

Staying Strong

Sahtú Youth and Elders Building Healthy Communities in
the Face of Climate Change

Volume II: Appendices



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Appendix A

Pietł'ánejo: the 2013 Tulít'a Fall Community Hunt



Pietł'ánejo

the 2013 Tulít'a Fall Community Hunt
a Time-honoured Aboriginal Actions Sustaining Traditional Eating (TAASTE) Project

Submitted by
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Submitted to
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March, 2014

Summary

With support from the NWT Time-honoured Aboriginal Actions Sustaining Traditional Eating (TAASTE) program, the Tulít'a District Education Authority sponsored activities at Pìetł'ánejo with the aim of learning how knowledge and appreciation of country foods can best be transmitted to new generations. The community hunt took place during September 17- 30.

Community participants and facilitators were successful in achieving the five objectives defined for the project, as follows:

1. Bring people to Pìetł'ánejo for the annual fall hunt.
2. Elders will teach and demonstrate for the youth how to cut up the meat.
3. Hunters will have youth hunting with them, teaching them how to skin and cut up the caribou.
4. Youth will learn how to respect wildlife, and learn that one does not waste any part of the caribou.
5. Have sharing circles, whereby the participants will discuss the concerns they have about traditional food, ex: there is no one to hunt for them.

Results

A review of project activities in relation to the objectives points to a number of accomplishments:

1. A total of 55 elders, parents, and youth participated in the on-the-land trip, as well as five resource people and researchers.
2. All of the young men had an opportunity to visit a recently killed animal and learn how to cut up the meat. All of the youth, both men and women, had the opportunity at the camp to cut



up, prepare, cook, and eat the meat. Many of the hunters took young men hunting and showed them how to skin and cut up both caribou and moose.

3. All of the fall hunt participants had ample opportunity to discuss issues and concerns relating to traditional food with each other. Almost all of the youth had at least one family member or relative on the trip and were able to learn from them. In addition, a sharing circle was held for the youth participants to reflect upon and share their experiences at Píetl'ánejo with each other.
4. Many of the hunters took young men hunting and showed them how to skin and cut up both caribou and moose.
5. The experiences on the land and at the camp reinforced values of respect for wildlife, as did stories from the elders and hunters at camp.

Recommendations

The following recommendations emerged as a result of this project:

1. A stable long term funding source should be identified to support continued on-the-land programs with a special focus on individuals and families who are otherwise unable to afford such trips. *This recommendation is especially directed to the Sahtú Renewable Resources Board's Traditional Economy Assessment and Action Plan project for 2014-2015.*
2. A community campaign to advocate for country food-based nutrition and healthy living should be established to ensure that lessons learned at the Píetl'ánejo community hunt have a lasting impact on the community.
3. A curriculum for high school students in country food-based nutrition and traditional on-the-land practices as the basis for healthy living should be developed as a basis for structuring learning on the land.
4. When possible, existing community events such as seasonal hunts should be expanded to include youth, educators, and resource people so that additional objectives that are important to the community can be achieved.

Máhsı Cho!

Thanks to the Sister Celeste Goulet and Jessie Campbell who developed the vision for supporting and enhancing the community fall hunt as a means of learning about the value of traditional foods in community health and well-being. A special máhsı cho to the hunters and the women of Tulít'a whose skills, knowledge and will to keep traditional harvesting traditions alive made this hunt possible. Finally thanks to the young men and women who participated in the trip and were willing to undertake the difficult tasks of learning both traditional skills and new research practices. These youth are bridging two cultures, and thus gaining the strength that is needed to maintain their heritage.

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Introduction

For as long as the Shúhtagot'Inę (Mountain Dene) of Tulít'a can remember, families have travelled up Begádeé (Keele River) into Shúhtagot'Inę Nënë (Mountain Dene territory, the Mackenzie Mountains) to harvest caribou, berries and other traditional foods in the fall. The destination at this time of year was Pietl'ánejo (Caribou Flats), an area with salt licks that attract tǫdzı (Northern Mountain Caribou). The Pietl'ánejo area has always been an important source of a variety of valued country foods and medicines, and a place for learning the traditional practices of harvesting, preparing foods, and sharing within and among families that are the basis for community health and well-being.

With support from the NWT Time-honoured Aboriginal Actions Sustaining Traditional Eating (TAASTE) program, the Tulít'a District Education Authority sponsored activities at Pietl'ánejo with the aim of learning how knowledge and appreciation of country foods can best be transmitted to new generations. The community hunt took place during September 17- 30, with a total of 60 elders, parents, youth and resource people and researchers. Youth participants were able to learn a variety of skills and lessons from the elders, including how to live on the land, how to respect animals, how to hunt caribou and moose, and how to prepare and cook caribou and moose meat.

Almost all of the youth participants had a parent, aunt, uncle, or other relative on the trip, and several entire families attended. In addition, several community members who did not come to Pietł'ánejo provided important assistance from Tulít'a by sending weather reports, arranging for additional supplies, unloading meat and delivering it to community members, and coordinating transportation to and from Pietł'ánejo. Half of the participants traveled to Pietł'ánejo via jet boats and the remainder traveled by chartered flight from Tulít'a to the Shell Airstrip. The primary camp was located next to the airstrip, with smaller additional camps both upstream and downstream.

Several other projects were also associated with the fall hunt. The Tulít'a Renewable Resources Council, along with other community organizations, provided funding for hunters to travel to and from Pietł'ánejo and distributed caribou and moose meat from the fall hunt to community members. In addition, the Chief Albert Wright School sent two teachers along as chaperones for students whose families could not attend the fall hunt. Finally, the Sahtú Renewable Resources Board staff and associated university researchers worked with fall hunt participants on the TAASTE project as well as a Health Canada project looking at climate change and health adaptation, caribou and moose health monitoring, and a caribou genetics project.

What's in This Report

In this report we provide a timeline of steps involved in planning and undertaking the trip, and a description of activities at the camp and on the land, including cultural and educational activities. This is followed by a listing of related follow-up projects, that will provide added value to the experience for the community and the Sahtú Region. We conclude with a short assessment of lessons learned from the community hunt, recommendations for future programming, and summary conclusions.



Project Objectives

A total of ten objectives were originally proposed for the project:

1. Bring people to Píetł'ánejo for the annual fall hunt.
2. Elders will teach and demonstrate for the youth how to cut up the meat.
3. Hunters will have youth hunting with them, teaching them how to skin and cut up the caribou.
4. Youth will learn how to respect wildlife, and learn that one does not waste any part of the caribou.
5. Have sharing circles, whereby the participants will discuss the concerns they have about traditional food, ex: there is no one to hunt for them.
6. Bring people to Píetł'ánejo for the annual fall hunt.
7. Elders will teach and demonstrate for the youth how to cut up the meat.
8. Hunters will have youth hunting with them, teaching them how to skin and cut up the caribou.
9. Youth will learn how to respect wildlife, and learn that one does not waste any part of the caribou.
10. Have sharing circles, whereby the participants will discuss the concerns they have about traditional food, ex: there is no one to hunt for them.



Partnerships

We have learned that organizing a community hunt including youth takes a lot of resources, time and skill. Ideally, community and regional organisations and leaders work closely together to help make the hunt a success and support lasting benefits for the community. About six community/regional organisations and two universities were involved in the community hunt in some way, under the leadership of the Tulít'a District Education Authority. These included:

Sister Celeste Child Development Center
Sahtú Divisional Education Council
Tulít'a Renewable Resources Council
Chief Albert Wright School
Sahtú Renewable Resources Board
University of Calgary
University of Manitoba

Coordination

Coordinating multiple partners and families is a labour of love for those who are supporting a community hunt. The following individuals played a special role in supporting expanded involvement in the 2013 hunt:

Sister Mary Celeste Goulet (lead)
Janet Bayha
Lorraine Kuer

Jessie Campbell
Fredrick Andrew



Participants

The following individuals participated in the 2013 Tulít'a Community Fall Hunt:

Elders (5)

Ethel Blondin-Andrew
Leon Andrew
Jonas Peters
Irene Roth
Frank Yallee

Camp Assistants (2)

Ronald Beyonnie
Michael Etchinelle

Chaperones (2)

Marc Champagne
Cathy Menacho

Resource People (4)

Reanna Campbell, SRRB
Joe Hanlon, SRRB
Jean Polfus, University of Manitoba
Dr. Anja Carlsson, University of Calgary

Youth (18)

Kristianna Andrew
Maylene Andrew
Ivan Antoine
Keisha Antoine
Francis Ayah
Eric Bayha
Zach Bayha
Thomas Horassi
Napoleon Kenny-Andrew
Brent Maccauley
Erica Maccauley
Rachel Maccauley
Rachelle Maccauley
Royden Maccauley
Shaylen Macpherson
Hope Menacho
George Wrigley
Donovan Yakelaya

Children (2)

Shyla Bayha
Naoka Washiee

Adults (22)

Corinne Andrew
Ricky Andrew
Terrence Andrew
Walter Andrew
William Andrew
Stella Bayha
Archie Erigaktuk
Conrad Fraser
Peter Horassi
Beatrice Kosh
Paul Maccauley
Gilbert Maccauley
Bobby Macpherson
Brad Menacho
David Menacho
Lawrence Menacho
Jimmy Mendo
Leon Sewi
Curtis Widow
Mildred Widow
Derrick Widow
Roderick Yallee





Timeline

In this section, we provide an overview of the phases involved in organising the fall hunt, including the pre-trip planning, travelling, the daily routine during the hunt, and the return home.

Pre-Trip Planning

In early spring 2013, the idea for the project was developed at a meeting in Tulít'a attended by Nina Wilson, Sister Celeste, Lorraine Kuer, Jessie Campbell, with Margaret Erasmus joining via speaker phone. The group members agreed that a family-oriented, on-the-land community trip would be a valuable activity to be supported by the TAASTE program, and that the annual fall hunt to Pietł'ánejo would be the ideal vehicle for the project.

In summer 2013, community organizations were asked for their input on the project and were asked if they would like to support or participate in it.

In the month before the fall hunt, there were several planning meetings that included representatives from trip partners as well as trip participants. The purpose of the meetings was to decide on a schedule, finalize a list of attendees, organize travel plans and arrange for supplies. The meetings also gave a chance for the organizers to explain the TAASTE objectives – for example, healthy diets based on traditional foods, and the values associated with living off of the land - to the rest of the fall hunt participants.

Travelling

On Tuesday, September 17, eight jet boats departed from Tulít'a to travel up the Mackenzie River and Keele River to Pìetł'ánejo. The trip took two days. Each jet boat carried three or four people. A total of approximately 27 fall hunt participants traveled by boat. On the following day, all of the camp supplies that could not be brought in by jet boat were purchased, packed, and prepared to be flown in to Pìetł'ánejo.

On Thursday, September 19, three chartered flights brought community members from Tulít'a to Pìetł'ánejo. The Twin Otter plane had a flight time of about 45 minutes and held up to 12 passengers plus all of their gear. A total of approximately 28 fall hunt participants traveled by plane. The jet boats also arrived at Pìetł'ánejo on this day.

Setting Up Camp

Once all of the charters arrived, the remainder of the day was spent preparing the camp. The main camp for the fall hunt was situated next to the Shell Airstrip, the location of a former mineral exploration site. Two families chose to camp nearby, one located a short distance upstream and the other located a short distance downstream. The youth associated with Chief Albert Wright School were split between a bunkhouse for the girls and several small cabins for the boys, with chaperones nearby. The remainder of the youth stayed in tents with or near their families. Canvas tents were set up, cabins were cleaned out, and the bunkhouses and kitchen both received some repairs plus new roof tarps.

Daily Routine

Each day at the camp followed a similar routine, involving elders, adults and youth men and women in a variety of tasks. Most of the men went hunting, either on foot or by jet boat. Most of the women worked at the camp, doing all of the cooking and cleaning as well as preparing the meat that was brought back by the hunters. The younger children remained at the camp with the women. The youth associated with Chief Albert Wright School worked with their chaperones, mostly following the same pattern as the rest of the fall hunt participants. The research teams worked on their individual projects as time allowed.

Return Home

On Saturday, September 28, the camp was broken down and three chartered flights returned to Tulít'a carrying about half of the fall hunt participants along with all of their gear. An additional charter returned country food for the community. The jet boats returned to Tulít'a separately.



Life at Pietł'ánejo

The families and resource people that travelled were involved in a wide variety of activities during the community hunt. In this section, we provide insights into the activities at the camp and travelling on the land, as well as cultural, educational and research activities.

Camp Activities

Any extended trip on the land requires a great amount of effort to be directed towards taking care of the camp. Youth members of the trip played an important role in helping with this.

Food Preparation

The young women, supervised by their chaperones and an elder, did the majority of the cooking and cleaning at the camp. They had access to a kitchen building (with very limited amenities!), and supplies had been flown in, but moose and caribou meat as well as fish soon became available. All of the youth and children spent time preparing the meat that was brought back to camp by the hunters, either with their families or under the supervision of the elders or chaperones. All of the youth also had a chance to make, and eat, their own drymeat. This was especially popular as a snack during the hikes later in the week!







Making and Breaking Camp

Many of the participants stayed in canvas tents. There was also a bunkhouse and several small cabins at the main Pielt'ánejo campsite, though all needed to be repaired and cleaned before anyone could stay in them. The youth, instructed by their elders, also built teepees and drying racks for the meat.



Firewood

The camp attendant, along with the young men, cut, hauled back to camp, split, and distributed all of the firewood required to keep the tents, bunkhouse, and kitchen warm. The wood was also needed to keep all the teepee fires going, because there was a lot of meat that needed to be dried and smoked!



On-the-Land Activities

All of the fall hunt participants had opportunities to participate in on-the-land activities. Both the youth who attended with their families and the youth who attended through the school spent a lot of time on the land, although their experiences differed somewhat.

Hiking

When not busy in camp, many of the youth took the opportunity to spend time on the land surrounding Pielt'ánejo. These hikes inevitably involved searching for berries and other plants, looking for wildlife, and hearing stories about the land or talking about those stories with each other.



Hunting and Fishing

All of the young men who were at Pietch'ánejo with their relatives went hunting on a daily basis, and some went fishing in the river, too. The youth also went hunting with their chaperone several times. The women did not go hunting, but several animals were spotted and hunted near the camp, so everyone at Pietch'ánejo still had the opportunity to witness the entire process. On three separate occasions, the youth were the first to spot caribou: twice across the river and once in the creek bed behind the main camp. After the animals were killed, elders demonstrated to the youth how to properly skin and cut up moose and caribou. Elders also demonstrated how to prepare both moose and caribou hides.







Gathering

Berry patches are plentiful around Pielt'ánejo, on the edges of the swamps and river as well as on the slopes of the nearby mountains. The female youth went on a day-long hike up a nearby mountain and spent time in the berry patch pictured below. The youth all also spent time on their hikes searching for plants and medicines that their elders taught them about. For example, they kept an eye out for diamond willow; according to an elder, it was the ideal wood for smoking dry meat.



Cultural Activities

The interactions between all the camp participants, and especially between elders and youth, can be difficult to document meaningfully. They are, however, one of the most important aspects of an on-the-land trip like the fall hunt. Cultural activities, such as stories and discussions about the land, animals, and the history of the Dene (including one's own family or relatives), strongly complement the hard work, skill development, and experiences that make up each day on the land. Values about how to act in camp and how to behave around animals are also passed on during these interactions



Storytelling

One of the elders led a night of storytelling that was attended by all of the youth and covered a wide variety of topics.

- Stories from his childhood, about traveling into the mountains, making a moose skin boat, then traveling back to Tulít'a.
- Stories from living in the bush as an adult and elder, about trapping and hunting
- Stories about the past, teaching lessons like how to behave properly in camp
- Stories about animals, including ducks, bears, and ravens
- Stories about medicinal plants that can be used for medicine
- Stories about the bushmen

The elder also performed a bunch of different card tricks for the youth and then sent them all to bed promptly at 10 PM. The youth spent much of the rest of the trip telling and retelling these stories to each other. They also learned that they were expected to go to bed (and wake up) much earlier!

Honoring the Land

The young women decorated willow branches with ribbons and placed them in the river to honor the land. Similar offerings were made by everyone on the fall hunt, using tea bags, tobacco, bullets, or matches. Learning when it was appropriate to do make these offerings, and seeing how to make the offerings properly were very important lessons for the youth.



Educational Activities

Sharing Circle

At the end of the week a talking circle was held for all of the youth to share their thoughts and experiences from the trip to Pietł'ánejo. The following list is either paraphrased or directly quoted from the youth participants:

- Their favorite experience from the trip
 - Climbing the hills
 - Making dry meat
- Their favorite new thing that they learned to do
 - How to skin a moose
 - How to get the hair off of a moose hide
 - How to make dry meat
 - How to arrange the branches to hang dry meat
 - Making all the different foods
 - How to cut the meat properly
- What they learned from the elders
 - “How to respect the land and take care of the country”
 - “All of the stories”
 - How to split wood
- Their favorite jobs around the camp
 - “Keeping busy all the time and picking up garbage whenever I see it”
 - “Cutting wood, I was no good at it but I tried”
 - “Getting wood and helping people”
 - “Cooking in the morning”
 - “Keeping busy, asking for something to do, and helping people”
 - Most of the youth also said that they enjoyed making their own dry meat.
- The new food they learned about, prepared, and got to eat
 - Dry meat was the most popular response.
 - Stew and bannock were the other most popular meal
- What they would do differently next year
 - “I’d get up earlier and get things done earlier, then hike in the day”
 - “I’d get a better blanket”
 - “I’d bring a gun so I could go hunting”
 - “I’d bring my best friend”
- What they learned about the land, animals, or Dene history
 - “To be respectful towards the animals and sacred grounds” (Many of the other youth echoed this statement)
 - “That caribou have no front teeth!”
 - “Stories about bushmen”
 - “”If you respect the land, good things will come”
- What they want to tell people in Tulít’a about their trip
 - “That I had good times with everyone here, that it was a good hunting trip, that I had fun.”
 - “I climbed my first mountain, had a fun time, would have frozen without an extra blanket!”

- o “Had fun, liked playing hide and seek, got to drive a quad, went hiking, and learned card tricks.”
- o “I had fun, I saw a chipmunk, I made dry meat, and I learned the differences between moose and caribou.”
- o “Come out here!”



Climate Change and Community Health Project

Reanna Campbell, who works on the SRRB's Climate Change and Community Health project, stayed with her relatives at a smaller camp downstream from the main camp. She worked with both elders and youth, talking about ways that the land is changing in response to climate change and ways that people can adapt to these changes. Some examples noted by the elders and shared with the youth included trees getting a lot dryer, water being higher than it should be at that time of year, caribou avoiding the flats at that time of year, seasons changing more quickly, additional rain during the summer, and collapsing river banks.

Climate change has the potential to impact the harvesting of traditional foods, and one of the focuses of Reanna's project is to learn how youth can respond to changes in the climate and still live healthy lives. This project empowers the young people of Tulít'a to lead the community in identifying how climate change is affecting people's health and what the community can do about it. The project also brings together elders and harvesters to guide the youth with traditional stories and experience in what to do when everything around you is changing. Through a series of workshops and health adaptation projects projects, youth from the Sahtú will have the opportunity to build positive momentum towards a healthier and safer Sahtú.



Caribou and Moose Health Monitoring

Anja Carlsson worked with hunters to collect organ, tissue, and blood samples from the moose and caribou that were killed. These samples can be used to determine how healthy the animals are and can also monitor any diseases or parasites they may carry. The wildlife health monitoring program began in 2003 in response to community concerns about wildlife health under a regime of rapid environmental change (climate and industrial development) in the Sahtú. During the winter of 2013, in collaboration with the genetic study, the health monitoring was expanded to include boreal woodland caribou, mountain caribou, barren-ground caribou and moose across the Sahtú. The objective of the program is to work with local hunters to maintain an ongoing wildlife health monitoring program that is responsive to the changing needs of the community and the changing health issues that emerge in wildlife. People in the Sahtú are the experts about what is happening to their animals, and when they have questions – for example, about whether or not the meat is healthy to eat – Anja's project can help them find the answers.

Caribou Genetics Project

Jean Polfus worked with the hunters to collect caribou DNA samples, usually in the form of blood or meat from the caribou that were killed. Jean explained her project to the youth and shared knowledge about caribou research across Canada. The goal of her research is to develop a comprehensive understanding of the identities and relationships among caribou populations and Dene people in the Sahtú region in order to inform and prioritize management efforts. The project brings together traditional knowledge and genetic analysis to organize and understand the biological diversity of caribou and to develop an approach to caribou research that balances and accommodates aboriginal and scientific ways of knowing. This research supports hunters by subsidizing their trips on the land and making sure that caribou populations remain healthy.



Follow-Up Projects

Pietł'ánejo (Fall Hunt Photo / Informational Book)

The Species at Risk Stewardship Fund is supporting the creation of a 96 page hardcover book that will be full of pictures and stories from the fall hunt. It will include contributions by the youth participants. Copies of the book will be given to every fall hunt participant and every resident of Tulít'a.

Chief Albert Wright School Spring Trip

Many of the youth participants in the fall hunt will be invited to go on a trip organized by Chief Albert Wright School that will take place during the month of May. The trip will include a focus on objectives including hunting and trapping, so the youth will get to continue learning many of the same lessons about traditional food, healthy diets, and healthy lifestyles that they were exposed to on the fall hunt.

Best of Both Worlds: Traditional Economy Assessment

The Sahtú Renewable Resources Board has received funding for two years of work on an assessment of the traditional economy and the creation of community action plans to strengthen it. One component of this project will involve a team of researchers from Wilfred Laurier University looking at food security and ways that the traditional economy can support healthy diets.

Lessons Learned

This project was very successful in involving a large number of community participants, both women and men, and providing opportunities for knowledge sharing among the three generations: elders, parents and youth. The partnerships with resource people and linkages made with related regional projects added considerable value to the project.

It became clear in organising this community hunt that funding support is a key to providing opportunities for many families and individuals – especially youth – to experience traditional practices on the land. This is because the cost and equipment requirements for travelling to Pietł'ánejo are significant, and only a select group of families has the necessary resources to make the annual trip.

More regular community on-the-land events would provide more opportunities for developing the experience needed for organising at a community level to achieve collectively developed objectives in youth learning. Individual families are accustomed to being very independent on the land, and special efforts are needed to encourage coordination with others and mentoring for youth that may not have knowledgeable family members with them.

It was apparent that there are significant challenges in setting up processes for effective learning, given that, currently, there are not many educational programs that involve both teachers from the school and community members with expertise on the land. Event organisers need to pay special attention to ensuring that a strong team is established to focus on the learning needs of

the youth, and to prepare structured activities for them that help them to bridge the two cultures. Attention needs to be paid to the roles of both young women and young men in life on the land, and programming should involve all participants equally.

Resource people with training from other places may face challenges in understanding the complex array of activities, practices and protocols on the land. The resource people who attended the Pielt'ánejo community hunt were able to prepare ahead of time with community event leaders so that positive and respectful learning relationships could be built and people could participate meaningfully in structured activities such as sharing circles or research projects.

Recommendations

Considering lessons learned from the Pielt'ánejo community hunt, Tulít'a TAASTE project organisers submit the following recommendations for consideration by champions of country food-based nutrition and on-the-land community wellness programs:

1. A stable long term funding source should be identified to support continued on-the-land programs with a special focus on individuals and families who are otherwise unable to afford such trips. *This recommendation is especially directed to the Sahtú Renewable Resources*



2. A community campaign to advocate for country food-based nutrition and healthy living should be established to ensure that lessons learned at the Pìetł'ánejo community hunt have a lasting impact on the community.
3. A curriculum for high school students in country food-based nutrition and traditional on-the-land practices as the basis for healthy living should be developed as a basis for structuring learning on the land.
4. When possible, existing community events such as seasonal hunts should be expanded to include youth, educators, and resource people so that additional objectives that are important to the community can be achieved.

Conclusions

In Tulít'a there is often a lot of talk about the importance of youth as future leaders and stewards of the land. Paradoxically, there are relatively few opportunities for many youth to learn on the land. This gap in community wellness programming was exposed during the 2013 Pìetł'ánejo community hunt. The TAASTE project provided an important opportunity to learn about community needs in present and future learning about nutrition and wellness from traditional Dene and Métis perspectives. The community hunt was a positive and motivating experience for everyone involved, and promises to lead to strengthened programming for the future.



Appendix B

Tulít'a Community Spring Hunt at K'áalq Túé (Willow Lake)

Tulít'a Community Spring Hunt at K'áalq Túé (Willow Lake)

Submitted by:

Chief Albert Wright School
PO Box 126
Tulít'a, NT
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Phone 867-588-4361

July-29-14

Objective

Provide on-the-land trapping, harvesting and survival training for approximately 10 youth in grades 8-12 at the Chief Albert Wright School (CAWS), including their participation in the Tulít'a community Spring hunt of ducks and geese during peak migration season. The program will draw heavily on the expertise of local harvesters and qualified local teachers. The program will integrate North Slavey language conversation in all the traditional activities. The program is meant to engage youth, 14-20 years old, in skills-based Traditional Knowledge, language and on-the-land learning. The students will learn from the harvester guides and other K'áalogot'ıne (Willow Lake people) about the traditional use of the K'áalq Túé area.

Trapping

- A lesson on trapping was done on a small lake in the K'áalq Túé area. Target animals: beaver and muskrat.
- Students were instructed in pelt handling techniques for beaver and muskrat and had numerous opportunities to practice skinning both animals.

Harvesting

- Students were instructed in the hunting and preparation of ducks and geese. Firearms safety was incorporated into this component. Male students had opportunities to go hunting on a daily basis. Female students had opportunities to work with elders in camp every day and focused more on the preparation of ducks, geese, and other animals as they were brought in.

Staffing

- Elder Gordon Yakelaya led the project as guide and Traditional Knowledge holder. Gordon grew up on the land and is an experienced trapper, hunter and outdoorsperson, and will instruct/lead the training in safety and on-the-land skills. He is fluent in both North Slavey and English

- Robert Horassi supported the group as a community assistant. Robert is an experienced trapper, hunter and outdoorsperson, and will support the training in safety and on-the-land skills
- Local schoolteachers Judy McPherson and Cathie Menacho acted as female chaperones, providing support for language and traditional activities.
- Schoolteacher Marc Champagne acted as male chaperone. Marc is an experienced hunter and outdoorsperson, and has coordinated several on-the-land trips for the Chief Albert Wright School.
- Other Elders, harvesters and community members out at the Willow Lake camp were engaged to teach the students. Elders who participated included Joe Bernarde, Alice Bernarde, Morris Mendo, and Charlotte Menacho.

Participants

- Thomas Horassi
- Donovan Yakelaya
- Jason Nataway
- Dallas MacCauley
- Jared Etchinelle
- Roydon MacCauley
- Lacey Wrigley
- Maylene Andrew
- Zanaide Clement

Three female students and six male students aged between 14 and 20 years in grades 8-12 participated. Numerous other youth were present at K'áalq Túé with their families and were participants in camp events supported by this funding.

Dates

May 3-12, 2014.

Locations

- Classroom skills, theory skills: Chief Albert Wright School
- On-the-land and Traditional Knowledge activities: K'áalq Túé (Willow Lake) area

Partnerships

- Sahtú Renewable Resources Board (SRRB): supplementary funding, coordination support, resources and programming on the Traditional Economy and community health effects of climate change (in partnership with the Pembina Institute)
- Tulít'a District Education Authority: coordination support
- Tulít'a Land & Financial Corporation: helicopter hours

Budget

The budget has been provided separately.

Lesson Plan

The following lesson plan was proposed; bolded items were achieved.

- **Trapping training**
 - **Demonstration snares and traps will be set around the K'áalq Túé area. Target animals: beaver and muskrat, and others as opportunities arise**
 - **Students will be instructed in pelt handling techniques**
- **Harvesting training**
 - **Students will be instructed in the hunting and preparation of ducks and geese, as well as other animals such as moose and caribou as opportunities present themselves. Firearms safety will be incorporated into this component**
 - Students will be instructed in the setting of nets for the harvesting of fish. Ice auger safety will be incorporated
- **Camp skills**
 - **Tent set-up and take-down**
 - **Gathering wood and making a fire**
 - **Collecting and boiling water**
 - **Meal preparation and dishes**
 - **Camp maintenance**
 - **Equipment maintenance: skidoos, fish nets**
- **Traditional Knowledge sessions, community and research skills**
 - **History, importance and use of the K'áalq Túé (Willow Lake) area**
 - **North Slavey language instruction, including place names, animal names, trapping and harvesting terms**
 - **Climate change and its effects on the area and people's health**
 - **Maintaining and strengthening the Traditional Economy in Tulít'a and the Sahtú**
 - **Participating and facilitating Traditional Knowledge interviews and talking circles, including with Elders**
 - **Sharing and communicating stories through different formats**

Documentation

After Gordon and Robert led the boys in setting up a canvas tent, Jason and Marc make a spruce bough floor.



Elders show the youth how to skin a beaver and prepare and cook the meat.



Eugene working with two of the youth to skin a beaver.



Marc and the youth cooking the beaver meat.



Thomas and Dallas tend the fire and cook beaver tail for dinner.



Jason and Wayne after learning axe safety, preparing walking sticks, and learning how to travel safely over frozen lakes.



Wayne and Jason collecting plants for use in tea and keeping wildlife away from campsites.



Gordon teaching Jason and Wayne about different kinds of sap and their uses.



This kind of sap was good for chewing.



Gordon, Wayne, and Jason looking for ducks and beaver.



Take a short lunch break and making tea.



Robert and Gordon teach the youth about muskrat habitat, how muskrat behave, and how to trap them.



Wayne, Eugene, and Jason are attentive students.



Appendix C

Climate Change and Community Health Workshop Materials



ʔehdzo Got'ine Gots'é Nákedí

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Phone (867) 588-4040

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Chief Richard Kochon, Behdzi Ahda First Nation, fax (867) 709-2202
Raymond Taniton, President, Dél'ine ʔehdzo Got'ine, fax (867) 589-8101
Roger Boniface, President, Fort Good Hope ʔehdzo Got'ine, fax (867) 598-2437
Norman Hodgson, President, Norman Wells ʔehdzo Got'ine, fax (867) 587-2545
David Menacho, President, Tulit'a ʔehdzo Got'ine, fax (867) 588-3726

Delivered via fax and email

January-17-15

RE: REPLY REQUESTED - Two Workshops, November 5-7, Tulit'a

- ***Environmental Research and Monitoring Workshop***
- ***Climate Change and Community Health Workshop***

Dear ʔehdzo Got'ine Presidents:

The ʔehdzo Got'ine Gots'é Nákedí (Sahtú Renewable Resources Board) is pleased to inform you of **two workshops** that are both taking place in on November 5-7 in Tulit'a on the themes of 1) environmental research and monitoring; and 2) climate change and community health. We are seeking participants for the two workshops, described in detail below.

1. Environmental Research and Monitoring Workshop

We invite each of the Renewable Resource Councils to send ***two delegates*** to a meeting to discuss how we can coordinate environmental research and monitoring throughout the Sahtú Region.

The idea for the Environmental Research and Monitoring Workshop came about in response to increasing levels of shale oil exploration activity in the region. Sahtú beneficiary organizations, co-management boards, government departments, and industry are all trying to figure out how to work together to plan and manage environmental research and monitoring. This is a chance for Sahtú beneficiary organizations to be in the driver's seat and ensure that research and monitoring meets the needs and goals of Sahtú people.

Workshop Objectives

- To build relationships among Sahtú, government, and industry agencies and organizations;

- To share information around what environmental research and monitoring has been done in the past, what is underway, and what is being planned in the Sahtú Region;
- To figure out the best ways to coordinate environmental research and monitoring in the region, considering ideas like a working group;
- To outline goals, funding needs, and timelines for coordination of environmental research and monitoring; and
- To identify Sahtú individuals and organizations who are interested and motivated to take a lead on coordinating environmental research and monitoring.

Draft Agenda

We are still working on the agenda, so we would welcome your ideas and input. The rough outline is as follows:

- Introductions
- Experiences so far with different kinds of environmental research and monitoring
- Past, current, and planned research and monitoring on each of the following topics: wildlife and wildlife habitat, harvesting and the traditional economy, surface and groundwater, socio-cultural investigations, cumulative effects
- Dene and Métis ways of knowing the land
- Coordinating environmental research and monitoring: what needs to be done, who should do it, how?
- Action planning, next steps

Funding

We are happy to cover \$200/day honorarium for two delegates from each ʔehdzo Got'ıne. For those travelling from out of town, we will also contribute the cost of air fare, per diems, and billeting in private accommodations (at the standard rate of \$50/night). You are more than welcome to send more than two delegates; however, unfortunately, we cannot cover expenses for additional delegates.

2. Climate Change and Community Health Workshop

Elders and youth from several Sahtú communities who have a particular interest and/or knowledge about climate change impacts on the land will be chosen to participate in this forum co-sponsored by the TRRC, SRRB and Pembina Institute. There will be a chance for delegates from each meeting to share the results of their discussions with the other group.

This forum is part of a year-long project led by the TRRC and a Youth Steering Committee in Tulít'a, with support from the Pembina Institute and the ʔehdzo Got'ıne Gots'ę Nákedı.

Forum Objectives

To learn from climate science experts and health experts about current risks and future climate change scenarios;

- To learn from traditional knowledge perspectives about changing climate / weather patterns, health and cultural implications;
- To learn from key stories chosen by the elders to teach about environmental change and uncertainty;

- To give young people and elders from Délı̨nę and Fort Good Hope a chance to share their learnings and reflections about previous climate change adaptation projects in their communities.

We welcome help from the RRCs in nominating youth and elders from your communities who have a particular interest and/or knowledge about climate change impacts on the land. We will follow up with those individuals to find out about their availability.

Reply Requested

Please respond at your earliest convenience to let us know:

- Who from your local ʔehdzo Got'ı̨nę will be available to participate in the Environmental Research and Monitoring Workshop; and
- Which elders and youth you would like to nominate to attend the Learning Forum on Climate Change and Community Health.
- Whether delegates require assistance in finding billets.

In the meantime, if you have any questions, please **email Joe Hanlon rrco@srrb.nt.ca or call Joe or Reanna Campbell at 867-588-4040**. Our workshop coordinating team members will also be touching base with you by phone to discuss the two workshops. We look forward to the opportunity to work with communities on coordinating research and learning about climate change!

Sincerely,



Deborah Simmons
Executive Director

Health and Climate Change: Cross-Community Learning Forum

Participant agenda

November 5th to 7th 2013, Tulit'a

When	Where	What
Tuesday		
7:30-8:30	Hotel	BREAKFAST
9 – 10:00	ARENA	Joint workshop introductions Feeding the fire ceremony
10:15-10:30	Hotel	Review of the workshop agenda
10:30 -12	Hotel	Climate change: current and future impacts, globally and in the north <i>Tom-Pierre Frappé-Sénéclauze, Pembina Institute</i>
11:50 -1:00	ARENA	LUNCH
1:15 - 3:00	Hotel	Report back from community research projects in Délı̨ne and Caribou Flats
3:00 - 3:30	Hotel	Climate change: how will it affect caribou? <i>Jean Polfus, University of Manitoba</i>
3:30 - 3:45	Hotel	BREAK
3:45 - 4:15	Hotel	Dene words for climate change
4:15 - 5:30	Hotel	Traditional stories about Dene law and the landscape
5:30 - 6:30	ARENA	DINNER
6:30 - 8:30	ARENA	Storytelling and drumming workshop <i>Leon Andrew</i>
Wednesday		
7:30-8:30	Hotel	BREAKFAST
9:00-9:15	Hotel	Intro to the day
9:15-9:45	Hotel	Health and climate change <i>Dr. Courtney Howard, Canadian Physicians for the Environment</i>
9:45-10:15	Hotel	Unconventional oil and gas extraction, climate change and health – how does hydraulic fracturing work?
Wednesday	...	(continued)
10:15-10:30	Hotel	BREAK
10:30-11:15	Hotel	Unconventional oil and gas extraction, climate change and health –

		the experience from Northeast BC
11:15-12:00	Hotel	Resource planning and health: opportunities to engage in planning processes <i>Sauna Morgan, Pembina Institute</i>
12:00-1:00	ARENA	LUNCH
1:00-2:30	ARENA	Dene and Métis ways of knowing the land
3:30-4:00	Hotel	Dene terminology
4:00-5:00	Hotel	The power of stories
5:00-6:00	ARENA	COMMUNITY FEAST
7:00-9:00	ARENA	Drum dance and celebration

Thursday

7:30-8:30	Hotel	BREAKFAST
9:00-9:15	Hotel	intro to the day
9:15-10:15	Hotel	Treaty history <i>Daniel T'seleie, University of Victoria</i>
10:15-11:00	Hotel	Dene terminology
11:00-12:00	Hotel	Prepare for report back
12:00-1:00	ARENA	LUNCH
1:00-1:30	Hotel	Report back to other workshop
1:30-2:30	Hotel	Report back from PowerShift BC conference <i>Archie Erigaktuk, Gerald Pierrot, Reanna Campbell</i>
2:30-4:00	Hotel	Next steps: skill building workshop
4:00-6:00	tbc	Open
6:00-7:00	ARENA	DINNER

Participants

Dél̓n̓ Elder	Leon Modeste
Dél̓n̓ Elder	Alfred Taniton
Dél̓n̓ Youth	Franklin Baton
Dél̓n̓ Youth	Cheyenne Beyonnie

Tulít'a Elder	Maurice Mendo
Tulít'a Elder	David Etchinelle
Tulít'a Elder	Theresa Etchinelle
Tulít'a Youth	Archie Erigaktuk
Tulít'a Youth	Chantal Bavard

Norman Wells Elder	Edward Oudzi
Norman Wells Youth	Carrie Campbell
Norman Wells Youth	Kathleen Tseleie

Fort Good Hope Elder	Thomas Manual
Fort Good Hope Elder	Frank Tseleie
Fort Good Hope Elder	Frank Pierrot
Fort Good Hope Youth	Gerald Pierrot
Fort Good Hope Youth	Lorina Tseleie

Colville Lake Elder	Marie Kochon
Colville Lake Adult	Barbara Blancho
Colville Lake Youth	Daniel Tutcho
Colville Lake Youth	Shaun Tobac
Colville Lake Youth	Tyrell Kochon

Appendix D

Tulít'a Focus Group Questions (March 2014)

Tulít'a March Focus Group Questions

Tell people about the three different topics you want to talk about:

- Caribou Flats (quotes for a photo book)
- How climate change is affecting community health
- Maintaining and strengthening the traditional economy

Get them to sign consent form – okay to use their name, or do they want to be anonymous? (though we need their name for the photo book)

Questions

Caribou Flats

1. What can you tell us about Caribou Flats and the fall hunt?
 - a. What is important for the community to understand or know about the Caribou Flats area?
 - b. What about how to use caribou/make tools/be respectful?
 - c. Are there important place names or any other knowledge about Caribou Flats that should be shared with the community, especially youth?
2. How can the planning and coordination of community-wide on-the-land events like the fall hunt at Caribou Flats be improved?
 - a. How can youth in particular learn and experience important traditional practices on the land, especially those who may not have family members that can take them out often?
 - b. How could on-the-land teaching be more structured for youth?
 - c. How can people and families who may not be able to afford to get out on the land often, be supported so that they can get out more?
3. What are some ways to support country food diets and healthy living for people in Tulít'a?

Climate Change

4. What do you think of when we say 'climate change'
 - a. How do you think climate change is affecting Tulít'a?
 - b. In what ways are the people of Tulít'a vulnerable to or affected by climate change?
3. What sorts of health issues are people in Tulít'a facing?
 - a. Physical

- b. Mental
- c. Social
- d. Cultural

4. Historically - in what ways have the people of Tulít'a shown their resilience to environmental changes and challenges?

- a. What kinds of environmental changes did people see in the past?
- b. How did people adapt to those changes to survive?

5. Do you know any old time stories that teach people about how to deal with environmental change and uncertainty?

- a. Are there stories about Yamóqzha or Yamoria that teach people about how to adapt to environmental change?
- b. Are there aspects of Dene law that teach people about this?

6. Have you noticed changes to the land in recent years? (last ten years or so). What sort of changes?

- a. More storms and extreme weather events?
- b. Later freeze-up?
- c. Changing freeze-melt-freeze patterns?

7. Have you noticed changes in wildlife in recent years? What sort of changes?

- a. Changes to health of game animals?
- b. Different movement and migration patterns of animals?
- c. New species?

8. Have hunting and harvesting practices been changing in recent years? How?

- a. Are you or harvesters you know going out as often?
- b. Are you or harvesters you know finding it more difficult or dangerous to go out?
- c. Is unpredictable weather/travel and ice safety becoming more of an issue?

9. Are you eating as much country food as you would like?

- a. Are you eating more store-bought food these days?
- b. How do you generally get a hold of the country food that you do eat? Has this changed over the last 10 years?

- c. Do you feel like food security is an issue for people in Tulít'a? (being able to access enough good quality, healthy food whenever you need it) Is it a big issue?

10. What are some ways for the community of Tulít'a to deal with the changes we have talked about?

- a. What community resources do you think are available?
- b. In what ways can Tulít'a better prepare for and adapt to climate change?
- c. How might Tulít'a work more closely with other communities in the Sahtu, on issues such as health and climate change?

Traditional Economy

13. What are the things that are keeping the Traditional Economy/traditional activities going and strong?

14. What are the challenges facing the community in terms of keeping the Traditional Economy/traditional activities strong?

15. Can people make a living and support their families through activities like trapping, fishing and arts and crafts, or is other income needed these days?

16. With more development and industry going on or coming, how do you think the Traditional Economy/traditional activities might be affected?

- a. How can industry and companies make sure that the Traditional Economy/traditional activities stay strong?
- b. What are some ways to make sure there is a good balance?

17. What kinds of jobs would be good to have available in the Sahtú? Do you think people would like more jobs out on the land like environmental monitoring, or are all jobs good?

18. Do you think being good on the land helps prepare people for jobs? Would skills in the bush help people in their jobs?

- a. What are the best ways to teach and learn these skills?
- b. What makes people successful, both in the bush and as workers?

19. What role do women have in their families and the community?

- a. In terms of traditional activities?
- b. In terms of having jobs and making an income?

20. What keeps youth from getting out on the land?

a. How can youth be supported to become successful in both worlds?

Appendix E

Climate Change in the Sahtú Region

Climate change in the Sahtú region

Observed climate change in Canada¹

To understand how climate change might affect the Sahtú, it is useful first to discuss how climatic conditions have changed across Canada, and how the natural environment responded to these changes. There are two reasons for this. First, there is the simple fact that broadening the scope gives us access to more data and research on climate impacts, as unfortunately, environmental data in the North is limited. Second, because climatic conditions naturally vary greatly both in time and in space, it is easier to detect and understand the impacts of a global phenomenon such as climate change by looking at longer periods of time and larger geographical areas. Thus, before zooming in and reviewing the climate impact observed in the NWT and the Sahtú, we first discuss how environmental conditions have changed across Canada, and how that has affected ecosystems and human activities.

Changes in air temperature, precipitation, snow and ice cover, and other climate change indicators

Because of its northern latitude, warming in Canada has progressed about twice as fast as the planetary average. Between 1950 and 2010, temperatures over land have increased by 1.5°C (Figure 1). Warming has been observed in all seasons, with the greatest warming occurring in winter and spring. The annual number of extreme warm days has also risen, while the number of cold nights has declined. This warming has been occurring even faster in northern Canada, as we will discuss further in the next section.

¹ Unless stated otherwise, information in this section is a synthesis of Warren, F.J., and D.S. Lemmen, eds. *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation*. Ottawa: Government of Canada, 2014. <http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2014/16309>.

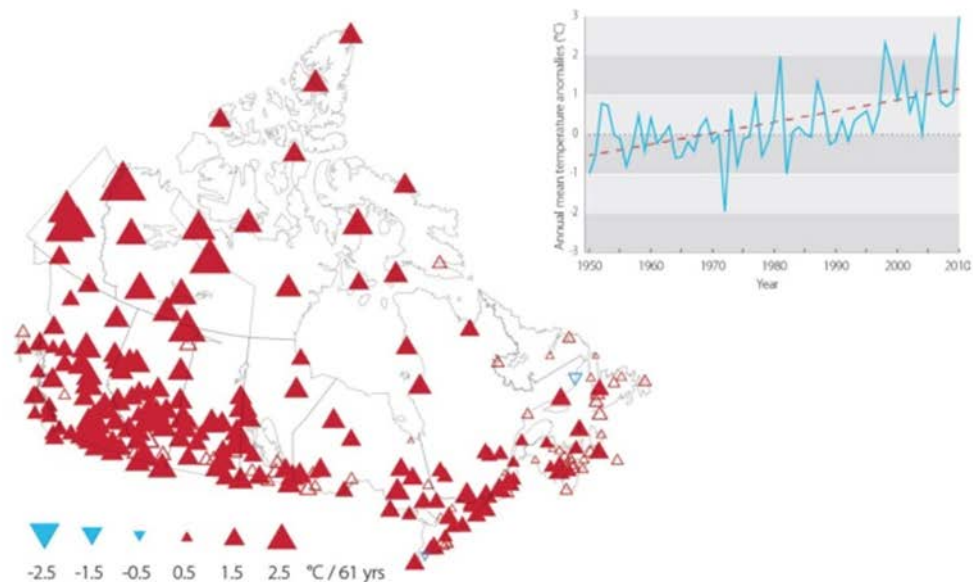


Figure 1 Patterns of change in annual mean temperature across Canada over the period 1950–2010. Upward (red) and downward (blue) pointing triangles indicate positive and negative trends respectively. Filled triangles correspond to trends significant at the 5% level. Inset: Annual mean temperature change for Canada (°C), 1950–2010, relative to the 1961–1990 average (represented by zero on the Y-axis) (Source: Vincent et al., 2012; Environment Canada, 2011, reproduced in Natural Resources Canada, 2014²).

This increase in temperature drives changes in the amount, timing, and form of precipitation (snow and rain). Over the same time period (1950–2010), Canada as a whole has become wetter; most areas get more rain in a typical year, while a few other areas are getting dryer (Figure 2). Changes in extreme precipitation events have been observed in many areas of the country, but no consistent pattern is evident for the country as a whole.

² Warren, F.J., and D.S. Lemmen, eds. *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation*. Ottawa: Government of Canada, 2014.
<http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2014/16309>.

Other indications of climate change have been observed in Canada. The Arctic sea ice has been decreasing in extent, both in summer and winter. Snowfall has decreased across southern Canada and the snow cover melts earlier in the spring. Glaciers in western Canada and the Arctic are shrinking. Sea level has been increasing globally because ocean water expands as it gets warmer, and because of melting glaciers, ice caps, and ice sheets. Whether this sea level rise is observed in a given region depends in great part on the motion of the coastline itself: sea level rise is most dramatic in areas where land is subsiding, and might be unnoticed in areas where the land is rising. Table 1 summarizes the range of indicators of climate change observed across Canada.

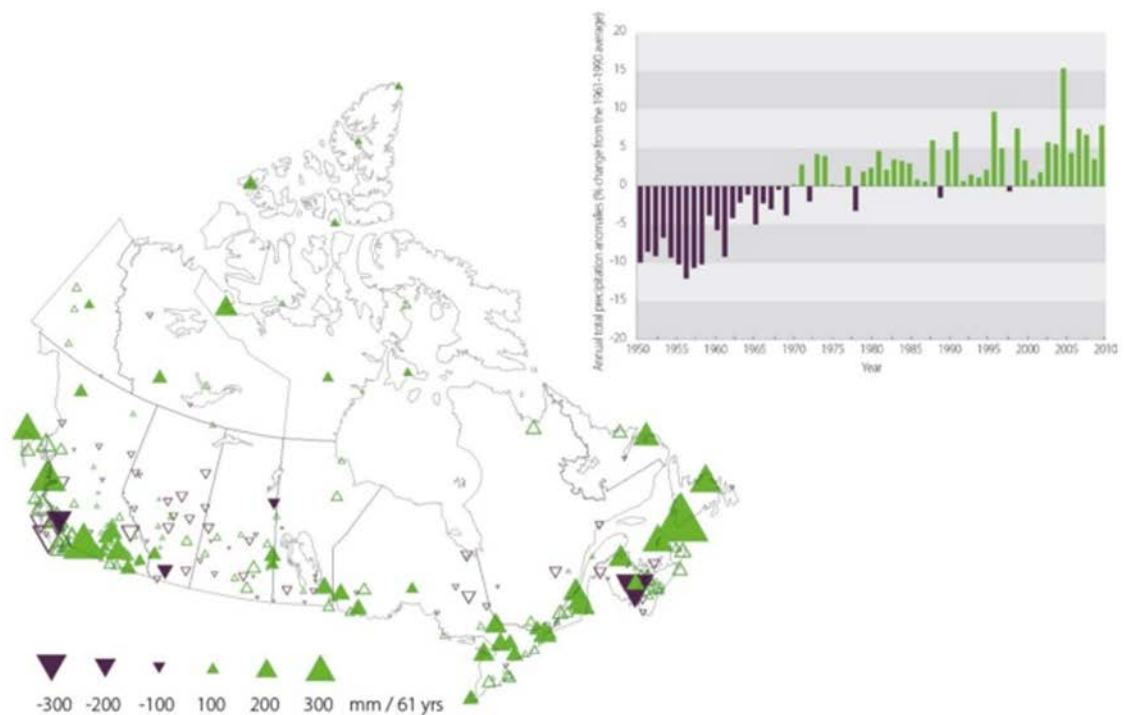


Figure 2 Patterns of change in annual total precipitation over the period 1950–2010. Upward (green) and downward (purple) pointing triangles indicate positive and negative trends, respectively. Filled triangles correspond to trends significant at the 5% level. Inset: Annual total precipitation anomalies (expressed in % change from the 1961–1990 average) for Canada, 1950–2010 (Reproduced from Natural Resources Canada, 2014).

Climate System Element	Observed Trends
Temperature	
Annual air temperature – Canada	The annual average surface air temperature over the Canadian landmass has warmed by 1.5°C over the period 1950-2010
Temperature Extremes	
Hot extremes – Canada	The frequency of warm days (when the daily maximum temperature is above the daily 90th percentile) during the summer has increased nationally since 1950
Cold extremes – Canada	The frequency of cold nights (when the daily minimum temperature is below the daily 10th percentile) during the winter has decreased nationally since 1950
Precipitation and other hydrological indicators	
Annual precipitation – Canada	Canada has generally become wetter in recent decades, as indicated by the increasing trend in annual average precipitation
Snowfall/Rainfall – Southern Canada	In several regions of southern Canada, there has been a shift in precipitation type, with decreasing snowfall and increasing rainfall
Streamflow – Canada	Observations suggest decreasing trends in maximum and minimum river flows over the period 1970-2005 in much of southern Canada, with increases in minimum flows in western Nunavut, Northwest Territories, Yukon and northern British Columbia
Snowfall – Canada	Annual snowfall has declined over most of southern Canada and increased in the north over the last 6 decades
Snow cover – Canada	Negative trends in snow cover extent have been observed during spring over the Canadian landmass, with largest declines observed in June
Permafrost	
Ground temperature – Canada	Permafrost temperatures at numerous borehole sites across Canada have increased over the past two to three decades
Sea Level	
Sea level – Global	Global average sea level rose about 21 cm between 1880 and 2012 at an average rate of 1.6 mm/year
Relative sea level – Canada	Relative sea level rise of over 3 mm/year has been observed on coastlines of Atlantic Canada and the Beaufort Sea coast, with lower amounts along Pacific coastlines. Relative sea level fall of 10 mm/year has been observed around Hudson Bay where the land is rising rapidly due to post-glacial rebound
Sea Ice	
Seasonal ice extent – Arctic	End-of-summer minimum ice extent has declined at a rate of 13% per decade over 1979-2012, while maximum winter sea ice extent has declined at a rate of 2.6% per decade
Ice Type – Arctic	A shift in ice cover from one dominated by thick multi-year ice (MYI) to one increasingly dominated by thin first-year ice (FYI) has been observed
Eastern Canada	Declines in winter sea ice extent have been observed in the Labrador-Newfoundland and Gulf of St. Lawrence region
Glaciers	
Glacier mass – Yukon, British Columbia, Alberta	Western Cordilleran glaciers are losing mass and shrinking rapidly to the smallest extents in several millennia. Glaciers in British Columbia and Alberta have lost, respectively, about 11% and 25% of their surface area over the period 1985-2005, while glaciers in Yukon have lost about 22% since the 1950s
Glacier mass – High Arctic	Significant negative mass balances are evident from the early 1960s into the first decade of the 21st century. The rate of mass loss for glaciers throughout the High Arctic has increased sharply since 2005, in direct response to warm regional summer temperatures
Lake and River Ice	
Spring ice thaw – Canada	Trends towards earlier ice-free dates (lakes) and ice break-up dates (rivers) have been observed for most of the country since the mid-20th century but are particularly evident in Western Canada
Ocean Climate	
Canada's oceans	Long-term changes in ocean temperature (increasing), salinity (variable sign), and acidity (increasing) have been observed in all three of Canada's oceans. Long-term decreases in subsurface dissolved oxygen levels have also been observed in the Atlantic and Pacific oceans off Canada

Table 1: Examples of observed changes in Canada. The length of the observational record varies with the indicator. Source: Natural Resources Canada, 2014.

Impact on ecosystems

Changes in temperature and precipitation have profound impacts on the natural environment as a whole. The range of some species of trees, birds, and butterflies has been observed to shift as temperature rises. Maple trees, for example, have experienced a significant northward shift since 1971. Changes in the timing of key annual events have also been observed, such as earlier migration to breeding areas and earlier flowering of plants. Increased pests, forest fires, and droughts have caused a large loss of forested areas in B.C. and the Prairies. Warmer winter temperatures in BC are one factor that has allowed Mountain Pine beetle populations to expand to unprecedented sizes, leading to the largest and most severe outbreak on record. As of 2012, about 18.1 million hectares of forest were affected. B.C.'s Fraser River sockeye salmon population has also decreased as a result of higher water temperatures.

Impacts of extreme events

As the climate warms, extreme events are expected to increase in frequency and/or intensity. For example, at the global scale, warm days and nights are virtually certain to increase in frequency and magnitude and heat waves are very likely to increase in duration, frequency and/or intensity.³ Large precipitation events and extreme sea levels, similar to that which caused the flooding in New Orleans during the Katrina hurricane, are also projected to occur more frequently.

In Canada, extreme events such as floods, storms (wind, ice and snow), wild fires, and heat waves have had an increasing impact on the health and safety of Canadians, and significant economic costs (Figure 3). In 2011, the Canadian insurance industry paid out a record \$1.7 billion for property damage associated with weather events. The 2013 June Alberta floods alone are likely to surpass this record, as the tally is estimated at \$1.7 billion dollars.⁴ Other factors such as increased wealth, greater

³ IPCC (2013): Summary for Policymakers; in Climate Change 2013: The Physical Science Basis.

Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, (ed.) T.F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, Nauels, A., Xia, Y. Bex, V., P.M. Midgley, Casati, B. and Yagouti, A. (2010): Analysis of extreme temperature indices in nine Canadian communities using the Canadian Regional Climate Model projections for public health planning; Ouranos. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

⁴ [Insurance Bureau of Canada, June Alberta Floods are Costliest Insured Natural Disaster in Canadian History – Estimate of insured losses exceed \$1.7 billion; Media Release, September 23, 2013,

exposure to risk and aging infrastructure also contribute to the increase in extreme-event related insurance claims, but the recent trends do show that there is significant vulnerability to extreme weather events. It is likely this trend will continue in the years to come, as studies suggest that heavy precipitation events, with associated increased risk of flooding, forest fires, storms, droughts (especially in the southern Prairies) and hot days and warm nights will continue to increase in frequency and/or intensity as global warming continues.⁵

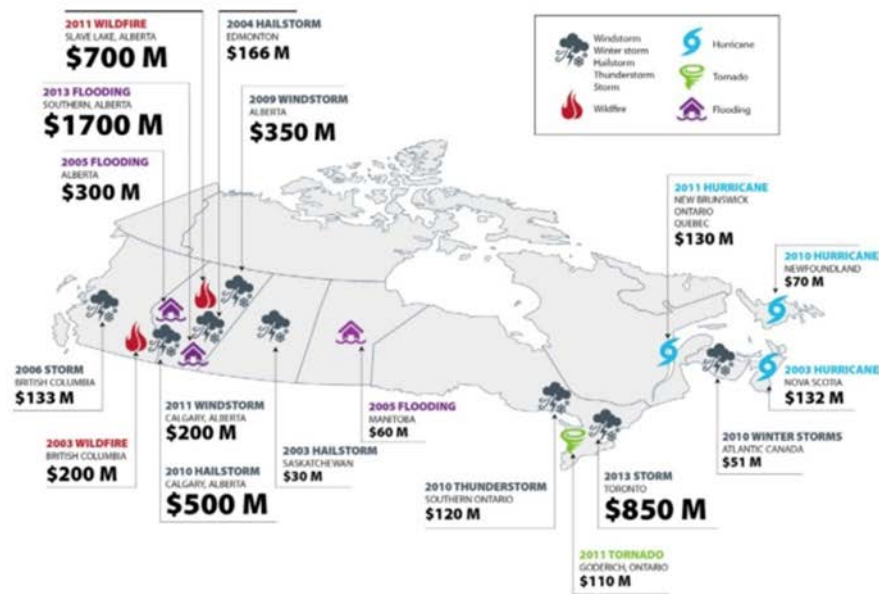


Figure 3: Examples of insured losses from extreme weather events in Canada (Source: Natural Resources Canada, 2014).

http://www.abc.ca/en/Media_Centre/News_Releases/2013/June_Alberta_Floods_are_Costliest_Insured_Natural_Disaster_in_Canadian_History.asp

⁵ Warren, F.J., and D.S. Lemmen, eds. *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation*. Ottawa: Government of Canada, 2014.

<http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2014/16309>.

Climate change projections for the North and for the Sahtú region

Northern Canada has seen a greater rate and magnitude of warming than the rest of the country (see Figure 1) and this ‘northern amplification’ will continue as global warming evolves. Figure 4 presents the projected change in air temperature (compared to 1961-1990 averages) across Canada for spring, summer, fall and winter for the mid and end of the twenty first century, under two different emission scenarios (A2 and B1, see textbox below). There are several important conclusions to draw from these maps. First, as expected, the warming is greater in the North – reaching upwards of 7°C in the Sahtú by the end of the century in the A2 scenario. Second, there is significant seasonal variation in the warming pattern: in the North, most of the warming will happen in the winter. Summertime warming is generally projected to be more uniform across the country, with the largest changes happening in the south. Third, even under the low emission scenario (B1), by the middle of the century the Sahtú is expected to warm by 2.5-3°C in the summer, and 4-5°C in the winter. These are averages estimates, based on a range of climate model results, each of which ran under a range of emission scenarios in the B1 family.

The winter warming has already been noticed locally: *“Community members in Fort Providence have experienced unusual weather changes in the winter, describing these changes as “fluctuations that have always been there but they are more evident now”. Participants stated that there has been a trend of warmer winters. A “chinook” that occurred during the December prior to the focus group had participants alarmed. Participants have also noticed a shift in the season, stating that “the colder season is happening about 2 months later than previously”.”*⁶

To get a better sense of the range of possible temperature, it is useful to compare the results from different models. Figure 6 presents the range of warming in the Sahtú by end of century as projected by 29 distinct climate models. Three different emission scenarios or representative carbon pathways (RCP) are considered (see Figure 7 and text box for more on RCPs). For each climate model, we compare the average Sahtú temperature in the last two decades of the 21st century (2081-2100) to the 1961-1990 average temperature. The pie graphs give the distribution of temperature

⁶ Guyot, M, and C Dickson. “Local Observations of Climate Change and Impacts on Traditional Food Security in Two Northern Aboriginal Communities.” *International ...* 65, no. 5 (2006): 403–415. <http://www.circumpolarhealthjournal.net/index.php/ijch/article/view/18135>.

predictions for each of the three emission scenarios.⁷ One way to interpret these graphs is to think of them as a wheel of fortune that one spins in a game of chance. Our climate models are not perfect – they do not allow us to predict perfectly the outcome of a certain level of carbon emissions. But looking at the range of values given by a variety of models can give us a sense of what is more or less likely to occur. No models predict a warming above 12°C. This does not mean it is impossible, but rather that our best science consider it likely that the warming will be below that value. Our ‘best guess’ may be to average the result of several distinct experiments, or models. Averaging over the 29 model outputs in the Coupled Model Intercomparison Project 5 (CMIP – see text box below) ensemble, we get an average warming for the Sahtú of ranging from 2.9°C for RCP 2.6 to 7.9°C for RCP 8.5 (Table 2).

Scenarios (see Figure 4)	Projected end of century warming		
	Min value	Max value	Average
RCP 2.6 (global emissions peak by 2025 and rapidly decline afterward)	0.9°C	4.5°C	2.9°C
RCP 4.5 (global emissions continue to increase, but at a slower rate, then peak by 2050, and decrease slowly afterward)	2.5°C	7.4°C	4.2°C
RCP 8.5 (global emissions continue to increase at current rate, and start to stabilize only)	4.8°C	11.0°C	7.9°C

⁷ We sort the model results in ‘bins’ of 1°C increment; i.e. how many models predict a warming between 0 and 1°C, between 1 and 2°C, between 2 and 3°C, etc., and then use the size of each pie slices to represent the number of models predicting a warming in that range.

toward the end of the century, reaching nearly 30 B tonnes CO ₂ / year)			
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Table 2 Average warming in the Sahtú by end of century (2081-2100 average compared to 1961-1990 average). Out of the 29 climate models results, we show the result of the model predicting the smallest warming, the result from the model predicting the highest warming and the average over all models (see Figure 8 to see the full distribution).

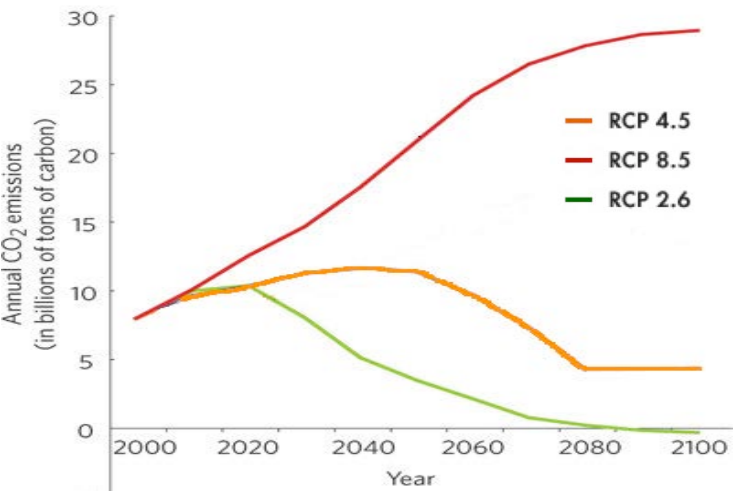


Figure 4 Annual Global CO₂ emissions for Representative Carbon Pathways (RCP) 2.6, 4.5, and 8.5 (modified from Inman, 2011⁸). RCPs were introduced in the latest IPCC report (Fifth Assessment Report). The IPCC authors chose four emissions trajectories to focus on, and have labelled them based on how much warming they would produce at the end of the century — 8.5, 6, 4.5 and 2.6 watts per square metre (W m⁻²). They chose four trajectories to avoid the common misconception that the middle scenario is the most likely; only three are presented here. The figure shows the annual carbon dioxide emissions (in billions of tons of carbon) out to 2100 for each of the RCPs. For more information on RCPs see <http://tntcat.iiasa.ac.at:8787/RcpDb/dsd?Action=htmlpage&page=welcome>

⁸ Mason Inman, Nature Climate Change 1, 7–9 (2011) doi:10.1038/nclimate1058
http://www.nature.com/nclimate/journal/v1/n1/box/nclimate1058_BX1.html

Climate projections and Emission scenarios:

Until recently, the analysis of future climate was based on a set of four storylines describing possible ways in which the world, and human interference with climate, might evolve in the future. Along with each of these storylines came a set of assumptions for the level of climate interference caused by human activities through the emission of greenhouse gases, aerosols and other air pollutants, and through land use changes such as deforestation. These factors change over time in a series of plausible scenarios which are grouped in four scenario families (each 'family' containing a range of possible emission scenarios) in the Special Report on Emissions Scenarios (SRES) (Nakićenović et al., 2000).

Climate scientists across the world then run computer simulations to estimate how much warming could be expected under each of these scenarios. The resulting projections are then grouped and compared in a project called the climate Coupled Model Intercomparison Project (CMIP). By comparing the results from each of these independent computer models, climate scientists can highlight areas where they differ, and ways in which they are similar, thus getting a sense of the level of 'uncertainty' of these climate projections. It is important to understand that the results from these models are not *forecasts*, i.e. they do not predict what *will* happen because the degree of warming we will experience ultimately depends on how much climate pollution we will emit, but rather *projections*, i.e. they predict the amount of warming we can expect under different plausible scenarios, each with different levels of global warming pollution.

The temperature and precipitation maps presented in Figure 4 and Figure 5 are the result of an average over a series of climate models (CMIP3 mean) for two emission scenarios: one assuming a low level of emissions (B1), and one assuming a medium-high (A2) level of emissions. It is worth noting that since the release of the SRES report fourteen years ago, global GHG emissions have been on a trajectory that is even higher than the majority of the scenarios considered in the 'worse case scenario-group' (A1FI) which assumed a globalized world focused on economic growth through fossil fuel intensive development. This means that if we continue on this trajectory, the warming expected by mid and end of century will almost certainly be higher than that corresponding to the A2 scenario in Figure 4 and Figure 5 (maps I to P).

The most recent coordinated global climate Coupled Model Intercomparison Project (CMIP5) used a new set of scenarios as the basis for projecting future climate change. The new scenarios, referred to as Representative Concentration Pathways (RCPs), describe trajectories of atmospheric concentration over time (for GHGs, aerosols and other air pollutants). These scenarios were used in the models that provided climate projection for the Sahtú as presented in Table 2 and Figure 8.

So what do these different degrees of warming mean on the ground, beside warmer temperatures? One of the main consequences of global warming is changes in the timing and amount of rain and snow in various regions. Figure 7 shows the projected seasonal changes in precipitation across Canada by mid and end of century for the B1 and A2 scenarios. Because predicting the amount of rain and snow is much more

complex than predicting average temperature, precipitation projections from climate models are much more variable than temperature projections. Nevertheless, certain trends can be observed.

As shown in Figure 6, increases in precipitation are projected for the majority of the country and for all seasons, at the exception of summer in parts of southwestern Canada (Figure 6 panels B, F, J, N). Increased precipitation does not preclude the possibility of droughts, as the increase in summer precipitation can be overpowered by the increased evaporation rates due to warmer air temperatures. An increase in aridity in southern Canada is projected, though there is a significant variation between scenarios. For northern regions an increase in precipitation is expected, particularly in autumn and winter.

Predicting what the impacts of what these increases in temperature and precipitation will be on the ground for the Sahtú and its communities is a complex question. One way to get a sense of the changes to come, under warming ranging from 0.9°C to 11°C, is to review the impacts that have been observed to date, as a result of the 2.5°C of warming that has taken place since the 1950s (Figure 1).

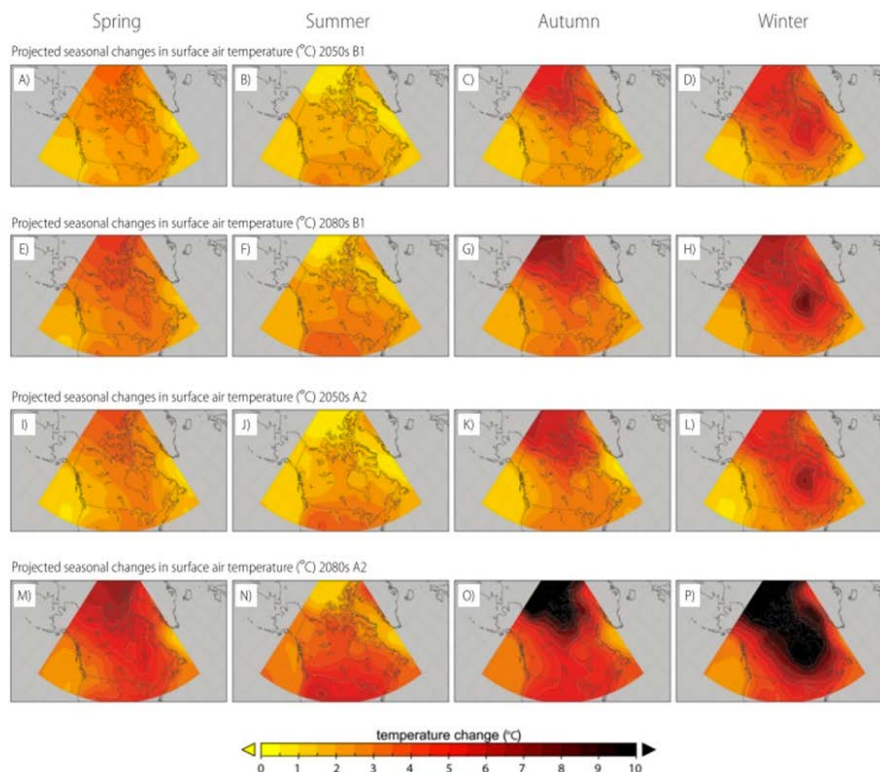


Figure 5 (above) Projected seasonal changes in temperature across Canada for the middle and end of the 21st century under two SRES scenarios: B1 (low emissions) and A2 (medium-high emissions). Changes are expressed relative to average values between 1961-1990. The star (□) indicates the location of Great Bear Lake in the Sahtú region. Row 1 (A-D) is scenario B1 at mid-century, row 2 (E-H) is B1 towards the end of the century, row 3 (I-L) is A2 at mid-century, and row 4 (M-P) is A2 towards the end of the century. Column 1 (A, E, I, M) is Spring, Column 2 (B, F, J, N) is Summer, Column 3 (C, G, K, O) is Autumn, Column 4 (D, H, L, P) is Winter (Data source: Canadian Centre for Climate Modeling and Analysis; figure reproduced from Natural Resources Canada, 2014)

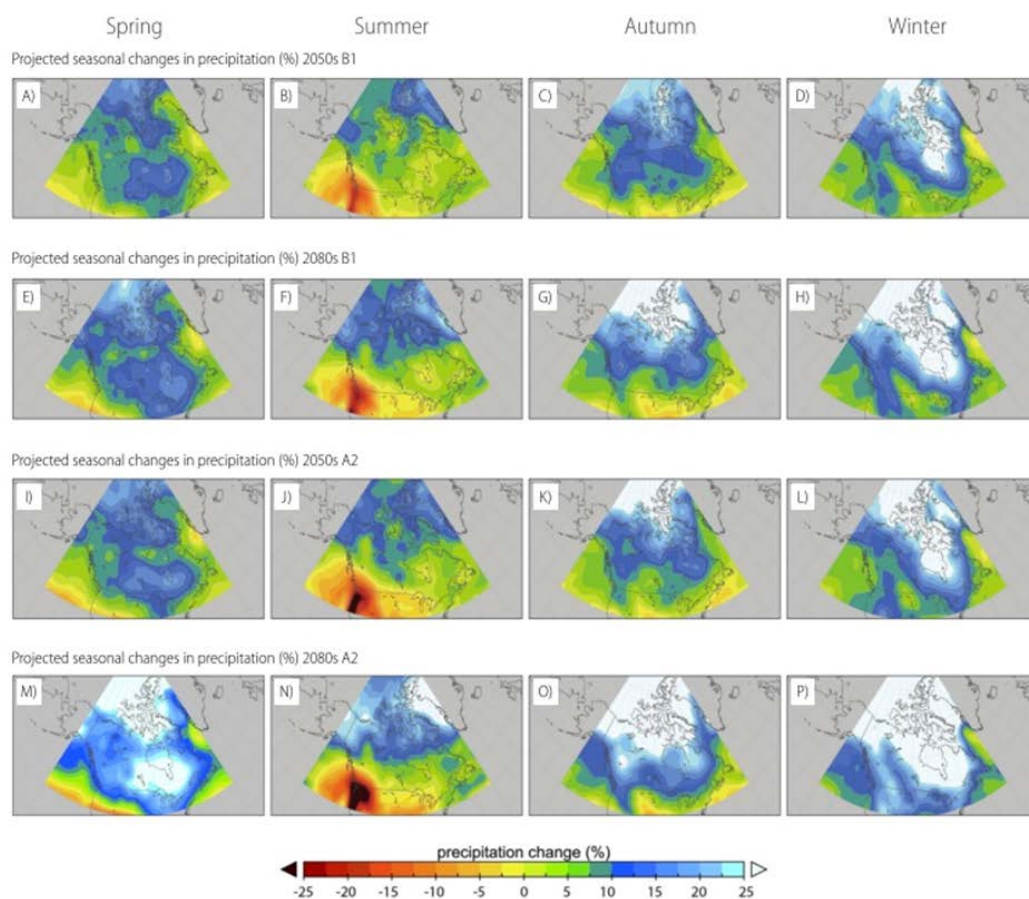


Figure 6 Projected seasonal changes in precipitation across Canada for the middle and end of the 21st century under various SRES scenarios. Changes are expressed relative to average values between 1961-1990. Row 1 (A-D) is scenario B1 mid-century, row 2 (E-H) is B1 towards the end of the century, row 3 (I-L) is A2 mid-century, and row 4 (M-P) is A2 towards the end of the century. Column 1 (A, E, I, M) is Spring, Column 2 (B, F, J, N) is Summer, Column 3 (C, G, K, O) is Autumn, Column 4 (D, H, L, P) is Winter (Source: Canadian Centre for Climate Modeling and Analysis, figure reproduced from Natural Resources Canada, 2014)

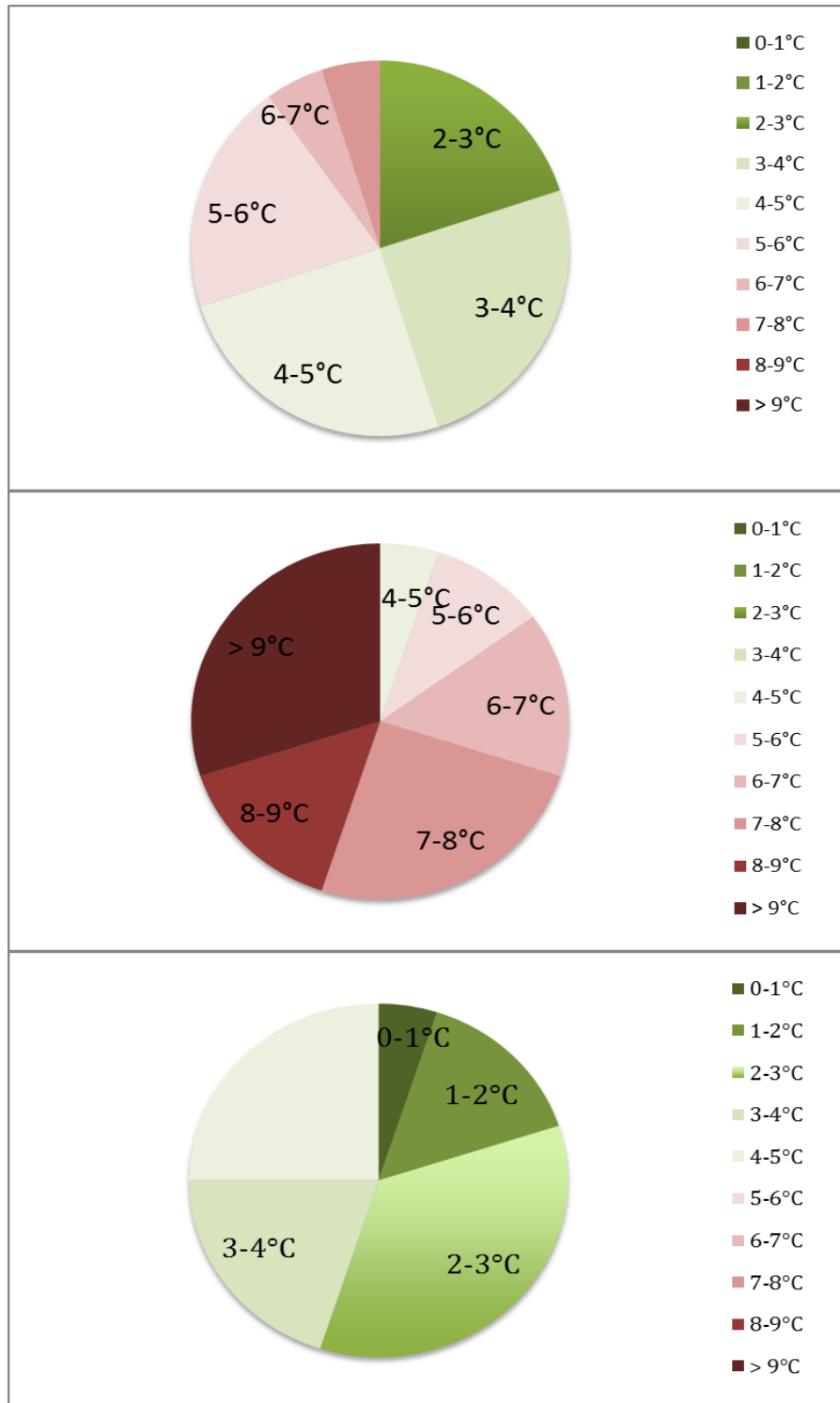


Figure 7 Range of possible temperature change for the Sahtú under three representative carbon pathways: RCP 2.6, RCP 4.5, and RCP 8.5. The colours correspond to expected average warming in the last two decades of the 21st century (2081-2100) compared to the 1961-1990 average. The size of each pie section is

proportional to the number of climate models, out of the 29 models in the CMIP5 ensemble that are projecting temperature changes in that range. Another way to think of it is to interpret each pie as a wheel of fortune that one spins in a game of chance. Under each RCP, the likelihood of a given outcome changes; under the RCP 8.5 emissions scenario, more than two thirds of models predict a warming over 7°C for the Sahtú by the end of the century. Under a RCP 2.6, more than half of the models predict that the temperature increase will stay below 3°C. Averaging over the 29 model outputs, we get an average warming of 2.9°C for RCP 2.6, 4.2°C for RCP 4.5, and 7.9°C for RCP 8.5 (2081-2100 average compared to 1961-1990 average). Which ‘wheel’ the Sahtú’s climate will be played on depends on the global effort to reduce greenhouse gas emissions and other forms of global warming pollution. Current trends put us on the RCP 8.5 trajectory, but there is still time to change direction. Based on CMIP5 data provided by Alex Canon, Pacific Climate Impact Consortium.

Climate change impacts in the Northwest Territories and the Sahtú region

Climate change impacts on livelihoods, culture, mental health and well-being have been reported by northern residents across Canada.^{9,10} This section summarizes the main ways in which climate change is changing the environmental conditions of the Northwest Territories, with a focus on the Sahtú region. Information presented here mostly comes from government reports and other Western scientific sources. To provide more local context, excerpts from a participatory study conducted with hunter and gatherers from Deh Gah Got’ie First Nation in Fort Providence, at the source of Deh Cho (the Mackenzie River) are also included. Summary of climate change impacts observed by the Dene and Métis people who have participated in our study are presented in Section 5.2 of this report.

Permafrost

Permafrost underlies about half of the Canadian landmass. Continuous and deep permafrost, extending all the way to the Arctic, is bordered to the south by a zone of relatively thin, warm, discontinuous permafrost. Continuous permafrost provides a strong, frozen support for infrastructure such as buildings, roads and airport runways.

⁹ Séguin, Jacinthe, ed. *Human Health in a Changing Climate : A Canadian Assessment of Vulnerabilities and Adaptive Capacity*, 2008

¹⁰ Furgal, Christopher, and Jacinthe Seguin. “Climate Change, Health, and Vulnerability in Canadian Northern Aboriginal Communities” no. 12 (2006): 1964–1970. doi:10.1289/ehp.8433.

However, temperature sensors inserted into boreholes drilled at numerous sites across Canada show that permafrost temperatures have increased over the past twenty to thirty years (Figure 8), mostly due to an increase in winter air temperatures.

Much of the infrastructure in the Sahtú is built on permafrost. Building on permafrost is an known engineering challenge in the North, but even as techniques improve, the rapid change in permafrost conditions have been causing problems. Ground movement caused by melting permafrost has resulted in the cracking or sloping of building walls and foundations, and in heaving, slope failure, sinkholes and potholes. Permafrost erosion along streams and rivers can damage dikes, bridges and culverts, and change the local hydrology, particularly in flat areas. Sewage lagoons and other water treatment facilities are particularly vulnerable to small changes in ground slope and flow direction.

As northern warming will continue to be amplified compared to the global average, it is expected that warming of the permafrost may increase more rapidly in the future than has been observed to date. The impact will be more severe in zones of discontinuous permafrost such as the Sahtú, and areas where the permafrost temperature is closer to the melting point. In areas of cold permafrost, climate warming will lead to a thickening of the active layer (seasonally thawed surface layer) and a decrease in permafrost thickness.¹¹

¹¹ Callaghan, T.V., Johansson, M., Asinimov, O., Christiansen, H.H., Instanes, A., Romanovsky, V., and Smith, S. (2011a) Changing Permafrost and its Impacts; in AMAP, 2011. Snow, Water, Ice and Permafrost in the Arctic (SWIPA): Climate Change and the Cryosphere. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. xii + 538 p

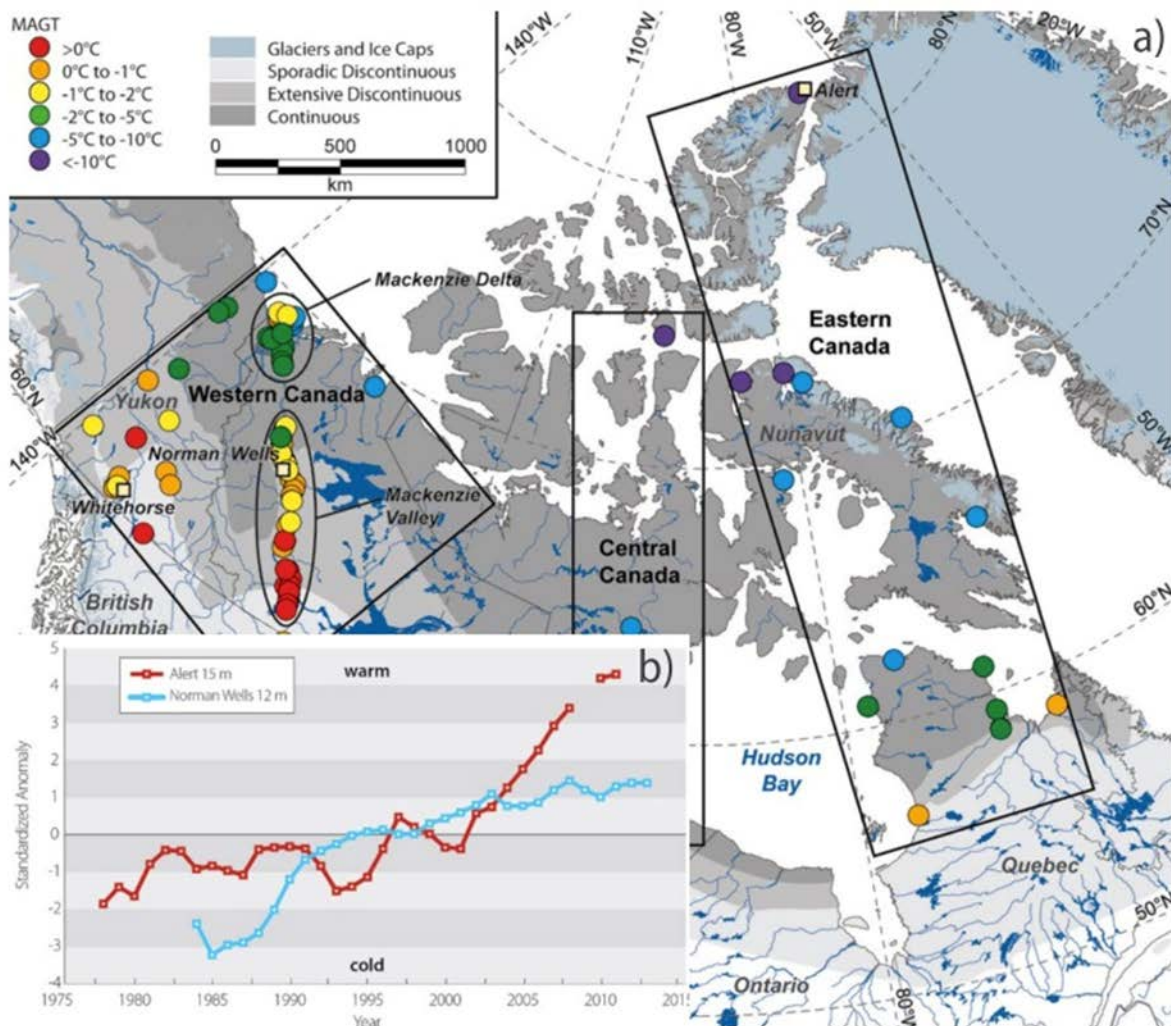


Figure 8 a) Mean annual ground temperature and permafrost zones. b) Permafrost temperature time series relative to 1988- 2007 mean for a site near Norman Wells (depth 12 m) and CFS Alert Nunavut (depth 15 m) in the high Arctic. Permafrost temperature in both of these locations have been increasing since the beginning of the measurement periods, in the early 1980s. (Credit: Sharon Smith, Natural Resources Canada, reproduced from Natural Resources Canada, 2014).

Ice conditions

Winter roads use compacted snow cover on land surfaces and frozen lakes and rivers to connect remote regions of the NWT. The NWT transportation system includes 1450 km of winter roads, and 2200 km of all-weather roads. As the air temperature warms, the reliability of winter roads is affected. In various areas of the Territory, the fall freeze-up has been delayed and the thinner ice melts earlier in the spring, resulting in

a shorter winter road season. Ice conditions also affect load weight limits, increasing the cost of supply delivery to remote communities and mines, as more trips with smaller loads are required.

The impact of this warming on critical transportation routes adds uncertainty and increases costs for industry, government, and communities. For example, the shortened road season in 2006 forced the Diavik Diamond Mine to spend an extra \$11.25 million to fly in fuel¹². Northern communities also depend on winter roads for the supply of affordable food, medicines and other goods.

Changes in ice conditions also affect the capacity of northerners to access the land and pursue traditional activities. For example, the timing of freeze-up or break-up has impacted access to trap lines or hunting grounds in time for prime season:

“Although people of Deh Gah Got’ie First Nation have not had any trouble traveling on the ice so far, they have noticed changes in the ice. Spring break-up is occurring at different times, sometimes earlier than usual and sometimes later. The changes in break-up times are affecting the goose harvest, making the geese more difficult to get to. While participants from this community reported a general trend of warmer winters, they also described that thicker ice is creating a more abundant break-up, sometimes causing the ice to pile up in the river and make it hard to travel down. “I remember my father crossing it (Mackenzie River) in May and now it breaks up and doesn’t move; break-up happens at different times than it used to. (...) A high amount of rain in the early winter before the snow fall creates a layer of slush under the snow, which can cause overflow and generates complications and unsafe conditions for travel across the ice. At this time of the year, trappers are setting their trap lines, and moose and caribou are still being harvested. When ice conditions are not safe, the ability to travel along the trap lines to the harvest areas is impaired, delaying the trapping period.”¹³”

¹² Pearce, T. D., Ford, J. D., Prno, J., Duerden, F., Pittman, J., Beaumier, M., and Smit, B. (2011): Climate change and mining in Canada. *Mitigation and Adaptation Strategies for Global Change*, v. 16, no. 3, p. 347-368

¹³ Guyot, M, and C Dickson. “Local Observations of Climate Change and Impacts on Traditional Food Security in Two Northern Aboriginal Communities.” *International ...* 65, no. 5 (2006): 403–415.
<http://www.circumpolarhealthjournal.net/index.php/ijch/article/view/18135>.

Alongside lake, river, and land ice, sea ice is also affected. Receding Arctic sea ice has resulted in significant habitat changes in the some of the regions where polar bears, seals, and other Arctic species live in. Reduced sea ice also leaves shore banks more exposed to coastal erosion and storm surges. The Tuktoyaktuk community has had to remove some buildings threatened by the erosion of the shoreline. Sea ice levels in the Northwest Passage were at a record low in summer 2007; as the melting of Arctic sea ice continues to accelerates, the Northwest Passage could become a viable commercial shipping route within a few years. More open sailing routes has already lead to an increase in maritime activity in the Arctic, raising issues related to national security, environmental regulation, and disruption of traditional lifestyles. As the sea ice retreats, resource exploration in the Beaufort Sea becomes more feasible, leading to the possible development of offshore oil exploitation.

Precipitation and hydrology

The amount and timing of rain and snow fall across the NWT are becoming more variable from one season to the next. Higher than average snow loads in wet heavy spring conditions have caused roof structures to collapse in certain communities. Larger snowfalls have also increased the cost of snow removal, and increased spring run-off, sometimes leading to wash-outs. The changing climate has lengthened the spring and fall transition seasons, increasing the period of freeze-thaw cycles. The increase in groundwater flow that accompanies the increased rain and snowfall accelerates the melting of the permafrost, as groundwater carries heat from the surface down to the frozen levels. Ground saturation has caused problems for foundations, earthworks, and buildings in some communities. Aklavik and Fort Good Hope in the Mackenzie River valley have experienced flooding in recent years because of changing precipitation patterns and spring run-off conditions.



Figure 9 Fort Good Hope flood, 2005

Photo credit: Valerie Aucoin, Flickr <http://www.flickr.com/photos/babybeav/19539032/>

Changes in water conditions have also been noted in Deh Gah Got'ie (Fort Providence), and has had both negative and positive impacts on people's access to traditional foods:

"Recent changes in water levels in the local creeks, rivers and lakes were a huge concern for members of both communities. People of Deh Gah Got'ie have said that water fluctuations are much more evident from year to year now and that, most recently, they have seen an increase in the current year's rain relative to previous years. This gave the women in the group reason to believe that there will be fewer berries in the summer to pick. The Horn River, a staging area for birds close to the community, is one area where major fluctuations in water levels are being noticed and have community members concerned. The staging area flooded in the spring and, soon after, became very dry. Participants attributed the drying of the area to an increase in beaver dams changing water levels of the local watershed. Community members were concerned that the spawning of fish could have been affected, decreasing the numbers of whitefish. Lower water levels in the Mackenzie River have made places that were accessible by boat inaccessible.

*Contrasting with this negative effect from dry water systems, drier conditions make it easier to travel during the fall harvest. Dry creeks, swamps, rivers and land require community people to change their methods of transportation from a boat to a truck or all-terrain vehicle, which makes it easier to travel to the harvesting area for the moose, and to transport the moose back to the community. In addition, when there is less water, the people of Deh Gah Got'ie said that the moose come to the river and are therefore closer to the community, making the travel distance for the harvest shorter."*¹⁴

Wildlife

As with forests, the impacts of climate change on wildlife are not as immediately obvious, but because of the changes in ecosystem conditions that are known to be occurring, effects on wildlife are expected in the longer-term. The climate in the NWT is naturally variable and the wildlife has evolved and adapted to this variability. For example, barren-ground caribou herd numbers fluctuate naturally and this may be

¹⁴ Guyot, M, and C Dickson. "Local Observations of Climate Change and Impacts on Traditional Food Security in Two Northern Aboriginal Communities." *International ...* 65, no. 5 (2006): 403–415.
<http://www.circumpolarhealthjournal.net/index.php/ijch/article/view/18135>.

linked to long-term climate patterns. When climate change combines with natural fluctuations such as the Arctic Oscillation, the effects to wildlife may be more noticeable. There has been an increased incidence of some southern species in the NWT, including magpie, skunk, coyote, white-tailed deer, elk, cougar, raccoon, salmon and some insect species. It is too early to tell what role climate change is playing in these species range expansions. It is possible that increased road corridors are the cause or that some species were always present but never recorded. New species have brought new diseases and parasites that might become established in resident wildlife species. There have been observed changes in the types of parasites and their distribution as well as the frequency, intensity and rate of development of infections. Wildlife parasites are strongly influenced by relatively subtle changes in climate such as increases in temperature or moisture. A decrease in the number of days per year in which sea ice covered the continental shelf coastline has been linked to decreases in the height and weight of cub and male polar bears in the southern Beaufort Sea polar bear population. There has also been increasing evidence that the timing of insect hatch is shifting, so that some bird species are arriving on their Northern breeding grounds too late to take advantage of the peak in insects. Over time this will probably lead to population declines for ducks, geese and shorebirds.

Changes in wildfire was also reported by Deh Gah Got'ie community members:

"Participants [...] expressed that they have noticed changes in their local animals, bird, fish and plant species. For the first time, cougars have been seen around [the community. ...] A noticed change in the timing of migratory birds, and an increased amount of new bird species such as eagles, are all recent observations of the people of Deh Gah Got'ie First Nation. The later arrival of geese has shortened the spring goose hunt by about one week. Ducks have been found with spruce needles in their stomachs, indicating that the vegetation that they would normally consume as a food source may not be available until later than usual and suggesting a later spring thaw. Along with the changes in bird species, women from Deh Gah Got'ie stated that they have noticed a number of different plant species that they haven't seen before. They did, however, question whether this was related to warmer temperatures, or if other environmental changes, such as pollution from rusty equipment and machinery left on the land and in the water, were the cause of this. An increase in beavers was also reported."

Climate change also affects caribou populations in complex ways. On the one hand, changes in the timing of key vegetation life-events, icing events, insect harassment, and increases of forest fire in wintering grounds increase the stresses on the herds populations – alongside other growing stresses due to industrial development and other human activities. On the other hand, increases in forage availability and warmer weather may act as positive influences. The interaction of all of these factors creates

uncertainty regarding the future of the large barren-ground caribou herds in the face of climate change and increased industrial development.

For many species, the current and projected rates of environmental change might be too fast for their natural ability to adapt. This will increase stress on ecosystems as key species playing a sustaining role at the base of the food chain or playing a balancing role as apex predators face declining population as a result of environmental stress. For example, research on food webs in Sirmilik National Park, Nunavut has demonstrated that lemmings play a key role supporting arctic biodiversity as a widespread and abundant food source for terrestrial predators and raptors.¹⁵ Their response to climate change will be a key factor affecting the health and biodiversity of this ecosystem. Given the magnitude of the environmental changes underway, communities who are dependent on northern ecosystems for food supplies or livelihoods are presented with a situation where radical ecological change is inevitable.

Food security

As climate change affects the availability, quality, and accessibility of traditional foods such as berries, wild greens, and game animals, it may increase food insecurity amongst remote communities of the NWT. The recent shift away from traditional foods and toward a greater reliance on imported processed goods can also increase the vulnerability of the communities as supply chain disruption and shipping costs increase due to deterioration of transportation infrastructure as discussed above. On the other hand, decrease in sea ice cover could increase the length of the shipping season, allowing more items to be brought to northern coastal ports and increasing the reliability and affordability of imported food supplies.

Some positive changes may also come as a result of climate change. As the climate warms, northern communities may be able to increase local food production through greenhouses and cold-tolerant field crops and forages. The longer growing season could cause a shift northward in edible plant foods, animals that graze those foods and their predators. This could increase access to certain country foods, although it might also exacerbate competition with species already gathered and hunted. The arrival of

¹⁵ Gauthier, G. and Berteaux, D. (ed.) (2011): ArcticWOLVES: Arctic wildlife observatories linking vulnerable ecoSystems, final synthesis report; Centre d'études nordiques, Université Laval, Quebec City, Quebec, Canada, 133 p.

new species can also bring or strengthen new diseases and pests that affect humans, plants, and animals.

While some changes may be beneficial, there is no doubt that overall the pace and magnitude of environmental change that is expected in the NWT – bringing profound stresses to ecosystems and human infrastructure – will pose an additional challenge to northern populations already facing a level of food insecurity much greater than any other populations in Canada.¹⁶

¹⁶ Council of Canadian Academies. *Aboriginal Food Security in Northern Canada: An Assessment of the State of Knowledge*. Ottawa, ON, 2014.