In 2007, CIER conducted research on climate change impacts and adaptation to help First Nations begin adaptation work. Funding was provided by the Indian and Northern Affairs Canada climate change program area. This is a summary of a larger report of the same title.
When we talk about climate, it not only means temperature but also includes rain or snowfalls, humidity, dryness, storms, and winds. Climate fluctuates and a certain amount of climate variability is normal for a region. For example, one area may be wetter in some years but drier in other years, with the average amount somewhere in between these ranges. When there is a change in the long-term weather patterns that a region normally experiences, this is called "climate change." Many prefer the term climate change to global warming because it includes all changes that can occur, such as different precipitation amounts, cloud cover, and winds patterns, in addition to temperature. It is normal for the climate to change over 1,000s of years, but over the last few decades, the climate, including variability from year to year, has been changing too quickly.

The source of climate change includes some natural causes but it is very likely that it is largely attributed to human-induced causes. Human activities have been contributing to climate change due to the release of greenhouse gases. Greenhouse gases are found naturally in the atmosphere. When sunlight is reflected off the earth’s surface, these gases act like a blanket to block reflected sunlight so it returns back to heat the planet. This process is essential in keeping our planet warm enough for life to exist, but if that ‘blanket’ gets too thick, it can increase the temperature to uncomfortable levels. This ‘blanket’ has doubled since the 19th century.\(^1\)

Human activities that have released greenhouse gases include burning of fossil fuels (e.g., coal and gasoline), burning and clearing of forests, and decomposing vegetation in hydroelectric dam reservoirs. Warmer global temperatures will change many things including the way the ocean currents move, how much ice melts at the poles, and which species will survive in certain regions.

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**Glossary**

**WEATHER** – the conditions of the day like hot, cold, sunny, or raining

**CLIMATE** – long-term (averaged over 30 years) weather patterns that are typical of a region

**CLIMATE VARIABILITY** – the change in weather patterns from year to year

**CLIMATE CHANGE** – Changes to long-term (averaged over 30 years) weather patterns

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**First Nation South of 60 and Ecoregions**

To help identify impact priorities for First Nations in Canada, CIER looked at common climate change impacts within ecological regions. First Nations within the same ecological region are more likely to share similar challenges from impacts.

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First Nations, along with other Aboriginal and northern communities, will likely be one of the most profoundly impacted populations within Canada by climate change. Given the diversity of ecosystems, vulnerabilities and social, economic and cultural characteristics of First Nations across Canada, it is important that each First Nation determine how they will be uniquely affected by climate change. Once First Nations south of 60 degrees latitude have identified potential impacts (using existing scientific information, Indigenous Knowledge and local realities), they will need to prepare and implement adaptation projects to reduce their vulnerability. Proactive adaptation measures can decrease the magnitude of future stresses, reduce the amount or intensity of stress felt by the community and be less costly over the long-term when compared to reactive measures.

If First Nations are not aware of how their community may be affected, then they can begin this dialogue by using the five priority impacts identified by CIER. This report summary outlines the five priority impacts as well as potential adaptation strategies and tools that First Nations can use to begin adapting to these impacts. We also present summaries of three case studies that highlight existing adaptation projects.

**IMPACT ONE: CHANGES TO ICE DUE TO WARMER WEATHER**

- Changes to the timing of freeze-up and thaw; often the fall freeze-up occurs much later and spring thaw occurs earlier than it has in the past
- Changes to the length of the freeze-up period; areas with continuous freeze-up period now experience intermittent thawing
- Change in the thickness of the ice throughout the winter; thinner ice intermittently or for the whole season

**Likely Vulnerabilities/Sensitivities in First Nations**

- Decreased safety on the land for people travelling between communities or for subsistence activities
- Resulting decrease in cultural subsistence activities and loss of Indigenous Knowledge and the associated traditional language about these practices
- Decreased health of First Nations who rely on wild foods, as they will be forced to purchase more market foods
- Negative social impacts by decreased ability of First Nations, who rely on ice and snow for transportation, to travel to other communities
- Increased costs of transporting goods (housing supplies, food, fuel) by air or barge due to shorter winter road season

**Adaptations**

1) Develop community communication networks (hazards mapping; monitoring community trails, etc)
2) Develop land camps to strengthen Indigenous Knowledge, maintain traditional skills and values
3) Build and maintain more cost intensive winter roads that will extend their seasonal life, such as the construction of permanent stream crossings
4) Extend airstrips in remote communities to accommodate larger planes to address a shorter road access season

**Case Study**

**Silaup Aistjpallianinga Project**

Changes in snow and ice will affect many First Nations south of 60. Implementing a monitoring program to record these changes may be a key step. The Kativik Regional Government (KRG) in northern Quebec, along with six Nunavik communities, developed working on an ice-monitoring program. Because the communities are only accessible by plant or boat (in the summer) the winter trail networks connect the communities, allow residents to travel to other villages and provide access to harvesting grounds. The project aims to identify the specific conditions under which ice becomes safe for travel and predict the potential changes that might occur along the trail networks within Nunavik.
**IMPACT TWO: CHANGES TO WATER QUANTITY AND QUALITY**

Changes in water quantity:
- Declining water levels in lakes and streams due to factors such as increased temperature, decreased snow cover, and receding glaciers
- Increased water quantity in some areas from increased precipitation and sea level rise

Decrease in water quality:
- Damage to water reservoirs to thawing permafrost
- Contamination of freshwater sources from storm surges and sea level rise on the coast, flooding, and extreme weather events in other areas
- Increased concentrations of contaminants (such as PCB’s, heavy metals, mercury, pharmaceuticals, and pesticides), nutrient additions (from agriculture and wastewater) and water borne diseases due to declining water levels and increased temperatures

Likely Vulnerabilities/Sensitivities in First Nations
- Negative affects to water quality from climate change will exacerbate existing water problems in First Nations
- Increased costs to obtain quality drinking water through either enhanced water treatment infrastructure or outsourcing drinking water, which would be intensified in Northern communities
- Negatively impact First Nation cultural uses of water such as subsistence harvesting of traditional foods and medicines or ceremonial practises

Adaptations
1) Protect and manage source water
2) Improve water conservation to decrease total water consumption through conservation initiatives, public education programs, and water-costing mechanisms
3) Initiate wetland conservation, protect and re-vegetate riparian zones
4) Incorporate climate change impacts when planning or designing sewage and water and treatment facilities; use higher levels of wastewater treatment (from primary to secondary or tertiary levels); implement more stringent water treatment guidelines
5) Water management using a watershed approach

**Case Study**

**Drinking Water Safety and Source Water Protection**

Our research indicated that First Nations should expect climate change to exacerbate current water issues in First Nations communities. Projects in Driftpile Cree Nation, Alberta, and Yellow Quill First Nation, Saskatchewan, both had water quality problems in their communities. Driftpile Cree Nation established a new water treatment system and developed a First Nation’s handbook on source water protection. Yellowquill First Nation, changed the source from a creek to an area of higher flow and ground water sources, as well as establishing a new water treatment system.

**Useful Guide - Developing a Municipal Source Water Protection Plan**

**Useful Tool - Drop by Drop: Urban Water Conservation Practices in Western Canada**
http://www.highriver.ca/LinkClick.aspx?link=DropbyDrop150.pdf&tabid=443
**IMPACT THREE: CHANGES IN ANIMALS BEHAVIOUR / LOSS OF KEYSTONE SPECIES**

Climate change will affect animal behaviour by altering the location and timing of life cycle events such as migration and reproduction (e.g. calving or spawning). As animal species respond to these environmental changes, this transition may result in decreased species’ health (increases in diseases or physical abnormalities), safety (due to unsafe land) and survival (effects on birthing or survival of young, unavailable food source). As animals and plants respond to the changing environmental conditions, this could lead to a loss of keystone species in ecoregions.

**Likely Vulnerabilities/Sensitivities in First Nations**
- Decreased health or loss of plants and animals in areas previously accessed by First Nations
- Negative impacts to culture: loss of knowledge about certain animals and plants, landscapes, and waterways, and the language associated with these practices
- Loss of food security for First Nations who rely on wild plants and animals for food and medicine and decreased health of First Nations who will have to depend more on store-bought foods
- Safety issues for First Nations if more dangerous animals move into areas used by First Nations
- Loss of economic opportunities such as ecotourism and guiding or outfitting

**Adaptations**
1) Habitat or species conservation; conserve or restore migration corridors; minimize landscape fragmentation
2) Change regulations to sport and commercial fishing, such as catch-and-release only, to decrease allowable catch or establish moratoriums on some fish
3) Build on social networks; share wild foods with community members (Elders, disabled people); develop food / freezer co-op in community
4) Ensure healthy diet transitions for First Nations who need to switch their reliance on wild foods, completely or partially, to market foods

Keystone species have a much larger impact on their ecosystem than would be expected based on their abundance or population. Even though they may be rare in numbers, a keystone species’ presence is vitally important and its disappearance may cause shifts in its environment. This is because many other species will rely on a keystone species for their continued survival and support.

**Useful Tool - Community Food Security Resource Kit**
[http://permanent.access.gpo.gov/lps6620/resoukit.htm](http://permanent.access.gpo.gov/lps6620/resoukit.htm)
IMPACT FOUR: INCREASE IN FREQUENCY AND SEVERITY OF EXTREME WEATHER EVENTS

Scientists predict that extreme weather events such as storms (wind, ice, thunder, and snow), floods, and droughts will occur more intensely and more often than has occurred in the past.

Likely Vulnerabilities/Sensitivities in First Nations
- Increased costs to respond to the weather events (snow removal and clean up of debris) and replace or repair damaged goods
- Loss or damage of infrastructure and property (on-reserve buildings, boats, equipment) including culturally important infrastructure such as cabins or other buildings along traplines; potential loss of important cultural sites
- Increased frequency of service loss (hydro, gas, telephone) and closures (road, business, school)
- Stress on emergency services, such as hospitals
- Heightened risk to human and animal life
- Loss of opportunities to engage in traditional or subsistence activities due to increased unpredictability and decreased safety
- Loss of economic opportunities in areas such as tourism, forestry, fishing, or agriculture

Adaptations
1) Incorporate the potential for extreme weather events in land management
2) Redefine construction standards for zoning, planning and building codes (e.g. move buildings and infrastructure out of flood prone areas)
3) Plan for emergency preparedness
4) Build network of cabins to provide shelter for hunters and travellers that get caught in extreme weather events
5) Use larger, more powerful sea-worthy boats and snowmobiles for harvesting and transportation
6) Install storm retention ponds in the storm drainage network for extreme rain; or use silt fences, tarping soil, and fill stockpiles to help minimize damage from storms

Case Study

Seabird Island Indian Band - Emergency Preparedness

Emergency preparedness can help First Nations meet the challenges posed by a number of climate change impacts, including those priority impacts identified through this project. This is especially true for increased frequency and severity of both extreme weather events and forest fires. Seabird Island First Nation, British Columbia, utilized emergency preparedness to meet challenges posed by increased flooding. Part of the Seabird Island plan includes educating community members on what they need to do in the case of a flood. Six emergency response pamphlets are available for download on the Seabird Island website to assist in this process. The band has tasked the Seabird Fire Department with distributing this information to the membership.
IMPACT FIVE: INCREASED FREQUENCY AND SEVERITY OF FOREST FIRES

Forest fires are predicted to increase in frequency and severity due to warmer winters, increases in extreme weather, increases in frequency and severity of drought, and increased presence of dead trees due to insect outbreaks (such as mountain pine beetle and spruce budworm), which is also predicted to increase due to climate change.

Likely Vulnerabilities/Sensitivities in First Nations
The majority of First Nations live in forested areas. These sensitivities would apply for First Nations during both their time in the communities and out on the land.

- Increased risk to human lives
- Higher costs of evacuation
- Greater human stress
- Increased damage to infrastructure within the community or on traditional territories
- Higher costs to replace or repair this infrastructure.

Adaptations
1) Develop an emergency preparedness and evacuation plan; substitute existing ‘high risk’ recreational sites for different areas to reduce potential threats to human life
2) Improve fire season readiness: build fire breaks around communities; forest fire training for local crews, and sufficient and operable equipment
3) Incorporate traditional or natural disturbance-based forest management practices, such as controlled burns, to decrease the likelihood of larger more intense forest fires
4) Select species and genetic varieties of trees that are more water efficient or more fire resistant. Trees that cannot survive in a warmer drier climate will die and the increased abundance of dead trees will increase the probability of forest fires.

Useful Guide - Steps in Developing an Emergency Plan

Useful Tool - Community Emergency Planning, Response, and Recovery
http://www.pep.bc.ca/Community/community.html

Useful Guide - A Participatory Guidebook for Community Risk Assessment and Risk Reduction Action Plan

Useful Tool - Community-based Vulnerability & Risk Management Toolkit
http://www.climadapt.com/tools.html
GENERAL ADAPTATION

CIER developed this category to include strategies that apply to multiple impacts. These general adaptations are:

1) Undertake comprehensive community planning that incorporates future climate change impacts in the development of the plan, its implementation and decision making
2) Strengthen informal social networks to adapt to increased uncertainty in environmental conditions when carrying out subsistence activities
3) Undergo hazards research to determine priority hazards in the community
4) Increase energy security and opting for renewable energy sources
5) Increase economic diversification
6) Increase or obtain insurance
7) Initiate climate change monitoring programs

CIER reached out to First Nations directly to learn what communities are doing to adapt to climate; despite our efforts we may have missed some very exciting work that is happening in First Nations. We are interested in hearing and sharing your stories about any projects or strategies that communities have or are completing so that others may learn from your experiences!

The following documents provide additional information to the topics presented in this summary document. They are available on the CIER website (www.cier.ca)

Appendix 1 National and Regional Maps
Appendix 2 Adaptation Network Survey and Results
Appendix 3 Impacts and Adaptation Tables
Appendix 4 Case Studies and Tools