indigenous peoples were the least common, and that among the few articles they found that did concern Indigenous peoples, most examined nutrition and mental health. What Indigenous groups that were considered was not specified in this review(13).

2 Purpose and objectives

Based on what we have seen in the background, there is need for research on how climate change will affect the health of specific Indigenous populations – motivated by the health gap between Indigenous – and non-Indigenous populations, the marginalization of these groups, their vulnerability to climate change, the local variability in climate change and culture, and the underrepresentation of Indigenous climate-health research in North America. Based on this, we aim to synthesize knowledge that we do have about how climate change will affect the health of *First Nation populations* in Canada, as well as vulnerabilities and factors of

resilience that this specific population inhabits. Through this we also intend to identify knowledge gaps to this theme, to develop incentives and priorities for further research.

3 Methods

3.1 Scoping review – an open approach

This study was be conducted as a literature review. As the purpose of the study is to synthesize existing knowledge and persistent knowledge gaps in a theme which is (as per the background, section 1.4) relatively unexplored, we chose to do a scoping review. As explained by Mays et al. (2001, p. 194), scoping studies "aim to map rapidly the key concepts underpinning a research area and the main sources and types of evidence available, and can be undertaken as stand-alone projects in their own right, especially where an area is complex or has not been reviewed comprehensively before."(14). Scoping reviews generally have a broader approach to the literature than, for instance, systematic reviews – they look at themes where several different study designs may be applicable and tend to not address very specific research questions or assess the quality of the included studies (15). Because of the nature of this project's theme, we wanted to include different study designs. We also wanted an open approach, where we could allow the found (or not found) literature to define subthemes to inform the purpose. We aimed to use a methodological framework as the one presented by Arksey and O'Malley (2005) as a starting point, in short:

Stage 1: identifying the research question
Stage 2: identifying relevant studies
Stage 3: study selection
Stage 4: charting the data
Stage 5: collating, summarizing and reporting the results

3.2 Designing the search

3.2.1 The databases

We chose to conduct the search in 4 databases, namely: Medline Ovid, Embase Ovid, Web of Science and the Indigenous Studies Portal. Medline and Embase both have a medical focus, and in conducting searches here, we were particularly covering the health aspect of our objectives. In addition to being a medical subject, our purpose/objective also has a distinct anthropological aspect. As such, we decided to include the Web of Science- database. The final *main* focus point of our study is Indigenous health/impacts on Indigenous populations in

Canada. As such, it became natural to include the Indigenous Studies Portal (I-Portal) in the search. As described on their website, the I-Portal "was launched in 2006 at the University of Saskatchewan as a tool for faculty, students, researchers, and members of the community to access digital Indigenous studies resources." The primary population focus is the Indigenous population of *Canada,* whilst other Indigenous populations are secondary. The I-Portal contains a range of substantive literature, including articles, theses, e-books and more (16).

Separate searches were designed for each database, as they work slightly differently. In Medline and Embase, Mesh Term-searches were conducted to find the relevant search terms for the categories we were interested in. Notably, even though these two databases are predominantly based on the same data foundations, some Mesh Terms are categorized in different ways – for instance, the term First Nation is a separate Mesh Term in Embase, categorized under "Indigenous populations", whilst in Medline, it is not. In Medline, the term "First Nation" is categorized under the *Mesh Terms: Indigenous peoples - American Indian or Alaska Native - Indigenous Canadians*.

In Web of Science, we largely worked with so-called "Topic searches" (Field tag: "TS", encompassing title, abstract, author keywords, Keywords Plus®). The I-Portal is in some ways less sophisticated than the other included search motors. Its advanced search does not offer Mesh Term/topic searches, or specifications on *where in the literature* the search should be focused (field tags like AB=abstract, KW=key words, TI= title etc.). Instead, the available parameters (where one can put in the search terms) are: Title, Author/Creator, Description, Journal Title, Publisher, and Publication Year. Because of this, we ended up doing a title search with Boolean operators (OR, AND, NOT). Additionally, there was a limit to the number of words one could include in the title search, meaning that there was a limitation on the amount of synonyms we were allowed to use. After the search was conducted one could apply various filters e.g., by location and theme.

3.2.2 Inclusion/exclusion criteria and search categories

As previously mentioned, the Scoping review approach to designing the search is open and dynamic [3.1]. As such, the inclusion – and exclusion-criteria, as well as the categories of search-terms were finetuned through a series of trial-searches in the elected databases.

The different categories of search-terms

Thematically, an important decision was to try to approach the theme of "health" through the Indigenous definition of the concept. In short, we considered that reviewing the health impacts of this population through their own definition of health would be a more relevant approach and would generate more relevant results for *this specific population*. – The western lens, largely focused on the physical and measurable aspects of health, would leave out a large part of what health is to First Nation populations (3).

The decision to approach "health" through an Indigenous lens, led us to a quite broad search, and – from a western perspective, pushed the theme even more towards anthropology. In fact, it led us to not utilize "health" as a separate category in the search, as we saw that including a "health category" (meaning the word health, its synonyms and antonyms) tended to leave out important literature about holistic health, e.g., community health, cultural identity, spiritual health etc. We therefore ended up with the following thematic categories:

First Nations/Indigenous Populations – Climate change and its impacts – Canada

Specifically, the searches ended up looking like this:

Web of Science:

TS=(Canada) AND
TS=("First Nation*" OR Indigenous OR Native* OR Trib*) AND
TS=("Climate change" OR weather OR "atmospheric pressure" OR "climatic change" OR "global warming" OR "greenhouse effect" OR "climate variability" OR "climatic variability" OR "carbon emission" OR cold OR cool OR Cooling OR Heat OR humid* OR ice OR Precipitation OR Rain* OR season* OR snow* OR storm OR temperature * OR warm OR warming OR wind OR "Ultraviolet radiation" OR UV OR "natural hazard" OR "natural hazards" OR "air quality" OR "food security" OR "food safety" OR "water safety" OR "water security" OR "carbon footprint" OR "environmental change" OR "environmental impact" OR "global climate" OR "high temperature*" OR "increasing temperature*" OR "rising temperature*" OR "climate crisis" OR "climate disruption" OR "climate instability" OR "extreme weather" OR "rising sea levels") AND
TI=("climate change" OR "climatic change" OR "global warming" OR "greenhouse effect" OR "climate variability" OR "climatic variability" OR "carbon emission" OR "natural hazard*" OR "environmental change" OR "environmental impact" OR "Climate crisis" OR "Climate disruption" OR "extreme weather" OR "rising sea levels" OR "rising temperature*"

OR "climate instability")
Generated 171 results

Medline:
exp Indians, North American/ AND exp Canada/ AND (exp Ice Cover/OR exp Natural Disasters/ OR exp food insecurity/ OR exp food security/ OR exp Water Supply/ OR exp climate change/ OR exp cyclonic storms/ OR exp droughts/ OR exp floods/ OR exp greenhouse effect/ OR exp rain/ OR exp snow/ OR exp Climate/)

Generated 126 results

Embase:
exp Canada/ AND exp indigenous people/ AND (exp environmental impact/ OR exp climate change/ OR exp climate/)
Generated 62 results

I-Portal:
Title search: ("climate change" OR weather OR temperature OR "Climate variability" OR "global warming" OR "natural hazard*"). Then adding the filters: “Canada” and “Health & Well-Being”. **Generated 39 results.**

In total, the search generated **398 results**.

After conducting this quite broad search, we scanned through the results with the developed inclusion/exclusion criteria in mind: To be included, the literature needed to:

Have sufficient focus on First Nation population(s) (including Dene): This meant that literature focusing *solely* on Inuit/Métis were excluded. However, if the focus was partially on other populations, articles were included if they had sufficient focus on First Nation population(s) to the extent that the presented results pertaining to First Nation(s) were distinguishable from the other included populations.
Have sufficient focus on the impacts of climate change: Climate change (as defined by the author, see below) and its impacts needed to be a main focus, or it needed to be identified as a defining factor of health-impacts, even if the main focus lay outside climate change (e.g., how First Nations are experiencing food security – if climate change was mentioned as an

influencing factor).

Be published between 2010 and 2024: As we wanted to include relatively new literature.

Be situated in Canada: The study area needed to be in Canada.

Be primary research: In other words, reviews were excluded.

Titles and abstracts were measured against the inclusion criteria by the author, by title, abstract, and in cases of doubt, the full text.

The definition of climate change for the purposes of this thesis

Climate change is, of course, a complicated and multifaceted theme. There are a range of factors influencing it and connecting to it. For instance, the theme of climate change is often spoken about in conjunction with environmental contaminants, like local air pollutants, oil spills etc. (7, 9). Both climate change and environmental contaminants can, for instance, impact ecosystems – environmental contaminants may e.g., lead to greater mortality through toxicity, whilst climate change can lead to greater mortality for species who rely on an environment with e.g., a specific temperature range, weather/seasonal patterns, or water levels (8). In this study, we shall focus on *climate change* on its own, defined as the changes in temperature, weather/seasonal patterns, water levels (and similar), caused by the accumulation of greenhouse gasses the earth's atmosphere (8).

3.3 Analysis – collating, summarizing, and reporting the results

The analysis of results was informed by the frameworks suggested by Arksey and O'Malley (2005), expanded upon by Levac et al. (2010) pertaining to scoping reviews. As reported by both Arksey and O'Malley and Levac et al., the analysis part of a scoping review needs to be systematic and reproducible. As suggested by the mentioned authors, we have reported the results in two steps: a descriptive numerical summary and a thematic analysis (coding/categorizing the data to look for patterns, reporting and analyzing emerging themes)(15, 17, 18).

4 Results

4.1 Numerical summary

The search was carried out in April/May of 2024. The search strategy generated 18 eligible studies of various characteristics. The year of publishing ranged between 2010 and 2024. Table 1. Shows the distribution.

Year:	2010	2012	2013	2014	2015	2016	2017	2019	2020	2021	2024
Number:	1	2	1	1	2	1	1	1	3	4	1

***Table 1** – distribution of included studies based on timing of publication.*

Of the 18 identified studies, two were theses (one PhD, one Major Paper as part of a master's thesis) and the remaining were peer-reviewed research articles. The methodologies used were quantitative (n=6), qualitative (n=7) and mixed methods (n=5). One mixed-method study, and one quantitative study used the same data source for their quantitative analyses (see section [4.2.1.2] for details about this). In terms of location by province, the studies were situated in Ontario (n=6), British Columbia (BC) (n=5), Quebec (n=3), Northwestern Territories (NT) (n=1), Prairie Region (Alberta, Saskatchewan, Manitoba) (n=1) and "across Canada" (including several provinces) (n=2). Note that some studies focused on more than one specified region/province. Figure 1 presents a visual representation of the geographic focus of the included literature.

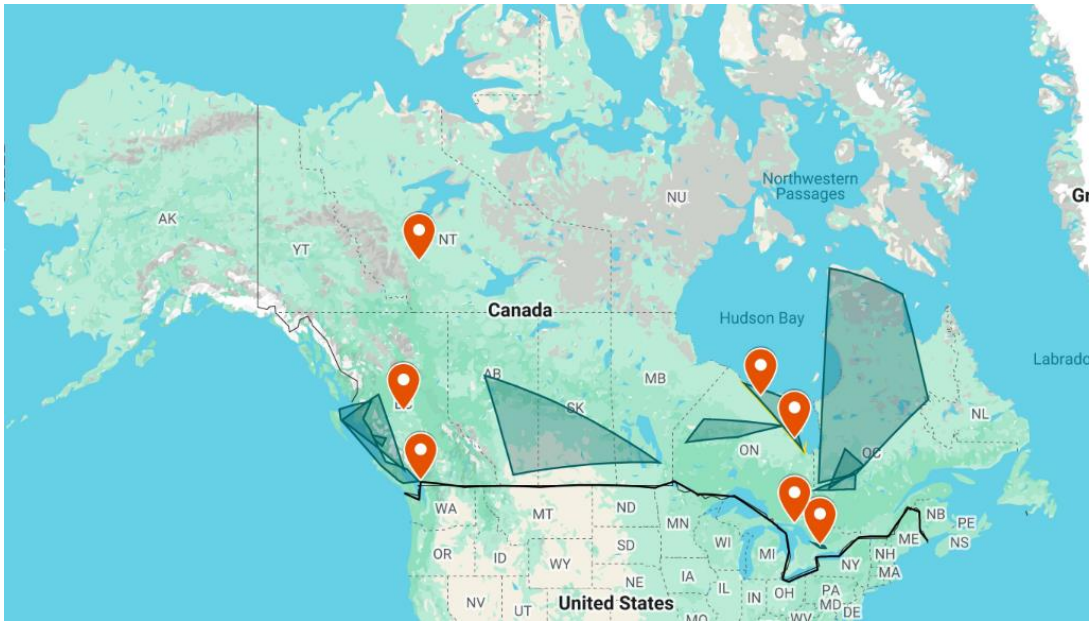

***Figure 2** – distribution of included studies based location. The red pins represent studies focused on one specific First Nation community, while the patches represent studies focusing on a larger area, including more than one community.*

We also looked at the quantitative distribution of 'main themes' in the included articles, to get a sense of thematic knowledge gaps. These results are presented in table X. The presented themes all pertain to the effects of climate change (e.g., the column "general health/well-being" refers to articles addressing how climate change *affects/impacts* health/wellbeing). Notably, to qualify as a 'main theme' the theme could not simply be part of study's discussion but had to be part of the study objectives/results.

General health/ wellbeing	Resilience/ adaptive capacity/ strategies	Food/ resource security	Nutritional values of specific foods	Water systems (including ice)	General impacts – community/ environment	Specific extreme weather events	Community health indicators
4	8	10	2	2	2	1	1

***Table 2** –Main themes in the included literature pertaining to climate change impacts. Note that several articles focused on more than one main theme.*

4.2 Thematic analysis

A number of central themes emerged from the included literature describing the impacts of climate change in First Nation health. Notably, a lot of the reviewed themes are interconnected and overlapping, reflecting the complexity of climate health-impacts and the approach we have chosen in this thesis, i.e., looking at health through the Indigenous definition/lens.

4.2.1 Food security, nutrition, and water systems

One of the most prominent themes found in the identified literature was how climate change impacts food security in First Nation communities, especially when it comes to traditional foods and subsistence harvesting. Traditional food systems can be described as "has been described as all foods identified within a particular culture that derive from local natural resources and includes sociocultural meanings associated with acquisition and use of such foods." (19). As seen in the numerical summary (table 2), some of the identified literature had 'food security' as their main/one of their main theme(s). Others had a broader approach,

looking at the impacts of climate change in general and finding that *one of* the important results/parameters were impacts on food security. Among the literature in the latter category were studies focusing on nutrition and water systems (including the impacts on ice cover and safety) (20-23). In the following section, we shall see how the mentioned themes both stand on their own and intertwine/interconnect with each other.

4.2.1.1 Changes in ecosystems, weather patterns and hydrological systems

In terms of food security, the included literature found that many climate-related factors was of influence, particularly changing ecosystems(19-22, 24-34), unpredictable/changing weather patterns (19-21, 24, 25, 27-35) and shifting water/hydrologic systems (20-22, 24-34). As found in this literature, changing ecosystems influences the survival of important traditional food species, as well as their distribution on the land and harvesting seasons (19-22, 24-34). In terms of species survival, one study explored the connection between recorded heat waves and fish "die-offs" in Albany River, James Bay, Ontario 2005, looking at two important food species: suckers and whitefish. Based on a combination of recorded weather data, and TEK of local knowledge keepers, they found a direct temporal connection between the heat waves and fish die-offs. They also concluded that there was potential for a northward shift of these species (even though it was not recorded by TEK), meaning that heat waves could impact local food security both directly through mortality, and indirectly by changes in distribution(25). Other studies explored projected scenarios of changes in ecosystems, finding that climate change massively influenced the future abundance of fish and other species (22, 26, 28).

Changes in harvesting season was, among other, exemplified by Dene woman of Fort Providence, Northwest territories, as part of an interview-based study in 2020:

> "Right now [early September], the jumbo fish are not supposed to be running... not until October and people are now catching jumbo fish in September... Usually they do not spawn until the month of October, towards the end September and the beginning of October. Now they're running too early." (24)

In addition to the above, changing ecosystems temperature could introduce new species, displacing important traditional food species (19, 24, 27, 30, 32, 33). Also, the introduction of new species, could lead to an increase in parasitosis and bacterial infections on important food

species like moose and bison, thereby affecting both mortality of these species, and the quality of food (24).

One participant in a project looking at the wellbeing of Whitefish River First Nation, Ontario, in the context of climate change, summarized how they observed changes in species, alluding to the complex interconnectedness of these ecosystems: “I do see a lot of changes, and it’s a *domino effect*. It’s affecting everything. Vegetation to mammals that live here: birds, migratory birds, fish, everything; even the berries that we used to eat. (Participant #8)”(32)

Challenges to subsistence harvesting:

Changing distribution of subsistence species and changes in harvesting seasons can both serve as barriers to subsistence harvesting. Some have already experienced that they need to travel further to access hunting – and fishing sites, due to the changes in distribution and novel migration patterns of some species (19, 21, 30, 32). As exemplified participant from the Heiltsuk Nation, participating in a study which, among other things, examined people’s perceptions of climate change impacts:

> “Some families will target other species, and some guys, myself included will go further.... getting to the [fishing] spot and then moving around and finding the fish out there, and spending the whole day of fishing out there, I’m looking at a 100-mile day, where a 100-mile day was nowhere near what we would ever even imagine growing up ... that would be at most a 60-mile day, if not less. Yeah, so access to plentiful amounts is definitely getting further away from the village.”(30)

Another factor that challenges planning and conducting of subsistence harvesting is changes in weather patterns and water systems (including ice). Most land-based activities are based on prediction of weather and environmental conditions, and wrong predictions can lead to safety hazards for those involved (21, 24, 30-33). For instance, as found in a study exploring “e impacts of climate change on local food procurement”, sudden shifts in weather can lead to hunters getting “trapped on the land” (24).

Many communities (especially remote northern ones) depend on winter roads both for importing important supplies, to travel out of the community and to carry out traditional activities in the wintertime (19, 21, 23, 24, 31-34). Winter roads are typically based on ice, snowpack or frozen land. Various studies documented changes in the ice-and snow-coverage

impacting the safety and reliability of winter roads (21, 24, 31-34). One study, concerning Fort Providence, Northwestern Territories, reported that their interviewees had observed "ice depth, changing breakup patterns and permafrost degradation."(24) In the study reporting on climate change and well-being in Whitefish River First Nation, Ontario, an Elder interview participant described the changes as such:

> "… you could drive a skidder or horses right on the ice and the swamps, there's no ice there now. You break through there like when your skidoo-ing out on those old trails, mud, no frost." (32)

One article looked specifically at changes in "blue-ice" and the subsequent impacts on populations in the Northern Ontario boreal area. As described in the article, ""Blue-ice" is a term embedded in their indigenous languages." It is strong and dense, making it safe to travel on, or as one Elder said: "blue-ice is the strong ice that freezes right". Findings showed that "Changes in blue-ice on the landscape are affecting transportation in traditional activities such as hunting and fishing, as well as the delivery of essential community supplies.". This impacts food/water security as well as energy security. As pointed out in this article, many of the communities in the studied area rely importation of potable water, and on diesel-generated electricity. As diesel also needs to be imported, energy security is impacted by changes in the blie-ice. Energy security, of course, impacts a community in various ways: "Electricity not only powers appliances, but also heating and cooling systems in homes, buildings (schools, nursing stations, and band offices), and the community water treatment plant." (21).

All in all, the many challenges to subsistence harvesting, create barriers, and thereby drive people away from these activities. This also impacts cultural identity, as we shall return to in section [4.2.2.1].

4.2.1.2 The importance of traditional food systems

Most of the included studies (in fact, all but two) reiterated the importance of traditional foods, highlighting that many communities rely on subsistence harvesting/traditional food systems (in varying degrees) for their nutrition and cultural needs (19-28, 30-35).

The nutritional value of fish/seafood:

For many First Nation communities, fish and seafood is an important part of their traditional food systems and holds nutritional value that is hard to replace by other foods (22, 23). One

study focused specifically on the nutritional value of seafood in coastal First Nations in British Columbia. This study found that the consumption of traditional fish food provided several important micronutrients, namely omega 3 fatty acids, niacin, selenium, vitamin D and protein. The nutritional data was combined with projected declines in harvest potential due to climate change. Based on this, they found that " Projected climate change was estimated to reduce the intakes of essential nutrients by 21% and 31% under 'strong mitigation' […] and 'business-as-usual' […] climate change scenarios, respectively, by the year 2050 relative to 2000." (22).

Demographics of food insecurity in relation to climate change

Two studies specifically looked at the demographics of food-security, one of which mainly focused on fish consumption, the other on food security in general(23, 35). One of these had a purely quantitative design, whilst the other was a mixed methods study, also incorporating qualitative interviews. The two studies utilized the same data source for their quantitative analyses, namely the *First Nations Food, Nutrition and Environment Study* – a quantitative, participatory study conducted between 2008 and 2018 among adult First Nation participants living on-reserve from across Canada, south of the 60th parallel (35). The one focusing on food security in general, highlighted that most adults would like for traditional foods to be a bigger part of their diet, but that climate change (among other factors) served as a barrier to this e.g., due to harvesting activities becoming increasingly difficult and more expensive (35). The one exploring fish and food security confirmed that fish/seafood contribute important nutrients to First Nation diets, and that climate change acts as a barrier to access of this and other traditional foods. This study reported regional differences in the relationship between fish/seafood and other traditional foods, and food security status. Across regions, they found that food *insecure* participants relied on traditional foods to a greater extent than food *secure* participants. For instance, they found that "Severely food insecure men (particularly in British Columbia, Alberta, Quebec/Labrador and the Atlantic region) tended to eat a higher amount of traditional foods, including fish/seafood, compared with food secure and moderately food insecure men, while no difference was observed in women."(23). This is an interesting finding when seen in conjunction with financial and socioeconomic impacts of climate change – something that we shall return to in the discussion section.

4.2.1.3 Financial impacts

As we have begun to touch upon in section 4.2.1.1, climate change can impact financial security and cost of living (21, 24, 26, 27, 33). As accessing supplies becomes more challenging – both subsistence harvesting and other, both on a personal and societal level – it also becomes more expensive. For instance, the need to travel further to access subsistence harvesting sites requires more fuel and sometimes more complex modes of transportation (21). It also requires more time, which can make it difficult to incorporate in day-to-day life. This was illustrated in the study about food security in the Dehcho Region, Northwest Territories as such: "The increasing costs of hunting, fishing, and gathering, combined with low-income levels, limit many Indigenous harvesters' land-based activities. At the same time, those engaged in the wage economy may have the resources but lack the time required for food procurement practices."(24).

As mentioned in regards to changes in the ice cover/winter roads, when winter roads (and transportation systems in general) are impacted, importing supplies becomes more expensive. The climate-change related impacts on winter roads lead communities to rely on costly air cargo. Additionally, not all supplies can be transported by air cargo – there is a weight-limit. This in turn affects in-store prices in the local setting, for instance making store-bought food more expensive (21). As we shall return to in the discussion section, the overall financial impacts of climate change challenges the health of First Nation people, as well as exacerbating an already poor socioeconomic status.

4.2.1.4 Positive changes to food security/culturally important species?

In the previous sections, we saw that the introduction of new species has the potential to harm food security by exchanging traditional food species, driving them to new locations and introducing infections/infestations that increase mortality or impact the quality of their meat. It is, however, important to note that introduction of new species could give new opportunities for subsistence harvesting, given that they're fit for human consumption/use. The same goes for changes in species distribution and abundance of species (26, 34). One of the identified studies looked at climate change's impact on two culturally important plant species – one recognized for its medicinal properties, the other as an important part of First Nation diets. The findings indicated that moderate climate change scenarios could actually make them more abundant. Severe climate change scenarios, however, was projected to decrease abundance of one of the two species (29).

The potentials of climate change leading to prospering of new subsistence species are unfortunately difficult to predict – both which species (and thereby the nutritional value) and their possible abundance(26). One study also found that a participant expressed disgust/lack of interest in harvesting invasive species (30). This demonstrates that, even if new species give new opportunities for subsistence harvesting, shifts in ecosystems ultimately lead to changes in/loss of cultural identity, which can negatively impact wellbeing. This shall be further explored in section 4.2.2.1.

4.2.2 Community health, mental health, and overall wellbeing

As mentioned in the background section, the Indigenous health definition goes beyond physical health, and indeed beyond food/water/energy security and safety, to include mental health, spiritual health, cultural identity, and wellbeing of the community and environment. In relation to this, an especially prominent theme in the identified literature was the impact of climate change on land-based activities, meaning hunting/fishing, gathering, ceremonial and recreational activities, or in short; "being on the land" or fostering the relationship to the (traditional) land (19-25, 27-34, 36)**.** In the section 4.2.1.1, we saw that these activities were impacted by changes in weather and water systems, and access to and distribution of culturally important species. In that section, however, we related these impacts to food security, personal safety, and financial impacts. The ability to practice these activities, as well as the adverse environmental impacts of climate change, also impact mental and spiritual wellbeing, as well as the cultural identity of First Nation peoples (19-36)**.**

4.2.2.1 Impacts on cultural identity

Cultural identity is impacted when the systems on which it is based are impacted – be that food/culturally important species (as we have seen in section), environmental systems (e.g., water levels/impact on winter roads), traditional activities, traditional knowledge (TEK) or indeed the Indigenous world view as a whole, as seen in the previous sections. Regarding world view, one participant in the study of how First Nations in the Canadian Prairie regions are experiencing and responding to climate change, described their relationship to the land as such: "we are the land and the land is us, there is no separation." This was also echoed by other participants in the study (27). In trying to understand the impact that changes in species survival and distribution have on cultural identity, one can look to another participant in the same study, exemplifying how changes of the land (the removal of buffalo) affected his identity: "The Buffalo embodied us and we embodied the Buffalo. And when it was gone, we

still have the beliefs, but I'm a whole lot less Blackfoot because the Buffalo is not [there] on a daily basis." (27)

Yet another aspect of First Nation cultural identity and world view is the relationship with and generation of 'Traditional knowledge', as mentioned in the background section and in the identified literature (mentioned to various extents in all but two studies)(19-27, 30-36). Unfortunately, rapid changes in climate will impact the validity of some of this knowledge – rapid changes in climate challenges the knowledge about the natural environment obtained over generations and dependent on a relatively slow-changing environment (25). However, as stated in the background, it is important to note that TEK is not a static concept. New Indigenous Knowledge is produced *as* people continue to utilize the land, thereby gaining first-hand experience about climatic changes (25). Claiming that TEK becomes irrelevant by climate change is therefore an incomplete truth. As shown in much of the identified literature, TEK is also valuable when examining the effects of climate change. This can be exemplified by one study utilizing TEK inform the connection between quantitative data on extreme weather events (heat waves) and fish "die-offs" in James Bay, Ontario (25). Also, one could argue that all the included literature utilizing a qualitative (n=7) or mixed methods (n=5) approach has also benefited from TEK/traditional knowledge, as they acquired information from traditional knowledge holders. Still, if the changes in the environment happen at a certain rapidity, the relevance and generation of TEK will be affected. Additionally, we have seen that the impacts of climate change (and other barriers) drive people away from land-based activities [section 4.2.1.1], which will also affect the generating of new knowledge, as less time is spent on the land.

4.2.2.2 Impacts on mental health and wellbeing

It is logical that impacts on traditional practices and cultural identity could affect mental health and well-being. This was found as one of the main themes in several of the identified studies (included in the "general health and wellbeing"-column in table 2)(32-34, 36). One of the studies focused specifically on mental health outcomes for First Nation residents in the eastern Canadian boreal forest. They quantitatively measured the outcomes utilizing the Environmental Distress Scale (EDS) and the Connor–Davidson Resilience Scale (CD-RISC-10), and also looked at mitigating/protective factors. Their findings indicated that "when Indigenous people perceive more environmental changes […], they feel more impacts on their well-being." A surprising finding was that people categorized as "resilient", e.g., due to their

time spent on the land felt *more* impacts than others. The authors hypothesized that this was in fact connected to their land-based activities, as "the most resilient participants could testify to the impacts of acute changes," feeling/seeing the changes first-hand (36).

4.2.3 Resilience/adaptive capacity

Many of the included articles described factors of resilience for First Nation peoples to climate change (20, 23, 24, 26, 27, 30, 33, 34). Importantly, Indigenous populations in Canada have lived on the land for generations, and as such have a great adaptive capacity for changes in nature, for instance, through their Traditional Ecological Knowledge (19-27, 30-36). As exemplified by a Cree participant in one of the included studies:

> "The Cree people have always adapted and they always will. Just like every other species out there. Some migrate. Some stay and adapt. Oh, yeah. I think we're still gonna be good either way, whatever happens.» (Interviewee #6) (34)

Despite this, many remarked that changes are happening faster and to a greater extent at this time in history. As we saw in section 4.2.2.1, this affects the validity of TEK, and subsequently the communities' ability to adapt. The identified literature also found that many have already had to change their lifestyles to adapt to the experienced changes and protect their health. For instance, some are now following the rule that they don't go out on the land/ice roads alone, and others buy/utilize specific equipment that is better suited to the new circumstances (21). This arguably shows adaptive capacity. However, this also demonstrates that adaptation can be expensive and inconvenient, creating barriers for participating in health-promoting traditional activities. We saw several examples of this in section 4.2.1.1. In the previous section, we also saw how time on the land, which is largely considered to be a factor of resilience, can be affected in unexpected ways by climate change (36). This goes to show resilience is a theme that should be further explored.

Some of the included studies explored adaptation strategies or ways of increasing resilience as one of their main objectives (19, 20, 27, 30, 32). This was generally achieved through interviews and/or focus group discussions in the local communities. Strategies discussed included:

- Indigenous autonomy, authority, and self-sufficiency,
- promoting knowledge sharing and education to gain increased awareness and spread adaptation strategies,
- connecting with the land and connecting youth to nature, and

- bridging Indigenous knowledge and Western Science (19, 20, 27, 30, 32).

As pointed to in one of the articles, these strategies/priorities for adaptation differs from actions typically proposed by non-Indigenous government, like protecting marine areas and ecosystem-management (30).

4.2.4 Summary of thematic findings

In summary, the changes seen in ecosystems, weather conditions, traditional activities and nutrition, mental health and overall wellbeing all impact the Indigenous definition of health for First Nation communities in Canada. In this section, the complexity of climate change health impacts also become clear – the connectedness between changes in the natural environment and the holistic health of First Nations. As we shall see in the discussion this is *further complicated* by socioeconomic factors, including social determinants of health and the legacy of colonization and ongoing discrimination.

5 Discussion

5.1 Discussion of results

5.1.1 Numerical results

5.1.1.1 Geographical focus and related themes

As seen in the results section [4.1], the largest number of studies were conducted in Ontario and British Columbia (BC). In BC, we can see from the map (figure 1) that they are mostly set in the coastal area. A possible reason for this could be that coastal communities are categorized as especially vulnerable to the impacts of climate change, for instance due to projected sea-level rise and impacts on sea-based livelihoods (7, 37). Cross-referencing the location with the main themes explored in these studies, we see that the studies focusing on BC largely targeted food security, especially in regard to fish/seafood. One of the BC-based studies also targeted the nutritional value of fish/seafood(22). The focus on fish and seafood comes as no surprise, as this has been/has always been an important part of the diets and cultures of these First Nation communities (22, 23). In other researched areas, the connection between placement and main theme was not as clear, but it generally seems fair to focus on what is relevant to the studied population. – It is logical that this is an important part of respecting the population of the researched area.

In previous studies, it has been established that northern and coastal communities are especially vulnerable to the impacts of climate change, and accordingly, more research has been conducted in these areas (7). Our research supports this when it comes to coastal communities. We did not, however, find a dominance of studies conducted in the northern regions of Canada. This is in all likelihood due to the fact that we focused our search on First Nations, meaning that we excluded the Inuit populations that reside in the northernmost parts of Canada (7).

5.1.1.2 Publication timing

The numerical results section showed the distribution of publication timing for the found literature [section 4.1]. In this, we may see a slight trend towards more studies published in the last years. For instance, we see that most of the eligible studies were published in 2021 (n=4), followed by 2020 (n=3). So far in 2024, one eligible study was published. All in all, we see that of the 18 eligible studies, which were published in a period of 15 years (2010 -2024, though the 15th year has not finished yet), 8 were published in the last 4 years. However, the fact that only 18 studies were eligible for this the scope of this study, affirms that this field is relatively new. As such, it is difficult to conclude on trends in terms of focus on our subject. Still, as place-based and population-specific (e.g. First Nations, not Indigenous populations in general) are identified as a knowledge gap (see section 1.4), we can hope that research on our theme is increasing.

Distribution of main themes

The most prevalent main themes were ‘food and resource security’ and ‘resilience and adaptive capacity/strategies’ (table 2). This goes against the research, addressed in the background, claiming that the most researched themes were mental health and nutrition. Notably Harper et al.’s research considers the Canadian Indigenous populations in general (i.e., First Nations, Inuit and Métis), which likely affects the distribution of themes. When it comes to ‘resilience and adaptive capacity/strategies’, the focus on this is consistent with research trends seen in research in later years (13). An increasing focus on adaptation is necessary as we see that climate change in itself cannot be completely avoided/mitigated (8). However, it is arguably important to have sufficient knowledge about observed and projected impacts to adapt in the most efficient way possible. As the theme of First Nations health and climate change is only just emerging (as we have seen from the small number of eligible

studies included in this thesis), it is arguably still important dedicate research to observed/projected impacts.

Concerning the distribution of main themes, it must again be reiterated that multiple of these are closely related – as seen in the thematic results section. The *qualitative* characteristics of the compiled evidence should therefore be considered collectively – as we shall do in the next section.

5.1.1.3 Thematic discussion

Aggravating the existing burden of disease, overall health, and the Inverse Care Law

As seen in the background, the Indigenous population of Canada (and across the world) experience a larger burden of disease than their non-Indigenous counterparts. Some of these conditions are highly lifestyle-related, like malnutrition, obesity, diabetes 2 and heart disease (3). In the results-section, it was demonstrated that climate change can have physical health implications by driving people away from traditional land-based activities (which includes physical activity), shifting diets from traditional foods to store-bought foods (which tends to be less healthy), reducing the accessibility of healthy and affordable store-bought foods (e.g., by compromising winter roads and community- accessibility) and disrupting personal/community finances. These are all factors that promote lifestyle-related diseases (38). Research also indicates that mental health affects how we make lifestyle choices, and poor mental health may therefore promote lifestyle-related disease (39). Our results also show a strong connection between climate change and mental health/wellbeing for First Nation peoples. As such, we can see that climate change has the potential to exacerbate an already dire situation in terms of disease burden by the western definition of health as well as the Indigenous (3).

Our results also demonstrated that those most affected by the decreasing accessibility of traditional foods, are the ones who are most food *insecure*, with the lowest socioeconomic status. This is concerning, as lower socioeconomic status is largely considered to correlate with poorer health outcome, e.g., as lower financial status affects the accessibility of quality food and healthcare services (3). As such, this thesis is/serves as yet another example of how the most marginalized are the most affected.

The above also brings us back to the Inverse Care Law (ICL). In the background, we saw how the ICL pertains to Indigenous populations in Canada, and it was hypothesized that climate

change might amplify the ICL. Both the results section, and the previous paragraphs in the discussion, show how this hypothesis can be affirmed. As we have seen, climate change is likely to increase the healthcare needs of First Nation populations. At the same time, it could make healthcare services less accessible, as transportation systems are implicated (e.g., ice/winter roads) making already remote communities even more isolated. This applies both to the importation of healthcare supplies and the ability to travel out of the community to access important healthcare facilities (21). This demonstrates that the ICL can be perpetuated from "both sides - climate change generates both a greater need for – and reduced access to quality healthcare. For an already "medically marginalized" population, the effect of this could be severe.

Indigenous health indicators

In the background, as well as the results, we saw that Indigenous health is affected by a complex set of sociocultural factors, like relationship with the land and a history of marginalization and oppression. This, and the fact that Indigenous populations define health in broader, more holistic terms, means that measuring physical health indicators such as burden of disease, does not capture the full picture. Because of this, there has been increasing focus on developing Indigenous-specific health indicators (28, 40). In fact, one of the identified articles focused on this, namely *Indigenous Community Health and Climate Change: Integrating Biophysical and Social Science Indicators* (2014), combining community health indicators with environmental indicators to see how climate change implicated community health(28). The community health indicators they used had been identified by Indigenous researchers in a previous study and were as follows: Community Connection, Natural Resources Security, Cultural Use, Education, Self Determination, and Well-being (28). In this thesis, we have especially seen that climate change can impact Natural Resources Security, Cultural Use (as traditional activities, sites and ecosystems are impacted), Education (as TEK becomes less relevant) and Well-being (as meaningful locations are harmed and the overall wellbeing is impacted). This demonstrates the relevance of Indigenous-specific health indicators, as well as it once more highlights the complexity of Indigenous health and the massive impacts that climate change can have.

Vulnerability vs. resilience

In this thesis, we have reported multiple factors that make First Nations vulnerable to climate change, both in general and in terms of health outcomes This is supported by much previous research (7, 41). At the same time, we have seen that First Nation populations are also resilient with considerable adaptive capacity. This is consistent with the tendency of climate change research to categorize Indigenous populations as simultaneously vulnerable and resilient (42).

The balance between the labels “vulnerable” and “resilient” is intricate and can have some unintended outcomes. This is for instance explored by Haalbloom and Nascher (2012) in a study about northern Indigenous populations. In their research, they found that “the label "vulnerable" is often generated by those who are more or less unfamiliar with the complexities of local culture, economies, and capabilities,” meaning that the label could be misunderstood/misplaced. Secondly, they found that “such labels can generate misguided actions and policy responses built on how peoples and places come to be seen and understood by others,” and lastly that “the label "vulnerable" has the potential to shape how northern indigenous peoples come to see themselves as they construct their own identities - and identifying themselves as vulnerable may ultimately hinder their efforts to gain greater autonomy over their own affairs.”(42). In the results section on resilience and adaptive capacity, we have also seen that autonomy/self-governance is essential for Indigenous populations in *building* adaptive capacity [section 4.2.3]. This is especially important given the complicated legacy of colonialism, which in itself creates a great incentive for Indigenous self-governance (3). As pointed to by Haalbloom and Nascher (2012), the word “vulnerable” also has specific connotations/synonyms, which tend to be negatively weighted, like "damaged," "helpless," "powerless," and “weak” (42). It is easy to imagine that internalizing these traits also affects cultural identity and mental health. Based on the mentioned, categorizing First Nations as “vulnerable” may therefore be a self-fulfilling prophecy.

5.1.2 Knowledge gaps

In this section, we shall discuss our findings in relation to knowledge gaps. This discussion will largely be based on the 2022 report from the National Collaborating Centre for Indigenous Health (NCCIH) on *Climate Change and Indigenous Peoples’ Health in Canada (7).*

The NCCIH reports that, for Indigenous populations in Canada in general (meaning First Nations, Métis and Inuit), “both the population and geographic focus of the research is uneven, with the majority focused on Inuit populations and the Canadian Arctic.” (7). As previously discussed, we found a particular focus on coastal First Nations (Pacific), but our exclusion of research pertaining the Inuit made it difficult to assess the focus on the arctic setting. Still, in the broad search (before applying the inclusion criteria), we did see a significant amount of research targeting the Inuit population.

In terms of geographic focus, the NCCIH also report that research on populations in the Prairie region is lacking (7). We *did* identify/include *one* article that focused on the Prairie region, namely: *"A Return to and of the Land": Indigenous Knowledge and Climate Change Initiatives across the Canadian Prairies* by Camreon et al., published in 2021. As the total number of identified articles was as low as 18, having one be about the Prairie region could be considered fairly good. Also, we must reiterate that 18 is such a low number, that addressing trends within this selection is imprecise at best. Still, the authors of this article utilized the identified knowledge gap as a direct incentive to conduct this research: “While research on Indigenous knowledges on climate change is increasing, especially in the Arctic, few studies document Indigenous perspectives on climate change in the Canadian Prairie provinces (Alberta, Saskatchewan, and Manitoba). This paper addresses this gap […]” (27). As such, plus the fact that the NCCIH specifically mentioned the Prairie region, it is reasonable to believe that research pertaining the Prairie region and First Nation health in the context of climate change, remains lacking.

Another knowledge gap identified by the NCCIH was the intersection between gender and climate change, reporting that Indigenous women’s perspectives, and the perspectives of gender-diverse people were lacking in current research (7). Our research supports this, as none of the included literature focused on gendered perspectives. This is concerning as women, especially Indigenous women, tend to be more affected by the socioenvironmental effects of climate change(7, 43). As described by Williams et al.: “Climate change is largely the result of the tightly interwoven forces of colonialism, patriarchy, and neoliberal forms of development. These conditions are constraining women’s knowledge, expertise, and unique agencies in addressing what is probably the most defining issue of our age.”(43).

In contrast to the lack of women’s perspectives, we found a great deal of focus on Elder’s perspectives of climate change. This was typically connected to the impacts on traditional

harvesting, and to the impacts on and to the methodological use of TEK. In essence, this seems natural, as Elders tend to be important the knowledge keepers regarding these themes (7). The NCCIH found that both Elder's perspectives and traditional harvesting were overrepresented in the literature (7), which seems to be consistent with our findings.

5.1.2.1 Section summary

In this section we have identified persisting knowledge gaps in the literature about First Nation peoples' health and climate change. We have found that many, but not all, coincide with the findings of the NCCIH report. We found that there is lack of focus on gendered perspectives. In terms of geographic focus, the theme we have explored seems to be too small to draw any certain conclusions, but a lacking focus on the Prairie regions *may* be persistent. In general, it is worth noting the small number of eligible studies generated from a quite broad search (see section 3). This speaks to the fact that climate – health research specifically focusing on First Nations still remains a knowledge gap as a whole.

5.2 Discussion of methods

5.2.1 Limitations to the design

As noted by Arksey and O'Malley (2005) as well as Levac et al. (2010), literature reviews, including scoping reviews, have become increasingly popular research designs in health research (15, 17). There are, however, some limitations to these designs. For instance, one can only access and review the literature that is published at the time the study is conducted – studies that are underway at this point are not included. This can lead to a bias, for instance when it comes to identifying knowledge gaps. An example of this that we have seen in our findings, is the fact that one eligible article has been published this year. As the year is not yet over, it is possible that more can be published, which might express a rising trend in research pertaining this theme. Scoping reviews generally do not review the quality of the included studies – and we have not done so in this thesis. We have briefly reported what methodologies were utilized (numerical summary, section 4.1) without discussing the quality. As such, knowledge gaps *based on quality* are not addressed (15).

5.2.1.1 The Norwegian Student Researcher

The background and experience of the researcher carrying out this study can affect the quality of the results. The researcher (I) is a Norwegian medical student. I have previously written about the health of First Nation peoples and conducted field work in a First Nation community (qualitative interviews). This work has included acquiring knowledge about the

First Nation/Indigenous situation both through literature and personal experience/contact with community members. Still, I am not of Indigenous/First Nation decent. This inevitably means that my understanding of Indigenous health and worldview is likely lacking, as I don't have the *lived experience* or integrated worldview of First Nations. I am, for instance, likely to be more affected by western knowledge paradigms and values than a First Nation community member would be. This can for instance affect *how I pose questions (i.e., the overall approach)* and *how I interpret the findings (e.g., the inclusion of studies and the synthesizing of thematic results).* As such there may be a culture-based bias. I have, however, tried to mitigate this by approaching the research through the Indigenous definition of health, as seen in the methods section.

Another personal aspect that may introduce some uncertainty to the quality of this thesis is the fact that this is my first time conducting a scoping review. This means that there may be details that a more experienced researcher would look into, that I have missed. I have, however, had excellent guidance from my supervisor and University Senior Librarian. (see Acknowledgements).

5.2.1.2 Climate change and destruction of land

As mentioned in the methods section, we have looked at the effects of climate change defined as changes in temperature and ecosystems due to the emission of greenhouse gasses. Protecting the environment does not, however, pertain to climate change alone, but also to environmental destruction, like deforestation, the release of toxic agents from industry etc. (44). These are also factors that influence Indigenous land and health (3). As such, we risk missing parts of the picture when solely looking at climate change. The intersection between environmental destruction, climate change and First Nation health is something that could be explored in future research.

5.2.1.3 Grey literature

In the methods section, we described that we utilized four databases to conduct our search, namely Embase Ovid, Medline Ovid, Web of Science and the Indigenous Studies Portal. However, as our theme is relatively new and emerging, it would likely be beneficial to include a search of grey literature, for instance of websites/organizations such as NCCIH, the Centre for Indigenous Environmental Resources and other Indigenous health/environmental organizations.

6 Conclusion

This thesis explores the intricate ways climate change affects the health and well-being of First Nations communities in Canada. Employing a scoping review methodology, we synthesized existing knowledge by systematically searching four databases, including Medline, Embase, Web of Science, and the Indigenous Study Portal.

Our approach to understanding health was framed through an "Indigenous lens," encompassing not only physical and mental health perspectives but also spiritual and community health considerations. By adopting this holistic perspective, we aimed to generate results that are relevant to the studied population.

Our findings confirm that climate change exacerbates existing health disparities, particularly through its effects on traditional land-based activities, diet, personal/community finances, cultural identity, and mental health. These disruptions increase the burden of lifestyle-related diseases and negatively impact mental health, highlighting the profound interconnectedness between environmental changes and health outcomes for Indigenous populations.

The study also affirms the Inverse Care Law (ICL), demonstrating that climate change not only heightens healthcare needs but also reduces access to healthcare services. This dual impact is especially severe for remote First Nation communities, further entrenching the healthcare inequities faced by these populations. Our research underscores that those most affected by climate change are often the most socioeconomically disadvantaged, perpetuating a cycle of marginalization and poor health outcomes.

Furthermore, the analysis of Indigenous health indicators reveals the inadequacy of conventional health metrics in fully capturing the health impacts of climate change on Indigenous communities. By incorporating Indigenous-specific health indicators we can better understand and address the multifaceted health impacts of climate change on First Nations.

A critical theme that emerged is the dual characterization of First Nations as both vulnerable and resilient. While climate change poses significant threats, the adaptive capacity and resilience of these communities are evident. However, labeling First Nations as vulnerable can have negative connotations and unintended consequences, potentially undermining their

autonomy and self-determination. This duality must be carefully navigated to support effective and empowering policy responses.

This thesis also highlights significant knowledge gaps in the existing literature. There is a marked lack of focus on gendered perspectives, despite their critical importance in understanding the full scope of climate change impacts. Additionally, it seems that research on First Nations in the Prairie region remains limited, underscoring the need for more geographically inclusive studies. The small number of eligible studies generated from our search (which started out quite broad), also indicates that First Nation health impacts in relation to climate change remains under-researched.

In conclusion, our research demonstrates the complex and multifaceted impacts of climate change on First Nations' health, emphasizing the need for holistic, culturally sensitive approaches to health measurement and intervention. Addressing the identified knowledge gaps and fostering greater inclusion of diverse perspectives will be essential in developing effective strategies to mitigate the health impacts of climate change on Indigenous populations. Through recognizing both the vulnerabilities and resilience of First Nations, we can support their efforts towards greater health equity and self-determination in the face of ongoing environmental changes.

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Works cited:

1. Organization WH. Fact Sheet on The Health of Indigenous Peoples [pdf]. 2007 [Available from: https://www.who.int/gender-equity-rights/knowledge/factsheet-indigenous-healthn-nov2007-eng.pdf?ua=1
2. World Health Organization, Organization PAH. Policy on Ethnicity and Health [pdf]. 2017 [Available from: https://iris.paho.org/bitstream/handle/10665.2/34195/CE160-15-e.pdf?sequence=1&isAllowed=y.
3. King M, Smith A, Gracey M. Indigenous health part 2: the underlying causes of the health gap. The Lancet. 2009;374(9683):76-85.
4. Henderson R, Montesanti S, Crowshoe L, Leduc C. Advancing Indigenous primary health care policy in Alberta, Canada. Health Policy. 2018;122(6):638-44.
5. Jewell E, Mosby I, . Calls to Action Accountability: A 2022 Status Update [Pdf-report]. Yellowhead Institute; 2022 [cited 2023 Feb 15]. Available from: https://yellowheadinstitute.org/wp-content/uploads/2022/12/TRC-Report-12.15.2022-Yellowhead-Institute-min.pdf.
6. Durkalec A, Furgal C, Skinner MW, Sheldon T. Climate change influences on environment as a determinant of Indigenous health: Relationships to place, sea ice, and health in an Inuit community. Social science & medicine. 2015;136:17-26.
7. National Collaborating Centre for Indigenous Health. Climate Change and Indigenous People's health in Canada. Government of Canada; 2022.
8. Organization WH. COP26 special report on climate change and health: the health argument for climate action [pdf]. Geneva2021 [cited 2021 19. October]. Available from: file:///C:/Users/miae/Downloads/9789240036727-eng.pdf.
9. Haines A, Kovats RS, Campbell-Lendrum D, Corvalán C. Climate change and human health: impacts, vulnerability, and mitigation. The Lancet. 2006;367(9528):2101-9.
10. Ford JD, King N, Galappaththi EK, Pearce T, McDowell G, Harper SL. The resilience of indigenous peoples to environmental change. One Earth. 2020;2(6):532-43.
11. Cookson R, Doran T, Asaria M, Gupta I, Mujica FP. The inverse care law re-examined: a global perspective. The Lancet. 2021;397(10276):828-38.
12. Health TLG. Breaking the inverse care law. The Lancet 2021;9(3).
13. Harper S, Cunsolo A, Babujee A, Coggins S, De Jongh E, Rusnak T, et al. Trends and gaps in climate change and health research in North America. Environmental research. 2021;199:111205.
14. Mays N, Roberts E, Popay J. Synthesising research evidence In Fulop N, Allen P, Clarke A and Black N (eds) Studying the Organisation and Delivery of Health Services: Research Methods. London: Routledge; 2001.
15. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. International journal of social research methodology. 2005;8(1):19-32.
16. I-Portal. About the Indigenous Studies Portal [Web Page]. [cited 2024. Available from: https://iportal.usask.ca/about.
17. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. Implementation science. 2010;5(1):1-9.
18. Braun V, Clarke V. Using thematic analysis in psychology. Qualitative research in psychology. 2006;3(2):77-101.
19. Domingo A, Charles K-A, Jacobs M, Brooker D, Hanning RM. Indigenous community perspectives of food security, sustainable food systems and strategies to enhance access to local and traditional healthy food for partnering williams treaties first nations (Ontario, Canada). International journal of environmental research and public health. 2021;18(9):4404.
20. Sanderson D, Picketts IM, Déry SJ, Fell B, Baker S, Lee‐Johnson E, et al. Climate change and water at Stellat'en First Nation, British Columbia, Canada: Insights from western

science and traditional knowledge. The Canadian Geographer/Le Géographe Canadien. 2015;59(2):136-50.
21. Golden DM, Audet C, Smith M. “Blue-ice”: framing climate change and reframing climate change adaptation from the indigenous peoples' perspective in the northern boreal forest of Ontario, Canada. Climate and Development. 2015;7(5):401-13.
22. Marushka L, Kenny T-A, Batal M, Cheung WW, Fediuk K, Golden CD, et al. Potential impacts of climate-related decline of seafood harvest on nutritional status of coastal First Nations in British Columbia, Canada. PLoS One. 2019;14(2):e0211473.
23. Marushka L, Batal M, Tikhonov C, Sadik T, Schwartz H, Ing A, et al. Importance of fish for food and nutrition security among First Nations in Canada. Canadian Journal of Public Health. 2021;112(Suppl 1):64-80.
24. Ross P, Mason CW. We Hardly Have Any Moose Around Here Anymore. Arctic. 2020;73(3):368-85.
25. Hori Y, Tam B, Gough WA, Ho-Foong E, Karagatzides JD, Liberda EN, et al. Use of traditional environmental knowledge to assess the impact of climate change on subsistence fishing in the James Bay Region of Northern Ontario, Canada. Rural and Remote Health. 2012;12(1):75-90.
26. Weatherdon LV, Ota Y, Jones MC, Close DA, Cheung WW. Projected scenarios for coastal First Nations’ fisheries catch potential under climate change: management challenges and opportunities. PloS one. 2016;11(1):e0145285.
27. Cameron L, Mauro I, Settee K. “A return to and of the land”: Indigenous knowledge and climate change initiatives across the Canadian prairies. Journal of Ethnobiology. 2021;41(3):368-88.
28. Donatuto J, Grossman EE, Konovsky J, Grossman S, Campbell LW. Indigenous community health and climate change: integrating biophysical and social science indicators. Coastal Management. 2014;42(4):355-73.
29. Thomas M, Boulanger Y, Asselin H, Lamara M, Fenton NJ. How will climate change and forest harvesting influence the habitat quality of two culturally salient species? Science of The Total Environment. 2024;927:172148.
30. Whitney CK, Frid A, Edgar BK, Walkus J, Siwallace P, Siwallace IL, et al. " Like the plains people losing the buffalo": perceptions of climate change impacts, fisheries management, and adaptation actions by Indigenous peoples in coastal British Columbia, Canada. Ecology & Society. 2020;25(4).
31. Royer M-JS, Herrmann TM. Cree hunters’ observations on resources in the landscape in the context of socio-environmental change in the eastern James Bay. Landscape Research. 2013;38(4):443-60.
32. Sritharan M. The Impacts of Climate Change on the Health and Well-being of the Peoples of Whitefish River First Nation, Ontario [Master's thesis: Major Paper]. Toronto, Ontario, Canada: York University; 2017.
33. Tam B. The Effects of Weather and Climate Change Variability on the Well-Being of a Rural and Urban Aboriginal Group in Ontario, Canada. Ontario, Canada: University of Toronto; 2012.
34. Lemelin H, Matthews D, Mattina C, McIntyre N, Johnston M, Koster R. Climate change, wellbeing and resilience in the Weenusk First Nation at Peawanuck: the Moccasin Telegraph goes global. Rural and Remote Health. 2010;10(2):106-23.
35. Batal M, Chan HM, Fediuk K, Ing A, Berti PR, Mercille G, et al. First Nations households living on-reserve experience food insecurity: prevalence and predictors among ninety-two First Nations communities across Canada. Canadian Journal of Public Health. 2021;112(Suppl 1):52-63.

36. Fuentes L, Asselin H, Bélisle AC, Labra O. Impacts of environmental changes on well-being in indigenous communities in eastern Canada. International journal of environmental research and public health. 2020;17(2):637.
37. Dolan AH, Walker IJ. Understanding vulnerability of coastal communities to climate change related risks. Journal of Coastal research. 2006:1316-23.
38. Tabish S. Lifestyle diseases: consequences, characteristics, causes and control. J Cardiol Curr Res. 2017;9(3):00326.
39. Velten J, Lavallee KL, Scholten S, Meyer AH, Zhang X-C, Schneider S, et al. Lifestyle choices and mental health: a representative population survey. BMC psychology. 2014;2:1-11.
40. Donatuto J, Campbell L, Gregory R. Developing responsive indicators of indigenous community health. International Journal of Environmental Research and Public Health. 2016;13(9):899.
41. Furgal C, Seguin J. Climate change, health, and vulnerability in Canadian northern Aboriginal communities. Environmental health perspectives. 2006;114(12):1964-70.
42. Haalboom B, Natcher DC. The power and peril of" vulnerability": Approaching community labels with caution in climate change research. Arctic. 2012:319-27.
43. Williams L, Fletcher A, Hanson C, Neapole J, Pollack M. Women and climate change impacts and action in Canada: feminist, Indigenous and intersectional perspectives. 2018.
44. Noyes PD, McElwee MK, Miller HD, Clark BW, Van Tiem LA, Walcott KC, et al. The toxicology of climate change: environmental contaminants in a warming world. Environment international. 2009;35(6):971-86.