Black River First Nation

A Decade of Climate Change Monitoring

2012-2023

Authors: Jack Johnson and Bob Austman

Featuring: Grades 9 and 10 Science Students

Black River Anishinabe School

Black River Elders and other community members

The climate change monitoring projects described in this document would not be possible without the cooperation and support of:

: *Black River First Nation Chief and Council*

: Past Principal Ron Head, Black River Anishinabe School

: Principal, Larry Sharpe, Black River Anishinabe School

: Teachers, Arokia Deivanayagam (Raja) and Kevin Peden

: Multi-years of Grade 9 and 10 Science students

: Canadian Indigenous Relations & Northern Affairs Canada (CIRNAC)

: Dr. Brian Kotak – Miette Environmental

: Many Others too numerous to list

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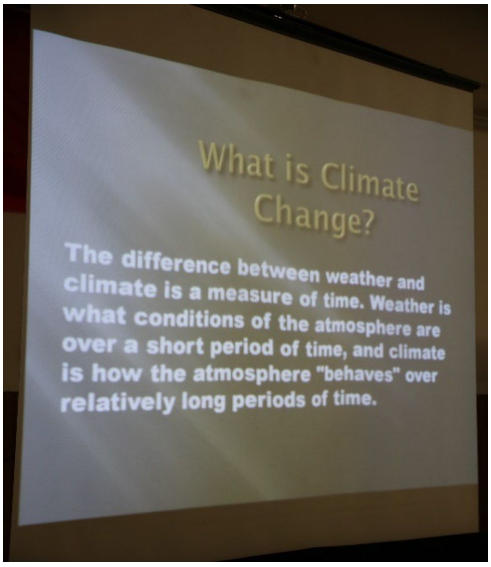
About the Black River First Nation and Our Climate Change Monitoring Activities

The Black River First Nation is situated at the junction of the Black and O'Hanly Rivers on the East side of Lake Winnipeg. The closest urban center is Powerview/Pine Falls approximately 40 Km. to the south and neighboring communities of Hollow Water First Nation and the hamlet of Manigotagan, Mb. located approximately 40 Km. to the North.



The Black River First Nation community is very close to the environment and have traditionally depended on what it offers for medicinal and food supplies. Although the days when they were solely dependent on hunting, fishing and gathering medicinal plants for their survival are disappearing, there remains a fairly large dependency on their traditional rights to continue with these activities for subsidizing their supply of food and medicine.

Black River First Nation has participated in numerous climate change monitoring projects since 2012 and is still involved in climate change monitoring projects with the Grades 9 and 10 from the Black River Anishinabe School. The First Nation is situated on the southern edge of the Manitoba Boreal Forest and is a gateway to a large area that can be and has been adversely affected by climate change.

This document is a summary guide to most of the climate change monitoring and related projects that the Black River Community has been involved with since 2012. Our first Climate Change Monitoring Project was started in 2012. It was titled Vulnerability/Risk Assessment and Development of Strategies in the Face of Climate Change in Black River First Nation, Manitoba: A Community Approach

This project involved a core group made up of Elders, Youth and other community members and some speakers from the scientific community. We realized that inviting community Elders to the workshop first and listening to their stories about what they have witnessed and experienced in regards to climate change and its affects over their lifetime, was very beneficial. By bringing in the Scientific community first, it is quite often a perception that they are telling the community members what they should believe. With the Elders and other community members able to talk about their experiences with climate change first, they were quite open and created a great atmosphere for discussion.

The original "Core Group" in our first Climate Change Monitoring Project

This project turned into a 3-year study on monitoring climate change and really got the community interested in pursuing the studies on climate change even further.

Among the outcomes of this 3-year project was the development of a document authored by Cindy Pierce and supported by Manitoba Model Forest organization titled "Pathways to Resilience". There was also an Emergency Response manual developed for the Black River First Nation community. The interest in climate change and how to mitigate the effects of climate change was the most important outcome of the project.

In year 2 of this project, Cindy Pearce, Owner of Mountain Labyrinths Inc., once again hosted the discussions with our core group of community members (Elders, youth, and others), Stan Kaczanowski, Fire Smart consultant, did a presentation on wildfires and how to make a community "Fire Smart" as the risk of a wildfire due to drought conditions caused by climate change, is very high in Black River. Brian Kotak, General Manager, Manitoba Model Forest, emceed the workshops and provided his knowledge and expertise throughout the project.

Participants identified many environmental and community impacts experienced already. These include:

• thinner ice on rivers and lakes, and a much longer ice-free period throughout the year (making trapping more difficult and winter transportation more dangerous);

• more frequent and intense rain storms (leading to flooding of ditches and roads in the community, overflow of the community's sewage lagoon to the O'Hanly River, and more turbidity in the river – potentially leading to higher drinking water treatment costs);

• more frequent incidents of freezing rain in the fall and winter (making transportation very dangerous);

• higher winds and more frequent wind storms (causing water to back up from Lake Winnipeg into the Black and O'Hanly rivers – leading to significant loss of land from bank erosion);

• outbreaks of spruce budworm (and resulting death of large areas of forest around the community – creating a significant fire risk);

• changes to wildlife populations (impacting community access to traditional foods);

• more frequent wildfires in the region (causing evacuation of the community). In one case, a wildfire burned across the only road into the community, cutting off their evacuation route for a period of time.

The future projections for climate in BRFN's traditional area (based on several GCMs used in Phase I of the project) include further increases in daily average temperature in all seasons (including increases of up to 7.5° C in winter by 2080).

Precipitation is also predicted to increase, and more frequent and more intense storms are anticipated.

Jack Johnson, Oral Johnston, Cindy Pearce and Dr. Brian Kotak

As with Phase I of the project, Phase II will continue to engage the community by working with a core team of community members. This is the same team of community representatives that was established in Phase I. This team represents a cross-section of community members, including Elders and youth, and was very effective at working together to identify climate change impacts, risks to the community, vulnerabilities of the community and priority actions to take with respect to climate change adaptation.

Community feasts, also part of the project, will highlight the project in the whole community. In Phase II this engagement will expand to include the Nation's leadership and staff through participation in core team workshops and specific activities designed for these individuals.

Also, as in Phase I, the community continued to use the draft guidebook ***"Pathways to Climate Change Resilience – A Guidebook for Canadian Forest-Based Communities"***– referred herein as the Guidebook, as a basis for the whole process of developing adaptation strategies that can be pursued in the community. The guidebook was developed by the Canadian Model Forest Network and was based on a framework for assessing the vulnerability of forest-based communities to climate change, developed by the Canadian Forest Service (Williamson et al., 2007). Following Phase III of our project, the guidebook will be revised based on the experience of this pilot project.

PROJECT OBJECTIVES

The project had an overall goal of mainstreaming climate change information throughout the community to ensure that Black River First Nation has the knowledge, skills and tools to become a climate-resilient community. This was accomplished through the following project objectives:

1. To strengthen community capacity and create regional First Nations climate change adaptation expertise by educating and providing for two-way knowledge exchange on the current and future climate change-related risks to, and adaptation strategies for BRFN.
2. To develop tools that better enable BRFN to adapt to climate change. These tools include: a Preparedness Plan, communication materials (brochure, poster, information for the community's website) for preparedness and response, and a Community Wildfire Protection Plan.
3. To conduct an assessment of shoreline erosion in cooperation with community members and create an action plan that can be used for future shoreline protection initiatives.

4. To continue to pilot the draft community guidebook "*Pathways to Climate Change Resilience: A Guidebook for Canadian Forest-Based Communities"* and to provide feedback to the Canadian Model Forest Network on potential revisions to the guidebook.

METHODOLOGY

Objective 1: Community Capacity and Climate Change Expertise

As with Phase I, the current project utilized workshops with a community core team (involving 15 to 20 individuals, representing a cross section of community members, including Elders and Youth) as well as community feasts to engage and inform the community. In Phase I, the community core team was made up of BRFNs Traditional Area Advisory Committee (mainly Elders), youth and other community members with an interest in climate change. In Phase 2, we found it very beneficial to have the same core group of community members engaged throughout the entire process. This enabled the process to maintain momentum (by not having to re-introduce concepts due to new people attending the workshops) and created a core group of community members with expertise in climate change adaptation. This was the main mechanism to support Objective 1 (building community capacity and creating climate change adaptation expertise in the community) in this phase of the project. Workshops were conducted with the core team around specific topics (identified below).

In Phase II the BRFN leadership and staff were included in key portions of the workshops with the core team, and specific activities were held with these individuals at the end of each workshop to share the findings of the core team on an ongoing basis.

Workshop 1. Day 1. A one-day workshop was held at the beginning of Phase II of the project. The purpose of the workshop was to provide a refresher for the core team on the activities and outcomes of Phase I of the project, and an introduction for the leadership and staff. This included a review of the regional climate profile (past, current and future climate projections), impacts identified by the community, priority areas for action, and adaptive capacity assessment. The workshop was facilitated by the Guidebook Author (Cindy Pearce, who was the lead consultant in Phase I) and our Fire Smart Consultant (Stan Kaczanowski). A second day of the workshop (see Objective 2 below) focused on preparedness and wildfire protection.

Stan Kaczanowski - Fire Smart Consultant

Workshop 1 occurred in May 2013. Two days of preparation were budgeted for the Guidebook Author and Fire Smart Consultant, in addition to the 2 days for Workshop #1.

Additional workshops were planned with the core community team. While these

workshops all contribute to meeting Objective 1, they are described below in the most relevant (appropriate) objective.

Objective 2: Development of Preparedness and Response Plan, Communication Tools and Community Wildfire Protection Plan

Workshop 1. Day 2. The second day of workshop #1 provided an interactive and participatory process for learning about preparedness and by reviewing preparedness plans from other communities. Breakout groups of the core team identified preparedness and response processes/procedures already in place in BRFN and developed ideas for new procedures, as well as methods of communicating such ideas (e.g., brochures, website, posters, etc.). The session will be facilitated by the Guidebook Author with expertise from the Manitoba Emergency Measures Organization and Manitoba Native Fire Fighters Association.

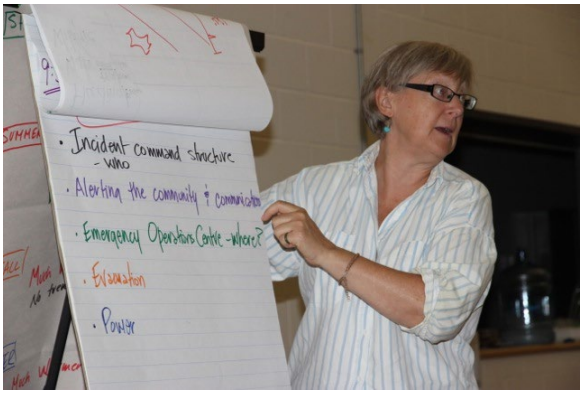
In the afternoon, the core team learned about methods for reducing a community's exposure to wildfire (using examples from other communities), and discussed how these examples apply to their community. The core team and relevant staff identified wildfire risks in and around the community and options/methods to reduce risks. The risk to wildfire was identified by the Community Core Team in Phase I of the project as one of the most significant risks to the community, and it is thought that this increased risk can be directly attributed to climate change (through increases in temperature, increased severe storm activity [e.g., lightning] and through climate-mediated spread of forest insect and disease outbreaks [e.g., spruce budworm], resulting in increased flammability of the forests surrounding the community). This was facilitated by the Fire Smart Consultant.

Workshop 1 closed with a community feast where core team members and facilitators reviewed the day with the larger community. Lunches for the 2 days of the workshop, as well as honoraria for the community core team members were budgeted for.

Develop Draft Preparedness and Response Plan and Draft Communication Products

The Guidebook Author took the ideas generated from the first workshop, along with information available from other community preparedness and response plans, and developed a draft plan for the community, with input from the Manitoba experts.

The Guidebook Author also developed draft communication tools identified by the core team and staff (e.g., brochure, poster, section for BRFN website, etc.). These activities occurred from July to September 2013.



Cindy Pearce - Leading the discussion

Develop Draft Community Wildfire Protection Plan. Using information gathered during Workshop #1, as well as information available from other regional data sources (e.g., forest inventory maps, spruce budworm tree mortality maps, etc.), the Fire Smart Consultant developed a draft Community Wildfire Protection Plan outlining the actions households and the BRFN can take to reduce wildfire risks. The task was budgeted for ten days and occurred between October and November 2013.

Workshop #2. A 2-day workshop was held with the community core team and relevant staff to review the draft Preparedness and Response Plan, draft preparedness communication tools and the draft Community Wildfire Protection Plan. The core team identified necessary revisions.

BRFN leadership joined the core team and staff at the end of the workshop to review the outcomes. The workshop was facilitated by the Guidebook Author and the Fire Smart Consultant. A community feast was held to highlight the draft plans and communication materials (and provide another mechanism for potential revisions). The workshop and community feast were held in early December 2013. The community core team also discussed next steps for the final phase of the project (Phase III).


Workshop Group just before Christmas

Revision to Preparedness and Response Plan, communication products and Community Wildfire Protection Plan. The Guidebook Author and Fire Smart Consultant revised the 2 plans and communication products based on the recommended revisions identified by the community core team in Workshop #2 and comments received at the community feast. Two days were budgeted for this process, for each consultant. The revisions will be done in January or February 2014.

Workshop #3. A final workshop was held with the community core team and relevant staff to review the final version of the Preparedness and Response Plan, preparedness communication products and the Community Wildfire Protection Plan. The team discussed options for implementing the various components of the plans. The workshop was facilitated by the Fire Smart Consultant only. The workshop occurred in mid March 2014. A report, summarizing the 3 workshops and outputs from the workshops was developed.

Objective 3: Shoreline erosion assessment and action plan. A consultant with expertise in shoreline erosion was contracted to lead this aspect of the project. This consultant trained up to three youth to assist with the assessment (by ground and by boat) along the Black and O'Hanly rivers in the community. The assessment identified areas of active erosion, potential erosion and stable shoreline. A report was produced, documenting the assessment results, identifying potential community impacts and providing initial recommended actions and potential funding sources to reduce erosion and strengthen community resilience to shoreline erosion impacts. The training and assessment work was carried out in the summer of 2013, and was anticipated to take 4 days to complete. The consultant's report was reviewed at Workshop #3 by the community core team and relevant staff.

Objective 4: Provide feedback to Canadian Model Forest Network on Community Climate Change Adaptation Guidebook.

Comments and suggested revisions were compiled throughout the workshops of Phase II of the project, and will be provided to the Canadian Model Forest Network in March 2014.

Students were deeply involved in discussions!

Dr. Brian Kotak, General Manager of Manitoba Model Forest

Phase III of the Project

This project covered 3 years. BRFN submitted a proposal in 2014 for the final year of the project (2014-15). Activities which brought the project to completion included developing a Wildfire Protection Plan for BRFNs proposed 600 lot cottage subdivision (The community has already negotiated an agreement on cottage development with the Province of Manitoba and started building a road into the proposed cottage area), hosting workshops and community meetings to build climate change adaptation into BRFNs strategic community plan, and to host a regional workshop in which BRFN will share experiences with other communities (both Aboriginal and non-Aboriginal) on how to develop climate change adaptation strategies.

COMMUNITY ENGAGEMENT

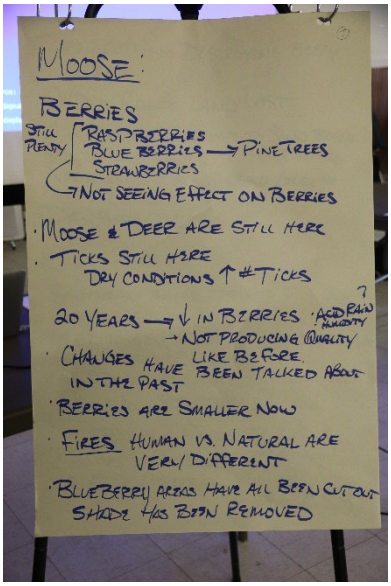
As mentioned in the previous sections, the project utilized workshops with a core team of community members, and relevant BRFN staff and leadership. This ensured consistent participation throughout the project (as was experienced in Phase I of this project). In addition, 2 community feasts were planned, which provided a

venue to highlight and discuss the various aspects of the project more broadly.

Various plans (Preparedness and Response Plan, Community Wildfire Protection Plan) and communication tools (brochures, posters, website postings) were also developed to provide further information on various aspects of the project. Outputs from Phase II of the project (e.g., plans, shoreline erosion report) and Phase I of the project (e.g., climate change projections, identified community impacts, priority actions) were used in Phase III of the project to develop a community strategic plan that mainstreams climate change adaptation.

DELIVERABLES

There are many deliverables from the project. These include both community-level and regional/national deliverables, as well as project-specific deliverables.



There are many and varied aspects to climate change monitoring

At a community level, the project:
• created a greater understanding and awareness among BRFN community members, staff and leadership of climate change, its potential impacts and how the community can become more resilient to these changes;
• identified risks to the community of wildfire
• strengthened community preparedness and response to situations resulting from a changing climate, and other causes; and
• identified shoreline erosion risks with potential actions and funding sources to address these risks.

At the regional and national levels, the project:
• developed a pool of BRFN community "experts" in climate change adaptation, that could assist other indigenous communities in the future development of adaptation strategies;
• increased awareness about climate change adaptation and strategies to reduce risk/vulnerability amongst regional First Nations and non-aboriginal communities; and
• tested/piloted the draft guidebook "*Pathways to Climate Change Resilience – A Guidebook for Canadian Forest-Based Communities*" and made recommendations for revisions as a regional and national resource.

More specifically-defined deliverables for the project include:

- A summary document of the workshops held and their outcomes
- Preparedness and Response Plan
- Communication products focused on preparedness and response
- Community Wildfire Protection Plan

- Shoreline erosion assessment and report
- Final project report and financial report

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Climate Change and How it Affects Individual and Community Health.

Health Climate change is an important factor in the health of the environment but also to individual and community health and safety! We believe we must recognize, mitigate and adapt to climate change as much as possible and as soon as possible.

Core group hard at work!

PLAIN LANGUAGE SUMMARY

Black River First Nation (BRFN) is a community located in the boreal forest of eastern Manitoba. Our community Elders, hunters, trappers and other land users have observed changes in climate over the last 50 years. Many of these changes are already having impacts (e.g., forest fires, flooding and erosion, tornadoes) on our traditional area, and community health, wellness and safety. From 2012 to 2015, we conducted a community-led project (with funding from INAC's Climate Change Adaptation Program) to conduct a vulnerability and risk assessment of climate change on the community. With the assistance of the Manitoba Model Forest (MBMF-non-profit organization located in the region) and using a climate change resiliency guidebook for forest-based communities (produced by the Canadian Model Forest Network), we completed a process to:

document community observations on changes in climate and how those changes translate into impacts on the community

model future climate predictions for the region (with the assistance of Natural Resources Canada)

assess future risks to our community

develop and prioritize actions to reduce risk to the community.

As a result of this project, several actions to reduce risk to the community have already been completed, including development of an emergency preparedness and response plan, upgrades to the drinking water treatment plant, conducting a shoreline erosion assessment and development of Fire Smart plans. The project has made a positive impact on our community, created a significant amount of awareness of climate change, and assisted in our "climate preparedness". However, some aspects of the impacts on community health were not addressed and this is what this project was focussed on.

This project conducted a vulnerability and risk assessment with respect to the impacts of climate change on community health, using the same process conducted in our previous project. Health was only a small

part of the previous project, and is the focus of this new project. A Core Team of 20 Elders, youth, hunters, trappers and band employees (health department, Chief and Council) formed the community-based project team. Some of the Core Team members from our previous project provided continuity to the process, as well as a mechanism to mentor new participants. Through a series of 4 workshops in the community (from May 2017 to March 2018), the Core Team learned more about the science of climate change (with the involvement of the Prairie Climate Centre, which is a collaboration of the University of Winnipeg and International Institute for Sustainable Development-IISD), through climate change modeling and predictions for temperature and precipitation for the region, review previously documented community observations on recent changes in climate and impacts to the community (as well as identified new ones), conducted a vulnerability and risk assessment as it relates to climate change impacts on specific health issues (as determined by the participants) and identified and prioritized actions to reduce these potential impacts.

As with our previous project, the MBMF will assist us by facilitating the process. In our previous climate change adaptation project, our community identified the impacts of climate change on moose (through increased fire and its effects on habitat, changes to predator-prey relationships) as a large, but unknown impact on community health. Moose are an important and healthy food source for our community. Through this current project, Joro Consultants will help the community to explore the potential effects of climate change to moose habitat and the moose population using the ALCES (A Landscape and Cumulative Effects Simulator) framework.

The Core Team participated in an interactive workshop using ALCES to provide their traditional knowledge on moose and moose habitat, to strengthen the simulations.

Doug Schindler of Joro Consultants, Inc. – explaining the ALCES package

The project resulted in several tangible outcomes for our community. It continued the process of engaging community members (including Elders, hunters, trappers, youth, etc.) in climate change dialogue, resulted in a vulnerability and risk assessment related to community health, created a prioritized list of actions to reduce the potential impacts of climate change to our community's health (including an evaluation of the potential impacts of climate change on moose), and provided ideas for additional research or actions.

Community Background

Through a community-initiated and community-led project from 2012-15, we have documented our community's

observations on changes in climate and seasons over the past 50 years, and how those changes have impacted our traditional area and our community (health, safety, etc.). For example, community members have observed changes in temperature (hotter summers, shorter and warmer winters), precipitation (more intense rain storms in early summer, more freezing rain events), more emergency events (tornadoes, forest fires) and impacts of our community's infrastructure (flooding of roads and overfilling of our sewage lagoon, shoreline erosion, effects of changes in water quality on our water treatment plant processes). The changes observed by our community members in temperature and precipitation match those determined from recent climate (meteorological) records in the region.

A look at Wild Fires in Manitoba

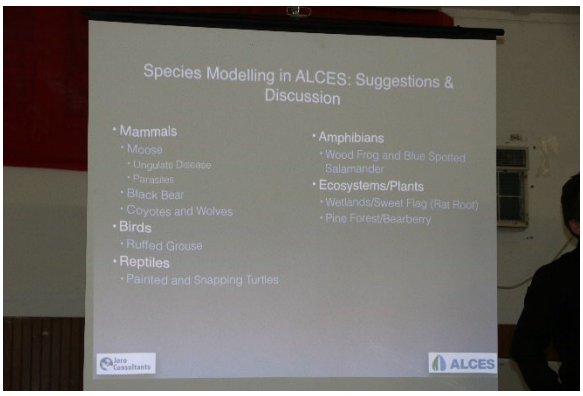
For example, our region has already experienced large increases in temperature over the last 50 years (changes of +0.6° C to +1.3°C in daily mean temperature, depending on the season). Through our previous climate change project, Natural Resources Canada indicated additional potential increases in temperature of up to +7.5°C. Our community members have already observed impacts of climate change due to the modest 0.6° to 1.3°C change. Future impacts under scenarios of up to a 7.5°C change will be even more severe.

Projections for changes to precipitation in the future, based on the previous modeling work by Natural Resources Canada, also indicated more intense rain storms in late spring followed by drier summers. Changes in the timing of precipitation and water availability will have profound impacts on the environment, natural disturbances such as fire, and the availability of food resources from our traditional area.

While our previous climate change project did allow us to assess our vulnerabilities and risks of climate change with respect to community health, the focus was more on infrastructure-related implications (e.g., drinking water treatment processes and sewage treatment capacity) and emergency preparedness. Through our previous project we did identify access to traditional foods (e.g., moose, berries) and medicines as being susceptible to climate change and therefore impacting our community, but did not address it (i.e., did not identify actions needed) in the project.

Moose in particular were identified, as an important food, but the effects of climate change on moose was not investigated. At the time, we lacked the project partners that have expertise in wildlife and climate change modeling. The moose resource in the region is currently under serious threat.

Recent aerial surveys conducted by the Province of Manitoba have documented a 60% decline in the moose population. The causes of the decline are many, and may include predation by wolves, diseases, hunting pressure and most likely climate change (although this has not been studied yet). Several of our community members participate on the Committee for Cooperative Moose Management (a multi-community, multi-stakeholder committee of the Manitoba Model Forest), which is studying the factors responsible for the population decline and identifying actions to reverse it. As a contribution to understanding how climate change may impact moose (for example, Climate Change and Human Health Adaptation Program for Southern First Nations Funding Application through changes in forest fire occurrence and habitat changes) in the region, we are proposing to conduct modeling of the impacts of climate change on moose using the ALCES model through this project.



A slide of the ALCES presentation

Driving on Manitoba Highway #304 May 10, 2022

Climate change has the potential to affect all of our community members through changes in our food supply. Changes in forest fires, droughts, flooding and other natural disturbances can alter the distribution and availability of many traditional foods such as wildlife (moose), berries and medicines as well. The recent decline in the moose population (and a partial closing in select areas for all hunters, including rights-based hunters) in our region has meant that our community does not have access to an important, healthy food staple. Our community members are forced to buy their meat at the store, which is not only very expensive, but a less healthy choice. The loss of hunting opportunities for moose also erodes our ability to continue traditional hunting practices and pass these practices down to younger generations. This

further erodes our culture and connection to the land. It is imperative that, through this project, we determine how climate change could affect our access to country foods, including moose.

Our project therefore will conduct a climate change vulnerability and risk assessment with respect to our community health, and more specifically, with respect to food security and access to traditional (country) foods. A key component of this will include a focus on moose.

PROJECT DESCRIPTION

Climate change is predicted to have significant impacts on the boreal forest in Canada, and therefore significant effects on communities that are located in, and depend on, the forested environment. Even without further increases in greenhouse gas emissions, models predict that the western boreal forest region in Canada could experience significant changes in climate with increases of up to 4.9°C in annual mean temperature, 4°C for the maximum temperature in the warmest months, 6.5°C increase in the minimum temperature of the coldest months and up to a 37% decrease in the climate moisture index by the year 2100 (Lempiere et al., 2008).

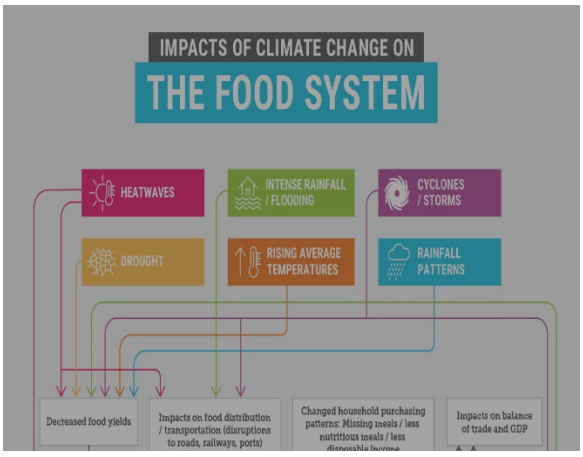
Through our previous project "*Vulnerability/Risk Assessment and Development of Adaptation Strategies in the Face of Climate Change in Black River First Nation, Manitoba: A Community Approach*", which was funded through the Climate Change Adaptation Program (INAC) from 2012 to 2015, we have documented community observations on how climate has changed over the last 50 years. The observations match those compiled from meteorological records from weather stations in our region. These include increases in daily mean temperature of +0.9°C in spring, +0.6°C in summer, +1.4°C in autumn and +1.3°C in winter. In addition, the spring and early summer period is also much wetter, receiving much more rainfall than "normal". Projections of future climate for the region using Global Circulation Models (CGMs), conducted by Natural Resources Canada under our previous project, indicate further increases in temperature of 7.5°C (in all seasons) and further changes to precipitation (wetter springs and drier summers).

Bob Austman explaining some of the changes that have occurred on earth over time.

Through the vulnerability and risk assessment conducted in our previous project, we have noted that the changes in temperature and precipitation already observed have had impacts on our community health. This has included smoke from forest fires, drinking water treatment processes that are unable to deal with changes in water quality, overflow of our sewage lagoon system (as a result of intense rainstorms and flooding in the community), and a general lack of

emergency preparedness (to forest fires, tornadoes, etc.).

As a result of the risk assessment, a number of priority adaptation actions were developed. Several have already been completed, including the development of an emergency preparedness and response plan, upgrades to the drinking water treatment plant, development of community wildfire protection (Fire Smart) plans, and an assessment of shoreline erosion in the community. However, there are several aspects of the effects of climate change on community health that were not explored fully. In particular, the vulnerability and risk assessment did not focus on Climate Change and Human Health Adaptation, or pay sufficient attention to how climate change will affect access to traditional foods, including wildlife and plants.



With this in mind, our project addresses our community's concerns with respect to climate change impacts on health from a traditional food perspective.

OBJECTIVES

Short-term

1. Through community participation and the use of traditional knowledge, to conduct a health vulnerability and risk assessment with respect to climate change

2. To identify and prioritize adaptation actions (both short-term and long-term) that can be implemented to reduce the risks (and potential benefits) of climate change to community health

3. Through community participation, the use of traditional knowledge and computer simulation (using ALCES), to evaluate the potential impacts of climate change on moose habitat and the moose population

4. To enhance community capacity and build regional climate change expertise in understanding climate change and its impacts on community health

5. To communicate lessons learned within the community and to other communities in the region by developing and distributing information on the project using printed and social media.

6. To develop a climate change adaptation plan based on the results of the risk assessment

Long-term

7. To continue the process to build capacity in the community to understand climate change and to take actions to adapt to climate change

Activities and Outcomes

The project included a series of four workshops with a Core Team of community individuals (described in the next section under Capacity Building) along with external

partners (Manitoba Model Forest, Joro Consultants, Prairie Climate Centre: University of Winnipeg and the International Institute for Sustainable Development) to conduct a vulnerability/risk assessment of the potential impacts of climate change on community health. The assessment will follow the process outlined in "Pathways to Climate Change Resilience – A Guidebook for Canadian Forest-Based Communities" developed by the Canadian Model Forest Network. The guidebook provides an easy to follow "trail map" or series of steps for assisting communities in becoming more climate resilient. Briefly, the process included workshops to:

- understand climate change science and climate predictions for the region
- conduct a vulnerability/risk assessment that links observed and predicted changes in climate to effects on the community's traditional area and community health as part of the risk assessment
- computer simulations of potential impacts of climate change on moose habitat and the moose population in the region
- identify and prioritize adaptation actions to reduce risks to the community,
- communicate and disseminate information on the project through two community feasts, a climate change presentation (including climate change science, previous work on climate change by the community and the current project) to students at the school in the community, and the development of communication tools (handouts, summaries, maps) for distribution within the community and to other communities in the region (as well as the use of social media and the Black River website) and an article on the project in one of the region's newspapers.

Each of the project partners provided specific expertise to the project. The MBMF facilitated all workshops and was responsible for the vulnerability/risk assessment portion of the project. The University of Climate Change and Human Health Adaptation Program for Southern First Nations Funding Application

Winnipeg and the IISD provided information and introductory presentations on climate change science and climate predictions. Prior to the first workshop, they developed the future climate predictions (temperature and precipitation) for the region, which includes BRFNs traditional area, using regional climate models.

Doug Schindler of Joro Consultants

Joro Consultants was responsible for compiling necessary data and information

needed to develop moose habitat simulations under a changing climate, they led the Core Team through an interactive workshop session to supplement the ALCES model with traditional knowledge and to finalize the simulations. All project partners attended each of the workshops, contributing their knowledge and expertise where appropriate. In addition, all project partners attended the community feasts (and gave short presentations at each feast), gave a presentation at the school and developed ideas for communication tools.

The MBMF worked with BRFN to produce a vulnerability/risk assessment and adaptation plan document, as well as assisted in any interim and final project reports to Health Canada.

Below is an outline of the main activities and tasks as well as anticipated outcomes.

Dr. Brian Kotak of MBMF worked with BRFN to produce a vulnerability/risk assessment and adaptation plan document

1. Project Planning and Identification of the Community Core Team Members

The Black River Project Coordinator contacted each of the Core Team members from our previous climate change projects to see if they were interested in participating in the current project (many have already expressed interest). Most of the former Core Team members are Elders. The Project Coordinator also ensured that the new Core Team included hunters, trappers, youth and representatives from the community's health department. Chief and Council were also invited to participate in all aspects of the project. Based on experience from our previous climate change project, we anticipated a maximum of 20 community members participating in the project. Having a Core Team consisting of a cross-section of community members involved in the project contributed to both Objectives 4 & 7 (capacity building).

The Project Coordinator and external project partners (MBMF, IISD, University of Winnipeg, Joro Consultants) worked together to plan out each of the workshops (including development of agendas, presentations, potential communication tools, etc.). Project planning occurred throughout the duration of the project and was done through conference calls, Skype or email.

2. Development of Future Climate Predictions for Black River Traditional Area

The Prairie Climate Centre (University of Winnipeg and International Institute for Sustainable Development), using downscaled climate data derived from 12

global climate models, and for 2 future emission scenarios (high carbon future and low carbon future), generated climate projections to the year 2080. A number of metrics and indicators were produced from the models, including changes in temperature (daily maximums and minimums), degrees above 30°C, precipitation, etc. This was done for a portion of eastern Manitoba that included Black River First Nation's traditional area.

These external project partners also developed visual products (e.g., maps) to graphically show how climate could change. Projections will be for 2 time periods: near future (2021-2050) and far future (2051-2080). They also created the climate record for the recent past (1981-2010).

This activity contributed the climate modeling projections required for the health vulnerability/risk assessment (Objective 1).

Joro Consultant staff member giving presentation

3. Compilation of data and information required for the ALCES simulations

In order to develop simulations to explore the potential impact of climate change on moose habitat and the moose population in the region, Joro Consultants assembled all required scientific data for the ALCES model. This involved compiling existing data on land cover (e.g., forest, water bodies, etc.), linear features, human footprint areas, forest fire and forest harvesting history, moose distribution, etc. Climate projections (from the Prairie Climate Centre) and potential scenarios of altered forest fire and other natural disturbance as a result of climate change was also integrated where possible. The ALCES simulation covered the geographic area of Game Hunting Area 26 in eastern Manitoba, which includes Black River First Nation's traditional area (it is also the same area in which future climate was modeled by the Prairie Climate Centre).

This activity provided a graphical and visual method of simulating potential changes in moose habitat and the moose population in response to climate change and therefore supported the overall health vulnerability/risk assessment (Objectives 1 & 3).

4. Workshop 2: Vulnerability/risk assessment and traditional knowledge gathering for the development of the ALCES moose model (2-day workshop)

This workshop had 2 components, The first focus was on linking community observations on changes in climate to changes in their traditional area and impacts on their health. It also included discussions of how future climate predictions will affect health impacts (either positively or negatively). The Core Team conducted a hazard assessment on each potential impact by evaluating a level of risk to health (low, medium, high), and the

likelihood of the impact occurring. This identified the highest hazards/risks to the community. The Core Team also evaluated the community's ability to adapt by evaluating the human, social and financial resources available.

The second part of the workshop was focussed on the development of future scenarios of moose habitat and the moose population using the ALCES modeling framework. Joro Consultants introduced ALCES and led the Core Team through a process to identify and incorporate local and traditional knowledge into ALCES. This was done "on-the-fly" and participants were able to see the results nearly instantaneously.

A Joro Consultants presentation

The ALCES simulations helped Core Team members (and the community) understand the potential impacts of climate change on one of their most important sources of healthy food (moose). A short project newsletter was developed to summarize the outcomes of the workshop. This was then distributed in the community (electronically and in printed form) and posted on social media.

This workshop continued to contribute to Objective 1 (health vulnerability/risk assessment, Objective 3 (use of ALCES), as well as capacity building (Objectives 4 & 7) and within community and external communications of the project (Objective 5)

5. Workshop 3: Review of health risk assessment, development of adaptation actions, refinement of ALCES model (2-day workshop). Community feast and project presentations.

This workshop provided an opportunity to review what was completed in the health risk assessment from the previous workshop, and led the Core Team through a process to identify adaptation actions that can be developed to reduce the potential impacts of climate change on health (or in some cases, as appropriate, to enhance any positive impacts).

A second component of the workshop was to review the ALCES simulation and complete the refinement of the model using additional local and traditional knowledge. A community feast was held on the evening of the second workshop day. Presentations on the project were made by our project partners at the feast.

It is anticipated that approximately 150 people were present (based on experience from our previous climate change project). We also know from our previous project that community feasts are one of the best ways of conveying project information to the wider community. The community feasts are a valuable mechanism to also continue to build climate change expertise in the community. Copies of the previous project newsletters and any new

communication materials were made available to the community at the feast.

The workshop and community feast contributed towards all seven of the project objectives

6. Workshop 4: Review of project, prioritization of adaptation actions, identification of next steps for project. Evaluation of project (1 day workshop).

Community feast and project presentations (at feast and at school)

The final workshop reviewed the adaptation actions identified in the previous workshop and the Core Team ranked the actions in terms of priority, and identified potential financial costs associated with each as well as assigning responsibilities (e.g., individual community members, Chief and Council, federal or provincial governments, etc.). The Core Team also discussed and documented what the next steps for the community should be, including ideas for future funding proposals.

Great discussions took place at a community feast

Finally, the Core Team conducted an evaluation of the project, including the processes used, results, where improvements can be made, etc. The project concluded with a presentation at the Black River School, and a community feast (which also included final presentations on the project). These presentations also included members of the Core Team.

The final workshop and feast contributed to all seven project objectives.

7. Development of a climate change adaptation plan

A separate climate change adaptation plan that documents the process undertaken, results and a prioritized list of adaptation actions was developed. This was posted on Black River First Nation's website and provided to Chief and Council. The adaptation plans fulfilled Objective 6.

8. Development/printing of a photo journal of the project

In our previous climate change project, we developed a photo journal (photo book) that describes the project in pictures taken at the workshops and community feasts. These photo books are created on-line (through Shutterfly or Apple), printed and distributed to all Core Team members, Chief and Council, project partners and project funders. The photo books are an excellent reminder to the community of the importance of the project and a mechanism to keep the climate change dialogue going in the community. Many of our previous Core Team members proudly keep their

photo books on display on their coffee tables!

The photo books contributed to Objective 5 (communications). Climate Change and Human Health Adaptation Program for Southern First Nations Funding Application.

9. Development of a project report (narrative, financial) to Health Canada

A final narrative and financial report were developed and submitted to Health Canada, as per the funding agreement.

Capacity Building

The project provided many mechanisms for capacity building with respect to understanding climate change and its potential impacts on health. Firstly, a Core Team, representing a cross-section of community members (including Elders, youth, hunters, trappers, health department officials, Chief and Council) was involved in the entire project and process. As with our previous climate change adaptation project in 2012-15, these Core Team members become the community's climate change experts, and helped to continue the climate change dialogue within the community long after the project was completed. The involvement of other external experts (in this case, Manitoba Model Forest, University of Winnipeg, International Institute for Sustainable Development, Joro Consultants) provided a wealth of knowledge and experience in climate science and policy, risk assessment and wildlife modeling and the project provided for community learning from these experts. The communication tools developed during the project (e.g., project newsletters) also enabled capacity building in the community and beyond (the communication materials will also be available through social media and Black River's website so that other communities can learn from our project). Presentations at the 2 community feasts also helped to inform community members and build capacity, as did the presentations at the community's school.

Youth

Several youth were part of the Core Team and attended workshops and feasts. As part of the Core Team, they also were involved in planning the workshops. Youth often have different perspectives on the environment around them on community issues and potential solutions. They therefore, offer a valuable contribution to our project.

The community youth took an active role in the climate change discussions

The youth learned how to interact with research scientists and through participating in the vulnerability and risk assessment process, learned how to problem-solve in a systematic way. Our youth represent the future leadership of our community, and as such, need to be knowledgeable and conversant in climate change science and the impacts on our community.

Traditional and Local Knowledge

The vulnerability and risk assessment approach are grounded in traditional and local knowledge. One of the first steps in looking at climate change is to document the community's observations first. This was done at the first workshop, by reviewing the community's observations from our previous climate change project and building on them.

The Core Team provided their knowledge of how a changing climate is currently impacting community health and how projected changes in climate may impact health in the future. In this way, the community's knowledge plays a main role in identifying not only the threats, but also the adaptation measures that need to be taken. Climate Change and Human Health Adaptation Program for Southern First Nations Funding Application.

We feel it is extremely important to introduce the youth in the community to climate change and the monitoring of it, as soon as they are able to get out on the land and understand the importance of climate change and its effects. This project involved the Grades 9 and 10 Science class students.

"The youth of today are the leaders of tomorrow!"

It is important to educate the youth but to also fill the gap between today's knowledge of climate change and that of the current adults and leaders of the community.

One of the more serious results of a changing climate is the effect it is having on traditional medicines and other plant and animals.

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Climate Change – Ice, Water and Snow

Treaty 5 communities in Eastern Manitoba are already feeling the effects of a warming climate. Winter roads are opening later, and closing earlier than ever before. These roads are a lifeline to communities along the shore of Lake Winnipeg, such as Bloodvein and Poplar River First Nations.

Climate models have predicted warmer winters in our region. This has resulted in more difficulties with back country travel. Trappers are having trouble accessing their trap lines. Hunters are having difficulty accessing their traditional hunting areas, which often involves crossing several rivers, creeks, and streams. This results in more food insecurity. There are fewer moose and deer harvested, resulting in the loss of healthy protein in their diet.

Our students have been monitoring the timing of ice formation and ice out on the local rivers (Black River and O'Hanly rivers). They have also been monitoring ice thickness, and learning about ice safety.

Special Sensors were placed under the ice to record water temperatures at the bottom of the river channel

Grade 9 students use an auger to drill holes on the Black River to measure ice thickness

We have also been monitoring water quality by measuring dissolved oxygen levels. Cold water can hold more oxygen, which means the waters can support more biomass. Low oxygen levels in summer can result in fish kills, which again can cause food insecurity as fresh fish has been part of the local diet for generations.
Changes in ice thickness create challenges for travel, hunting, and fishing. Science students learned how to safely measure ice thickness, and to recognize dangerous ice formations such as pressure ridges and frazzle ice. They also learned the formula for calculating safe load limits for ice (i.e. 6 inches of ice = 6 squared x 100 = 3600 pounds).

Grade 9 science students measure dissolved oxygen from water samples taken in winter from the Black and O'Hanly rivers

Climate Change and Snow Depth
Climate models in our region show an increased variability of precipitation. Students tracked snow depth along a 100 meter transect. Measuring sticks were placed at 10-meter intervals. Readings were taken every week. Variation in snow depth can create challenges. Too much snow or not enough snow can impact such things as travel, and can cause winter kill in populations. It can also indicate the probability of drought or flooding in the region.

Grade 9/10 students taking snow depth readings along a 100 meter transect

The data from snow depth monitoring was shared with the Wildlife Branch (Manitoba Conservation). The data was used to predict the risk of winter kill in local ungulate populations such as White-tailed Deer. One such measure used was the 50/50 formula, whereby if there were 50 consecutive days with more than 50 centimeters of snow on the ground, the local deer herd could lose 30 – 50% 0f the herd due to winter kill. Once again, this could have a serious reduction of locally sourced protein in the form of venison.

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Climate Change and Invasive Species

Invasive species are most commonly defined as a non-native plant, animal or other organisms that dominate the encountered ecosystem and impairs its ability to function normally. Invasive species displace or damage native fauna and flora, often posing serious threats to local biodiversity and causing adverse environmental, economic or public health damage. The lack of a natural competitor in this new ecosystem allows invasive species to be successful and resistant enough to survive in a foreign environment.

It is important to remember that biological invasions are a fundamental and integral aspect of nature and have always been present in the history of life on Earth. What is of concern however, is the extraordinary rate at which the invasions are now taking place. This requires constant monitoring at the community level.

Climate change is altering vital aspects of the environment like temperature and precipitation, the frequency of extreme weather events, as well as atmospheric composition and land cover. The temperature, atmospheric concentration of carbon dioxide (CO_2) and available nutrients are the key factors that will drive a species' chance of survival. Changes in these factors will most likely stress the ecosystems and the increase chances of invasions.

Changing temperature and precipitation regimes can have a long-term effect on ecosystems. A warming ecosystem may provide the conditions necessary for foreign species to become established. When this happens, the foreign invader has the potential to out compete native species. This can create havoc in the entire food web once it is disrupted by foreign invaders.

Our project will focus on 5 invasive species suspected to be in our region. They are:

- Rusty crayfish
- Spiny water flea
- Zebra mussel
- Emerald ash borer
- Eurasian milfoil

Four of the above invasive species are found in aquatic ecosystems, while the Emerald ash borer is found in forested ecosystems.

Zebra Mussel

All monitoring is carried out in the open water season.

Direct observation along shorelines is carried out to detect the presence of the Zebra mussel. The shoreline of Lake Winnipeg contains remnants of dead Zebra mussels, believed to be washed ashore from other parts of Lake Winnipeg. Zebra mussels, like all mollusks, require calcium for proper growth of their shell, but the

watersheds flowing into the lake from the east have very low calcium levels. They flow over granite bedrock which contains very little calcium.

Traps are set out to detect the presence of the Rusty crayfish. This invasive species will easily out compete local crayfish populations. Crayfish are an important prey species for a variety of fish, so the presence of the Rusty crayfish can seriously disrupt aquatic food chains. Fortunately, we have not detected the presence of any Rusty crayfish at this point in time.

Fine mesh screens are placed in open water to detect the presence of the Spiny water flea. These tiny invasive invertebrates disrupt the food chain, and are so abundant they can clog fishnets. They are present in Lake Winnipeg.

Eurasian milfoil is an aquatic invasive plant than can clog creeks, rivers, and streams and degrade fish habitat. When the plants die, the bacteria of decay can use up a lot of oxygen, thereby reducing water quality. Eurasian milfoil is found in some tributaries of Lake Winnipeg.

The Emerald ash borer has not yet been detected in the Black River traditional area. It has been found in the city of Winnipeg. This invasive insect can cause total mortality in hardwood stands of both Green Ash and Black Ash.

Long cold winters usually kill the larvae of invasive insects, but warmer winters increase their survival rate.

Rusty Crayfish. Note the rust-colored patch on the carapace (shell)

Spiny water flea

Emerald ash borer

Eurasian milfoil

Trap used to detect the presence of Rusty crayfish

Checking the Black and O'Hanly rivers for the presence of the Spiny Water Flea. Visual inspection detected their presence as well as the presence of Eurasion Millfoil

As the climate warms, it is important to continue monitoring for the presence of invasive species. Without constant vigilance, these invasive species may be impossible to eradicate once they are established.

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Climate Change and The Monarch Butterfly

The Monarch Butterfly is considered to be an indicator species, sort of a "canary in a coal mine", which forewarns us of climate change. Black River First Nation is at the northern limit of the range of the Monarch Butterfly. Our goal for this segment of the project is to:

1. Create a butterfly garden in the schoolyard,
2. Monitor the presence of the Monarch to determine their abundance from year to year
3. To re-introduce the Monarch Butterfly in the community to build up their numbers. The Monarch Butterfly migrates from the Sierra Madre Mountain in Mexico to southern Canada. The Monarch faces many climatic hazards during its journey from the wintering grounds to southern Canada. The population is at risk from extreme wind events, extreme drought, heavy precipitation, storms, early and late frosts, as well as habitat loss.

Grades 9/10 students built raised garden beds for a pollinator garden. Shown here is a Monarch Larva feeding on milkweed, the Only plant that can sustain it. The school is shown in the background

Students learned that climate change can have an impact not only on furbearing animals and wild game on which they rely, but also the pollinators that play such an important role in our food supply. Students learned that if it were not for the pollinators, we would only have wind pollinated foods such as wheat, barley and oats in the grain family, and that all of our fruits and vegetables are dependent on pollinators such as bees, wasps and butterflies.

Bob Austman checking out the milkweed garden

Students keeping the weeds down in the milkweed garden

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Climate Change and Agriculture and Food Sustainability

Climate models predict an increase in global temperature and extremes in precipitation including more drought and flooding. Along with that comes more soil erosion and the possibility of more invasive species. This creates uncertainty about our planet's food supply.

Our project involved a field trip to the Bruce D. Campbell Farm and Food Discovery Centre. This is essentially a research site operated by the University of Manitoba, and is dedicated to educating the public on the importance of agriculture, but also examines its role in contributing to climate change.

GHG come from man-made and natural sources

Students learned about greenhouse gas emissions in agriculture, such as those released during the manufacturing of fertilizers, emissions from farm machinery, as well as carbon emitted during soil disturbances such as tillage. Students also learned about less well-known greenhouse gasses such as methane, which is emitted from belching cattle and decomposing manure.

Students learned about methods of reducing greenhouse gas emissions in agriculture, noting such things as zero-till farming which requires less tillage. Under this system, farmers do not cultivate the soil. Instead, they plant the seed directly into the previous year's stubble and in doing so they burn less diesel fuel in their machinery, and reduce the amount of carbon emitted whenever the soil is disturbed.

Students gather in a classroom prior to the tour to learn about the carbon cycle and the role of agriculture in greenhouse gasses

Students also learned about research into a variety of livestock feed that will reduce the emissions of methane, a greenhouse gas 40 times more powerful than carbon dioxide. By altering the diet of livestock, the cattle will emit less methane when fed certain blends of forage crops.

Students learned that farm machinery can run on biofuels, which produce less nitrous oxide in their exhaust. They learned about alternate energy being used on farms, such as wind turbines and solar panels.

Screen shot of a slide at the Discovery Centre

With our global population now at 8 billion humans and counting, it is more important than ever to understand how agriculture feeds us all. But it is also important to understand how agriculture is a contributor to climate change, and to understand how its impact on climate can be reduced or mitigated through a variety of approaches, such as more efficient use of fertilizer, planting cover crops to absorb carbon, and creating pockets of biodiversity on farms that support pollinators and other important species of plants and animals.

Students learned that there are ways to reduce greenhouse gas emissions and ways to sequester carbon, thereby generating hope for their future, and the future of at least seven generations.

Fish Farming

Later that day the class visited a fish farm specializing in raising Arctic Char. Specialized tanks contained 600,000 fish in various stages of growth. This is a very efficient way of producing healthy protein for human consumption. Arctic Char are rich in Omega 3 and Omega 6 and polyunsaturated fats; hence it is healthier than eating red meat, pork, or even poultry.

Fish farming is also is a far more dependable way of producing food, being nearly exempt from the variables of a changing climate. The worse thing that can happen in extreme weather is a region wide power outage. However, the fish farm has backup generators in the event of a severe storm knocking out the main power supply. Fish farming may be part of the solution in an era of climate change. It is sustainable, and can help create greater food security.

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Climate Change – Peer-to-Peer Project

An important aspect of our work is sharing it with other communities. Our Peer-to-Peer project enabled us to partner with the community of St. Laurent. This project had some of the teaching staff visit the Black River Community to share their climate change monitoring experiences with those of Black River's.

St. Laurent Community School was recommended to us by our Program Officer because they have made sustainability one of the pillars of their school's mission statement. St. Laurent has several similarities to Black River First Nation. They are situated on the shore of Lake Manitoba while Black River is situated on the east shore of Lake Winnipeg. Both communities have a largely Indigenous population.

Teachers from St. Laurent schools

The first part of the project was spent sharing various projects that involved students. St. Laurent school has spent time and energy 'greening' their school grounds. Black River Anishinabe School created a pollinator garden with a focus on attracting Monarch butterflies.

Monarch butterflies, an indicator species, are very sensitive to climate change. It is important to monitor this species, and to provide milkweed habitat wherever possible.

Workshop participants assisted with placing tags on Monarch butterflies as part of a "Monarch Watch" program

The group visited a variety of projects that are ongoing in Black River, such as the weather station, forestry research plot, butterfly gardens, and the outdoor education camp at the mouth of Black River known as Camp Makwa. During the boat trip to Camp Makwa we demonstrated examples of damage to the community caused by our changing climate. such as shoreline erosion.

We then discussed other aspects of climate change such as the increasing populations of invasive species. We showed the group examples of invasive species such as Zebra Mussels, and aquatic invasive species such as Eurasian Milfoil. Although we had traps in the water to determine if the Rusty Crayfish or the Spiny Water Flea were present, there were fortunately none found at this point in time. We also demonstrated the pheromone traps designed to attract the Emerald Ash Borer, which is present in

Manitoba but has yet to be found on Black River traditional territory.

We then visited our snow depth monitoring site. This project is valuable as a means to show the extreme variability in precipitation year to year.

Our forestry research plot has been established to monitor forest growth, productivity, and health. This research plot will also reveal the impact of climate change such as windstorms, drought, flooding, and the presence of invasive species. Invasive species are predicted to be an issue because the eggs and larvae of invasive species are surviving warmer winters.

Workshop participants discussed challenges facing forests as our climate changes. These challenges include more frequent and more intense wildfires, wind and ice storms, as well as increases in forest insects, disease and invasive species.

A boat tour along the Black and O'Hanly rivers showed shoreline erosion. Trees along these riparian zones are at risk because of increased erosion during windstorms. These damaged trees often fall into the river, disrupting fish habitat and making navigation difficult.

A variety of handouts and power point presentations were provided to the teachers from St. Laurent school to use in their science classes. We hope to continue our partnership. Were it not for the pollinators, we would only have wind pollinated foods such as wheat, barley and oats in the grain family. All of our fruits and vegetables are dependent on pollinators such as bees, wasps and butterflies.

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Climate Change Monitoring – Using Our Weather Station for Baseline Data Gathering

Baseline data is extremely useful in tracking subtle changes in temperature and precipitation. Black River students have been collecting and storing weather data for the last 5 years. The weather station collects and stores data digitally. We now have 5 years of data on daily high temperature, daily low temperature, precipitation (millimetres), barometric pressure (millibars), wind speed (meters per second), wind direction (0 -360 degrees), wind gusts (meters per second) and relative humidity (%).

So far, we have shown a slight variation from the nearest Environment Canada data from the closest community (Powerview/Pine Falls). The 'urban heat island' effect may explain the differences since we are almost at the same latitude, and both Powerview/Pine Falls and Black River are right on the shore of Lake Winnipeg.

Grade 9 students download data from the weather station to a laptop computer. Graphs are then printed out back at the classroom and the data is analyzed.

Along with the weather data, students learn about the factors that create our daily weather patterns. Basic meteorology is covered during class time. Students learned about:

- Air masses
- Ocean currents
- Cloud formation
- Weather extremes such as tornadoes, waterspouts, and the polar vortex
- Precipitation including fog, hail, and types of rainfall such as convective thunderstorms and orographic precipitation
- Air pressure
- Warm fronts and cold fronts

Students also learned about greenhouse gasses and how they can affect global weather patterns. They also learned about anthropogenic induced climate change, and how they can individually reduce their carbon footprint.

All relevant handouts, charts, and graphs are contained for each student in their "Pizza Box Portfolio". The students decorate their pizza box portfolio with drawings or a collage of pictures based on a climate change theme.

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Climate Change and Its Impact on Fisheries

Black River is on the eastern shore of Lake Winnipeg, the 10th largest fresh water lake in the world. Climate change has already had an impact on its water quality. Water levels have been impacted by back-to-back drought years (2020 and 2021) as well as extreme wind events. This has contributed to severe shoreline erosion, reduced fish spawning habitat, and nutrient overload resulting in algae blooms. Added to this is the presence of invasive species such as Zebra Mussels and the Spiney Water Flea.

Students were taken out for a field trip onto Lake Winnipeg to work with commercial fishers. Students learned about the impact of climate change on lake ice, and the dangers facing commercial fishers. Freeze up on the lake occurs later, and ice breakup occurs earlier. This has a direct affect on the safety of commercial fishers. They also learned about the impact of toxic algae blooms and invasive species on fish populations. Increases in extreme wind events has also made it difficult for fishers to retrieve their nets in the summer season.

Local fishers from Black River First Nation are also feeling the effects of these changes.

Grade 9 students on Lake Winnipeg with New Iceland Fisheries

Black River students assisted commercial fishers with retrieving their catch, while learning about the impact of climate change on fisheries.

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Community Workshop – June 1, 2023

Our workshop took place on June 1, 2023. Over 60 community members and Elders were invited. There were several agencies invited to participate, along with staff and Grade 9 students from Black River Anishinabe School.

The event was held at the Band Hall from 9 a.m. until 3:30 p.m. After the opening prayer by Elder Warren Bird, presentations from the following groups were well received.

Jack Johnson opened the sessions with an overview of the 10 year history of climate change monitoring in the community. Bob Austman then explained the level of student involvement in data collecting over the years, such as water and ice monitoring, invasive species surveillance, snow depth monitoring, weather station data collection, etc.

The Manitoba Metis Federation shared their work In climate change monitoring and even had a live data feed from their local weather station situated in St. Laurent.

This was followed by a presentation by the Centre for Indigenous Environmental Resources. She outlined the impact of climate change on several communities and how communities can adapt and mitigate the effects of severe weather.

The Grade 9 Science Class have been saving their climate change notes and activities all semester in what is known as a 'pizza box portfolio". These were decorated with scenes from a variety of climate change photos and drawings. The pizza box portfolios were on display for all participants to see. The Grade 9 students then presented some climate change terms and definitions they learned about during the semester.

After a luncheon, Bob Austman then gave a presentation on what we have learned about climate change at the local level, and shared data from the forest research plot, ice and water sampling, snow depth monitoring, and weather station data. He then showed a video about the Greenland Ice Core Project which highlighted climate change research at the global level.

The workshop concluded with a sharing circle. Elders shared their observations about the changes they have seen over the years, including murkier waterways, more storms, more shoreline erosion, and how much windier it has been since his childhood.

After the sharing circle, Jack Johnson outlined the importance of climate change adaptation and preparation, and he demonstrated and displayed the Emergency Preparedness Document. It is essential for all communities to plan for the changes that will be coming as the climate warms up, the atmosphere holds more moisture, and the storms become more intense.

Conclusions

Over the last decade, the community of Black River has become immersed in the science of climate change and how it can affect all aspects of life including human health and safety, biodiversity and ecosystem functionality, as well as man-made structures such as housing, roads and bridges. Now that the community recognizes the challenges associated with climate change, they are in a much better position to prepare for them.

The community can adapt to the coming changes and work toward mitigating the harmful effects such as preparing emergency plans in the event of wildfires or improving drainage infrastructure in the event of overland flooding. Knowledge is power! We trust that the knowledge gained over the last decade will help protect residents from harm and help them prepare for the forthcoming changes.

Links to Sites of Interest

Greenland Ice Core Project
www.youtube.com/watch?v=QzrliPlEaU4

Manitoba Metis Federation live weather dashboard: mmf.mb.ca
www.mmf.mb.ca/weather-dashboard

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