

**A First Nations Political Ecology of  
Climate Change in Saskatchewan**

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Studies in Partial Fulfillment of the Requirements for the Degree  
of Master of Arts in the Department of Geography and Planning  
University of Saskatchewan  
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By

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## ABSTRACT

Climate change is the major global environmental challenge of this century. Globally, climate change impacts are unevenly distributed. In Canada, the impacts of climate change are reported to be exacerbated in northern and Indigenous communities. To help understand why this condition exists, I have applied the theoretical lens of political ecology as an explanatory tool. Political ecology links ecological outcomes to power differentials that result from control of government and other institutions over local and Indigenous peoples. This research took place in three First Nation communities in the Canadian province of Saskatchewan. Community members collected data for this study using semi-structured interviews and a survey questionnaire developed by each community. Data analysis categorized the impacts of climate change at the individual and community level. This research shows how the creation of ‘Indian Reserves’ and the forced relocation of Indigenous people onto relatively small parcels of “land reserved for the Indians” (*Indian Act 1876*) has led to multi-faceted risk exposure to weather and climate events. This research makes a contribution to a ‘developed world’ political ecology.

**Keywords:** Climate Change, Saskatchewan, Canada, Political Ecology, Colonization, First Nation

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## LIST OF ABBREVIATIONS

°N	- Degree North
AFOT	- Aboriginal Focusing-Oriented Therapy
CAQDAS	- Computer aided qualitative data analysis software
CO <sub>2</sub>	- Carbon dioxide
F-gases	- Fluorinated gases
GEOGRAPHY 849	- Indigenous planning course in Geography & planning
GHG	- Green House Gases
IPCC	- Intergovernmental Panel on Climate Change
Km	- Kilometers
MT	- Metric tonne
NE	- North East
NWT	- Northwest Territories
UN	- United Nations
WHO	- World Health Organization

# 1. INTRODUCTION

## 1.1. Research Context

Global climatic conditions in the past half-century have changed more rapidly than in any other period on earth (McNeill, 2001). Arguably, climate change is the biggest global environmental problem of our time (Olausson, 2014) prompting both debate and worldwide attention. Climate change events such as melting of glaciers, flooding, frequent wildfires, weather unpredictability, freezing and shorter winter seasons, warmer summer season, drought, coastal storms, sea surge and melting permafrost are all climate change manifestation affecting the lives, and livelihoods, of people (CIA, 2015; McClymont & Myers, 2012; Furgal et al, 2008; CIER, 2006).

Studies by over 2,000 researchers in the 195 United Nations member countries under the auspices of Intergovernmental Panel on Climate Change (IPCC) show that there is great scientific consensus that climate change is real and that human activities and government policies which are shaped by global economic forces are the main drivers which directly and indirectly affects human wellbeing. Some of the notable human activities driving climate change stretch back to the Industrial Revolution and include burning of fossil fuels, land exploitation, globalization, deregulation, neoliberal economic reform and global market integration. The cumulative impact of these human activities is varied across space and time yet contributes to wealth concentration, food insecurity, loss of livelihoods, ecosystem disruption, human risk and forced migration (Webb et al., 2017; Peet & Watts, 2004; Oreskes, 2004; IPCC 2001).

The impacts of climate change are reported to be greatest in northern latitudes in both North America and Northern Europe (Ruosteenoja et al. 2016; Furgal and Seguin 2006). In Canada, current studies indicates that Northern and Indigenous communities are disproportionately affected by climate change (Lemmen et al 2008). Climate change is also affecting the capacity of ecosystems to provide services to those people practicing subsistence and traditional livelihoods (Aastrup et al., 2018; Petersen, 2009). Studies indicate that the Northern region of Canada warmed by 1.6 °C between 1948 and 2014. This rate is twice the global average and has led to sea-ice loss, loss of lake and river ice, reduced snow cover, thawing of permafrost, species disappearance and warmer seas which accelerates the melting of ice caps (Arctic Council, 2016; Clark et al., 2016; Ford, 2012; Aastrup et al., 2018; Duerden, 2004).

Economic policies rooted in colonialism play a role in climate change impacts in Indigenous communities in Canada given that climate change is a product of capital accumulation and political

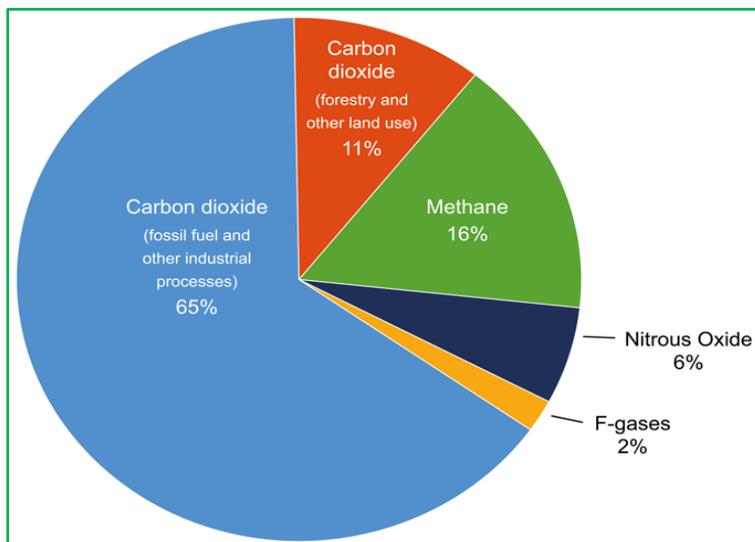
economic forces (Baijius & Patrick, 2019; Tyler et al., 2007; Wolfe, 2006). Colonialism in Canada, and the supporting institutions such as policies and laws of the state continue to affect Indigenous people’s livelihoods and socio-cultural practices. It is argued here that climate change, and its multiple impacts on Indigenous communities, is an extension of colonialism adding one more layer to ‘cultural genocide’ experienced by Indigenous people (Baijius & Patrick 2019; Downing and Cuerier 2011).

The thesis will explore whether an approach from political ecology, a theoretical analytic tool, explains why climate change impacts are exacerbated in Indigenous communities in Canada.

## 1.2 Climate Change

Climate change is the result of emission and absorption of a combination of greenhouse gases (CO<sub>2</sub>, Methane, Nitrous Oxide and hydrofluorocarbons (F-gases) as captured in Figure 1.1 below) into the lower atmosphere. The result of this is the warming of the lower atmosphere, generally referred to as global warming or enhanced greenhouse effect (NCCRAF, 2018).

Figure 1.1: Causes of climate change (NCCRAF, 2008)



In terms of socio-economic activities, the Intergovernmental Panel on Climate Change (IPCC, 2019) alongside the Food and Agriculture Organization (FAO, 2008) state that that land-use change drives climate change, contributing about 17 to 20 percent of global CO<sub>2</sub> emissions annually. Furthermore, they argued that land use changes by humans via deforestation, urbanization, transportation and agriculture leads to the emissions of high amounts of CO<sub>2</sub> and other greenhouse gases into the atmosphere through fertilizer use, burning of farm residues and other unsustainable farming practices common in developing countries contribute to global warming (Nabuurs et al., 2013; FAO, 2008; Bashmakov et al., 2007). In the developed world,

resource consumption and other forms of capital accumulation drive the highest per capita GHG emissions globally, largely from the transportation sector.

### **1.3. Research Purpose**

The purpose of this research is to apply political ecology as an explanatory, theoretical tool to understand why climate change is exacerbated in First Nation communities in Canada.

### **1.4 Research Objectives**

- 1) To synthesize the results of a community-based climate change survey conducted by, and in, three First Nation communities in Saskatchewan, Canada.
- 2) To identify community and individual impacts of climate change as well as adaptation and mitigation strategies in these three communities.
- 3) To report these research results and make recommendations to the case study communities respecting adaptation or mitigation strategies that might lessen the impacts of climate change.
- 4) To make a scholarly contribution to a 'First World' political ecology.

### **1.5 Positionality**

As an International Student, I entered this program of study knowing nothing about the Indigenous People of Canada. Based on this, my Supervisor advised me to enrol for a course titled "GEOGRAPHY 849 - Planning with Indigenous Communities" in order to introduce me to the Indigenous ways of doing things and prepare me for the task ahead. While taking the course, I visited some Indigenous communities in Saskatchewan and met with some professionals and Indigenous people working as planners and Elders in Indigenous communities in Canada. These visits and meetings helped me to better understand the culture and issues of Indigenous People of Canada. The issues faced by the Indigenous communities, especially the environmental issues were similar to what some communities in my home country Nigeria experience. This increased my interest to learn more about Indigenous communities in Canada and to look for creative ways of finding solutions to these issues, as some of these solutions can also be implemented in my home community.

## 2. LITERATURE REVIEW

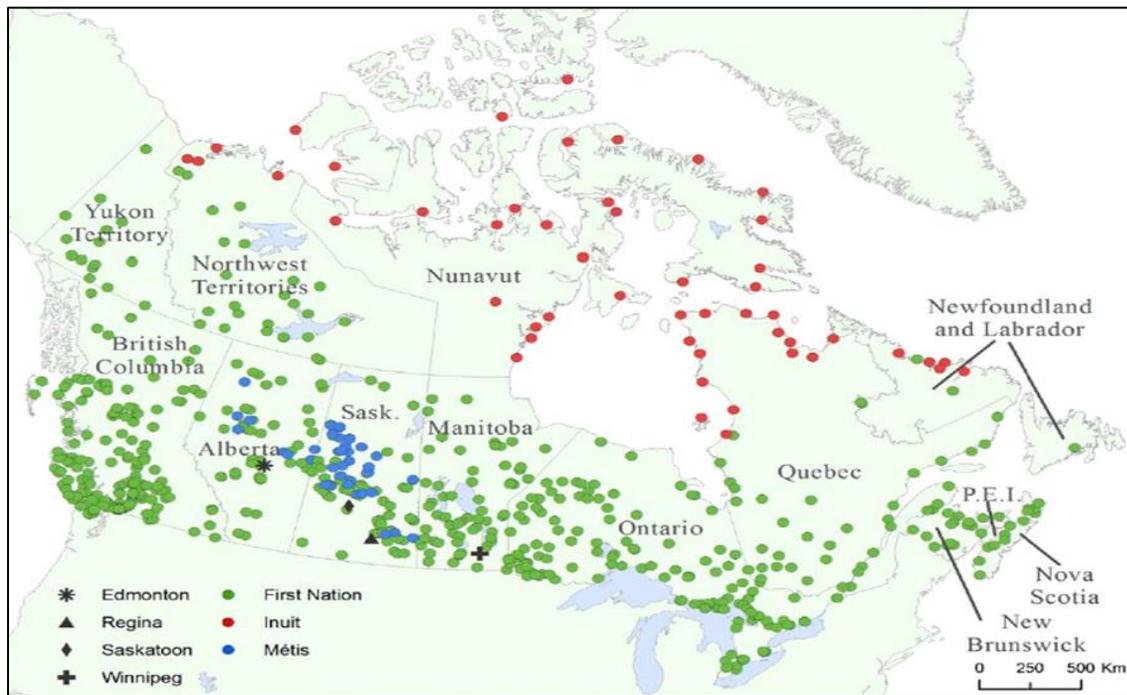
### 2.1 Indigenous People of Canada

The Indigenous peoples of Canada (except the Métis) are the original inhabitants of Canada long before the coming of the European settlers and colonization (NCCA, 2013). The Indigenous people of Canada are made up of First Nation, Métis and Inuit, as recognized in Section 35(2) of the Canadian Constitution Act, 1982. A brief explanation of the Indigenous people is noted in Table 2.1, while their distribution across Canada is as shown in Figure 2.1.

Table 2.1 : Indigenous people of Canada (MNC, 2020; Statistics Canada, 2017; NCCA, 2016).

	First Nations	Métis	Inuit	(Non-Status)
Brief explanation	They are the original inhabitants of Canada who lived across the various provinces except Nunavut, prior to the coming of the European settlers. they exist in many distinct cultural groups or nations within 630 distinct communities	They are new Aborigines- mixed children from the marriage/ relationship between Indians and European settlers/fur traders	These are original inhabitants of the Arctic regions of Canada.	These are First Nations descendants  That were not registered Indians in Canada,
Population	977,230	587,545	65,025	43,980
% population	58.4%	35.1%	3.9%	2.6%
Province Located	All province of Canada, except Nunavut.	Manitoba, Alberta and Saskatchewan  Ontario and BC	NWT, Nunavut and Quebec	75% live in Quebec, Ontario, BC & Alberta
Place of residence	45% live on reserve, 51% live off-reserve	About 70% of Métis live in urban centre, While the remaining 30% live in rural and hinterland communities along river and lakes shores.	Most of the Inuit people in Canada live in their traditional lands collectively known as Inuit Nunangat	75% of them live in urban areas and the remaining 25% live in rural communities
Language & culture	Ktunaxa, Dene, Salishan, Tsimshianic, Algonquian (Cree), Wakashan, Siouan and others	Metis speak Michif	Inuit people speak Inuktitut,	First nation languages.

Figure 2.1: Location of Indigenous people of Canada (Ford et al., 2010)



Indigenous people in Canada all have a distinct culture, belief system and traditional knowledge in the face of ongoing structures of colonialism and its existing legacies in Canada (Statistics Canada, 2017; Whyte, 2016). The United Nations Declaration on the Rights of Indigenous People empowers Indigenous People to pursue self-determination in terms of their political status, legal, economic, social and cultural development and institutions and right to autonomy or self-government in matters relating to their internal and local affairs” (Whyte, 2016; UNGA, 2007).

In terms of population, the total number of Indigenous people in Canada is 1,673,785, based on 2016 census. This accounts for 4.9% of the total Canada population. Indigenous people in Canada have the highest population growth rate when compared to other groups in Canada (Statistics Canada, 2017; Cooke et al., 2007). Despite this high rate, Indigenous people are susceptible to the negative effects of climate change, as they are still being marginalised by the Canadian government and suffer high mortality and morbidity rates when compared to the non-Indigenous population. Indicators of marginalization include health inequalities, high rates of incarceration, socio-political inequalities, poverty, constrained institutional capacity and lack of technological capacity (Ford et al., 2010; Wilson & Young, 2008).

### **2.1.1 First Nations of Saskatchewan**

The percentage of First Nation population in Saskatchewan is 10.7 percent, significantly higher than the percentage for Canada (2.8) (Statistics Canada, 2019). First Nations in Canada have their treaty rights affirmed by Section 35 of the Constitution of Canada's Act 1982. One of their most important cultural teaching is to respect their environment and live in harmony with their natural environment as many Indigenous people depend on the environment for their survival and wellbeing (Golden et al., 2015).

However, the standard of living in First Nations communities presents a major challenge as First Nations living on reserve, are generally at the bottom of statistical data regarding income, employment, formal education, housing quality, longevity, and morbidity from various diseases (Flanagan, 2016). Indigenous leaders typically attribute First Nations' low standard of living to the effect of past injustices such as colonialism, violation of treaties, and the legacy of harm inflicted by the residential school system. Correspondingly, First Nations have demanded compensatory remedies such as payment of damages, return of land to aboriginal jurisdiction, Indigenous control of education, child and family services and health services with revival of Indigenous languages, and "nation to nation" dealings with Canada to recognize Indigenous sovereignty (Walker et al., 2013; Phare, 2009).

In Saskatchewan, there are approximately 70 First Nation reserves, contributing to the total registered First Nation population of 129,138 as at February 28, 2009 (Statistics Canada, 2017). Furthermore, there are 10 Tribal Councils in Saskatchewan and 11 independent First Nations in the province. Sixty-one out of the 70 First Nation reserves in Saskatchewan are affiliated with each of the 10 Tribal Councils. These Tribal Councils assist member First Nations to achieve their social, cultural, political, health, economic and financial goals as a Nation. There are 5 major linguistic group spoken by the First Nations in Saskatchewan: Cree dialects, Dakota, Dene (Chipewyan), Nakota (Assniboine) and Saulteaux. Saskatchewan is host to multiple Treaty areas including Treaty Area 2, 4, 5, 6, 8, and 10.

### **2.2 Colonization and its impact on First Nations**

Colonization in Canada by European settlers commenced through the fur trade era starting in the 1700s with trade partners between the Europeans and First Nations (GC, 2017). However, the Royal Proclamation of 1763 and the recognition of United States of America at the end of American War of Independence in 1783 gave birth to the era of signing treaties in 1764 between the British Crown and 22 First Nations (Borrows & Coyle, 2017). This began the establishment of agricultural colonies in Canada and the development of Indian Act (1876). These events led to loss

of land and water rights for First Nations as well as efforts by the federal state toward forced assimilation. Blakemore (2019) described colonialism as a brutal and illegitimate subjugation of Indigenous people in their own land. She defines colonialism by Western (European) countries which happened globally from the beginning of nineteenth to mid-twentieth centuries as one nation controlling Indigenous people living in their lands by use of power to conquer and exploit while imposing its own values, language and culture on Indigenous people.

In Canada, most studies on the impact of colonization of First Nations record negative impacts of colonialism. Harold Cardinal (1969) in his book titled “The Unjust Society” described the colonization of the First Nations by the European settlers as brutal and pure tyranny.

In addition, Adam et al. (2014) and Aquash (2013) state that about 98% of Indigenous lands were taken away from Indigenous people and they were forced to live in secluded reserves with no access to their lands, resources and water. These reserves and the First Nation inhabitants became the responsibility (wards) of the federal government with the aim of bringing the Indigenous political orders under the control of Canadian (settler) governance structures. Also, the federal government implemented the Natural Resources Transfer Act (1930), which facilitated the transfer of all administrative responsibility for lands and resources within each provincial jurisdiction to the various provinces of Canada. This transfer to the provincial governments makes it difficult and complex for the federal government to fulfil treaty obligations as these First Nations are not under the control of provincial governments.

First Nations were frequently described as “savages” and their way of life tagged as illegal, ceremonies forbidden and existing Indigenous knowledge, culture and values were abolished and replaced with Eurocentric (Christian, Enlightenment thinking) ways of life and values. The “Pass” system made it illegal for First Nations to travel off their assigned ‘reservation’ without a government issued pass. Furthermore, many First Nation children were forcibly taken away to residential schools, where they were often abused and forcefully indoctrinated into Christian belief systems. All this resulted in the existing and variable conditions of child welfare, food insecurity, under-employment, diseases, mould in houses and schools, and overcrowded housing in First Nation communities (Baijius & Patrick, 2019; Kappo & King, 2018; Miller, 1996).

In trying to ameliorate the negative impacts of colonialism on First Nations, several Indigenous models have been developed and implemented in recent years to address intergenerational trauma and sufferings, marginalization, discrimination and nation-to-nation conflicts in many First Nation communities. The Shirley Turcotte’s Aboriginal Focusing-Oriented Therapy (AFOT) program

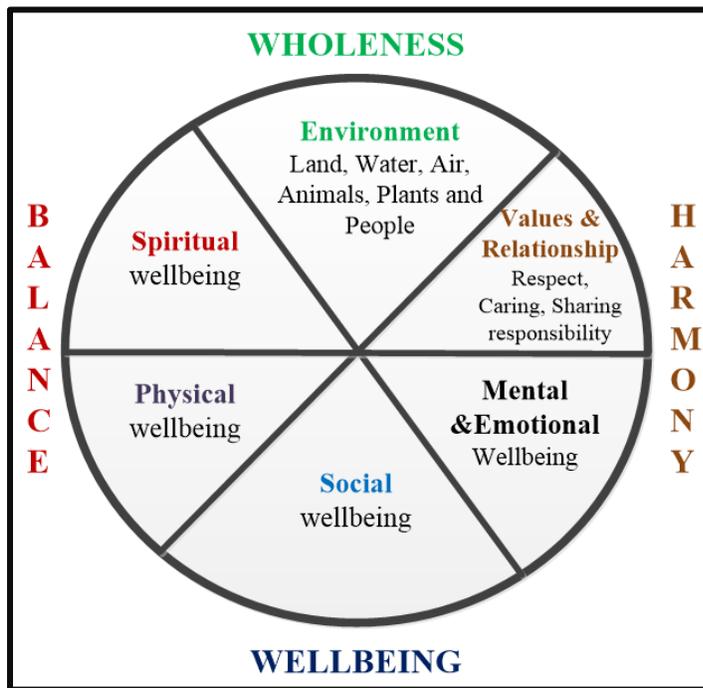
which is aimed at taking care of intergenerational trauma due to colonialism among First Nations. The AFOT program was designed to handle the restoration of cultural values in First Nation communities alongside land-based practices to promote First Nation's wellbeing and mental health. The Truth and Reconciliation Commission was implemented by Canada to repair the relationship between Indigenous peoples and the Canadian state. Recent review of the project performance using some key performance indicators, shows a steady significant shift in the status quo over the years. This shift is from deeply rooted marginalization and stereotyping First Nations to creating and maintaining a mutually respectful relationship between the Indigenous people and the non-Indigenous people in Canada (Schiffer, 2016; Walker et al., 2013). However, Kappo and King (2018) argued that despite the implementation of these models colonialism still exists as a result of government policies and that Indigenous communities still have no rights and power over their lands and resources.

### **2.2.1 Land relationships in First Nation and colonization in Canada**

First Nations have strong cultural and spiritual connections to their land and environment, as they see it as a source of life, hence, the need to live in harmony with the land and its natural resources (Flanagan, 2016). Furthermore, many First Nations believe that that the spiritual and cultural respect to lands are heterogeneous across their various communities, as some sections of their land are referred to as Sacred sites – meaning that these sites have higher spiritual relevance to the people and their culture more than other land sections. Hence, any destabilization of the harmony between the activities of humans and the land (sacred and non-sacred) in these communities, undermines First Nation culture.

Poonwassie and Charter (2001) explain that while First Nations sees land as a source of life and wellbeing with spiritual attributes that requires humans to live in harmony with nature, the settlers see land as a resource that need to be controlled and exploited using political power in order to maximize economic values. In order to restore First Nation sovereignty and control, ICT (2015) and Phare (2009) posit that some First Nations have won legal cases against Canada at the Supreme Court, thereby, strengthening First Nation's land relationships and confirming their right to land ownership in Canada (ICT, 2015; Koller-Armstrong, 2009). Foley (2004) believe that First Nations reclaiming their lands will help them restore balance and harmony that earlier existed between them and their environment as captured in the Medicine (health) wheel below (see Figure 2.2), while improving their general wellbeing and their spiritual and cultural relationships with the land (Poonwassie & Charter 2001).

Figure 2.2: The medicine Wheel (Foley, 2004)

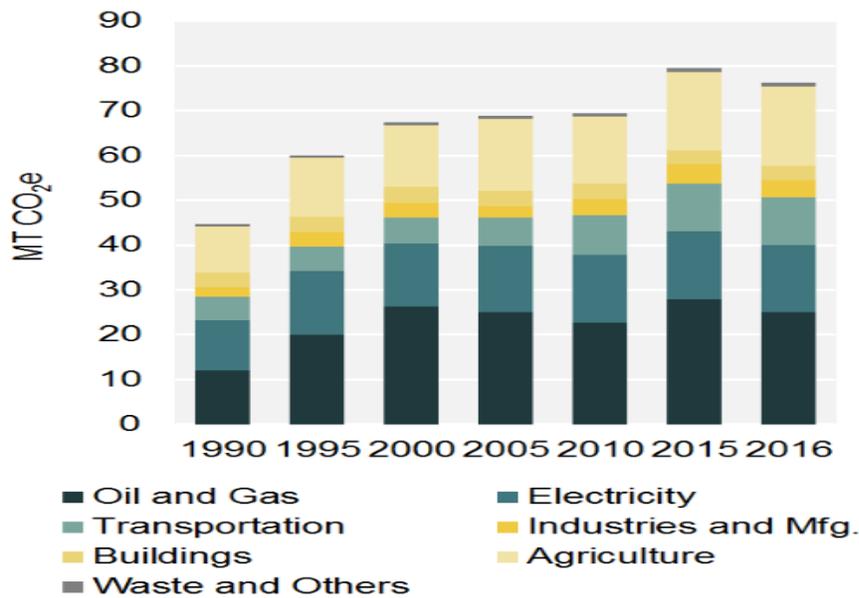


### 2.3 Climate Change

Climate change is undoubtedly one of the major global environmental challenge in recent decades. The impacts of climate change can be felt globally across all sectors of an economy and all segments of a society directly or indirectly (Makondo & Thomas, 2018).

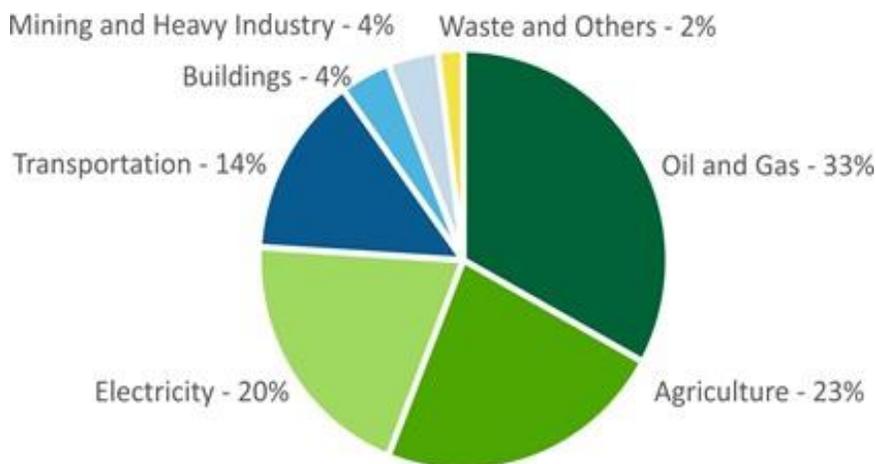
In Saskatchewan, Canada, climate change is a critical issue that affects many aspects of people's lives and sectors of the economy directly and indirectly (Lemmen et al., 2008). This issue is critical because the province has the highest emission per capita in Canada at 66.9 tonnes of CO<sub>2</sub>e which is higher than the national average of 19.4 tonnes per capita. Also, in 2016, Saskatchewan GHG emission stands at 76.3 MT of carbon dioxide equivalent (CO<sub>2</sub>e representing a 71% increase in emission when compared to the value in 1990 as captured in Figure 2.3 (CER, 2019).

Figure 2.3: Carbon dioxide equivalent history in Saskatchewan (CER, 2019)



Environment and Climate Change Canada (ECCC 2019) using 2016 data as shown in Figure 2.4 below, stated that Saskatchewan’s economy is emissions-based as the major source of revenue for the province such as oil and gas, agriculture, electricity and transportation had the highest amount of greenhouse gases emission of 33%, 23%, 20% and 14% respectively (ECCC, 2019).

Figure 2.4: Sector representation of greenhouse gas emission (ECCC, 2019)



## 2.4 Political Ecology

According to Robbins (2004), political ecology has many definitions due to its interdisciplinary application. Political ecology cuts across many disciplines such as: sociology, environmental management, history, anthropology, geography, political science, and biology. In this study, I adopt Bryant and Bailey (1997) definition of political ecology which states that environmental changes and ecological condition within a location are a result of the power relations among human

groups alongside political processes and policies. In other words, to understand environmental change requires a critical assessment of political processes and the power dynamics that prevail between and among human groups and institutions.

Political ecology focuses on political nuances affecting human-environment relationships with respect to environmental change. It is argued that focusing on external political influences is key to understanding environmental change as global interest in resources leads to overexploitation of natural resources and land mismanagement (Vayda & Walters, 1999). Historically, earlier studies in political ecology such as Bryant and Bailey (1997), Blaikie and Brookfield (1987), Watts (1985) and others were concentrated on Third World political ecologies to explain land degradation at the hands of colonial interests and associated impacts on local people. In line with this, the three fundamental linked assumptions of political ecology include:

- The costs and benefits of environmental change within a state are not evenly distributed.
- This uneven distribution of costs and benefits of environmental changes reinforces the prevailing social and economic disparities within a state or system.
- The uneven distribution of benefits and costs of environmental change alongside the reinforcement or reduction of prevailing inequalities within a system holds political consequences with respect to the altered power relationships that are produced among the different actors within the system (Robbins, 2004; Bryant & Baily, 1997).

Furthermore, studies shows that use of the political ecology framework to identify the winners and losers, the power differentiation and hidden costs of environmental change will help in explaining social and environmental outcomes by answering questions such as what are the root causes of the environmental change?; who benefits and who loses from the change?; and what socio-political movements have grown based on the change?

From the above assumptions, Robbins (2004) produced the four pillars of political ecology (see Table 2.2) which include: 1) Degradation and marginalization, 2) Environmental conflict, 3) Conservation and Control and 4) Environment identity and social movement. All four pillars of political ecology may be useful and applicable to a better understanding of Indigenous-Colonial relations in Canada. For the purposes of this study, I apply the “Conservation and Control” thesis to understand condition leading to the exacerbation of climate change impacts on First Nations in Canada.

Table 2.2: Theses of political ecology (after Robbins, 2004)

<b>Theses of Political ecology</b>	<b>Explanation and relevance to research</b>
Degradation and marginalization	This pillar tend to explain the rationale and how environmental changes came to be within a locality of marginalized people, especially in the line of ethnicity, gender and political status. It explains how political powers are used to overexploit natural resources globally in the traditional lands of marginalized people as a result of increased integration in the global market and labelling traditional practices unsustainable in order to gain control over the resources.
Environmental conflict	This pillar explains the role resource scarcity plays in environmental conflicts. Here, due to growing scarcity of natural resources, land rights and access to natural resources within traditional lands of Indigenous people were taken from the communities and handed over to the elites, private firms, international investors and government agencies. However, the activities on these elites on the lands negatively affects these communities (for example: water contamination due to mining). These negative impact on the environment tends to leads to long-term conflict between the elites (resource exploiters) and Indigenous people.
Conservation and Control	This pillar explain how the state uses its policies such as conservation and control of lands to reduce land and resource access of local and Indigenous populations for the benefit non-Indigenous populations. However, most studies shows that enforcing these policies in Indigenous communities have negative impacts on these communities, as these move by government limits their survival opportunities and takes away their means of livelihood while making them at risk by dispossessing their land, leading to limited sources of income and poverty.
Environmental Identity and social movement	This pillar explains how communities affected by continuous degradation of their environment by external firms can lead to the formation of powerful local, regional or international socio-political movements and groups by the affected communities to oppose the continuous the government and firms with respect to the continuous degradation of their environment. The new political movement and groups will represent a new form of political identity or actions in the quest for the marginalized communities to control and manage their own resources in order to ensure their survival.

Studies have shown the strengths and weaknesses of political ecology when applied to environmental issues within a location. In terms of strengths of political ecology, Quandt (2016) believes that the two of the major strengths of political ecology are its emphasis on power and power relationships between two distinct group of people, and its grass root, case-based method alongside its ability to examine the relationship between humans and their environment at various scales. Quandt (2016) further adds that political ecology clearly recognizes the critical role political power and inequality plays in environmental problems. Political ecology highlights the origin of environmental issues and also explains how power differentials and marginalization shape people's interaction with the environment (Quandt, 2016; Fabinyi et al., 2014; Agrawal, 2005; Adger et al., 2001).

In summary, political ecology framework has been used to evaluate environmental issues in Third world (developing) countries. However, it is employed in this study to reveal the 'Third World' within a developed First World country, Canada, by exposing the uneven power relations between First Nations and the state (Federal government). These disparities metamorphosed from the era of colonization including the use of government policies to dispossess traditional lands from First Nations, creating land enclosures ("lands reserved for the Indians") exposing the occupants of those enclosures to the impacts of climate change with low quality and underdeveloped infrastructure along with limited mobility options.

## **2.5 Research gaps**

A review of existing studies shows that most climate change studies in Indigenous communities in Canada focus mainly on northern communities. In addition, no study applies a framework from political ecology to explain to explain the heightened impacts of climate change in Indigenous communities in Canada.

Furthermore, there are numerous studies on the impact of colonialism and its policies on the Indigenous people, their environment, their rights and the economic status. Whyte (2018) investigate how settler colonialism resulted in environmental injustice in Indigenous communities of Canada, using political ecology to understand how settler colonialism strategically contributed in undermining First Nation's social resilience in terms of self-determination. Also, Coombes et al (2012) apply political ecology to study the role of Indigenous activism in tackling the high rate of environmental degradation in Indigenous communities of New Zealand and Australia. Schroeder et al (2006) evaluate the underdevelopment and marginalization of "Third World" neighbourhoods in North America using political ecology framework. In Canada, Baijius and

Patrick (2019) used political ecology framework to critically evaluate water insecurity crisis in First Nations communities on the Canadian prairie. From the literature reviewed, scholarly gaps exists in the use of political ecology to study climate change impacts in Indigenous communities.

### 3. RESEARCH DESIGN

#### 3.1 Overview

In this chapter, the research methodology used in this research project will be identified and described. This chapter comprises of the research design, research locations, research approach and data collection and analysis methods employed.

#### 3.2 Research Design

Creswell (2014) and Kothari (2004) described the ‘research design’ as a conceptual structure or outlined process within which a research project is carried out. It shows the research blueprint and outlines what the researcher will do from identifying the research location, philosophy, research approach and methods to data collection and analysis.

This research evolved from a research partnership between three First Nation communities in Saskatchewan, Prince Albert Grand Council (Prince Albert, SK) and the funder, Health Canada’s Climate Change and Health Adaptation Program for First Nation Communities South of 60°N. In September 2017, Health Canada hosted a meeting with First Nation communities in Saskatoon. The purpose of the meeting was to promote a funding program that allowed First Nation communities to complete a climate change assessment in their community. Three communities within Prince Albert Grand Council were successful in their applications and received funding to complete climate change assessments.

Prince Albert Grand Council worked with a committee from each of the three communities to develop a household interview questionnaire. Training was provided by Prince Albert Grand Council to specific community members within each community to administer the questionnaire. These were intended to be household interviews conducted by trained community members with the homeowner or head of household. Specific targeting of individuals, youth, Elders, land users, was not the intension but rather, broad coverage of the community. In one community, Hatchet Lake, the household interviews were voice recorded and transcribed by the interviewers. In the other two communities, Shoal Lake and Red Earth, the same interview questions were asked but administered verbally, door-to-door, with handwritten responses recorded by the interviewers. This was the preference in all three communities. The recorded data was then provided to me, anonymously, for analysis. The research questions for all communities is referred to here as the research instrument.

Health Canada funding provided for a payment to the interviewers (\$100/interview) as well as a payment to the interviewees (\$25) through Prince Albert Grand Council for Shoal Lake and Red

Earth, and through Hatchet Lake Health Centre for the Hatchet Lake interviewers and interviewees.

The interview and survey questions were designed to tease out impacts on individuals, housing stock and infrastructure as well as the broader communities. Impacts on lifestyle, traditional land uses, human health and environmental change were all the subject of the research instrument.

### **3.3 Study Area and Demographics**

This research project follows a community-based participatory research approach conducted in three First Nation communities of Saskatchewan: Shoal Lake Cree Nation, Red Earth Cree Nation and Hatchet Lake Dene Nation.

#### **3.3.1 Red Earth Cree Nation**

Red Earth is a Cree First Nation community located about 370 km NE of Saskatoon, Saskatchewan, near the Manitoba boarder. Their native spoken language is Swampy Cree. The population of the Red Earth Cree Nation as of June 2020 is 1,903 people, with an on-reserve population of 1,638 people. Furthermore, majority of community member living in the reserve are below 40 years of age, and the reserve boast of about 206 houses, with an average of 9 persons per house (Red Earth 2020).

The Indian Reserve of Red Earth or *Mihkoskiwakak* is located along the Carrot River in NE Saskatchewan. The Red Earth Indian Reserve is situated about 77 km east of the Town of Nipawin, approximately 225 km NE of Prince Albert and about 140km West of The Pas community in Manitoba. In the 1800s, the Red Earth Crees had marriage links with the Crees at Fort à la Corne. Towards the end of the 1800s, the Red Earth socially grew closer to Shoal Lake Crees more than they did with Fort à la Corne, leading to intermarriages between Red Earth and Shoal Lake community members (Red Earth 2020; Red Earth 2013; CBC 2011).

Geographically, the ancestral lands of the indigenes of Red Earth Cree Nation include areas of lands and waters eastwards into parts of the Province of Manitoba, and back into Saskatchewan along the Pasquia hills (southern foothills) and westwards towards Nipawin town and back east, just close to the EB Campbell Hydro Station Transmission Line. The Red Earth community shares their ancestral lands with Shoal Lake Cree Nation, and traditional economy is still being practiced. The sustenance and subsistence fishing, hunting, gathering and trapping, are common and help maintain their harmonious relationship with the land and land resources throughout their ancestral and traditional territory (PAGC 2014; Red Earth 2020).

### **3.3.2 Shoal Lake Cree Nation**

The Shoal Lake Cree Nation is situated about 233km NE of Prince Albert, Saskatchewan, and close to Red Earth Cree Nation. Their first spoken language is Swampy Cree. In terms of population, the Shoal Lake Cree Nation comprises of about 1147 members, with 932 members, living on-reserve as of June 2020. Also, over 55% of the Community's population is below the age of 24 (Shoal Lake, 2020).

The Shoal Lake community place a great value on the boreal forest, alongside other environmental and natural resources within their land. According to the Elders, they stated that the boreal forest contributed to the abundance of land resources within their territory. This is because, the spruce trees in the boreal forest were known culturally as the medicine for the land, therefore, all things on the land thrived because of these trees. In all this forested majesty, members of the Shoal Lake community always talk about the aesthetics of their community due to the forested landscape as a result of the boreal forest within their community. Furthermore, Elders in the community believes that "everything though was beautiful and for our benefit. All the different types of trees were very beautiful at that place where we were." (Shoal Lake, 2011).

The origin of Shoal Lake as a long-lasting settlement began in the 1800s, as remembered through oral history and recorded through David Meyer's Thesis (Meyer 1982). According to Meyer (1982), the founding leaders of Shoal Lake Cree Nation were Osawask (Yellowbear) and Kismoswakapaw (Old Standing Moose). Osawask was a known active traditional medicine man and was very popular around his community. According to some of the Elder's account as captured by Meyer (1982), Yellow Bear was the leader of the Shoal Lake Cree Nation, who led his people out of The Pas band/area in Manitoba to their current land known as Shoal Lake. It was here (their present location) that the ancestral members of the community found abundance in the water and forests that would nurture the lives of their children, because, the land had every resources that the people would need. Further studies shows that Osawask chose the present location of Shoal Lake territory comprising of the Pasquia hills as a location for his community because it had beautiful game and medicines, and also isolated from Europeans (Meyer, 1982).

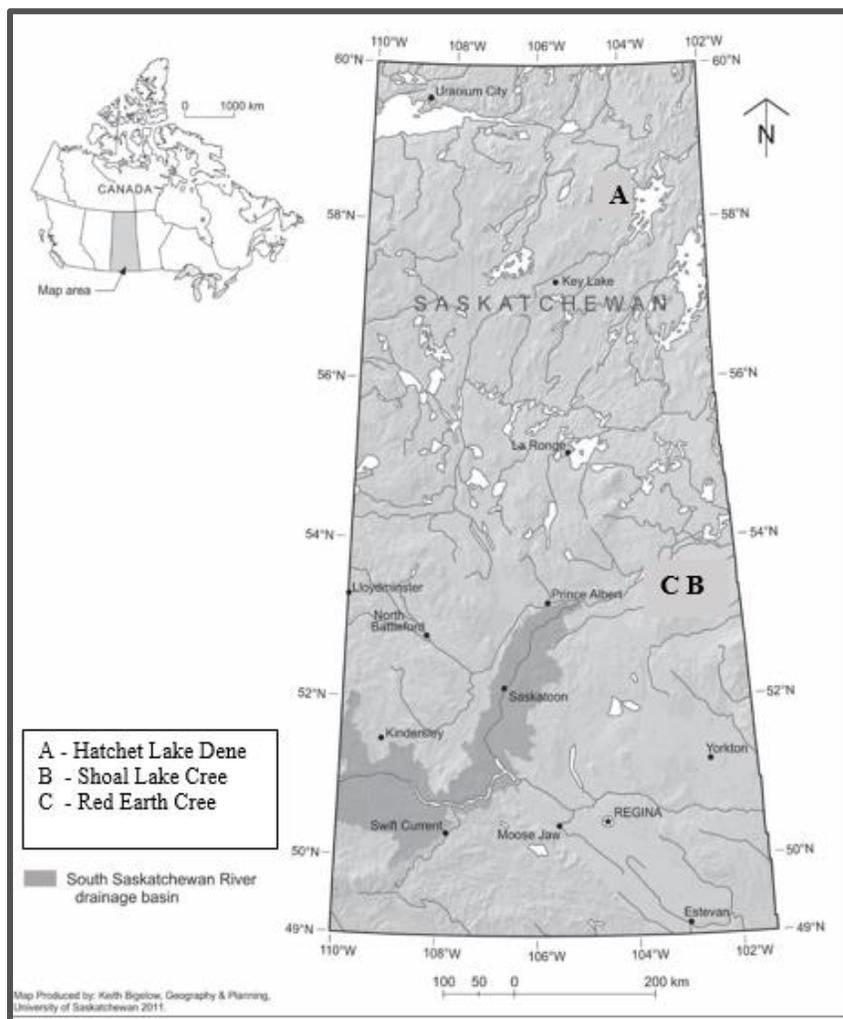
Apart from Church missionaries and the Indian agents that visits Shoal Lake to make their annual rounds, Shoal Lake Cree Nation remained semi-isolated and access to the community was by the river system. As years passes by, so did the community of Shoal Lake, it took many years for the Federal Government to provide Health, education and Social Services (Shoal Lake, 2007).

### 3.3.3 Hatchet Lake First Nation

Hatchet Lake Denesuline First Nation is a Dene Nation with about 1,913 registered members, with about 1,450 members are living on reserve, while the remaining 463 members off reserves. Hatchet Lake community can be accessed via boat barge in summer & spring and ice road in the winter. Year round access to Hatchet Lake community is provided by an Airline firm that operates flights to and from nearby communities and southern Saskatchewan (EARMP, 2016; INAC 2010).

Geographically, Hatchet Lake community is located on the south eastern shore of Wollaston Lake, known in Dene as “Axe” Lake. The Hatchet Lake Band are part of a big mixed Aboriginal group, known as “the Denesuline”, or “The People”. Hatchet Lake is a member of the Athapaskan linguistic group. Traditionally, the Hatchet Lake people lived as a hunting and gathering community as recently as the 1940s, mainly hunting caribou. Today, many of the community members continue to practice traditional lifestyle with hunting and fishing (PAGC 2014).

Figure 3.1: Locations of the research communities



The total population of the three research communities (on reserve) is 4,020 people. However, the research data was collected from a total of 121 people across the three communities sampled as captured in Table 3.1 below. This represents 3% of the total community population.

Table 3.1: Research population and gender distribution

<b>Community</b>	<b>Male</b>	<b>Female</b>	<b>Unkown</b>	<b>Total</b>
Shoal Lake	31	18	17	66
Red Earth Lake	23	9	0	32
Hatchett Lake	8	15	0	23
<b>Grand Total</b>	<b>62</b>	<b>42</b>	<b>17</b>	<b>121</b>
<b>Percentage (%)</b>	<b>51%</b>	<b>35%</b>	<b>14%</b>	<b>100%</b>

In this study, 66 people were interviewed in Shoal Lake (representing 7.1% of their on-reserve population), 32 people were interviewed in Red Earth Lake community (representing 2 % of their on-reserve population) and 23 persons were interviewed in Hatchet Lake community (representing 1.6% of their on-reserve population). Furthermore, male had the highest numbers of respondents in this study, with 62 participants (representing 51% of the total respondents), while 42 Females were interviewed (representing 35% of the total respondents), while the gender of 17 anonymous respondents (being 14% of the total respondents) were unknown.

The research respondent’s population is diverse in terms of age, gender and occupation.

### 3.4 Research Methods

This research adopted qualitative methods of data collection and analysis to identify various emerging themes and research variables as well as respondent’s perceptions and experiences on the subject matter (Saunders et al., 2009; Kothari, 2004). This qualitative method is suitable for this research because of its explorative nature to record and report interviewee information, knowledge and experiences.

### 3.5 Semi structured interview

Semi-structured interviews involve in-depth probing of the research participants in order to obtain their personal views, opinions and reflect their experiences about the research areas. (Saunders et al., 2009; Yin, 2009). Face-to-face interviews for this study were conducted by members of the research community in Hatchet Lake. In Shoal Lake and Red Earth the same research instrument was used but it was administered by members of the community as a door-to-door survey questionnaire. A total of 121 people (23 in Hatchet Lake, 32 in Red Earth Lake & 66 from Shoal Lake First Nations) were contacted by the community interviewers using a research instrument (semi-structured interview guide). The response from individual participants in Hatchet Lake were

recorded with a digital recorder, transcribed and forwarded to the academic researcher at University of Saskatchewan to be summarized, analysed and interpreted for results. In Shoal Lake and Red Earth, door-to door questionnaire surveys using the same research instrument were used for data collection.

The data gathering process lasted for a period of seven (7) months, starting in Hatchet Lake community in August 2019 and ended in Shoal Lake Community in March 2020. During the interviews, digital recorders (Hatchet Lake) and questionnaire survey (Red Earth and Shoal Lake) were used to record direct quotations about people's personal perspectives on, and experiences with climate change, while also allowing the respondents to present multiple meanings to climate change. The interview guide is presented in Table 3.2 below.

Table 3.2: Interview guide and their rationale

Qs No.	Research Questions	Rationale for the Questions
Q 1	Has your livelihood (hunting, fishing, trapping, etc.) been affected by climate change (weather change)?	To ascertain the impact of climate change on the participants, their homes, their livelihood and their communities
Q3	Has your house or cabin ever been affected by weather change?	
Q4	Have you ever been affected personally by climate change? How?	
Q5	Have you ever been in any danger from a weather change event?	
Q2	Have you seen any changes in your community that were possibly caused by weather change? Describe	To uncover the observable changes within the research communities from the participant's viewpoints.
Q6	Are you doing anything at home, or on the land, to adapt to weather change?	To ascertain how the community members are adapting to the impact of climate change.
Q7	What do you think is causing weather change?	To know how the indigenous views of what causes of climate changes
Q8	Is there anything that can be done to reduce the impacts of weather change?	To understand how the community members are mitigating and adapting to climate change impacts in their communities, individually and collectively as a community.
Q9	How can your community respond to these weather changes?	
Q10	Who in your community is most at risk from weather change?	To ascertain the group of people in these communities that are safe and the others that are at risk to the impacts of climate change
Q11	Do you feel safe in your community with weather change?	
Q12	Who can you contact to get more information about climate change?	To ascertain the indigenous ways the community members get more information about the changes in their various communities as a result of climate change.
Q13	What changes do you expect to see in your community with future weather changes?	To understand what the community members think of their communities in the near future, with respect to the current changes due to climate change. Also, to know how climate change impacts in Indigenous communities can be tackled from the using the participants views.
Q14	Do you have any ideas, suggestions as to what climate change should include?	

### 3.5.1 Preparation for interviews

In this research, the research communities owned the entire interview process, from participating in the interview questions formulation with Prince Albert Grand Council through conducting the field work (interviews) to transcribing the interviews from Hatchet Lake. Apart from assisting with formulating the interview question, the academic (University of Saskatchewan) members of the research team were not involved with the data collection. The data collection in the three research communities were carried out by the respective communities between August 2019 and March 2020.

### **3.6 Data analysis**

According to Saunders et al (2009) and Kothari (2004), qualitative data can be analysed manually via content analysis or electronically using computer aided qualitative data analysis software (CAQDAS), such as NVivo12™ by grouping emerging related research themes from the data. In this research, we intended to use NVivo12™ for data analysis. However, considering the small numbers of research participants, content analysis alongside manual coding was used to analyse all the interview transcripts from the three research communities. Content analysis was used to analyse both the interviews research data, because it works well with qualitative research by eliminating subjectivity in results and makes the detection of themes, patterns of trends (Duong et al., 2017; Creswell 2014; Kothari, 2004).

After receiving all the interview transcripts from the three research communities, these transcripts were reviewed and summarized. The summarized interview data were analysed using the content analysis method and manual coding to group the data into areas of analysis based on emerging themes. Manual coding is effective with qualitative data analysis with small respondent population and involves the iterative review of transcribed data over time manually in order to identify emerging themes and patterns and group the data into the themes. The results will be reported in the chapter that follows.

## 4. RESULTS

### 4.1 Chapter Overview

The research participants interviewed have all lived in these communities for more than 15 years. The research participant represent equally both male and female participants (See Table 3.1 above), Elders and youth were interviewed all having multiple and diverse working experiences and local knowledge.

Table 3.1 above shows that a total number of 121 participants were interviewed in the three communities out of which 62 (51%) are males, 42 (35%) are females and the gender of the remaining 17 people (14%) are unknown. The data were collected from the respondents using a research instrument with a semi-structured interview approach in Hatchet Lake, which allowed all the participants to tell their “climate change” story as it relates to their community, while sharing their knowledge, experiences and perspectives.

For data collection, 11 interview questions were asked in Hatchet Lake and 14 interview questions were asked in each of Shoal Lake and Red Earth. The questions were developed by Prince Albert Grand Council in cooperation with a committee of members from each of the three communities. The door-to-door interviews (Hatchet Lake) and surveys (Shoal Lake and Red Earth) were undertaken by community members using a research instrument consisting of research questions. The research instrument is available in *Appendix A*. After analysing the transcribed interviews and survey data collected, the following five categories emerged:

- Observed Changes in the Community
- Personal impact on livelihood and household
- Mitigation measures to prevent Climate Change
- Adaptation measures to cope with Climate Change, and;
- People most at risk in the communities from Climate Change.

These response categories will now be described in greater detail.

### 4.2 Observed changes

Numerous responses describing observed changes in the three research communities as shown in Table 4.1. Due to the variability in the interview sample size and the geographic range of the case study communities, cross-community comparisons is not relevant to this study. What is relevant are the specific responses of individuals in each community as a reflection of climate change across that community.

In Shoal Lake Cree Nation the greatest reporting of observed changes is less plants, trees, berries and vegetation cover. In addition, fewer moose and a shallower lake that is drying in places were additional observed changes. All these major observed changes are linked to participant uses of the land. As one participant noted:

*“Well, climate change has changed our wildlife. No more ducks due to less water. The trapping is becoming less (and) with less game in the lake we have to travel further. Our lake is drying out, there is not enough water”.*

In terms of observed climate impacts, the major observed changes reported include more heavy winds, heavy rainfall and colder winters as well as more thunderstorms. Hot summer weather rounded out the responses regarding observed weather changes:

*“I noticed it’s getting hotter and severe thunder storms during summer. Lots of flooding around the community”.* Another community resident also noted:

*“The weather is unpredictable now, we don’t know how the weather will be. It seems it’s windy all the time, the sun is making it hotter. Winter isn’t coming in slow, it’s all of a sudden; we are the ones affected”*

In Red Earth Cree Nation the major observed changes reported included colder winters, fewer moose, and shallower lake that is drying in places. In the words of one resident:

*“Moose are scarce. The lake seems to be getting shallow and contaminated every year due to the weather change. This has led to reduction in quantity of ducks in lakes & have affected the fishing of walleye.”*

In terms of observed climate impacts, the major observed changes reported at Red Earth Cree Nation include more extreme weather and hot summers. As one resident noted:

*“It’s affecting my trapping because of floods, you can’t trap due to too much water and it’s hard to get to the beaver houses. Also, floods in the spring is about 3 inches of water caused by melting snow or rain”.*

In Hatcher Lake Dene Nation, the major observed changes reported include fewer caribou, hot summer weather, and fewer berries and plants. In the words of a resident:

*“I have noticed that fishing has slowed down due to extreme weather, especially considering that we don’t have as much rain again these days. Also, I have noticed that*

*our evergreen trees in our community are turning brown due to extreme heat due to climate change”.*

In terms of observed climate impacts at Hatchet Lake, the major observed changes reported include hot summer weather as well as sudden, extreme, unstable weather conditions. One community member stated:

*“Hunting, trapping and fishing have been affected. There are visible changes in my community. We witness extreme cold and hot weather which changes suddenly. This has led to illnesses and sometimes sudden deaths of members.”*

Table 4.1: Summary of data on observed Changes

<b>Observed Changes in the Community resulting from climate change</b>			
<b>Themes</b>	<b>SHOAL N=66</b>	<b>RED EARTH N=32</b>	<b>HATCHET N=23</b>
Less Wildlife	8	1	
Fewer Moose	17	5	
Sudden, extreme, unstable weather conditions		4	3
Fewer Caribou			6
Trees dry, dying		2	1
Shallow lake, less water in lake, drying	13	5	
Less plants, berries, trees, vegetation	24	2	3 (blueberry)
Heavy winds	11	1	2
Seasons (timing is changed)	4	1	
Heavy rainfall	8		2 (summer)
Colder winters	10	7	
Hot summer Weather	4	4	4
More thunderstorms/tornadoes	5	2	2

The observed changes as reported by the participants all appear to have occurred within a human lifetime. This signifies rapid change, decadal change, that is noted consistently across the interviews and household surveys.

Table 4.2 shows the observed changes that are most common within each of the three communities. The report of less wildlife including fewer large game animals (moose for Shoal Lake and Red Earth; caribou for Hatchet Lake) is consistently noted for all communities. Also, each community reported fewer plants, berries, and dryer trees and reduced vegetation in general. Heavy winds, shallow lakes, hotter summers and more thunderstorms were also reported as an observed

environmental change in each community. While colder winters were reported in both Shoal Lake and Red Earth (central Saskatchewan) this was not reported in Hatchet Lake (northern Saskatchewan).

Table 4.2: Most common observed changes reported (Top 3)

<b>Rank</b>	<b>Shoal Lake</b>	<b>Red Earth</b>	<b>Hatchet Lake</b>
1	Fewer plants, berries, trees, vegetation	Colder Winters	Fewer Caribou
2	Fewer Moose	Fewer Moose	Hotter summers
3	Dryer, shallower Lake	Shallow Lake	Sudden, violent weather

### 4.3 Personal Impacts (Livelihood, household & community)

This area of analysis aims at uncovering how climate change has affected the livelihood, lifestyle households of the respondents in the three research communities. A series of questions were used to ascertain how climate change is affecting respondent's livelihoods and their households. From the interview responses, 11 themes emerged in this area of analysis shown in Table 4.3.

Table 4.3: Impact on livelihood and households

<b>THEME(S)</b>	<b>SHOAL N=66</b>	<b>RED EARTH N=32</b>	<b>HATCHET N=23</b>
Less trapping	6	20	9
Mould in houses, on walls, ceilings, floors	35	11	5
More Forest fires	9	3	1
Hunting grounds flood, impacts on traditional foods	9	4	
Flooding in house, basements, walls	15	3	1
General flooding in community	9	20	
Less hunting	27	16	14
Personal health impacted by climate	14	10	1
Less fishing	18	15	12
Travel difficult		2	4 (2 wind 2 ice)
Fear of climate change, concern for safety	1	1	2
<b>TOTAL</b>	<b>143</b>	<b>105</b>	<b>49</b>

In Shoal Lake Cree Nation the greatest personal impact reported was mould in homes and cabins, flood waters in homes and in the community as well as less hunting and less fishing. In terms of land-based traditional activities, 60 of the 143 stated impacts reported livelihood impacts including

less trapping, hunting and fishing. Impacts related to high water, including flooding in basements, around homes and in communities were noted in 33 of the 143 stated impacts. A resident of Shoal Lake stated:

*“We have mould inside and outside the house. My house is deteriorating fast due to flooding and heat waves. We also have mice infestation due to poor housing”.*

In the words of another resident:

*“Flooding has caused mould in my house and heavy rainfall runs in windows and the flooring and into front and back doors. High winds will cause drafts and dampness. “*

In Red Earth, the greatest personal impacts reported were flooding in community, less trapping and less hunting. In terms of land-based traditional activities 51 of the total 105 stated impacts reported livelihood impacts including less trapping, hunting and fishing. Impacts related to high water including general flooding in basements, around homes and in the community were noted in 27 of the 105 stated impacts.

A Red Earth resident stated:

*“Climate change has affected our livelihood. We stay in camps from March to July to trap. There are fewer moose and ducks these days unlike in the past due to climate change.”*

In Hatchet Lake Dene Nation, the greatest personal impacts reported was less hunting, less fishing and less trapping. It is noted that all these observed impacts attach to land-based traditional activities. Of the 49 total stated impacts for the interviews, 35 were linked to traditional land use activities.

A Hatchet Lake resident noted:

*“To go hunting we have to go farther North into the North West Territories and Nunavut using snowmobiles, which takes up to a week journey. Also, the winter road is affected across the lake [Wollaston Lake]. It lasts a shorter time and takes a long time to freeze up.”*

The winter road over the lake is the old way in and out of Hatchet Lake by private car and supply trucks during winter months. Air travel is expensive and limited in both service and load capacity.

In addition, of the 121 people interviewed in the three communities 113 persons representing 94.4% of the respondents stated that they have been in one way or the other (livelihood, lifestyle, house and personal) affected by climate change over the years in their environment/communities.

Table 4.4 provides the three most common climate change impacts affecting livelihood. In each community, the common impact of climate change was reported to be loss of traditional livelihood, including fishing, trapping and hunting. In the north, Hatchet Lake reports personal safety whereas Red Earth reports community impacts from fire and floods while Shoal Lake reports mould and basement flooding in homes and cabins.

Table 4.4: Most common impacts (Livelihood, households and community) - (Top 3)

<b>Rank</b>	<b>Shoal Lake</b>	<b>Red Earth</b>	<b>Hatchet Lake</b>
1	Mould in Houses	Less Trapping/Flooding in Community	Less Hunting
2	Less Hunting	Less Hunting	Less Fishing
3	Less Fishing	Less Fishing	Less Trapping

Personal health impacts from climate change were noted for both Shoal Lake (14 stated impacts) and Red Earth (10 stated impacts). There were no state impacts on personal health from climate change reported from Hatchel Lake. However, fear of climate change and difficulty with travel was reported with 6 stated impacts at Hatchet Lake. This is likely connected to danger associated with winter road travel over the lake.

#### **4.4 Mitigation measures against climate change & impacts**

This section will identify the extent to which mitigation measures are being practiced to reduce or prevent the impacts of climate change at home and in their communities. The interview responses led to the emergence of 13 themes related to climate change mitigation ranging from a call for less pollution to reforestation and the use of solar panels (see Table 4.5).

Table 4.5: Summary of mitigation measures data for climate change in communities

<b>THEME</b>	<b>SHOAL</b>	<b>RED EARTH</b>	<b>HATCHET</b>
Reduce pollution/emission: Less mining, industries, pulp mills, less chemicals use, cars use	7	4	8
Reforestation, plant more trees	8		1
Stop cutting trees	3		
Stop litter, keep land clean	3	2	1
Use solar panels	2		
Stop using propane	3		
Prevent forest fires, less burning	2		
Start recycling	4	1	1
Government is cause, they need to change	3		
Less driving, more walking	4	4	
Garbage Collection	3		
Sustainable land development	1	1	
Reduce energy/ Oil & gas use	5	1	
Education, Discussions & Community awareness	10	8	7

There are two notable themes which emerged across all the three sampled communities. The first theme is that in all communities, attention to education and community awareness about climate change was the most common mitigation measure. Presumably, education and community awareness will lead to changed lifestyle habits regarding travel, consumption and other individual and community actions that will lessen the severity of climate change. This theme is something that may be internally controlled within the community. The second theme that is consistently recorded across all three communities is external to community control recommending that industries and other pollution sources (mining, industrial activities, etc.) be reduced on a broad scale to lesson, or slow down, the effects of climate change. Beyond these two themes, there is little that can be compared across all three communities. However, with each community there are some notable results. For example, at Shoal Lake there was a strong response recommending reforestation and the planting of more trees. Also at Shoal Lake there was a strong response for a recycling program and reduction in energy usage such as oil and gas. In both Red Earth and Shoal Lake there was a mitigation response for more walking (and less driving).

On the other hand, further analysis shows that 19 respondents (3 from Hatchet Lake, 8 from Red Earth and 8 from Shoal Lake Communities) out of the 121 people are of the opinion that they don't know what to do towards mitigating climate change and its impacts in their various communities.

#### 4.5 Adaptation measures for climate change impacts

This section will focus on examining strategies by the respondents to adapt to climate change impacts. The result of specific interview/survey questions produced 17 themes as indicated in Table 4.6.

Table 4.6: Adaptation Strategies

THEME	SHOAL	RED EARTH	HATCHET
Gravel around my home, fix drainage	3	1	
Use of wood & woodstove to warm up	2	2	2
Reforestation, plant more trees	8		1
Improved drainage around house	2	5	
Get first aid supplies	2		
Need a safety shelter (tornadoes)	1		
Emergency response plans, Evacuation of people, use of generator, flash lights	9	2	2
Build on higher, drier land	2		
Grow plants inside cleaner air	1		
Nothing I can do that will help	30	17	9
Adding shade around my house, cool inside of house	1	1	2
Hunting	1		
Clean house of mould	1		
Grow food, potatoes, vegetables	5		1
Protective clothing, sun screen			2
Store food and water for any bad weather	2		
Plan with weather forecast before travel	1	4	3

The results shown in Table 4.7 indicate one theme that is consistently reported across all three communities. The adaptation response stating: “*There is nothing that can be done*”, reflects an element of despair or helplessness shared across all three communities. A resident of Shoal Lake stated:

*“I can’t do anything because I don’t have the skills to do the stuff I need to do. I need to put gravel and sand around my house and also insulate my house”.*

From the Indigenous community worldviews, some of the research participants argued that nothing can be done to adapt because that is how Mother Nature wants things to be. One of the participants noted:

*“Personally, I believe that whatever the weather is, is how Mother Nature have put it. What can we do about it?”*

The only other theme represented across all three communities was having an emergency response plan in place in the community to include emergency evacuation and emergency equipment such as a generator and flashlight capability.

With the exception of the most frequent response to this question, the responses vary between each community (see Table 4.7). For Shoal Lake the second and third most frequent response was the need for more reforestation as well as local food production and improved home drainage resulting from floods. A Shoal Lake resident stated: *“We are trying to adapt to what we have today to provide our traditional food”*.

In Red Earth, the second and third most frequent response was improved home drainage from flood waters and improved community awareness. One community member noted: *“Well, I did place some dirt or mud around the house so maybe it can stop some of that water from going into the crawlspace.”*

Last, in Hatchet Lake the second and third most frequent response was the need for more shade protection around homes and to avoid sunburns. More shade needed to reduce intense summer sunshine heating of homes and the maintenance of a travel plan. The travel plan applies to all seasons but especially in winter over the frozen ice road. A Hatchet Lake resident noted:

*“I prepare the younger ones (especially my grandchildren) for the future changes. They wear long-sleeved clothes, wear sunscreen and play under shade to avoid sun burns.”*

Table 4.7: Climate change adaptation measures (Top 3 for each community)

<b>Rank</b>	<b>Shoal Lake</b>	<b>Red Earth</b>	<b>Hatchet Lake</b>
1 <sup>st</sup>	Nothing	Nothing	Nothing
2 <sup>nd</sup>	Reforestation	Improved home drainage	Shade protection
3 <sup>rd</sup>	Grow food/improved home drainage	Community awareness	Travel safety plan

#### **4.6 Most at risk in research communities**

This area of analysis aims at ascertaining the group of people that are most at risk from the impacts of climate change within the case study communities. The research participant’s responses led to the emergence of 8 groups of people, reported as themes in Table 4.8.

Table 4.8: Group reported most at risk from climate change impacts

<b>THEMES</b>	<b>SHOAL</b>	<b>RED EARTH</b>	<b>HATCHET</b>
Elders	46	26	9
Children	17	11	8
Infants, Babies	22	7	6
Pregnant women	5	2	
Hunters, Fishers and Trappers	5		2
People chronic illness: asthma, diabetes & disable persons	12	2	3
Future generations	2	1	1
Everyone	3	1	2

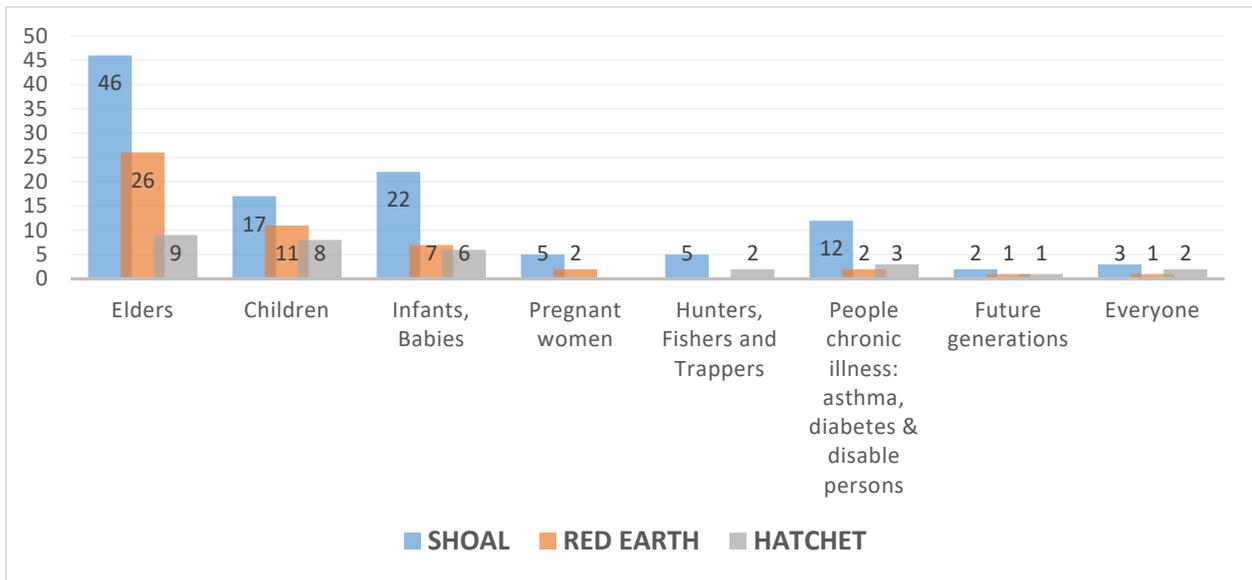
The group of people consistently reported to be the most at risk to the impacts of climate change across the three research communities are Elders. For example, in Shoal Lake, a resident stated: *“Elders are at risk from heat waves and forest fires”*. Children, infants and those with chronic illness were also reported across all the communities as all being ‘at risk’ groups (see Figure 4.1). In the words of a Shoal Lake community member: *“Chronically ill people are at risk from weather change. Elders, and new born babies and asthmatics”*.

A Hatchet Lake community member voiced a concern for personal health and safety:

*“The Elderly are at risk from climate change. Also, I don’t feel safe in my community anymore because there is a lot of cancer patients. Especially skin cancer. People are dying”*.

Individuals with chronic illness such as asthma and diabetes were also reported in all communities as people at risk. This was especially the case for Shoal Lake where pregnant women and traditional land users were reported to be people at risk.

Figure 4.1: People at risk from climate change



## 5. DISCUSSION

In this chapter, the research results will be discussed in tandem with the academic literature on political ecology. The chapter will assess the applicability of political ecology as a theoretical tool to explain why the impacts of climate change are exacerbated in Indigenous communities.

### 5.1. Political ecology and climate change

The majority of the participants (110 persons) have observed significant, impactful, and harmful changes in their various communities as a result of climate change. The observed changes in the communities will be critically discussed in five sub-themes: Community Health; Traditional Culture; Local Economy; Public Safety; Human Adaptation. While these separate categories or sub-themes will be reported separately, it is acknowledged that each does not exist in isolation. For example, a reduction in country food sourcing will negatively impact community health while also negatively impacting the cost of living and cultural practices around hunting and fishing. Climate change impacts in Indigenous communities, as will be shown, is multi-dimensional.

#### 5.1.1 Community Health

Participant observed that they are experiencing less animal harvest and less wildlife population in their various communities. Some respondents in Shoal Lake and Red Earth stated that moose and wild animals such as bears are scarce and have migrated down south into the farms due to constant forest fires, unpredictable weather and lack of berries in the community. Lower water levels in area lakes (Shoal Lake, Red Earth) has impaired local fishing, a healthy source of community food. In addition, participants posited that other animals such as deer, muskrats, rabbits and beavers are now very scarce due to shallow water, flooding and early melting of lake ice respectively – all associated with climate change. These and other species traditionally play a significant role in community diet. Country foods including berries have long provided health sustenance to community members. Hatchet Lake participants stated that the observed scarcity of caribou in their community. They stated that most of these animals have migrated farther north and east, even into the Northwest Territories causing hunters and trappers have to travel for weeks in order to hunt caribou. These participants further claimed that the scarcity of wildlife and country foods, which constitute the major sources of Indigenous food supply, has led to food insecurity. Many hunter reported that they are unable to secure winter food supplies, leading to reliance on processed foods and resultant health challenges such as obesity and diabetes. These observations stated by some the participants aligns with the findings of Furgal and Seguin (2006). These authors report that

many animals have changed their travel/migration routes due to climate change; therefore, making these animals scarce, leading to food insecurity and poor nutrition.

While global climate change, an external force, is driving these changes, the actions of the state through colonization have intensified climate change impacts on Indigenous communities. The 'Indian Reservation' system and the state control of enclosure of Indigenous people has served to limit physical movement of individuals to pursue traditional livelihoods while creating an increasing dependency on industrial food-chain products. Here, political ecology is a useful explanatory tool to answer the question of why Indigenous people are disproportionately impacted by climate change. Where non-Indigenous communities reliant on the industrial food chain have many food availability options and healthy food replacement choices, Indigenous communities are less able to adapt due to physical isolation from commercial food suppliers. The loss of locally accessible country foods necessitates a forced change in the local diet as Indigenous people transition towards high sugar and carbohydrate foods all introducing negative health impacts.

The high incidence of flooded basements and crawl spaces beneath homes in this study is one more example of a negative health impact from climate change directly linked to actions of the state. The mould infestation issues in First Nation's homes is a well-known issues in Canada and has been studied by many scholars. According to Optis et al. (2012), the mould issues in these Indigenous communities is part of the national housing crisis in Canada with respect to First Nations. The 2002/2003 survey by The National Aboriginal Health Organization shows that 44% of 10,616 research participants living in reserve communities testified that they experience mould growth in their various homes (First Nations Centre, 2006). Also Optis et al. (2012) added an example of studies on housing issued carried out in Ahousat First Nation in the central coastal area of Vancouver Island, BC, Canada, where 69% of homes (100 out of 144 homes) in the community experienced mould growth.

The creation of 'Reservations' has resulted in exposure of my communities to flooding and black-mould conditions in reserve housing. Reserve housing, both type and location, is provided by the state with little or no consultation with community leadership or members. Poor health conditions as a result of high water and mould was reported in all three case study communities. Again, actions of the state in creating these reservations along with the choice of housing location has exacerbated this community health problem in the face of climate change.

### 5.1.2 Traditional Culture

From the results of this study it is recognized that climate change is having an impact on Indigenous traditional culture. The reported absence of game animals such as caribou and moose had a direct implication on traditional land use practices. The reduction of hunting opportunities not only impacts Elders and adults accustomed to country food harvesting but will also impact youth and future generations of Indigenous people. Less trapping of beaver and muskrat will have the same affect wherein youth will lose this traditional land use practice and traditional communal activity of local food harvesting.

Fishing was also reported to be impacted from climate change with lower lake levels, flooding, and other climate induced impacts believed to negatively affect fishing.

With respect to the declining traditional knowledge alongside the Indigenous cultural practices due to climate change, the research data shows that these issue manifests in the three research communities in the form of less hunting, fishing and trapping, lack of attention to traditional knowledge, lack of certain cultural activities due to natural disasters and evacuation of community members. For example, a respondent from Red Earth stated: *“Yes, hunting fishing trapping, gathering and camping are affected. We can’t access our traditional area and hunting grounds in North West again due to flooding”*. Also, another respondent from Red Earth believe that *“These days we don’t pay much attention to traditional knowledge, signs of changes in our communities such as animal behaviour and availability”* The respondent went further to recommend that their community should pay close attention to their environment using both traditional and contemporary knowledge to identify signs of climate change impacts in their community.

Based on the unpredictability of traditional knowledge and the declining cultural practices and events due to climate change as mentioned by the respondents, Turner and Clifton (2009) note that Indigenous people of Canada heavily rely on their generations-old knowledge of knowing seasonal resources, the weather patterns, rainfall patterns, snowpack and water nature. However, the impact of climate change have made these features to be less predictable in these communities, consequently, making these community members to rely heavily of enhanced weather technologies instead of their original Traditional Knowledge. Also, Downing and Cuerrier (2011) believes that climate change and weather unpredictability in First Nation’s communities in Canada has led to loss of traditional knowledge, alongside survival skills in case of severe weather conditions among the younger generations, resulting to more injuries and deaths, especially while carrying out

subsistence activities like hunting and fishing. In trying to buttress how climate change affects cultural practices in Indigenous communities, Kornfeld (2017) gave an example - where lack of precipitation (drought) due to climate change forced the people of Ojibwe Bad River Reservation in northern Wisconsin alongside, Fond du Lac Band of Minnesota, to cancel their annual *Manoomin* (wild rice) harvests in their various communities.

We see here that the state endorsed reservation system has created a condition wherein outside forces such as climate change impose significant negative impact on traditional culture. Examining this condition from the perspective of political ecology helps to explain how this condition has been constructed. Political ecology enables a critical theoretical approach to explain how state control and enclosure of a population through the “Indian Reservation” system is contributing to loss of traditional culture in the face of accelerated climate change.

### **5.1.3 Local Economy**

In all three study communities, respondents noted the additional costs (including time) of travel related to hunting country foods. For example, a Hatchet Lake respondent stated:

*“Yes. Mostly hunting. We have to go further north into NWT and Nunavut using Snowmobile, which takes up to a week journey. This is as a result of scarcity of Caribou in the community with.”*

In terms of local economy, Natcher (2009) believes that “mixed (social) economy” is currently being practiced in most Northern Indigenous communities as a result of multiple institutions within these Indigenous communities that carry out a blend of commercial (wages based) and subsistence (non-commercial) activities, which involves both monetary (money transfers) and non-monetary transactions (sharing of native foods with members) that are governed by traditional exchange patterns and norms. Studies shows that the lack of these traditional foods, loss of traditional knowledge and the increased cost and time required to harvest these traditional foods in recent time due to climate change, makes these traditional foods very expensive to harvest. By extension, the local social economy is also negatively affected should there be an exodus of members from these communities (abandoning their culture, cultural practices and environmental knowledge) to cities where they depend on “blue collar jobs” to survive (Norton-Smith et al., 2006).

Other economic impacts include cost of installing air conditioning, flood protection around homes, cost of fire or flood evacuation and the loss of employment due to poor road and transport infrastructure. The reduction in fishing opportunities in Hatchet Lake caused the closure of the local fish plant along with many jobs.

Again, the forced enclosure of Indigenous people on reservations raises the economic exposure of climate change on Indigenous people. The control thesis of political ecology is a useful explanatory tool to help understand this dimension of local impacts on a population.

#### **5.1.4 Public Safety**

Transportation and community accessibility is one of the major impacts of climate change in the three research communities. Some of the transportation issues presented by the various research participants include late formation and early melting of lake ice roads, flooding of access roads, making these road flooded, muddy and swampy; therefore, difficult for cars to access various locations in these communities. For Hatchet Lake community, the participants decried the lack of an all season road and other transportation infrastructure in their community, as they depend on air transportation, waterway transportation using barges in spring and summer or through lake ice roads in winter season. These forms of transportation are seen by the community members as costly and very risky these days due to climate change. According to one the respondents:

*“Our winter (lake ice) roads are affected by climate change, because, it takes a long time to freeze up and only last for a shorter period when compared to the olden day”.* Also, another respondent from Hatchet Lake stated that *“Gusty winds and blizzards are making boat transport across the lake difficult these days”.*

These reports of early melting of the winter lake ice roads is consistent with Golden et al (2015) in a case study of a northern boreal forest community in Ontario, Canada. In that study, they compare the duration, thickness, depth and areas of coverage of blue ice (winter ice roads) They discovered that in the past these lake ice roads starts to form in September/ October and lasts till May the next years before melting (8 months). However, more recently the lake ice roads form late (December) and start melting In March (3-4 months). This issue have affected food and energy security in these communities, because the diminishing winter road in these community considerably creates scarcity of common good and services supplied to the communities via heavy-duty trucks.

In Red Earth and Shoal Lake communities, their major barrier to transportation and movement within these communities include lack of standard road infrastructure and frequent flooding. According to the respondents, these two factors have made transportation within and outside these communities very difficult. For example, a Red Earth respondent noted:

*“The impact of flooding (from the school to the store) was much, to the extent we had to start using canoe to move around within the community”, while a Shoal Lake participant also stated that “Our internal roads and highways (near garbage dump) have been flooded, making them swampy and muddy. This makes movement within the community and outside the community very difficult”.*

The enclosure of these communities vis-à-vis the state ‘Indian reservation’ system has created a condition of exposure to environmental hazards related to public mobility. While these changes are externally driven by global climate change, the state has failed to provide appropriate transportation infrastructure. Again, the fiduciary responsibility of the State toward Indigenous people in Canada has not been upheld. The enclosure of Indigenous people on ‘reservations’ is a place-based, control mechanism; however, the conditions affecting these places is undergoing rapid climate change impacts. One of those impacts is public transportation – thinner lake ice making ice road transportation dangerous, if not impossible. Other changes include flooding of community roads. State-led investment in road infrastructure is now urgently required for these and other Indigenous communities to overcome climate change impacts on transportation safety.

#### **5.1.5 Human Adaptation**

Indigenous adaption measures identified by the three communities in this research include planting more trees, having better emergency response plans, growing their own food such as potatoes and to relying on weather forecast to plan for daily travel.

Table 5.1 summarizes the various Indigenous adaptation measures taken by various community members in this research order to adapt to local climate change.

Table 5.1: Adaptation measures to Climate change impacts in the 3 research communities

Climate change impacts	Adaptation measures to climate change impacts
Health and Safety Impacts	<ol style="list-style-type: none"> <li>1. Stocking up drugs in case of road flooding,</li> <li>2. Cleaning homes and growing plants inside the house to prevent airborne diseases,</li> <li>3. Wearing of long sleeved clothes and use sunscreen to prevent sun burn.</li> <li>4. Heavy reliance on weather disaster emergency kits.</li> <li>5. Making and staying in shades or trees planted in their gardens within their yards in order to protect them and their family from sun burns and heavy rains.</li> </ol> <p>Quote: <i>“I prepare the younger ones (especially my grandchildren) for the future changes. They wear long-sleeved clothes, wear sunscreen and play under shades to avoid sun burns”</i></p>
Flooding and Water security	<ol style="list-style-type: none"> <li>1. Putting gravel, sand bags and mud around homes and fixing drainages to avoid floods affecting the integrity of their houses.</li> <li>2. Erecting high platforms in camps and hunting grounds due to flooding</li> <li>3. Storage of clean drinking water in their homes in case of power outage, weather disaster or flooding which may contaminate their source water.</li> </ol> <p>Quote: <i>“We build higher platforms on hunting/camping grounds to help us adapt to flooding and sleep better”</i></p>
Food insecurity	<ol style="list-style-type: none"> <li>1. Planting of potatoes and other garden vegetables</li> <li>2. Buying of processed foods.</li> <li>3. Harvest enough plants and animal food sources and store in case of any weather disaster in future.</li> <li>4. Reliance on emergency food supplies during disaster</li> </ol> <p>Quote: <i>“we prepare for food, Water &amp; other stuff in case it happens (Disasters)”</i></p>
Housing impacts	<ol style="list-style-type: none"> <li>1. Use of woodstove, air conditioners and fans to heat and cool homes in extreme weather (hot or cold) conditions.</li> <li>2. Building of cabin in case of emergency or disaster.</li> <li>3. Regular home cleaning and maintenance due to heavy rainfall, snow fall and because of the moulds</li> <li>4. Use of generators, lanterns and touch lights just in case of power outage.</li> </ol> <p>Quote: <i>“We bought generators and lanterns just in case we experience power outage”</i></p>
Transportation impact	<ol style="list-style-type: none"> <li>1. Reliance on daily weather forecast before travelling.</li> <li>2. Application of more gravel on our roads.</li> <li>3. Discovering/create alternate transportation routes and methods of transportation in order to move around (use of canoe to move within the communities during flooding )</li> </ol> <p>Quote: <i>“Yes. I go online and check weather daily to know when to go out on the lake or ice”</i></p>

<b>Climate change impacts</b>	<b>Adaptation measures to climate change impacts</b>
Traditional culture and knowledge maintenance and transmission.	<ol style="list-style-type: none"> <li>1. Use of past experiences while preparing for sudden weather change towards keeping their families safe.</li> <li>2. Training their children and grandkids to look after their lands, air and water for the future.</li> <li>3. Frequently studying how older people are adapting to new ways of hunting, trapping and fishing.</li> </ol> <p>Quote: <i>“I do talk to my children to look after the land and water. Generally, all we need is to teach our children and grandchildren to look after the land, water and air”</i></p>

IPCC (2007) notes that a combination of mitigation and adaptation strategies will yield a better result against the impact of climate change. On the other hand Makondo and Thomas (2018) argued for the combined use of Indigenous knowledge with western scientific knowledge. Also, Hanrahan et al. (2014) believes that these identified Indigenous adaptation measures to climate change impacts are short-term measures in order to adapt to the changing climatic condition. However, authors suggest that Indigenous communities should combine short-term measures with long-term climate change adaptation strategies – which involve socio-political advocacy to challenge some of the institutional processes and policies that promote and extend the marginalization of First Nation communities with respect to infrastructure development and decision-making on land use (Lesperance, 2017; Golden et al., 2015; Whitfield, 2015; Hanrahan et al., 2014).

The analytical tool of political ecology extends the utility of climate change adaptation to include institutional adaptation to enable longer-term, systemic adaptation. This is not to suggest the elimination of reservations, unless this is a desire of Indigenous people, but rather to recognize that reservations require sustained funding and innovative programming from the state to adjust to the inevitable impacts of climate change in Indigenous communities. Such programming should include but not be restricted to alternative energy solutions, food security through local food production, food sovereignty initiatives to promote traditional foods, infrastructure funding and community improvements, training in community land use planning, source water protection planning, and more. Capacity building will enable Indigenous communities to adjust and adapt to climate change in the years ahead. Many respondents reported themselves at a loss when it comes to adaptation. They simply reported there was nothing they could do. This should be a call to action for the federal government to put in place adaptation funding and programs for and with Indigenous communities.

## 6. CONCLUSION

This final chapter provides a reflection on the research purpose, research significance as well as recommendations from this research.

In First Nation communities, climate change impacts are exacerbated as they extend beyond the physical (infrastructure and human health) to include socio-cultural factors including traditional medicines, traditional foods (caribou, moose, muskrat, fish), housing conditions and water security. Also, disappearing winter road access has considerably increased the cost of goods and services supplied to these communities and has made living in these communities increasingly difficult and unsafe during certain times of the year.

In this research, political ecology has proven to be a useful tool for better understanding the causes leading to environmental issues. This is consistent with other application of this theoretical approach (Barrow, 1999). According to Neumann (2005), Robbins (2004) and Paulson et al. (2003), political ecology is embedded with theoretical and philosophical roots, hence it can be successfully applied to contemporary and historical environmental issues.

Political ecology has predominantly been applied in the “Third World” to explain that subsistence and low-income people are not responsible for environmental issues they face in their communities. But rather, existing and historical political, social, colonial and economic structures and forces in these “Third Worlds” in the form of international laws and policies, land and water rights, marginalization and trade issues are the root causes of these environmental issues experienced by subsistence communities (Bryant, 1992; Blaikie & Brookfield, 1987). In the more recent literature, a “First World” political ecology has emerged based on increasing cases of marginalization and loss of land use rights due to the ongoing legacy of colonialism and its many institutional structures (Robbins, 2004).

The above scenario depicts the situation and condition of Indigenous people of Canada – whose historical experience with colonialism by the European settlers led to their removal from their traditional lands, forcing them to live in “reservations” with limited economic powers, restricted mobility, interrupted cultural and social practices alongside imposed religion, education and language. Climate change is proving to be an additive, external pressure exerted on Indigenous communities that serves to exacerbate the impacts of climate change.

The enclosure of Indigenous people in Canada on “lands reserved of the Indians” extends the definition of the “control” thesis of political ecology (Robbins, 2004). The reserve system, by its very design and purpose, serves to enclose, concentrate and restrict Indigenous people to a fixed location. Land enclosure by state control has exacerbated the impacts of climate change for on-reserve First Nations in Canada not only on the physical infrastructure in these communities but also on traditional livelihood practices with significant human health consequences.

Members of these, and other, First Nation communities are regarded as ‘occupants’ of federal land. Hence, since colonization Indigenous people have largely been excluded from decision-making regarding the location of reservations, location of residential buildings, building materials, roads and community access, health and social service provisions. While the state holds a fiduciary responsibility over these forms of land use planning and infrastructure services, the quality and maintenance of such infrastructure is a source of concern in many First Nation communities (Baijius and Patrick 2019; CIER 2006). Political ecology, specifically the ‘control thesis’ of political ecology, helps to explain how the absence of First Nation’s control and participation in decision-making has inflicted negative impacts on traditional food supply, raised water insecurity, flooding damage to homes and mould damage, wildfire impacts, and many forms of unsafe travel conditions.

The impacts of climate change may be seen as the outcome of a power imbalance where land enclosure from the “Indian reservation system” has concentrated the impacts of climate change as well as limited opportunities for community and individual adaptation. In addition, the impacts extend beyond the physical (infrastructure) to include more significantly, human health as well as cultural and traditional livelihood impacts.

## **6.1 Research Recommendations**

It is recommended that further research that uses an approach from political ecology be conducted with Indigenous communities across Canada. Such an approach will both contribute to the political ecology literature and also help to better understand the impacts of colonization on Indigenous people in Canada and beyond.

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## 8. APPENDIX A

### INTERVIEW QUESTIONS

1. Has your livelihood (hunting, fishing, trapping, etc.) been affected by climate change (weather change)? Please explain.
2. Have you seen any changes in your community that were possibly caused by weather change? Describe.
3. Has your house or cabin ever been affected by weather change?
4. Have you ever been affected personally by climate change? How?
5. Have you ever been in any danger from a weather change event?
6. Are you doing anything at home, or on the land, to adapt to weather change?
7. What do you think is causing weather change?
8. Is there anything that can be done to reduce the impacts of weather change?
9. Who can you contact to get more information about climate change?
10. Who in your community is most at risk from weather change?
11. Do you feel safe in your community with weather change?
12. How can your community respond to these weather changes?
13. What changes do you expect to see in your community with future weather changes?
14. Do you have any ideas, suggestions as to what climate change should include?