Court of Appeal File No.: C65807

COURT OF APPEAL FOR ONTARIO

IN THE MATTER OF A REFERENCE to the Court of Appeal pursuant to section 8 of the *Courts of Justice Act,* RSO 1990, c. C.34, by Order-in-Council 1014/2018 respecting the constitutionality of the *Greenhouse Gas Pollution Pricing Act,* Part 5 of the *Budget Implementation Act, 2018, No. 1,* SC 2018, c. 12

RECORD OF THE INTERVENER
ATHABASCA CHIPEWYAN FIRST NATION
(Affidavit of Lisa Tssessaze, affirmed December 17, 2018)

Dated: February 20, 2019

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AFFIDAVIT OF LISA TSSESSAZE

I, Lisa Tssessaze, of 220 TaigaNova Crescent, Fort McMurray, Alberta, SWEAR THAT:

1. I have personal knowledge of the facts and matters deposed to in this Affidavit, save and expect where the same are stated to be on information and belief, in which case I believe those facts and matters to be true.

2. I am a member of the Athabasca Chipewyan First Nation (ACFN). I am employed as the director of the Dené Lands and Resource Management (DLRM) office of ACFN and have been director since 2009.

3. I swear this affidavit on behalf of ACFN and have authorization from ACFN Chief and Council to do so.

4. ACFN is making this application for leave to intervene in this matter because we are concerned that Crown action concerning the *Greenhouse Gas Pollution Pricing Act* must consider the Aboriginal and Treaty rights of ACFN and other Aboriginal peoples, and because uncontrolled climate change severely imperils the ability of ACFN people to maintain our traditional way of life.

ACFN, our Treaty Rights and our Traditional Territory

5. The members of ACFN are Dené people. We call ourselves *Dënesųłiné*, which means "the original people" in our language. We also call ourselves *K'ái Tailé Dené*, meaning "people of the land of the willow", a reference to our longstanding and ongoing dependence on the Peace Athabasca Delta (PAD). A first-hand history of our people, including much that we know from our Elders, is published in the book "Footprints on the Land", attached as **Exhibit "A".**

6. I refer to ACFN's Treaty rights and Aboriginal rights collectively as our "Rights", which are recognized and affirmed under s. 35 of the *Constitution Act, 1982*.

7. ACFN is a northern First Nation. Our traditional territory centres on the PAD, which is located in the north-eastern corner of Alberta, and extends north, south, east, and west for hundreds of kilometres into other provinces and territories. To the north, our territory extends to Great Slave Lake in the Northwest Territories. The south, it extends to Cold Lake in Alberta. To the east, it extends across northern Saskatchewan and Manitoba as far as Hudson's Bay. To the west, it extends to the Birch Mountains and includes Wood Buffalo National Park. We have practiced our Rights within this far-ranging traditional territory for millennia. Please refer to the map attached at page 33 of **Exhibit "A"** for a delineation of our traditional territory.

8. ACFN's traditional territory is directly related to the historic migration routes of the barrenland caribou. ACFN are Dené who are traditionally known as *Etthen Eldeli Dené*, meaning "caribou eaters", because our livelihood and culture revolved around hunting caribou.

9. Our ancestors signed Treaty 8 with Her Majesty in 1899. Treaty 8 recognizes the right of ACFN people to hunt, fish, trap, and "practice our usual vocations" throughout a vast territory (about 840,000 km^2, or larger than France) that ranges across parts of British Columbia, Alberta, Saskatchewan, and the Northwest Territories. Please refer to the map attached as **Exhibit "B"** for a delineation of Treaty 8 territory.

10. ACFN is a "band" under the *Indian Act*, with a total registered population of about 1,200 people in Alberta, elsewhere in Treaty 8 territory and the world.

11. ACFN has eight reserves in Alberta that the Government of Canada has designated for our use and benefit: Chipewyan 201, Chipewyan 201A, Chipewyan 201B, Chipewyan 201C, Chipewyan 201D, Chipewyan 201E, Chipewyan 201F, and Chipewyan 201G ("Reserves"). Our Reserves are located in the south-eastern portion of the PAD and along the Athabasca River. Please refer to the map attached as **Exhibit "C"** for the locations of our Reserves.

ACFN Land Use and Impacts from Climate Change

12. ACFN members continue to exercise our Rights upon our traditional territory in ways that sustained generations of our ancestors for thousands of years: hunting, fishing, trapping, gathering medicinal plants, and travelling the land and waterways. Living from the land and exercising these Rights is central to our identity and culture, and therefore, necessary for our survival as Aboriginal people.

13. ACFN and other *K'ái Tailé Dené* people have lived on our traditional territory for at least 7,000 years according to archeologist but we know we have been here much longer. Survival in our remote territory is difficult. Boreal, subarctic, and arctic climate zones are scarce in food and have extreme weather. Our ancestors have passed down knowledge that

lets us survive in these conditions. Our culture's knowledge of the land and how it changes throughout the seasons means that our people understand how when animals migrate, understand when and where to hunt, fish, trap, or gather, and understand how to travel by land or water safely. That knowledge is essential to the exercise of our Rights, and ultimately, is the key to our survival in the North.

14. Unfortunately, climate change is throwing much into question for us. The effect of climate change on the PAD is expected to be profound within a single human lifetime. By 2080, the climate is projected to become much warmer and more extreme, in ways that could fundamentally alter the animals and plants in the environment on which our Rights depend.

15. Research published this year by scientists at Environment and Climate Change Canada confirms the expectation that the environment of the PAD will be severely affected by climate change. According to the scientists' report at **Exhibit "D"**,

> "the projected warming over the [Athabasca river basin] range between 2.8 and 7.1 °C, [and] the corresponding projected increase in precipitation ranges between 7.9% and 25% by the 2080s with respect to the 1980s baseline period."

16. The ACFN believe that climate change of this pace and magnitude will affect our ability to live in the PAD as we have done for millennia. For those of us living on the land: a warmer climate with greater extremes will affect hunting, fishing, trapping, gathering, and travel. For those of us settled in Fort Chipewyan and who use our Reserves: the same is true, but our community can be cut off when the winter road to the rest of Canada fails. For all of us: there can be massive wildfires, of the kind that devastated northern Alberta and Saskatchewan in 2016. Changes such as these would make our lives more difficult and dangerous.

17. We agree with the Canadian Council of Ministers for the Environment (including Ontario) when they write at **Exhibit "E"**:

> "For Canadians in the North, however, the impacts of a changing climate have been more pronounced. A shorter, less reliable ice season has made winter hunting and fishing more difficult and dangerous. The traditional knowledge that Aboriginal people relied on in the past to live off the land is also becoming harder to apply as a result of more variable weather and changes in the timing of seasonal phenomena. In addition, winter roads that provide supply links to many northern communities are becoming less reliable and cannot be used for as long."

18. We agree with the Government of Canada, when it wrote in its *Seventh National Communication on Climate Change and Third Biennial Report* to the United Nations (to be filed in Canada's record) that climate change impacts:

> "have high human and financial costs, and are already causing rapid and irreversible change in Canada's northern and coastal regions. These threats are often more acute for some Indigenous Peoples, who live closer to the land, with a strong socio-economic and spiritual connection to it."

19. To illustrate our concern, I will discuss three climate change impacts that can be particularly detrimental to ACFN: impacts to caribou, the Winter Road, and the PAD. This is not an exhaustive list of the effects to our way of life, but just three examples that we foresee presently.

20. **Caribou.** Caribou are a very important species to ACFN. As *Etthen Eldeli Dené*, we have a unique relationship with them because the livelihood and survival of our ancestors was based on harvesting caribou. For thousands of years, our people hunted both woodland and barrenland caribou. Our ancestors would use caribou for meat, clothing, shelter, tools, thread, drum skins, and many other products. Some of our Elders who are still alive today grew up when our people still used caribou for these purposes.

21. Our Elders and ancestors before them used to travel great distances as nomads throughout the year to follow the migrations of the caribou herds. They would cover vast distances, by canoe, dogsled, and snowshoe. This was our traditional way of life for millennia.

22. Unfortunately, environmental changes within living memory have pushed our ancestors' way of life to the brink. We fear that climate change could eradicate that way of life totally.

23. Today, we cannot hunt woodland caribou anymore, because in 2003 the boreal population was listed as "Threatened" under the federal *Species at Risk Act*, which makes it illegal to kill them. Our Right to hunt woodland caribou therefore cannot be exercised, and we can only regain that Right if the environment stabilizes for the woodland caribou to recover their numbers. We are very worried that climate change will destabilize the environment and put a permanent end to a Right that our people have enjoyed for millennia.

24. Today we are limited to hunting barrenland caribou—but that also is increasingly tenuous. Large groups of barrenland caribou used to travel across the Lake Athabasca, past Fort Chipewyan, and spend the winter south of the lake in northern Alberta and Saskatchewan. Our ancestors mastered the technique of hunting these caribou as they slept on the ice. After the early 1950s, however, the barrenland caribou stopped using this migration route and have not returned this way.

25. ACFN members still hunt barrenland caribou today, though we have to travel great distances into Nunavut, the Northwest Territories, northern Saskatchewan, and even outside our Treaty 8 territory into other provinces to do so. We often send hunters out for a "community hunt", that is, to bring caribou meat back to be shared in the community. This

is very expensive but worthwhile to keep the traditions alive and provide traditional foods to community members who cannot hunt themselves.

26. However, we do not conduct the hunt every year; it depends on what we hear from our friends and relations in the North. If we hear word that caribou herd numbers are low, then we do not hunt as there are too many pressures on those caribou as it is. When our hunters do go out, they say that there are fewer caribou and that the caribou are changing their routes each year. Ten years ago these routes used to be very consistent. Now, we are travelling further and further away from home and having a more difficult time finding them.

27. Barrenland (or "barren-ground") caribou were listed as "Threatened" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2016, which is a precursor to listing them as such under the *Species At Risk Act* and prohibiting hunting, perhaps imminently. Climate change threatens to bring that about, and as COSEWIC writes in its species assessment, excerpted at **Exhibit "F"**:

> "Future climate change may act as a continuing threat for Barren-ground Caribou through a complex mechanism involving shifts in timing of greening, lower summer forage quality, and subsequent lower calf production and reproductive potential of females, then population declines. Unpredictable weather events, which are increasing in frequency in a changing climate, are also implicated in population declines."

28. If climate change makes barrenland caribou populations decline further as COSEWIC scientists envisage, to the point of being listed as "Threatened" under the *Species at Risk Act*, there would be no huntable caribou populations whatsoever in the traditional territory of our people. That would be an unprecedented change for our people

and would eliminate a significant source of food and other necessities on which our survival—indeed our culture and identity—has depended since our beginning.

29. **Winter Road**. While our members live throughout the traditional territory, the cultural and administrative nucleus of our community is in Fort Chipewyan, Alberta. Fort Chipewyan is an isolated community – over 200km north of Fort McMurray– and is only accessible by boat or by plane for about 8 months of the year. During winter, an ice road runs from north of Fort McKay to Fort Chipewyan. This Winter Road travels over wet muskeg and crosses a number of rivers, which must be sufficiently frozen to support vehicles.

30. The Winter Road is a lifeline for the community. It is the only way that we can get certain goods into Fort Chipewyan, particularly heavy or hazardous freight that is impractical to airlift, such as lumber, heavy equipment, or fuel oil. The Winter Road brings life-sustaining goods such as food and medical oxygen into the community. As it is, the heavy trucks that bring these goods to Fort McMurray are only allowed to proceed north on the Winter Road for about 1 month – from January to February. The Winter Road is also the most affordable transportation into or out of the community, compared to the alternatives of boat or airplane. Having the Winter Road improves the quality of life in our community, makes the cost of living more affordable, and provides economic opportunities. The Winter Road also allows us to access our Reserves in the winter.

31. Climate change is affecting winter roads across Canada due to shorter and warmer winters and more frequent freeze-thaw cycles. Some communities have lost their winter roads permanently and ACFN fear the same may happen to our Road.

32. We have already had years when warm winters meant that the rivers did not freeze, so the Winter Road was diverted and we had to drive across Lake Athabasca instead. The Road was only open for about 3 weeks when that happened. And generally speaking, while the Regional Municipality of Wood Buffalo (RMWB) maintains the Road from December 15 to April 1, the RMWB will caution us to only use the Road "at your own risk" by mid-March because it is unsafe.

33. Around these times of the year, the waterways are usually not navigable, so if the Winter Road is unserviceable then we only have one way to get into and out of the community: by airplane. This is potentially unsafe in emergency situations if we have to evacuate the community.

34. There are no plans to build an all-weather road to our community, nor could ACFN afford such a major investment.

35. Our concern about climate change affecting the Winter Road is shared by the Canadian Council of Ministers for the Environment (including Ontario) which writes at **Exhibit "E"**:

> "As a result of a recent string of warm years, there has been increasing concern about the difficulties that a shorter or more unpredictable ice season might bring to isolated northern settlements. Frozen lakes and rivers are essential to winter travel in the North. Hunters and trappers depend on them. So do whole communities whose supplies are trucked in from the south on winter roads that are built in part over frozen rivers, lakes, and bogs."

36. We agree with the Government of Canada, when it wrote in its *Seventh National Communication on Climate Change and Third Biennial Report* to the United Nations (to be filed in Canada's record) that:

> "Remote communities, Indigenous Peoples, and isolated economic sites often depend on a network of winter roads for critical shipments of medical

> supplies, food, fuel, and equipment. Climate change continues to affect the length of time that winter roads can be operational and whether they are viable at all, making these communities and sites more reliant on other transportation routes or modes. This significantly increases the cost of living and doing business in the North, affecting the ability to attract investment, the prosperity of local businesses, and the strength, health, and well-being of remote communities and Indigenous Peoples."

37. **Peace Athabasca Delta (PAD)**. The PAD is one of the world's largest freshwater inland deltas and is formed at the confluence of the Peace and Athabasca Rivers. The PAD forms part of Wood Buffalo National Park (the "Park") and contributes to the "outstanding universal value" that earned the Park its status as a UNESCO World Heritage Site. The wetlands of the PAD provide habitat to numerous species as well as millions of migratory birds from across North America, and in 1982 were designated a "Wetland of International Importance" in international law under the *Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention).*

38. As mentioned above, ACFN's identity as a people – the *K'ái Tailé Dené* – depends on our living in the PAD. Six of our eight Reserves are located in the PAD. The PAD is also the central place where we practice our Rights: it is where our ancestors hunted moose and caribou, fished for many species of fish, hunted migratory waterbirds, gathered berries and medicinal plants, trapped for muskrat, beavers and other furs, and raised their families. ACFN people continue to exercise these practices and Rights today.

39. The environmental integrity of the PAD and the ability of ACFN members to use it depends on a sufficient quantity of clean water flowing into it from the Peace and Athabasca Rivers at amounts appropriate for the time of the year.

40. However, starting in the 1960s and accelerating in the last 20 years, the PAD's flow regime has been disrupted by upstream industrial development. Hydro-electric dams have

dramatically altered the flow regime on the Peace River. Water withdrawals by oil sands operators both reduce the flow and contaminate the downstream Athabasca River.

41. As a result, we have watched sediment build up and islands form in our waterways, weeds grow in waterbodies, and grasses - followed by the more permanent willows – shrink those waterbodies. Our members are now unable to access large parts of the PAD for much of the year, including our Reserves. Navigability is particularly bad in the Fall hunting season when ACFN members hunt moose. Without access to key hunting, gathering, trapping, and fishing areas, ACFN members cannot feed their families and share wild-foods other community members, particularly Elders who cannot hunt for themselves.

42. Compared to 30 years ago, there are far fewer waterbirds stopping over in the PAD during their annual migration, in part because large areas of their habitat have dried up. ACFN hunters have to go further from home for longer periods of time to find birds – this is very expensive and time-consuming. We can no longer hunt enough birds to feed our families or share with those in the community who cannot hunt for themselves. We also cannot find bird eggs in places we used to because breeding habitat has turned to mudflats.

43. Hardly any of our people trap fur any longer because the fur-bearing animals – especially muskrat – have become very scarce as the PAD has dried up. Likewise, lower and warmer waterbodies with more weeds and algae are bad for fish, and many of the lakes in our territory do not support fishing any more.

44. ACFN is concerned that climate change will add to and amplify the existing industrial impacts to the Peace and the Athabasca rivers and the PAD. Both the Peace and the Athabasca rivers are fed by snowpack and glaciers, while Spring ice-jams along these rivers are necessary to replenish the "perched basins" and inland lakes within the PAD.

45. When ACFN welcomed the International Union for Conservation of Nature (IUCN) and the World Heritage Committee (WHC) to our territory in the Fall of 2016 to assess the threats to the Park, their report, attached as **Exhibit "G"**, concluded that:

> "As a high latitude wetland-dominated landscape, the PAD is disproportionately vulnerable to climate change, and evidence is mounting that climate change has already had a significant effect on the hydrology and ecology of the PAD."

46. In the 2018 Strategic Environmental Assessment of Wood Buffalo National Park, the report prepared for Parks Canada, attached as **Exhibit "H"**, concluded at page 4 that:

> "With respect to climate change, the majority of relevant literature reviewed indicated future climate changes in the PAD over the next thirty-plus years will likely cause less surface water to be available, and what will be available will reach PAD water bodies earlier in the spring than at present. Increased temperatures will potentially produce thinner snowpack in the headwater and tributary areas of the PAD, which in turn will result in reduced average annual peak, spring peak, and summer flows. Anticipated increases in air temperature may also produce mid-winter thaws, which could cause winter flows to increase from current levels and have a negative impact on ice quality both in terms of safe travel across and in the structural quality of the ice and its ability to contribute to ice jam flooding events."

47. Climate change means additional, more severe, and potentially irreversible negative impacts to the PAD; further diminishing the quantity and quality of habitats for wildlife, fish, and waterbirds, and increasing the risk of ecosystem-wide environmental disasters such as wildfires. Without adequate habitat, the fish, birds, muskrat, beaver, moose, buffalo, medicinal plants, and other species that have sustained our people for thousands of years will not be available to ACFN.

48. A drier PAD could also create more greenhouse gas emissions. The IUCN and WHC concluded at page 16 of their Mission Report, attached as **Exhibit "G"**, that water flows into the Park are important to sustain highly organic peat deposits. The Mission

Report also noted that warming and drying from climate change could tip the carbon balance of the Park towards net carbon emission rather than being a carbon sink – in other words, a positive feedback loop that would make climate change worse.

49. **Conclusion regarding climate change impacts to ACFN**. To be clear, ACFN understands that mitigating climate change may require careful balancing of the economy and the environment. In expressing concern about climate change, ACFN should not be understood as being opposed to industrial development, within reason. Indeed ACFN benefits from oil sands development through the employment that it provides to our members and the ACFN-owned group of companies that provide contracting services to the oil sands industry.

50. However, we believe that industrial activity should occur responsibly, and should bear the true cost of its environmental and social impacts rather than subsist on the hidden "subsidy" of environmental catastrophe that climate change represents—which is really a subsidy paid for by harm to our people and territory. This is why we support a Canada-wide price on emissions of greenhouse gases such as carbon dioxide.

51. We consider it unacceptable that Ontario now refuses to accept carbon pricing. According to the scholarly report attached at **Exhibit "I"**, Ontario has the second highest total greenhouse gas emissions of the provinces in Canada.

52. The Crown has a duty to deal honourably with Aboriginal people. Frankly, we do not see as honourable Ontario's choice to reject carbon pricing that would mitigate its very high emissions, because that choice is tantamount to accelerating climate change which Ontario knows harms the exercise of our Rights and us as a people. We see Ontario's choice as violating our Rights.

53. ACFN believes that greenhouse gas emissions must be reduced to the point of being net neutral, and urgently. For ACFN, impacts from climate change to the wildlife, the PAD, and the Winter Road intersect with and exacerbate each other. If we cannot hunt caribou or hunt, trap, fish, and gather in the PAD, cannot travel in the PAD and along the Athabasca River, and cannot use the Winter Road, we will become more isolated in a land that no longer sustains us. Having been stripped of the ability to practice our Rights, we will be forced to leave our territory and live elsewhere. We will no longer be *Dënesųłiné*; no longer the *K'ái Tailé Dené*; and no longer the *Etthen Eldeli Dené*. ACFN will have lost our identity. We will have ceased to survive as an Aboriginal people. That this may come about from climate change is, from our perspective, an existential threat.

ACFN and the matter of the *Greenhouse Gas Pollution Pricing Act*

54. ACFN wishes to intervene in this reference case in support of the Government of Canada's authority to enact the *Greenhouse Gas Pollution Pricing Act* (the "Act"). We do so for several reasons.

55. First, as a northern community: ACFN is convinced that to minimize the harm of climate change, it is necessary to put a price on pollution throughout Canada. We are victims of geography, because while the majority of Canada's greenhouse gases are emitted from large southern communities, without a national price on pollution, the brunt is borne by northern communities in the Boreal and the Arctic where climate change is stronger and faster. Basically, the South gets the benefits associated with polluting, while the North gets the costs associated with pollution. The ACFN believes that the *Act*, if it is valid law and implemented, goes some way to curing this unequal relationship that prejudices us.

56. Second, as an Aboriginal community that lives on the land: ACFN recognize that Crown action—or, more typically, inaction—on climate change may deprive us of the environment in which the Rights integral to our culture and identity can be practiced, with the worst possible outcome being that we cease to survive as Aboriginal people. ACFN's relation to the Crown is federal—"Her Majesty" in Treaty 8 is the Government of Canada, as is the constitutional power over "Indians"—and so we depend on the federal government to defend our Rights from climate change. We have a distinct interest in the *Act* because it is the principal federal law to prevent our Rights being diminished by climate change.

57. Third, as a Nation having the inherent right of self-government, ACFN agree with the Government of Canada that cooperative federalism applies to greenhouse gas mitigation, but adds that both the federal and provincial Crown are subject to s. 35 of the *Constitution Act*, 1982. ACFN believes that the appropriate federal-provincial balance of powers under the *Constitution Act*, 1867, cannot be decided in isolation, but also requires that constitutionally-entrenched Aboriginal and treaty rights be considered. To put it bluntly: Canada's constitution possesses three levels of government having constitutional rights, not just two.

58. Fourth, as Aboriginal people with interests in the ecological integrity of the North, ACFN are concerned that the Government of Ontario, in its current, very new climate plan (issued on November 29, 2018, and attached as **Exhibit "J")** has seriously increased the threat of climate change to our people. Ontario's new climate plan eases its target for greenhouse gas emissions relative to Ontario's former climate plan (now repealed) and will make the impact of climate change worse. Ontario also concedes in its new plan that there is added harm to Northern people:

> "People across the province – especially Northern communities – and all sectors of the economy are feeling the impacts of climate change and paying more and more for the costs associated with those impacts."

59. The Government of Ontario never consulted ACFN (or to the best of my knowledge any other Northern First Nations) before repealing its former climate plan having the more ambitious greenhouse gas reduction targets.

Timing of this Motion to Intervene

60. I am advised by Amir Attaran and Matt Hulse, legal counsel to ACFN, that this Court has set December 21, 2018 for the submission of applications to intervene and January 15, 2018 to hear applications to intervene. Mr. Attaran and Mr. Hulse also advised me that this matter is scheduled to be heard from April 15, 2019.

61. Once I learned that submission for applications to intervene were due on December 21, 2018, I took steps to seek, and did receive, the necessary approvals from the ACFN Chief and Council to authorize the filing of this motion to intervene as soon as possible.

62. If ACFN is let intervene in this matter, it is prepared to participate in and meet the Court's present hearing schedule and will no delay the hearing in any way.

63. I make this Affidavit in support of the ACFN's application to intervene in this appeal on the matter.

SWORN/AFFIRMED before me at the City of Fort McMurray, in the Province of Alberta this 17 day of December, 2018.

Gail Gallupe

A Commissioner for Taking Affidavits in the Province of Alberta

Gail Gallupe
Expiry: April 7, 2020
#0742640

Lisa Tssessaze

This is Exhibit "A"
referred to in the Affidavit
of Lisa Tssessaze affirmed before me
this 17 day of Dec., 2018

Gail Gallupe

Commissioner for Taking Affidavits, etc.

Gail Gallupe
Expiry: April 7, 2020
#0742640

000018

Footprints on the Land

Tracing the Path of the Athabasca Chipewyan First Nation

Footprints on the Land

Tracing the Path of the Athabasca Chipewyan First Nation

Footprints on the Land traces the traditional land use of the Athabasca Chipewyan First Nation people. As told by the Elders, this book is an attempt to record and preserve the valuable knowledge, culture and history of the Athabasca Chipewyan First Nation.

The history of the ACFN describes an originally healthy and relatively affluent society that over the last 250 years has been colonized and disenfranchised and has been losing traditional lands. This book, along with the Traditional Land Use and Occupancy Study is part of an effort to rebuild and restore the spirit, health and dignity of the ACFN people.

It is the beginning of a longer process of recording, preserving and teaching about Athabasca Chipewyan land use, traditional knowledge and cultural and spiritual traditions.

Cover illustration by
Trevor Michael, ACFN member.

 Published 2003.
Printed in Canada.
ISBN 0-9733293-0-0

Footprints on the Land

Tracing the Path of the Athabasca Chipewyan First Nation

A Special Thank You

The Athabasca Chipewyan First Nation
would like to acknowledge the following for their support of this project:

BENEFACTORS

TrueNorth Energy

Shell Canada

Suncor

Syncrude Canada

CONTRIBUTORS

BC Hydro

Indian and Northern Affairs Canada

Sustainable Communities Initiative of Natural Resources Canada

Athabasca Tribal Council

Cumulative Environmental Management Association

Alberta Department of Energy

Canadian Natural Resources

Petro-Canada

Deer Creek

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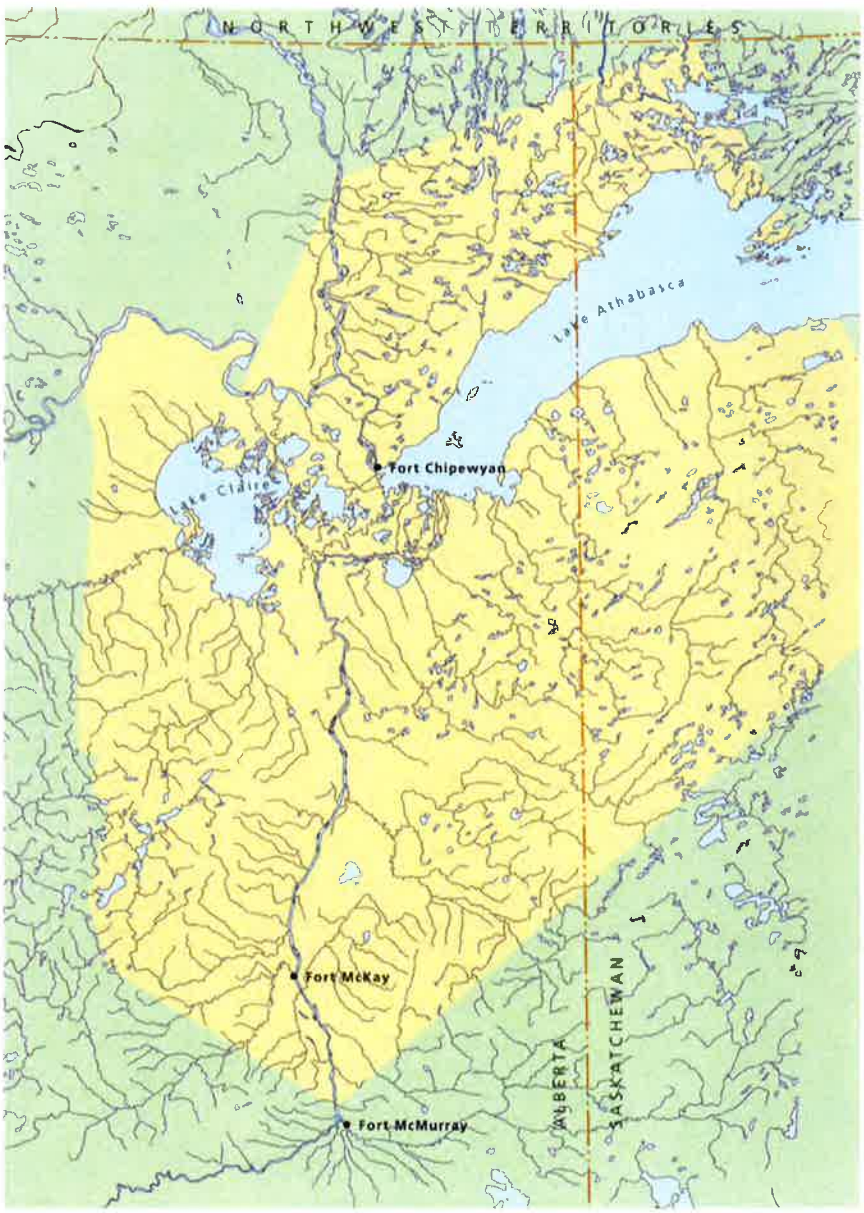
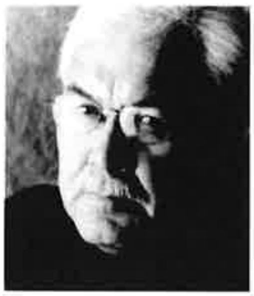
Athabasca Chipewyan First Nation Traditional Lands This map presents the core area of the traditional lands of the ACFN which has been used by the Athabasca Chipewyan people for hundreds, if not thousands of years. While ACFN land use was not limited to this area, the map represents a reasonable estimate of the more intensively used lands.

Athabasca Chipewyan First Nation Traditional Lands



Letter from Chief Archie Cyprien



Chief Archie Cyprien
Athabasca Chipewyan
First Nation

The land is the essence of Athabasca Chipewyan First Nation (ACFN) culture, values and spirituality. The fact that we have been removed from the heart of our traditional land has made the conclusions reached in our recent Traditional Land Use and Occupancy Study all the more poignant. It is clear to me that our people want and need to return home.

This book, produced as a companion to the study, is an attempt to record and preserve our knowledge, culture and history as told by our Elders. It is our hope that the historical information presented here will clarify our passion for the land and in doing so support the ACFN negotiations, planning and land claims issues.

The core area of the traditional lands of the ACFN is identified in the map presented on the opposite page. This map presents an area that has been used by the Athabasca Chipewyan people for hundreds, if not thousands of years, and their use of this land has continued to the present day. While ACFN land use was not limited to this area, the map represents a reasonable estimate of the more intensively used lands.

Interested parties may contact us to make use of the Traditional Land Use Study to increase their awareness of the importance of the land and its uses to our traditional way of life.

I wish to thank the Elders for their invaluable contributions to the study, the ACFN Council who have stewarded this project from beginning to end, and band members for their wholehearted and practical endorsement, as well as band administration, consultants and all those who worked tirelessly behind the scenes.

Additionally, I thank government and industry for their financial backing. Without the help and support of everyone involved, this important project would not have seen the light of day.

Sincerely,

Chief Archie Cyprien,
Athabasca Chipewyan First Nation

Elders, Mary Bruno, Eliza Flett, Mary Madeline Marcel, Josephine Mercredi and Margaret Simpson visiting.

Letter from the Chairman of the Steering Committee

Pat Marcel
Chairman
TLUOS Committee

I am proud to have been the chairman of the Traditional Land Use and Occupancy Study Steering Committee. It has been a wonderful opportunity to record the knowledge of the Elders and also to contribute to the study.

It has become clear that the insight and information garnered here is long reaching. Already, a permanent committee of Elders – the Denesoline Traditional Knowledge Elders Committee – has been formed to consult with industry and government and offer recommendations to Chief and Council. This new committee will be funded in part by organizations using the Traditional Land Use Study for environmental impact assessments and other negotiations. Use of the information found here will improve the ultimate outcome of any project and will help prevent damage to the environment.

The information and history contained in this book, while comprehensive, is not complete. We look forward to expanding the scope of the project by interviewing more Elders for information on genealogy, traditional medicines and traditional ecological knowledge.

I offer my heartfelt thanks to all the members of the TLUOS Steering Committee, including Charlie Voyageur, Councillor Alec Bruno, Councillor Arsene Bernaille, Councillor Rene Bruno, Chief Archie Cyprien, Councillor Lily Marcel, Band Administrator Patricia Lepine, and Alice Rigney.

Thank you.

P. Marcel

Pat Marcel
Chairman, TLUOS Committee

Instead of sitting in the backyard of his Fort Chipewyan bungalow, Alex Flett would prefer to still be out on the land.

A Very Special Thank You

In the summer of 2000, the Athabasca Chipewyan First Nation Chief and Council responded to the urgent need to record valuable traditional knowledge, heritage, cultural land use and spiritual information by initiating a traditional land use and occupancy study. The study took place during 2001and 2002 and was published in 2003. This book describes the traditional land use of the Athabasca Chipewyan First Nation and their ancestors as researched in that study.

The history of the ACFN describes an originally healthy and relatively affluent society that over the last 250 years – since the arrival of the European fur trade – has been colonized and disenfranchised and has been losing traditional lands. The Traditional Land Use and Occupancy Study is part of an effort to rebuild and restore the spirit, health and dignity of the ACFN people. It is the beginning of a longer process of recording, preserving, developing and teaching about Athabasca Chipewyan land use, traditional knowledge and cultural and spiritual traditions. For this reason it is important that studies of this nature be initiated, controlled and directed by the Aboriginal people.

A traditional land use and occupancy study is based upon the experience and knowledge of community Elders. The basic goal of this study was to record information about land use practices of the ACFN people in an accurate, fair and sensitive manner. Elder interviews were conducted and recorded in the Dene language as much as possible, and the roles of both male and female Elders were acknowledged in the questionnaire and in the interview process. It was also important to ensure that this study was conducted in a manner that was consistent with the principle of self-determination of Aboriginal peoples.

Morningstar Mercredi, an ACFN member, initiated the study organization and was retained by the ACFN to prepare a strategy for study funding. Chief Archie Cyprien and the ACFN Council (Rose Ross, Rene Bruno, Alec Bruno and Lily Marcel) appointed an Elders Committee to supervise the focus, content and methods of the study. The ACFN Council also approved the budget and appointed administrative personnel to assist in the project. In February 2001, Patricia Lepine, an ACFN member, was appointed Administrative Coordinator and a consultant, Jim Tanner, was retained to act as project manager for the study.

The committee

The Traditional Land Use and Occupancy Study (TLUOS) Committee was made up of five Elders – Charlie Voyageur, Pat Marcel, Alec Bruno, Rene Bruno and Arsene Bernaille – two interviewers – Councillor Lily Marcel and Alice Rigney – and the Administrative Coordinator, Patricia Lepine. Jim Tanner served as an ex-officio member. The committee met regularly throughout the project, reviewing the proposal, questionnaire and budgets and providing overall direction and guidance.

Support for the project

Randi Allan, CEO, ACFN Group of Companies, has made a tremendous contribution to the success of the project in many ways, helping from its inception with coordination, organization and raising of funds.

The project was supported by TrueNorth Energy, Shell Canada, Suncor Energy, Syncrude Canada, BC Hydro, Indian and Northern Affairs Canada, Sustainable Communities Initiative of Natural Resources Canada, Athabasca Tribal Council, Cumulative Environmental Management Association, Alberta Department of Energy, Canadian Natural Resources, Petro-Canada and Deer Creek.

The ACFN Band Council contributed both financial and administrative support. Patricia Lepine and Susan Michael also supplied administrative support. Interviewers Alice Rigney and Lily Marcel went beyond their responsibilities and contributed time to the committee and to many other tasks, including data entry. Lionel Lepine and Everett Bruno provided support for the interviews, and Everett Bruno provided GIS, technical support and data entry and attended the Elder interviews. The GIS course was attended by Lionel Lepine, Everett Bruno, Lily Marcel, Cherie Stewart, Rose Adams, Karen Adam and Roberta Lepine.

Sharon Bruno also assisted in entering data, and Leonard Flett helped with the interviews. Pat Marcel, Charlie Voyageur, Alec Bruno, Arsene Bernaille and Rene Bruno attended many additional meetings and working sessions to review the surveys and data. Chief Archie Cyprien also contributed many hours to the project reviewing the information provided to Chief and Council. In addition to his role as Chief, he assisted in the mapping of the areas where his parents and grandparents hunted and trapped. Thanks go to Morningstar Mercredi for initiating the organization and fund raising for the project; Joanne Barnaby for her contributions to the organization and scope of the project; Lindsay Giles, who contributed extra time to the mapping; Ann Blyth who conducted the GIS course; and Jordan Kuschminder, Ed McCullough, Gloria Fedrichuk and Kate Peach for their contribution to the archaeological sections of the book.

A very special thank you goes to the Elders of the ACFN who contributed their time and knowledge and without whom this project would not have been possible.

This study is only a beginning. There are several areas where this work could be extended and expanded to serve the interests of the ACFN people. We are hopeful that new and continuing projects, such as the Elders Committee process, the recent archaeological project and the traditional youth camp project, will allow further data to be collected, interpreted, presented and developed and that this study will continue to benefit the ACFN community in preserving, protecting and developing their culture.

The Traditional Land Use and Occupancy Study

Chief

Chief Archie Cyprien

Steering Committee

Arsene Bernaille
Alec Bruno
Rene Bruno
Pat Marcel
Charlie Voyageur

Interviewers*

Lily Marcel
Alice Rigney

Administrative Coodinator

Patricia Lepine

Elders

Alice Adam * •
Eusebe Adam
Horace Adam •
Joe Adam
Marie Adam •
Mary Louise Adam *
Arsene Bernaille
Alice Boucher *
Gina Boucher *
Alec Bruno
Mary Bruno
Rene Bruno
Dorothy Cardinal * •
Ernie Cardinal •
Evelyn Cardinal * •
Celine Cyprien
Janet Dashcavich •
Therese Deranger * •
Alex Flett
Dora Flett •
Eliza Flett
Louise Flett
Victoria Flett
Elizabeth King Goodwin * •
Yvonne Hoffman * •
Anne L'Hommecourt *
Marvin L'Hommecourt *
Mary Matheson * •
Baptiste Marcel
Frank Marcel
Chief Fred Marcel
George Marcel
John Marcel
Mary Madeline Marcel
Margaret Marcel
Mary Marcel •
Pat Marcel
Annie Mercredi •
Charlie Mercredi
George "Smoky" Mercredi •
John Mercredi
Josephine Mercredi
Victoria Mercredi
Alphonse Piche *
Margaret Simpson •
Elise Whitedeer •
Pete Whitedeer
Albert Voyageur
Alice Voyageur * •
Charlie Voyageur

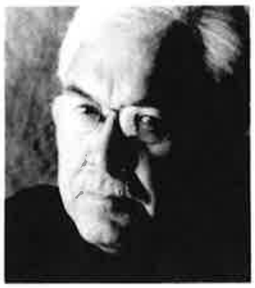
* Not photographed
• Not interviewed

*Leonard Flett conducted one interview

Chief

Steering Committee

Band Administration


Chief Archie Cyprien


Arsene Bernaille


Alec Bruno


Patricia Lepine


Pat Marcel


Charlie Voyageur


Alice Rigney


Rene Bruno

The Storytellers


Eusebe Adam


Horace Adam


Joe Adam


Marie Adam


Mary Bruno


Ernie Cardinal


Celine Cyprien


Janet Dashcavich


Alex Flett

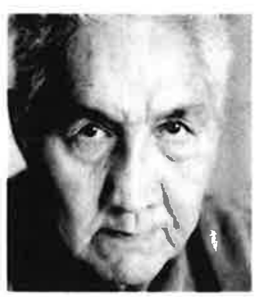

Dora Flett


Eliza Flett


Louise Flett


Victoria Flett


Baptiste Marcel


Frank Marcel


Fred Marcel


George Marcel


John Marcel


Mary Madeline Marcel


Margaret Marcel


Mary Marcel


Annie Mercredi


Charlie Mercredi


George "Smoky" Mercredi


John Mercredi


Josephine Mercredi


Victoria Mercredi


Margaret Simpson


Elise Whitedeer


Pete Whitedeer


Albert Voyageur

Fred Marcel, the last traditional Chief of the ACFN, was an active trapper and an elegant speaker for the First Nation.

CHAPTER ONE

In the Footsteps of the Glaciers

The identity of a people is ultimately defined by their relationship to the land. The Dene people known as the Athabasca Chipewyan have occupied the lands shown on the map on page four for thousands of years. While their history tells of many changes over the centuries, the core of their identity and culture is still tied to their traditional use – hunting, gathering, collecting of medicinal plants – and spiritual understanding of the land.

The Athabasca Chipewyan First Nation (ACFN) is a band of Aboriginal people registered under the Indian Act pursuant to Treaty 8. Although many of the ACFN people now live in Fort Chipewyan, Alberta, they are descended from nomadic Dene peoples who occupied the taiga, barren lands and boreal forests of northern Canada following the retreating glaciers of the last ice age.

Dene Elders have passed on many powerful legends telling how their people came to occupy these lands. Some legends trace Dene ancestors back over many millennia to another continent. Scientific research supports some of these ancient stories. Geologists have determined that twice over the past 100,000 years a land bridge connected Siberia with Alaska. This occurred during an ice age between 75,000 and 45,000 years ago, and again during the last ice age, between 25,000 and 14,000 years ago. Each time, as the glaciers advanced, the sea level dropped as much as 300 feet, creating a land bridge across the Bering Strait – the 90 kilometres of water that today separates the shores of Siberia and North America.

CHAPTER ONE

In the Footsteps of the Glaciers

Lands of the Northern Athapaskan-Speaking People (Dene) The Northern Athapaskan-speaking people can be collectively referred to as Dene, or "the people." The Mackenzie Dene include the Kutchin, Hare, Mountain, Bear Lake, Dogrib, Yellowknife, Slave and Chipewyan peoples.

Beringia
Ninety kilometres separate the shores of mainland Siberia and Alaska today. Beringia was a land bridge that connected those two continents during two intervals, between 75,000 and 45,000 years ago and between 25,000 and 14,000 years ago.

A short walk between continents

Archaeologists generally believe that the first peoples in North America migrated across the Bering land bridge – commonly called Beringia – during the later ice age. They base this partly on the fact that the earliest archaeological sites in Siberia close to Beringia are only 14,000 years old. Along with the first North Americans came numerous species of animals, many of them giants – such as camels, sabre-toothed tigers, giant sloths, mammoths, and an early horse – which have since become extinct. Many anthropologists suspect that harvesting of these animals by early peoples may have contributed to their disappearance. Of the 22 species of mammals known to have existed in northeastern Siberia at the time of the second land bridge, evidence of 21 of them has also been found in Alaska. Dene legends often tell of these giants, including a now-extinct giant beaver.

The Dene and other Athapaskan-speaking peoples of North America are believed to have their roots among the peoples who walked across the Beringia land bridge. While there is no definitive archaeological proof, traditional legends support this theory. In the late 1700s, North West Company explorer Alexander Mackenzie recounted a traditional story told by the Dene people about how they had come from another country inhabited by wicked people and how they had traversed a great lake full of islands. According to Father Gabriel Breynat, a central figure in Treaty 8 negotiations, the "Caribou Eaters" or "Etthen eldeli Dene" – as the Chipewyan were known among their fellow Dene – talked about how their ancestors once lived on another continent to the west and migrated eastward during a great famine.

CHAPTER ONE

In the Footsteps of the Glaciers

The last ice age covered most of the northern part of North America during its largest expansion. As the ice receded, a corridor opened connecting Alaska and southern regions of the continents

Wisconsian Ice Sheet 12,000 years ago

Wisconsian Ice Sheet 9,000 years ago

Many Dene legends speak of great floods. As the glaciers of the last ice age – collectively known as the Wisconsian Ice Sheet – retreated, massive amounts of ice melt created large lakes and flooded vast areas in what is now northern Canada. By around 10,000 years ago, geologists believe, the melting glaciers had left an ice-free corridor several hundred kilometres wide in northeastern Alberta/Saskatchewan. People quickly followed in the footsteps of the retreating ice, taking up land that the glaciers had left behind. There is evidence of people living near the edges of glaciers as far north as the Great Slave Lake area between 8,000 and 6,500 years ago. Artifacts dating back approximately 7,000 years have been found on what would have been the shoreline of Lake Athabasca at the time.

The Legend of Two Giants

Chipewyan legends tell of two giants who fought a great battle in the Arctic many years ago. One fell dead with his legs landing in the Arctic, his backbone forming the mountains and his head ending up close to where the Chipewyan people lived. The "head of the giant" melted, as a glacier would melt, with the giant's blood (the rivers) flowing from the body. ACFN Elders, including Victoria Mercredi, say the body of the giant represents the lands of the Dene people. Some believe this story might relate to the migration of the Dene from the north.

Victoria Mercredi

Victoria Mercredi has recounted many legends including the legend of Otchôpè, the Arctic Giant, the Copperwoman and many other Dene legends. Many of these legends are described in "Inkonze: The Stones of Traditional Knowledge," by P.R. Couter and L. Hoffman - Mercredi, published by Thunderwoman Ethnographics, 1999.

CHAPTER ONE

In the Footsteps of the Glaciers

Arrow Heads and Points
Used by Athapaskan peoples 1,000 to 1,500 years ago in northeastern British Columbia

Projectile Point and Biface
These artifacts were found in the Old Fort Point area as part of the Historical Resources Study for the ACFN Old Fort Point Reserve Land. Projectile points such as these are found within the toolkits used by early Dene ancestors in the region. Among the tools, are a variety of "all purpose" tools such as this large bifacially flaked tool.

By their tools you shall know them

Much can be learned about a people and their relationship to the land by the tools they leave behind. Because only a small part of the entire tool kit of a culture is preserved through time, archaeologists often find little more than stone tools, pottery and animal remains as clues to understanding cultures of the past. The basic tool kit of the peoples who lived in the sub-arctic regions of Canada, including the ancestors of the Dene, changed gradually over time. Archaeologists have found evidence that these peoples developed a tool kit perfectly suited to a nomadic lifestyle that responded to the dramatic seasonal changes of the land.

Artifacts found in the Lake Athabasca area reflect the lives of nomadic peoples whose livelihood was based primarily on hunting caribou and fishing. People expanded into the area soon after the glaciers retreated and large glacial lakes drained. There were at least two important early cultural traditions in the area: the Northwest Microblade tradition and the Northern Plano tradition. A later cultural tradition, the Taltheilei, moved into the area about 3,000 years ago. The Taltheilei people were the direct ancestors of the Dene peoples.

The people who developed into the Northwest Microblade tradition migrated into Alaska from Beringia about 11,000 years ago and are known by their small cutting tools. The most common of these tools were simple flake tools that were used briefly and discarded. "Microblade technology" lasted for over 6,000 years and has been found at the Bezya site in northeastern Alberta, which dates to around 4,500 years ago.

The Northern Plano peoples used distinctive spear points shaped like lance heads. Tools of this type have been found in Alaska dating to about 10,500 years ago and in the Lake Athabasca area dating from about 8,000 years ago. The tool kit of the Northern Plano peoples also included stone adzes (axe-like tools), chi-thos (disc-shaped tools for working hides) and wedges, reflecting a life spent between forest and tundra.

Paleo-aboriginal peoples left behind tools giving some information about their location and occupations in the early history of this region. Although anthropologists are able to connect the Taltheilei people with modern Dene, the connection or evolution of peoples occupying this region in earlier times is unclear.

Paleo-aboriginal times 11,000 to 8,000 years ago.

Paleo-aboriginal times 8,000 to 6,500 years ago.

Paleo-aboriginal times 6,500 to 2,600 years ago.

Aboriginal times 2,600 to 1,500 years ago.

CHAPTER ONE

In the Footsteps of the Glaciers

Evidence of the Taltheilei people dating to about 3,000 years ago has been found in the northern prairie provinces and into the tundra. The hunting traditions carried on today by the Athabasca Chipewyan First Nation can be traced back to these people. The Taltheilei depended primarily on caribou and fish, supplemented by moose and snowshoe hare. These Dene ancestors used distinctive dart or lance points, as well as chi-thos, adzes and wedges. The oldest Taltheilei sites are found within the Beverley caribou herd range, which stretches from the northern tundra to Great Slave Lake, Lake Athabasca and Reindeer Lake.

The Taltheilei adapted to the seasons, making the most of food resources that were available or particularly abundant at specific times of year. They located their warm weather hunting camps on or near the barrengrounds at caribou water crossing points, and set up smaller sites as they dispersed in smaller groups throughout the forests in the caribou winter range.

Caribou and fish were the common threads throughout the lives of the early peoples in the region. Caribou provided meat, fat, sinew and skins, as well as bone and antler for tool-making. The people knew their migration routes well and used major water crossings along these routes as campsites and hunting locations continuously over about 7,000 years. Fishing locations were also well known and used continuously. Caribou were particularly abundant during their migration, while fish were most abundant at spawning times. The peoples of the region balanced the harvesting of these two resources through the seasons.

Athapaskan spoken here

The Chipewyan language is one of approximately 50 Athapaskan languages known today. The word "Athapaskan" comes from a Cree word meaning "a place where grass is everywhere." This likely refers to the Peace/Athabasca delta, one of the largest fresh water deltas in the world and an important source of food and furs for Aboriginal peoples for centuries. Because of the natural wealth of the delta, it also became a centre of early fur trade activity – muskrat furs from this area became a standard to which all other muskrat were compared. Also, Lake Athabasca provided an ample supply of fish to support both aboriginal traditional use and the early fur trade establishments in the area. Today, the Athabasca Chipewyan First Nation Reserve 201 includes about one-third of this important centre.

Athapaskan Language Groups The Athapaskan language groups extended over large portions of western North America. Although several Athapaskan languages are quite different, the southern languages of the Navajo and Apache are closely related to Chipewyan.

In the Footsteps of the Glaciers

The natural wealth of the delta and the human activity it has supported may explain why the word "Athabasca" gained such importance and why it became the name of a group of Aboriginal languages. Athapaskan languages include three major divisions: the Pacific Coast groups, the Southern Athapaskan groups and the Northern Athapaskan groups. The first grouping extends through northern California. The second, called "Apachean," covers groups in the southwestern United States and adjacent plains – Apache, Navajo and Mescalero among them. The Chipewyan belong to the third major group, the Northern Athapaskan speakers who inhabit the land known as "Denendeh," or what is now Alaska and the western two-thirds of sub-arctic Canada. The Chipewyan peoples (or Etthen eldeli Dene) have traditionally occupied the southeastern part of Denendeh.

Comparing languages of different Aboriginal groups gives clues to the possible relationships between them. Of particular interest is the close relationship between the languages of the Chipewyan and Apachean peoples such as the Apache and Navajo. The similarity between their languages suggests these peoples were closely related in the recent past, perhaps as little as 600 years ago. By contrast, the differences between the Athapaskan languages spoken by the Pacific Coast groups and that of the Chipewyan suggest these groups split apart as many as 1,600 years ago.

Again, science and legend may provide clues. Around 1,140 years ago, a huge volcanic eruption, called the "White River Ash Falls," occurred. Some archaeologists believe this may have had a major effect on the Dene peoples, possibly causing some to migrate to what is now the southwestern United States. Dene legends speak of events that could be interpreted as volcanic eruptions. One tells of a "melting mountain" that resulted in people no longer being able to understand each other's language, most likely because of their separation.

The linguistic connections among the Northern Athapaskan speaking groups indicate there would have been considerable sharing, communication and circulation among them. While the inter-relationships among the various Dene peoples before the arrival of the Europeans are not well documented, these linguistic connections suggest that the Dene people have existed as a cultural group for many years. Dene traditional stories and legends bear this out. Consequently, today the northern Dene identify themselves as a distinct cultural group. And in the process of reclaiming their culture the Dene have increasingly defined themselves as a distinct political group.

We are "The People"

While the term "Chipewyan" is commonly used for certain Dene peoples and their place names, it is not a Dene term. "Chipewyan" is a corruption of the Cree word "witshipeean," meaning "pointed skins." By calling their northern neighbours "Chipewyan," the Cree were referring to the pointed tails of the skin shirts worn by these people. However, the late 18th century trader-surveyor David Thompson noted that the "Northern Indians" called themselves "Dinnie." In fact, when the first fur traders arrived in North America, the various Dene peoples called themselves simply "Dene," which means "the people."

Pointed Skins
The word "Chipewyan" is derived from the Cree name "witshipeean" meaning "pointed skins."

Each Dene group has a distinct dialect and history, and each was named among themselves for their occupation or location. In the Dene language, the Chipewyan people were known as the "Etthen eldeli Dene," or the "Caribou Eaters," because they hunted and relied upon the large herds of caribou in the barren lands, the taiga and the boreal forest for their sustenance. The Chipewyan people now living south and east of Fort McMurray were called "Kkrest'ayle kke ottine," meaning the "trembling aspen people" in the Dene language.

Still another name for the Chipewyan was "Desne the ottine" or "Desnedekenade," meaning "great river people." ACFN Elders interpret this to mean "people living on the Athabasca River." It might also refer to people living on the Slave or Mackenzie rivers. In legends the Chipewyan people in this area were called the "Theilanottine," meaning "men of the end of the head" or "those who dwell at the head of the lakes." These people are associated with the region around Lake Athabasca. The Fort Chipewyan Dene are called "K'ái tailé Dene." This name refers to the Athabasca Chipewyan people and Dene peoples living on the Athabasca delta.

These Dene names come from traditional knowledge passed down by the Elders and from records of the early fur traders. However, because the early fur traders forged working relationships first with the Cree, they tended to use the names the Cree had given their Dene neighbors. This is how the term "Chipewyan" came into common usage. Today many Chipewyan people do not like being called by a Cree name, partly because of a long history of hostilities between the two groups. They prefer to be called Etthen eldeli Dene, K'ái tailé Dene or simply Dené.

Charlie Voyageur, still very active on the land.

CHAPTER TWO

The "Original Affluent Society"

Birch Bark container
Originally these containers were used as cook pots by placing hot stones inside with the meats and liquids. More recently these containers would be used for berry picking and gathering medicines, mosses and eggs.

The Etthen eldeli Dene (Chipewyan) people's livelihood during aboriginal times and well into the fur trade era was based on caribou harvesting. We know this from traditional stories passed down by Elders and observations recorded in the diaries of early explorers and fur traders.

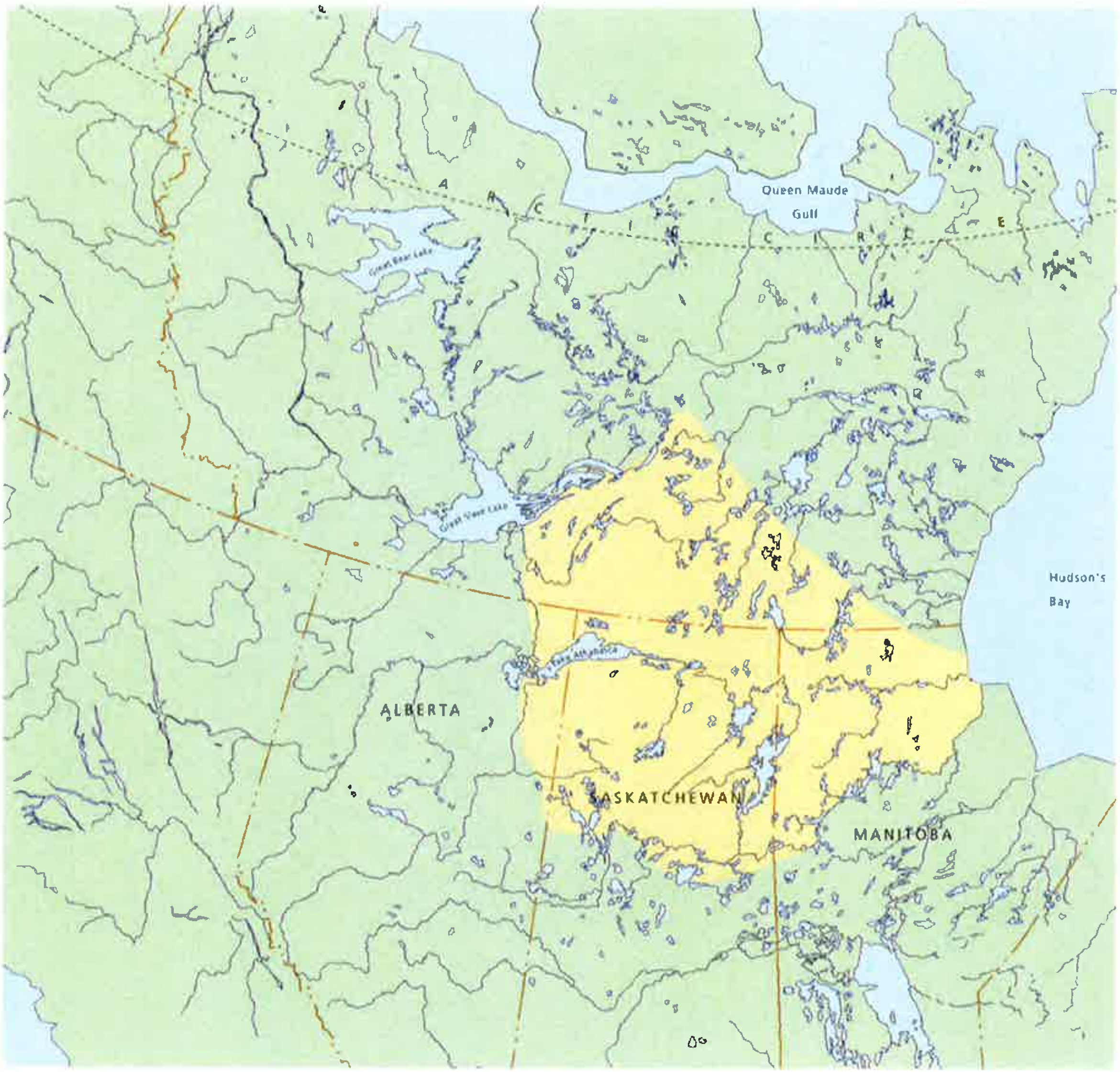
Hudson's Bay Company explorer Samuel Hearne's descriptions of the Chipewyan people, based on his observations during the time he spent with them in the 1770s, suggest the Chipewyan had attained both security and comfort in their caribou-based livelihood. "...the real wants of these people are few, and easily supplied; a hatchet, an ice-chisel, a file, and a knife, are all that is required to enable them, with a little industry, to procure a comfortable livelihood," Hearne wrote. He also noted that the Chipewyan "...live generally in a state of plenty, without trouble or risk; and consequently must be the most happy, and in truth, the most independent also."

Indeed, by some measures the Etthen eldeli Dene during aboriginal times could well have been included among the groups that anthropologist Marshall Sahlins described in his groundbreaking paper "The Original Affluent Society." Sahlins debunked the common anthropological view that hunter-gatherer societies led dismal lives of hardship characterized by an "incessant quest for food." He argued that many traditional societies enjoyed a relative abundance of food and a certain material comfort. "When you come to examine it the original affluent society was none other than the hunter's – in which all the people's material wants were easily satisfied," he wrote. Canadian historian Arthur J. Ray would include in this category of affluent societies the "caribou eaters," the "parkland bison hunters," and the "bison-moose hunters" of the boreal forest.

CHAPTER TWO

The "Original Affluent Society"

Pre-contact Lands of the Etthen eldeli Dene The pre-contact lands of the Etthen eldeli Dene, or "caribou eaters," was bounded by the limits of the caribou migration to the south and the Yellowknife and Inuit peoples to the north.



CHIPEWYAN TRADITIONAL LANDS IN ABORIGINAL TIMES

Caribou Eaters

The Chipewyan people were known as "caribou eaters." Their livelihood was based upon the caribou providing meat, clothing, shelter, tools, thread, milk and many other products.

Land without boundaries

While we know the Chipewyan were "caribou eaters," it is difficult to determine the range of the lands they occupied before the arrival of the Europeans and during the early years of the fur trade. Anthropologists have created conflicting theories of aboriginal land occupancy based upon different interpretations of the journals of early traders and explorers. However, many of those journals are not very reliable for this purpose because the Europeans often confused different Aboriginal groups and called them by similar names. For example, the early fur traders at Hudson Bay called the Dene people the "Northern Indians" and the Cree, the "Southern Indians." They knew little about the land in the interior or about the Aboriginal peoples and were unable to accurately identify the traditional areas of the various Aboriginal groups.

Although Alexander Mackenzie recorded that he encountered Beaver peoples – like the Chipewyan, an Athapaskan-speaking group – after passing the Methye Portage north of Lac La Loche around 1789, some anthropologists question his accuracy. They maintain that the Cree had occupied the area around Lake Athabasca and the Athabasca River since aboriginal times. Others argue that the Chipewyan occupied the area below Lake Athabasca and were pushed to the north (and the Beaver to the west) as the Cree expanded their territories during the early fur trade. Some European observers noted that the Chipewyan were unfamiliar with certain techniques of stretching furs and other skills associated with the boreal forest, yet they appeared to be familiar with many other aspects of life in the boreal forest. Based on what is known through traditional and recorded knowledge, it appears that the Cree and the Chipewyan were familiar with much of the same territories, even in very early times.

In any event, it is not appropriate to try to assign boundaries to various groups, because aboriginal land use was not limited by the European concept of "ownership." Different peoples may have occupied the same lands at different times or in different seasons. Land use studies show that traditional lands of Aboriginal peoples tend to overlap, especially where there are language or cultural relationships between the groups. Overlapping is also common where the traditional areas are very large and sparsely populated. The Etthen eldeli Dene lands in aboriginal times were among the largest and the least intensely populated of any northern group.

CHAPTER TWO

The "Original Affluent Society"

The best way to determine the original lands occupied by the Etthen eldeli Dene peoples is to look at barren land caribou migration patterns, because the Etthen eldeli Dene's early territory was likely associated with the range of the caribou. There are anthropologists who believe this traditional area did not extend below Lake Athabasca, but they tend to base their theories on observations of modern-day caribou migration patterns. However, in aboriginal times the populations of the barren land caribou were likely larger than they are now. Traditional knowledge suggests that with the larger populations of earlier times, the caribou would have ranged farther south and west – in some cases well into the boreal forest. This means the Etthen eldeli Dene traditional area is likely to have extended well below Lake Athabasca and to the headwaters of the Churchill River system. Indeed, ACFN Elders Alec Bruno, Charlie Voyageur and Rene Bruno say that in the early part of the 20th century the caribou would cross Lake Athabasca and winter below the lake in areas of northern Alberta and Saskatchewan. ACFN Elders have noted that after the early 1950s, the caribou stopped migrating south of Lake Athabasca in large numbers as a result of the devastating forest fires in the area that destroyed their food supplies. Even though the lichen has grown back, the caribou have not migrated back through this old route.

The Great Bounty of the Caribou (Etthen)

Before the arrival of the European fur traders, caribou provided the Etthen eldeli Dene peoples with almost all the basics of a relatively affluent lifestyle. The Etthen eldeli Dene hunted caribou to supply their needs for tools, clothing and shelter in addition to food for themselves and their dogs. Nothing went to waste. Bone and antler were fashioned into spear points, fish hooks, and a variety of other tools. Hides were used to make lodging, carriers and clothing. Rawhide, gut and sinew were put to use for lacing, snowshoe netting, gill nets, caribou snares, and many other necessities of life. Anthropologist J.G.E. Smith estimated that 20 caribou might have provided the necessary domestic annual needs of one person.

Chipewyan Traditional Lands and Caribou Migration The pre-contact territory of the Chipewyan people was directly related to the migration of the caribou herds. The range of caribou migration likely provides reasonable limits to the normal Chipewyan hunting and gathering territory.

Chipewyan Traditional Lands in Aboriginal Times
Tree line
1-2 Usual winter range of barren ground caribou
2-3 Maximum winter penetration of barren ground caribou
Bathurst herd
Beverly herd
Kaminuriak herd

CHAPTER TWO

The "Original Affluent Society"

A sharing society

In aboriginal times the Etthen eldeli Dene had to travel great distances to follow the migrations of the caribou herds. As a result, they occupied a large traditional area with one of the lowest human population densities in the world – an average of one person per 150 square kilometres. They also had to travel light, relying on traditional knowledge and relatively simple tools to survive.

The Etthen eldeli Dene developed a culture and an economic system that reflected their dependence on caribou and enhanced their ability to survive. This system was based on cooperation and sharing – both of food and of information about the location of caribou herds. For example, ethnographic studies suggest Etthen eldeli Dene men were required to marry women as distantly related from them as possible. This kinship system, known as "marrying out," helped ensure that word would spread rapidly along the tree line when the caribou herds crossed. According to the Elders, marrying out is still common among the Chipewyan.

Etthen eldeli Dene social structure was based on the family unit. Etthen eldeli Dene families organized themselves into hunting units that varied in size and makeup according to their economic purpose. A typical hunting unit would centre around a husband and wife and their relatives, possibly including brothers and their wives, or children and their spouses. Two or more families might share a hunting camp. Several hunting units might come together for a meat camp or fish camp or for a large caribou hunt.

The Etthen eldeli Dene carried out their large communal hunts in early winter and in spring during the caribou migrations. To locate the herds, they would divide into smaller hunting groups and spread out across a broad potential caribou path. Etthen eldeli Dene hunters had developed a very efficient technology, called a "pound," for harvesting the largest number of animals possible during these hunts. Once they had located a caribou migration path, they would build a large fence (pound) of bushy trees with openings containing snares to trap the animals as they passed through. Since a hunting group could kill many more caribou than it required, Etthen eldeli Dene hunters distributed the meat among other hunting groups by way of the kinship and sharing systems they had developed. During other seasons they divided into smaller hunting units to pursue smaller groups of caribou and other game.

By the time the European fur traders began arriving in western Canada in the late 17th and early 18th centuries, the Chipewyan had established the largest population and landmass of any northern group. Using caribou as their main source of food, clothing and shelter, they had an estimated population in the barren land/boreal forest region of approximately 4,000 people.

Top: Moose Hide

Chipewyan women and children are shown in front of a moose hide.

Bottom: Chipewyan Camp pre 1921

Summer hunting and gathering camp adjacent to lake.

Margaret Simpson (Marcel), enjoying a peaceful moment beside the lake.

CHAPTER THREE

First Encounter: Arrival of the Fur Trade

The Etthen eldeli Dene peoples first came into contact with the European fur trade society in the 1680s on Hudson Bay. Since that time the circumstances of the Etthen eldeli Dene have undergone significant changes due to the effects of the fur trade culture and economy.

According to fur trade records and traditional knowledge, the Cree peoples dominated the northwestern fur trade in the late 1600s and early 1700s by assuming an early role as middlemen between the traders and other Aboriginal groups. Newly armed with guns they acquired from the Europeans, they aggressively sought furs and protected their dominant position, pushing the Beaver peoples west to the headwaters of the Peace River and preventing the Chipewyan from trading furs directly at York Factory.

It is likely that the first effects of the fur trade on the Etthen eldeli Dene were raids by armed Cree looking for furs during the late 17th century. Many Etthen eldeli Dene were killed during these raids and it is believed they retreated to the security of the caribou lands north of Lake Athabasca as a result. Explorer Samuel Hearne noted in the early 1770s that he thought the Dene and Cree peoples "had always been at war with each other." In fact, a common name for the Cree in the Dene language (Enná) is translated as "enemy." Some ethnographers are not sure whether the hostilities between these peoples were caused by the arming of the Cree by the fur traders or if the early arming of the Cree exacerbated a long-standing enmity between the two groups.

The fur traders at York Factory on Hudson Bay knew of the "Northern Indians" and were eager to involve them in the fur trade. However, because of the Etthen eldeli Dene's abundant caribou-based livelihood and their determination to avoid the armed Cree, they would not come to the Hudson Bay to trade. It was not until 1715 when an Etthen eldeli Dene woman named Ttha'nalther made peace between the Chipewyan and the Cree that the Chipewyan people began to participate in the fur trade as middlemen. (See the story of Ttha'naltther on page 38.) During the same year, a party of traders led by a Cree known as Captain Swan (Wa pa su) was sent out on a mission to make peace with "all the Indians." In 1717, the Hudson's Bay Company constructed Fort Prince of Wales on the mouth of the Churchill River specifically to trade with the Chipewyan people.

Ttha'naltther's (Falling Sand) Story

The story of the Dene woman Ttha'naltther (Falling Sand) is an important part of the Etthen eldeli Dene's oral history concerning their early encounters with the fur trade.

According to stories told by the Elders, the beautiful Ttha'naltther was captured and enslaved by the Cree in the early 18th century during one of their armed raids into Chipewyan areas to obtain furs for trade. The Cree had acquired guns from the European traders and had killed many Chipewyan people during these raids.

Ttha'naltther travelled to Fort York with her captors and while there she told James Knight, the chief Factor of the Fort York trading post, about the treatment of her people at the hands of the Cree. Troubled by Ttha'naltther's story, Knight sent company trader William Stuart into the interior with Ttha'naltther on a mission to make peace between the Cree and the Chipewyan and to bring the Chipewyan into the fur trade. According to Elders' stories, Ttha'naltther was a courageous and dynamic woman who spoke Cree "with indifference." Stuart also spoke Cree.

The trip into the interior was difficult and Ttha'naltther had some trouble locating her people, most likely because they were trying to avoid the threatening Cree. She finally found them somewhere north of Lake Athabasca and east of the Slave River.

However, the Chipewyan people most likely had been pushed north and east as a result of the increased aggressiveness and firepower of the Cree during this time.

It appears that Ttha'naltther was instrumental in making peace between the Cree traders and the Chipewyan and in encouraging her people to join the fur trade, thus beginning a new era in their history. A painting entitled Ambassadress of Peace in the Hudson's Bay Company archives depicts Ttha'naltther standing with arms outstretched between representatives of both Aboriginal groups.

JOSEPHINE MERCREDI
Josephine Mercredi told the story of Ttha'naltther, an important story about the early relationship between the Cree and Chipewyan people. Josephine has also explained the cultural meaning of the story of Cree Burn Lake as presented in "Inkonze: The Stones of Traditional Knowledge."

A Fine Kettle of Broth

In the late 1700s, Hudson's Bay Company surveyor Peter Fidler journeyed through the Athabasca region with Chipewyan guides. During his travels he lived off the land with his Chipewyan hosts and recorded the many things he learned from them. Here, he tells how the Chipewyan women made broth:

"The Indians made to me a new fashioned kettle, of the paunch of the cow (buffalo), by making a hole in the ground of about two feet in diameter and one foot deep to support the bag and the four corners were propped up with sticks set in the ground in six or eight places keeping the mouth extended about two feet wide. They broke the bones of the buffalo and made marrow fat – boiled meat – made broth all in this uncommon apparatus by immersing hot stones frequently into it – every one of us hauled a stone for the above purpose, for the birch rind kettle, or for occasionally making water." – Peter Fidler, quoted in J.G. MacGregor, *Peter Fidler: Canada's Forgotten Explorer, 1769-1822.*

CHAPTER THREE

First Encounter: Arrival of the Fur Trade

Expanding into the boreal forest

Two major forces in the 1770s and 1780s drew the Etthen eldeli Dene further into the fur trade and into the boreal forest: increased competition between the fur trading companies and a severe smallpox epidemic. The Hudson's Bay Company's rival, the Northwest Company, began to move into the interior and cut off the supply of furs to the Hudson's Bay Company posts on the bay. In the competition that followed, both companies began aggressively building inland posts. By 1778, the Northwest Company had established posts on the Churchill River – at Ile à la Crosse and on the Athabasca River. Hearne established the first inland Hudson's Bay Company post at Cumberland House in 1774, near what is now the eastern border of Saskatchewan. In 1778, Peter Pond, of the Northwest Company, established a successful trade on the Athabasca River and set up a post – the first Fort Chipewyan – about 40 miles up river from Lake Athabasca.

The establishment of the inland posts allowed the Chipewyan people to trade without risking the long and dangerous trip to Hudson Bay. These developments encouraged them to move farther into the boreal forest, where they could pass by the posts regularly to trade their furs. As a result of this shift in their traditional harvesting centre, the Chipewyan gradually changed the emphasis of their livelihood from caribou to furs, moose, fish and other boreal forest resources. But even as the Etthen eldeli Dene gradually became more involved with the fur trade, some bands maintained their ability to return to their earlier traditional livelihood.

In 1781 there was a devastating outbreak of smallpox in the Athabasca region. It is not clear to what degree the Cree and Chipewyan of the area were affected by the disease. However, it is believed that the reduction of the Cree population in northern areas due to smallpox contributed the southwestern migration of the Chipewyan following the epidemic. Fur traders moving into this area at the time noted that the Chipewyan at Lake Ile à la Crosse considered themselves to be strangers in the area. Also, it was after the epidemic (1788) that Mackenzie recorded encountering Athapaskan-speaking people at the Methye Portage. This means the Beaver and other Athapaskans were apparently no longer confined by the

Mission, church and rectory
The first church on this location was built in 1851. It was later replaced with a larger church as shown in the photo.

Cree to the Peace River area. These observations and others suggest that after the devastation of the smallpox epidemic, the Chipewyan people were able to move into areas that had previously been dominated by the Cree.

The journals of Hudson's Bay Company explorer Peter Fidler provide considerable information about the livelihood of the Chipewyan peoples at the time of his travels with Chipewyan guides in the late 1700s. Fidler's records show that the Chipewyan were well adapted to life in the boreal forest and were likely involved in a nomadic boreal forest land use pattern.

In the following years competition among the fur trading companies increased significantly. The new XY Company constructed a second post at Fort Chipewyan in 1799, and in 1802 Fidler built Nottingham House close to Fort Chipewyan for the Hudson's Bay Company. This period of competition came to an abrupt end in 1821 when the fur trade merged into a monopoly under the Hudson's Bay Company.

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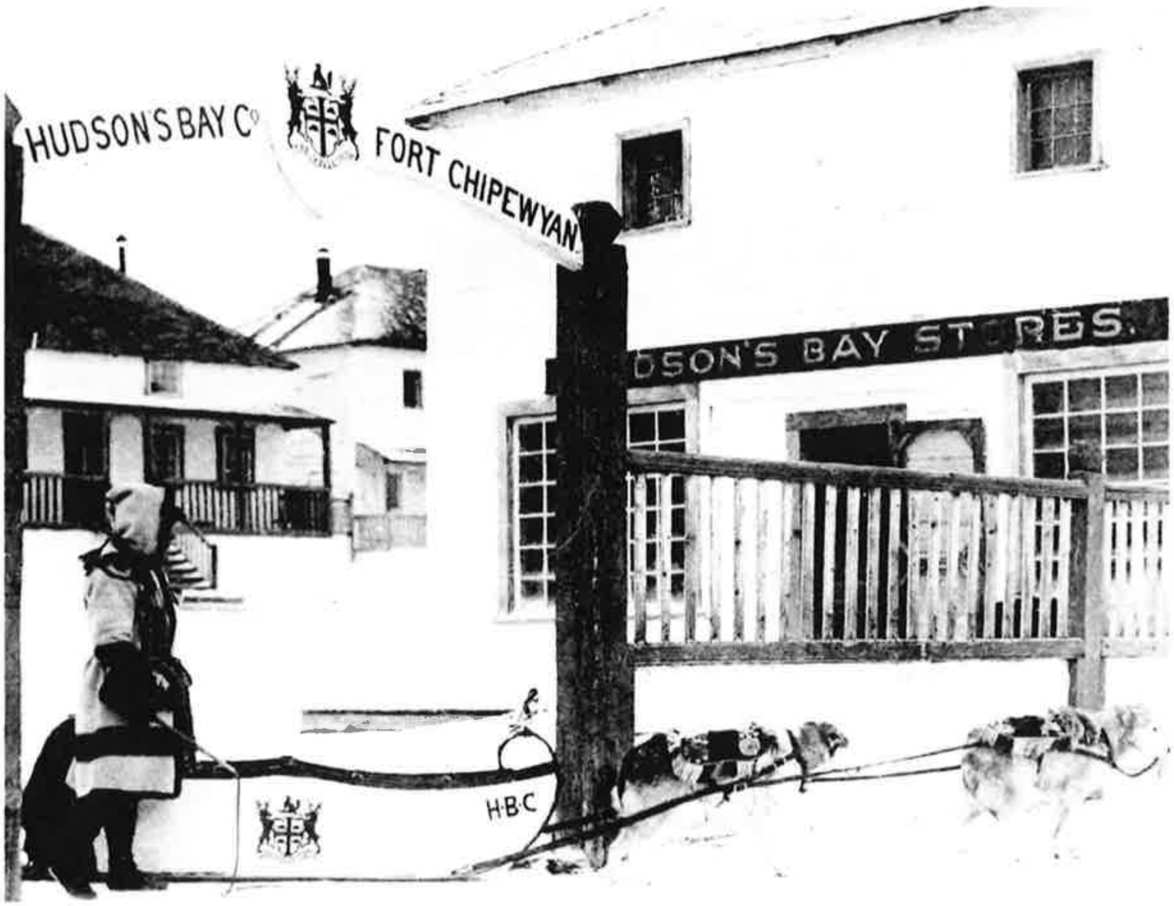
First Encounter: Arrival of the Fur Trade

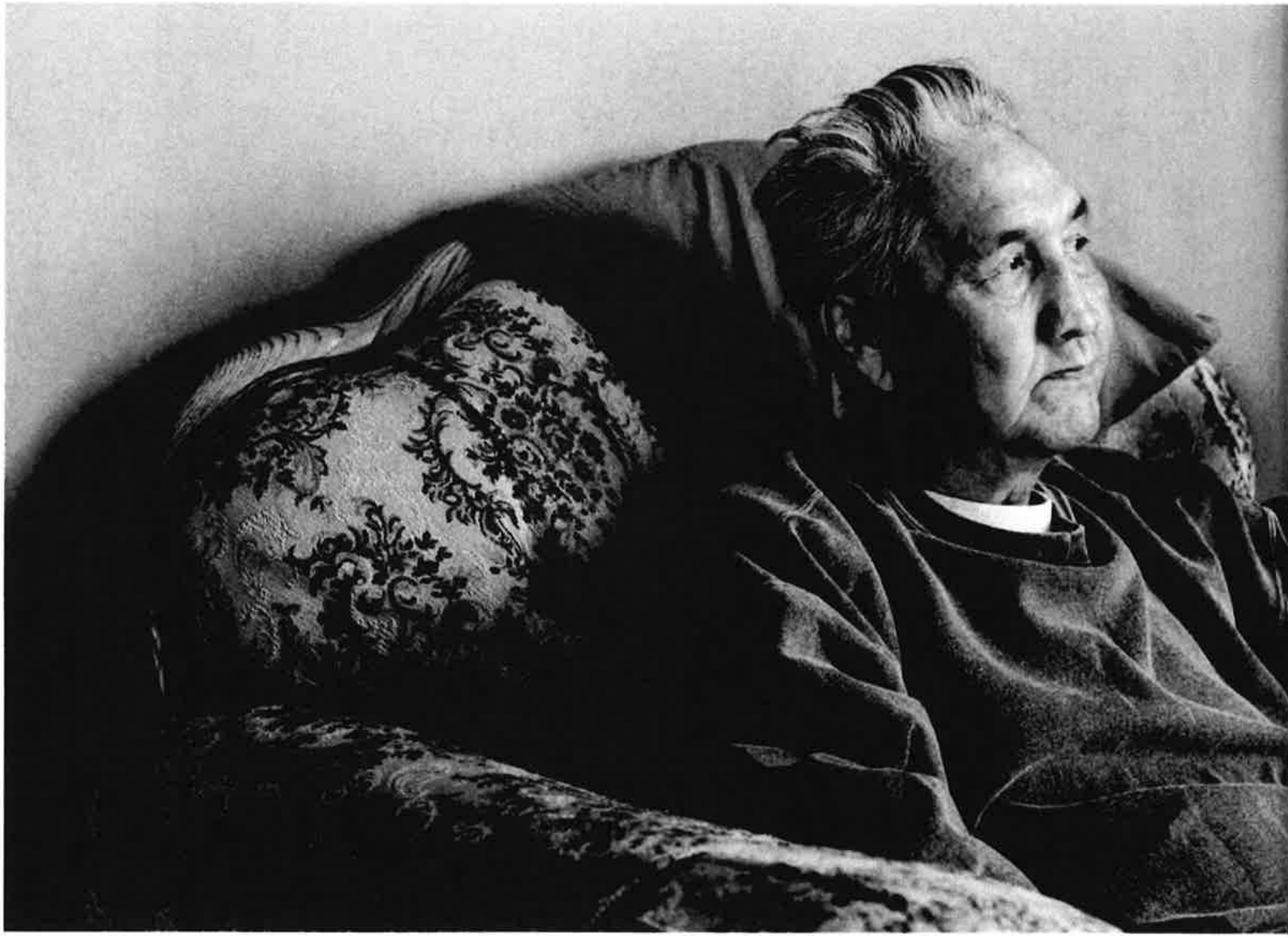
The "Caribou Eaters" enter the fur trade

Although the raiding and the conflict between the Cree and Chipewyan did continue, the period between 1715 and 1760 was relatively peaceful. During the 1750s and 1760s, the Beaver people in the Peace River region and the Slave people – another Dene group – north of Lake Athabasca attempted to bypass the Cree and establish a direct trade with the Prince of Wales fort. This enraged the Cree and led to an extended period of warfare between the Cree and the Athapaskans. In 1761, the Europeans at Hudson Bay sent a Chipewyan named Matonabee, who spoke Cree fluently, to attempt to make peace between the warring groups. After several years, most likely during the winter of 1764-65, he managed to secure a peace agreement between the Cree and the Beaver people at a location that became known as Peace Point. This event also gave the Peace River its name.

Just as the Cree acted as middlemen between western Aboriginal peoples and the fur traders, the Chipewyan became middlemen between Dene peoples such as the Dogrib and Yellowknife peoples and the fur traders. Because of a lack of fur-bearing creatures in the barren lands (hotelnene) where the Etthen eldeli Dene people traditionally hunted, the European traders encouraged the Chipewyan to move farther into the boreal forest to support the fur trade. However, due to resource depletion caused by the intensive harvest of the fur trade, life in the boreal forest presented frequent periods of starvation for those Chipewyan who succumbed and became dependent on the trade. As a result, there was a strong incentive for the Chipewyan people to pursue their traditional livelihood of caribou hunting even after expanding into the boreal forest region. Ethnographer James G.E. Smith maintains that the range of the Chipewyan people was likely increased by their early participation in the fur trade as they continued their harvesting of caribou. Smith notes that because of their caribou hunting, the Chipewyan were able to remain very independent of the fur trade from 1769 to 1772.



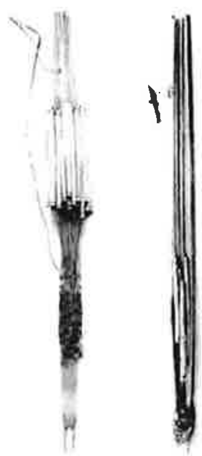
Hudson's Bay Company Post
Hudson's Bay Company post, Fort Chipewyan, with cariole and dog team in foreground.



Frank Marcel, a quiet moment.

CHAPTER FOUR

A Time of Great Changes



Rabbit Snares

These snares are stored and carried on the piece of wood. Before setting, they were usually rubbed with jack pine to kill the smell of humans. Each snare is set by hanging from a toss-pole placed in the branches of a felled tree. The toss-pole is toggled to another stick so that when the rabbit goes through the noose the toggle is released and the toss-pole jerks the animal off the ground. The snares were made and used by women.

Although the Etthen eldeli Dene people were reluctant at first to become involved in the fur trade, they eventually became completely immersed in the trade. As they shifted their primary livelihood from "caribou eaters" to trappers, middlemen and provisioners, their tools, their economy and their relationships also began to change.

The proliferation of trading posts in the interior negatively affected aboriginal economies in fundamental ways. The trade turned useful traditional goods into commodities. Furs were no longer valuable for their own use but as goods for sale to meet the demands of a much larger market of people who lived outside the local ecosystem, on another continent. Aboriginal people traditionally lived a nomadic life, ranging over thousands of kilometres and harvesting food where seasonal surpluses occurred. The Europeans remained in fixed settlements, consuming considerable amounts of food and wood in their immediate vicinity, often in quantities beyond the land's capacity to provide. The trading posts purchased the large amounts of provisions they required from the Aboriginal people. Thus, the Etthen eldeli Dene were gradually coaxed away from their traditional caribou-based livelihood to service these settlements as trappers, middlemen and provisioners.

During the late 1700s or early 1800s, the Theilanottine and K'ái tailé Dene (Flat Willow Dene or Delta Dene, as the ACFN people are called) began to remain more consistently in the Fort Chipewyan area supplying provisions and furs to the trading posts. As a result, they ventured less often to Hudson Bay or out into the barren lands. These people were ancestors of the Athabasca Chipewyan First Nation people and closely related to the Gankwendene or Fond du Lac people of northern Saskatchewan. An 1823-24 report estimated the population of the Fort Chipewyan area at 593 Chipewyan and 60 Cree.

Fur trade brings disease and famine

As they became more involved in the fur industry and less dependent on caribou, the Etthen eldeli Dene faced increased risks of food shortages. The lands around trading posts often were over exploited, causing local traditional food sources to become less reliable. As a result, the Aboriginal peoples depended more and more on the trading posts to supply their staple foods. According to the Northern River Basins Study published by Alberta Environmental Protection in 1996, there were periods of starvation among the Aboriginal peoples in 1822, 1839-43, 1873 and

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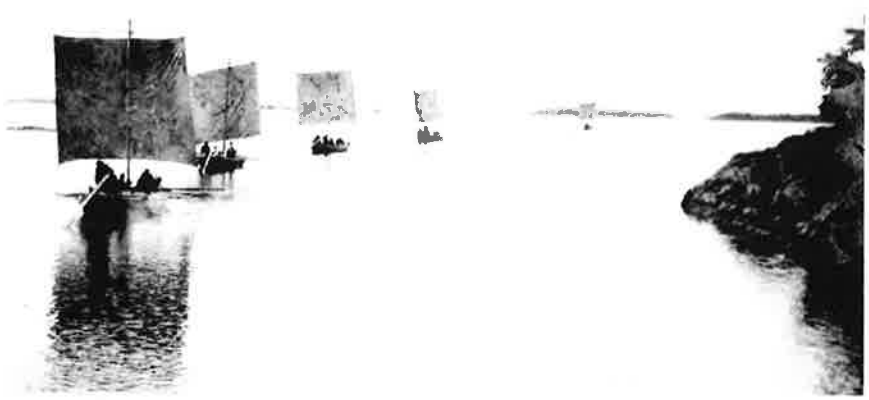
1887. The study, which was based on traditional knowledge and historical research, also indicated that there was a scarcity of game animals around Fort Chipewyan in 1850, 1871, 1873, 1882 and 1889.

The Aboriginal people also suffered regular epidemics of smallpox, whooping cough, measles and flu, because they had little immunity from these European diseases. The Cree population in the Fort Chipewyan area was all but wiped out by the outbreak of smallpox in 1781. The Etthen eldeli Dene were also devastated by the epidemic. The 1996 Northern River Basins Study recorded many outbreaks of disease during the 1800s among the people of the Lake Athabasca region. They include an influenza epidemic in 1835 as well as epidemics of measles and other diseases in 1819-20, 1846 and 1865. Chief Factor R. McFarlane of the Fort Chipewyan trading post wrote in 1873 that 23 men, women and children died in an epidemic that year. This was a significant proportion of the Aboriginal population at the post, he pointed out. Chipewyan Elders tell of a particularly devastating influenza epidemic that occurred around 1920.

Several other important changes came about with the spread of interior trading posts and the consolidation of the fur trade into a Hudson's Bay Company monopoly in 1821. In order to make trapping more attractive to Aboriginal people, the Hudson's Bay Company introduced a system of credit allowing them to run up debt.

York Boats
York boats using sails to assist in the long journey from Fort Chipewyan to Hudson's Bay



This further increased the reliance of the Aboriginal people on the trading posts. The company also introduced the York boat to transport furs from the interior posts to the shipping terminals on Hudson Bay. This new trade structure eliminated opportunities for the Cree and Etthen eldeli Dene to act as middlemen, forcing them to become either trappers or suppliers of provisions. It was during this period that the Etthen eldeli Dene began to permanently shift their methods of livelihood.

Changes in traditional rounds

Even as the Etthen eldeli Dene people of the Fort Chipewyan area became more committed to the fur trade, they continued to base their livelihood on their ability to support themselves off the land by hunting, trapping, fishing and gathering. While some southern Chipewyan groups stopped hunting caribou entirely, most bands continued to hunt caribou to supplement their livelihood. However, they shifted the centre of their annual rounds in order to pass by the fur trading posts. Gradually, over the century between 1820 and 1920, they reduced their range of travel, establishing their camps in more permanent social groupings or micro villages strategically located near their key hunting, trapping and fishing resources. Because of their history of wide-ranging migration, the Etthen eldeli Dene were able to shift their regional identities easily and adapted quickly to the boreal forest and to micro-village living. However, they still tended to travel farther than other Aboriginal peoples because of their nomadic tradition.

Sarah Bell, a Chipewyan woman who was born in the 1870s, travelled on annual rounds with her people – the English River Band in Saskatchewan – when she was a child. She passed on her traditional knowledge of the annual rounds to band member Moise McIntyre during the 1940s. In her recollections, Sarah Bell described the activities of two Chipewyan groups, one following a northern round and the other a southern round. Their activities were likely very similar to those practised by many Chipewyan people during the 19th century.

The southern group wintered in small multi-family encampments in the vast area between Foster River and Cree Lake in northern Saskatchewan. Prior to spring breakup, the people lived close to birch groves where they made new canoes.

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In spring, the group would gather close to the Ile à la Crosse trading post for fishing and trading. There was also a spring muskrat hunt. In early August the group travelled farther south to Dore Lake and the headwaters of the Smoothstone River to continue hunting and fishing. In the fall the group would follow a circular route northward through the Churchill River or Souris River back to Foster Lakes. Here they would divide into their winter hunting and trapping groups.

The northern round also involved trading at Ile à la Crosse. This group wintered at Black Birch Lake, where they hunted and trapped in smaller family groups west and southwest of Cree Lake. At breakup the entire group assembled at the headwaters of Clearwater River and travelled to Fort McMurray and Fort Chipewyan to trade. They then travelled north of Lake Athabasca to hunt barren land caribou for food and winter clothing. In late fall and early winter they followed the caribou south and returned to mid-winter hunting and trapping areas in northern Saskatchewan.

Both of these rounds reflect the current locations of Chipewyan settlements in Saskatchewan and Alberta and were likely farther south than the original caribou-based rounds of the Chipewyan before the advent of the fur trade. It is significant that both start close to Ile à la Crosse for the purpose of fur trading. Before the fur trade, the rounds of the Etthen eldeli Dene would not have concentrated on fur trapping and would not have started and ended close to a fur trading post. Sarah Bell's traditional knowledge shows how the Chipewyan people adapted their rounds to the fur trade and how closely they integrated their traditional harvesting livelihood and their early commercial fur trade activities.

Early ACFN micro-villages

The Elders of Fort Chipewyan have described rounds followed by their parents and grandparents in the early 20th century that resemble the annual rounds described by Sarah Bell. While the Elders did not describe the annual cycles in the same detail, their stories show that the K'ái tailé Dene lived in a social and economic environment similar to that of their Saskatchewan cousins.

Adopting New Technologies

Participation in the fur trade brought about at least three major changes in the tools or technologies used by the Etthen eldeli Dene which have significantly affected their livelihood and culture.

In order to carry heavier loads more securely over greater distances, the Etthen eldeli Dene adopted the larger Algonquin-style canoes used by the Cree. This canoe took a large amount of effort to build, so it wasn't likely to be thrown away after use. As a result, the Etthen eldeli Dene were more likely to use the waterways rather than their former overland routes.

The Chipewyan also began to use dog sleds more often. Although Aboriginal peoples had used dog sleds before, they used them much more during the fur trade because sleds allowed them to travel faster and farther. This technology contributed to the settlement of the Chipewyan into micro-villages because it allowed them to hunt or visit trap lines and return long distances to centrally located cabins. However, the dogs needed to be fed all year round. As a result, fishing for dog food became an important and very time-consuming activity.

A third technological change was the introduction of the rifle. While the use of traditional pounds was as efficient as or even more efficient than the rifle for killing caribou, the rifle was much more efficient for hunting moose in the forest.

Top: Sled
These sleds were used to transport heavier loads including people, furs and meats. They were covered by a wrapper which in earlier times was made of moose or caribou skins.

Left: Dog Harness
A tanned caribou-skin with padded collar and trace for fastening the dog to the sled.

Right: Dog Whip
Wooden handle covered with tanned caribou-skin and decorated with woolen pompoms and wool wrapped to form a pattern of colours of red, pink, orange, blue, green and white. Tapering lash of braided babiche.

Bottom: Canoes
Canoes were used to carry heavier loads more securely over greater distances.

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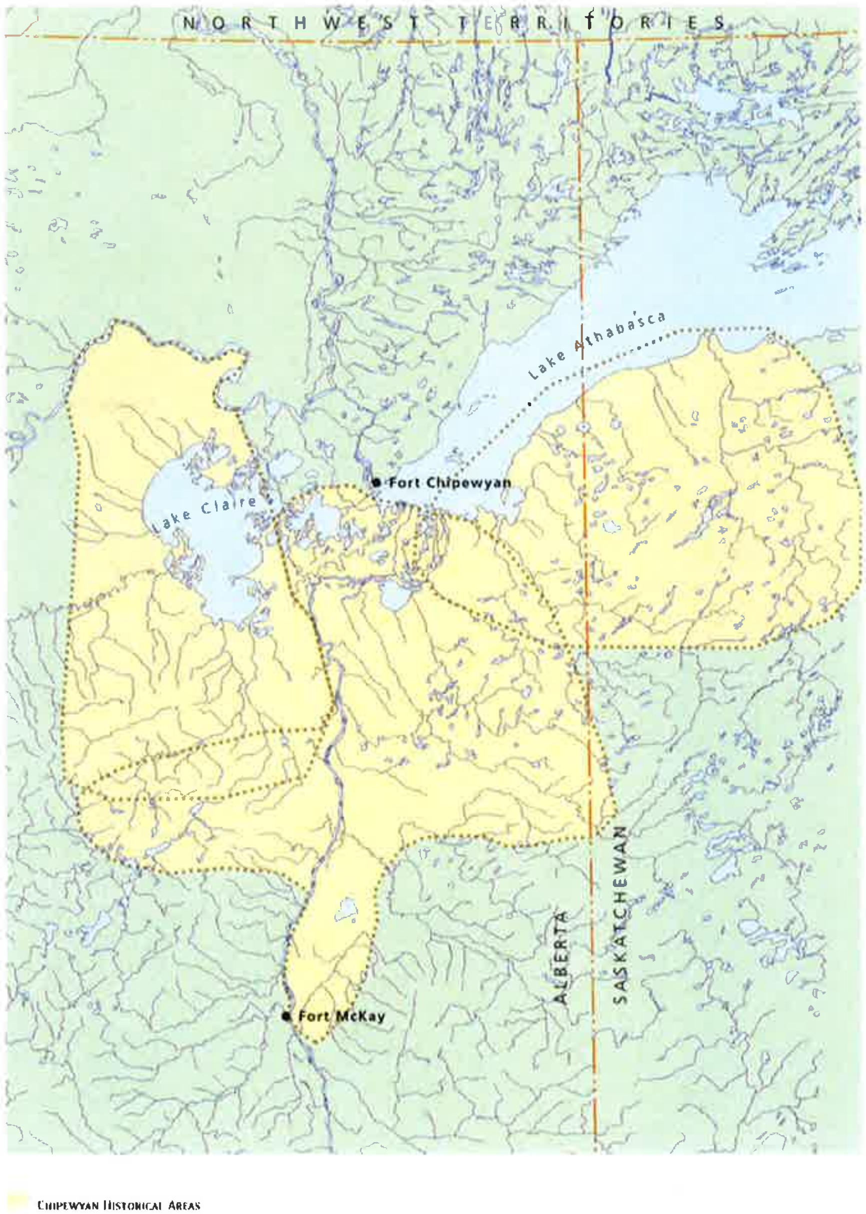
CHAPTER FOUR **A Time of Great Changes**

ACFN Land Use Areas in the Early 1900s

This Elders' map shows where their parents and grandparents lived, trapped, hunted and fished in the early 1900s.

These historical areas represent the more intensive land use areas of several early Athabasca Chipewyan groups. These groups were from Old Fort on the south shore of Lake Athabasca, Point Brule and Poplar Point, Jackfish, and the Birch River area. The traditional land use of these people extended beyond these intensive use areas.



ACFN Family Roots in 1920

The Elders of the ACFN have created a map that shows where their grandparents and parents lived, trapped, hunted and fished in the early 1900s. The following is a list of the people and families that occupied the micro-village areas at the time. As these lists were compiled through Elder interviews, some families may have been missed.

Point Brule and Poplar Point

Raymond Boucher
Ted Boucher
Willie Boucher
Jonas Coghan
Edward Cyprien
Moise Cyprien
Alec Flett
John Baptiste Flett
Rudolph Flett
Joe Hymen
Marvin L'Hommecourt
Moise L'Hommecourt
Norbert L'Hommecourt
Roy L'Hommecourt
Ben Marcel
Adam McCrae's widow
George McDonald
Alphonse Piche
Jonas Piche
Pierre Piche
Adam Trip de Roche
Boniface Trip de Roche
Baptiste Willow

Old Fort

Alex Adam
Ernest Adam
Jimmy Adam
Joe Adam
Johnny Adam
Louison Adam
Pat Adam
Pierre Adam
Arsene Bernaille
Alec Bruno
Charlie Bruno (Piche)
Francois Bruno
Napoleon Bruno
Rene Bruno
Baptiste Crookedneck
Armand Deranger
Isadore Deranger
William Laviolette
Albert Marcel
Armas Marcel
August Marcel
Baptiste Marcel
Julian Marcel
Martan Aze
Antoine Mercredi
Charlie Mercredi
Eli Mercredi
Gabriel Mercredi
J.B. Mercredi
John Mercredi
Joseph Mercredi
Larry Mercredi
Pat Mercredi
Smoky Mercredi
Tony Mercredi
Wilfred Mercredi
Jarvis Piche
Louis Piche
Joe Robillard
Pete Whitedeer

Jackfish Lake

Francois Bruno
Napoleon Bruno
Magloire Cardinal
Raphael Flett
Jonas Laviolette
Archie Marcel
Ben Marcel
Daniel Marcel
Fred Marcel
Freddy Marcel
Henry Marcel
Joe Marcel
Big John Marcel
John Marcel
Joseph Marie Marcel
Matthew Marcel
Narcisse Marcel
Pat Marcel
Raymond Marcel
Walter Marcel
Gabriel Mercredi
Marie Mercredi
Jonas Piche
Pierre Piche
Boniface Trip de Roche
Charlie Voyageur
Isadore Voyageur

The River

Joe Dene
Pierre Ratfat

Birch River Families

Adam
Bruno
Flett
Fortin
Gladue
Piche
Ratfat
Simpson
Trip de Roche

CHAPTER FOUR

A Time of Great Changes

The families would live, trap and hunt together, travelling in groups depending upon the season and the activity. They developed a communal trapping area system that was a natural evolution of their earlier cooperative caribou-hunting system. Once a group identified their trapping area, they respected each other's lines within that area. (See "Mutual Respect Within the Trapping Area," page 53.)

The K'ái tailé Dene family groups made their rounds within three areas similar in size to those described by Sarah Bell. These three groups centred their activities around the Fort Chipewyan trading post and established several micro-villages in locations that offered good sources of fish and easy access to trap lines during the winter months. One group occupied a western area that included much of what is now Wood Buffalo National Park. The summer villages or camps in this area were along the Birch River. Another group occupied an eastern area that took in lands well into Saskatchewan and north into the Northwest Territories. Their summer villages included the Old Fort area on the south shore of Lake Athabasca, or what is now Old Fort Point, and the lower portion of the Athabasca delta, close to Jackfish Lake (Richardson Lake), known as Jackfish. A southern group lived in several settlements along the Athabasca River in summer and hunted and trapped from the Birch Mountains to beyond the Saskatchewan border. Their settlements included Point Brule and Poplar Point, as well as several smaller villages. The villages of Old Fort Point and Jackfish are still in use.

By the 1920s the micro-villages had developed from tent camps into groups of permanent log cabins. The first cabin in the Jackfish micro-village area was built by Benjamin Marcel in about 1918. Many more log cabins were built over the next few years, and the changeover to the fur trade/boreal forest subsistence economy was complete. While the K'ái tailé Dene people still made regular hunting and gathering trips on the land, they had made the log cabin their home base. However, despite the changes in their livelihood and range of travel, the Chipewyan people retained many of the characteristics of their nomadic caribou livelihood and it continues to influence their lives today.

Mutual Respect Within the Trapping Area

Even as they moved into the boreal forest and participated in the trapping economy, the Caribou Eaters maintained cooperative systems of the type they had developed for survival with their earlier, caribou-based economy.

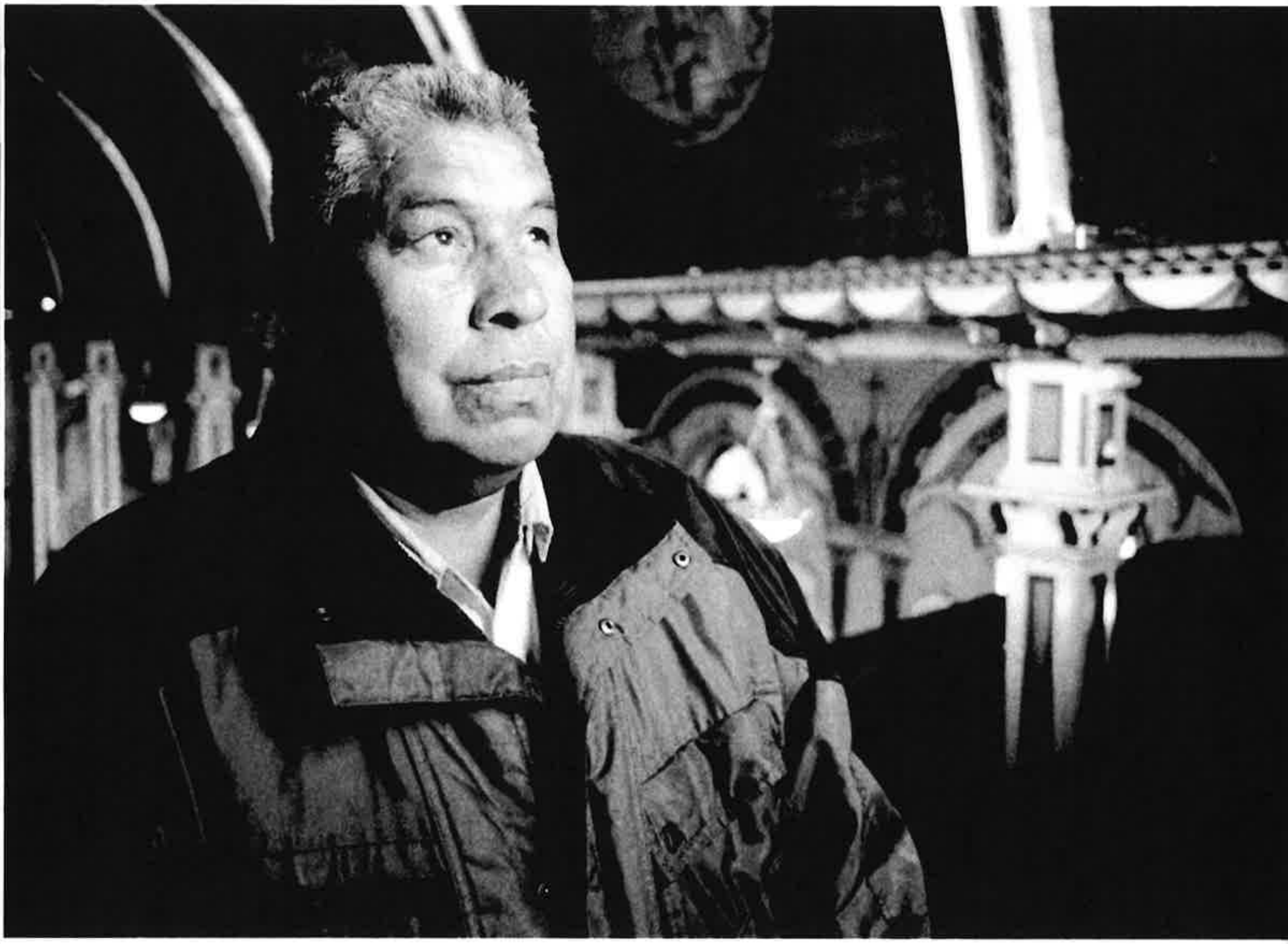
Rather than dividing territory into family-owned trap lines, the Etthen eldeli Dene tended to identify large areas on which many families could establish lines. A trapping area was open to all of the people from a certain group. A group might consist of 10 or 15 people with a group leader. If a trap line was not in use, a trapper could take it.

"There were three to four families in an area (micro-village)," an ACFN Elder explained. "You would claim a trap line by making a trail and no one else would use that area. We travelled long distances – like to La Loche to trade a dog. We knew the country for 100 or 200 miles around. We knew which land was ours. We travelled together."

Under this communal method of establishing trapping areas, every individual's trap line was respected. According to one ACFN Elder, "Those people always trapped there before any boundary was established. It was their traditional area. Within the group, in the larger trapping area, a trapper would 'cut the trail' in an area that was unused by others. That was his trap line. You left him alone – there was mutual respect."

Arsene Bernaille

Arsene Bernaille is still active on the land and eagerly anticipates the spring hunt each year. A self-taught fiddler, Arsene plays at traditional fiddle dances.



Albert Voyageur inside the Roman Catholic Church, "The Nativity of the Blessed Virgin Mary" – which was built in 1909.

CHAPTER FIVE

Treaties and Transitions

While the Etthen eldeli Dene's way of life was changing to accommodate the fur trade, several major developments came about in the late 1800s that would have more far-reaching effects on the lives of all Aboriginal peoples of western Canada.

The British North America Act of 1867 established the Dominion of Canada with four provinces: New Brunswick, Nova Scotia, Ontario, and Quebec. Shortly after, in 1870, the Hudson's Bay Company surrendered its rights in the northwest (Rupert's Land) to the new Canadian Confederation in return for money and ownership of certain lands in perpetuity. As part of this acquisition, the Canadian government promised to honour the terms of the Proclamation of 1763, which included negotiating with Amerindians for the termination of their title and the creation of reserves for their exclusive use. The northwest was "Indian territory." In order to provide for orderly occupation of this vast area, the new Canadian government needed to obtain rights from the Aboriginal peoples who occupied the lands. The government began to negotiate treaties with Aboriginal groups, starting with Treaties 1 and 2 in 1871 with the Chippewa and Swampy Cree tribes in Manitoba. Treaties 3 through 7 quickly followed at the rate of one a year up until 1877.

During this same period, the United States government stopped negotiating treaties with Aboriginal peoples. The American West was being settled rapidly, and without treaties, the Aboriginal peoples of the West felt their lands were being stolen. They responded with force. The resulting hostilities became known as the "Indian Wars." Several major battles occurred during this time, including the famous Battle of the Little Big Horn in 1876.

After signing Treaty 7, the Canadian federal government also suspended its treaty-making process. There was considerable discontent among Cree Chiefs – including Big Bear and Poundmaker – with the terms of Treaty 7, which was signed with the Blackfoot and other tribes at the Blackfoot crossing of Bow River and Fort Macleod. During this time the Métis were also struggling for recognition of their land rights. The lack of action by the Canadian government in addressing these issues led to hostilities in Canada similar to those experienced in the United States. The struggle for recognition of Métis and Aboriginal land rights came to a head in 1885 with the

Canadian Métis and Indian War, also referred to by some as the Northwest Rebellion or the Riel Rebellion. Following this struggle, there was severe repression of many Aboriginal peoples in western Canada, and the Canadian government further postponed the treaty-making process.

No treaty, no aid

During this period, the Etthen eldeli Dene were engaged in a traditional livelihood, participating in the fur trade and travelling rounds based on the natural game cycles of their area. But, after the transfer of power in the northwest, the new Canadian federal government did not pursue the same cooperative economic relationship with Aboriginal trappers as the Hudson's Bay Company had developed. During difficult times of famine or disease, the Hudson's Bay Company had offered food and medicines to the Aboriginal people. But the government did not recognize any obligation towards people with whom they had not signed a formal treaty. Aboriginal peoples without treaties, including those in what is now northern Alberta, suffered devastating consequences. Even those with treaties did not always fare well.

During the deadly 1873 epidemic, Chief Factor R. Mcfarlane of the Hudson's Bay post at Fort Chipewyan complained in a Chief Factor's report about the neglect on the part of the government to aid Aboriginal people in times of hardship. He wrote additional formal complaints in 1880. Then, in 1883, following several years of hardship and severe epidemics, the Chipewyan Chiefs sent an appeal for help directly to the Prime Minister. It appears these pleas for assistance were ignored.

The signing of Treaty 8

The Dominion government continued its policy of withholding aid from Aboriginal groups that had not signed treaties. What's more, the government was not willing to enter into any treaty discussions with those groups. The Canadian government turned a blind eye to the suffering of the Aboriginal people of northern Alberta until 1899. Two developments kindled new interest in negotiating treaties with these Aboriginal groups: northern Alberta had become a route to the Klondike during the gold rush of 1896-98; also it was discovered that the region might contain vast quantities of oil. The government finally negotiated Treaty 8 in the summer of 1899.

At that time, the Aboriginal people lived off the land in various communities in the bush. When the treaty commissioners arrived in Fort Chipewyan, the Chiefs of the Chipewyan and Cree presented the conditions under which they would accept the government's proposals. These conditions included the complete freedom of their peoples to fish, hunt and trap. Their terms also included education for their children.

After the difficult times they had been through, it is likely the Aboriginal people of the area were looking to the government to protect their traditional livelihood when they signed the treaty. However, the people of Treaty 8 later discovered that the treaty printed by the government contained a clause that was not in the original treaty they had signed in the summer of 1899, according to Father Rene Fumoleau, an Oblate priest who researched the history of Treaty 8. This clause stated that the freedom to fish, hunt and trap was "subject to such regulations as may from time to time be made by the Government of the country." In his book *As Long as This Land Shall Last*, Father Fumoleau says that Pierre Mercredi, who served as interpreter for the Chipewyan at the Fort Chipewyan Treaty 8 signing ceremony, said that this clause was not in the original treaty he witnessed at Fort Chipewyan. (See "As Long as This Land Shall Last," page 59.) The Dominion government had already passed the Unorganized Territories Game Preservation Act in 1894 to protect game from over-exploitation by the fur trade. This act restricted harvesting of certain animals and birds and was created without consulting the Aboriginal peoples most affected by the legislation.

CHAPTER FIVE

Treaties and Transitions

Treaty 8 created two new legal entities in Fort Chipewyan: the Athabasca Chipewyan Band (Athabasca Chipewyan First Nation) and the Mikisew Cree Band (Mikisew Cree First Nation). At the same time, a North West Mounted Police (later known as RCMP) detachment was posted to Fort Chipewyan to administer government laws and programs. This was the beginning of a long series of assimilation policies by the Canadian government and of misunderstandings between the government and the people of Treaty 8.

More newcomers, more changes

The fur trade opened western Canada to other European influences. Following on the heels of the traders, Roman Catholic Oblate missionaries set up a mission in Fort Chipewyan in 1849. Anglican missionaries arrived in the area in 1874. The missionaries set up schools for the purpose of providing Aboriginal people with "a personal knowledge of Christ" and teaching their children the customs of European civilization. Their influences would have even more significant and far-reaching effects on the lives of Aboriginal people than the technological changes that occurred in their culture in the 19th and 20th centuries.

In the early 1900s, the Etthen eldeli Dene people in the Fort Chipewyan area were strongly encouraged to send their children to residential schools operated by Roman Catholic missions. Respecting the "white man's law," the Aboriginal parents entrusted their children to the missionaries. The children who passed through the mission doors were changed forever. For many it was the first time they had heard themselves called "Chipewyan," the term used for them by their traditional enemies, the Cree, and adopted by the Europeans. (As mentioned earlier, they were known among themselves as "Dene".) Like all Aboriginal children attending residential schools, they were also called "sauvages" (French for "savages"). Most had come from a loving extended family where children were treated with affection and were considered on loan from the Creator. They found themselves in a cold, foreign institution where corporal punishment was the norm, and where physical, mental and sexual abuse was common. At home they would have been taught their families' values, stories, language and cultural identity. However, the missionaries did not respect their culture and forbade them to speak their own language. The children of the residential schools often emerged without the concept of love, without parenting skills, without knowledge of who they were, and without respect for themselves.

"As Long as This Land Shall Last"

Pierre Mercredi acted as interpreter for the Chipewyan people of Fort Chipewyan at the signing of Treaty 8. He said later that the original treaty signed by the Chipewyan contained no mention of a promise to obey any hunting regulations set by the government. Nevertheless, such a clause was inserted in the final printed copy of the treaty that was sent later to the people of Treaty 8.

"I read the Treaty to them and there was no clause in it which said they might have to obey regulations about hunting. They left us no copy of the Treaty we signed, saying that they would have it printed and send a copy to us. When the copy came back, that second clause (that they shall promise to obey whatever hunting regulations the Dominion Government shall set) was in it. It was not there before. I never read it to the Chipewyans or explained it to them. I have no doubt that the new regulation breaks that old Treaty. It makes me feel bad altogether because it makes lies of the words I spoke then for Queen Victoria." – Pierre Mercredi, interpreter for the Chipewyan of Fort Chipewyan, quoted in Rene Fumoleau, *As Long as this Land Shall Last.*

The damage they experienced would take many generations to heal. To this day, the hamlet of Fort Chipewyan is still working on recovery of its aboriginal culture and identity. (See "What Happened to Us Must Never, Ever Happen Again," page 60.)

Also in the late 1800s, construction of the railways into southern Alberta brought more Europeans to settle and exploit the economic opportunities of Western Canada. This development tended to shift transportation routes away from the waterways of Lake Athabasca. When the Canadian Pacific Railway reached Calgary in 1883 and land routes were constructed northward, the Athabasca River became a more important transportation route. By the early 1900s, the Chipewyan people were feeling the effects of white settlement.

What Happened to Us Must Never, Ever Happen Again

Residential schools had a profound effect on generations of Aboriginal people in Canada. Here an ACFN member tells of her peoples' experiences in residential schools.

Holy Angel Residential School

In 1924, the Holy Angel Residential School was built. A second school by the same name was built in 1944 and demolished in 1975-76.

"Within the residential schools, the degradation of the aboriginal culture was endemic. The Grey Nuns made sure that the 'savages' were grateful we were being taught the 'Christian way.' To speak aboriginal language was guaranteed punishment. Aboriginal ways were considered evil and wrong, and they had to change or go to hell. So many of the children got to the point where they were ashamed to acknowledge their family, and with it, their identity. The punishment they endured is loaded upon their shoulders to this day....

"Residential life was better in the 1940s and 1950s in the sense there was better food, warmer quarters, and adequate clothing, but the affection and love that they were all used to before they entered the mission was still missing. Most mission kids shook their parents' hand as a sign of hello and goodbye. There was no physical contact between the kids and the Grey Nuns. In fact, siblings were not allowed to talk to each other. The children were not allowed to show their feelings or speak their thoughts. They were often called by their number instead of by their Christian names! Many of these kids cried themselves to sleep only to wake up to their night-mares still there.

"There were many contradictions in the missions. The teachers claimed that English was the language of commerce and therefore a requirement for survival, yet the Grey Nuns always spoke French. In the fall, (the children) would be paraded out to pick blueberries. The nuns would check carefully to ensure the children did not eat any of the many blueberries while they were picking them. Yet none of the children can remember ever having blueberries served to them in the mission.

"Aboriginal language and culture were belittled to such an extent that it was not unusual to hear 150 mission children cheering for the cowboys killing off the Indians in an old western movie.

"The kids left the mission, not belonging anywhere, with low self-esteem, encountering discrimination and intimidation. This affected their children and their family lives. Some mission survivors to this day will not talk about their experiences, the pain and shame still on their shoulders. Many of the mission children cannot speak their language, which means that they can't speak to their Elders and grandparents.

"Our parents were not informed of what was happening to their children....We were not happy but we were taught not to talk about what was happening, so many stories never got beyond those walls for years.

"I spent ten years in the Holy Angels Residential School – ten years I don't have fond memories of. There were fun times, too, friendships that still continue to this day. When we 'mission kids' get together, we do laugh at some of the stories from those lost years. But in the back of our minds, we all feel the same: what happened to us must never, ever happen again."

Victoria at home with her husband, Alex Flett. Victoria continues to make traditional garments, like slippers made of moose hide with beaver trim and intricate beadwork.

CHAPTER SIX

Rules, Regulations, Reserves

Although the K'ai taile Dene people had signed Treaty 8 thinking it would protect their traditional livelihood, they soon discovered it provided little protection from new and growing pressures on the land and their way of life. The people found themselves in a continuing struggle to preserve their traditional livelihood from the effects of European settlers and government control. Meanwhile, the government neglected to keep many of its promises of Treaty 8, and the Chipewyan people continued to be exposed to waves of disease, starvation and scarcity of resources.

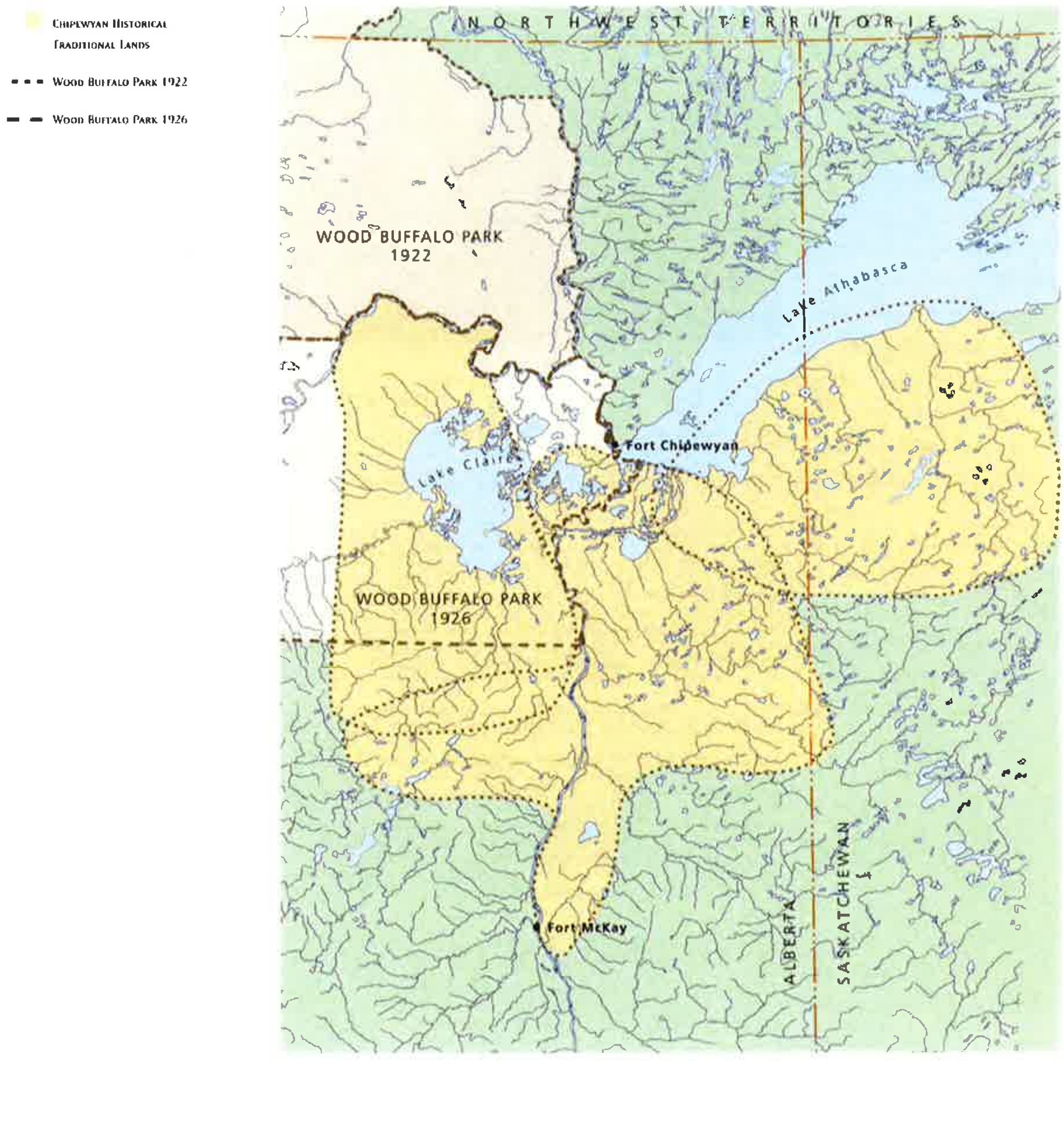
After the construction of the railways in the late 1800s, there was in influx of immigrant commercial trappers in the Lake Athabasca region. Apart from the Unorganized Territories Game Preservation Act of 1894, the commercial fur trade was a largely unregulated, open-access industry. The immigrant trappers disrupted the traditional trapping livelihood of the Chipewyan peoples in several ways. They competed with the Aboriginal trappers for the land's finite fur resources, causing problems of over-exploitation. Also, the newcomers did not respect or follow the traditional cooperative trap line rules that the Aboriginal trappers had developed to ensure mutual respect and survival of all. The Aboriginal trappers were aware of the times when the availability of furs was at its peak and practiced sustainable harvesting, taking only the best furs while leaving the rest for other years. They also recognized the rights of trappers on neighbouring trap lines and often relied on this mutual good will for assistance with any emergencies that arose. This mutual respect was accompanied by some clear rules about trespassing on another's trap line. But the white trappers ignored these rules, routinely trespassing on Aboriginal trap lines and even removing traps set by Aboriginal trappers.

The problem had grown worse with the expansion of the railways. In 1912 a railway line reached Athabasca Landing. In 1915, another line was extended to Peace Landing and with it came more Métis and white trappers to Fort Chipewyan. After World War I ended, even more white trappers flooded into the area.

The Aboriginal trappers and hunters reacted angrily to this "invasion." They petitioned the federal government to honour the promises it had made in Treaty 8 to protect the rights of the Aboriginal peoples to live off the land. But they got no action from the government. In their anger, they resorted to burning specific parts of the forest. They increased their own fur trapping to out-compete the white

Expansion of Wood Buffalo Park

Many Chipewyan people lived and hunted in the Birch River area around Lake Claire. In 1926 the Wood Buffalo Park was expanded into this area.



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CHAPTER SIX

Rules, Regulations, Reserves

Wood bison
In the late 1700s explorer Peter Fidler joined with Chipewyan people in harvesting wood buffalo. As a result of the Unorganized Territories Game Preservation Act of 1894 and the creation of Wood Buffalo Park in 1921 and the expansion in 1926, the Chipewyan's access to this important source of meat was restricted.

originally concentrated on the east side of the lake, however people from Fort Chipewyan participated. By this time most people in the region had small motors on their boats.

Despite the arrival of the commercial fishing industry, by 1930 drought and hunger had hit the region hard. Park officials had made a verbal promise that each family would be allowed one bison per year. This promise was not kept. Instead, during the 1930s park wardens killed a few bison each year and provided the meat to the missions and to Indian Affairs relief programs.

Meanwhile, in 1928, the federal government began entering into a series of agreements with Manitoba, Saskatchewan, Alberta and British Columbia to transfer ownership of natural resources to the provinces. The federal government attached certain conditions to the transfer that would protect the rights of Aboriginal people to hunt, trap and fish. The relevant clause in the Alberta Natural Resources Transfer Agreement of 1930, which was confirmed by the Constitution Act of 1930, reads as follows:

"In order to secure to the Indians of the Province the continuance of the supply of game and fish for their support and subsistence, Canada agrees that the laws respecting game in force in the Province from time to time shall apply to the Indians within the boundaries thereof, provided, however, that the said Indians shall have the right, which the Province hereby assures to them, of hunting, trapping and fishing game and fish for food at all seasons of the year on all unoccupied Crown lands and on any other lands to which the said Indians may have a right of access."

Aboriginal people in northern Alberta continued to suffer from the effects of the park and unfair competition from white trappers. As a proposed solution to their complaints, the Government of Alberta began to impose closed seasons on wildlife. While the government intended the closed seasons to apply to Aboriginal people, the regulations actually violated the terms of Treaty 8. Aboriginal trappers challenged these regulations, correctly citing the clause in the Natural Resources Transfer Agreement assuring them the right to hunt, trap and fish "for food at all seasons of the year." The Supreme Court of Canada eventually ruled that the agreement effectively and unilaterally took away their right to hunt, trap or fish "commercially" but preserved their right to hunt, trap and fish for food. To this day, Aboriginal people worry about being charged for violations when they hunt or trap for food. In many cases they are now defended by additional Supreme Court rulings. However, aboriginal hunting rights are not always respected and laws prohibiting aboriginal hunting for food must be based upon valid conservation reasons or they are non-constitutional.

The Chipewyan were suffering severe hardship as a result of the game regulations and the often biased enforcement of the regulations in favour of white trappers. As well, they were being pushed out of their most productive hunting and trapping grounds by the settler-trappers, who often left the land over-exploited. The situation prompted ACFN Chief Jonas Laviolette to send a letter in 1938 asking the Alberta government to come to his people's rescue. (See "How are We to Live?", page 68.)

In 1939, the Government of Alberta introduced a registered trap line system in the province. ACFN members acquired trap lines under the new system. Originally, Aboriginal people obtained their trapping licences for free. However, by 1944, the government was charging all trappers royalties on the furs.

In 1946, the federal government introduced a regulation to limit each hunter to one moose per year in Wood Buffalo Park. In 1947, there was a large fire in the park, which some attribute to the fact that the government would not allow the Aboriginal people to conduct the controlled burns they traditionally initiated in the area. Trapping areas were introduced in the park in 1949. These were group areas and operated in a manner similar to the Aboriginal people's older traditional systems.

"How Are We to Live?"

Aboriginal fur trappers followed a cooperative system of mutual respect for each other's trap lines based on communal rules that ensured survival of all and of the fur resource. White trappers recognized no such rules and disrupted this system to the extent that their activities seriously threatened aboriginal livelihoods. Government game regulations, as they applied to Aboriginal hunters and trappers, were adding to these pressures. In 1938, Chief Jonas Laviolette sent a letter to Alberta's Minister of Agriculture pleading for the government to "come to our rescue":

"I am taking the liberty of writing to you, in regard to the game Regulations enforced this winter which puts us in an awkward position to make our living at this place [Fort Chipewyan, Alberta], and as Chief of the Chipewyan band. I have to make some complaints to you, and I hope you take steps to remedy the situation, that is to say, that the strangers from outside (white trappers) are taking all our best hunting grounds from us, and they do not allow the Indians to hunt near these, and this has been going on since a good few years. The result is, a good many Chipewyans of my Band cannot find any place to trap rats; and how are we to live, all the place left for Chipewyan belonging to Jack Fish Lake, old Fort and Big Point is the delta, which is barren, no rats there, nothing but sand bars, and we cannot go anywhere also to trap rats.

"I wish to mention also, that the present Game Guardian ... is not fit for a game Guardian, is siding on white trappers only, and Indians never see him to talk to him, I presume that this Game Guardian and a few trappers (his favourites) are the ones that are making laws as they please. And another thing is, if an Indian sets a few traps before the white trappers, those white trappers take the traps away (Indian traps) and set their own traps there. We cannot call that just, that which happens often; according to our Treaty, we are free to trap and fish and hunt anywhere.

"I wish to mention also that the White trappers are taking Big ground and Big Lakes for their own trappings, while a poor old Indian has no chance to kill a few rats, and most of those white trappers are Russians, Germans and Swedes. I want *fair play* for my Band of Chipewyans and I hope the Government comes to our rescue."

Gravesite of Chief Jonas Laviolette
Chief Jonas Laviolette died in 1952.

The creation of Reserve 201

After years of petitioning by the ACFN people for a reserve in the area, the federal government had approved Indian Reserve 201 at the southeast end of Lake Athabasca in 1937 and the provincial government passed a certificate of title to the federal Crown. However, due to administrative red tape, the reserve was not officially declared until 1954. In 1940, the government allocated Reserve 201 to the ACFN. This provided the Chipewyans with exclusive lands free of competition from the settler-trappers and therefore with some protection of the Band's trapping and traditional livelihood.

Once Reserve 201 was created, the ACFN people were able to re-establish their traditional rules regarding animal preservation and mutual respect on the trap line. These traditional hunting rules provided each trapper with an area that would be respected by other members of the Band. Often when ACFN members held registered trap lines they would share their lines among members of their family and close trapping friends. In such cases, the same traditional rules of respect would apply.

During the 1940s and 1950s, Chief Laviolette set quotas or maximum harvests per family for muskrat trapping on the reserve. The limit was based on the number of people in a family and how much was needed to support a family of that size. According to ACFN Elders Charlie Voyageur, Rene Bruno, Arsene Bernaille and Pat Marcel, the quota system was a sort of band bylaw. A single man was allowed 200 muskrats; a family of four got 500; a larger family might be allowed 750. The ACFN trappers put tags on their muskrats and the Indian agent helped keep control of the numbers sold. However, there were independent traders in the area, so some band members sold muskrats on the "black market." But, with Chief Laviolette's conservation method in effect, there were always plenty of muskrats, the Elders say. In 1952, Chief Laviolette died and the quota rule ended.

Commercial trapping continued to be a major part of the Athabasca Chipewyan economy for decades. By the late 1960s, the ACFN people were generating 30 per cent of their income from trapping and most of the men either trapped full time or at least took part in winter and spring trapping activities. With trapping providing a base income, the people continued other forms of traditional harvesting to supplement their livelihood. Even as store-bought food became available to the community, almost all of the meat consumed by ACFN members came from trapping, traditional hunting, gathering and fishing.

Industry and government bring more changes

Throughout the first half of the 20th century, the Chipewyan people felt increasing pressure to move into a central location such as Fort Chipewyan. Immigration, government regulations and increasing industrial activity in the area threatened their traditional livelihood. Nevertheless, they continued to hunt, gather and trap. Some were able to obtain outside employment but most obtained seasonal or temporary work and returned to their traditional rounds for survival. Those who didn't trap full time worked in river transportation or in commercial fishing or found jobs as labourers, carpenters, fire fighters, welders or cooks in the summer and fall in the forestry, construction and mining industries that were taking hold in northern Alberta.

In the 1940s the Indian agent made a concerted effort to arrange work outside of Fort Chipewyan in these industries for the men of the region who were having trouble supporting themselves and their families on the land. Because of World War II and the resulting interest in uranium, the federal government nationalized Eldorado Gold Mines, located at the east end of Lake Athabasca. The Northern Transportation Company was also nationalized because it shipped supplies up the Athabasca, Slave and Mackenzie rivers, and supplied Eldorado as well. Uranium mining began in Saskatchewan in 1953. Other employment opportunities had opened up when a sawmill was started in 1951 in Wood Buffalo Park. The Swanson Lumber Co. started operations in 1955, also in the park. Major road building projects came along with all the new industrial activity. In 1955, the Mackenzie Highway was completed to Hay River in the Northwest Territories. By 1957, there were road building projects all over northeastern Alberta. These projects brought more settlers to the region, but also provided employment that helped Aboriginal people supplement their livelihood when game was scarce and furs were low. The work was mostly labour, and often seasonal and low paying. The sawmill was one of the most consistent sources of employment and many people moved close to the mill to work there. Others were able to find jobs with the river transportation company, some worked in the mines, and many worked on road construction.

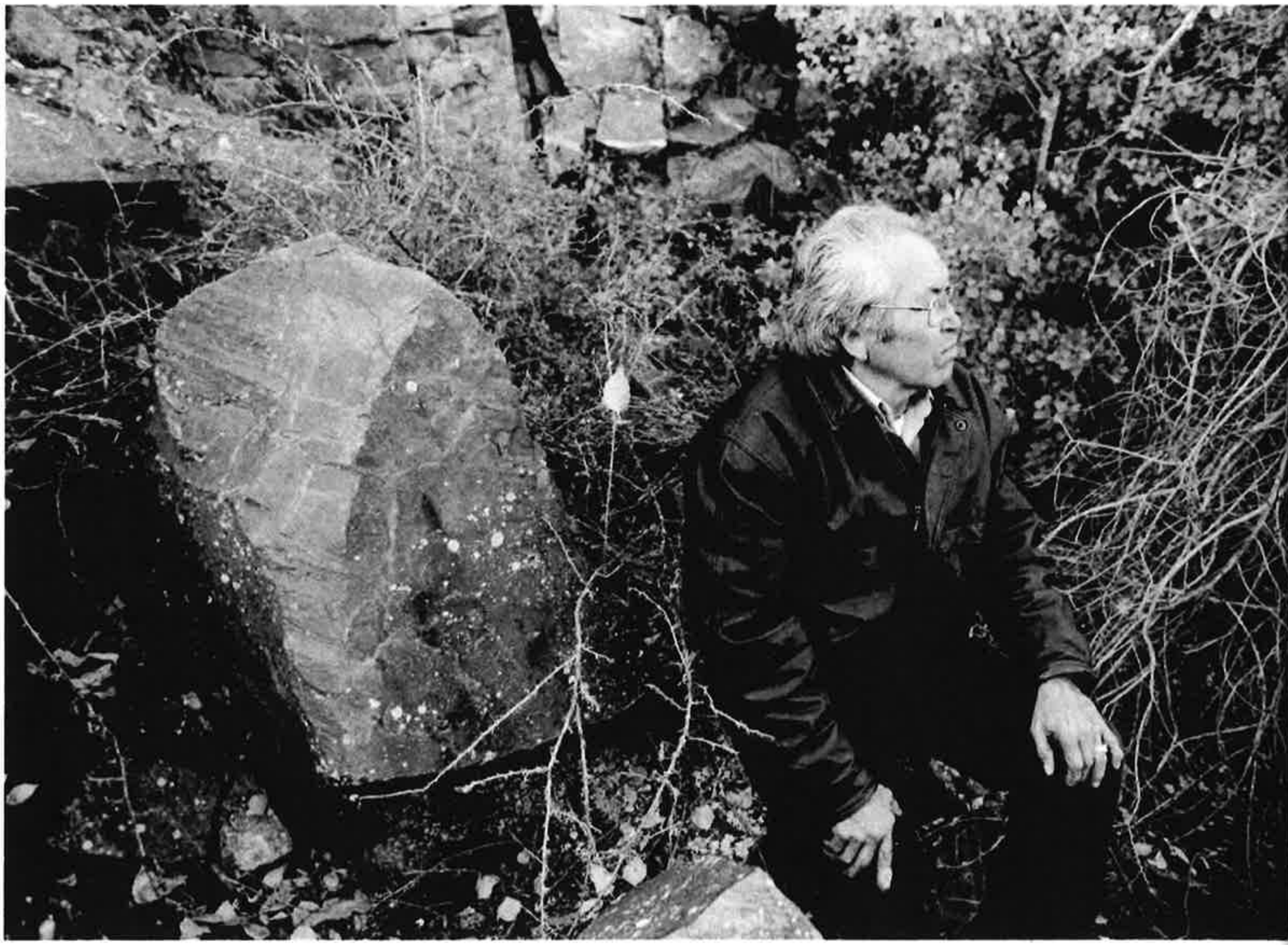
The Dene as Conservationist

The Dene peoples understood the cycles of abundance and scarcity on the land and approached hunting and trapping with respect for the need to conserve the land's resources. The white trappers had no concern for conservation. Rather they exploited the resources of an area and moved on. In 1926, H.J. Bury, the federal agent in the Fort Chipewyan area, described the differences between the Aboriginal and white trappers:

"A comparison between the Indian mode of trapping and that followed by the average white trapper proves beyond all doubt that the Indian is a game conservationist. The Indians trap on the same grounds each year, get their fur when it is prime, refrain from total extermination of the fur bearing animals and exercise as a rule careful restrictions with regard to the use of fire in the bush.

"The average white trapper is not concerned with the question of continuous yearly trapping in one district. Having picked out a promising territory his main object is to clean it out during one season and move to new grounds the following year. With this in mind, he resorts to methods, which result in the extermination of all furbearers in his territory. He is accused ...of dynamiting beaver houses and dams, and the trapping of unprimed fur by catching animals with traps equipped with cloth wrapped jaws so as to keep them alive in captivity until the arrival of cold weather...."

Meanwhile, the federal government introduced programs that brought about other economic and social changes. Family allowance payments began in 1944, which helped ACFN families cope to some extent. When Aboriginal people were encouraged to move into settlements closer to the missions or employment opportunities, there often was no housing for them. In 1958, Health and Welfare Canada opened an office in Fort Chipewyan, and in 1959, the federal government began a housing program to help the ACFN people make the transition from living in the bush to living in towns. Although the Aboriginal people of northern Alberta were significantly affected by these and many other government initiatives in the early and middle years of the 20th century, it was not until 1960 that Aboriginal people were given the right to vote.



Rene Bruno is still an active hunter and retains a wealth of traditional knowledge.

CHAPTER SEVEN

Following the Seasons

Despite the many disrupting changes brought to northern Alberta by industry and white settlement, the people of the ACFN continued their traditional activities on the land. Each season and each year brought opportunities to harvest animals, fish and plants, and the people responded to what the land offered. They continued to follow the seasons, moving in family groups and cooperating to harvest foods as they became available.

Whereas in earlier times the ancestors of the ACFN people followed the seasonal movements of the caribou herds, once the Chipewyan had adapted to the boreal forest and to micro-village living, they had a greater variety of foods available to them. Moose meat became an important staple in their new environment. They supplemented this with bison and caribou in the winter and muskrats, waterfowl and fish in the spring, summer and fall.

By the mid-1900s, the annual rounds of the ACFN people had changed significantly from those of a half century earlier. In the mid-1800s, the Chipewyan were still following a nomadic lifestyle. But now, although hunters still travelled great distances, their micro-village cabins had become the centre of their activity.

The men left the cabins, sometimes for up to three months at a time, to hunt caribou and trap line furs, travelling well into Saskatchewan or the Northwest Territories. They returned to the cabins for Christmas, Easter and at the beginning of each new harvesting season. A family might leave their cabin for short hunting or gathering trips in summer. And in the spring the entire family moved to the Peace/Athabasca delta for the muskrat trapping season and the waterfowl hunt that immediately followed.

Current ACFN Elders have described these rounds in great detail from their own personal experience, as well as that of their parents and in some cases their children. Their stories cover the period from around the time Wood Buffalo Park was created up to the present. And the cycles they describe centre around the micro-villages of Jackfish, Old Fort Point and Point Brule, in addition to smaller groupings along the Athabasca River, "all the way to Fort McKay." Jackfish, a grouping of cabins on the main channel of the Athabasca River delta, is located close to excellent fishing and is a convenient base for trapping muskrats during the spring. The cabins at Old Fort Point are close to good fishing and waterfowl as well as being close to trap lines.

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Winter hunting and trapping

During the winter months, November to March, the men of a family – father, sons, brothers, brothers-in-law – journeyed great distances from their summer camps or cabins to hunt caribou or work their trap lines to harvest fine furs such as lynx, marten, wolf, wolverine, fisher, ermine, fox, beavers and mink. In the late 1800s and early 1900s women might have joined them, but this was rare in recent times. They travelled by dog sled or by foot with dog packs. During the late 1960s and early 1970s, they changed their mode of transportation in winter to snow machines. This new technology allowed them to travel farther and faster and to make more frequent trips back to their central cabins. It also decreased their need to fish for dog food. In the time of dog sleds, a trapper needed to catch literally thousands of fish to be used as dog food during the winter.

Before departing, the men planned their route and made sure that all dog harnesses were ready and the dogs fit and healthy. They prepared their traps, snares, nets and floats, and packed all the necessary equipment – two axes, chisel, sharp knives, guns and shells, airtight heater, snowshoes, etc.

When they arrived at the trap line they made necessary repairs to the cabin, or set up camp if there was no cabin, gathering spruce boughs for the tent floors. They fished to feed the dogs, gathered firewood, set the nets, if needed, and set the traps along the trails. A trapper might have over 100 traps on a line extending over 50 miles. The group always kept an eye out for moose tracks and other hunting opportunities. Throughout the winter, they made several trips home, visiting their traps and snares along the way.

The women remained at the cabins in the micro-village, where they harvested mink, grouse, rabbits and other local resources. They also helped their husbands get ready for their winter hunting journeys. They prepared their husbands' clothes – moccasins, wrap-arounds, leggings, parka, fur hat, beaver mitts, work mitts and knit socks. They prepared foods such as moose meat, dry meat, dry fish and headcheese, and bought dry goods such as flour, baking powder, sugar, tea, lard, salt, jam, rice, rolled oats, raisins and other dried fruits. They made bedrolls with canvas covers, feather robes, pillows, and duvet covers with flannelette sheets. It was also their responsibility to make and repair toboggan wrap-arounds, make dog booties for travelling over rough ice, and prepare and repair the tent, as well as skin, flesh and dry the fine furs. In addition, they maintained the home, did the laundry and watched over the children.

Muskrat
Muskrat furs from the Peace/Athabasca delta became a standard to which all other muskrats were compared.

Spring muskrat season

In the spring, whole families moved to the delta for the spring muskrat season, which started on March 1. People in the Jackfish micro-village were well positioned for the muskrat hunt. Others would come from their cabins at Old Fort Point and along the Athabasca River by boat to set up their spring ratting camps.

Muskrat season was an important time of year for the ACFN people because it brought all of the people together. Also, harvesting a significant number of muskrat would allow a trapper to pay off debts and provide him with supplies to last throughout the summer. "During this period, every trapper from the community took some time to get a few rats," according to one ACFN Elder.

A trapper might set up to 200 traps, which he checked twice a day. Muskrats were also shot and usually floated to the surface when killed this way. The trappers would take the muskrats back to camp to be skinned and cleaned. The hides were tacked to boards, or stretchers built by the men, and the women scraped them clean of fat and meat using dull knives or scrapers made from moose bone. The pelts were left to dry for two or three days. To prepare the muskrat meat, the women removed the heads and tails, eviscerated the carcasses and washed them in cold water. Then they split the carcasses down the backbone so they could be laid flat for smoking and drying. The meat was placed on a rack above a slow-burning fire and left to dry in the sun for three days before being stored for future use. To prepare it for eating, the women would soak the dried meat and then boil it. The men often helped with the skinning, fleshing and drying.

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Warm Memories

ACFN Elder Mary Madeline Marcel was a new bride of 16 in 1937 when she joined her husband Benjamin Marcel on their first summer hunting trip together to the mainland with a group of families from Jackfish. The young newlywed didn't have many skills that would be useful on a month-long hunting and camping trip, so her husband, who was 36, told her to stay behind. As Mary's daughter Alice Rigney tells the story:

Mary Madeline Marcel
Mary Madeline Marcel still enjoys being on the land, preparing country foods and passing on traditional skills.

"Mom told him that she was going and needed to know what to pack for the journey overland. Dad told her to make dog packs. She had no idea how to do this so she went over to her sister-in-law's and looked at their dog packs until she had an idea on how to pack the necessary items for such a journey. She had to pack the bedroll, clothing for two, dry goods (flour, tea, sugar, baking powder, lard, raisins, rice, rolled oats, dry milk, matches, pots and pans, dishes and cutlery) and balance the packs so that they didn't fall over to one side or the other. This took some skill and practice. My dad helped Mom load the precious cargo on four dogs and then they were ready.

"Other extended family members on the trip included Isadore and Columbe Voyageur, Uncle Joe and Rosa, Jonas and Annie Piche, and Marie Mercredi, Gabriel Mercredi's mother. They left Jackfish Lake and boated as far as Jonas Laviolette's house (now Magloire Cardinal's home). They unloaded the boats, put the dog packs on the anxious animals and started on their journey. The men and women travelled together until they arrived at Big Rock, where they had lunch (fish cooked over a fire, bannock and tea) and rested the dogs. The dogs each had a leash, which the women would hold so they didn't wander or chase rabbits or grouse. From Big Rock, the men left before the women, who would follow about three hours later.

"Granny Marie (Mercredi) was the leader as she was the oldest and the wisest. The men were headed for the campsite and were hunting along the way. When the women started on the trail, which followed the natural ridge of the sand hills, they would watch for notch signs on trees, which was their signal indicating the direction the men went.

"Mom said it was a hot day and the dogs were thirsty. The women did carry water for the dogs in pails, but the dogs' sharp noses told them there was water up ahead and they started to pull away from the women. Granny Marie told the women to hold on to the leashes. However, some of the dogs got away and made a beeline to the lake, much to the dismay of the onlookers. One of Mom's dogs got away and followed the others into the lake – it was the one with the blankets! Needless to say, that was the spot where camp was to be for the first night. The women got their dogs out of the water and proceeded to dry the bedding and clothing.

"Setting up a good camp is important as comfort counts! Mom cut young spruce boughs, which she laid in the tent – nature's carpet. The soothing scent makes the atmosphere cozy. A shot was heard in the distance, and then another. About two hours later, my mom said, she saw my dad coming over the ridge with a pack on his back that looked pretty heavy. My dad had killed a bull moose and a bear; both animals were in good shape. The pack on his back was so heavy, she wondered how he was able to carry so much meat.

"Later, when the tent was set for the night, the fires were burning, the blankets were drying, and the dogs were tied up, the children were happy, and the atmosphere was one of happiness – a feast was on the way. Dinner [on such trips] was usually the choice cuts, which included the brisket and ribs, usually boiled and made into soup. Bannock and tea completed the meal.

"The next day the men left to hunt for more game, while the women dried the meat from the previous kill."

"All this took about two days. Then the dried meat was placed in the moose hide, tied securely and stored high in the trees where no animals could reach it. The meat was cached in this manner until the return trip. Then it was time to travel to the next camp. And so, for one month, this group of Dene people travelled the sand hills, with the men going ahead and hunting, the women following with the children and dogs, camping beside lakes, making dry meat and storing it. On the return trip, the meat was picked up from the caches and the group went back to Jackfish with their valuable cargo.

"Mom remembers these times as the 'good old days.' No one got sick; the mood of the group was positive; there was good humour and much laughter around the campfires. All treated the children with kindness; they were never spanked, and the many stories they were told were also lessons of life.

"They didn't have many material goods; they only carried what they needed. And if you ran out of jam, then there was always a berry patch that you could find and make your own – this was a very practical group. This trip was about gathering food for the winter; it was also about teaching the young the traditional way of life."

Pat Marcel says this type of summer trip was common right up to the time he entered residential school in the late 1940s. The people would live from tent to tent all summer long. The longest they would stay in one place was two nights. After Pat went to residential school in 1946, he went hunting and fishing with his dad whenever he could.

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Following the Seasons

A Stage
Men would build a "stage" or platform to serve as a home in the event of a flood.
Illustration by Trevor Michael – ACFN member

Muskrat was an important food for the ACFN people. During this season, they ate muskrat every day. They also fed it to their dogs. Many ACFN Elders commented that they were happy when the spring waterfowl season arrived: even though they really liked muskrat meat, they were more than ready for a change after eating it for two months straight.

During the later part of muskrat season, the river would regularly flood. On arriving at the delta, the men would build a "stage," or platform, to serve as "home" in the event of a flood. The stage would be made of trees from the delta and would be large enough to provide space for a tent and a living area. This allowed families to remain on the delta until the water subsided. Floods generally lasted no more than a few days.

Muskrat season was usually very successful, with most families averaging about 3,000 rats.

SPRING WATERFOWL
"The people" were happy to see the migratory birds return each spring. After winter and almost two months eating muskrat meat they were ready for a change of diet.

Spring waterfowl hunt

The spring hunt for migrating birds – ducks, geese, swans – began as soon as the waterfowl returned. The birds arrived in the area in late April and departed in May. The hunt usually centred around Goose Island, where many families gathered and lived for two or three weeks. They harvested the birds with shotguns from boats in the river, on the delta, on Lake Athabasca or on smaller lakes. The waterfowl passed through again in the fall, but fewer birds were taken at that time. A family would take anywhere from 20 to 200 ducks, five to 50 geese, and two to 10 swans each year.

In their spring camps the people dried the waterfowl meat, made grease from the fat and collected feathers for making bedrolls and pillows. In the evenings, the people exchanged stories around their campfires, and shared food and bottomless pots of tea. This was a time of much joy and laughter as they celebrated the end of the recent, successful muskrat season – and a change in diet.

When the lake was clear of ice, the families made the crossing back to Fort Chipewyan. There they would sell their furs to the Hudson's Bay Company or other trader, pay their bills, and stock up on groceries, clothing and other staples needed for the upcoming season. They might also buy new motors or boats.

Summer fishing, hunting and gathering

After the spring hunts and a short visit to town for trading, replenishing supplies and socializing, the families moved back to their cabins. There they began planting their vegetable gardens, an activity introduced by the settler society. The gardens provided an additional source of food – usually potatoes, carrots, turnips, cabbage, onions, beans and cucumbers. Sometimes the whole family would go on two- or three-day trips for hunting, fishing and gathering.

Fishing was an important summer activity for the ACFN people, as it supplied food for the family and dogs as well as a source of income. The men would set the nets and visit them daily – twice a day when the fish were running. The women dried fish to store for winter use and to sell.

BLUEBERRIES
The K'ai taile Dene would pick hundreds of pounds of blueberries each year to make into jam, to dry and mix with other foods.

I'll Raise You a Blueberry

The people of the ACFN looked forward to the seasons not only for their harvesting opportunities, but also for the unique socializing opportunities they offered. The daughter of an ACFN Elder recounts her mother's special memories of a fall berry-gathering expedition to Old Fort in the early 1940s:

"It was early in the fall – my mom and dad and their two young children left Jackfish Lake and travelled to Old Fort. There was no one there. However, Dad knew that the people had gone to Moose Point to hunt and pick berries, so he headed the boat in that direction. When they came around the point there were many tents and campfires.

"Dad landed his boat where my granny and Mosum had their boat. Mom and Dad set up the camp, had dinner, and Mom got the children ready for bed. My granny told my dad that there was usually a card game going on in the evening and that they were playing for berries! My parents didn't have any berries as they had just arrived there, so Granny told Dad to take a couple of pails and try his luck.

"Mom put the kids to sleep and also went to bed. She didn't hear Dad come to bed. When she awoke in the morning, there along one wall of the tent were pails of berries; there must have been at least 14 pails. She had enough berries to last for some time, but picking berries is a social time that families enjoy doing, so she (still) picked her share."

In July and August, the men hunted moose and, less often, bear. In summer, moose go into the water to escape from insect pests, so the men would hunt them from canoes or boats on the rivers and lakes during this season. In late summer, bears go down to the rivers to feed on berries. Bears were harvested for their fat, which would be rendered into grease and lard for bannock. The men would also check berry patches while they were out in their boats.

The women would dry meat, tan the moose and bear hides, maintain the home, and look after the children. Men and women shared responsibility for tending the gardens and feeding the dogs.

CHARLIE MERCREDI
Charlie Mercredi maintaining a log cabin

Fall berry harvesting, hunting and preparing for winter

From September to the end of October most families would be on the reserve or at their fall camps preparing fish, foods and equipment for the winter hunting and trapping season.

This was a time to gather straw and sand to prepare root cellars and to harvest vegetables from the gardens. The people would also travel by boat or by foot to berry patches beside lakes or along rivers to gather cranberries, blueberries and a variety of other berries to make into jellies and preserves or to dry for later use. It was not unusual for a family to collect more than 100 pounds of blueberries and low bush cranberries each year. They also gathered and dried a large variety of plants and other substances, which they used for medicines. These included Labrador tea, rat root, mint, spruce gum, poplar bark and saskatoons, as well as beaver castors and bear gall bladders.

The men would fish and hunt by boat on the rivers and lakes close to the summer camps or on Lake Athabasca. They also hunted on foot with dog packs. They used nets for fishing, rifles for hunting big game such as moose and bear, and shotguns for waterfowl. The women snared rabbits and shot grouse. Back in camp the men would hang fish and meat to dry and store for winter use. They might need as many as 2,000 to 4,000 fish for winter dog food alone, based on a typical ration of one whole fish per dog per day. The fish were also valuable for making fish oil, a well known (if not well liked!) medicine. Other fall activities included tanning moose hides and making grease from moose and bear fat.

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There was also work to do preparing and maintaining equipment. This meant pulling boats out of the water and putting motors away for the winter, as well as preparing traps and repairing toboggans and dog harnesses for the coming hunting and trapping season. Then there were the routine daily tasks: cooking, mending, doing laundry, cleaning house and hauling water for the women; feeding and watering the dogs and gathering, chopping and stacking firewood for the men. The men also helped the women care for the children. Both men and women taught traditional knowledge to the next generation through storytelling and legends.

Louise Cyprien
The Grandmother of Chief Archie Cyprien holding a flesher, made from the leg bone of a moose which is used for scraping a moose hide.

Many hands made light work

Travelling in family groups had many advantages. When the men went on hunting trips together, they worked as a team and were usually successful. This kept their confidence high and the whole group content.

When a hunter killed a large animal, there were many people to help. He would share the animal and the clan would help dry the meat, make grease from the fat, and prepare the moose hide.

There was also safety in groups. In case of an accident, or if a woman went into labour, there was usually someone in the group who could perform the needed procedure with confidence, using traditional knowledge passed down through the generations.

The social activities of the Athabasca Chipewyan people were an important part of their seasons. Social events ranged from large celebrations like Treaty Days, weddings and dances to daily events like harvesting and preparing moose meat or gathering berries. These social occasions were times to re-kindle friendships, to exchange stories and teach traditional skills.

"We would do things together during gathering times like when we picked berries or when someone got a moose. Everyone would help in the preparation of the moose meat and dry meat," said one ACFN Elder. The work and the meat were shared and the Elders fondly remember the social aspects of these harvesting days. The daily social activities were located in the bush where the moose was shot or the berries were picked. During these times the children were taught by demonstration and by letting them try things themselves. As the entire group participated it was natural for young children to learn through participation. "From a very young age I was able to snare rabbits because my grandmother taught me and I still know it today," said another Elder.

During these times around campfires or during other activities, the Elders would tell the stories and legends. "Storytelling was like passing on history," the Elders explained. They said that listening to legends was equivalent to learning to read. They learned their history and became steeped in the culture through this oral tradition. "We did not have a written language but we could remember stories and legends very well." Elders of today have very pleasant memories of these social times where they learned their traditional skills and legends.

There were also more formal social occasions at New Years, at Treaty Days and at weddings. When the trappers came in during Christmas and New Year's there would usually be a celebration. There was also an important gathering during the summer at Treaty Days. But there were other celebrations and dances during the year and of course wedding celebrations.

"Sometimes Dad would put up a dance," one Elder recalled. "It was quite a process because you had to have enough food for everyone for several days, three days and three nights and no booze. They were sober dances. And you had to feed their dogs too. You had to have a lot of food. People would get dressed up in beautiful jackets made of moose hide and caribou with fringes. They would even dress up their dogs."

During the summer, Treaty Days was an important gathering. The Elders would hold meetings and discuss issues of importance to the nation and the Chief would take these matters up with the Indian Agent. There would also be a celebration. It would include a feast, games, drumming and competitions. The people would hold canoe races and pole vaulting and all sorts of other competitions, as well as hand games. Hand games were an ancient form of gambling where two teams of four participants would hide objects in their hands and try and strategize to fool the other team.

Mary Bruno, like most of the Elders, is spiritually connected with the Roman Catholic Church.

CHAPTER EIGHT

Drastic Changes

By the late 1960s, trapping was an integral part of the traditional life of the Athabasca Chipewyan people, providing a base livelihood of roughly 30 per cent of their income.

The Peace/Athabasca delta in those days was a vibrant ecosystem, teaming with thousands of muskrats. But a development in 1967 doomed the muskrats and devastated the Dene people's traditional way of life. That year the Government of British Columbia completed the building of the W.A.C. Bennett Dam, blocking the Peace River at Hudson Hope and creating a reservoir at Williston Lake which took years to fill. By diverting the water into the reservoir, the dam decreased the seasonal floods that normally filled the perched basins in the Peace/Athabasca delta. But this water was the lifeline of the Dene people because the muskrats needed new water in the basins in order to live and multiply. As the frequency of the floods diminished, the delta and the basins dried out and the muskrats were gone.

The action of a Crown corporation located hundreds of miles away had drastically altered the way of life of the ACFN people. But the Dene were not even aware the dam was being built, nor were they told about the major changes that would affect their lives once it was completed. The effects of the dam were not temporary. Over the long term, with the level of the lake lower during the spring, the frequency of the floods continued to decline. Weirs and ditches were constructed by the Peace-Athabasca Delta Implementation Committee (PADIC), a joint effort by the Governments of Canada, Alberta and Saskatchewan, in an effort to keep the delta wet. But these attempts were only marginally successful. The Bennett Dam was the beginning of the end of trapping. With the delta drying up and the muskrats gone, the traditional way of life for the ACFN people was permanently changed.

Moving away from the land

Over the decade leading up to the development of the Bennett Dam, some important fur prices had fallen gradually, while some others increased. Overall the fur business was still economical in the 1960s. However, in the years immediately following completion of the dam, the muskrat harvest in the delta reached historical lows, while average Canadian muskrat levels fell less steeply, to levels

CHAPTER EIGHT

Drastic Changes

A Way of Life, Lost

ACFN Elder Alec Bruno was among the Chipewyan people who lost a way of life after the W.A.C. Bennett Dam was completed in 1967. He summed up the effect the dam had on his people:

Alec Bruno
Alec trapped fine furs on trapline N22 which included a large portion of northern Saskatchewan. Several trappers were assigned to this trapline and managed themselves using traditional trapping rules and relations.

"No water, no rats. After 1967, Reserve 201 was never the same. Without water, nothing grows. By 1969, there was no water nowhere.... We blame BC Hydro for the change in the delta.

"When we moved to Fort Chip, everything changed. We didn't have that lifestyle any more. The reason we moved into town was that the delta dried up. Indian Affairs knew about that, but they always used 'school' as the reason we moved families.

"My way of life has been taken away from me. Of course I miss it. I go over it in my mind all the time. My mind is always out there on the land. You don't forget it. It was the only life I knew. It was a good life."

experienced in the mid-1940s. This greatly affected the ability of delta trappers to continue their trade and forced many of them out of business. As the prices of fine furs rose in the late 1970s and 1980s, some Athabasca Chipewyan people temporarily resumed trapping for fine furs and began to participate in muskrat harvesting again. But the combined effects of falling fur prices and the depletion of the muskrat population in the delta due to the dam sealed the fate of the Chipewyan trapping industry. ACFN trappers were not able to sustain themselves without a healthy muskrat harvest.

Fort Chipewyan
The Holy Angels Residential School was demolished in 1976. Left standing today, are the Roman Catholic Church, "The Nativity of the Blessed Virgin Mary" built in 1909 and the rectory built in the early 1950s

To support themselves and their families many trappers took jobs as labourers and found other seasonal work. However, a significant number of men continued to trap and hunt during one or two seasons and found outside employment for the rest of the year. Many families moved into Fort Chipewyan and Fort McMurray around this time to improve their chances of finding work. Those who did move continued to hunt, trap and fish during specific seasons.

Other forces pushing the ACFN people away from the land had been present for many years. Since the 1940s the residential school mission in Fort Chipewyan had been taking the Chipewyan children from the lands. By moving into town the Chipewyan people could be closer to their children. They would also have easy access to medical care and social assistance. As well, there were a few jobs to be had with the bands and government in Fort Chipewyan and Fort McMurray. However, these northern centres still didn't offer a solid foundation of wage-based employment.

The majority of the people knew only one way of life – trapping and living off the land. Their traditional bushman skills didn't provide the trappers or their children with the skills they needed for employment. While they were used to cycles of abundance and scarcity on the land, many were experiencing a poverty unlike any they had known before. Most didn't even have a house of their own, so it was not unusual for as many as 20 people to live under one roof without work or other meaningful activity.

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Drastic Changes

Old Ways, New Ways

Life changed drastically for the ACFN people after they moved off the land and into town. These are only some of the ways their current lifestyle differs from their traditional lifestyle on the land:

Traditional Lifestyle	Current Lifestyle
Trapping as a livelihood	Working for wages or receiving welfare
Country foods from the land	Store bought foods and fast foods
Moccasins	Store bought shoes
Stories and legends	Television and video games
Medicine from the land	Medicine from the nursing station
Dog teams	Skidoos or quads
Sharing	Not sharing
Child rearing by all	Child rearing by nuclear family
Traditional language	English
Problem-solving by healing circles	"I'll do it on my own" attitude
No diabetes	Diabetes common
Living off the land	Making short visits to traditional lands

DOGSLEDS & SNOWMOBILE
Dogsleds were replaced by the snowmobile in the late 1960s. This cut down the need to fish for dog food and allowed trappers to travel farther and faster.

This new way of living created many social problems. Drinking, family violence, and sexual abuse were not uncommon. At first most Dene families still had their cabins to go to on the weekends, where they carried on traditional life. They hunted for birds in the spring. In the fall they hunted birds and moose and gathered berries. They hunted big game and participated in commercial fishing. But most stayed in town for freeze-up and break-up. If the men stayed out in the fall or spring, the women usually stayed in town so the children could attend school. Some people managed to continue trapping, fishing and hunting for a living but they were very few.

"Today, a lot of the kids don't have the slightest idea of what living out on the land is all about. You want your children to know about their culture and traditional way of life."

ACFN Elder Alec Bruno

On the land, families worked and played together and sharing was a way of life. After they settled into town life, ACFN people were more reluctant to share meats and other products from the land. Now, when a hunter killed a moose, only immediate family members expected a share of the meat. Instead of being reared by the extended family group, children were raised in isolated nuclear families. Watching television and playing video games took the place of hearing traditional stories and legends by the campfire. Living in town, the people depended more and more on store-bought food and fast food. As they became less active and adopted unhealthy non-traditional diets, they became susceptible to diabetes.

No longer living on the land, the ACFN people were losing not only the occupational basis of their culture but the traditional knowledge and skills they needed to pursue their traditional livelihood. Elders and parents had passed on their knowledge of traditional life and trapping to their children for generations. The decline of trapping and other traditional activities also brought a decline in the passing of this knowledge.

ACFN Elder Alec Bruno regrets this loss: "Today, a lot of the kids don't have the slightest idea of what living out on the land is all about. You want your children to know about their culture and traditional way of life."

The Economics of Trapping

Trapping, like farming, depends upon natural cycles and market prices. If either does not cooperate, it becomes extremely difficult to make a living as a trapper. When prices for fine furs were high, trapping could be a profitable occupation. When they were low, or the allowable numbers were regulated, trapping became uneconomic, even when supplemented by traditional foods and a traditional lifestyle.

Since the 1950s there have been significant fluctuations in the prices of various furs depending on availability. Beaver prices remained relatively stable through a gradual decline from $70 to $100 per pelt in the 1950s to between $20 and $50 per pelt in the 1990s. Mink prices generally followed the same trend. Lynx prices were relatively stable during the 1950s and 1960s, but spiked upwards in the 1970s and 1980s, only to fall significantly in the 1990s. Fisher and martin prices likewise climbed in the late 1980s and dropped significantly in the 1990s.

Muskrat prices were very strong – above $10 per pelt – before 1950, but dropped off during the 1950s to between $5 and $10 per pelt. The price of muskrat rose to the $10 level again during the mid-1970s and early 1980s, only to plunge to record lows in the 1990s.

Over the same period – 1950s through 1990s – a number of factors affected the availability of various furs, including natural fluctuations and cycles, over harvesting, depletion and regulation. Among natural factors, for example, the rabbit cycle would affect the cycle of the lynx and other carnivores that prey on rabbits. Likewise, mink feed on clams, fish and muskrat and are found close to waterways. So when the muskrat population declined after the Peace/Athabasca delta dried up, the delta mink population fell victim as well.

Among human factors, competition, waste and over harvesting by settler-trappers impacted Aboriginal people who relied on trapping as a traditional livelihood. Government regulations also affected the economics of fur trapping. For example, ACFN Elder Charlie Voyageur used to trap 50 to 70 lynx a year on his trap line north of Lake Athabasca. But in the mid-1960s, the government surveyed lynx populations and laid down a restriction of one lynx per line.

It also limited otter and wolverine to one each. However, the restriction was based on a miscalculation. In the study, the government grouped the Fort Chipewyan area in with the open farm country of Lac La Biche, failing to realize they were different ecosystems. The resulting restrictions made the trapping of lynx, otter and wolverine uneconomical for ACFN trappers.

The introduction of the snow machine in the late 1960s and early 1970s cut down the need to fish for dog food and allowed trappers to travel farther and faster. But it also added new costs to the supplies and equipment an Aboriginal trapper needed to remain competitive. Rising costs plus the gradual decline of beaver and mink prices put continuing economic pressures on ACFN people who depended on trapping for a living.

Given all these factors, it wouldn't take much to upset the delicate balance of the fur economy. When the Bennett Dam was constructed in 1968, its effect on the muskrat harvest in the Peace/Athabasca delta struck a devastating and lasting blow to the trapper's traditional livelihood. This along with the general fall in fur prices eventually caused the industry to collapse.

Lynx
In the mid-1960s, the government surveyed lynx, wolverine and otter populations and laid down a restriction of one of each per line. These restrictions made trapping uneconomical for ACFN trappers.

Eliza Flett lived and raised her family with her husband on the trapline for many years.

CHAPTER NINE

Respecting and Preserving Traditional Knowledge

Traditional knowledge is the body of skills and knowledge Aboriginal people use to survive and to live in harmony with their environment. Like learning to swim - traditional knowledge doesn't come from a book. It is handed down by the Elders through the generations and forms the core of the person and the community.

The saying "it takes a whole village to raise a child" aptly describes how the ACFN community passed on traditional knowledge and skills to their children. Parents and grandparents, extended family and friends were all involved in teaching the next generation about their culture and environment. The men taught the younger boys how to track, hunt or trap each species of animal their people used for food or fur. They taught them how to make traditional traps and how and where to set their traps. They showed them how to navigate on the land and how to remember landmarks.

Parents and grandparents, extended family and friends were all involved in teaching the next generation about their culture and environment.

The women taught the younger girls how to cook, sew, can fruits and vegetables, and prepare meats and grease. They showed them how to tan hides, how to make clothing from moose and caribou hides, and how to stretch and prepare furs. They also taught the girls how to collect feathers, make bedrolls and pillows, and collect and preserve medicines and berries.

All young people were taught how to care for dogs and how to use dog teams. They learned migration routes, the locations of fish lakes and spawning areas, and how to set nets in summer and winter. They learned how to forecast the weather, to build shelters, and to listen to their environment. Safety and respect were always an important part of the lessons the children learned from an early age.

In addition to practical traditional knowledge and skills, Elders taught children their people's history and culture through stories and legends. Traditional knowledge was the means by which the ACFN people maintained and promoted their cultural and spiritual identity. For example, although there is no Dene word for "please," children learned that sharing was a way of life and an integral part of their culture. This extended even to a form of traditional adoption whereby people with many children would give a child to a childless couple.

CHAPTER NINE

Respecting and Preserving Traditional Knowledge

Traditional knowledge in practice

Through a lifetime's experience of trapping and hunting the ACFN Elders have gained a wealth of knowledge about the characteristics, habits and locations of many species of animals. Elder Pat Marcel, for example, described how to hunt moose along a river. When the hunter finds moose tracks, he moves away from the tracks and down wind of the moose. He then approaches the tracks again and again to determine when the moose is preparing to sleep. As the animal prepares to sleep it doubles back towards its route to ensure it isn't being followed. When he sees the tracks double back, an experienced hunter takes the opportunity for the kill.

Following tracks is also the key to successful caribou hunting. A skilled Dene hunter could spot caribou tracks many months old. By following tracks and knowing caribou feeding habits, he would be able to harvest a caribou in a matter of three days. Knowing the feeding habits of bears, ACFN hunters quietly drift down river and listen. Bears feed along riverbanks and are very noisy eaters.

ACFN trappers know they will find lynx where there are rabbits and mice. They know wolverine are travellers and are very fierce and powerful. Charlie Voyageur says he once found a wolverine that had dragged a trap around all winter and still fought to the end. On the other hand, he says, the ermine, or weasel, can be friendly if approached carefully and fed. ACFN people learn how to trap mink or marten with a traditional deadfall trap, made by supporting a few large logs on small sticks. To get the bait, the animal has to pull on a stick. This causes a log to fall, trapping the animal underneath. ACFN children learn that the best way to remove a porcupine quill from a dog's muzzle is to first cut off the end of the quill and allow it to deflate.

The Sacred Call of the Loon

Listening carefully to what the environment has to tell them is an important part of the traditional knowledge of the ACFN people. Many Elders of the ACFN community say that if they listen a loon will tell them what is happening around the water. For example, loons have certain calls for when they see an animal enter the water, and others to note an animal passing by. Taken in this context many Aboriginal stories and legends that tell of birds talking to people are easily understandable. Some ACFN Elders consider the loon sacred and believe the spirits of their ancestors speak to them through the loon.

How to Tan a Hide

Tanning hides is an important part of the traditional knowledge passed down by ACFN women to the next generation. This method of tanning a moose hide is similar to the method used to prepare the hides of caribou and other large animals:

Soak the hide in water. Then scrape off all the flesh – a traditional scraper was made from the leg bone of a moose or caribou – and remove the hair. Work the moose brains and fat into the hide to keep it supple. Soak the hide for 24 hours, wring it out and roll it. Let the hide swing over a fire to dry. Scrape it again. Sew the hide and smoke it again until it is ready.

ACFN women made a variety of items from moose hide, including shirts, pants, mittens, slippers and covers.

Elders know the cycles of the animals they trap and hunt. For example, snowshoe hares, which the ACFN people shoot or snare for food and fur, go through seven- to 10-year cycles. Each family would harvest hundreds of rabbits a year. Rene Bruno recalls a winter when other animals were scarce and he lived entirely on rabbits. During the spring trapping season on the delta, trappers know how to check the "pushups" – muskrats' mud and stick homes – with a rat spear. They then open the rats' plunge hole and place a trap on the feeding platform. Elders and even the children were able to call muskrats by emulating their mating calls.

The women Elders of the ACFN have acquired a wealth of traditional knowledge about the uses of various medicinal herbs, which they passed on to the girls of the community. For example, rat root, Labrador tea, mint and tamarack bark could be boiled together to make a remedy for colds and sore throats. Rat root alone could be chewed as a mouth freshener or to soothe a sore throat, while tamarack bark could be chewed to a pulp and placed on cuts as an antiseptic. Spruce gum placed on cuts also acted as an antiseptic and prevented scarring. Dried puffballs were used to stop bleeding and when inhaled protected the lining of the nose in cold weather.

CHAPTER NINE

Respecting and Preserving Traditional Knowledge

Mountain ash was used for heart ailments and in Dene is called "naidii dechen" or "medicine stick." Willow fungus made a good mosquito repellent. The girls learned also that, when gathering herbs for medicines, they must pay respect to Mother Earth by sprinkling or burying tobacco in the place where the herb was harvested.

The whole family had roles to play in making dry fish and the children learned how this was done by assuming increasingly more responsible tasks as they grew older. The young children washed the fish, while the older ones did the scaling. Other family members sliced the fish and the men hung the fish on poles to dry in the sun and wind. The people would gather diamond willow wood and alder for the smoking fire, meanwhile regularly checking the fish to ensure it wasn't spoiling. Children kept the blackbirds away with slingshots or .22 rifles. It took about a day for the fish to dry, and in good weather, the dry fish stayed on racks overnight. Then the backs were cut off and the fish were put on sticks and hung in the smoke house for about two days until it was ready for storage.

Traditional knowledge also benefits settler society

The examples mentioned above are only a small part of the vast storehouse of traditional knowledge the ACFN Elders passed on to the next generation of their people. They illustrate clearly how the traditional lifestyle of the ACFN people was based on a uniquely intimate knowledge of the land and a respectful relationship with the environment. Because of this, traditional knowledge is useful not only to First Nations peoples but to settler society as well. The Elders' knowledge of animal habitat and behaviour, for example, can be useful for resource management, for preserving food opportunities for Aboriginal people, and for planning industrial development in a way that optimizes environmental sustainability.

Settler society sometimes recognizes the value of traditional knowledge and attempts to "collect" it from the Elders the way one would catalogue the various plants and animals in an ecosystem. But, traditional knowledge goes far beyond merely "collecting" information. It also includes knowledge about the inter-relationships among the plants and animals of an ecosystem. Traditional knowledge must be practised by gaining one's livelihood from the land over the days and months, seasons and years while living in tune with the environment. This means that scientists, resource managers and industrial planners need to bring the Elders into the planning process and continuously consult them in order to obtain the benefits of their traditional knowledge.

Pat Marcel told a story about how consulting the Elders could have saved some fish biologists from Edmonton a lot of time and money. The biologists came up north to tag pickerel and without asking advice from anyone locally, they built a fish trap on the Maybelle River. Pat's father, Benjamin Marcel, explained to them that there were no fish spawning in the Maybelle River. In fact, he told them that these fish spawn in the lakes and bays. The biologists ignored this information and continued in their misguided study. After several days without success, they finally came to Benjamin Marcel. He showed them where the fish spawned and where to place their nets and traps. Marcel's sons made the biologists' tagging job easier by helping them set their nets on the channel where the river enters the lake.

"Extra Virgin" Bird Oil and Indian Popcorn

The ACFN people used every part of the animals they hunted, fished or trapped including the fat, which they rendered into grease or oil. Bear fat was rendered into grease and lard for bannock, but according to one Elder, "Bird oil is better oil, like your extra virgin oil."

The rendering process for bear fat produced a tasty byproduct called "Indian popcorn." Rendering the fat would take a day and involved cutting the fat away from the meat and into one-inch cubes. The cubes of fat were placed in a large pot and heated slowly until the fat was liquefied. At this point, remnants would be floating on the top and would be skimmed off. This "Indian popcorn" was considered a delicacy and was eaten with bannock or dried meat. The rendered fat was poured into jars and stored in the root cellar for winter use.

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Respecting and Preserving Traditional Knowledge

The ACFN Elders point out that resource managers could have learned a lesson or two from Chief Jonas Laviolette, who kept the muskrat population on the delta healthy through a quota system on Reserve 201 during the 1940s and 1950s. Chief Laviolette set limits on the numbers of muskrats each family could harvest based upon his traditional knowledge of the muskrat. He had no muskrat surveys or scientific studies to consult, but only his traditional understanding of the capacity of the delta and the ability of the muskrat to reproduce. This kind of traditional knowledge could be very useful in managing regional resources in the Fort Chipewyan area.

Controlled burning is another traditional way the Aboriginal people exercised their stewardship of the land. Arsene Bernaille told how his grandfather would light a fire around the edge of Lake Athabasca to promote berry growth and add new habitat for moose. The Chipewyan people conducted burns regularly to maintain buffalo habitat in the area that is now inside Wood Buffalo National Park. But ever since the Aboriginal people were prevented from burning in this region, wildfires have been more frequent in the park.

Charlie Voyageur told about the spring when he was 11 years old and was out picking eggs. One day he left his campfire burning while he picked duck eggs and the fire got away from him. His father was going to punish him for letting the fire go out of control, but his grandfather said: "Leave the kid alone – he has done the country good." "Two years later the raspberries were tremendous in that area," Charlie recalled.

Charlie Voyageur and Pat Marcel explained how traditional knowledge could be used to dam and divert water to preserve Jackfish Lake as a spawning lake for many kinds of fish including whitefish, pickerel and suckers. At one time Richardson River used to feed into the lake through Jackfish Channel. However, the channel was diverted away from the lake to provide some people access to their cabin. As a result, the channel going out to the lake is now too small and freezes over, making it difficult for fish to spawn in early spring. The Elders recommend that the old channel be opened to allow more water to flow, as it did before, into the lake.

This would refresh the lake and allow more fish to spawn. Their recommendation is based on broad, in-depth knowledge of the area, the species of fish and their behaviour, and the ecology of the area. It is also based on the need of the ACFN people to continue to live off the land and to harvest the fish in their traditional way. Water diversion is a common aboriginal traditional technique for maintaining fish populations. But government officials are reluctant to approve the diversion of Jackfish Channel because they do not understand the ecology of the area.

Scientists often receive the benefits of ACFN traditional knowledge without giving proper credit to the Elders who help them. Charlie Voyaguer frequently takes muskrat surveyors out to test for muskrats on the delta, but although he has been involved in many studies, he has never seen the published reports. In fact, many people have come to the area to do studies or make films and have recorded traditional knowledge. But the Elders who help them rarely get credit in the films or scientific papers produced even though they often have a great deal to do with the success of the projects. Elders also resent the fact that they never receive copies of the studies or films that are produced with their help. They are determined that in the future traditional knowledge will be treated properly, with acknowledgement and compensation given to the true owners of the information.

LAKE ATHABASCA
Traditional knowledge must be practised by gaining one's livelihood from the land over the days and months, seasons and years while living in tune with the environment.

Respecting and Preserving Traditional Knowledge

A fundamental right of Aboriginal people

The ACFN people believe that not only should Aboriginal people receive credit for sharing their traditional knowledge, they should also have a guarantee that they will be consulted and their voices heard on any issues having to do with industrial development or resource management in northern Alberta.

Traditional Rights

"Indigenous peoples have the right to practise and revitalize their cultural traditions and customs. This includes the right to maintain, protect and develop the past, present and future manifestations of their cultures, such as archaeological and historical sites, artifacts, designs, ceremonies, technologies and visual and performing arts and literature, as well as the right to the restitution of cultural, intellectual, religious and spiritual property taken without their free and informed consent or in violation of their laws, traditions and customs."

From the United Nations
"Declaration on the Rights of Indigenous Peoples," article 12, 1993.

Recent Supreme Court decisions have supported the Aboriginal peoples' legitimate claim to exercise their traditional lifestyle on Crown lands. Recent court rulings in British Colombia have established that private companies also have a duty to consult with Aboriginal peoples before undertaking any activity on their traditional lands. In a landmark case, infringement was deemed to refer not only to creating undo hardship, but also to denying Aboriginal Peoples their preferred way to exercise their right to hunt and fish for food.

ACFN Elders have noted that the availability of traditional foods has been declining due to intensive industrial development in the oil sands region, hydro-electric developments, and competitive hunting and recreational harvesting. As a result, they say, their preferred way of hunting and fishing has been affected. Therefore it is imperative that Aboriginal Elders be included in consultations with respect to resource developments and in regional resource planning, not only for their vast understanding of the resource, but to supply information on aboriginal harvest requirements as stipulated in the Canadian Constitution.

Going Home

The case has been made that preserving traditional knowledge is important not only for the future of the ACFN, but also for the scientific community, for resource managers and for commercial fishermen. In order for this to happen, the ACFN people must be able to pursue their traditional harvesting activities as they and their ancestors did when they lived in micro-villages. But the impact of settler society has taken away much of their opportunity to continue their traditional way of life on the land.

At one time the ACFN people centred their traditional harvesting around four micro-village areas – Jackfish on the Peace/Athabasca delta, Birch River and what is now Wood Buffalo National Park, Point Brule and Poplar Point on the Athabasca River, and Old Fort Point. Now, three out of the four have been impacted by settler society. The park pushed people out of Birch River; the delta was devastated; and oil sands plants are impacting the Athabasca River. The ACFN people were forced, not by choice, to relocate to the north shore of Lake Athabasca.

However, there are areas on the south shore of Lake Athabasca that are core to the ACFN traditional lands. The south shore has not been as impacted by settler society and is one area that may offer economic potential for the ACFN people. Through the exchange of land, the ACFN is looking to revitalize their community. Using traditional harvesting and tourism as an economic base, the ACFN will once again have a solid footing on the land from which they can pass on their traditional knowledge and culture to their children. As Chief Archie Cyprien says: "It is time to go home."

Glossary

The following are traditional Dene names for the plants and animals found on the traditional lands of the ACFN people:

Fur Bearing Animals

Beaver	Tsha
Ermine/Weasel	Techkale
Fisher	Tha chok
Grey Wolf	Nuneá
Hare/Rabbit	Gah
Lynx	Chize
Marten	Tha
Mink	Tchjuzi
Muskrat	Dzen
Otter	Nambe
Porcupine	Tsee
Red Fox	Nagee thoashe
Red Squirrel	Dlie
Silver Fox	Tsamba nagidé
Skunk	Nooltsee
Wolverine	Naghaye

Big Game Animals

Moose	Deniye
Female Moose	Deni es'udahi
Black Bear	Sas
Caribou	Etthën
Barren Land Caribou	Ot'thelie thenne
Woodland Caribou	Thunzea
Bison	Ejëre

Fish

Jackfish/Pike	Uldai
Pickerel	Ehch ui
Sucker	Gothéchaé
Trout	Luézané
Whitefish	Lú
Grayling	Sat ié/Ts ét ite

Birds

Common Loon	Ta tsenne
Grebe	Notha tselle
Whistling Swan	Gogoos
Canada Goose	Ha chok
Snow Goose	Ho ga
Mallard	Tsheth tshok
Canvasback	Thaeeoée
Teal	Edjowasé
Pintail	Otchel tshethe
Common Golden Eye	Bedthe yelah
Ruffed Grouse	Et'theree
Sharp-tailed Grouse	Dih
Sandhill Crane	Delth
Willow Ptarmigan	K'asba
Wavies/Grey-fronted Goose	Da theth

Berries, Trees and Medicinal Plants

Blueberry	Tsatchoth
Highbush Cranberry	Ts utséljié
Lowbush Cranberry	Na clre
Raspberry	Dakalé jié
Saskatoon	K ihijié
Strawberry	Idziyazé
Birch	Ki
Jackpine	Gani
Muskeg	Niteli
Rosehip	Ihtsoté
Sweetgrass	Tt otsén
Tamarack	Nithe
Poplar	K és
White Spruce	Tsuchoghé
Spruce Gum	Eldzéghé
Labrador Tea	Naghodhi

Credits

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Page 49 Dog Sled Courtesy of Charlie Voyageur

Dog Harness. ©Royal Scottish Museum. RSM 558.61

Dog Whip.©Canadian Museum of Civilization. CMC VI-E-48, image no. S75-4172

Canoes. 1975, Courtesy of Leonard Flett

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Footprints on the Land

Tracing the Path of the Athabasca Chipewyan First Nation

"Participating in this study has helped me understand the true heritage of this land. I continue to be struck by the depth of the knowledge and abilities of the K'ái tailé Dene to comfortably live off what this land provides. Now, as a result of working on this project, when I am on a plane in the north, I feel an extra sense of security both spiritually and practically when an Elder is also on the plane. I hope that the strength of these traditions comes through in these pages and it will contribute to and benefit future K'ái tailé Dene generations and promote more understanding among settler society and Aboriginal peoples."

Jim Tanner

"Interviewing my Dene Elders has been a journey for me. I was raised on the Peace/Athabasca delta from birth until the age of five. My early years are beautiful memories, with loving parents and extended family; the only language I heard and spoke was the Dene language. But I went to residential school for 14 years and came home, speaking only English. I lost my language and with it, my identity.

I wanted to communicate with my Elders but I couldn't. My grandmother told me that if I spoke our Dene language, the Elders would know who I was. It was a challenge but I was determined to speak my language. It paid off in more ways than I imagined."

Alice Rigney

This is Exhibit "B"
referred to in the Affidavit
of Lisa Tssessaze affirmed before me
this 12 day of Dec., 2018

Gail Gallupe
Commissioner for Taking Affidavits, etc.

Gail Gallupe
Expiry: April 7, 2020
#0742640

"… We assured them that the treaty would not lead to any forced interference with their mode of life…"

David Laird, J.H.Ross, J.A.J. McKenna, Report of Commissioners for Treaty No. 8, 22nd September, 1899.

> "… The commissioner representing the Queen … picked up a blade of grass and said, "In the future, this will never be taken away from you. Don't have any wrong ideas about it. You will always have it. As long as the sun walks and the rivers flow. The way you are making a living in the bush will never be restricted." That was told to us by the Queen from overseas, Queen Victoria. But now the white man is so dishonest. We have lost many things…"

Transcript of interview with MCFN elder, Louis Boucher, age 82, an MCFN member and witness to the signing of Treaty No. 8, conducted in Cree by Richard Lightening on February 6, 1974.

> "…As long as the sun is rising here, the river flowing, the lake is here and the grass is growing, nothing will change. That's the kind of Treaty they made."

Transcript of interview with ACFN elder, Rene Bruno, February 1, 2010.

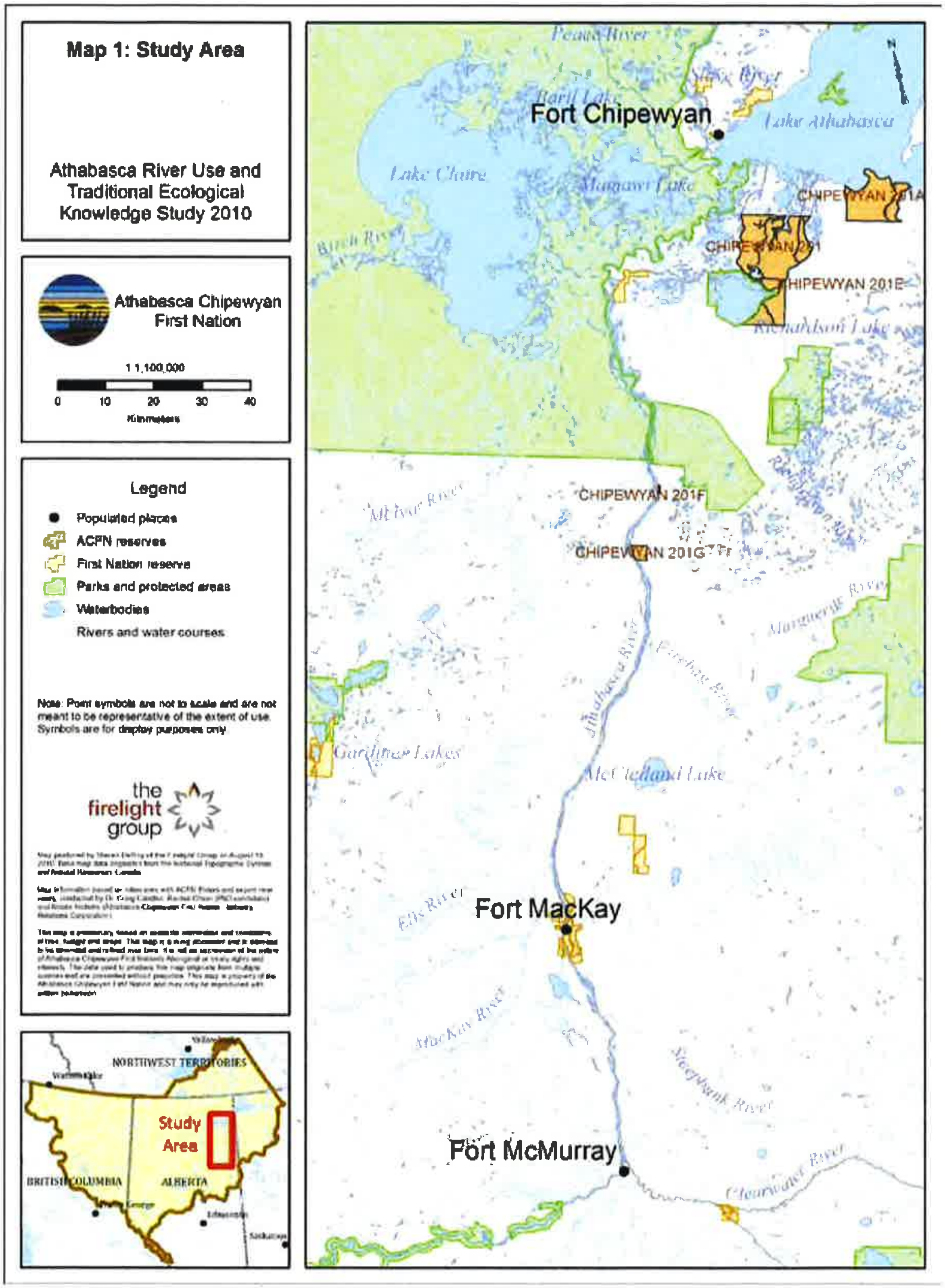
This is Exhibit "C"
referred to in the Affidavit
of Lisa Tssessaze affirmed before me
this 17 day of Dec., 2018

Gail Gallupe

Commissioner for Taking Affidavits, etc.

Gail Gallupe
Expiry: April 7, 2020
#0742640

ACFN Map 1: Study Area



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this 17 day of Dec., 2018

Gail Gallupe

Commissioner for Taking Affidavits, etc.

Gail Gallupe
Expiry: April 7, 2020
#0742640

Received: 23 February 2017 | Revised: 23 January 2018 | Accepted: 11 February 2018

DOI: 10.1002/rra.3273

RESEARCH ARTICLE

WILEY

Effects of projected climate on the hydrodynamic and sediment transport regime of the lower Athabasca River in Alberta, Canada

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Funding information
Environment and Climate Change Canada's Climate Change Adaptation Program (CCAP); Joint Canada-Alberta Oil-Sands Monitoring Program (JOSMP)

Abstract

The potential effects of climate change on the hydrodynamic and sediment transport regime of the lower Athabasca River (LAR) in Alberta, Canada, is investigated. Future climate projections for the region suggest a potential increase in mean air temperature and precipitation by about 2.8–7.1 °C and 8–25%, respectively, by the end of this century. Implications of these climatic changes on the hydrologic regime of the LAR are found to be significant with spring flows expected to increase by about 11–62% and 26–71% by the end of the century for a moderate and high emissions scenarios respectively with corresponding decreases in summer flows. The effects of such changes are examined using the MIKE-11 hydrodynamic and sediment transport modelling system with inflow boundary conditions corresponding to the changing hydro-climatic regime. The results suggest that there will be an overall increase in flow velocity, water level, and suspended sediment concentration and transport for most seasons except in the summer months when there may be some decreases. The projected changes in suspended sediment concentration will result in an overall increase in mean annual sediment load in the LAR and to the Peace Athabasca Delta by over 50% towards the latter part of this century (2080s) compared with the 1980s base-line period. Implications of such potential changes in the transport characteristics of the river system to the mobilization and transport of various chemical constituents and their effects on the region's aquatic ecosystems are subjects of other ongoing investigations.

KEYWORDS

climate change, hydrodynamic modelling, lower Athabasca River, sediment transport

1 | INTRODUCTION

The sediment load transported by rivers has important implications for the functioning of aquatic ecosystems through its influence on material fluxes, geochemical cycling, and water quality. In addition to its important role in river morphodynamics and delta development, sediment transport is responsible for transporting a significant fraction of nutrients and other constituent chemicals with implications on different ecosystems and habitats such as fish and benthic communities (Walling, 2009). The hydrodynamic and sediment transport regime in river systems is determined by the prevailing morphological and hydro-climatic condition in the region through linkages via the hydrology of the river basins. Consequently, the future state and variation of

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flow as well as sediment and constituent chemical transport in river systems will most likely be affected by a changing climate. Some of the effects could be through changes in the magnitude and timing of seasonal mean as well as extreme river discharges, sediment inflow, flow velocity, and depth, which would in turn affect the available environmental flow, shear stress, erodibility, and transport capacity of rivers (Thodsen, Hasholt, & Kjærsgaard, 2008).

There is a growing body of evidence that climate change is having a significant impact on the sediment loads and transport in rivers. Comparing data collected in the 1970s with those from the 1990s, Amsler and Drago (2009) showed that recent increases in precipitation and run-off across parts of the Parana–Paraguay system in South America have caused increased erosion and sediment mobilization and indicated that climate change has been strongly affecting the hydro-sedimentological regime of the river network. Using a GIS-based model under a climate-change scenario, Asselman, Middelkoop, and Van Dijk (2003) investigated the potential effects of changes in climate and land use on the mobilization of fine sediment and the net transport of wash load from the upstream basin to the lower Rhine delta. Their research indicated that erosion rates will increase in the Alps and decrease in the German part of the basin as a result of the changing climate and land use. Modelling climate induced changes in suspended sediment transport for two Danish river catchments, Thodsen et al. (2008) also found that suspended sediment transport increases during winter months as a result of the increase in river discharge caused by enhanced precipitation, and decreases during summer and early autumn months when precipitation also decreases. Similarly, Praskievicz (2016) investigated the potential impacts of climate change on streamflow and suspended-sediment transport for snowmelt-dominated rivers in the interior Pacific Northwest and indicate that climate change is likely to amplify the annual cycle of river discharge and simulated changes in suspended-sediment transport that generally follow the changes in streamflow.

The current and projected future states of flow in the Athabasca watershed has been actively investigated by a number of recent studies. Some of the studies that were based on analysis of observed streamflow data in the region have shown statistically significant decreasing trends in streamflow, particularly in recent decades (Bawden, Linton, Burn, & Prowse, 2014; Sauchyn, Luckman, & St-Jacques, 2015). However, using a correlation model between river flow and climate variables to reconstruct long-term (>100 years) natural modes of river discharge, Chen and Grasby (2014) did not find true long-term declines of the annual flow in the Athabasca River basin (ARB). The findings of Rood, Stupple, and Gill (2015) from century-long records also contrast with interpretations from the above short-term studies and emphasize the need for sufficiently long time series for hydrologic trend analysis. Peters, Atkinson, Monk, Tenenbaum, and Baird (2013) demonstrated that potentially inconsistent and/or divergent trend results can be obtained when using different time periods and/or regions of the watershed. A number of hydrologic modelling studies have also been used for projecting streamflow in the ARB under multiple climate scenarios derived from various Global Climate Models (GCMs; Eum, Dibike, & Prowse, 2017; Leong & Donner, 2015).

With respect to sediment transport, Conly, Crosley, and Headley (2002) determined the contribution of the upstream boundary and tributaries in the annual load of sediments in the lower Athabasca River (LAR) and found that suspended sediment derived from main stem and tributary sources between Fort McMurray and Embarras account for 18% of the mean annual load of the Athabasca River with the remaining originating upstream of Fort McMurray. A recent study by Shrestha and Wang (2018) used the Soil and Water Assessment Tool with future climate projections over the ARB and show a potential increase in soil erosion rate due to climate change is greater than reported soil formation rates in the region. Studies that have attempted numerical modelling of flow and sediment transport in the LAR found it to be challenging due to the complex morphology and seasonality of the flow regime. Andrishak, Abarca, Wojtowicz, and Hicks (2008) and Pietroniro et al. (2011) made early attempts to numerically model the flow in LAR using one-dimensional (1D) models that incorporated simplified rectangular sections to represent channel geometry. More recently, Shakibaeinia et al. (2016; 2017) and Kashyap, Dibike, Shakibaeinia, Prowse, and Droppo (2016) developed an integrated numerical modelling framework (1D and two-dimensional) for simulation of flow and sediment transport covering larger portions of the LAR using detailed surveyed bathymetric data.

Although there are a number of studies that have investigated the potential impacts of climate change on the hydrologic (discharge) regimes of the LAR, none have examined the implications of the altered flow regimes on the hydrodynamic and sediment transport characteristics of the river. Therefore, this study investigates the potential impacts of future climate on hydrodynamic and sediment transport regime of the LAR by employing the MIKE-11 1D flow and sediment transport model. While the hydrodynamic and sediment transport model used for this study was calibrated/validated using historical observed discharge and sediment inflow data (Shakibaeinia, Dibike, Kashyap, Prowse, & Droppo, 2017), the corresponding future scenario data are derived from a recent study by Eum et al. (2017). Eum et al. (2017) and Dibike, Eum, and Prowse (2018) investigated the potential hydrologic response of the ARB to projected changes in future climate using the Variable Infiltration Capacity (VIC) process-based and distributed hydrologic model (Liang, Lettenmaier, Wood, & Burges, 1994). The climatic forcings for the VIC hydrologic model were derived from a selected set of GCMs from the latest Coupled Model Intercomparison Project (CMIP5) and statistically downscaled to a higher (10 km) spatial resolution. A subset of the VIC simulated river discharge scenario data corresponding to the baseline period of 1970–1999 (1980s), and the two future periods of 2040–2069 (2050s) and 2070–2099 (2080s) are used as upstream and tributary inflow boundary conditions for the 1D hydrodynamic and sediment transport model of the LAR. Outputs of the hydrodynamic and sediment transport model simulations for the baseline and future periods are then analysed to quantify the potential changes in the mean annual and monthly values of water levels and flow velocities as well as suspended sediment concentrations (SSC) and sediment load in the LAR. The results are also presented in terms of projected changes in the exceedance probabilities of those variables at a location along the LAR.

2 | STUDY AREA AND DATA SETS

2.1 | Site description

The Athabasca River, with a 156,000 km^2 drainage area, originates from the Columbia glacier in Jasper National Park and flows approximately 1,500 km north-eastward to Peace Athabasca Delta (PAD) and Lake Athabasca. The hydrodynamic and sediment transport scenario simulation is conducted over the ~200 km reach of the LAR starting from below the city of Fort McMurray and extending to Old Fort which is located few kilometres upstream of the river discharging into the PAD (Figure 1). This river reach is characterized as meandering and braided with vegetated islands and alternating sand bars as the river and many of its tributaries cuts through the McMurray formations where bitumen can be found close to the earth surface. Major tributaries within the LAR reach include the Steepbank, Ells, MacKay, Muskeg, and Firebag Rivers. Mean daily temperatures in the LAR range between approximately −20 °C in January and around 15 °C in July while the mean annual precipitation in the region is <500 mm with over 60% occurring as rainfall and the remainder as snowfall (Conly et al., 2002). The mean annual streamflow at the station below Fort McMurray over the period of 1958 to 2011 is around 615 m3/s, ranging between mean monthly values of 158 m3/s in February and 1,368 m3/s in July (HYDAT, 2012). Sediment transport plays an important role in the Oil-Sands region of the LAR and the PAD ecosystem as the bitumen-related chemical constituents (such as metals and polycyclic aromatic hydrocarbons) are mainly transported by fine sediments (Garcia-Aragon, Droppo, Krishnappan, Trapp, & Jaskot, 2011; Ghosh, Gillette, Luthy, & Zare, 2000).

2.2 | River bathymetry data

The river bathymetry data for the LAR are obtained by combining different legacy data sets with a high-resolution (0.5 m) bed elevation data between Fort McMurray and Old Fort surveyed by Environment Canada using a Geoswath sonar sensor (Shakibaeinia et al., 2016; Shakibaeinia et al., 2017). The topography of floodplains and islands are reproduce using high resolution (5 m) light detection and ranging (LiDAR) data along the LAR banks from Alberta Environment and Parks that was further processed into Digital Elevation Model (DEM) by Environment and Climate Change Canada, and Digital Elevation Model data of the region from Geobase (2012). The data from all these sources were combined to construct a continuous bathymetry for the LAR main channel and adjacent flood plains with a resolution ranging from 10 to 25 m. The data were then interpolated on the 1D cross-sections along the LAR (200 cross-sections with ~1 km intervals) to construct the required model geometry.

2.3 | Historical hydrometric and sediment data

The historical hydrometric (flow rates and water levels) and sediment data used as boundary conditions as well as for the purpose of model calibration and validation were obtained mainly from three different sources including (a) The Water Survey of Canada, 2013 hydrometric stations, (b) Regional Aquatics Monitoring Program, 2013 hydrology stations, and (c) The VIC hydrologic model of the ARB (Eum et al., 2017) that provides flow data for the smaller tributaries where there are no hydrometric stations. Table 1 lists the hydrometric stations used in this study along with the responsible agencies that collect the data. Climate data required for the study, such as air temperature (daily and hourly), wind speed, cloud coverage and precipitation, were obtained from Environment Canada climate database (Environment Canada climate data, 2011). The measurements for SSC in the LAR and its tributaries are usually taken at various frequencies covering different time periods; hence, continuous time-series data that can be used directly as upstream and lateral boundary conditions are not available. Instead, the available observed data are used here to develop sediment-discharge rating curves that can then be used to

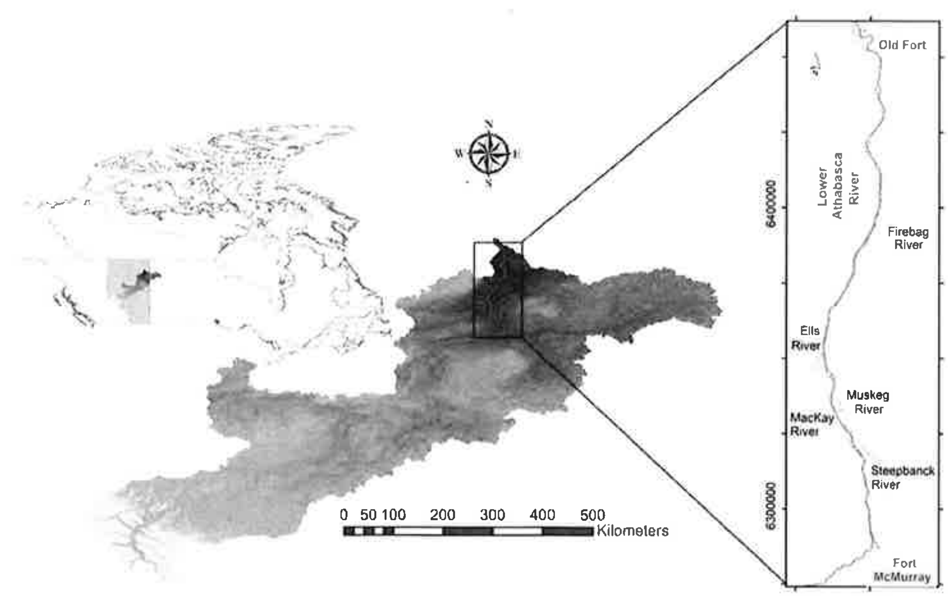

FIGURE 1 Study area: the Athabasca River basin (ARB) and the lower reaches of the Athabasca River (LAR) below Fort McMurray, in Alberta, Canada [Colour figure can be viewed at wileyonlinelibrary.com]

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TABLE 1 Name and locations of the hydrometric stations in the LAR and tributaries used in this study along with the responsible agencies that collect the data

	Station ID	Station name	Operator	Data type			Coordinates	
				Flow	W.L.	SSC	Easting	Northing
Mainstem	07DD011	Athabasca River near Old Ft.	WSC		✓		469,487	6,470,518
	07DA001	Athabasca River Below Ft. McMurray	WSC	✓	✓	✓	475,439	6,293,000
	07DD001	Athabasca River at Embarras Airport	WSC	✓		✓	477,079	6,451,600
	S24	Athabasca River below Eymundson Creek	RAMP	✓	✓		466,313	6,372,760
	S46	Athabasca River near Embarras airport	RAMP	✓	✓		470,241	6,463,206
	ATR-DC	Athabasca River at Donald Creek	RAMP			✓	475,020	6,298,154
	ATR-SR	Athabasca downstream of Steepbank River	RAMP			✓	470,937	6,319,625
	ATR-MR	Athabasca upstream Muskeg River	RAMP			✓	463,504	6,332,230
	ATR-DD	Athabasca downstream of developments	RAMP			✓	463,856	6,367,949
Tributaries	07DA006	Steepbank River near Ft. McMurray	WSC	✓		✓	475,285	6,317,398
	07DA008	Muskeg River near Ft. Mackay	WSC	✓		✓	465,543	6,338,813
	07DC001	Firebag River near the mouth	WSC	✓		✓	487,908	6,389,883
	07DA017	Ells River near the mouth	WSC	✓		✓	456,928	6,347,420
	07DB001	Mackay River near Ft. Mackay	WSC	✓		✓	458,014	6,341,017
	07DA014	Calumet River	WSC	✓		✓	458,990	6,362,490
	07DA011	Unamed River near Ft. Mckay	WSC	✓		✓	468,990	6,391,131

Note. LAR = lower Athabasca River; RAMP = Regional Aquatics Monitoring Program; WSC = Water Survey of Canada.

generate continuous time series of SSC. Some examples of such rating curves are shown in Figure 2.

2.4 | Hydro-climatic data for the future period

2.4.1 | Climate scenario projections

The climate scenario is based on the latest GCM projections conducted within the framework of the CMIP5 (Taylor, Stouffer, & Meehl, 2012). However, because of the higher computational demand of running the hydrodynamic and sediment transport model of a 200 km reach for over a hundred years with multiple emission scenarios, only two out of the six GCMs selected by Eum et al. (2017) to drive the VIC hydrologic model of the Athabasca watershed are considered in the present study. The two GCMs, namely, the Canadian CanESM (Arora et al., 2011) and the French CNRM (Voldoire et al., 2013) models are selected based on the ranking of the CMIP5 models, which differs by region, that is carried out by the Pacific Climate Impact Consortium to provide the widest spread (range) in projected future climate for smaller subsets of the full ensemble (Cannon, 2015). CNRM represents the closest scenario to CMIP5 multimodel ensemble mean whereas CanESM is the farthest from the first selected GCM (i.e., CNRM) corresponding to higher projected increases in precipitation and temperature. Moreover, as the GCMs data are at coarser resolution (200–300 km) and as they are also known to have seasonal biases compared with the observed climate for the historical period, a widely

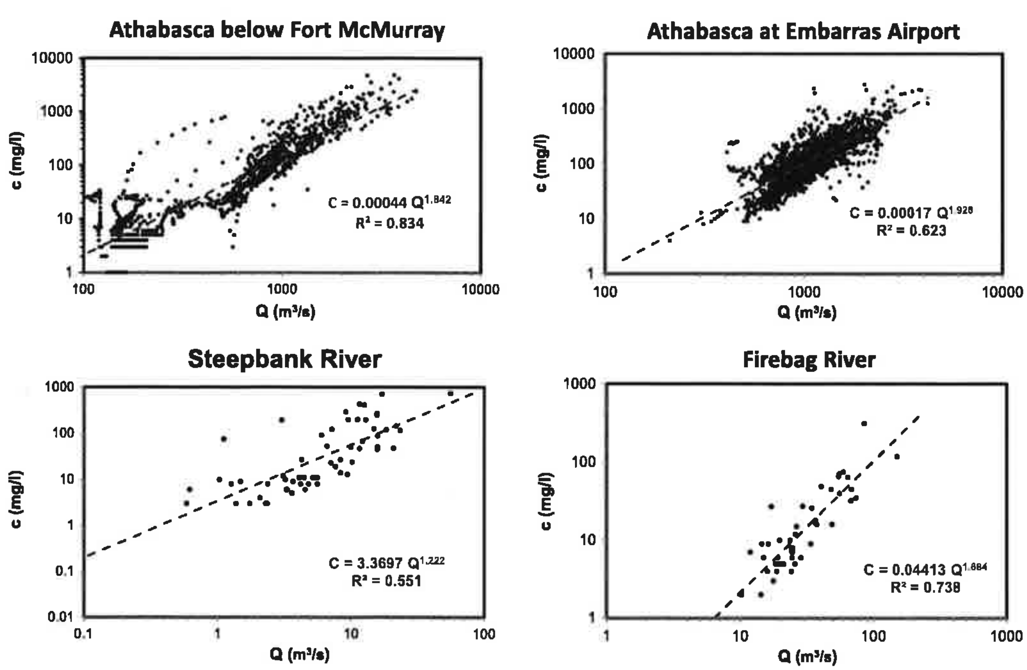

FIGURE 2 Example sediment-discharge rating curves (in log scale) for the LAR below Fort McMurray (St. ID: 07DA001), Athabasca River at Embarras Airport (St. ID: 07DD001), Steepbank River near Ft. McMurray (St. ID: 07DA006), and Firebag River near the mouth (St. ID: 07 DC001) [Colour figure can be viewed at wileyonlinelibrary.com]

used statistical technique, namely, Bias-Correction/Spatial Disaggregation (Wood, Leung, Sridhar, & Lettenmaier, 2004), was applied to spatially downscale the GCMs' outputs based on the 10-km resolution Australian National University thin plate spline (ANUSPLIN) algorithm based gridded observed data (Hopkinson et al., 2011). Also, only two of the emission scenarios, namely, the RCP4.5, which is a stabilization scenario that achieves the goal of limiting emission and radiative forcings, and the RCP8.5, which is an emission scenario that greenhouse gas increases as usual until 2100, were considered for the hydrologic simulation (Eum et al., 2017). Therefore, a total of four sets of the ARB VIC hydrologic model projections corresponding to two GCMs (CNRM and CanESM), and two emission scenarios (RCP4.5 and RCP8.5) are employed in this study. Table 2 shows the projected changes in mean annual temperature and precipitation over the ARB corresponding to each of the four scenarios considered with respect to the baseline period. While the projected warming over the ARB range between 2.8 and 7.1 °C, the corresponding projected increase in precipitation ranges between 7.9% and 25% by the 2080s with respect to the 1980s baseline period. In general, CanESM model project wetter and warmer future scenarios compared with that of CNRM.

2.4.2 | Hydrologic model simulations for the baseline and future periods

Eum et al. (2014; 2017) developed the ARB VIC hydrologic model using gridded high resolution (10 km × 10 km) ANUSPLIN daily

TABLE 2 Projected changes in mean annual temperature (T) and precipitation (P) over the ARB compared with the baseline period of 1980s for each of the four scenarios considered in this study

			ΔT (°C)		ΔP (%)	
Scenarios	**GCMs**	**RCPs**	**2050s**	**2080s**	**2050s**	**2080s**
1	CanESM	RCP4.5	3.73	4.15	12.3	22.3
2	CanESM	RCP8.5	4.37	7.05	20.5	25
3	CNRM	RCP4.5	2.17	2.83	4.3	7.9
4	CNRM	RCP8.5	2.82	4.64	7.5	13

Note. CanESM = Canadian Earth System Model; CNRM = Centre National de Recherches Meteorologiques; GCMs = Global Climate Models; RCP = Representative Concentration Pathway.

precipitation and air temperature data over the 1985 to 2010 historical period. The model generally performs well in replicating most of the observed streamflow data with a Nash–Sutcliffe coefficient of efficiency for the Fort McMurray station of 0.79 and 0.74 for the calibration (1985–1997) and validation (1998–2010) periods, respectively. Hydrologic model simulations were also conducted for the baseline period of 1970–1999 (1980s) as well as for the two future periods of 2040–2069 (2050s) and 2070–2099 (2080s) using the select set of climate scenario data. While the baseline climate scenario corresponds to the historical emission level, the projected climate for the two future periods corresponds to each of the two emission scenarios (RCP4.5 and RCP8.5).

Figure 3 shows box-plots of observed and simulated monthly mean discharges and their distribution at the Fort McMurray hydrometric station for the baseline period. The three sets of simulated flows correspond to the ANUSPLIN gridded observed climate data and the statistically downscaled GCM climate scenarios from the CanESM and CNRM during the 1980s baseline period. While the simulated flows slightly overestimate the winter low flows and underestimate the summer high flows, the results presented in Figure 3 indicate that the VIC hydrologic model of the ARB driven by the statistically downscaled GCM climate data was able to reproduce the main features of the observed hydrologic regime at the Fort McMurray station very well. Moreover, Figure 4 presents comparison of the VIC model simulated mean monthly discharges between the baseline and the two future periods at the Fort McMurray station corresponding to each climate model and emissions scenario combinations considered for this study. All those projections agree in the overall future increase in the annual mean river flows despite their seasonal difference in both magnitudes and signs of change. For example, the mean projected increases in spring flows by the 2080s (compared with the baseline period of the 1980s) for the RCP4.5/RCP8.5 emissions scenarios are +11/+26% and + 62/+71% when the VIC model is forced with the CNRM and CanEMS climate projections, respectively. The corresponding decreases in summer flows are also −2/−3.5% and 0/−12% for the two emissions scenarios and the two GCMs, respectively. Over all, the VIC hydrologic model driven by the CanEMS climate projection is found to be more sensitive to increased emission

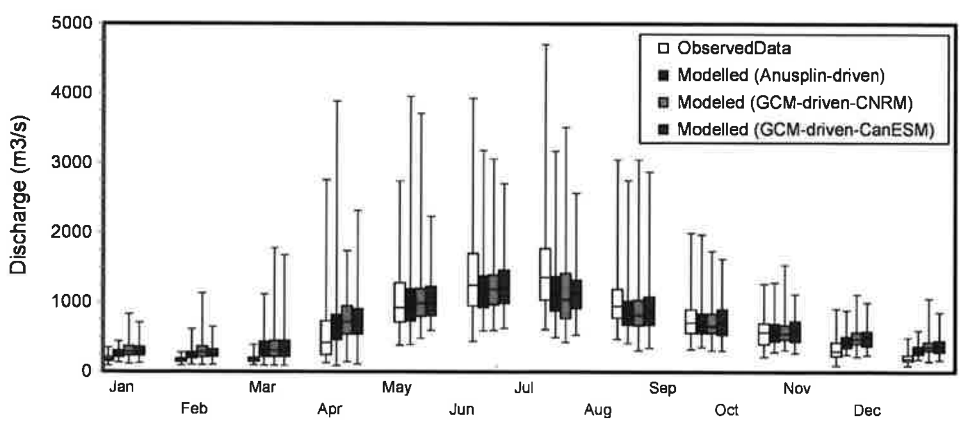

FIGURE 3 Comparison of observed and Variable Infiltration Capacity model simulated monthly mean discharges at the Athabasca River downstream of Ft. McMurray averaged over the baseline period of 1970–1999. Flows are simulated by the Variable Infiltration Capacity model driven by the ANUSPLIN gridded observed data and statistically downscaled GCMs' data from CNRM and CanESM. GCM = Global Climate Model [Colour figure can be viewed at wileyonlinelibrary.com]

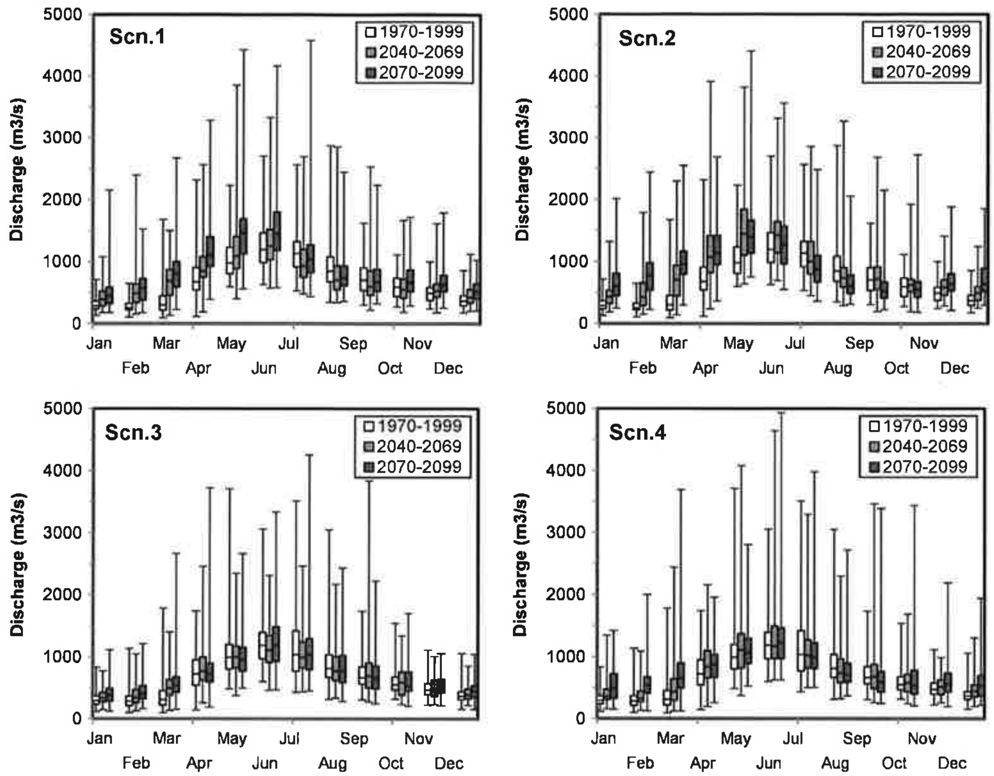

FIGURE 4 Comparison of the baseline (1980s) and future (2050s and 2080s) monthly mean discharges at the Athabasca River below Fort McMurray as simulated by the Variable Infiltration Capacity hydrologic model of the Athabasca River basin driven by spatially downscaled precipitation and temperature data corresponding to the two GCMs forced with the two emissions scenarios (Scn. 1: CanESM & RCP4.5, Scn. 2: CanESM & RCP8.5, Scn. 3: CNRM & RCP4.5, Scn. 4: CNRM & RCP8.5) [Colour figure can be viewed at wileyonlinelibrary.com]

scenario and resulted in higher increases/decreases that those driven by the CNRM climate projections. The changes in streamflow are also generally higher for RCP8.5 compared with the RCP4.5 and the 2080s compared with the 2050s, although that may not be always the case because of possible nonlinear hydrologic response of the watershed to the projected increases in precipitation and temperature. The following section presents the implication of these projected changes in the hydrologic regime of the ARB on the hydrodynamic and sediment transport regime of the LAR.

3 | HYDRODYNAMIC AND SEDIMENT TRANSPORT MODEL OF THE LAR

3.1 | Hydrodynamics

Although a two-dimensional model could have provided a more detailed results on potential changes in sediment erosion and deposition along the river and its floodplains, the application of such model in the context of a climate change impact study that requires long-term (~100 years) simulation with multiple climate models and emissions scenarios over a large (200 km) river reach is computationally prohibitive. Consequently, this study employs the MIKE-11 (Danish Hydraulics Institute, 2012) 1D numerical modelling system for the long term hydrodynamic and sediment transport simulation along the LAR. The 1D (area averaged) equations for conservation of mass and momentum are given by the Saint Venant's formulation:

$$\begin{cases} \dfrac{\partial A}{\partial t}+\dfrac{\partial Q}{\partial x}=q \\ \dfrac{\partial Q}{\partial t}+\dfrac{\partial}{\partial x}\left(\dfrac{\alpha Q^2}{A}\right)+gA\dfrac{\partial h}{\partial x}+gA(S_0-S_f)=0 \end{cases}, \tag{1}$$

where t is the time, x is the streamwise distance, $h(x, t)$ is the water height, $Q(x, t)$ is the discharge, $A(x, t)$ is the flow area, q lateral inflow (per unit length), α is momentum distribution coefficient, $S_0(x)$ is the bed slope, $S_f\,(x, h, Q)$ is the friction slope, here given by Manning equation as:

$$S_f=\frac{gn^2Q|Q|}{A^2R^{4/3}}, \tag{2}$$

where n is Manning's coefficient and R is the hydraulic radius calculated from a parallel channel analysis in which the total conveyance of the section at a given elevation is equal to the sum of the conveyances of the parallel channels. The MIKE-11 hydrodynamic module (HD) uses an implicit finite difference method to solve the above Saint Venant's equation (Danish Hydraulics Institute, 2012).

3.2 | Sediment transport

To model the transport of fine sediments, the Advection–Dispersion (AD) and Cohesive Sediment Transport modules of MIKE-11 are used. The AD module is based on the 1D conservation of mass (of dissolved or suspended materials). The Cohesive Sediment Transport module is coupled with AD module and is used to describe transport of suspended fine sediments. The erosion/deposition is considered as a sink/source term of the AD equations. The areal averaged 1D AD equation used in MIKE-11 is given by:

$$\frac{\partial AC}{\partial t}+\frac{\partial QC}{\partial x}-\frac{\partial}{\partial x}\left(AD\frac{\partial C}{\partial x}\right)=AKC+Sq, \tag{3}$$

in which C is the concentration, D is dispersion coefficient, K is linear decay coefficient, S is source/sink concentration, and q is lateral inflow. The two primary source/sink terms are sediment deposition (S_d) and erosion (S_e). When the bed shear stress, τ_b, is less than the critical shear stress for deposition, τ_{cd}, the particles and flocs in suspension begin to deposit onto the bed. By contrast, the river bed begins to erode when the bed shear stress, τ_b, exceeds the critical shear stress for erosion, τ_{ce}. The deposition and erosion rates S_d, S_e are described by the Van Rijn equations (1984):

$$S_d=W_s c\left(\frac{\tau_{cd}-\tau_b}{\tau_{cd}}\right)\quad \text{if } \tau_b\le\tau_{cd};\ \&\ S_d=0 \text{ if } \tau_b>\tau_{cd} \tag{4}$$

$$S_e=E_0\left(\frac{\tau_b-\tau_{ce}}{\tau_{ce}}\right)^n\quad \text{if } \tau_b\ge\tau_{ce};\ \&S_e=0\ \text{ if } \tau_b<\tau_{ce} \tag{5}$$

where W_s is the sediments settling velocity, and E_0 and n are the erosion coefficient and exponent, respectively. The erosion rate and critical shear stress values used in this study are based on physical laboratory experiments conducted by Droppo et al. (2014) in a circular flume on sampled bed materials collected from the lower Athabasca region.

3.3 | Model setup

As a first step in setting up the 1D MIKE-11 river model, 200 evenly divided cross sections of the LAR (with an average interval of ~1 km) were generated from the combined bathymetry data of the ~200 km river reach. The flow and sediment transport boundary conditions for the model include time series of flow rates and the corresponding sediment concentration at the mainstem upstream inflow boundary below Fort MacMurray as well as at the confluences of each of the tributaries with the main channel. The time series of water level near Old Fort and a zero-gradient sediment concentration were used as downstream boundary conditions. The important effects of river-ice cover on the hydrodynamics and sediment transport characteristics of the LAR during the cold season have also been taken into account by introducing a synthetic shear stress value at the water surface, equivalent to the under-ice shear stress computed by an off-line river-ice model. This permits modelling of the increase in water level and decrease in bed-shear stress, caused by the winter ice cover. The procedure for including the effect of winter ice cover on the river flow (by externally coupling a river-ice model) is presented in detail in Shakibaeinia et al. (2016). The MIKE-11 model of the LAR was set up for the following three sets of model simulations corresponding to the historical and future periods: (a) the calibration/validation period, (b) baseline or reference period, and (c) future scenario period.

The historical period between 2001 and 2011 was selected for calibration/validation of the hydrodynamics and sediment transport model on the basis of available observed discharge and SSC data at various locations along the study reach. The first 3 years of data are used to adjust model parameters, and the model is subsequently validated by comparing observed and simulated data over the entire 11-year period. The key hydrodynamic model parameter for calibration is the bed-roughness that was adjusted to achieve a best match between modelled and observed water levels. The sediment transport parameters used for model calibration are critical shear stresses for erosion and deposition, erosion rate, and fall velocity. The detailed calibration/validations process of the LAR hydrodynamic and sediment transport model is explained in Shakibaeinia et al. (2017). Figure 5a shows the daily time series of simulated and measured river discharge and water level near Bitumount (x = 80 km from the upstream boundary below Ft. McMurray). The simulated and measured values over the validation period of 2001–2011 compare very well with Nash–

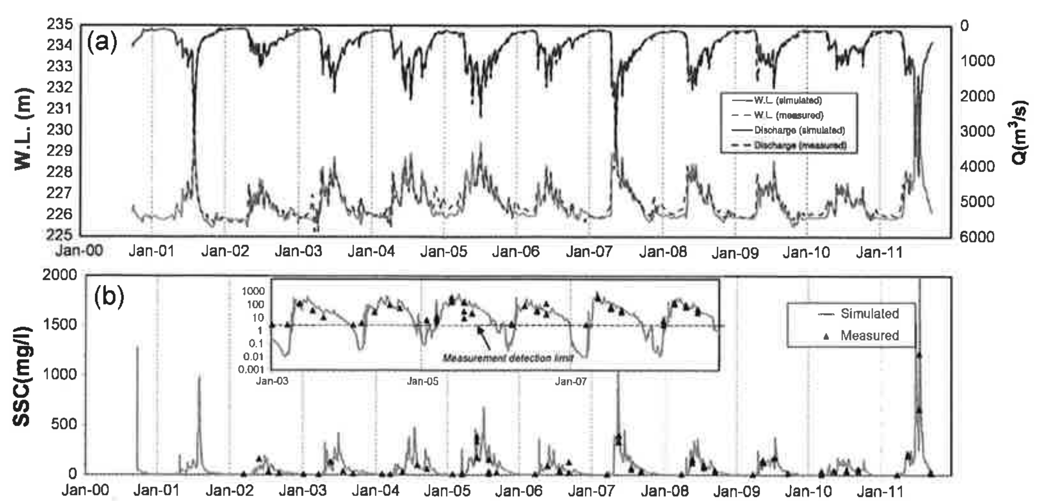

FIGURE 5 Comparison of measured and MIKE-11 simulated results for (a) water level (W.L.) and river discharge (Q) at x = 80 km (Stn.: S46), and (b) suspended sediment concentration (SSC) at x = 82 km (Stn.: ATR DC), for the model validation period of 2001–2011 [Colour figure can be viewed at wileyonlinelibrary.com]

Sutcliffe efficiency values of 0.96 and 0.89 for daily discharge and water level, respectively. The corresponding time series of the simulated and measured SSC in the LAR near Bitumount (x = 82 km from the upstream boundary) are also shown in Figure 5b. A secondary graph with a logarithmic SSC scale is also plotted on the same Figure 5b for a better visual comparison of the order-of-magnitude in seasonal variations. The simulated and measured SSC values generally show good agreement (with Nash–Sutcliffe efficiency = 0.67), and the plots also exhibit the variability of SSC throughout the year with several orders of magnitude difference between the high and low flow seasons. The maximum SSC occur during the summer months of June and July, when the flow rates are higher, whereas it gets very small (near zero) during the winter low-flow season, which also corresponds to low bed shear stress and river-ice cover.

4 | EFFECTS OF PROJECTED CLIMATE ON THE HYDRODYNAMIC AND SEDIMENT TRANSPORT REGIMES

The potential effects of climate change on the hydrodynamic and sediment transport regimes in the LAR are investigated using the streamflow scenario data simulated with the VIC hydrologic model of the ARB for the baseline (1980s) and the two future periods (of 2050s and 2080s) as presented in Eum et al. (2017). The hydrologic model outputs corresponding to each combination of GCM and RCP pairs are used as upstream and lateral boundary conditions to the MIKE-11 hydrodynamic and sediment transport model of the LAR. The time series for the upstream and tributary sediment inflows corresponding to each scenario are also generated by applying

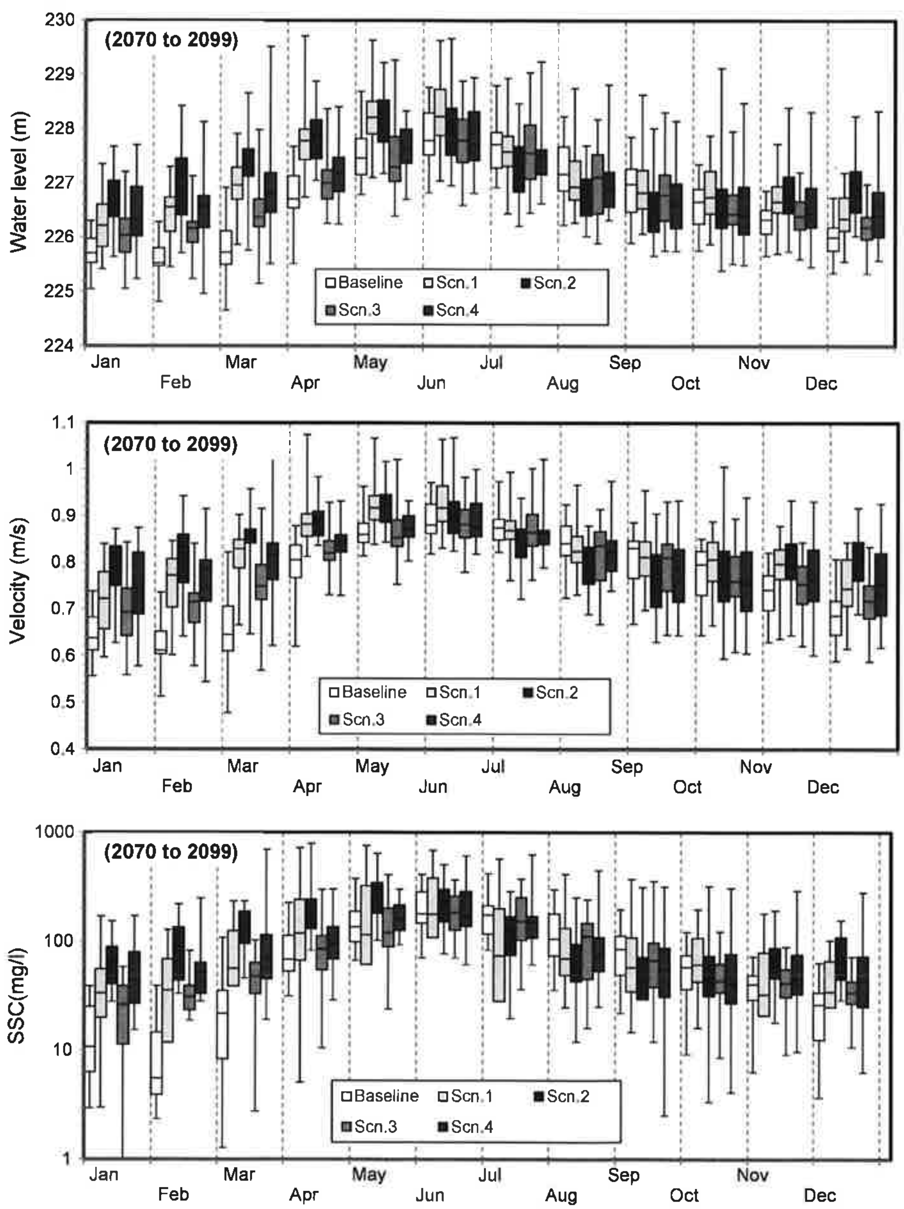

FIGURE 6 Comparison of simulated monthly mean water level, flow velocity, and suspended sediment concentration (SSC) for the 1980s baseline and the 2080s future periods in the lower Athabasca River at a location near Bitumount corresponding to the four hydro-climatic scenarios (Scn. 1: CanESM & RCP4.5, Scn. 2: CanESM & RCP8.5, Scn. 3: CNRM & RCP4.5, Scn. 4: CNRM & RCP8.5) [Colour figure can be viewed at wileyonlinelibrary.com]

the sediment-discharge rating curves developed using the historical observed data. The assumption here is that the current sediment-discharge rating curves at each inflow location will still be applicable under future hydro-climatic conditions. This assumption is justifiable since the morphology of Athabasca River immediately upstream of the main sediment inflow boundary (near Fort McMurray) is characterized by steep slope and deep and narrow valley with coarse riverbed; and sediment-rating curves in such morphology are less sensitive to potential changes in the flow magnitude as it is less likely to overtop the river or to pose a significant change in the river morphology. With all the driving boundary conditions provided, the MIKE-11 model simulates the flow velocity, water level, and SSC along the LAR corresponding to the two GCMs (CanESM and CNRM) under two emissions scenarios (RCP4.5 and RCP8.5). The potential effects of the projected climate on the hydrodynamic and transport regime in the LAR are then identified by computing the changes in flow and sediment transport variables between the baseline and the two future periods.

4.1 | Projected changes in average monthly values

Changes in mean monthly values in simulated flow velocity, water level, and SSC between the baseline (1980s) and each of the two

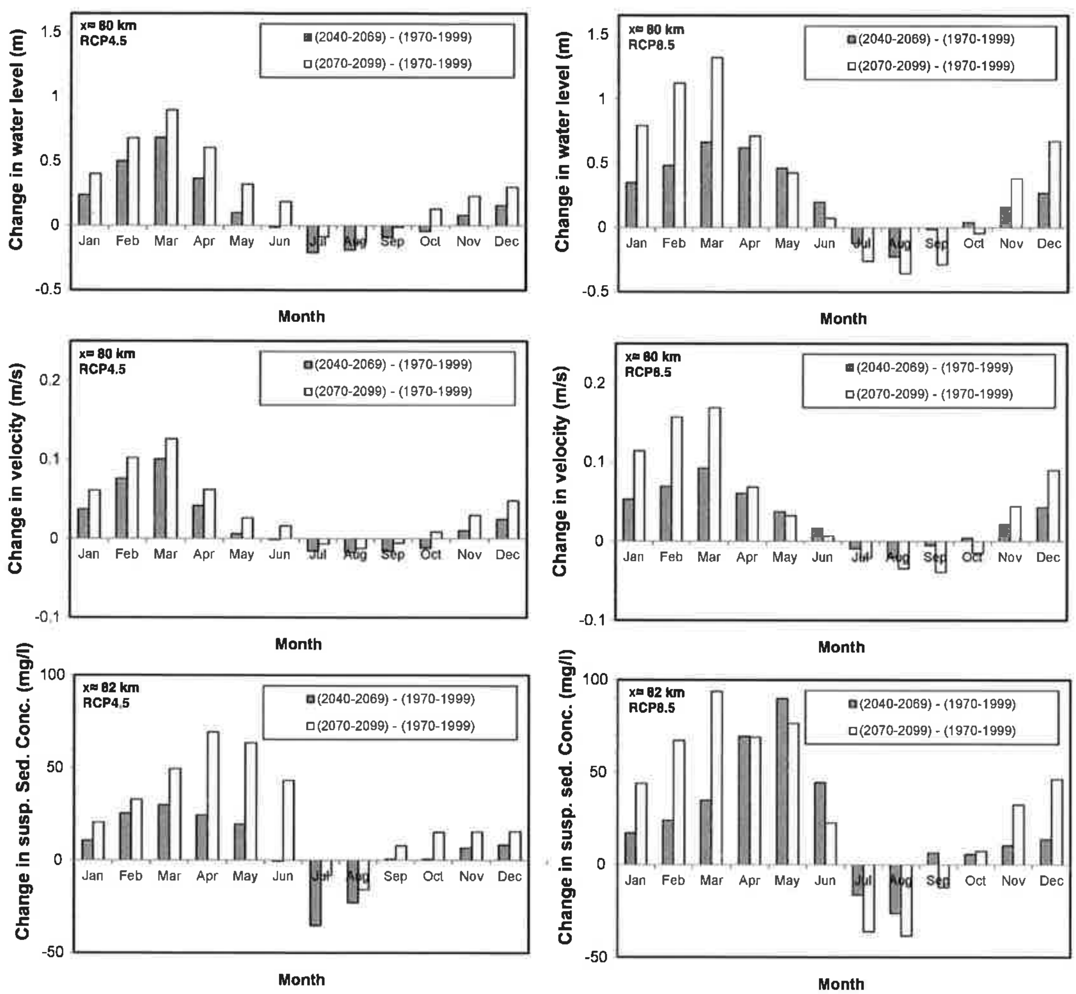

FIGURE 7 Mean projected changes in monthly averaged water level (top), flow velocity (middle), and suspended sediment concentration (SSC; bottom) between the 1980s baseline and each of the two future periods (2050s and 2080s) corresponding to the RCP4.5 (left column) and RCP8.5 (right column) emissions scenarios [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 3 Average sediment loads in the LAR (at Stn.: ATR DC; x = 82 km) for the different scenarios and future periods and the corresponding percent change with respect to the baseline period

Period	Sediment load	Scn.1	Scn.2	Scn.3	Scn.4	RCP4.5	RCP8.5
1970–1999	Mass (ton/day)	8,774.0	8,660.8	8,392.4	8,854.9	8,583.2	8,757.9
2040–2069	Mass (ton/day)	10,929.8	15,853.080	7,834.181	9,986.3	9,382.0	12,919.6
	Change (%)	24.6	83.0	−6.7	12.8	9.3	47.5
2070–2099	Mass (ton/day)	16,640.9	15,168.4	10,151.1	11,725.8	13,396.0	13,447.1
	Change (%)	89.7	75.1	21.0	32.4	56.1	53.5

Note. (Scn. 1: CanESM & RCP4.5, Scn. 2: CanESM & RCP8.5, Scn. 3: CNRM & RCP4.5, Scn. 4: CNRM & RCP8.5). LAR = lower Athabasca River.

future periods (2050s and 2080s) are presented in Figure 6 for a location near Bitumount. The results show an overall projected increase in each of these flow variables over most seasons except in the summer and early fall months of July, August, and September when they all show potential decreases. For example, the monthly median values of water-level/flow-velocity/SSC in March are projected to increase from their baseline values of 225.7 m/0.65 m/s/22 mg/L to their corresponding values by the 2080s ranging from 226.6 m/0.75 m/s/49 mg/L to 227.4 m/0.86 m/s/120 mg/L depending on the climate models and emission scenarios considered. These results are also consistent with the projected changes in the hydrologic regime as simulated by the VIC model of the ARB. However, there are also clear differences in the magnitudes of the projected changes resulting from each of the two GCMs. The projected changes in the mean monthly values of water level and flow velocity corresponding to the CanESM are consistently higher than those of the CNRM. For instance, the maximum water level change by the 2080s is 37% higher for CanESM projection comparing with that of CNRM. The differences are even more pronounced in the case of changes in SSC, where those corresponding to CanESM projection exhibit up to 5 times higher concentration than those of CNRM possibly because of the exponential relationship between flow velocity and SSC. Such differences are exhibited for both RCPs, and the magnitude of the climate change effect is generally higher for the RCP8.5 emissions scenario compared with that of the RCP4.5.

While the variation in the results corresponding to each GCM show the sensitivity of the potential impacts to the particular climate scenarios used to drive the hydrologic model, a more robust interpretation of the results can be made by computing the mean values of the projected changes corresponding to the two GCMs considered in this study. Figure 7 shows the ensemble projected changes in mean monthly values of the three flow parameters between the baseline and the two future periods. The results once again indicate the seasonal variations in the magnitude of changes with the higher projected increases in mean monthly values (of up to 1.3 m for water level and 0.17 m/s for flow velocity) occurring in the winter and spring months and a decrease (of up to 0.4 m for water level and 0.05 m/s for flow velocity) occurring in the late summer and early fall months of July, August, and September. The projected changes are generally higher for the 2080s period compared with the 2050s, and they are also larger for the RCP8.5 emissions scenario compared with that of the RCP4.5, especially during the latter period.

Projected changes in the concentration of suspended sediments shows a pattern similar to that of the water level and flow velocity. SSC is projected to increase for most of the year except the summer months of July and August when it is expected to decrease. The highest increase in SSC (of 93 mg/L) occurs in March, and the highest decrease (of about 38 mg/L) occurs in August for RCP8.5 emission scenario during the 2080s. The results also show some lags between the months of highest increases in water level and flow velocity (in February and March) and the months of highest increases in SSC (mostly in April and May). This seems to be because of the lag time between the increased sediment inflows at the upstream and lateral (tributary) boundaries and their subsequent effect on SSC along the study reach. All these results are consistent with the corresponding patterns of projected changes in streamflow presented in Figure 3. Table 3 also shows the combined effect of the overall projected increases in discharge and SSC on the total sediment load transported through the LAR and the corresponding changes with respect to the 1980s baseline period. The results show that the increases corresponding to the different scenarios ranging from 21% for CNRM with RCP4.5 to 89.7% for CanESM with RCP4.5 scenarios. The multimodel mean projected increases in the sediment load transported by the LAR

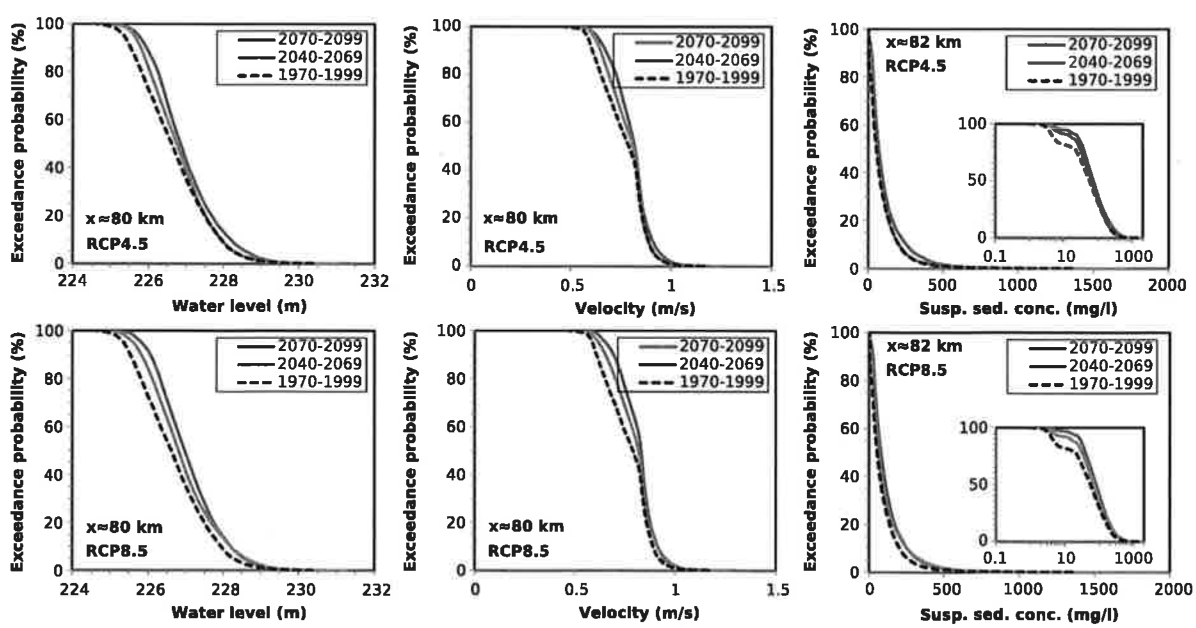

FIGURE 8 Exceedance probabilities for daily mean values of water level (left column), flow velocity (middle column), and suspended sediment concentration (right column) at a location near Bitumount for the 1980s baseline and two future periods (2050s and 2080s) corresponding to RCP4.5 (top row) and RCP8.5 (bottom row) emissions scenarios [Colour figure can be viewed at wileyonlinelibrary.com]

by the 2080s corresponding to the RCP4.5 and RCP8.5 emissions scenarios are 56.1% and 53.5%, respectively. These projected increases in sediment load are attributable to the potential increases in the sediment generating capacity of a wetter climate along with the higher sediment carrying capacity of a higher discharge.

4.2 | Projected changes in exceedance probability

The scenario simulation results are also presented in terms of probability of exceedance describing the likelihood of the daily mean value of a specified flow variable being exceeded in a given time period. Figure 8 presents the exceedance probabilities of daily mean water level, flow velocity, and SSC for the baseline and future periods for a location near Bitumount by combining simulation results corresponding to the CanEMS and CNRM projections. The results show an overall increase in the exceedance probabilities of each of the three flow parameters for all future scenarios. For the RCP4.5 case, the exceedance probabilities of lower flow and SSC values exhibit substantial increases by the 2050s while the corresponding increases for higher values do not occur until the 2080s. For example, the probability of exceedance for a flow velocity of 0.7 m/s increases by ~10% (from 75% to 85%) by the 2050s and 15% (to 90%) by the 2080s. On the other hand, for the RCP8.5 case, the exceedance probabilities for both high- and low-flow parameters show noticeable increases by the 2050s, and only the low flows show further increases in their exceedance probabilities by the 2080s. This is because channel overflow to adjacent floodplains during periods of high flow prevents the water level and mean flow velocity from increasing any further. Figure 8 also shows that projected increases in exceedance probabilities of the SSC (plotted in both logarithmic and non-logarithmic scales) are mainly for lower concentrations (SSC < ~10 mg/L) following similar patterns of changes to that of flow velocity (and therefore bed shear stress). Plots of exceedance probabilities at other locations along the river have also shown similar patterns of projected changes (not shown).

5 | SUMMARY AND CONCLUSIONS

The potential effect of climate change on the hydrodynamic and sediment transport regime of the LAR is investigated. The main sources of uncertainty in the study are the range of climate projections and the corresponding hydrologic simulations. An attempt is made to capture the variations in the hydrologic response to a range of potential climate projections by applying the VIC hydrologic model outputs corresponding to two of the CMIP5 GCMs (CNRM and CanEMS) representing moderate and higher rates of changes in precipitation and temperature over the study region, respectively, under each of the two emission scenarios (RCP8.5 and RCP4.5). Statistical downscaling of the GCM climate scenarios is also important in that, in addition to removing possible biases, it disaggregates the climate data (daily precipitation and temperature) to a higher spatial resolution that is most appropriate to drive the process based and distributed VIC hydrologic model. The projected increases in both precipitation (+8% to +25%) and temperature (+2.8 to +7 °C) over the Athabasca watershed are expected to alter the hydrologic regime in the river by increasing the winter and spring flows and reducing the summer flows as a result of increasing rain on snow events and earlier timing of the freshet initiation because of the warming climate.

The transport model simulation study showed that the projected changes in the hydrologic regime will have serious consequences on the hydrodynamic and sediment transport regimes of the LAR. An overall increase in mean water level (by up to 1.3 m), mean flow velocity (by up to 0.17 m/s), and suspended sediment consecration (SSC by up to 93 mg/L) is projected for most seasons except in the summer when they all show potential (but smaller) decreases consistent with the hydrologic projections. The projected changes in these variables are larger for the RCP8.5 emissions scenario compared with that of the RCP4.5, especially during the latter period (2080s) when the changes are generally higher. There is also an indication that there will be some lag between the months of highest increases in water level and flow velocity on the one hand and the months of highest increases in SSC on the other because of the response time between the increased sediment inflows at the upstream and lateral (tributary) boundaries and their subsequent effect on SSC along the study reach. The scenario simulation results also show an overall increase in the exceedance probabilities of all the three flow parameters for all future scenarios. For the case of RCP4.5, the exceedance probabilities of lower flow and SSC values exhibit substantial increases by the 2050s whereas the corresponding increases for higher values occurred only by the 2080s. On the other hand, for the case of RCP8.5, the exceedance probabilities for both high and low flow parameters have shown noticeable increases by the 2050s, and only the low flows show further increases in their exceedance probabilities by the 2080s. In all the above cases, there is an inherent uncertainty in the magnitude of changes projected by the cascade of models arising from a number of factors such as emission scenarios, observed or estimated inputs to the models, sediment inflow rating curves, and model parameters. However, the hydrodynamic and sediment transport modelling approach applied in this study using hydrologic projection corresponding to the two climate models (CNRM and CanEMS) and the two emissions scenarios (RCP4.5 and RCP8.5) depict the general direction of potential changes in the flow and sediment transport regime of the LAR.

In general, climate change is projected to cause increasing precipitation and temperature in the Athabasca watershed that will, in turn, alter the hydrologic regime in the LAR system. Through hydrodynamic and sediment transport simulation in the LAR, this study found that, by the end of this century, there will be a corresponding potential increase in flow velocity and water level leading to an overall increase in sediment load and transport in the LAR and to the PAD compared with the contemporary baseline period. Implications of such potential changes in the transport characteristics of the river system to the mobilization and transport of various chemical constituents and their effects on the region's aquatic ecosystems are subjects of other ongoing investigations.

ACKNOWLEDGEMENTS

The financial support for this study was provided by the Joint Canada-Alberta Oil-Sands Monitoring Program (JOSMP) and Environment and Climate Change Canada's Climate Change Adaptation Program (CCAP). The authors would like to thank Drs. Fred Wrona and Anil

Gupta of Alberta Environment and Parks (AEP) for their involvement at the different stage of this research project. The authors acknowledge Dr. Fay Hicks for providing some cross section data, Tom Carter and Jennifer Pesklevits for collecting and processing the GeoSwath data for the lower Athabasca River, and Boyang Jiao in data preparation and model simulation. The authors also acknowledge Dr. Roderick Hazewinkel from AEP for facilitating access to the LiDAR data used for preparing the bathymetry for the Athabasca River and its flood plains.

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How to cite this article: Dibike Y, Shakibaeinia A, Eum H-I, Prowse T, Droppo I. Effects of projected climate on the hydrodynamic and sediment transport regime of the lower Athabasca River in Alberta, Canada. *River Res Applic*. 2018;34:417–429. https://doi.org/10.1002/rra.3273

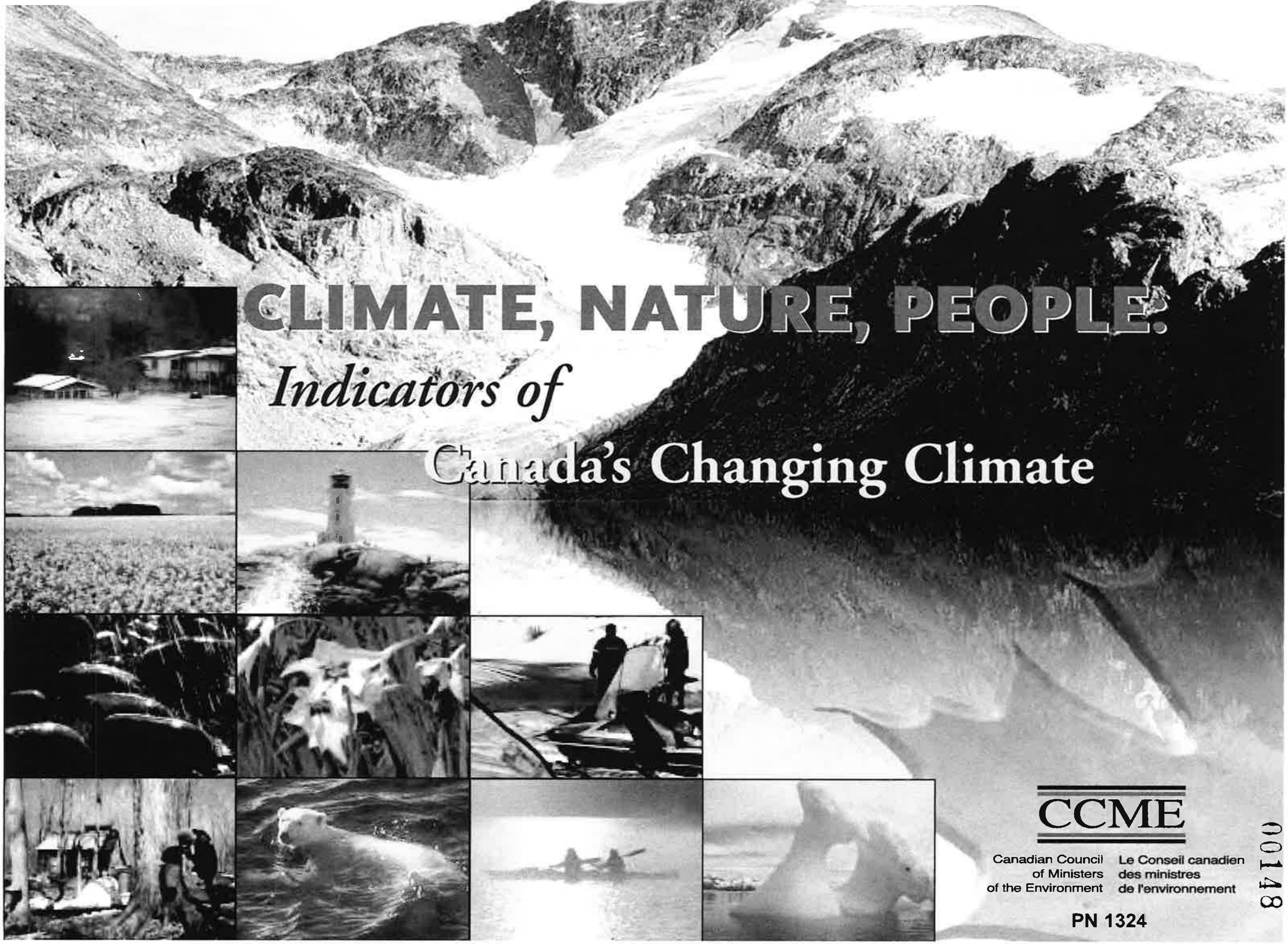
This is Exhibit "E"
referred to in the Affidavit
of Lisa Tssessaze affirmed before me
this 17 day of Dec., 2018

Gail Gallupe

Commissioner for Taking Affidavits, etc.

Gail Gallupe
Expiry: April 7, 2020
#0742640

CLIMATE, NATURE, PEOPLE:
Indicators of Canada's Changing Climate



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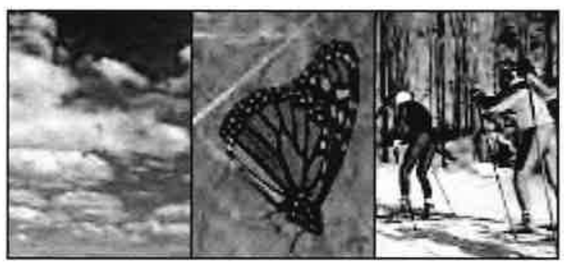
Climate, Nature, People:

Indicators of Canada's Changing Climate



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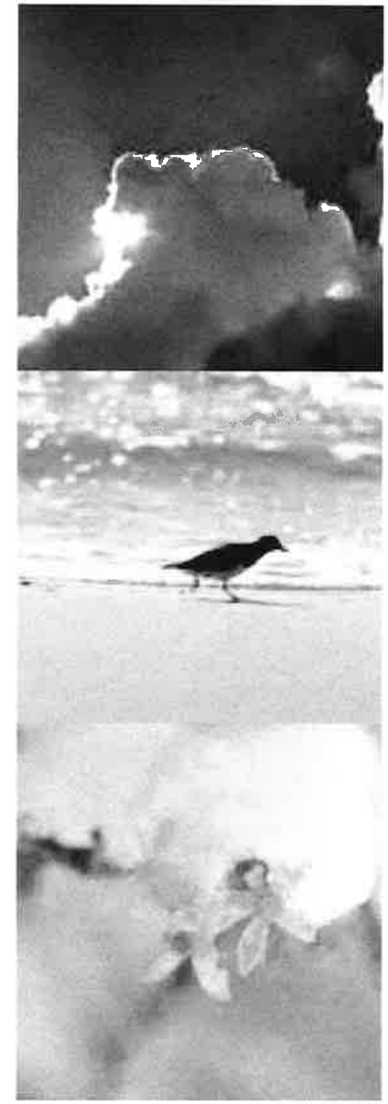

HIGHLIGHTS

This set of indicators identifies changes in Canada's climate during the past 50 to 100 years and investigates selected impacts of these changes on Canadians and their environment. Key findings include:

CLIMATE

- Almost every part of southern Canada, from coast to coast, was warmer at the end of the twentieth century than it was at the beginning. Northwestern Canada has also seen strong warming over the past 50 years, but the Northeast has become cooler.
- Most of Canada has become wetter, with increases in precipitation ranging from 5% to 35%.
- Because of increased precipitation, Canada was generally snowier at the end of the twentieth century than at the beginning. Over the past 50 years, however, higher spring temperatures have reduced the proportion of precipitation falling as snow in some parts of southern Canada.
- Sea surface temperatures have risen substantially on Canada's west coast but appear to have changed little on the east coast.

NATURE

- Rising sea levels are making many areas along the Atlantic, Pacific, and Beaufort Sea coasts more vulnerable to flooding and erosion.
- Ice on rivers and lakes in most of Canada is breaking up earlier in the spring. During the past 30–50 years, however, there has been a tendency in much of the country towards earlier freezing dates in the fall.
- Most glaciers in Canada are shrinking.
- The area of the Canadian Arctic that is permanently covered by sea ice has decreased by about a quarter since the late 1960s. Hudson Bay is now ice free a week longer, on average, than it was 30 years ago.
- A shorter ice season has made survival more difficult for polar bears on the western side of Hudson Bay.

- Warmer temperatures may be contributing to recent increases in the population of the mountain pine beetle, an insect pest responsible for the destruction of valuable timber in B.C.
- Key stages in plant development, such as budding, leafing, and flowering, are occurring earlier, mainly because of earlier and warmer spring weather.

PEOPLE

- The traditional knowledge that aboriginal people relied on in the past to live off the land is becoming harder to apply as a result of more variable weather and changes in the timing of seasonal phenomena. A shorter, less reliable ice season has also made winter travel, hunting, and fishing in the North more difficult and dangerous.
- Although recent years have been marked by severe drought on the Prairies, long-term data do not show that droughts are occurring more often.
- Since 1900, data for the Great Lakes show periodic changes in water levels but no long-term trend towards lower water levels. Recent low water levels, however, have had important consequences for shipping, hydroelectric generation, and wildlife.
- The frost-free season has been getting longer in most parts of Canada because the last spring frosts have been happening earlier.
- Heating needs across most of Canada have decreased during the past century. Many parts of the country have also seen cooling needs rise.
- There is no strong evidence that extreme weather events have become more common in Canada, even though the 1990s witnessed some of the most damaging and costly weather disasters in Canadian history.

Because of the large size of Canada, the rate, extent, and impact of changes in climate vary from one part of the country to another. The indicators also show that the links between climate and specific impacts on nature and people are often complex.

Indicators will continue to be important tools for tracking the social, economic, and environmental effects of changes in our climate. Further work on the existing indicators and development of additional indicators is needed to expand our understanding of these impacts.

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IS CANADA'S CLIMATE CHANGING?
And does it really matter?

Climate affects just about every aspect of nature and human life. The kinds of plants and animals that inhabit a particular place are determined to a great extent by climate. So is the amount of water in a river or the height of a shoreline. Likewise, our health and safety, our comfort and mobility, our food supply, and our access to water all depend in one way or another on climate, as do many other things we need or value. When climate changes, all of these are affected too – sometimes slightly, sometimes considerably, sometimes for the better, and sometimes for the worse.

Canada's climate has begun to change in a number of ways, and some impacts of those changes are already noticeable. As citizens we need to be aware of those changes and their consequences for the world around us. That is why the Canadian Council of Ministers of the Environment (CCME) commissioned this report. Its objective is not to predict how climate change might unfold in the future but to give Canadians some idea of how a changing climate may already have affected their lives and the environment.

To do so, it uses what are known as indicators. Indicators are simple things that we can measure to learn about the condition of something more complex. In medicine, for example, blood pressure or body temperature are common indicators of the health of the human body. In economics, gross domestic product (GDP) indicates the wealth of a country by measuring the value of what it produces, usually in a year. Indicator measurements can also be tracked over a period of time to show whether or not there has been a change in condition. A change in GDP, for example, tells whether a country is getting richer or poorer, at least in money terms.

Climate change indicators do much the same thing. Some of them help us determine whether our climate is changing or not. These indicators are based on features of climate, like temperature and precipitation. Others indicate whether or not a changing climate is affecting the environment and people's lives. These indicators are aspects of nature (like glaciers or sea level) or people's activities (like growing garden plants or crops or heating our homes) that are considered sensitive to changes in climate. By tracking changes in the indicators over time, we can get a fairly good picture of how climate has been changing during the same period. We can also see how these changes are affecting our daily lives and how we might need to respond.

Nearly 100 possible indicators were examined for this report. The dozen that remain are the ones that best met the following criteria.

- The indicator had to measure changes that are important either for people or the environment.
- Data for the indicator had to be reliable and available for a long period of time, ideally 50 to 100 years or more. This is so that we can be more certain that the indicator is actually reflecting real, long-term changes in climate rather than natural short-term variations or cycles that change every few years or decades.
- The influence of climate on the indicator had to be clear and direct. This is sometimes a difficult requirement, because the environment and human activities are almost always subject to several forces of change at once.
- Data for the indicator had to be available in most parts of the country that the indicator is relevant to. This helps us see differences in the impacts of changes in climate across the country.

The 12 indicators have been grouped into two sections. The first includes those whose impacts are more directly on nature; the second, those whose impacts are more directly on people.

Because of the size and diversity of Canada, changes in climate are not occurring at the same rate or in the same way in every part of the country. That means that the indicators will also show different results in different parts of the country. To provide both the detail and the broader picture needed to understand these changes, the report presents each indicator through the following four elements:

- a brief introduction that explains the indicator's importance and sensitivity to climate
- a Focus section that looks at how the indicator has behaved over a period of time in a particular part of the country
- a context section, called The Bigger Picture, that summarizes how the indicator has behaved in other parts of the country or in the rest of the world and considers some of its implications

- a boxed story or list of facts that highlights additional information about the indicator and its significance.

Most of the indicators are based on data that have been collected and analyzed by government or university researchers. In selecting sources, care was taken to ensure that the reliability and statistical significance of the data could be adequately assessed. Because this publication is aimed at the general public, however, it does not provide extensive discussion of analytical methods, although the statistical significance of the data is noted where appropriate. Those interested in exploring such details further should refer to the original sources of information listed at the back of the publication.

Some indicators also use information derived from traditional and local knowledge. Traditional knowledge is the detailed environmental knowledge of aboriginal peoples who still survive to a large extent by harvesting the plants, animals, and other resources that the natural environment provides. It is expert knowledge that depends on close observation, and some of it has been accumulated over many generations.

CCME hopes that this brief report will give Canadians a better understanding of how climate change can affect their lives and a desire to learn more about it. The report ends, therefore, with references to sources of additional information about climate change impacts and actions that individuals might take to address their concerns about climate change in Canada.

001155

Climate is often defined as average weather. More precisely, it is the long-term average for a particular time period and place. It is usually based on weather data that cover a span of at least 30 years, and it includes temperature, rain, snow, humidity, wind, sunshine, air pressure, and other weather characteristics.

Climate is naturally variable. It is never exactly the same from one period to another. Sometimes it can shift dramatically within a few hundred or thousand years, as it does when ice ages begin and end. Usually it varies within much narrower limits. For most of the past 1000 years, for example, the world's average temperature has remained within about half a degree of 14°C.

Over the past 100 or so years, however, the world's climate has changed noticeably. The world's average temperature was approximately 0.6°C warmer at the end of the twentieth century than it was at the beginning, and the 1990s were the hottest decade in 140 years of global climate records. Such changes may seem trifling, but the difference between global temperatures now and at the peak of the last ice age is a mere 5°C. Evidence of earlier climates suggests that global temperatures have warmed more during the twentieth century than in any other century during the past 1000 years.

Why are temperatures rising? Part of the reason may be an increase in energy from the sun. But atmospheric scientists attribute most of the warming over the past 50 years to increases in the quantity of greenhouse gases in the atmosphere. These are gases like carbon dioxide, methane, and nitrous oxide that absorb and retain heat from the Earth's surface. They are a small but extremely important part of the planet's natural atmosphere – so important, in fact, that without them, Earth would be some 33°C cooler than it is now and too cold to support life.

Since the early days of the industrial revolution some 200 years ago, huge increases in the burning of fossil fuels like coal and oil and the replacement of large areas of forest by farmland have greatly increased atmospheric concentrations of these gases. Concentrations of carbon dioxide and other greenhouse gases are still increasing, and as they do climate scientists expect that global temperatures will continue to get warmer.

Higher temperatures are not the whole story though. They in turn give rise to changes in other features of climate, such as rain and snowfall, winds, and the movement of weather systems. As a result, the world is not just becoming warmer. Weather patterns, like the amount of rain or snow in a given season or the occurrence of various weather extremes, are also changing. Some of these changes are already beginning to alter our environment – affecting the shape and character of the landscape, the makeup and behaviour of plant and animal communities, and the quality of people's lives.

Climate hasn't changed evenly around the world. Some parts of the globe have warmed more than the average. Others have warmed less. Some have even cooled. Because of the large size of Canada, it is no surprise then that the rate, extent, and impact of changes in climate vary from one part of the country to another.

Climate Records

When studying climate change, researchers use climate records that cover as long a period of time as possible. That makes it easier to distinguish between real, long-term change in the behaviour of the climate system and temporary changes, lasting only a few years or decades, that result from the system's natural variability.

In Canada, long records dating back 100 years or more are available for the southern half of the country. However, in the North – Yukon, the Northwest Territories, Nunavut, northern Quebec, and northern Labrador – records dating from before the 1950s are rare. To get the best possible understanding of climate change in Canada, then, we have to look at both a 100-year picture that covers only the southern half of the country and a 50-year picture that covers the whole country.

The two pictures are generally similar, but in some cases they disagree. That may be because changes that can dominate the shorter 50-year picture do not show up as strongly when looked at over a 100-year time span. Or it may be that the 50-year picture is showing new changes that were not evident earlier. It is difficult to determine, however, whether changes that show up only in the 50-year picture are temporary or represent a real and continuing pattern of change.

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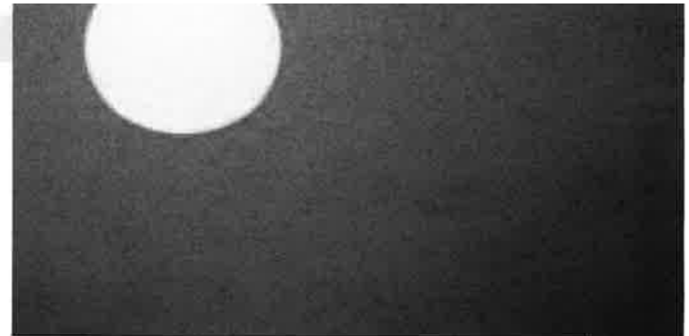


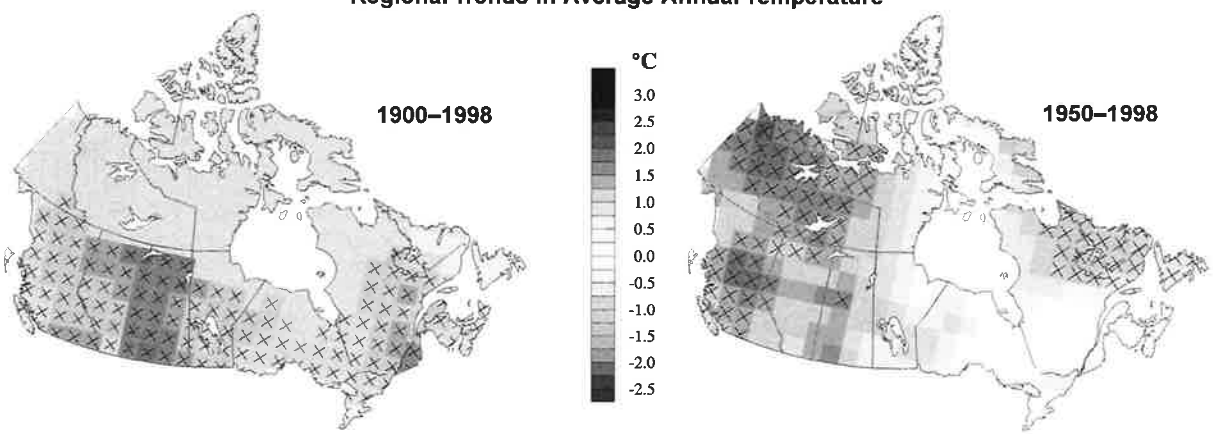
Temperature

Whether we look at the 50-year or the 100-year picture, it is clear that temperatures have been changing in just about every part of Canada. The 100-year picture shows that southern Canada as a whole warmed by 0.9°C between 1900 and 1998. During that time, the greatest warming – about 1.5°C – took place on the Prairies and the least – about 0.5°C – on the east and west coasts.

The 50-year picture, from 1950 to 1998, is more complicated. It still shows most of the country getting warmer, especially in the West and Northwest. However, it also shows that temperatures in parts of Ontario, Quebec, and the Maritimes changed little during this period, while the northeastern corner of the country – eastern Baffin Island, northern Quebec, and Newfoundland and Labrador, actually became cooler. The greatest warming occurred in the Mackenzie Basin, where the average annual temperature increased by 2°C over the 50 years. The greatest cooling – as much as 1.5°C – has been in parts of northern Quebec and Labrador. For all of Canada, the average temperature change during this period was 0.3°C.

In both the 50- and 100-year pictures, the greatest amount of warming has occurred in spring, and the next greatest in winter. Of all the seasons, fall has warmed the least.

Regional Trends in Average Annual Temperature

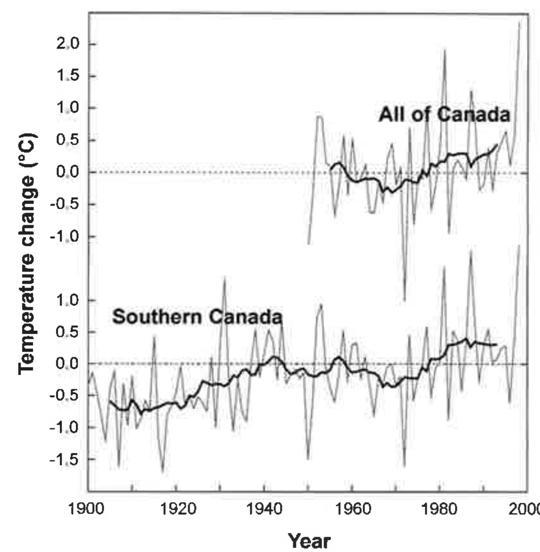


Source: *Adapted from Zhang et al., 2000*

Over the course of the twentieth century, all of southern Canada, from B.C. to Newfoundland and Labrador, warmed to some extent. In these maps, southern Canada is defined as the region lying south of the 60th parallel (the line that forms the northern border of B.C., Alberta, Saskatchewan, and Manitoba).

Since 1950, the greatest warming has occurred in the West and Northwest, while the Northeast has cooled. An x indicates results that are statistically significant. That means that scientists have a high degree of confidence that the changes are part of a real long-term trend and are not just due to chance.

National Annual Temperature Trends



Source: *Adapted from Zhang et al., 2000*

The graph shows the difference between each year's average temperature and the average for 1961 to 1990. The dark line running through each plot smooths out the year-to-year differences and makes it easier to see the general pattern of change over time. In southern Canada, temperatures rose rapidly between the early 1900s and the 1940s. They then fell slightly until the late 1960s but have continued to rise since then.

00157

Highs and Lows

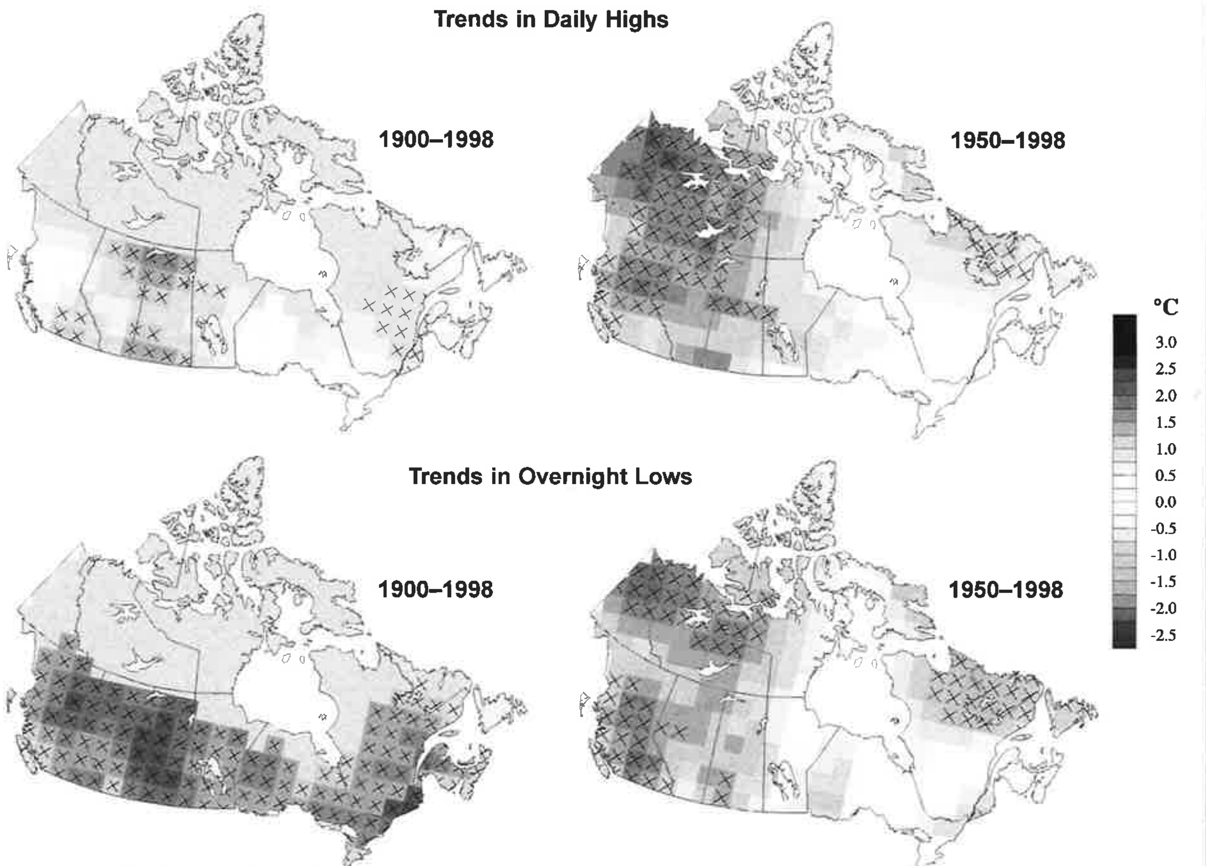
Climate change is usually discussed in terms of changes in average temperature, but averages don't tell the whole story. How warm it gets during the day and how cool it gets at night can also have important effects on people and the environment. Daily highs, for example, have a substantial influence on the growth of plants, while overnight lows determine when the first and last frosts occur and thus influence the length of the growing season.

For humans, higher daytime temperatures reduce heating requirements in the winter but increase the need for cooling in the summer. In the North, warmer nighttime temperatures affect transportation by shortening the number of weeks in which it is possible to travel on the ice and frozen ground. Changes in daily highs and overnight lows can have numerous other effects as well on everything from human health and safety to the survival of insect pests.

Over the past 100 years, daily high temperatures have risen in every province of Canada. Daily lows, however, have risen much more – in some cases twice as much, mainly because of strong nighttime warming in the earlier part of the last century. Both highs and lows have also increased more in winter than in summer.

In the shorter 50-year record, in contrast, significant differences between daytime and nightime warming do not show up in many parts of the country. However, some important seasonal differences are apparent. In Canada's Northwest, both winter and summer temperatures have increased, but the increase in winter temperatures has been much greater. In the Northeast, temperatures have cooled in winter but have become somewhat warmer in summer.

What all of this means is that – except for the northeastern corner of the country – more warming has gone on at the lower end of the temperature scale than at the higher end. The reduction in the number of cold winter nights has been more noticeable than the increase in hot summer days. So far, then, a warming climate has not made Canada appreciably hotter, but it has made it less cold.



Source: *Adapted from Zhang et al., 2000*

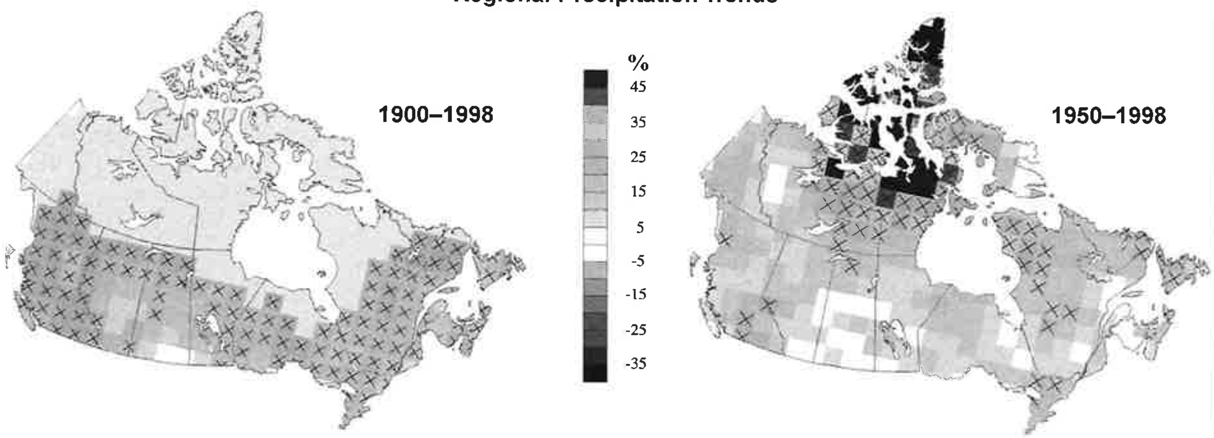
Over the past 100 years, overnight lows warmed more than daily highs across all of southern Canada. For the past 50 years, differences between daytime and nighttime temperatures have been far less striking. The x's in all maps indicate trends that are statistically significant.

Precipitation

As well as becoming warmer, most of Canada has become wetter. Almost all of southern Canada, except the southern Prairies, saw significant increases in precipitation between 1900 and 1998. Most of southern Canada now receives about 5–30% more precipitation than it did in 1900. Since 1950, the central Arctic has also seen significant increases, in some cases as much as 35%. The increases were evident in all seasons, although since 1950 they have been most widespread during the fall. Some parts of the country, however, experienced seasonal decreases in precipitation during this period. These occurred mostly in winter and spring.

The trend towards more precipitation is consistent with the way that our climate is expected to change in a warming world. That is because higher temperatures evaporate more water from the Earth's surface and a warmer atmosphere can hold more water vapour. That makes more moisture available in the air to fall as rain or snow, and in most regions that is likely to result in more precipitation during the year. Some areas may still get drier, however, as a result of changes in the circulation of the atmosphere.

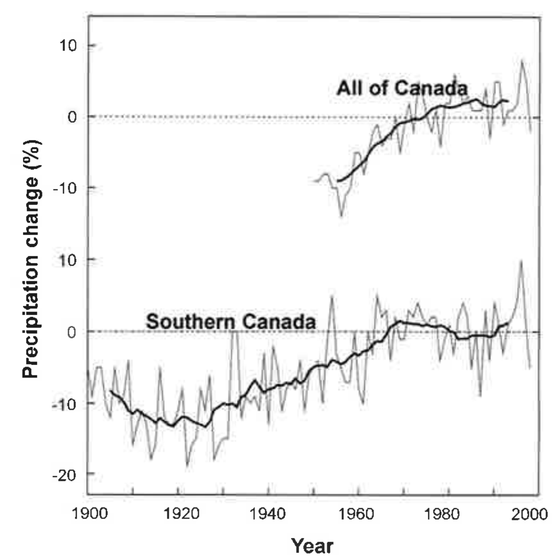
Regional Precipitation Trends



Source: *Adapted from Zhang et al., 2000*

The maps show average changes in annual precipitation (in per cent) for southern Canada between 1900 and 1998 and all of Canada between 1950 and 1998. Almost all of the country, except parts of the southern Prairies, has seen an increase. An x indicates changes that are statistically significant.

National Annual Precipitation Trends



Source: *Adapted from Zhang et al., 2000*

Canada has become wetter during the twentieth century. The graph shows the difference (in per cent) between each year's average precipitation and the average for 1961–1990. The dark line through the centre of each plot smooths out year-to-year differences so that longer-term changes are easier to see.

Snow and Rain

A warmer atmosphere may also affect the amount of precipitation that falls as rain and the amount that falls as snow. That is partly because the increases in precipitation that come with a warmer atmosphere may not be evenly distributed between the cold seasons (when precipitation is more likely to fall as snow) and the warm seasons (when it will fall as rain). It is also because a warmer climate is likely to have more fall, spring, and even winter days when temperatures are too high for precipitation to fall as snow. Over time, such changes can be expected to make Canada a rainier but less snowy place. What has actually happened so far, however, is more complicated. The trends depend very much on what part of the country you look at and when.

The 100-year precipitation picture actually shows the southern half of Canada becoming somewhat snowier. That's partly because of more precipitation in winter (which usually falls as snow) and partly because a larger proportion of fall precipitation fell as snow. Over the past 50 years, however, the proportion of precipitation falling as snow in the South has gone unchanged or decreased. These decreases are mainly a result of higher spring temperatures that have caused more precipitation to fall as rain. In some areas, though, they are the result of less winter and spring precipitation. But even though snow made up a smaller proportion of total precipitation in these years, the second half of the twentieth century was still snowier in southern Canada than the first – simply because the total amount of precipitation in the second half was greater

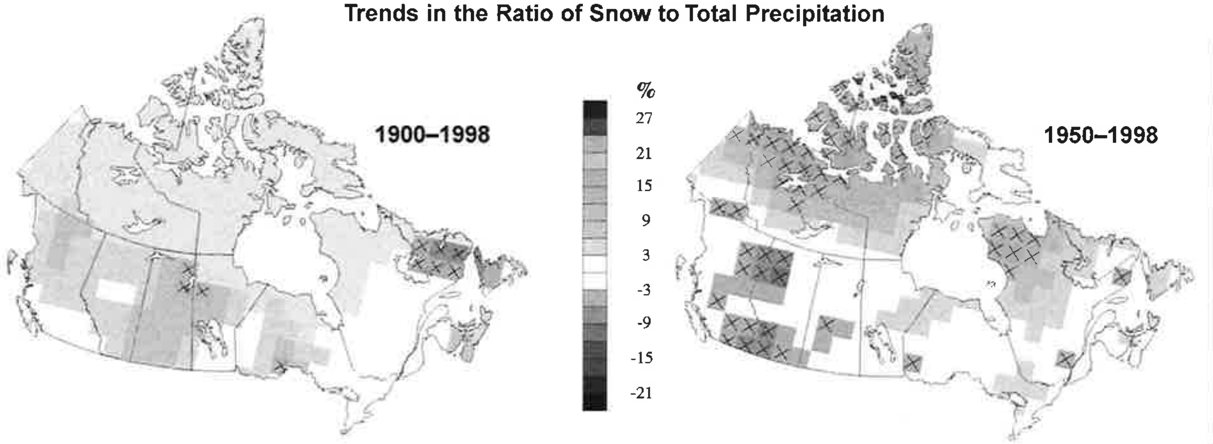
In the North, the past 50 years have seen an increase in the proportion of the year's precipitation that falls as snow. That reflects an increase in precipitation generally, especially during the cold seasons – fall, winter, and spring – when temperatures are still mostly cold enough to favour the formation of snow.

Whether precipitation falls as rain or snow is not a trivial matter. Less snow can result in lower snow-clearing costs, fewer transportation delays, less time lost at work, and fewer deaths and hospital admissions as a result of accidents, exposure, and injuries and heart attacks from snow shovelling. More rain in winter, however, could be a serious hazard if it occurs as freezing rain.

Snow is also a source of many ecological, economic, and social benefits. Snow stores moisture during the winter, and a lack of it can result in serious water shortages later in the year for hydroelectric systems, industries, farms, municipalities, inland waterways, and freshwater fisheries.

Finally, changes in snow cover can play an important role in climate change. Snow is highly reflective, and extensive snow cover retards the onset of warmer temperatures in spring by reflecting incoming sunlight away from the Earth's surface. When spring precipitation falls as rain rather than snow, the snow cover disappears faster and warmer weather arrives earlier.

Trends in the Ratio of Snow to Total Precipitation



Source: *Adapted from Zhang et al., 2000*

The maps show changes in the proportion of total precipitation that falls as snow. The green squares indicate that the amount of snow in the total precipitation mix has increased. Red indicates a decrease. An x indicates results that are statistically significant.

Sea Surface Temperature

The world's oceans are an important part of the climate system. They are a source of moisture for the atmosphere and a reservoir and transport system for heat. In fact, the top few metres of the world's oceans hold as much heat as the entire atmosphere. What happens to ocean temperatures is a crucial part of climate change.

The surface layer of the ocean is also important ecologically, because that is where sea life is most plentiful. Many factors affect the vitality of sea life, but water temperature is particularly significant. Fish, for example, are sensitive to water temperature and will have difficulty reproducing and surviving in water that is either too hot for them or too cold. Many species, in fact, will change their migration routes and feeding grounds to stay within their preferred temperature range. Water temperature also affects the ease with which winds and storms can replenish the nutrient supply of the surface layer by mixing it with the colder, nutrient-rich water below. Cold, salty water mixes best because it is very dense. Warmer water doesn't mix as easily because it is less dense and tends to float on the cooler water underneath it.

The oceans too have been warming, and like the atmosphere they have not warmed at the same rate everywhere. As with air temperatures, complete sets of measurements going back several decades are also needed to detect reliable trends in sea surface temperatures. Unfortunately, records of this kind for many Canadian locations are not available, and that makes it difficult to put together a 50- or 100-year picture of temperature changes in Canadian coastal waters.

The best data come from the Pacific coast, where lighthouse keepers have been measuring sea surface temperatures at several locations along the coast since the first half of the twentieth century. These records show temperature increases ranging from 0.9°C per century off the west coast of Vancouver Island to 1.8°C per century in the Georgia Basin.

Complete long-term records for the Atlantic coast are fewer and harder to assess. The best available set, for Cape Spear, Newfoundland, shows no long-term change in temperature. Generally, however, the results for the Atlantic and Pacific coasts agree with the general pattern of air temperature change in these areas.

As for other areas, such as the Gulf of St. Lawrence and the Arctic Ocean, records are either too short to give an accurate picture of climate change or need further analysis. It will be some time, therefore, before we have a good idea of how sea surface temperatures on all of Canada's coasts are changing.

Change in Sea Surface Temperature, 1914–2001

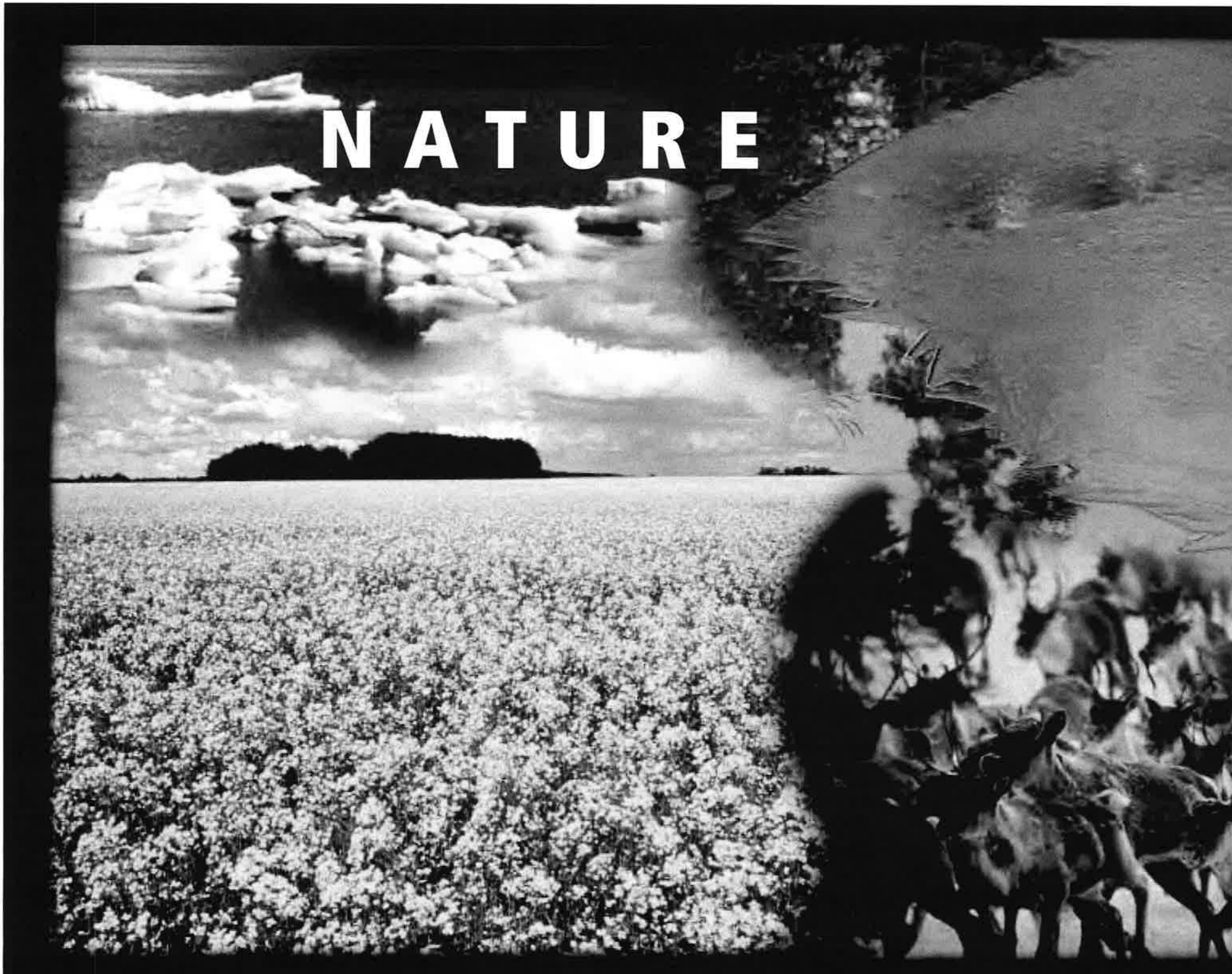
Source: *Environment Canada, with data from the British Columbia Ministry of Water, Land and Air Protection and Fisheries and Oceans Canada*

Sea surface temperatures have risen substantially on the west coast but appear to have changed little on the east. The rate of temperature change (in °C per century) is indicated in the blue circles. NC indicates no change.

Climate Change – What Next?

Canada's climate has changed, and in most regions of the country Canadians are now experiencing climates that are recognizably different from those that were familiar to their grandparents.

In looking at the indicators that follow, we should keep in mind that these changes are still continuing. In fact, the amount of climatic change seen over the past century is likely to be quite small compared to what most scientists expect to occur over the next 100 years and beyond. Changes that are now just becoming apparent are likely to become more obvious in the future, and other changes that have not yet been detected can be expected to emerge. That makes it important to continue tracking climate change and its many impacts. Indicators like the dozen that follow and others yet to be developed will be needed to help us understand those changes and their effects on us and our environment.



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Weather and climate shape the physical environment. As a result, changes in climate should be clearly reflected in changes to our seas, lakes, rivers, and lands.

Changes in climate also affect plants and animals. However, the effects on Canada's forests, on freshwater fish habitat, or on the spread of natural pests, for example, are harder to interpret because living things vary in their ability to adapt to different climates. They may be affected by other stresses as well, such as habitat loss or pollution.

The six indicators selected for this section focus on physical features and living things that have shown a very clear sensitivity to changes in climate. They are:

- Sea Level Rise
- Sea Ice
- River and Lake Ice
- Glaciers
- Polar Bears
- Plant Development

Rising sea levels are making Canadian coasts more vulnerable to flooding and erosion.

Rising sea levels threaten familiar shoreline environments. Coastal wetlands, which are important ecosystems and barriers against shoreline erosion, gradually disappear. Bluffs and beaches are more exposed to erosion by waves, groundwater is more likely to become contaminated by salt water, and low-lying coastal areas may be permanently lost. In addition, wharves, buildings, roads, and other valuable seaside property face a greater risk of damage as a result of flooding from storms.

Although global sea levels have been rising since the last ice age, a changing climate is causing them to rise faster. That's mainly because a warmer climate causes sea water to expand as it warms, but water from melting glaciers and polar ice caps is also contributing to the rise. Over the past century, these factors have raised the average level of the world's oceans by between 10 and 20 cm.

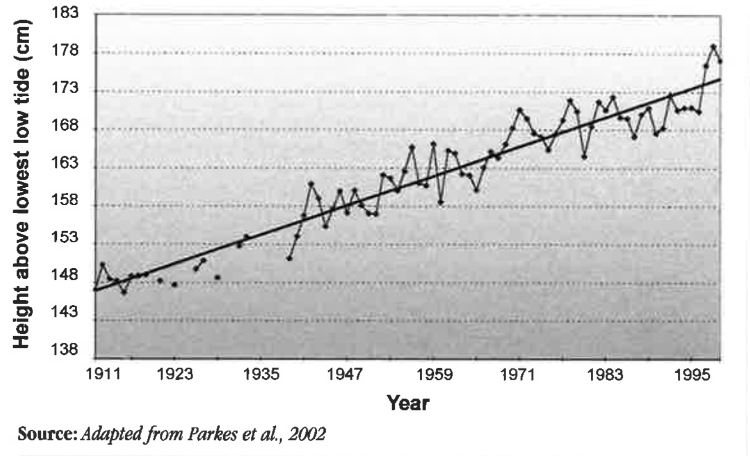
Local movements of the land as it adjusts to post–ice age changes can affect sea level too. Along coasts where the Earth's crust is rising, sea levels will increase more slowly or may even fall. Where the Earth's crust is sinking, sea level rise will be greater. As a result, changes in sea level can vary considerably from place to place.

FOCUS: Charlottetown, P.E.I.

Charlottetown is seriously threatened by rising sea levels. Much of its historic core lies just a few metres above the sea, and over the past century the city's average sea level has risen by nearly 30 cm. About 20 cm of that increase is probably the result of local sinking of the land after the last ice age. The rest can be linked to global sea level changes resulting from a warmer climate.

Charlottetown is not about to disappear permanently under the ocean, but higher sea levels are increasing its exposure to severe flooding from storm surges. Storm surges are caused by low air pressure and onshore winds and can temporarily raise the local water level a metre or more above normal. When a large storm surge occurs at the same time as very high tides, extensive flooding occurs.

Between 1911 and 2001, seven storm surge events were large enough to flood the Charlottetown waterfront. But as the sea continues to rise, increasingly smaller storm surges will cause flooding, and large storm surges will reach further inland if the land is not protected. If the sea had been at its present level throughout the twentieth century, storm surges would have flooded the city's waterfront on two more occasions.



Source: *Adapted from Parkes et al., 2002*

The annual sea level at Charlottetown between 1911 and 1998 is shown here in centimetres above the lowest expected low tide level. As well as contributing to long-term increases in sea level, climate also contributes to seasonal and year-to-year variations.

THE BIGGER PICTURE

With the longest coastline in the world, Canada is threatened on several fronts by rising sea levels. However, the possible impacts vary considerably from one place to another. In Atlantic Canada, coastal areas face the possibility of more frequent storm-induced flooding and greater rates of erosion. In Quebec, there is a growing risk that seaside roads along the North Shore of the Gulf of St. Lawrence, on the Gaspé Peninsula, and on the Îles-de-la-Madeleine will be damaged by coastal erosion and landslides.

Another highly vulnerable area is the Beaufort Sea coast – one of the few parts of the Arctic where sea levels appear to be rising. Coastal erosion there is made worse by the melting of sea and ground ice and is already causing the loss of town waterfront and structures in places such as Tuktoyaktuk.

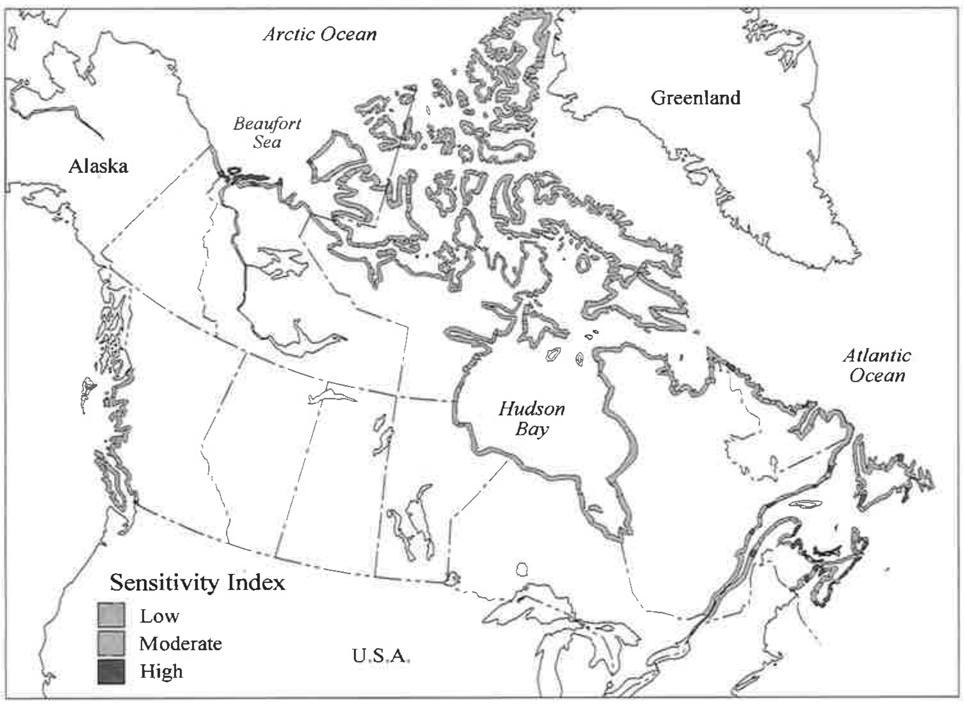
In B.C. much of the coast is too steep and rocky to be seriously affected by sea level rise. Nevertheless, Prince Rupert, the highly urbanized Fraser Delta, and many low-lying areas of ecological and archaeological interest on Vancouver Island, the Queen Charlottes, and the Gulf Islands face a growing risk of flooding and erosion as a result of higher sea levels.

THE GREAT STORM SURGE OF JANUARY 21, 2000

The storm rolled in from the Carolinas, walloping Atlantic Canada with up to 54 cm of snow and a 1.4-metre storm surge that reached parts of the Canadian coast just as unusually high tides were nearing their peak. The maximum water level exceeded the previous record by almost 40 cm in Charlottetown and even more along parts of the New Brunswick coast. As the storm passed through, massive chunks of ice piled up against the shore and the sea rushed in, flooding streets and buildings.

In Charlottetown, ice damaged wharves and knocked a lighthouse off its foundations. Much of the downtown core was flooded, power supplies were threatened, and city workers made makeshift dikes out of snow to hold back the incoming water. At the city's largest hotel, floodwaters came within metres of the underground parking garage.

Buildings were flooded and several people had to be evacuated from homes in seaside communities around P.E.I. and across the Northumberland Strait in New Brunswick and Nova Scotia. In Shediac, New Brunswick, boats and a backhoe were pressed into service to rescue stranded residents. At Malagash Point, Nova Scotia, two cottages were lifted off their foundations and carried several hundred metres down the beach. The storm also brought severe damage to the island of Newfoundland. High waves battered homes in Port aux Basques, while in Lamaline, on the Burin Peninsula, several houses were flooded and a breakwater was destroyed. Residents described it as the worst flooding to hit the village since the tidal wave of 1929. Miraculously, no lives were lost, but the storm left millions of dollars of damage in its wake.



Source: *Natural Resources Canada*

Sea levels on both the Atlantic and Pacific coasts are rising but they are falling along much of the Arctic coast. The possible impacts of sea level rise depend not only on the rate of increase but on the coastline's sensitivity to higher sea levels. Sensitivity is determined by such factors as the height of the shoreline, its resistance to erosion, and the force of incoming waves.

FOCUS: The Western Arctic

"The sea ice, which is like land to us Inuit, has started to change..."

Sea ice is essential to the survival of many Arctic animals, and people in northern communities depend on it for hunting and fishing. It protects sensitive coastlines from wave erosion, and it influences local air and water temperatures and the changing of the seasons. It is also a danger to offshore oil rigs and an obstacle and hazard to shipping. Sea ice occurs along more than 90% of Canada's coastline. Only the Pacific coast is ice-free all year.

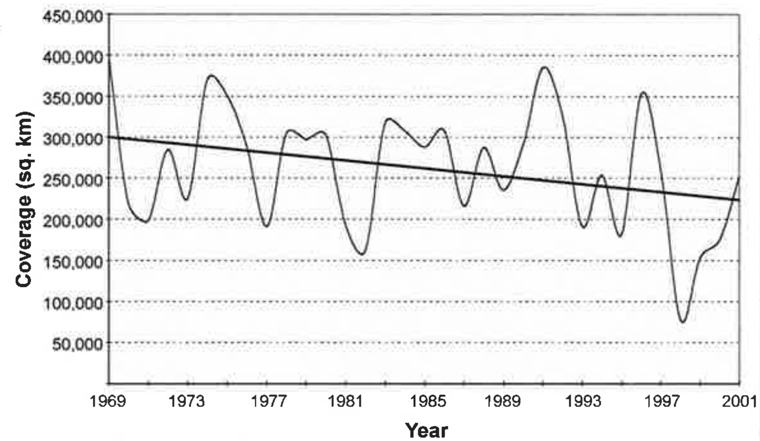
Canadian Arctic waters are almost completely ice covered in winter, but the ice normally begins to melt in July and doesn't refreeze until October. Some more southerly areas, like Hudson Bay and the Beaufort coast, become almost completely ice free in August and September. Other areas retain some or even quite a bit of ice cover throughout the year.

Sea ice is affected not only by air temperature but also by wind, snow cover, sunshine, the temperature and saltiness of the sea, and ocean currents. Changes in any of these factors can cause large year-to-year variations in the extent and thickness of sea ice and in the length of the ice season. Over the longer term, though, changes in air temperature are one of the most important influences on the amount of sea ice.

The western Arctic warmed considerably during the latter half of the twentieth century. It is therefore an area where we might expect to see a decrease in the amount of sea ice as a result of more melting in summer. That, in fact, appears to be happening. Over the past three decades, the area covered by sea ice throughout the year has shrunk by an average of about 80,000 square kilometres. That's an area slightly larger than New Brunswick and about a quarter of the area covered at the end of the 1960s.

The ice may also be getting thinner, but estimates of how much thinner are difficult to obtain. American scientists, using data collected by submarines, concluded that the average ice thickness in the Beaufort Sea at the end of September had decreased by about 45% between 1958–1976 and 1993–1997. Those results, however, were based on only a small number of submarine tracks. A more recent Canadian Ice Service study suggests that the ice may have thinned by only a quarter of that amount. Ongoing research suggests that the answer may lie somewhere between these estimates.

Permanent Ice Coverage – Western Arctic



Source: *Environment Canada*

Permanent sea ice is ice that doesn't melt in the summer but remains throughout the year. In the western Arctic, the area covered by permanent sea ice has decreased by about 25% since 1969. Because these records cover only a few decades, however, we can't be completely sure whether this trend is the result of natural variations in the Arctic climate or longer-term climate change.

An ice road crosses the frozen Beaufort Sea.

THE BIGGER PICTURE

Sea ice coverage has decreased in the eastern Arctic as well and at about the same rate as in the west. In Hudson Bay, the ice-free season is now more than a week longer than it was 30 years ago. Along the Atlantic coast and in the Gulf of St. Lawrence, however, no clear trend has developed. In 2002, ice coverage in the Gulf hit its lowest level in more than 30 years, but ice accumulations in the area have varied considerably from one decade to another.

Changes in Arctic sea ice are now making it harder for some polar bear and seal populations to survive. For many Northerners, travel over the ice has also become more dangerous and less reliable, and hunting on the ice has become more difficult. In addition, sensitive coastal areas along the Beaufort coast and in the Gulf of St. Lawrence face a higher risk of erosion as longer ice-free periods increase the exposure of shorelines to high waves from storms.

In the Arctic, the season open to shipping is becoming longer, promising easier access to northern resources and renewing interest in trans-Arctic shipping routes. As other nations become more interested in these routes, however, Canada's sovereignty over its Arctic waters may be challenged.

Less sea ice can also mean more climate change. Ice, like snow, reflects much of the sun's energy back to space. When less ice covers the oceans, more of the sun's energy is able to warm the Earth's surface and temperatures rise higher and faster, particularly in polar regions in the spring.

Seal pups are born on the ice and must stay there until they can swim. In early 2002, many harp seal pups were lost in the Gulf of St. Lawrence when a mild winter resulted in a lack of sea ice.

SEA ICE AND THE INUIT

The Inuit, who rely on the ice for hunting and fishing, have an extensive knowledge of past and present ice conditions. The changes reported by the Inuit observers below not only provide further evidence of sea ice loss but also show how Inuit life is being affected.

"We used to go on the sea ice with dog sleds to hunt seals – now we have to use boats....We used to go a long way out – now we hunt close to shore."

Andy Carpenter (Sachs Harbour, Northwest Territories)
Sea Ice Variability and Climate Change Workshop, University of Winnipeg, 2002

"The sea ice, which is like land to us Inuit, has started to change its characteristics. The sea ice now shears off, and once it starts to melt there is no stopping it."

Larry Audlaluk (Grise Fiord, Nunavut)
Elders' Conference on Climate Change, Cambridge Bay, 2001

"Thin ice is now the norm in Frobisher Bay....Even in what we used to call early spring, the sea ice is now precarious and downright unnavigable by snowmobile in some areas."

Pauloosie Kilabuk (Iqaluit, Nunavut)
Elders' Conference on Climate Change, Cambridge Bay, 2001

"Now, even before the end of May, the sea ice has broken away. We have had a few cases where Inuit had to be rescued by boat, as a whole coastline had become ice-free. We may no longer be able to harvest seals or polar bears."

Zach Novalinga (Sanikiluaq, Nunavut)
Elders' Conference on Climate Change, Cambridge Bay, 2001

Freeze-up and breakup times are changing, and northern communities are worried about the consequences.

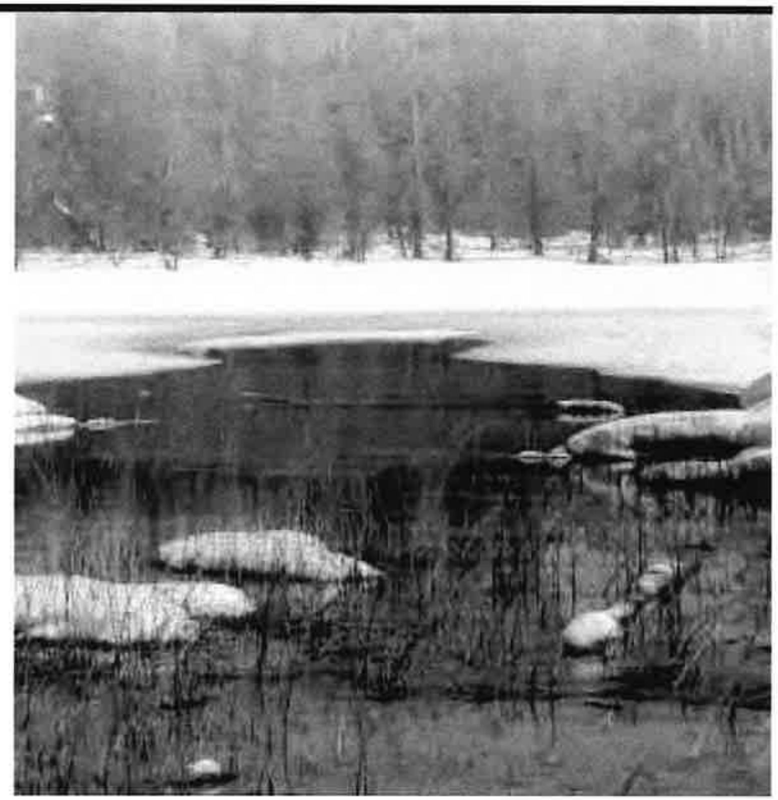
The formation and breakup of ice on rivers and lakes marks not only the changing of the seasons but also a change in the way that water can be used for travel, fishing, and recreation. It has important consequences for fish and other aquatic life too, because ice blocks the transfer of oxygen from the air to the water. In addition, changes in the duration of ice cover can affect the food supply for aquatic life, while changes in freeze-up and breakup times can cause birds to change their migration patterns. Spring breakup on rivers also brings a risk of floods caused by ice jams and damage to bridges and other structures from floating ice and debris.

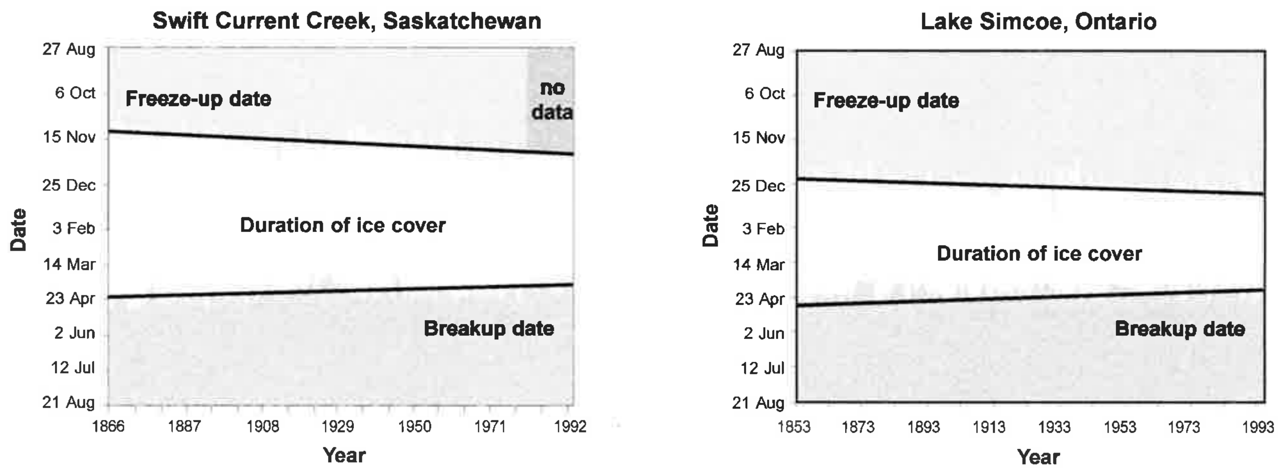
The timing of freeze-up and breakup depends on a number of things, including precipitation, wind, sunshine, and various features of the water body itself, such as its size and the characteristics of its currents. Spring breakup times are more variable because they are also influenced by the amount of snow cover and the coldness of the preceding winter. Air temperature, however, is particularly important for both freeze-up and breakup, and changes in the timing of these events provide a good reflection of trends in fall and spring temperatures.

FOCUS: Saskatchewan and Ontario

Over the years, many people other than scientists have kept surprisingly good records of freeze-up and breakup dates. Where such records are available, freeze-up and breakup times can sometimes be traced back a century or more. In the case of the two locations shown here – Swift Current Creek in southwestern Saskatchewan and Lake Simcoe in south-central Ontario – the records date from the 1860s and 1850s respectively. They show that the average freeze-up date for Lake Simcoe is now about 13 days later than it was 140 years ago, and the average breakup date is about 4 days earlier. For Swift Current Creek, over a period of about 115 years, the change is more dramatic. Freeze-up is now about 24 days later and breakup about 14 days earlier.

These results are what might be expected from the temperature record of the past century, which shows more warming in southern Saskatchewan than in southern Ontario.





Source: *M. Futter/Ecological Monitoring and Assessment Network*

Over the past century and a half, Swift Current Creek and Lake Simcoe have been freezing later in the fall and breaking up earlier in the spring.

000164

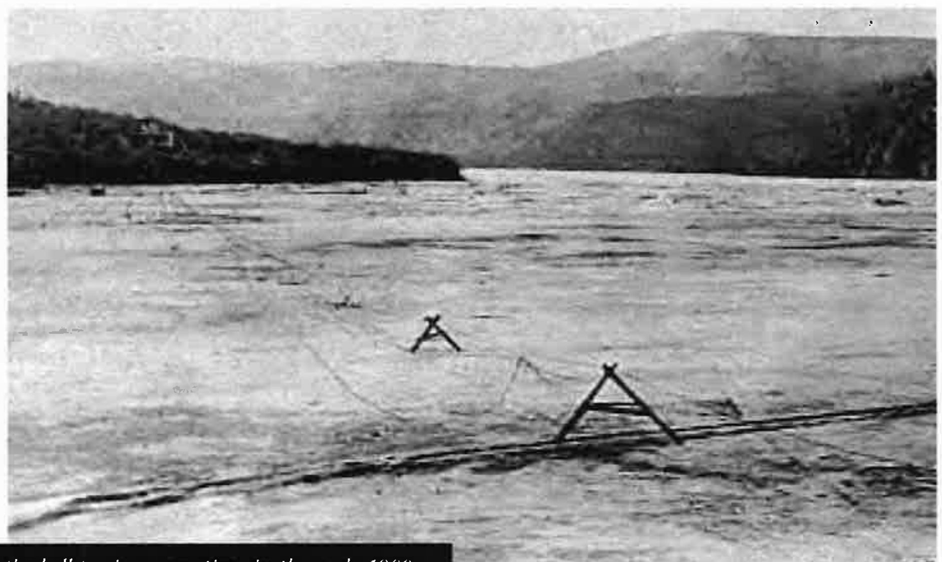
THE BIGGER PICTURE

An international team of scientists recently used various historical records to compile freeze-up and breakup dates for 39 rivers and lakes in Europe, Asia, and North America. They found that over the past 150 years, these lakes and rivers were freezing later in the fall and breaking up earlier in the spring. They concluded that across the Northern Hemisphere freeze-up is now occurring an average of 5.8 days later than it did a century ago, while breakup is happening 6.5 days earlier. In Canada the few rivers and lakes for which we have long historical records – like Swift Current Creek and Lake Simcoe – tend to fit the pattern of later freeze-up and earlier breakup.

BETS AND BELLS ON THE YUKON – SPRING BREAKUP AT DAWSON CITY

Thanks to the gambling instincts of a few prospectors, breakup records for the Yukon River at Dawson City go back to 1896. That spring, after betting on the exact minute when the breakup would start, the men set a series of wooden tripods across the middle of the river, ran a cord from them to a bell on the shore, and waited for it to signal the first shifting of the ice.

The bell has been set up every year since. It has rung as early as April 9 and as late as May 28. For most of the twentieth century, breakup was a May event, but since the mid-1980s April breakup dates have been more common. The average spring breakup date now arrives about 6 days earlier than it did a century ago.



Waiting for the bell to ring, sometime in the early 1900s.

Our most extensive and reliable source of scientific data for Canada, however, covers only the past 30 to 50 years and reveals a more complex pattern. It shows breakup starting earlier in the spring almost everywhere in the country except in the Atlantic region – but it also shows a widespread tendency towards earlier freeze-up dates in the fall. The net result is that there has been an increase during this period in the amount of time that most Canadian rivers and lakes remain ice-covered. The largest increase – more than a month – has been in Atlantic Canada.

These results match up well with the way that temperatures have changed in different seasons and different parts of the country over the past half century. Although they differ from the longer-term results, they don't contradict them. They merely reflect the fact that different patterns may show up when climate is viewed over shorter and longer periods.

As a result of a recent string of warm years, there has been increasing concern about the difficulties that a shorter or more unpredictable ice season might bring to isolated northern settlements. Frozen lakes and rivers are essential to winter travel in the North. Hunters and trappers depend on them. So do whole communities whose supplies are trucked in from the south on winter roads that are built in part over frozen rivers, lakes, and bogs.

Manitoba, for example, builds about 2400 km of these roads every winter, and more than 25,000 people in 29 settlements rely on them. In 1997–1998, when the winter road season was unusually short, the provincial government had to supply these communities by air. The additional costs reached $14 million, or about three times the cost of building the winter road system. During the winter of 2001–2002 a number of the roads did not open until February, and one did not open at all.

00169

Glacier shrinkage is changing the landscape and threatening water supplies.

Glaciers are powerful tourist attractions, but they are also a significant source of water for many rivers and streams. They therefore have a great influence on stream flow and the things that depend on it, such as power generation, irrigation, municipal water supplies, fish and other forms of aquatic life, and recreation.

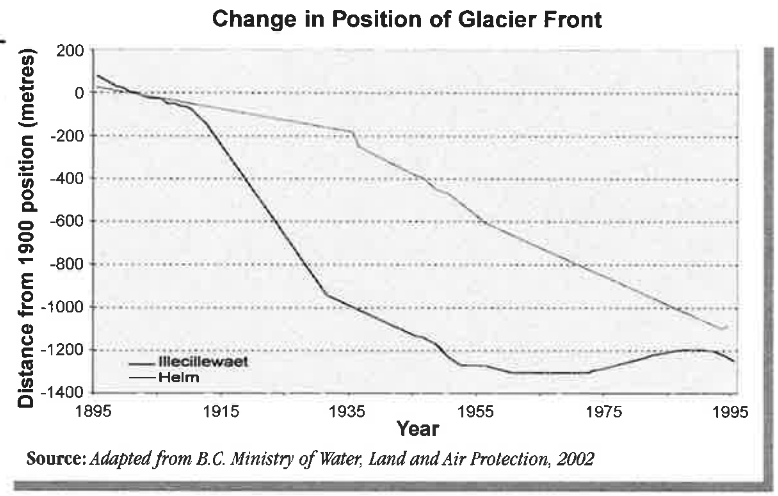
The total size of a glacier is closely linked to two climate-related phenomena: the amount of snow that falls on it in the winter and the amount of snow and ice lost to melting in the summer. Growth or shrinkage of the glacier eventually causes its front to advance or retreat, although the position of individual glacier fronts can change at different rates because of differences in the glaciers' elevation, length, speed of movement, and other factors.

Warmer temperatures increase the rate at which a glacier melts, and so does more rainfall. More snowfall, on the other hand, adds to a glacier's growth. In most areas, however, warmer temperatures are having a greater effect on glacier size than changes in either rain or snow.

FOCUS: British Columbia

Most of the glaciers and icefields in British Columbia have lost substantial amounts of ice over the twentieth century. The indicator presented here records what is happening to two mountain glaciers in different parts of southern B.C. – the Helm Glacier in Garibaldi Provincial Park north of Vancouver and the Illecillewaet Glacier in Glacier National Park near the Alberta border.

As the graph shows, both glaciers shrank by more than a kilometre between 1895 and 1995, although they have done so at different rates. The Helm Glacier has shrunk fairly steadily, but the Illecillewaet Glacier has changed more erratically, shrinking rapidly in the early part of the last century but then advancing in the 1970s and 1980s before staring to shrink again. The temporary growth was probably a result of a period of increased snowfall at higher elevations that offset the melting at lower levels.



Source: *Adapted from B.C. Ministry of Water, Land and Air Protection, 2002*

The graph plots the distance in metres between the positions of the glacier fronts in 1900 and their positions in other years. The minus values indicate that the glacier front has shrunk from its position in 1900.

Illecillewaet Glacier, 1999

000166

Since 1950, the greatest warming in Canada has occurred in the west and the northwest. Most glaciers in these regions are also shrinking rapidly. The 1300 or so glaciers on the eastern slopes of the Rockies, for example, are now about 25% to 75% smaller than they were in 1850. The area of warming also covers many of the High Arctic islands in Nunavut, where glaciers such as the Melville Island South Ice Cap have been shrinking gradually since at least the late 1950s. In eastern Nunavut, however, the situation is more complex: some glaciers are shrinking, while others are growing.

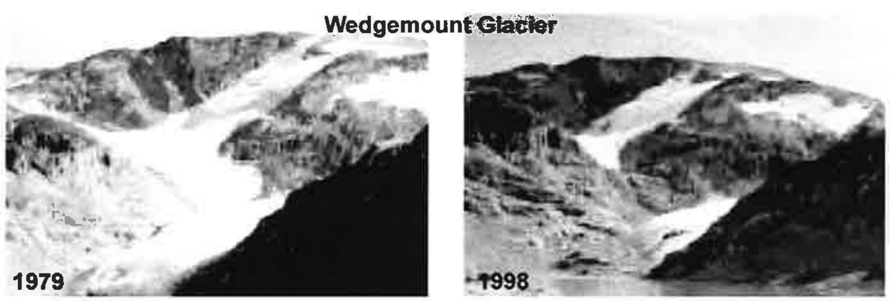
The melting of glaciers is a concern for Alberta, Saskatchewan, and Manitoba. Farmers depend on glacier-fed rivers like the Saskatchewan and the Bow for irrigation water, and cities like Edmonton, Calgary, and Saskatoon rely on them for municipal water supplies and recreation. At The Pas in Manitoba, reduced flows on the Saskatchewan could interfere with the native fishery and hydroelectric power generation.

Although the early stages of glacier shrinkage from melting are likely to increase the water supply to rivers, the flow of meltwater will eventually decrease as glaciers get smaller. The loss of water could be substantial. In a dry August, for example, about 25% of the water in the Bow is glacial. Recent evidence indicates that the amount of glacier water entering the Prairies' largest river, the Saskatchewan, has already begun to decrease.

What's happening in Canada is happening in other parts of the world. According to the World Resources Institute, the total size of the world's glaciers has decreased by about 12% during the twentieth century.

GLACIER FACTS

- Put them together in one place and Canada's 200,000 square kilometres of glaciers and icefields would cover an area about half the size of Newfoundland and Labrador. After Antarctica and Greenland, Canada has more glacier ice than any other part of the world.
- Meltwater from glaciers along the Alberta–B.C. border ends up in all three of Canada's oceans – the Pacific, the Arctic, and the Atlantic (through Hudson Bay).
- The Thompson glacier on Axel Heiberg Island in the Canadian High Arctic is growing while the neighbouring White glacier is shrinking. Both have been affected by earlier cooling and more recent warming, but the smaller White glacier has responded faster to the warming.
- Glaciers trap air, and all the chemicals in it, when they freeze. Air bubbles trapped in the ice are a valuable source of information about past climates and environments. More recently, glaciers have become a resting place for toxic chemicals deposited from the air. When the glaciers melt, these chemicals are released into rivers and lakes. Toxic chemicals that were once stored in the ice of Bow Glacier have now been detected in the waters of Bow Lake in Banff National Park.
- Alpine ice patches – mini-glaciers just a few hundred metres long or wide – are disappearing rapidly from Yukon mountain ridges. Their disappearance is producing a treasure trove of ancient human and animal artifacts. Because the ice is vanishing so rapidly, however, archaeologists are having trouble investigating all the new discoveries before the material decays or is disturbed.
- Wedgemount Glacier near the resort town of Whistler, B.C., has shrunk hundreds of metres in just the past two decades.



Source: *Adapted from Canadian Geographic, 1998, and National Atlas of Canada*

Areas with glaciers and ice caps, shown here in blue, are found in B.C., Alberta, Yukon, the Northwest Territories, and Nunavut.

001171

Polar bears are superbly adapted to the frozen Arctic environment. But can they survive in a warmer world?

Polar bears spend most of their lives on a frozen sea. This harsh environment is critical to their survival, because it is on the sea ice that they find the seals that are their main source of food.

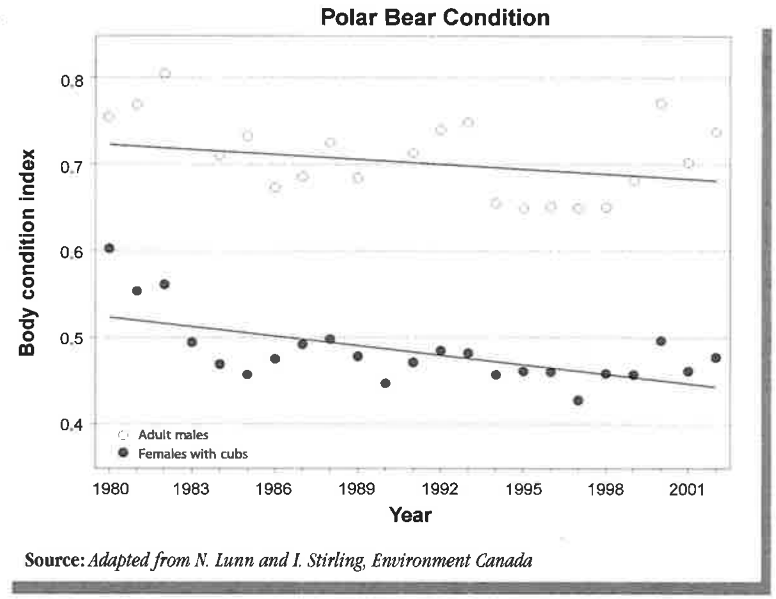
Climate change is expected to reduce the extent and thickness of sea ice in many parts of the Arctic and cause it to break up earlier. A shorter ice season would not only make it more difficult for polar bears to hunt but could also affect the abundance of their prey. These changes, if they continue, could eventually threaten the survival of polar bears in many, though not all, parts of Canada's North.

FOCUS: Western Hudson Bay

Polar bears in the northern Arctic can stay on the ice year-round, but on Hudson Bay the sea ice breaks up in the summer and is half gone by late June or mid-July. Although the bears stay on the ice as long as possible, they eventually come ashore, usually by late July or early August. While on land they eat very little, living mostly on fat reserves built up during their last few months on the ice. The later they leave the ice, the fatter they are, and the better their chances of survival. If the ice breaks up early, the bears must survive longer on less fat.

The timing of breakup varies considerably from one year to another, but by the late 1990s the ice on the western side of the bay was breaking up about two weeks earlier on average than it had in the late 1970s. According to scientists who have been studying polar bears in the region during those same years, the trend towards an earlier breakup has been matched by a decline in the physical condition of the bears. The animals have been getting thinner during their stay ashore and their birth rate has fallen. Although other factors can affect the health of polar bears, earlier breakup of the sea ice is the most likely cause of poorer health among the western Hudson Bay bears.

With little more than 20 years of data available, researchers can't yet point to a long-term decrease in the size of the polar bear population. However, if the body condition of the bears continues to decline over the next few decades, it seems certain that birth rates and population will decline also.



Source: *Adapted from N. Lunn and I. Stirling, Environment Canada*

The body condition index (which measures the relationship between weight and body length) provides good evidence of the general health of polar bears. The higher the index number, the healthier the bears. The decline in body condition since the early 1980s appears to be caused by a trend towards earlier breakup of the sea ice. That trend, in turn, is related to an increase in spring air temperature, which has risen at an average rate of 0.2–0.3°C per decade since 1950.

THE BIGGER PICTURE

There are as many as 25,000 polar bears in the world, and most of them, about 15,000, are in Canada. None, however, have been studied as long as those of western Hudson Bay. As a result, not much is known about how bears in other regions may have been affected by changes in climate. Nevertheless, the Hudson Bay evidence does raise concerns about the possible fate of other populations in the southern Arctic if the tendency towards shorter ice seasons continues.

Seals also depend on the sea ice, especially as a place to raise their young until they are old enough to swim and feed on their own. A study by scientists and Inuit hunters in the Beaufort Sea area has shown that seal pups born during short ice seasons are in poorer than average condition, perhaps because of later birth or earlier weaning. A trend towards shorter ice seasons could therefore result in a declining seal population. That, in turn, could create further survival problems for polar bears.

CHANGING ECOSYSTEMS

As climate changes, different plants and animals are affected in different ways. Some may benefit and expand their range and population. Others may migrate to areas where the environment is more favourable. If they don't, or can't, they face a more difficult existence or even extinction. As a result, changes in climate are altering and reshaping many of Canada's ecosystems. These changes are most evident in the North, but they are happening in other parts of the country too.

- New species are being seen in the western Arctic. Salmon have recently been reported in the Mackenzie River, while robins have been sighted on Banks Island. The bird is so rare in the area that there is no name for it in the local Inuvialuit dialect.
- Until recently, ring-necked ducks ranged no farther north than central B.C. In 1980 they were sighted in the northern Yukon and are now frequently seen in the area.
- The arctic fox can be found from Ellesmere Island to James Bay, but it is disappearing from the southern part of its range. Meanwhile, its southern cousin, the red fox, is advancing northwards.
- Until the 1980s, the Virginia opossum was unknown in southern Ontario. Milder winters now allow it to thrive as far north as Georgian Bay.
- Milder winters are also keeping long-tailed ducks in southern Ontario throughout the year. Because their feeding areas ice over less often, they now winter on the Lake Ontario shore instead of migrating further south.
- A comparison of fish surveys done in southern Ontario's Grand River watershed in 1983 and 1996 shows that many warm-water species are now colonizing the upper portions of the system, while many coldwater species have become less common.
- Since the mid-1990s, the explosion of the mountain pine beetle population in B.C. has resulted in the devastation of billions of dollars worth of timber. Warmer temperatures may be making it easier for the beetles to survive and multiply.
- In Manitoba, butterflies are appearing up to 12 days earlier in spring than they did 30 years ago.
- Red squirrels in southwestern Yukon now breed 18 days earlier on average than they did 10 years ago.

An arctic fox in its winter coat.

Major stages in the development of plants, such as budding, leafing, and flowering are triggered by seasonal changes in temperature, moisture, and the amount of light. In southern Canada, plants begin to develop rapidly when average daily temperatures reach and stay above certain critical levels.

As a result, the timing of plant development varies from year to year with changes in weather conditions. The early arrival of warm weather results in plants developing sooner, while their development is slower if warm weather is delayed. Over the longer term, these changes in the timing of plant development make a good indicator of changes in climate. Farmers, ranchers, and gardeners are especially interested in these changes because of their effects on the way that crops, livestock, and garden plants have to be managed.

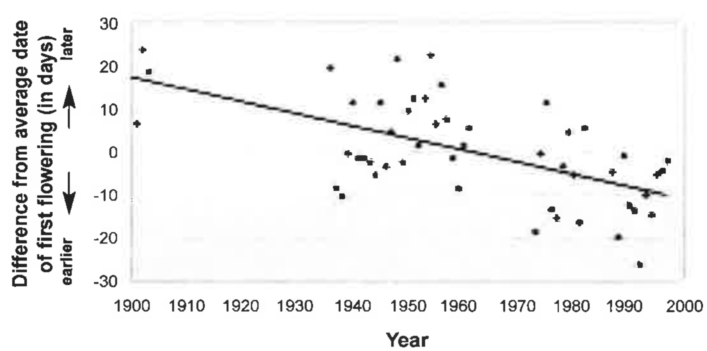
As our climate has changed, spring across much of the country has been getting warmer earlier. That should give most plants a head start on their development and result in the earlier arrival of noticeable events like budding and flowering.

FOCUS: Edmonton

At various intervals over the past 100 years, observers in the Edmonton area have recorded the flowering date for a common North American tree, the trembling aspen. Researchers from the University of Alberta put four of these sets of observations together to see if there had been any noticeable change in the flowering dates during the twentieth century. They found that between 1901 and 1997 the average date of flowering had advanced by about 26 days – from early May at the beginning of the century to early April at the end.

The trend towards earlier flowering coincides with warmer springs on the Prairies. During the twentieth century, daily high temperatures in spring increased, on average, by more than 2°C, and overnight lows increased even more. The city of Edmonton has warmed more than nearby rural areas, mainly because it has less green space and more asphalt and buildings. This "urban effect" may have also influenced the earlier flowering of the trembling aspen in the area.

Date of First Bloom: *Trembling Aspen*
Edmonton, Alberta



Source: *Adapted from Beaubien and Freeland, 2000*

The graph shows the difference between the average first-flowering date of trembling aspen in Edmonton (the zero line) and the flowering date for specific years between 1901 and 1997. Over the century, the first-flowering date advanced by about 26 days. Because flowering dates are not available for every year, this value is only approximate.

An aspen in full bloom.

00174

THE BIGGER PICTURE

Most studies of plant development in Canada cover periods of about 20 years or less. Nevertheless, these and the few long-term studies that are available agree with what was seen in Edmonton – most plants are reaching major stages in their development earlier in the spring. Since 1937, for instance, the average date of full bloom for McIntosh apple trees in Summerland B.C. has advanced by about 5 days. Similarly, the average date when lilacs come into leaf in the United States and southern Canada advanced by 5–6 days between 1959 and 1993. In Europe, where more data covering longer periods are available, the trends are even stronger. Satellite observations also show an earlier greening of the Northern Hemisphere. Northern forests are now coming into leaf several days earlier and losing their leaves several days later than they did in the early 1980s.

These changes could have important consequences for ecosystems, agriculture, and human health. Earlier development means a longer growing season, which creates opportunities for growing new crops and improving farm yields. However, disease-carrying and crop-eating insects could become more of a problem since their breeding and growth are also affected by temperature. Hay fever sufferers could find their miseries starting earlier too. In addition, complex ecological relationships could be upset if interacting species, like plants and the insects that pollinate them or birds and the insects they eat, respond at different rates to climate change.

NOVA SCOTIA'S THOUSAND EYES

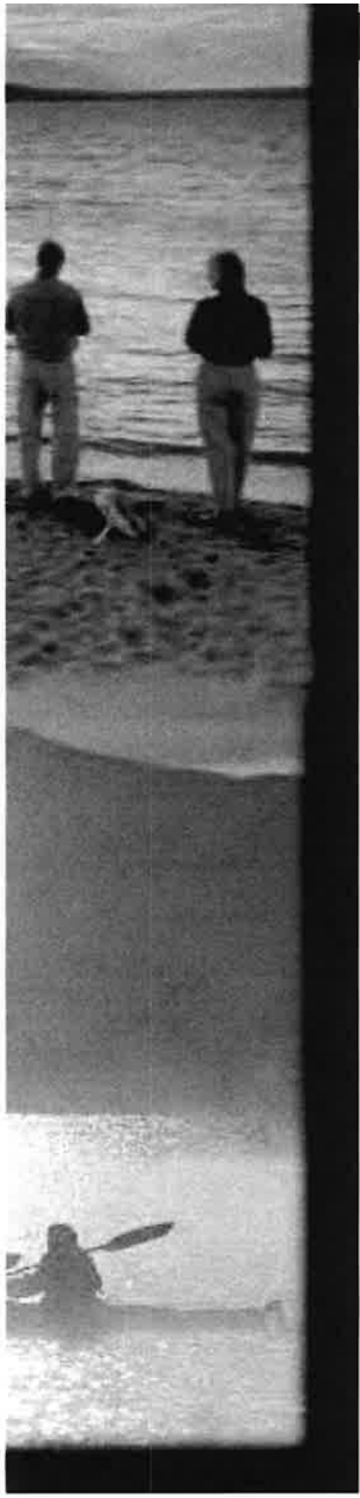
Between 1900 and 1923 hundreds of Nova Scotia students took part in a unique project that recorded more than 200 different seasonal natural events. It was the brainchild of Dr. Alexander MacKay, an innovative educator and naturalist and the province's superintendent of schools. The students recorded events as diverse as the flowering of plants, the emergence of butterflies, the return of migrating birds, and the occurrence of thunderstorms. Their observations were sent to Dr. MacKay and recorded in large, handwritten ledgers, which now provide an invaluable record of the seasonal behaviour of Nova Scotia wildlife in the early twentieth century.

A century later, Dr. MacKay's initiative has been revived as the Thousand Eyes Project. Once again, students are observing and recording natural phenomena, although this time other Nova Scotians can participate too. The project also uses the power of computers and an interactive web site to coordinate activities and to collate and report observations. As observations accumulate, it will be possible to compare today's results with those from 100 years ago. From these comparisons, scientists hope to get new insights into how Nova Scotia's climate is changing and how nature is responding.

A page from one of Dr. MacKay's ledgers, 1923.


PEOPLE

000172



People and their activities are greatly influenced by climate. How we earn our living, how we build our homes and communities, and how we spend our leisure time all depend on the kind of weather we expect.

As with natural ecosystems, it is not often easy to separate the influence of climatic changes on human activities from other influences. And unlike other species, we humans have a greater ability to lessen the impacts of such changes by using technology and by modifying our behaviour.

To consider some of the ways in which a changing climate may be affecting the daily lives of Canadians, this section examines the following six indicators:

- Traditional Ways of Life
- Drought
- Great Lakes–St.Lawrence Water Levels
- Frost and the Frost-free Season
- Heating and Cooling
- Extreme Weather

As Canadians learn more about trends in climate, they may want to know more about potential economic impacts. For example, how might changes in climate affect shipping seasons, construction methods, insurance requirements, and tourism opportunities? They may also wish to consider climate changes in evaluating potential health and social impacts, such as the spread of insect-borne diseases, injuries due to cold and heat extremes, and weather-related traffic accidents.

00177

The lessons of the past are less useful as a guide for the future.

The lives of many Canadians are closely tied to the land. This is especially true for aboriginal communities, who get much of their food from hunting and fishing and the harvesting of edible plants and berries. These traditional activities are also an important part of aboriginal culture, which contains a large amount of knowledge about climate and how it affects these activities and the environment that supports them.

The North's climate is changing, however, and it is changing faster than in most other parts of Canada. These changes are affecting many aspects of the northern environment, such as ice and terrain conditions and the supply of game, wild plants, and fresh water. As a result, native peoples are finding it harder to rely on the traditional knowledge and practices they have used for so long to survive in a region that is usually frozen for more than half the year.

FOCUS: Western Nunavut

Follow the line of the Alberta-Saskatchewan border north to the Arctic Ocean and you come to Coronation Gulf. The gulf and Bathurst Inlet to the east are the heart of a region known as West Kitikmeot. This region is home to the Bathurst caribou herd whose range extends across West Kitikmeot and south into the Northwest Territories.

In recent years, the Kitikmeot Inuit, who inhabit the region, have noticed dramatic changes in the local climate and environment. Winters and summers have become warmer, and sea and lake ice have been melting earlier in the spring. Fall freeze-up – an August or September event just a few decades ago – now happens mostly in October or November. The weather has also become more variable, and short-term temperature swings that cause repeated thawing and freezing have become more common. With a more variable climate, weather and ice conditions have become harder to predict, and that has made it more difficult and dangerous for hunters and others travelling on the land and ice.

The changing climate has affected plants and wildlife too. Summer vegetation is richer, and birds and animals rarely seen before are appearing more frequently. Because the Kitikmeot Inuit get much of their food from hunting, fishing, and sealing, they are affected by all of these changes.

They are particularly concerned, though, about the impacts on caribou. More plentiful vegetation can support a larger herd, but hotter summers put more stress on the animals, while the more rapid appearance of large expanses of open water in the spring forces them to alter their migration routes. More frequent thawing and freezing of the snow cover can result in starvation, because it leaves a thick layer of ice that the caribou can't dig through to reach the vegetation below. Thin ice is also a hazard. Two snowmobilers travelling in the Coronation Gulf area discovered stark evidence of this in 1996, when they suddenly encountered hundreds of antlers sticking through the ice – an "antler forest" that marked the site of a mass caribou drowning.

A caribou herd crosses an expanse of water.

THE BIGGER PICTURE

Climate change is a major concern throughout Canada's arctic and subarctic regions, and many communities have begun to record their observations of how it is affecting their environments and their lives. From the Yukon to central Nunavut most local observers agree that the climate is getting warmer. In eastern Nunavut, however, opinions are mixed as to whether it is warming or cooling, while in Nunavik (northern Quebec) residents have noticed warmer summers but more extreme cold in the winter. In northern Labrador, the perception is again one of general warming. In all regions, however, it is agreed that the weather has become more variable, stormier, and harder to predict.

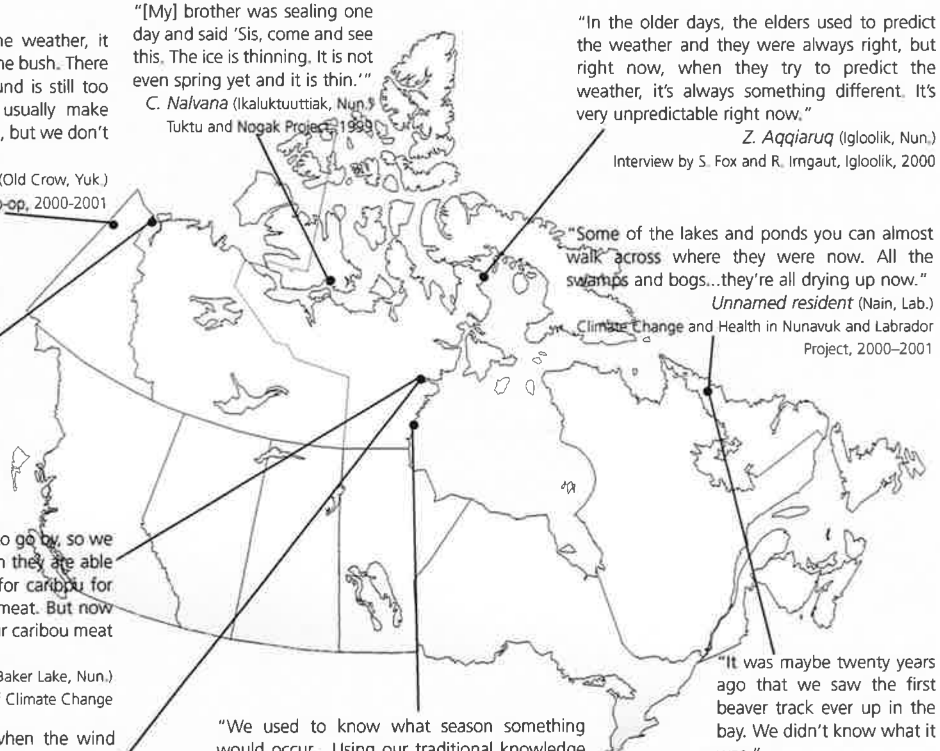
These observations generally agree with the scientifically measured trends, although the scientific record gives a stronger impression of cooling in the eastern Arctic than the reports of local observers do. This may be because local observers have given more emphasis to recent years, which have been unusually warm. The scientifically measured trends, on the other hand, cover a span of 50 years and include a greater number of cold years. But that could be changing. Parts of northern Quebec, at least, have been warming since the mid-1990s.

As a result of changes in climate, familiar environments are becoming less familiar. As in Kitikmeot, people in most parts of the North are noticing the arrival of birds, fish, and animals that have not been seen in their regions before. They are also noticing more unusual weather and more storms. Thunder and lightning, once very rare in the Arctic, are now being experienced more often, and in 2001 the Mackenzie Delta got its first tornado warning.

In coastal areas, people can no longer hunt, fish, or travel on the ice as often or as long as they used to, and thinning ice is making these activities more dangerous. Changing wind patterns are also making it more difficult to apply traditional navigational techniques like following the direction of snow drifts. Survival on the ice is more difficult as well, because stronger winds are often packing the snow harder and making it unsuitable for building igloos. Getting drinking water by melting sea ice is harder too, because old multiyear ice, which is mostly fresh water, is no longer as easy to find, and the more plentiful new ice is salty. In inland areas, problems such as melting permafrost and the drying of lakes and rivers are adding to the difficulties of tending traplines or travelling to hunting and fishing grounds in some areas.

Northerners are adapting to these changes in a number of ways – changing the timing of hunting and fishing activities, going to different locations, harvesting different types of fish and game, and being more cautious when travelling on the ice. Some changes also offer advantages. Extremely harsh winters are fewer and more time can be spent on the land in the summer. What is most endangered though is a way of life that has been based on a long relationship with the cold polar climate, a way of life that is very much a part of the identity of northern people.

CLIMATE CHANGE – THE NORTHERN EXPERIENCE



"Because of too much change in the weather, it makes it hard for people to go out in the bush. There is not much permafrost and the ground is still too soft under the snow. The grounds usually make cracking noises when it gets really cold, but we don't hear that anymore."
Shirley Kakfwi (Old Crow, Yuk.)
Arctic Borderlands Ecological Knowledge Co-op, 2000-2001

"[My] brother was sealing one day and said 'Sis, come and see this. The ice is thinning. It is not even spring yet and it is thin.'"
C. Nalvana (Ikaluktuuttiak, Nun.)
Tuktu and Nogak Project, 1999

"In the older days, the elders used to predict the weather and they were always right, but right now, when they try to predict the weather, it's always something different. It's very unpredictable right now."
Z. Aqqiaruq (Igloolik, Nun.)
Interview by S. Fox and R. Irngaut, Igloolik, 2000

"The snow melted in April. Usually the snow stays until June and waters the ground."
Unnamed resident (Aklavik, N.W.T.)
Arctic Borderlands Ecological Knowledge Co-op, 1998–1999

"Some of the lakes and ponds you can almost walk across where they were now. All the swamps and bogs...they're all drying up now."
Unnamed resident (Nain, Lab.)
Climate Change and Health in Nunavuk and Labrador Project, 2000–2001

"Traditionally we didn't have calendars to go by, so we observed the nesting of the birds. When they are able to fly that is the time to start hunting for caribou for clothing skins and to start caching the meat. But now in the month of August you can't do your caribou meat caching. It's too warm."
Eugene Niviatsiak (Baker Lake, Nun.)
From Inuit Knowledge of Climate Change

"The wind blows a lot harder and when the wind blows that hard it packs the snow...so hard that it's almost like ice and it's not good now. You can't make igloo shelters with it."
M. Aqigaaq (Baker Lake, Nun.)
Interview by S. Fox and M. Kaluraq, Baker Lake, 2001

"We used to know what season something would occur....Using our traditional knowledge you would know what was going to happen when, but you can't predict anymore."
Donald Uluadluaq (Arviat, Nun.)
From Inuit Knowledge of Climate Change

"It was maybe twenty years ago that we saw the first beaver track ever up in the bay. We didn't know what it was."
Unnamed resident (Nain, Lab.)
Climate Change and Health in Nunavuk and Labrador Project, 2000–2001

000179

Is drought becoming more frequent and severe? It's too soon to tell.

For farmers, drought means poor crops, more damage from insect pests, a greater risk of soil erosion by the wind, and possibly the need to sell off herds of cattle that can't be watered and fed. But drought can have many other impacts as well – water usage restrictions in cities, poorer water quality, higher food prices, lower power outputs from hydro dams, more forest fires, shrinking wetlands, and more stress on fish and waterfowl.

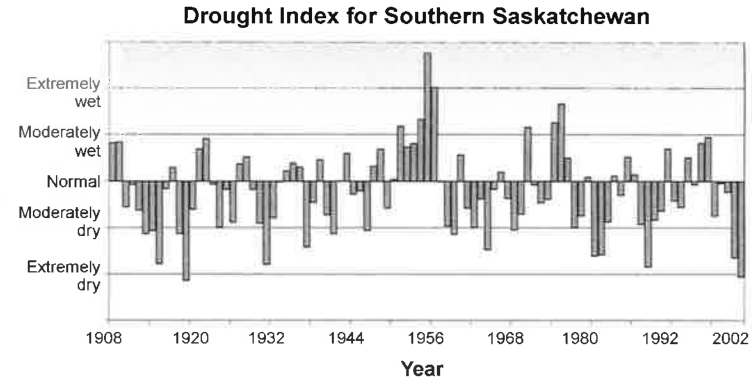
Although a warmer world is likely to be wetter overall, droughts could happen more often or be worse as a result of climate change. Why? In some areas it is because higher temperatures and a longer warm season could cause more moisture to be lost through evaporation than is gained from any increase in precipitation. Changes in weather patterns could also cause some places to get less rain than they used to while others get more. Or less rain might fall during the growing season (when it's needed) and more during the harvest season (when it's not).

FOCUS: The Prairies

The Prairies are one of Canada's most drought-prone regions. Their climate has also changed more over the past century than that of most other parts of the country, so it is here that we might expect an early indication of more frequent or more severe drought.

Climate records for the Prairies, however, do not show droughts happening more often than they did in the past. Nor is there any evidence yet that Prairie droughts are becoming more severe. Droughts that occurred 3–4 thousand years ago, for example, appear to have been worse than any in modern times.

Still, the most recent droughts on the Prairies have been quite severe. In fact, for some areas, 2001 and 2002 were drier than the driest years of the 1930s, when the region was devastated by the most destructive drought in Canadian history.



Source: *Adapted from R. Hopkinson, Environment Canada*

The index estimates the severity of drought on the basis of precipitation, the amount of moisture in the soil, evaporation, and other factors. It shows a number of droughts in the region over the past 100 years but no clear tendency towards either more severe or more frequent drought.

00180

Next to the Prairies, southern Ontario and the B.C. interior are the regions of Canada most affected by drought. Droughts also affect eastern Canada, but do not occur as often or last as long.

Although precipitation has generally increased in Canada during the twentieth century, there are some signs that severe dryness is occurring more often. The country as a whole, for example, has seen more extreme summer dryness – though not necessarily full-blown drought – in the second half of the century than in the first. Since the 1960s more of the country has also experienced unusually warm and dry spring weather. Two of the most severe and widespread droughts in Canadian history have occurred in the past 15 years. The drought of 1988 affected Ontario, Quebec, and the B.C. interior as well as the Prairies, while the drought of 2001 affected almost all of southern Canada and continued across the central and northern Prairies in 2002.

Could these recent events mark the beginning of a shift towards a more drought-prone climate? Perhaps. But more time will be needed to see if drought patterns in Canada are actually changing.

DROUGHT 2001

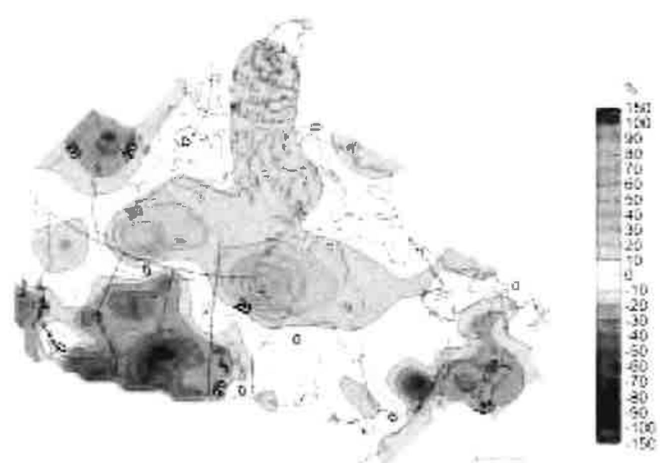
The drought of 2001 was one of the most intensive and widespread in Canadian history, affecting almost every farming region in the country. As so often before, it was worst on the Prairies, where wheat and canola yields fell by 43% from the previous year.

In the Great Lakes–St. Lawrence region, it was the driest summer in 54 years. Montreal's Dorval weather station recorded its driest April ever as well as a record 35-day rainless spell in the summer. Atlantic Canada had its fourth dry summer in five years, and both Charlottetown and Moncton reported their driest July and August ever. Most parts of B.C., in contrast, had a wetter than normal summer, but the preceding winter saw only about half the average levels of precipitation along the coast and in the southern interior.

While 2002 brought a return of normal conditions to the rest of the country, the drought lingered in many parts of central and northern Alberta and Saskatchewan. Failure of the hay crop forced many farmers to sell off their herds. Others more fortunate were able to keep going with surplus hay donated by eastern farmers. The soft wheat harvest was the smallest in 28 years, while barley yields hit a 34-year low. Canola fared poorly too, as output fell 35% below the already weak yields of the previous year.

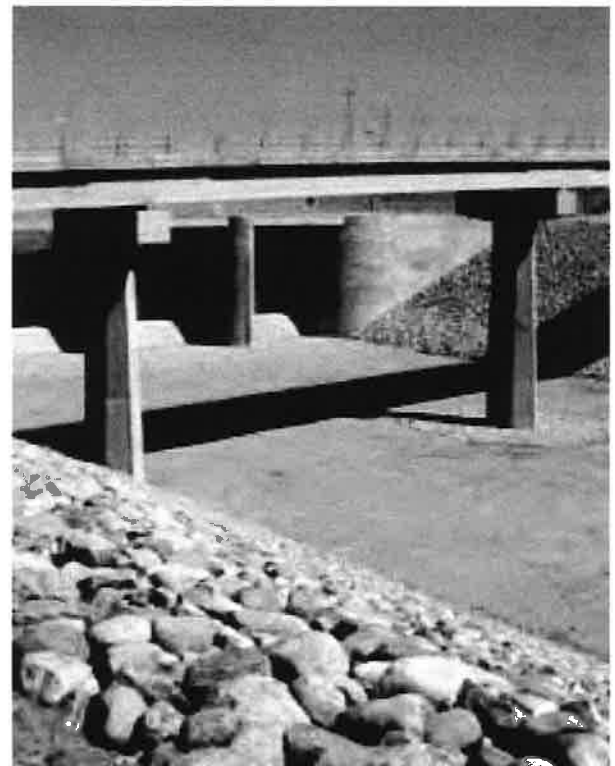
Farmers felt the effects most directly, but the impacts rippled through every level of the economy – from small-town merchants serving cash-strapped farming communities to consumers across the country facing higher prices at the supermarket.

Differences from Normal Precipitation, 2001



Source: *Environment Canada.*

In 2001 rain and snowfall totals for the year were below normal for much of Canada. During the summer, dry conditions affected almost every farming region in the country.



The St. Mary reservoir channel near Spring Coulee, Alberta, after 66 days with no rainfall, summer 2001.

Do recent drops in lake levels indicate a new trend or are they part of a natural cycle?

Water levels in the Great Lakes are the result of a balance between water entering the system (through inflows from rivers, rain, snowfall, snowmelt and runoff) and water leaving it (through outflows to rivers, evaporation to the air, and withdrawals for various human uses). Natural seasonal and yearly variations in these factors can result in temporary changes in lake levels, but more permanent changes could come about as a result of climate change.

Changes in the climate of the Great Lakes–St. Lawrence region have brought more rainfall to replenish lake waters, but they have also brought higher temperatures, a longer warm season, and a shorter ice season, all of which increase evaporation and water loss. If the increases in rainfall and evaporation balance each other, climate change may have little effect on lake levels. There are concerns, however, that continued warming will increase evaporation rates more than precipitation and cause lake levels to fall.

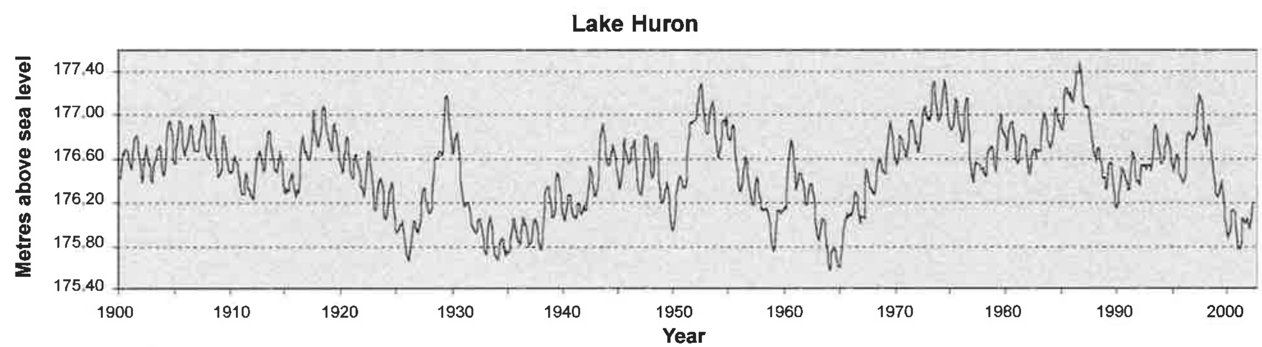
A significant lowering of lake levels could reduce the output of hydroelectric power, force ships to carry lighter loads, require cottagers to relocate docks, boathouses, and water intakes, and shrink or dry up wetlands that are important food sources and breeding grounds for fish and waterfowl. Extensive dredging would be needed to deepen channels and keep the connecting rivers between Lakes Huron and Erie navigable for commercial shipping. Similarly, the St. Lawrence River below Montreal might have to be totally transformed by the addition of dredged channels, locks, and dams to keep it open for large ships.

FOCUS: Lake Huron

Located in the middle of the Great Lakes system, Lake Huron is perhaps the most suitable of the lakes to use as an indicator of the effect of climate change on water levels. Lake Huron also reflects the influence of natural forces more directly than Lakes Superior and Ontario, where water levels are regulated to some extent by Canadian and U.S. authorities.

Over the past century, water levels in Lake Huron have not shown a consistent long-term trend. Instead, they have alternated irregularly every couple of decades between higher and lower phases. Extreme low water levels on the lake occurred in the mid-1960s, while the longest period of low-water levels was in the hot, dry years of the 1930s. Through the 1970s, 1980s, and most of the 1990s, lake levels were actually higher than the long-term average.

In the late 1990s, however, low water levels, similar to those of the 1960s, returned. It remains to be seen whether these signal the beginning of a longer trend or are just another phase in the lake's periodic swings between low and high water phases.



Source: *Environment Canada*

The graph shows changes in the average monthly lake level between 1900 and 2002. The level is given in metres above sea level. Although water levels in Lake Huron have varied considerably from decade to decade, no long-term change is yet apparent.

THE BIGGER PICTURE

Water levels in each of the Great Lakes and the St. Lawrence River are influenced to some extent by local climate and drainage conditions. Consequently, they do not always change in exactly the same way. Nevertheless, the long-term picture for Lake Huron is fairly representative of the system as a whole. Water levels in the Great Lakes have fluctuated within a range of about 1.8 metres over the past century, but no long-term trends have been apparent in any of the lakes or in the St. Lawrence River. Temperature changes in the region have been fairly small – about 0.5°C over 100 years – and that may be one reason why long-term changes in water levels have not yet appeared.

Still, concerns about low water levels remain, and one good reason is that the economic costs they impose are so high. Between 1988 and 1991, for example, when water levels at Montreal were 30 cm below average, the tonnage of goods passing through the port fell by 15%.

LOW WATER BLUES

After nearly three decades of high water levels, the rapid drop in lake levels in the late 1990s came as a sharp surprise to many. By 1999 the levels of all of the Great Lakes and the St. Lawrence River were below their long-term averages, and the system had lost almost as much water as flows over Niagara Falls in two and a half years.

In spite of above-average spring and early summer rains, water levels continued to drop in 2000. Cottagers found their docks on dry land and marina owners were forced to call in dredges to dig channels so they could keep their businesses open. Ships had to run lighter and higher in order to pass through canals and shallow channels, and hydroelectric power production was down substantially at both Niagara and Sault Ste. Marie.

The following year was not much better. In August, water levels in Montreal harbour were a record 95 cm below average. In late October, sustained high winds in Lake Erie pushed large volumes of water toward the lake's eastern end. This short-term effect caused already low water levels to fall a further 1.5 metres at the lake's western end and in the Detroit and St. Clair rivers. That was enough to make the link between Lakes Erie and Huron impassable for large vessels, and shipping traffic came to a halt until water levels rose two days later.

The Atlantic Huron transits the Welland Canal. For every 2.5 cm drop in water levels, a ship like this must travel 100 tonnes lighter to pass through the connecting waterways of the lower Great Lakes.

The frost-free season begins on the first day in spring when temperatures remain above freezing and ends on the first day in fall when freezing temperatures return. The earlier the frost-free season starts or the later it ends, the longer the growing season will be. A longer frost-free season is of interest to farmers and home gardeners alike because it gives them more choice in what they can grow and a better chance of seeing their annual crops and flowers survive to maturity.

The flip side of a longer frost-free season is a shorter frost season, and that is a benefit to governments that have to keep roads ice-free and for individuals and transportation companies that have to deal with ice hazards. It also means a longer season for construction. It is a disadvantage, however, to northern communities and to businesses like logging and oil and gas exploration that rely on frozen ground and waterways for moving goods and heavy equipment.

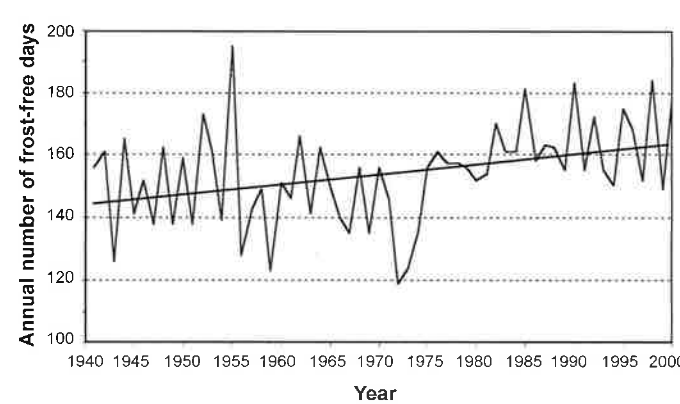
A number of factors can affect the persistence of frost. These include elevation, exposure to sunlight, vegetation, and proximity to water bodies or cities. As a result, even locations that are quite close to each other can have very different frost seasons. Air temperature, particularly the overnight low, is the dominant force, however, and regions that are becoming warmer can also expect to see shorter frost seasons.

FOCUS: Southwestern Ontario

Southwestern Ontario, with its mild climate and rich soils is prime farming country. Over the past century, it has warmed by about 0.5°C, somewhat less than the national average. Still, this has been enough to have a noticeable impact on the length of the frost-free period.

Temperature records for London airport, in the centre of the region, show that the average length of the frost-free season has increased by more than 18 days since the 1940s. The increase reflects a strong rise in winter and spring temperatures and especially in overnight lows.

Length of Frost-Free Period at London Airport, Ontario



Source: *J. Klaassen, Environment Canada*

A new soybean crop is off to a good start on this farm near London.

THE BIGGER PICTURE

The frost-free season has been getting longer in most other parts of Canada too. The biggest increases over the past 100 years have been seen in B.C. and on the Prairies. For most of Canada, spring has warmed more than any other season. Not surprisingly, then, the frost-free season has been getting longer largely because the last spring frosts are happening earlier.

While the frost-free season is getting longer on average, it can still vary considerably from one year to another, and unusually late spring or early fall frosts can still occur. While farmers thus face a smaller risk of losing a crop to frost, they still have to be cautious about planting too early or shifting production to varieties that require a longer growing season.

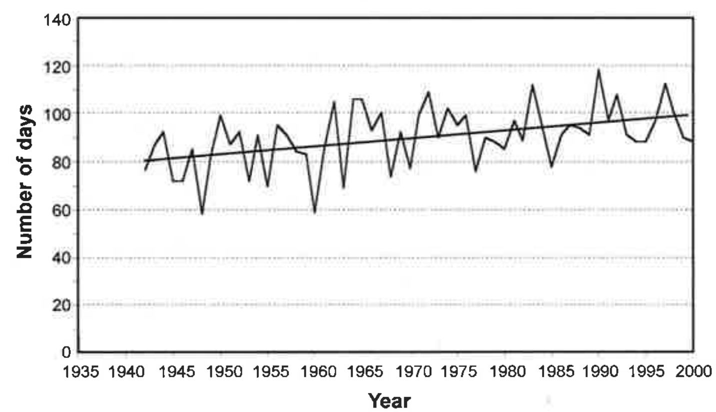
THE THAW-FREEZE-THAW-FREEZE SEASON

The transition from the frost to the frost-free season and back again is neither smooth nor sudden. As spring temperatures warm or fall temperatures cool, days with temperatures above freezing typically alternate with nights when temperatures are below the freezing point. Repeated cycles of thawing and freezing can be hard on trees and plants, especially in late winter or early spring. Large herbivores like deer and caribou suffer too, because refreezing puts a hard, icy crust on the snow that makes moving about and feeding difficult. When they occur in combination with rain and snow, thaw-freeze cycles also contribute to the weathering of building materials.

Preliminary studies indicate that in much of Canada thaw-freeze cycles are happening more often. Most of the stronger trends have been found in southern Ontario. The weakest have been in British Columbia. At Trenton, Ontario, thaw-freeze events have been increasing at the rate of 3.2 days per decade. At Swift Current, Saskatchewan, the rate is 3.9 days per decade. An interesting exception is the city of Toronto, where thaw-freeze cycles have been decreasing, possibly because of warming effects related to the city's growth.

Since the early 1980s, the construction industry has noticed that materials such as bricks and concrete are not lasting as long as expected in some parts of the country. Faster weathering as a result of more frequent thaw-freeze cycles is believed to be contributing to this problem, and because of it, building owners and taxpayers are facing added maintenance costs for buildings and other structures that use these materials.

Number of Thaw-Freeze Days per Year at Trenton, Ontario



Source: *J. Klaassen, Environment Canada*

A day with a thaw-freeze cycle is one in which the daily high is above freezing and the overnight low is below freezing. In the 1940s Trenton averaged about 80 days with thaw-freeze cycles. By the 1980s and 1990s that number had climbed to about 95.

Trends in Length of Frost-free Period (days/100 years)

Source: *Environment Canada*

Orange dots indicate a longer frost-free season, blue dots a shorter. The larger the dots, the greater the change in the length of the season. The x's indicate changes that are not statistically significant. The largest increase (about 50 days per century) has occurred in central B.C. The largest decrease (about 30 days per century) has been in St. Anthony's, Newfoundland.

The amount of energy needed to heat a home for a year depends on how many cold days there are in the year and on how cold it gets on each of those days. When the weather is slightly cool, a little bit of heat might be needed for a few hours in the evening or early morning to stay comfortable. On a very cold day, a lot of heat will be needed all day and all night. A day's average temperature gives some idea of how much heat will be needed on that day.

Climatologists use a measurement known as heating degree-days (HDDs) to estimate heating needs more precisely. They assume that people will use at least some heat on any day that has an average outdoor temperature of less than 18°C. They then calculate the heating needs for each day by subtracting the day's average temperature from 18. The result is the number of heating degrees for that day or HDDs.

Cooling requirements, known as cooling degree-days or CDDs, can be measured in much the same way. The assumption this time is that there is some need for cooling on days when the average temperature is above 18°C. Subtracting 18 from the day's average temperature thus gives the number of cooling degrees for that day or CDDs.

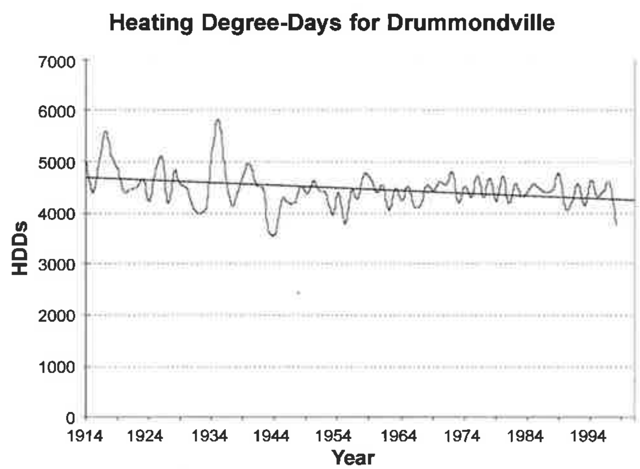
When the heating or cooling degrees for each day are added up for a season or year, the result is a very useful statistic that indicates how much demand there is for heating or cooling as a result of different climate conditions. The amount of energy actually needed to heat or cool a particular building will, of course, depend on many other factors, such as how well the building is insulated and the temperature that it is kept at.

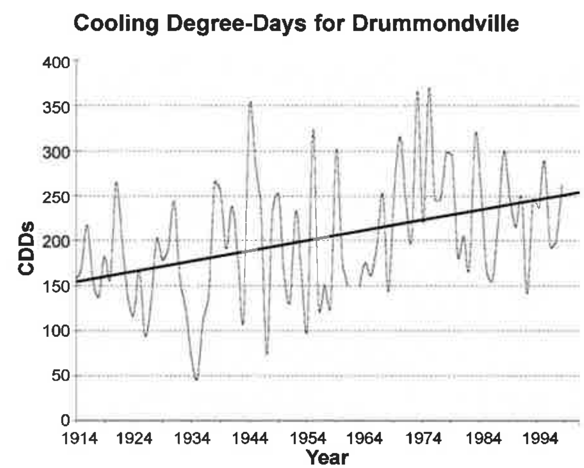
FOCUS: Drummondville, Quebec

In Canada, heating is always a bigger concern than cooling, and Drummondville is no exception. The city, 100 km northeast of Montreal, averages about 4500 HDDs a year, but with 250 CDDs a year (about the same as Montreal and Toronto) it still has plenty of hot summer days when air conditioning is welcome.

Over the past century, the average annual temperature in the Drummondville area has warmed by about 0.5°C – less than in some other parts of Canada but still enough to have had a noticeable impact on heating and cooling needs. At the beginning of the twenty-first century, Drummondville now averages 445 fewer heating degree-days per year than it did in the early twentieth century and has 100 more cooling degree-days. Those figures amount to a 9.5% decrease in HDDs and a 65.5% increase in CDDs.

Because the need for heating is much greater than the need for cooling, the energy savings from lower heating requirements are still more significant to the average person than any additional energy costs from higher cooling requirements. In fact, cooling becomes a significant cost only when people switch from electric fans to air conditioning to meet their cooling needs. As the cooling degree-day trend rises, however, more people may be inclined to make that change, and at that point cooling degree-days will begin to have an important impact on their budgets.





Source: *Environment Canada*

Because it is a large change in a small number, the increase in CDDs looks more important than the decrease in HDDs. However, the decrease in HDDs has had a greater impact on people's energy needs in Drummondville, simply because heating needs there are much greater than cooling needs.

00186

Heating degree-days in Canada vary from about 3,000 a year in balmy Victoria to about 13,000 in the Far North. Over the past century, HDDs have declined significantly in most of Canada.

Cooling degree-days range as high as 400 per year in the Windsor area of southwestern Ontario but average fewer than 100 in many parts of the country. Increases in cooling degree-days have been smaller and less widespread than the decreases in heating degree-days. Nevertheless, significant increases have occurred over the past century in southern B.C. and parts of the Prairies as well as in southern Quebec and the Maritimes. These trends are consistent with the way that our climate is changing – that is, both winters and summers have been getting warmer, but winters have warmed more.

In cities, these trends may also be affected by what is known as the heat island effect. City surfaces, like roads, buildings, and rooftops, absorb large amounts of heat from the sun during the day and then release it at night as they cool. Cars, furnaces, air conditioners, and other heat-producing equipment also add warmth to city air. As a result, temperatures within a city, especially a densely built downtown core, are often noticeably warmer than temperatures recorded on the city's outskirts. As a city grows, the heat island effect grows with it. Consequently, heating needs can decrease and cooling needs increase simply because a place is becoming more urbanized. It is a difficult task, however, to determine just how much of the warming in our cities is due to the heat island effect and how much is due to climate change.

HEATING AND COOLING DEGREE-DAYS ACROSS CANADA

The table gives heating and cooling needs for locations in each of the ten provinces and three territories. Heating needs in Vancouver are about half those in Winnipeg, although differences between other cities in southern Canada are less dramatic. Cooling needs, on the other hand, differ much more widely across the country.

Heating and Cooling Degree-Days for Selected Canadian Cities (Average Annual Totals, 1971–2000)

	HEATING DEGREE-DAYS	COOLING DEGREE-DAYS
St. John's, Newfoundland & Labrador	4,881	32
Charlottetown, Prince Edward Island	4,715	100
Halifax, Nova Scotia	4,367	104
Saint John, New Brunswick	4,754	37
Montreal, Quebec	4,575	235
Toronto, Ontario	4,066	252
Winnipeg, Manitoba	5,777	186
Regina, Saskatchewan	5,661	146
Edmonton, Alberta	5,708	28
Vancouver, British Columbia	2,926	44
Yellowknife, Northwest Territories	8,256	41
Whitehorse, Yukon	6,811	8
Resolute, Nunavut	12,526	0

Source: *Environment Canada*

Some of Canada's worst weather disasters occurred in the past decade. Do they signal a trend?

Extreme weather is weather that is unusual and often destructive. It includes events such as heat waves and cold spells, floods, droughts, severe thunderstorms, blizzards, ice storms, hurricanes, and tornadoes. For some kinds of events, however, what is considered extreme for one location may be quite normal for another. A 20 cm snowfall may be exceptional in Victoria, but not in Quebec City or St. John's.

Because different weather extremes have different causes, climate change could affect these extremes in a variety of ways. Although climate change could moderate some extremes, there are also concerns that it could lead to an increase in some of the most dangerous and destructive weather extremes. Some of these concerns are based on scientific arguments about how the processes that cause these extremes will be affected by a warmer climate. One such argument, for example, suggests that heavy rainstorms could become more common because a warmer atmosphere can hold more moisture to fuel these storms.

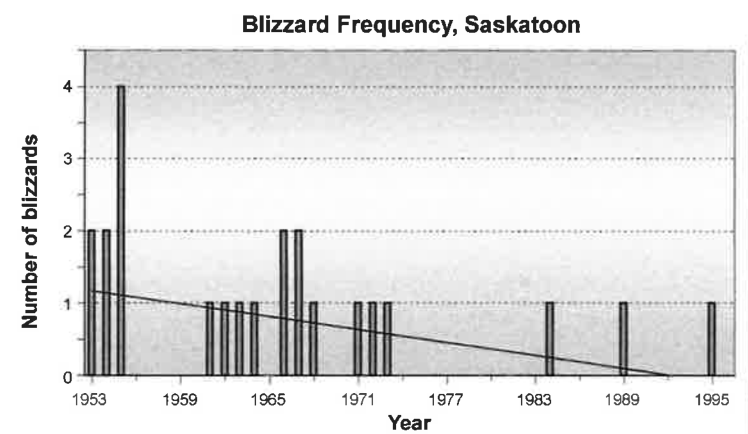
What is generally accepted, however, is that the warm season will get longer in most parts of Canada and that warm conditions will extend farther northwards. As a result, the risk of severe hot weather events such as heavy thunderstorms, hail, and tornadoes would extend over a longer period and affect a wider area. On the other hand, the time span in which severe winter weather may occur is likely to become shorter. Nevertheless, winter storms could still be quite intense.

Weather phenomena are very complicated, and unusually destructive events in particular are often the result of chance combinations of several factors. Consequently, there is still much to learn about how these events might be affected.

FOCUS: Prairie Blizzards

Blizzards combine bone-chilling temperatures, strong winds, and dense, blowing snow to pack one of winter's heaviest punches. They occur in almost every part of Canada, but Prairie blizzards are legendary for their ferocity. One that struck the Regina area in 1947 lasted 10 days and buried an entire train in a kilometre-long snowdrift.

Climate change could affect the intensity and frequency of these storms as well as the paths that they follow. As a result, blizzard patterns may be changing. In fact, a recent study shows that the number of blizzards has decreased significantly in southern Saskatchewan over the past half century. In Manitoba, however, there has been no change in blizzard frequency – possibly because the storm systems that affect Saskatchewan are not entirely the same as those that affect Manitoba.



Source: *Adapted from Lawson, 2003*

In Alberta, Saskatchewan, and Manitoba, a winter storm is a blizzard if it lasts at least 4 hours and has winds of 40 km/hour or more, a wind chill of –24.4°C or lower, and blowing snow with visibility less than 1 km. Over the past half century, the number of blizzards hitting Saskatoon has declined significantly. Regina has shown a similar trend, but Winnipeg has had no change in blizzard frequency.

000188

THE BIGGER PICTURE

The 1990s witnessed a clustering of unusually severe weather events in both Canada and other parts of the world, including such disasters as the 1996 Saguenay flood in Quebec, the 1997 Red River flood in Manitoba, and the 1998 ice storm in Ontario, Quebec, and New Brunswick. The pattern continued in 2000, when the village of Vanguard, Saskatchewan, was flooded by 333 mm of rain in 10 hours – one and half times as much as it normally receives in a year.

Economic losses from weather events have also climbed sharply in recent years. However, the size of these losses also mirrors the growth of our society and economy: an extreme event today will affect more people and more property than it would have a few decades ago. That makes it harder to determine how much of the increase in losses is actually due to an increase in severe weather.

A similar problem also makes it difficult to judge whether tornadoes are occurring more frequently. Although the number of tornadoes reported over the past century has increased, climatologists note that the increase closely tracks the growth of the country's population. That makes it difficult to conclude whether more tornadoes are actually occurring or whether more are simply being reported.

We are on more solid ground in dealing with widely measured climate variables such as temperature and precipitation, and here, so far, there is little evidence of an increase in extremes. Canadian temperature records show that most of the country, except for the eastern Arctic, has seen a significant decrease in extremely cold weather over the past half century. At the same time, there has been no consistent increase in extremely hot weather.

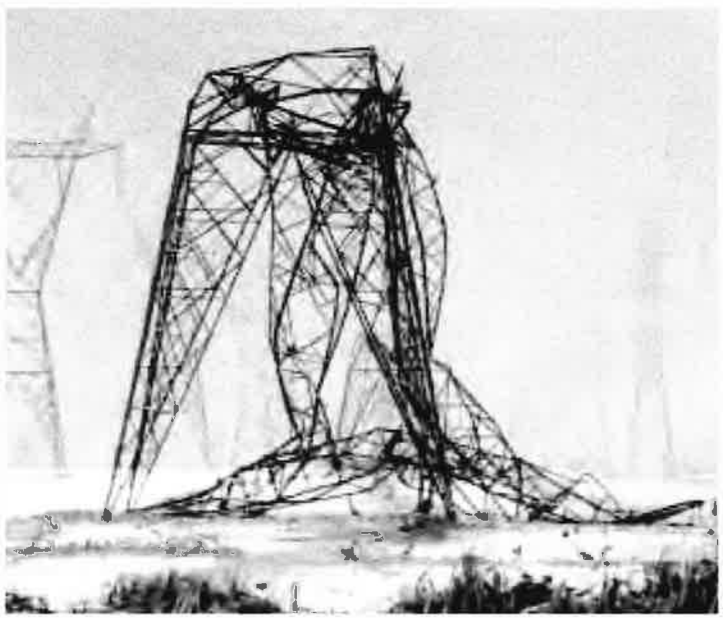
There has also been no trend towards more frequent heavy rainfalls in Canada, even though precipitation has increased across the country during the past century. Since the 1940s most weather stations in southern Canada have recorded fewer heavy rainfalls, but the number of rainy days has increased. In some other parts of the world, however, such as the United States, Japan, and Australia, there has been a trend towards more intense precipitation.

It is hard to tell, therefore, whether many kinds of extreme weather events are becoming more common or not. Since extreme events are usually rare, it could take decades to detect a pattern of change.

THE GREAT ICE STORM OF 1998

Episodes of freezing rain are common in most of Canada, and occasionally they develop into major ice storms that are notable both for their sparkling beauty and the crushing weight of ice they leave on power lines and trees. But none had ever been as persistent or destructive as the storm that struck much of eastern Canada in January 1998.

Over a period of six days, freezing rain fell intermittently over an area extending from central Ontario to Prince Edward Island. Millions of trees, including valuable sugar maples, were toppled or damaged, and downed power lines left more than 4 million people without electricity. The Montreal area was affected the worst. Up to 100 mm of freezing rain fell south of the city, and some localities were without power for as long as five weeks. More than 600,000 people in Quebec and eastern Ontario sought refuge in emergency shelters, while 16,000 troops worked with utility crews from six provinces and eight American states to restore power and clean up the damage.



The storm was blamed directly for 28 deaths, and with damage estimated at over $5 billion, it was by far the costliest weather disaster in Canadian history. It is impossible to say that a single event such as this is the result of climate change. However, it does represent the kind of extreme event that some fear could become more common as climate change continues.

The climate in many parts of Canada appears to be changing. Although these changes are still in their early stages, the indicators make it clear that some impacts are already being felt by individuals, communities, businesses, and ecosystems. The severity and extent of these impacts varies quite a bit from one part of the country to another. Some are of relatively minor importance, some are quite serious. Some are harmful, while others are beneficial.

CLIMATE

The greatest changes have occurred in the western Arctic, the Mackenzie River Basin, and the Prairies, where rates of warming over the past century have equalled or exceeded 1.5°C – nearly triple the global average of about 0.6°C. The B.C. coast and the Great Lakes–St. Lawrence region have warmed at approximately the same rate as the planet as a whole, while northeastern Ontario, central Quebec, and the Atlantic Provinces have warmed the least, at about half the global rate. The eastern Arctic, northern Quebec, and Labrador, in contrast, have cooled, in some areas by as much as 1.5°C over the past 50 years.

Seasonally, most of Canada has experienced warmer and earlier springs, hotter summer nights (but little change in the number of hot summer days), and shorter, milder winters with less frequent cold spells. Falls, however, have shown a slight cooling trend, although most of the cooling has happened late in the season.

Canada has also become wetter almost everywhere and at every time of the year. Precipitation has increased by anywhere from 5% to 35% in most of the country since 1950. Only the southern Prairies have seen little or no increase. Over the same period, the proportion of yearly precipitation falling as snow has also been changing. The southern half of the country, for the most part, has become less snowy but rainier. The North, on the other hand, has become somewhat snowier.

Unfortunately, the picture for sea surface temperatures is less complete. Good data are available for the west coast and show surface temperatures increasing at rates between 0.9°C and 1.8°C per century. Information for eastern regions is more difficult to assess but tends to show little change, while data for the Arctic are either unavailable or need further analysis. The trends that have been detected are generally consistent with scientific expectations of climate change. They are also mirrored fairly closely by the indicators, which tend to show more change in the West and Northwest than in the East.

NATURE

As the indicators make clear, many aspects of Canada's physical environment are responding to changes in climate. Receding glaciers, thinner and less extensive sea ice, and earlier breakup dates for ice on rivers and lakes can all be connected to a warming atmosphere. Atmospheric warming is also a partial contributor to sea level rise along the Atlantic and Pacific coasts and in the Mackenzie Delta. As a result, these areas are becoming more vulnerable to shoreline erosion and flooding from heavy storms and high tides. In addition, the 1990s witnessed

some of the most costly weather disasters in Canadian history. There was no strong evidence over the long term, however, that the extreme weather events that were examined were becoming more common.

The indicators also showed a number of impacts on living things. Populations of some species, such as the polar bears of western Hudson Bay, are finding survival more difficult as a result of changes in climate. For others, such as the mountain pine beetle, Canada has become a more hospitable place. Key stages in plant development, such as budding, leafing, and flowering, are also occurring earlier, due mainly to earlier and warmer spring weather. At the same time, plants and animals from warmer areas have advanced northwards and species adapted to colder conditions have retreated.

Most of these responses provide further evidence that climate is changing, but they also offer important insights into how these changes are altering and reshaping the natural world.

PEOPLE

For Canadians living in the southern half of the country, winters are becoming less hazardous as they become shorter and less extreme, and consumers are saving energy as a result of reduced heating needs. A longer frost-free season is also increasing the potential for growing new varieties of crops. On the negative side, cooling needs are increasing in much of the country, and more frequent thaw-freeze cycles are reducing the durability of some building materials.

For Canadians in the North, however, the impacts of a changing climate have been more pronounced. A shorter, less reliable ice season has made winter hunting and fishing more difficult and dangerous. The traditional knowledge that aboriginal people relied on in the past to live off the land is also becoming harder to apply as a result of more variable weather and changes in the timing of seasonal phenomena. In addition, winter roads that provide supply links to many northern communities are becoming less reliable and cannot be used for as long.

Some indicators, however, have not shown any significant trends. Although recent years have been marked by severe drought on the Prairies and low water levels on the Great Lakes, the corresponding indicators showed no significant change over the long term. There could be several reasons why trends did not appear. One is that these phenomena are not as responsive to climate change as thought. Another is that more time and further warming will be needed before the changes become significant. Only time – and continued tracking of the indicators – will tell.

A CLIMATE CHANGE LIBRARY

The climate change assessments published every five years by the Intergovernmental Panel on Climate Change (IPCC) are the most comprehensive and authoritative source of information available on the subject. These reports are highly technical, but plain language summaries are available on the IPCC web site, which is listed in the international section below. The latest volumes are:

IPCC, 2001. *Climate change 2001: The scientific basis.* Cambridge, Cambridge University Press.

IPCC, 2001. *Climate change, 2001: Impacts, adaptation, and vulnerability.* Cambridge, Cambridge University Press.

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Other publications of interest to the general reader

Association professionnelle des météorologistes du Québec, 1999. *Changements climatiques et météo extrême.* L'Association. Province de Québec. (This publication can also be downloaded from www.sca.uqam.ca/apmq.)

Burroughs, W.J., 1997. *Does the weather really matter? The social implications of climate change.* Cambridge, Cambridge University Press.

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RESOURCES ON THE WEB

The sites listed below were active at the time this report was prepared. Since publication, however, the contents or addresses of some sites may have changed, and some sites may have been discontinued. If one of the links provided here no longer works, you may be able to find a replacement site by searching under the name of the organization responsible for the original site.

International

http://www.ipcc.ch. The Intergovernmental Panel on Climate Change is the most authoritative source of scientific information on the causes and impacts of climate change and responses to it.

http://www.unfccc.int. This United Nations site contains the texts and other information relating to the United Nations Framework Convention on Climate Change and the Kyoto Protocol.

http://www.iisd.org/climatechange.htm. Based in Winnipeg, the International Institute of Sustainable Development promotes the development of regional, national, and international responses to climate change. It is a good source of information on climate change in the Arctic.

http://www.climatehotmap.org. This map-based web site documents observations of climate change and its impacts from around the world.

http://www.usgcrp.gov/usgcrp/nacc. A number of regional and sectoral reports on the consequences of climate change for the United States are available from this site. Many will be of interest to Canadians, especially those in regions near the U.S.

http://yosemite.epa.gov/OAR/globalwarming.nsf. The U.S. Environmental Protection Agency's climate change site contains material on how regions in the U.S. and other parts of the world may be affected by climate change.

National

http://www.climatechange.gc.ca. The Government of Canada's climate change web site has an abundance of information on the science of climate change, impacts on Canada, and Canadian responses. It also contains a large selection of links to other sites and resources for teachers and students.

http://www.ec.gc.ca/climate. Environment Canada's climate change site provides fact sheets on climate change science, impacts, and adaptation and control measures.

http://www.msc-smc.ec.gc.ca/ccrm/bulletin. Environment Canada's Climate Trends and Variations Bulletin relates the average temperature and total precipitation of the most recent season and year to longer-term regional and national changes.

http://www.ec.gc.ca/soer-ree. Canada's state of the environment InfoBase features *Environmental Signals: Canada's National Environmental Indicator Series,* a frequently updated series of indicators on climate change and other environmental issues.

http://adaptation.nrcan.gc.ca. From this site you can download *Climate Change Impacts and Adaptation: A Canadian Perspective,* for information on the implications of climate change for water resources, forestry, agriculture, and the coastal zone. The site also offers an excellent series of posters depicting the impacts of climate change on health and safety, communities, land resources, water, and coastal regions in different parts of Canada.

http://www.c-ciarn.ca. The Canadian Climate Impacts and Adaptation Research Network site is useful for people who already have some knowledge of climate change. The site's

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database has references to hundreds of papers on climate change impacts in Canada.

http://www.nccp.ca. The National Climate Change Policy Process site contains information on federal, provincial, and territorial climate change policy activities, as well as links to the sites of provincial and territorial governments, international agencies, and non-government agencies. Click on the link to the Climate Change Hub Gateway for access to the national climate change public education and outreach hub system, where you will find an extensive list of resources for the general public as well as for those working in public education.

Provincial and Territorial Government Sites

To find out more about how individual provinces and territories are responding to climate change, go to the following provincial and territorial web sites and follow the links to climate change.

http://www3.gov.ab.ca/env. Alberta Environment.

http://www.gov.bc.ca/wlap. British Columbia Ministry of Water, Land and Air Protection.

http://www.gov.mb.ca/est. Manitoba Energy, Science, and Technology.

http://www.gnb.ca/0085. New Brunswick Department of Natural Resources and Energy.

http://www.gov.nf.ca/env. Newfoundland and Labrador, Environment.

http://www.gov.nf.ca/mines&en. Newfoundland and Labrador, Mines and Energy.

http://www.gov.nt.ca/RWED/eps. Northwest Territories Resources, Wildlife, and Economic Development, Environmental Protection Service.

http://www.gov.nu.ca. Government of Nunavut.

http://www.ene.gov.on.ca. Ontario Ministry of the Environment.

http://www.gov.pe.ca/infopei/Environment_and_Land. Prince Edward Island, InfoPEI.

http://www.menv.gouv.qc.ca. Ministère de l'environnement du Québec.

http://www.mrn.gouv.qc.ca. Ministère des ressources naturelles du Québec.

http://www.se.gov.sk.ca. Saskatchewan Environment.

http://www.gov.ns.ca/energy. Nova Scotia Department of Energy.

http://www.environmentyukon.gov.yk.ca/epa. Yukon Department of Environment, Environmental Protection and Assessment.

Nature

http://adaptation.nrcan.gc.ca/posters. Natural Resources Canada's climate change posters cover every region of the country and explain how climate change is affecting sea level, sea ice, glaciers, water resources, and other aspects of the natural environment as well as human activities.

http://www.crysys.uwaterloo.ca/education/crysys_education.cfm. Go to this site for information from Canadian ice researchers on sea ice, glaciers and ice caps, river and lake ice, and snow.

http://ice-glaces.ec.gc.ca. The web site of the Canadian Ice Service provides information on current ice conditions along Canada's coasts and in the Great Lakes.

http://pbsg.npolar.no. The home page of the Polar Bear Specialist Group provides up-to-date information on the status of the world's polar bear populations as well as information on conservation issues, a polar bear FAQ, and links to other polar bear sites.

http://www.taiga.net/coop/indics. This site, maintained by the Arctic Borderlands Ecological Knowledge Cooperative, contains an extensive set of indicators that document changes in the physical environment and wildlife of northern Yukon.

http://www.thousandeyes.ca. Check the home page of Nova Scotia's Thousand Eyes project for background on the project and the latest update on results.

http://www.naturewatch.ca. NatureWatch gives amateur scientists a chance to contribute to the scientific monitoring of changes in the natural environment. Current programs include IceWatch, PlantWatch, FrogWatch, and WormWatch, and others are under development.

People

http://www.msc-smc.ec.gc.ca/media/top10. Go here for David Phillips's stories of headline-making weather events and impacts from the past year, the past decade, and the past century.

http://www.taiga.net/nce. The Northern Climate Exchange site is a good place to start for information on climate change in the North and its impacts on northern life.

http://www.agr.gc.ca/pfra/drought. The Prairie Farm Rehabilitation Agency posts regular updates on drought risks in western Canada, along with information on coping with drought.

http://www.on.ec.gc.ca/water/level-news. The latest information on Great Lakes water levels can be found at this site. For more information about Great Lakes water levels, go to the Canadian Hydrographic Service web site, **http://chswww.bur.dfo.ca/danp/tidal_e.html** and the web site of the Great Lakes Information Network, **http://www.great-lakes.net**.

http://www.msc-smc.ec.gc.ca/saib/climate/climat_e.cfm. Follow the links to the climate change pages of the Meteorological Service of Canada's Science Assessment and Integration Branch site and download fact sheets on extreme weather and reports and updates on recent climate events and advances in climate science.

Responding to Climate Change

http://www.climatechangesolutions.com. This site, run by the Pembina Institute in partnership with Environment Canada, Natural Resources Canada, and the Climate Change Action Fund, offers an extensive assortment of tools and resources to help families, municipalities, schools, farms, industries, and businesses reduce their greenhouse gas emissions.

http://energysolutionsalta.com. This Alberta-based site has energy-saving tips and case studies that all Canadians will find useful for reducing greenhouse gas emissions in the home, at work, in the community, and on the road.

www.climcalc.net. Use the climate change calculator to estimate your own contribution to climate change and determine the best way of reducing it.

http://oee.nrcan.gc.ca. Check this site to compare the energy efficiency of appliances, cars, and other products and to get official statistics and publications on energy use in Canada.

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CCME would like to express its thanks to the following past and present members of the Climate Change Indicators Task Group for their efforts in developing this document and seeing it through to publication.

Earle Baddaloo, Nunavut Department of Sustainable Development

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The Climate Change Indicators Task Group would like to express its gratitude to the following for contributing background analyses, data, graphic material, and advice in support of the project.

John Falkingham, Environment Canada; Don Forbes, Natural Resources Canada; Martyn Futter, Laurentian University; Ross Herrington, Environment Canada; Ron Hopkinson, Environment Canada; Elizabeth Kilvert, Environment Canada; Joan Klaassen, Environment Canada; Nick Lunn, Environment Canada; Abdel Maarouf, Environment Canada; Éva Mekis, Environment Canada; Ralph Moulton, Environment Canada; George Parkes, Environment Canada; Bernard Pelchat, Fisheries and Oceans Canada; Brian Petrie, Fisheries and Oceans Canada; Daniel Scott, Environment Canada; Avrael Spigelman; Bill Taylor, Environment Canada; Lucie Vincent, Environment Canada; Robert Whitewood, Environment Canada; Xuebin Zhang, Environment Canada.

The Task Group would like to thank the following experts for reviewing portions of the manuscript in draft.

Randy Angle, Alberta Environment; Robin Armour, Yukon Territorial Government; Diane Beattie, B.C. Ministry of Water, Land and Air Protection; Ramona Billy-Bird, Manitoba Conservation; Danny Blair, University of Winnipeg; Laura Blair, Alberta Environment; Andrew Bootsma, Agriculture and Agri-Food Canada; Isabelle Brochu, Ministère de l'Environnement du Québec; Chris Burn, Carleton University; Bill Calder, Alberta Environment; Shane Chetner, Alberta Agriculture, Food and Rural Development; Quentin Chiotti, Pollution Probe; Ed Dean, Saskatchewan Environment; Henry Desjarlais, Saskatchewan Environment; Bob van Dijken, Northern Climate Exchange; Marie-Christine Dubé, Ministère de l'environnement du Québec; Larry Dyke, Natural Resources Canada; Peter Dzikowski, Alberta Agriculture, Food and Rural Development; Joan Eamer, Environment Canada; John Falkingham, Environment Canada; Sal Figliuzzi, Alberta Environment; Sarah Gammel, Saskatchewan Environment; Ann Gerry, Saskatchewan Environment; Wayne Gosselin, Saskatchewan Agriculture, Food and Rural Revitalization; Ross Herrington, Environment Canada; Dale Hjertaas, Saskatchewan Watershed Authority; Doug Jackson, Manitoba Agriculture and Food; Richard Janowicz, Indian and Northern Affairs Canada; Jesse Jasper, Environment Canada; Lois Harwood, Fisheries and Oceans Canada; Allan Howard, Alberta Agriculture, Food and Rural Development; Pamela Kertland, Natural Resources Canada; Joan Klaassen, Environment Canada; Gary Kofinas, University of Alaska; Brent Lakeman, Alberta Environment; Janice Larson, B.C. Ministry of Energy and Mines; Kelly Leavesley, Manitoba Conservation; Gary Lines, Environment Canada; Gavin Manson, Natural Resources Canada; Abdel Maarouf, Environment Canada; Sean McGinn, Agriculture and Agri-Food Canada; Humfrey Melling, Fisheries and Oceans Canada; Brian Mills, Environment Canada; Jennifer Milton, Environment Canada; Ralph Moulton, Environment Canada; Ted O'Brien, Prairie Farm Rehabilitation Administration; Ken Panchuk, Saskatchewan Agriculture, Food and Rural Revitalization; Gloria Parisien, Saskatchewan Agriculture, Food and Rural Revitalization; James Popplow, Manitoba Health; Huguette Proulx, Ministère de l'environnement du Québec; Rick Raddatz, Environment Canada; Daniel Rainham, Dalhousie University; Ed van Randen, Yukon Energy, Mines and Resources; Dieter Riedel, Health Canada; Ignatius Rigor, University of Washington; Catherine Roberge, Ministère de l'Environnement du Québec; Don Russell, Environment Canada; Joost van der Sanden, Natural Resources Canada; Dave Sauchyn, Prairie Adaptation Research Collaborative; Barb Scaife, Manitoba Conservation; Sharon Smith, Natural Resources Canada; Norm Snow, Inuvialuit Joint Secretariat; Steve Solomon, Natural Resources Canada; John Spacek, Manitoba Transportation and Government Services; Chris Spence, Environment Canada; Raymond Stemp, Alberta Environment; Ian Stirling, Environment Canada; Bill Taylor, Environment Canada; Lucie Vincent, Environment Canada; Brian Waddell, Alberta Environment; Alfred Warkentin, Manitoba Conservation; Steve Washen, Manitoba Agriculture and Food; William Watkins, Manitoba Conservation; Elaine Wheaton, Saskatchewan Research Council; Paul Whitfield, Environment Canada; Doug Wilcox, Manitoba Crop Insurance Corporation; Rick Williams, B.C. Ministry of Water, Land and Air Protection; Stephen Wolfe, Natural Resources Canada; Bob Wynes, Saskatchewan Environment; Bryan Yusishen, Manitoba Agriculture and Food; Terry Zdan, Manitoba Transportation and Government Services; Xuebin Zhang, Environment Canada; Francis Zwiers, Environment Canada.

The Task Group would also like to thank Lura Consulting for facilitating an early workshop on the project; the Government of Canada Climate Change Action Fund – Public Education and Outreach for funding support; ERIN Consulting for preparing a technical report on candidate indicators; Brad Owen and Natalie Oliver of Saskatchewan Environment for technical and administrative support; and Janet Meldrum for assistance with photo research.

Text and art direction: David Francis, Lanark House Communications

Design: BTT Communications, Toronto

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00198

This is Exhibit "F"
referred to in the Affidavit
of Lisa Tssessaze affirmed before me
this 17 day of Dec., 2018

Gail Gallupe

Commissioner for Taking Affidavits, etc.

Gail Gallupe
Expiry: April 7, 2020
#0742640

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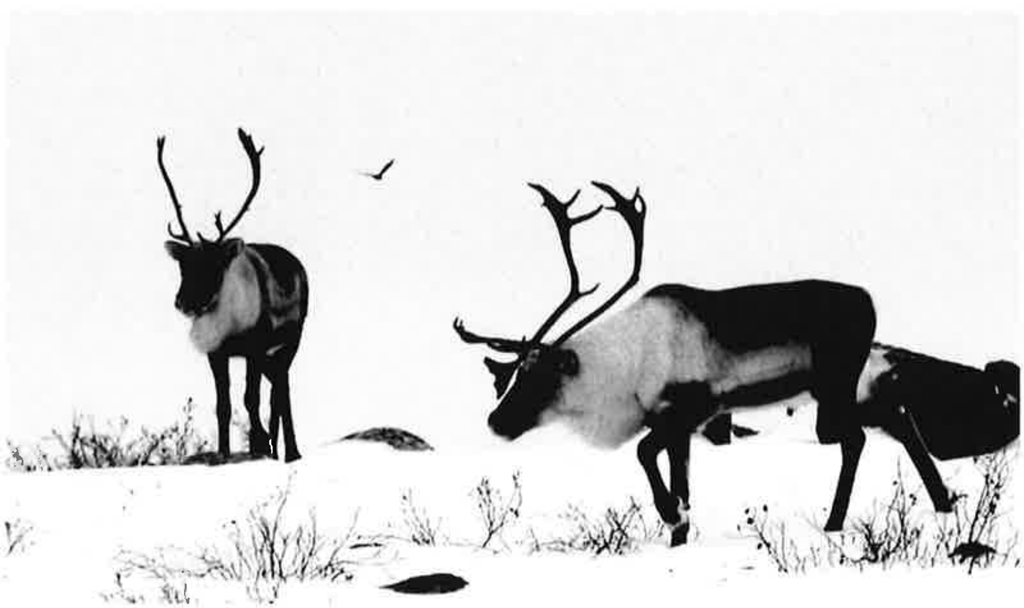
COSEWIC
Assessment and Status Report

on the

Caribou
Rangifer tarandus

Barren-ground population

in Canada



THREATENED
2016

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

COSEWIC. 2016. COSEWIC assessment and status report on the Caribou *Rangifer tarandus*, Barren-ground population, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 123 pp. (http://www.registrelep-sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1).

Production note:
COSEWIC would like to acknowledge Anne Gunn, Kim Poole, and Don Russell for writing the status report on Caribou (*Rangifer tarandus*), Barren-ground population, in Canada, prepared under contract with Environment Canada. This report was overseen and edited by Justina Ray, Co-chair of the COSEWIC Terrestrial Mammals Specialist Subcommittee, with the support of the members of the Terrestrial Mammals Specialist Subcommittee.

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Également disponible en français sous le titre Évaluation et Rapport de situation du COSEPAC sur le Caribou (*Rangifer tarandus*), population de la toundra, au Canada.

Cover illustration/photo:
Caribou — Photo by A. Gunn.

Catalogue No. CW69-14/746-2017E-PDF
ISBN 978-0-660-07782-6

COSEWIC
Assessment Summary

Assessment Summary – November 2016

Common name
Caribou - Barren-ground population

Scientific name
Rangifer tarandus

Status
Threatened

Reason for designation
Members of this population give birth on the open arctic tundra, and most subpopulations (herds) winter in vast subarctic forests. Well-known for its large aggregations, lengthy migrations, and significant cultural and social value to northern Aboriginal Peoples and other Canadians, its 14-15 subpopulations range from northeastern Alaska to western Hudson Bay and Baffin Island. Numbering more than 2 million individuals in the early 1990s, the current population is estimated at about 800,000. Most subpopulations have declined dramatically, but two are increasing, including the Porcupine Caribou Herd. For 70% of the population with sufficient data to quantify trends, the decline is estimated at 56% over the past three generations (since 1989), with several of the largest herds having declined by >80% from peak numbers. Available survey data for an additional 25% of the total population also indicate declines. Evidence from both local Aboriginal people and scientific studies suggests that most herds have undergone natural fluctuations in numbers in the past; however, available demographic data indicate no sign of rapid recovery at this time and cumulative threats are without historical precedent. Status meets criteria for Endangered because of a reduction in numbers of ≥50%, but Threatened is recommended because, overall, this population does not appear to be facing imminent extinction at this time. Despite worrisome declines across most of the range, the current numerical abundance of the Porcupine Caribou Herd and the initiation of numerous management actions by governments, wildlife management boards, and communities support Threatened as a more appropriate conservation status. The status of these subpopulations will have to be carefully monitored and may warrant re-assessment within five years.

Occurrence
Yukon, Northwest Territories, Nunavut, Alberta, Saskatchewan, Manitoba

Status history
Designated Threatened in November 2016

COSEWIC
Executive Summary

Caribou
Rangifer tarandus

Barren-ground population

Wildlife Species Description and Significance

All the world's caribou and reindeer belong to a single cervid species, *Rangifer tarandus*, and are found in arctic and subarctic regions as well as in northern forests. Barren-ground Caribou are characterized by long migrations and highly gregarious behaviour, often travelling in groups of hundreds or thousands. As a relatively large herbivore with an extensive distribution and high numbers, Barren-ground Caribou is a keystone species, playing a key ecological and cultural role in northern ecosystems.

The significance of Barren-ground Caribou to the peopling of northern Canada is evident from archaeological findings tracking the distribution of people and Barren-ground Caribou relative to the retreating glaciers some 8,000 years ago in the central barrens and as long as 12-15,000 years ago in the central range of the Porcupine subpopulation. Barren-ground Caribou have been and continue to be a key resource for people in northern Canada; in some cases these animals have such importance that families would follow their migration. They have significant direct economic value from harvest, primarily for subsistence use. They also contribute to the northern economy through wildlife tourism and recreational hunting; beyond this, they have incalculable cultural value for people throughout the subpopulation ranges.

Distribution

The global range of Barren-ground Caribou extends from Alaska to western Greenland, and is continuous across northern continental mainland Canada, from northwestern Yukon to Baffin Island. The northern extent is the Arctic mainland coast; the southern extent is northern Saskatchewan, Alberta and Manitoba. Sampling efforts and methods have varied among subpopulations, leading to differences in interpreting subpopulation structure; 14-15 are recognized in this report. Some are combined for the purposes of generating population abundance and trend estimates, for a total of 13 units. Ten subpopulations have been consistently identified for the past several decades, mainly through fidelity to calving areas.

Fluctuating abundance of individual subpopulations affects distribution; as Barren-ground Caribou decline in abundance their distribution (especially during winter) changes, reducing the length of fall and pre-calving migration. Mainland subpopulations of Barren-ground Caribou generally migrate toward the Arctic coast to calve, and occur during summer and fall on the tundra of the Southern Arctic ecozone. Western and central mainland subpopulations usually winter in the boreal forests of the Taiga Cordillera, Taiga Plains or Taiga Shield ecozones.

Habitat and Habitat Trends

Habitat requirements are partly driven by the need for forage, which depends on the timing of the caribou's annual breeding cycle and its nutritional costs relative to the brief plant growing season and long winters of the sub-arctic and arctic regions. Caribou are generalist foragers, especially in summer, and select among grasses, sedges, shrubs and forbs for nutrient content according to the stage of plant growth rather than plant species. Barren-ground Caribou require large annual ranges (several hundred thousand square kilometres in size) to enable selection of alternative habitats in response to annual variations in the environment, such as snow cover, plant growth, and/or predation or parasite risk. Habitat attributes that are important for calving include those that reduce predation risk and maximize nutrition intake; these vary among calving grounds. Forage requirements depend on the timing of the annual breeding cycle relative to the brief plant growing season and long winter that is characteristic of the sub-arctic and arctic regions. On summer ranges, caribou seek habitats that reduce exposure to insect harassment, while obtaining high-quality forage. While most subpopulations winter in the boreal forest, several remain in tundra habitats at that time.

Within the previous three generations, there has been some reduction in habitat as a consequence of the natural fragmentation of the winter ranges caused by forest fires and increasing human presence (i.e., infrastructure) on the caribou ranges. However, habitat outside the forested winter range is still largely intact at the landscape scale. The generally increasing trends in human population will increase economic development (industrial development, roads and traffic) within Barren-ground Caribou ranges in the future.

Biology

Caribou usually first calve at three years of age, although they can calve at two years when conditions are favourable. Females give birth to a single calf and may breed every year, although if nutritionally stressed they do not conceive every year. Calving is highly synchronized, generally occurring over a 2-week period in June. The breeding system is polygynous. Annual migrations and gregarious behaviour are the most conspicuous characteristics of most Barren-ground Caribou subpopulations. They are adapted to a long winter season when cold temperatures, wind chill and snow impose high energetic costs. Those costs are met through reducing their maintenance energy requirements and mobilizing fat and protein reserves.

Predation is an important factor affecting many facets of caribou ecology, as caribou movements and habitat choices are often made to minimize exposure to predators. An array of predators and scavengers depend on Barren-ground Caribou: Grizzly Bears (*Ursus arctos*) are effective predators on newborn calves, while Gray Wolves (*Canis lupus,* hereafter referred as Wolves) are predators of all sex and age classes throughout the year. Pathogens (including viruses, bacteria, helminths and protozoa) together with insects, play an important role in caribou ecology with effects ranging from subtle effects on reproduction through to clinical disease and death.

Population Sizes and Trends

The current population of Barren-ground Caribou is estimated at about 800,000 individuals. Between 1986 and mid-1990s, the overall trend was an increase to > two million, followed by a decline, which has persisted through today. Of 13 subpopulation units used to derive abundance estimates, eight are declining, two are increasing, and three are unknown. The median three-generation percentage decline in the total number of Barren-ground Caribou was 56.8% (range = -50.8 – -59.0%), based on the summed population change for seven subpopulations with sufficient survey data, which comprise almost 70% of the total current population. Four of these seven subpopulations declined by >80% during this period, one had a median decline of -39%, characterized by marked variability, whereas the remaining two increased. Available survey data for three additional subpopulations, representing about 25% of the total population, also suggest declines; the current trajectories of another three subpopulations are unknown, due to lack of recent surveys.

Evidence from ATK and scientific study suggests that Barren-ground Caribou subpopulations undergo periods of high and low numbers (fluctuations) that might resemble population cycles. The evidence is, however, insufficient to consistently infer a naturally occurring cyclic increase across the full range of subpopulations. Available demographic data, cumulative changes to the environment, habitats, and harvest regimes for many of these subpopulations are without historical precedent, such that it would be risky to assume there will be a naturally occurring recovery, at least to numbers recorded in the 1990s, for many of the subpopulations.

Threats and Limiting Factors

Climate and weather influence other limiting factors important for Barren-ground Caribou, including forage availability, predation, parasites and diseases – in complex non-linear and cascading ways. So many aspects of caribou ecology are affected by weather that a warmer climate could have a significant but complicated suite of positive and negative effects.

Industrial exploration and development in Barren-ground Caribou ranges has increased over the past several decades, such that there are several new mines and hundreds of prospecting permits, mineral claims and mineral leases on several subpopulation ranges. Subsistence and sport harvest can be significant causes of mortality that can increase the rate of decline and lead to a lower population size after populations have been reduced for other reasons. Chemical contaminant levels in tissues are generally low at present. The changing conditions on the caribou ranges also include the administrative and political complexity of a mix of settled and unsettled land claims, with changes in jurisdictional boundaries and mandates. The implementation of management actions is challenged by the inter-jurisdictional complexity between political, land management and wildlife management agencies, combined with the migratory nature of caribou and their use of extensive seasonal ranges.

Protection, Status, and Ranks

Protection of Barren-ground Caribou subpopulations by territorial and provincial jurisdictions is through harvest regulation and habitat protection. The co-management regime is a shared management responsibility among governments and bodies established through land claim legislation and through renewable multi-jurisdictional agreements among public governments (for the Porcupine, Beverly and Qamanirjuaq subpopulations). The Porcupine Caribou subpopulation is the only subpopulation of Barren-ground Caribou covered by an international agreement signed between Canada and the United States in 1987. The Barren-ground Caribou designatable unit (DU) was assessed for the first time by COSEWIC as Threatened in November 2016. It is currently not scheduled under the federal *Species at Risk Act* (*SARA*). The 2015 national general status for Caribou in Canada will not be available until the 2015 General Status Report is published August 2017. This Canada-wide rank will apply to all DUs of Caribou combined, with nothing specific to Barren-ground Caribou. The 2015 territorial rank for Yukon for Barren-ground Caribou is Vulnerable to Apparently Secure, and for Northwest Territories is Sensitive. At present, there is no specific rank for Barren-ground Caribou for Nunavut; however, for all DUs combined, the territory-specific general status rank for Caribou in Nunavut is Apparently Secure. Federal protected areas that exclude industrial land uses but allow continued subsistence hunting cover about 6% of Barren-ground Caribou ranges, including eight national parks.

TECHNICAL SUMMARY

Rangifer tarandus

Caribou, Barren-ground population (Designatable Unit 3)

Caribou, population de la toundra (Unité désignable 3)

Range of occurrence in Canada (province/territory/ocean): Northwest Territories, Nunavut, Yukon, Saskatchewan, Manitoba, Alberta

Demographic Information

Generation time (*Calculated using IUCN guidelines (2008)*)	8-9 years
Is there a projected continuing decline in number of mature individuals?	Yes
Estimated percent of continuing decline in total number of mature individuals within 2 generations	Unknown
Estimated percent reduction in total number of mature individuals over the last 3 generations.	Estimated at 57% for 7 subpopulations with sufficient information to quantify trends, representing ~70% of the total current population
Suspected percent increase in total number of mature individuals over the next 3 generations.	Unknown, but based on past dynamics, where marked fluctuations in abundance have been documented in some subpopulations, numbers may increase within three generations. However, there is uncertainty to this prediction due to ongoing cumulative changes to the environment and unknown success of management actions.
Estimated percent reduction in total number of mature individuals over any 3 generations period, over a time period including both the past and the future.	~57%
Are the causes of the decline clearly reversible and understood and ceased?	Causes of declines are complex and not well understood. Reversible: possibly. Ceased: no.
Are there extreme fluctuations (>1 order of magnitude) in number of mature individuals?	Insufficient information to assess

Extent and Occupancy Information

Estimated extent of occurrence	4,253,842 km²
Index of area of occupancy (IAO) (Always report 2x2 grid value).	247,840 km² (calving grounds; calculated only for 8 subpopulations with sufficient data)
Is the population severely fragmented?	No
Number of locations	Unknown, but certainly > 14
Is there an observed continuing decline in extent of occurrence?	Extent of occurrence fluctuates with abundance, thus recent annual areas for some subpopulations are reduced from maximum recorded abundance in the 1990s

Is there an observed continuing decline in index of area of occupancy?	Range size changes with abundance, thus recent annual areas in some subpopulations are reduced from maximum recorded abundance in the 1990s
Is there an observed continuing decline in number of populations	As many as three subpopulations may have disappeared within the past three generations
Is there an observed continuing decline in number of locations?	Uncertain
Is there an observed continuing decline in area of habitat?	Yes
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature* Individuals (in each subpopulation)

Subpopulation (year of most recent survey)	**N Individuals**
1. Porcupine (2013)	197,000
2. Tuktoyaktuk Peninsula (2015)	1,701
3. Cape Bathurst (2015)	2,259
4. Bluenose-West (2015)	15,268
5. Bluenose-East (2015)	38,592
6. Bathurst (2015)	19,769
7 (8). Beverly/Ahiak (2011)	195,529
9 & 10. Lorillard + Wager Bay (2002)	41,000
11. Boothia Peninsula (1995)	6,658
12. Qamanirjuaq (2014)	264,661
13. Southampton Island (2015)	12,297
14. Coats Island (1991)	500
15. Baffin Island (2014)	4,856
Total (extrapolated from estimates and trends to 2015)	**~800,000**
*Population estimates are of all individuals	

Quantitative Analysis

Probability of extinction in the wild is at least 20% within 5 generations. (Population viability analyses [PVAs] are not available)	Not done.

Threats (actual or imminent, to populations or habitats)

- Disturbances from human activity
- Climate-mediated habitat and weather changes
- Over-hunting
- Predation
- Pathogens and insects (may intensify under a warmer climate)

Rescue Effect (immigration from outside Canada)

Status of outside population(s)?	Three subpopulations in Alaska may be part of this DU, but have not been evaluated. All three are currently declining.
Is immigration known or possible?	Unknown but unlikely
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Yes
Is rescue from outside populations likely?	No

Data Sensitive Species

Is this a data sensitive species?	No

Status History

COSEWIC: Designated Threatened in November 2016.

Status and Reasons for Designation:

Status: Threatened	**Alpha-numeric codes:** Meets Endangered, A2acd+4acd, but designated Threatened because it does not appear to be facing imminent extinction or extirpation.

Reasons for designation:
Members of this population give birth on the open arctic tundra, and most subpopulations (herds) winter in vast subarctic forests. Well-known for its large aggregations, lengthy migrations, and significant cultural and social value to northern Aboriginal Peoples and other Canadians, its 14-15 subpopulations range from northeastern Alaska to western Hudson Bay and Baffin Island. Numbering more than 2 million individuals in the early 1990s, the current population is estimated at about 800,000. Most subpopulations have declined dramatically, but two are increasing, including the Porcupine Caribou Herd. For 70% of the population with sufficient data to quantify trends, the decline is estimated at 56% over the past three generations (since 1989), with several of the largest herds having declined by >80% from peak numbers. Available survey data for an additional 25% of the total population also indicate declines. Evidence from both local Aboriginal people and scientific studies suggests that most herds have undergone natural fluctuations in numbers in the past; however, available demographic data indicate no sign of rapid recovery at this time and cumulative threats are without historical precedent. Status meets criteria for Endangered because of a reduction in numbers of ≥50%, but Threatened is recommended because, overall, this population does not appear to be facing imminent extinction at this time. Despite worrisome declines across most of the range, the current numerical abundance of the Porcupine Caribou Herd and the initiation of numerous management actions by governments, wildlife management boards, and communities support Threatened as a more appropriate conservation status. The status of these subpopulations will have to be carefully monitored and may warrant re-assessment within five years.

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Meets Endangered A2acd, with 3-generation decline of 56% estimated for 70% of the population (based on aerial surveys [a], with habitat quality decline [c] and exploitation [d] also driving population decline), with an additional 25% of the population undergoing unquantified declines; trends for the remaining 5% are unknown. Also meets A4acd (past and future), because some ongoing decline is predicted based on current demographic information and ongoing threats.
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable.
Criterion D (Very Small or Restricted Population): Not applicable.
Criterion E (Quantitative Analysis): Not applicable.

PREFACE

Several designatable units (hereafter referred as DUs, formerly "populations") of caribou (*Rangifer tarandus*) have been assessed more than once by COSEWIC (COSEWIC 2002; 2004; 2014a,b; 2016). All are currently listed under Schedule 1 of SARA. This status report for Barren-ground Caribou (DU3) follows an analysis of designatable unit structure of caribou in Canada undertaken by COSEWIC as a special project (COSEWIC 2011) to define the DUs for future status assessments and reassessments of this species according to the latest guidelines (COSEWIC 2015). Although prevailing taxonomy (Banfield 1961) recognizes four native extant and one extinct subspecies in North America, it is out of date and does not capture the variability of caribou across their range in Canada. Based on the COSEWIC DU criteria for discreteness and significance (COSEWIC 2015), Barren-ground Caribou were recognized as a DU (COSEWIC 2011) and are assessed here for the first time.

This status report benefited from the simultaneous drafting of a status report in development for assessment under the territorial *Species At Risk (NWT) Act* (SARC 2016). The traditional knowledge section of that report was a particularly important source of ATK, as were products from subpopulation-specific caribou hearings and conservation actions being conducted in NWT and NU. This report also includes updates from traditional ecological knowledge collected and summarized from First Nations and Métis sources by the COSEWIC Aboriginal Traditional Knowledge (ATK) Subcommittee. These sources have been compiled and assessed in two reports: the Caribou ATK Source Report and the Caribou ATK Assessment Report.

A map of place names referred to in this report is in Appendix A.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2016)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

Environment and Climate Change Canada / Environnement et Changement climatique Canada
Canadian Wildlife Service / **Service canadien de la faune**

Canada

The Canadian Wildlife Service, Environment and Climate Change Canada, provides full administrative and financial support to the COSEWIC Secretariat.

Also considered a threat to Barren-ground Caribou is non-traditional harvest practices, including reckless shooting, overuse of motorized vehicles, wastage of meat and leaving carcasses on the ground, not sharing meat, and not using the entire carcass. Multiple ATK sources (WMAC (North Slope) and Aklavik HTC 2009; Beaulieu 2012; Sangris 2012; BQCMB 2014b; Benson 2015) indicate that Barren-ground Caribou may abandon an area if such hunting practices are occurring. It is also commonly observed that killing or disturbing the leaders of the migration can be detrimental from a variety of perspectives (Whaèhdôö Nàowoò Kö [Dogrib Treaty 11 Council] 2001).

Climate Change

The signals of climate change are especially strong in the Arctic, as measured by reductions in sea ice and warmer temperatures. Although evidence is already strong for changes such as an increase in shrubs (Myers-Smith *et al.* 2011), changes to the ecology of Barren-ground Caribou will be complex, consisting of positive and negative effects, most of which are interacting and non-linear (Cebrian *et al.* 2008; Chen *et al.* 2014). The effects of climate change on forage availability during calving and summer appear important (Griffith *et al.* 2002; Chen *et al.* 2014) but are still not well understood. A climate envelope was measured at which lower availability of summer range forage explained some of the variation in productivity 2-3 years later in the Bathurst subpopulation (Chen *et al.* 2014).

Future climate change may act as a continuing threat for Barren-ground Caribou through a complex mechanism involving shifts in timing of greening, lower summer forage quality, and subsequent lower calf production and reproductive potential of females, then population declines. Unpredictable weather events, which are increasing in frequency in a changing climate, are also implicated in population declines. In August 2016, 47 caribou carcasses were found on Prince Charles Island with unusually low fat reserves indicative of starvation. A storm (e.g., rain on snow) creating a layer of ice and preventing access to forage is the most likely explanation (Van Dusen 2017).

Caribou may be susceptible to heat stress (Soppela *et al.* 1986): days with mean daily temperatures exceeding 25°C are infrequent for Bluenose-East, Bathurst and Qamanirjuaq subpopulations and the number of days when temperatures exceeded mean+2 SD for the 1990s was similar to the 2000s. 2014 stands out with more high temperature days for the three subpopulations, which exceeded previous totals for 1979 to 2014 (CARMA unpubl. data). As such, there are considerable limits to present understanding and consequent uncertainty until more explorative modelling and discussion takes place.

Climate change is a growing concern for migratory species, where timing of arrival to breeding grounds is critical for survival (Crick 2006). Highly productive seasonal habitats become less food-rich and predictable in space and time and species like caribou are forced to contend with a decoupling of climate variables between seasonal ranges, such that mistimed migration becomes an increasing likelihood (Robinson *et al.* 2009).

This is Exhibit "G"
referred to in the Affidavit
of Lisa Tssessaze affirmed before me
this 19 day of Dec., 2018

Gail Gallupe

Commissioner for Taking Affidavits, etc.

Gail Gallupe
Expiry: April 7, 2020
#0742640

United Nations
Educational, Scientific and
Cultural Organization

Organisation
des Nations Unies
pour l'éducation,
la science et la culture

World Heritage
Patrimoine mondial **41 COM**

Paris, 10 March 2017
Original: English

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION

ORGANISATION DES NATIONS UNIES POUR L'EDUCATION, LA SCIENCE ET LA CULTURE

CONVENTION CONCERNING THE PROTECTION OF THE WORLD CULTURAL AND NATURAL HERITAGE

CONVENTION CONCERNANT LA PROTECTION DU PATRIMOINE MONDIAL, CULTUREL ET NATUREL

WORLD HERITAGE COMMITTEE / COMITE DU PATRIMOINE MONDIAL

Forty-first session / Quarante-et-unième session

Krakow, Poland / Cracovie, Pologne
2-12 July 2017 / 2-12 juillet 2017

Item 7 of the Provisional Agenda: State of conservation of properties inscribed on the World Heritage List and/or on the List of World Heritage in Danger

Point 7 de l'Ordre du jour provisoire: Etat de conservation de biens inscrits sur la Liste du patrimoine mondial et/ou sur la Liste du patrimoine mondial en péril

MISSION REPORT / RAPPORT DE MISSION

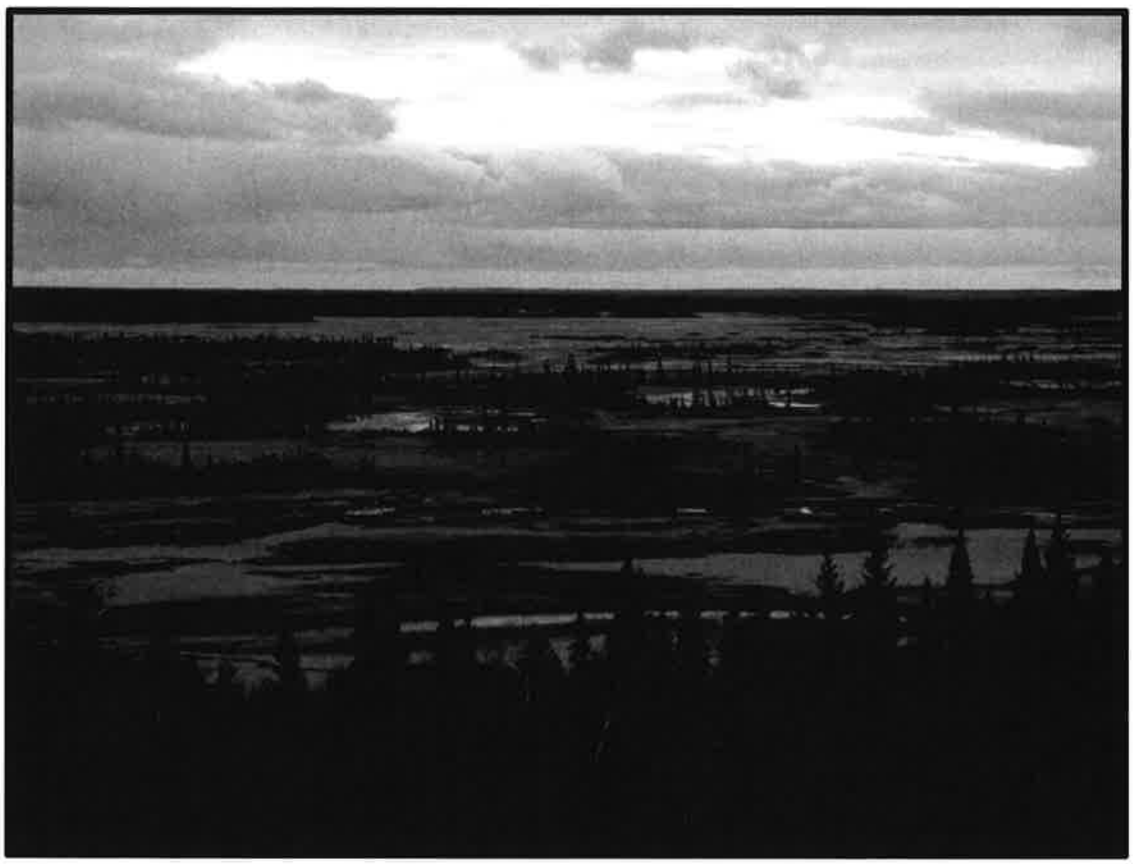
Wood Buffalo National Park (Canada) (N 256)
Parc national Wood Buffalo (Canada) (N 256)

24 September – 4 October 2016

UNESCO World Heritage Centre - WHC
International Union for Conservation of Nature - IUCN

Reactive Monitoring Mission to Wood Buffalo National Park, Canada

25 September - 4 October 2016



Mission Report, March 2017

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ACKNOWLEDGEMENTS

The mission would like to sincerely thank the Governments of Canada, Alberta, British Columbia and the Northwest Territories for the hospitality and cooperation. We are particularly grateful to Parks Canada Agency (PCA) for the excellent preparation and management of the mission at all stages and for facilitating transparent access to information, stakeholders and rights-holders in exemplary fashion. We owe a debt of gratitude to PCA's CEO Daniel Watson for personally taking the time to set off and conclude the mission. We very much appreciated both the gesture and the direct exchange. Sincere thanks are likewise due to the indefatigable PCA team accompanying the mission, Ashley Campbell, George Green and Gilles Seutin, as well as to Jonah Mitchell and Stuart Macmillan for sharing their first-hand knowledge about Wood Buffalo National Park and the region. Melody Lepine with the Mikisew Cree First Nation was instrumental in helping us understand many of the serious indigenous concerns, which had contributed to triggering the reactive monitoring mission documented in this report in the first place. We sincerely wish to thank her personally and the Chiefs, Elders, Councillors and members of the First Nations and Métis met during the mission.

The mission furthermore owes a debt of gratitude to the representatives of numerous federal, provincial and territorial governmental institutions, non-governmental organizations, universities, consulting companies, law firms and the private sector for sharing their views. All people consulted during the mission in person or by phone are listed in Annex 5; possible omissions are unintentional and exclusively the authors' responsibility.

Last but not least, the mission owes a debt of gratitude to the World Heritage Centre and IUCN for their full support throughout the mission and helpful comments on draft versions of this report.

The mission would like to recall that the issues discussed in this report are part of much larger societal debates and decision-making. The mission has neither a mandate nor any intention to position itself in these debates. The mission's hope and ambition is to provide a balanced and independent technical contribution from the perspective of the World Heritage Convention in line with its transparent Terms of Reference, which are documented in full text as Annex 2. The mission hopes that the touching mutual respect and solidarity all actors displayed in response to the devastating Fort McMurray fires earlier in 2016 will be reflected in decision-making affecting the future of the Peace-Athabasca Delta, Wood Buffalo National Park and its inhabitants and users.

ABBREVIATIONS AND ACRONYMS

ACFN	Athabasca Chipewyan First Nation
AZE	Alliance for Zero Extinction
CAPP	Canadian Association of Petroleum Producers
CCME	Canadian Council of Ministers of the Environment
CEA	Cumulative Effects Assessment
CEAA	Canadian Environmental Assessment Agency
CFIA	Canadian Food Inspection Agency
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species
CNPA	Canada National Parks Act
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSIA	Canada's Oil Sands Innovation Alliance
CPAWS	Canadian Parks and Wilderness Society
CWS	Canadian Wildlife Service
DKFN	Deninu K'ue First Nation
ECCC	Environment and Climate Change Canada
EIA	Environmental Impact Assessment
EIMP	(National) Ecological Integrity Monitoring Program
ESA	Endangered Species Act (U.S.A.)
FPIC	Free, Prior and Informed Consent
FWS	Fish and Wildlife Service (U.S.A.)
GHG	Greenhouse Gases
GPOP	Parks Canada Guiding Principles and Operational Policies
GWBNPE	Greater WBNP Ecosystem
IAS	Invasive Alien Species
INAC	Indigenous and Northern Affairs Canada
IUCN	International Union for Conservation of Nature
JOSM	Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring
JRP	Joint Review Panel
KFN	K'atl'odeeche First Nation
LARP	Lower Athabasca Regional Plan
LRRCN	Little Red River Cree Nation
MBM	Minor Boundary Modification
MCFN	Mikisew Cree First Nation
MRBTWMA	Mackenzie River Basin Transboundary Waters Master Agreement
NGO	Non-governmental Organisation
NRBS	Northern River Basins Study
NREI	Northern Rivers Ecosystem Initiative
OG	Operational Guidelines
OUV	Outstanding Universal Value
PAD	Peace-Athabasca Delta
PADEMP	Peace-Athabasca Delta Ecological Monitoring Program

PADTS	Peace-Athabasca Delta Technical Studies
PAH(s)	Polycyclic Aromatic Hydrocarbons
PC(A)	Parks Canada (Agency)
RAMP	Regional Aquatic Monitoring Program
SARA	Species at Risk Act
SEA	Strategic Environmental Assessment
SLFN	Smith Landing First Nation
SOC	State of Conservation
SRFN	Salt River First Nation
TC	Transport Canada
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
UNESCO	United Nations Educational, Scientific and Cultural Organization
WBNP	Wood Buffalo National Park
WHC	World Heritage Centre
WCD	World Commission on Dams

EXECUTIVE SUMMARY

Exceeding the size of the Netherlands, Wood Buffalo National Park (WBNP) encompasses approximately 4.5 million hectares of Canada's boreal plains in northern Alberta and the southern Northwest Territories. WBNP is comprised of a vast mosaic of boreal grasslands, wetlands and forests, with numerous rivers, creeks, lakes and ponds. What is today WBNP has been the traditional territory of indigenous peoples long before European arrival and continues to be to this day. The land in the park and its surroundings is an integral part of indigenous and local culture, spirituality and livelihoods, including of the Métis. WBNP's impressive natural heritage includes the world's largest herd of free-ranging Wood Bison (*Bison bison athabascae*) and the breeding ground for the only wild, self-sustaining migratory flock of Whooping Cranes (*Grus americana*). In recognition of its global significance and intactness, WBNP was inscribed on the World Heritage List under natural World Heritage criteria (vii), (ix) and (x) in 1983. Two Ramsar sites are located within WBNP.

The vast Peace-Athabasca Delta (PAD) is widely recognized as the particularly valuable and vulnerable heart of the park and World Heritage property. Supported by ample and consistent evidence from both western science and indigenous knowledge, the majority of local Aboriginal Peoples, scientists, Parks Canada (PCA) staff, and conservation NGOs argue that the integrity of the PAD has been affected by decades of massive industrial development along the critically important Peace and Athabasca Rivers without prompting adequate management responses. The Mikisew Cree First Nation therefore submitted a petition to the World Heritage Committee in late 2014, which was considered in a formal Committee Decision (**39 COM 7B.18**, Bonn, 2015) requesting the State Party of Canada to invite a joint World Heritage Centre/IUCN reactive monitoring mission to assess the state of conservation of the property and potential threats to its Outstanding Universal Value (OUV). The mission took place from 25 September to 04 October 2016 and as per its terms of reference assessed the current effects of flow regulation on the Peace River; the potential (cumulative) impacts of the planned Site C Hydroelectric Dam on the PAD; the impacts of existing and proposed oil sands projects in the Alberta Oil Sands region, including as the various projects relate to Aboriginal Peoples; and "any other relevant issues that may negatively impact the OUV of the property".

Overarching concerns identified by the mission are (i) longstanding and unresolved conflicts and tensions between Aboriginal Peoples and governmental and private sector actors which call for a coherent management response in line with the legal framework and unambiguous political commitments to reconciliation; (ii) governance deficiencies, including but not limited to water management across jurisdictions, impact assessment and environmental monitoring; and (iii) the effects of observable and anticipated climate change affecting the property's high-latitude ecosystems. The scale, pace and complexity of industrial development along the critical corridors of the Peace and Athabasca Rivers is exceptional and does not appear to be subject to adequate analysis to underpin informed-decision-making and the development of matching policy, governance and management responses.

The concerns shared by Aboriginal Peoples and many respected senior scientists crystalize in the PAD. Climate change interacts with and adds complexity to the permanent change induced by natural factors and decades of multiple human-induced stressors. As a high latitude wetland-dominated landscape, the PAD is disproportionately vulnerable to climate change, and evidence is mounting that climate change has already had a significant effect on the hydrology and ecology of the PAD. Hydropower development along the upper Peace River, has been a growing concern for around half a century. The construction of the Bennett Dam in British Columbia in the late 1960's set in motion an array of hydrological and ecological impacts altering the entire Peace-Athabasca-Slave system by a combination of flow regulation and climate change. Among other effects, flow regulation for hydropower directly influences the timing and magnitude of flows that can translate to a reduction in recharge through extreme high water events that block outflows from the PAD or create ice jams that contribute to flooding of the PAD and hydration of its perched basins. Hydration of the PAD affects its biodiversity, productivity and navigability in many ways. The Site C and the proposed Amisk hydropower projects have so far not been assessed in terms of their impacts on the already altered PAD even though the latter is both a fundamental contributor to the justification of World Heritage and Ramsar status and home to several Aboriginal Peoples. The mission strongly recommends that all projects proposing further flow modification of the Peace River - and of the directly linked Athabasca and Slave Rivers - consider cumulative impacts on the PAD as part of their assessment and that the best available environmental flow assessments be conducted for all three rivers as a means of identifying environmental flow needs for the PAD.

The vast Alberta Oil Sands are located immediately to the south of the PAD along the lower Athabasca River. Mounting evidence suggests oil sands impacts are related to atmospheric deposition of contaminants (e.g. sulphate) in the PAD and adjacent WBNP lands, transport of water-borne contaminants such as mercury and even incorporation into the food web via bird eggs and fish, and fatal exposure to toxic tailings ponds, yet governments and industry seem to be unwilling to adequately monitor or accept these claims. Severe human health concerns related to exposure of these contaminants whether through water, food or air require investigation. The area is also centred on a major migratory bird flyway that includes passage of countless migratory waterfowl and songbirds, including the endangered Whooping Crane. The proposed Teck Frontier project would place the oil sands development ever closer to the southern boundary of WBNP and thereby the threats and risks originating from leaks and spills from tailings ponds; additional water withdrawal; and atmospheric deposition of particles containing contaminants such as polycyclic aromatic hydrocarbons (PAHs), nitrogen oxides, and sulphate.. The proposed Teck Frontier project would also result in direct encroachment into the documented habitat of the disease-free Ronald Lake Wood Bison Herd, which is of major conservation importance.

Change in the PAD as such is undisputed and there are clear, consistent and conceivable hints at causal relationships with industrial development, confirmed by western science and local and indigenous knowledge. The limitations of existing monitoring in place and the exemption of the Site C project from in-depth assessment make conclusive judgments difficult. The absence of proof is not proof of absence though and the differing opinions should primarily be seen as an indicator for the need to generate better information to enable informed decision-making.

While the mission focused its efforts on understanding impacts on the OUV of WBNP from the aforementioned threats, there are other threats to the property that should be acknowledged, studied and monitored. Forestry is a major industry and land use in the region with multiple direct and indirect environmental impacts. Commercial logging was conducted even within WBNP into the early 1990s, i.e. including after its World Heritage inscription. The related pulp and paper industry has resulted in well-documented air and water contamination. Further risks stem from past uranium mining near the shores of Lake Athabasca, the expanding agricultural region to the south and the increasingly intense resource development in the upper Peace River watershed. All of the aforementioned stressors should be fully considered as part of the strategic environmental assessment (SEA) for WBNP and include changes both inside and outside the property that are deemed potentially important with respect to its Ecological Integrity under the overall lens of climate change. One key finding of the mission with respect to the cumulative impacts of the threats to the OUV of the property is that they are far more complex and severe than previously thought. The mission therefore strongly recommends a reconsideration of the scope and depth of the SEA study, and consequently the resource allocation.

The mission identified a number of additional concerns. First, the boundary configuration and the absence of a buffer zone leave much room for improvement. There are several options to enhance coordination and cooperation between the federal land management of WBNP and neighbouring provincial and territorial jurisdictions. All should be discussed, including in order to comply with World Heritage buffer zone requirements as defined in paragraphs 103 to 107 of the *Operational Guidelines for the Implementation of the World Heritage Convention*. Second, the property would benefit from a renewed focus on and investment in the scientific capacity of Parks Canada Agency to meet the various challenges to the Ecological Integrity of the WBNP. The property's modest staffing and resourcing deserves re-consideration in the view of the mission. Third, the long-term future of the property's two most iconic species, Wood Bison and Whooping Crane, remains uncertain and requires permanent attention.

At the time of its initial establishment and subsequent expansion, WBNP was located within a vast intact and remote landscape, which for the most part was very difficult to access. While WBNP continues to be a comparatively remote protected area, the mission fully agrees with most observers that continuation of the development approach of the last decades renders the future of WBNP uncertain at the very best, in particular as regards the PAD. Several current project proposals add severity and urgency to this message.

After careful consideration, the mission concluded that the State Party should be given one opportunity under the World Heritage Convention to immediately develop a structured and adequately funded response guided by the below recommendations, in effect amounting to "major operations" in the sense of Paragraph 177 of the *Operational Guidelines for the Implementation of the World Heritage Convention*. The mission is of the opinion that an absence of a major and timely response would constitute a case for recommending inscription of WBNP on the List of World Heritage in Danger due to the combination of credible and severe concerns combined with inadequate State Party response to existing and expected Committee requests. The State Party of Canada certainly has the scientific capacity to analyse the situation like few others to inform a more balanced decision-making. Doing so will respect its longstanding involvement in and commitment to the *World Heritage Convention*.

The following list provides an overview of all individual recommendations to the State Party offered in chapter 3. All recommendations are explained in detail in the corresponding sub-chapters.

Recommendation 1
Adopt a clear and coherent policy and guidance to enable the transition to a genuine partnership with First Nations and Métis communities in the governance and management of the property.

Recommendation 2
Considering the increasing pressures on the property at this time, prioritise conservation and ensure that the State Party's science capacity enables Parks Canada's legal obligation to maintain and restore the Ecological Integrity of the property.

Recommendation 3
To enable informed decision-making, conduct environmental flows assessments to the highest international standards for the Peace, Athabasca and Slave Rivers as they pertain to the health of the Peace-Athabasca Delta (PAD), in order to identify water flows needed to sustain the ecological functioning of the PAD under the circumstances of existing and planned future dams and water withdrawals. These assessments should incorporate projections of climate change and should determine the cumulative effects on the PAD and the property of flow regulation of all existing and proposed dams on all three rivers.

Recommendation 4
Conduct, in line with the IUCN World Heritage Advice Note on Environmental Assessment, an environmental and social impact assessment of the Site C project and, if moved forward, any other hydropower projects potentially affecting the Outstanding Universal Value of the property.

Recommendation 5
Conduct an environmental and social impact assessment of the proposed Teck Frontier oil sands mine project in line with the IUCN World Heritage Advice Note on Environmental Assessment, fully taking into account the Outstanding Universal Value of the property, including the Peace-Athabasca Delta.

Recommendation 6
Conduct a systematic risk assessment of the tailings ponds of the Alberta Oil Sands region with a focus on risks to the Peace-Athabasca Delta, and submit the report of this assessment to the World Heritage Centre, for review by IUCN, in accordance with Paragraph 172 of the *Operational Guidelines*.

Recommendation 7
Establish adequate baseline hydrological information of the Peace and Athabasca River Basins to enhance the reference for monitoring and assessing current and future hydrological conditions.

Recommendation 8
Expand the scope of the Strategic Environmental Assessment (SEA), which was requested by the Committee in its Decision **39 COM 7B.18**, so that it adequately reflects the scale, pace and complexity of industrial development, land use changes and river flow manipulations in the Peace and Athabasca River watersheds, both in terms of individual and cumulative impacts.

Recommendation 9
Expand the scope of monitoring and project assessments to encompass possible individual and cumulative impacts on the Outstanding Universal Value of the property and in particular the PAD.

Recommendation 10
Conduct a comprehensive assessment of options, in order to underpin decision-making to put in place an effective buffer zone, as defined in the *Operational Guidelines*. The Birch River deserves particular attention as the only relatively intact major watershed of the PAD.

Recommendation 11
Conduct a systematic assessment of options to better realize synergies between the property and land use planning in its immediate vicinity, including the existing and planned provincial protected areas.

Recommendation 12
Consolidate the management resources and capacity to a standard commensurate with World Heritage status and adequately respond to the challenges facing the property by:
a) Reinstating a year round status and staffing of WBNP;
b) Recruiting a full-time Superintendent exclusively in charge of WBNP;
c) Ensuring an adequate Parks Canada presence in Fort Chipewyan, part of the critical Peace-Athabasca Delta area and a major ecological region of WBNP.

Recommendation 13
Further develop the existing Cooperative Management Committee established by the State Party, and consolidate a functional and effective mechanism to involve Aboriginal Peoples in the management of the property.

Recommendation 14
Ensure that the preparation and skills of involved governmental staff correspond to the requirements inherent in the evolving relationship with First Nations and Métis communities.

Recommendation 15
Further harmonize and adopt the Species Recovery Strategy for Wood Bison throughout its range, including but not limited to the Greater WBNP Ecosystem, and specifically:
a) Urgently invest in comprehensive and independent analysis of the conservation importance and status of the Ronald Lake Bison Herd, including threats to it posed by proposed development, within a broader Species Recovery Strategy;
b) Dedicate, in full cooperation with Aboriginal Peoples, adequate attention and funding to the management of Wood Bison, including as regards the development of disease management options other than culling.

Recommendation 16
Continue to closely monitor the entire used and potential nesting area of the Whooping Crane within the Greater WBNP Ecosystem so as to be able to respond to possibly changing management requirements.

Recommendation 17
Incorporate invasive alien species (IAS) into the overall monitoring of the property and the PAD based on science and local and indigenous knowledge, and based on monitoring results, develop an appropriate management response to control the spread of IAS.

1. BACKGROUND TO THE MISSION

Wood Buffalo National Park (WBNP) was established in 1922 with the objective to protect northern Canada's last remaining bison herd. Enlarged in 1926, WBNP is Canada's largest national park to this day at around 4.5 million hectares, a surface area exceeding the size of the Netherlands. WBNP is located in the boreal plains of northern Alberta and the southern Northwest Territories of north-central Canada. WBNP and the broader region, sometimes referred to as the Greater WBNP Ecosystem, are part of the Interior Plains of North America, which are characterized by poorly drained (hydric) lowlands underlain by sedimentary rock and karst topography, and in some southern areas by black spruce muskeg on flat land. The impressive landscape is a living and dynamic mosaic of vast wetlands, boreal forests and grasslands, intersected by numerous rivers and creeks and dotted with innumerable lakes and ponds. Underlain by permafrost, the grasslands are the largest intact grass and sedge meadows left in North America.

What is today WBNP has been the traditional territory of several First Nations long before European arrival and continues to be to this day. History changed course when the fur trade became a major economic activity in the area in the 18th century. Researchers, adventurers, missionaries, prospectors and subsequently governmental representatives followed the footsteps of the fur traders. Fort Smith and Fort Chipewyan were created, to this day major settlements of Dene and Cree First Nations and Métis communities. The land in the park and its surroundings is an integral part of indigenous and local culture, spirituality and livelihoods. There are far-reaching indigenous rights at various levels, only partially respected in the view of all First Nations and Métis representatives met and many other observers. The establishment of the national park itself resulted in conflicts and tensions. Despite increasing recognition and efforts, these conflicts and tensions have never been resolved.

WBNP is home to a broad range of very diverse natural features, several undoubtedly of global conservation significance. While a brief overview can hardly start to do justice to the natural wealth, a selection of conservation values of particular note are listed hereafter:

- Some of the largest relatively undisturbed and least fragmented forest, grassland and wetland ecosystems in North America;
- Increasingly rare ongoing large-scale ecosystem processes with limited human interference, including the comparatively natural fire regime;
- Extensive salt plains and gypsum karst with associated extraordinary plant communities;
- The world's largest herd of free-ranging Wood Bison (*Bison bison athabascae*) with a unique uninterrupted predator-prey relationship between this species and the Grey Wolf (*Canis lupus*);
- The summer range and breeding ground of the only wild, self-sustaining migratory flock of the endangered Whooping Crane (*Grus americana*);
- Significant populations of migrating, nesting, breeding and moulting waterfowl at an intersection of four major bird migration flyways - among many other significant wildlife populations.

Illustrating the global importance, two Wetlands of International Importance have been recognized within WBNP under the Ramsar Convention, the "Whooping Crane Summer Range" and the famous Peace-Athabasca Delta (PAD). The crane nesting area is also recognized as one of only two Alliance for Zero Extinction (AZE) sites in all of Canada. In addition to its cultural and socio-economic importance, the PAD is widely accepted to be the most complex, most fascinating and most vulnerable part of WBNP. Along with many smaller rivers and creeks, the Peace, Athabasca and Birch Rivers converge at the western end of Lake Athabasca to form one of the world's largest inland deltas, arguably the world's largest boreal inland delta. While it is not agreed what exactly constitutes the delta, it is widely accepted that roughly 80% of it is located within WBNP. As the heart of WBNP in the view of many, the PAD's enormous ecological, cultural and economic importance is indisputable. In addition to being the world's largest Dark Sky Preserve since 2013, WBNP in 1983 was inscribed on the World Heritage List according to natural World Heritage criteria (vii), (ix) and (x) in recognition of the broad and diverse range of irreplaceable conservation values of global significance.

Despite protection granted by longstanding national park status and multiple global recognitions, the notion of a remote place unaffected by human activities is not tenable anymore. Industrial development along the critically important Peace and Athabasca Rivers has led the majority of local First Nations and Métis communities, scientists, Parks Canada (PCA) staff, conservation NGOs and others to conclude that the integrity of the PAD and WBNP has continuously and increasingly been affected over the past decades. In the perception of all consulted local residents, the pressures have already resulted in tangible negative impacts on the PAD today and imply an uncertain future for the delta and its inhabitants and users.

From a World Heritage perspective, the severity of these concerns first drew major international attention when the Mikisew Cree First Nation (MCFN) submitted a detailed petition to the World Heritage Committee in December 2014. The petition received major support from numerous First Nations and Métis, environmental NGOs, scientists and retired PCA leadership, eventually resulting in a World Heritage Committee Decision requesting the State Party of Canada to invite a joint IUCN/World Heritage Centre reactive monitoring mission (hereafter "the mission") to better understand the situation (**39 COM 7B.18**, Bonn, 2015, see Annex 1 for full text). This background can be interpreted as a sign of increasing recognition of indigenous rights and perspectives in the World Heritage arena, in line with broader national and international processes.

As detailed in the Terms of Reference provided as Annex 2, the concrete objectives of the mission were to "assess the state of conservation of the property, as well as potential threats to its Outstanding Universal Value (OUV)". More specifically, the ToR required the mission to review and assess:

- "The current effects of Peace River flow regulation activities associated with operation of the W.A.C. Bennett Dam and Peace Canyon Dam, on the OUV of the property;
- The potential (cumulative) impacts of the planned Site C project on the hydrological regime of the PAD that could impact the OUV of the property, and the ecological processes as they relate to the OUV of the property, also taking into account the effects of climate change;
- The impacts of existing and planned oil sands projects in the Athabasca Oil Sands Region, as well as their associated tailings ponds, on the OUV of the property, including the impact on movement of migratory birds, and discuss the development and implementation of monitoring programs with the relevant authorities and stakeholders;
- The above-mentioned developments on the ecosystems that support some of the traditional ways of life of indigenous communities."

In line with paragraph 173 of the *Operational Guidelines*, the mission was further tasked and mandated to "review any other relevant issues that may negatively impact the OUV of the property, including its conditions of integrity and protection and management". The mission was conducted by Tilman Jaeger (representing the UNESCO World Heritage Centre) and Dr. Stephen Davis (representing IUCN) and took place from 25 September to 04 October 2016, postponed due to the devastating fires in and around Fort McMurray earlier in the year.

2. LEGAL AND MANAGEMENT FRAMEWORK

While a detailed account of the human history of this part of North America is beyond the scope of this report, it is important to reiterate that what is today the national park and World Heritage property has long been inhabited and used. What is called natural resource governance and management today has been an integral part of indigenous life in the region for a long time and in many ways continues to be. It can reasonably be argued that the natural environment has been shaping indigenous life while indigenous peoples simultaneously have been shaping the natural environment in many ways. The indigenous past, present and future is today reflected and considered in many facets of the legal and policy framework, including in Canada's Constitution, Treaty Eight and specific court decisions and it is essential to be aware of this backdrop. In the view of all indigenous representatives met by the mission, however, governmental decisions continue to routinely contradict or conflict with indigenous rights. Meetings and discussions during the mission made it very clear that many conflicts and tensions remain to be addressed. While numerous First Nations and Métis representatives acknowledged that PCA increasingly and credibly acknowledges and respects their rights, culture, knowledge and concerns, much remains to be done to make the legal obligations and strong political commitments to reconciliation a reality.

WBNP's formal conservation history, according to most sources, is related to the end of the federally promoted killings of bison in Canada in 1898. In 1922, some 2,600,000 ha of land were designated as a bison sanctuary under the then Forest Reserves and Parks Act. Four years later, WBNP was enlarged to its vast present surface area. From a contemporary understanding, the longstanding status as a national park is slightly misleading, as one explicit management priority between 1922 and 1964 was job creation through various forms of resource extraction and use. Far from contemporary connotations of the terms sanctuary and national park, commercial logging, fishing and bison meat production were explicitly promoted. Bison management involved massive operations, including habitat manipulations and intensive predator control, namely mass culling of wolves.

The federal authority over WBNP was shifted from the Northern Administration Branch of the Department of Northern Affairs and Natural Resources in 1964 to the National Parks Branch of the Department of the Interior (Olsen, 1992), a process completed only in 1969 according to Potyondi (1979). It is only since then that management has formally been focusing on nature conservation. WBNP is federal crown land almost in its entirety. The original land base of the park has decreased slightly with the excision of eight small areas for creation of indigenous reserve lands. A ninth is currently proposed. Total area excised or proposed to be excised is some 6,500 ha (around 0.15 % of the park).

Several small First Nations reserves are today situated inside WBNP's boundaries. The Government of Canada is the land manager of WBNP, which is administered by PCA, one of three departments/agencies under the responsibility of the Minister of Environment and Climate Change Canada (ECCC). PCA's mandate and obligation includes impact assessments of proposed activities within national parks. Assessments of proposed projects outside of national parks with potential impacts on national parks trigger PCA involvement, but are otherwise led by the Canadian Environmental Assessment Agency (CEAA). Examples of PCA involvement in assessments regarding WBNP include Site C, Glacier Power (Dunvegan) and Amisk hydroelectric project proposals, as well as the Teck Frontier and Joslyn North oil sands project proposals.

Central pieces of federal law and policy determining and guiding management include (i) the Canada National Parks Act (CNPA) and Regulations (2000); (ii) the Parks Canada Agency Act (1998); (iii) the WBNP Game Regulations (1978); and (iv) the Parks Canada Guiding Principles and Operational Policies (GPOP, signed in 1994). GPOP includes a short section on what is being referred to as "aboriginal interests". GPOP also contains explicit and repeated reference to Canada's commitment to cultural and natural heritage under the World Heritage Convention and PCA's "leadership role" in this context.

The explicit recognition of the maintenance and restoration of "Ecological Integrity" as a "first priority" in Canada's National Parks Act is remarkable, both as a conceptual framework and as a legal obligation. The CNPA defines Ecological Integrity as "a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes" (see chapter 7 for link to full text of the Act and other legislation). Ecological Integrity guides site level planning, monitoring and reporting, including to Parliament and the public. At the national level, the concept is reflected in an Ecological Integrity Monitoring Program (EIMP). While PCA has no mandate beyond federal crown land within parks, it is clear that Ecological Integrity necessarily implies interaction with land and resource use or any other development outside of the national parks, particularly when development results in, or can reasonably be expected to result in impacts on national parks. In this sense, Ecological Integrity can also be interpreted as a mandate and obligation to interact with other federal actors and adjacent jurisdictions, actors, stakeholders and rights-holders, such as provincial and territorial governments, First Nations, Métis, local communities, civil society, the scientific community and the private sector.

In no particular order, further directly relevant pieces of legislation and policy include the Canadian Environmental Protection Act (1999), Fisheries Act (1985), the Migratory Birds Convention Act (1994), the Species at Risk Act (2003), the Navigation Protection Act (1985), the Indian Act (first passed in 1876 with several amendments since), the Canadian Biodiversity Strategy (1995) and "Canada's Action on Climate Change", as the governmental websites put it at the time of writing. The more obvious federal counterparts of PCA include, but are not limited to, the Canadian Environmental Assessment Agency (CEAA), the Canadian Wildlife Service (CWS) and Transport Canada (TC). Coordination and cooperation is ever more essential with these and many other federal, provincial and territorial institutions, First Nations, Métis, civil society and the private sector.

At the operational level, WBNP belongs to PCA's Southwest Northwest Territories Field Unit, directed by the Field Unit Superintendent. The latter simultaneously serves as the Superintendent of WBNP and reports to PCA's Chief Executive Officer via the Executive Director, Prairies, Yukon and Northwest Territories and Senior Vice President of Operations. There are administrative PCA offices in Fort Smith and Fort Chipewyan, the two main settlements. The latter is accessible by air, water or winter road only. Since 1984 management plans guide operations. The latest and current plan was approved by Parliament in 2010 (Parks Canada Agency, 2010). Like the 2009 State of the Park Report (Parks Canada Agency, 2009), the current plan conceivably prioritizes cooperative management, bison management and the PAD. The current plan also provides direction in the form of zonation for protection of rare and endangered species, ecological maintenance and restoration and visitor experience and use. The next management plan is due in 2020, a substantial undertaking given the attempts to increase the involvement of stakeholders and rights-holders in a polarized setting.

3. IDENTIFICATION AND ASSESSMENT OF ISSUES

3.1 Governmental Relationships with First Nations and Métis

According to Indigenous and Northern Affairs Canada (INAC) the term "Aboriginal Peoples" encompasses First Nations, Inuit and Métis in Canada. The terms "First Nations" and "Inuit" are widely used, legally undefined terms comparable to internationally common definitions of "indigenous peoples". The Métis, in INAC's definition, are "people of mixed First Nation and European ancestry who identify themselves as Métis". It is important to understand that a total of eleven First Nations and Métis live in and around WBNP and today have various and far-reaching rights, which national park establishment had historically restricted despite Treaty Eight (see below).

In alphabetical order, Métis in WBNP are organized as (i) Fort Chipewyan Métis Local 125; (ii) Fort Resolution Métis Council; and (iii) Fort Smith Métis Council and (iv) Hay River Métis Government Council. First Nations, likewise in alphabetical order, include the (i) Athabasca Chipewyan First Nation (ACFN); (ii) Deninu K'ue First Nation (DKFN); (iii) K'atl'odeeche First Nation (KFN); (iv) Little Red River Cree Nation (LRRCN); (v) Mikisew Cree First Nation (MCFN); (vi) Salt River First Nation (SRFN); and (vii) Smith's Landing First Nation (SLFN).

During the mission a "need for healing" was repeatedly suggested to describe the relationship between Aboriginal Peoples and governmental institutions, a clear indication of a troubled history. Concrete reasons for tensions and conflicts in WBNP were commonly related to (i) access restrictions to natural resources, including historic resettlement; (ii) limited or lacking consultation or other forms of involvement in decision-making directly or indirectly affecting First Nations and Métis; and (iii) limited or lacking linkages between consultation and decision-making when consultation does occur, leading to "consultation fatigue".

As the federal land manager, PCA has a direct presence on the land and thus directly engages in local relationships. PCA has been and continues to be both a source and a target of tensions. Many First Nations representatives highlighted specific past incidents, often conflictive personal encounters or encounters of family members with PCA staff. One representative called the national park a "weapon against First Nations". On a more optimistic note, PCA's direct presence on the land comes with important new responsibilities and opportunities at a time of new commitments to reconciliation. Numerous aboriginal representatives acknowledged important and credible efforts to improve relationships on the part of PCA.

Park management prides itself on WBNP being the first national park in Canada to allow traditional harvesting. Decades of a controversial past permitting system put the claim in perspective though. Today, following court cases in 2003 and 2005, permits to hunt, fish and trap for personal use are no longer required. Formally, much more meaningful rights have been granted over time. Section 35 of Canada's Constitution Act (1982) recognizes and affirms existing aboriginal rights. Furthermore, WBNP is located within the vast area covered by Treaty Eight (1899, see map 6 in Annex 6). One of eleven numbered treaties across Canada, Treaty Eight in principle has far-reaching implications, including but not limited to natural resource use. However, the terms of Treaty Eight have been "subject to different interpretations regarding the nature and fulfilment of the obligations incurred by the federal government" ever since (Madill, 1986).

More recently, Canada has made a strong commitment to the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) after years of being one of its most visible opponents. UNDRIP encompasses the concept of Free, Prior and Informed Consent (FPIC) in many of its articles. At the national level, concrete commitments to reconciliation are contained in public mandate letters, which determine ministerial priorities. The public mandate letter addressed to the current ECCC Minister calls for a "renewed, nation-to-nation relationship with Indigenous Peoples, based on recognition of rights, respect, co-operation, and partnership".

Testing the above framework against opinions expressed to the mission, a deep gap emerges. In the view of all First Nations and Métis representatives met, there is an enormous lack of clarity, as well as a mismatch between political commitments and their lived reality. As the various layers granting rights overlap and are rooted in differing governmental responsibilities and institutions, First Nations perceive it as next-to-impossible to enhance clarity and move towards a more level playing field, which was described as extraordinarily frustrating.

At the more tangible level of WBNP, the exact nature of rights is likewise not entirely clear. According to PCA's GPOP "people and the environment are inseparable." More specifically, GPOP states that "where aboriginal interests have not been previously dealt with by treaty or other means, it is the Government of Canada's policy to negotiate comprehensive claims based on traditional and continuing use and occupancy of land." At the same time, the current legal, policy and management guidance for WBNP does not amount to a clear and coherent framework reflecting existing laws, Treaty Eight, court decisions and commitments. For example, while court decisions granting harvesting rights are respected, they remain to be clearly reflected and defined in applicable guidance and planning documents.

The Aboriginal Committee for the Cooperative Management of WBNP is a promising vehicle and step towards a better relationship between governmental park management and First Nations and Métis. Established in 2014, the Committee represents a good beginning even though apparently not all of the eleven Aboriginal Peoples participate. Based on discussions during the mission, it appears to enable a partially effective form of consultation rather than full cooperation at this stage.

Several First Nations representatives expressed dissatisfaction with WBNP's World Heritage status; a national and intergovernmental decision they say they never had any part in. Many First Nations explicitly called for inscription of WBNP on the List of World Heritage in Danger in line with the MCFN Petition (MCFN, 2014; see also MCFN, 2016), also as a means to draw attention to indigenous concerns. At the same time, a smaller number of First Nations representatives positioned themselves against such a recommendation, fearing that such status might restrict their harvesting rights. The mission wishes to put on record that the latter thinking appears to be based on a misconception. While the mission sees a fundamental and urgent need to enhance clarity with regard to indigenous rights and their relationship with national park objectives, it does not consider indigenous resource use to be a threat to the property's OUV at this stage.

At a time when First Nations and Métis unanimously call the adequacy of current consultation practices into question, it is a long way to collaboration and an even longer way to shared decision-making. The scale of this shift implies a coherent long-term vision and approach, as well as considerably strengthened efforts. Drawing on several discussions during the mission, cooperation between PCA and Aboriginal Peoples based on common interests, as opposed to common values, might be the most promising avenue to explore. It is a misconception to expect governmental conservation and Aboriginal Peoples to have the same objectives for the same reasons. Common interests, however, certainly exist in terms of better understanding and reducing external pressures on WBNP's cultural and natural resources. Despite a difficult history and relationship, it should be recalled in this context that PCA has successfully protected WBNP from major industrial development within its boundaries, which in all likelihood would have occurred without national park status.

In summary, national park status has long been conflicting with interests, rights and aspirations of First Nations and Métis. WBNP is in a transition towards more meaningful realization of indigenous rights, which comes with opportunities and risks. If the legal framework and political commitments are to be taken seriously, a fundamental shift seems indispensable and clear rights will have to be coupled with clear responsibilities. A step-wise approach is encouraged so as not to dismantle the current governance and management before a functional alternative is in place. There is a need to improve clarity and coherence of the applicable legal and policy framework comprised of various bits and pieces of very different eras. Some indigenous representatives suggested dual naming of the park and property, i.e. the parallel use of English and indigenous names as a gesture and symbol of a new beginning. The idea deserves to be discussed in the view of the mission.

Recommendation 1
Adopt a clear and coherent policy and guidance to enable the transition to a genuine partnership with First Nations and Métis communities in the governance and management of the property.

3.2 Overarching Concerns about Governance

3.2.1 Governance of Impact Assessment and Environmental Monitoring

Severe concerns about both regulatory failure and regulatory capture were consistently brought forward in writing and in personal communication during the mission. Current efforts "to restore trust in environmental assessment", in the wording of a federal governmental press release and other official websites online at the time of writing, suggest a political recognition of such concerns. Even if one does not accept the notion of a "regulatory crisis" which was repeatedly communicated to the mission, one still has to accept the widespread perception of such a crisis. It is undoubtedly one factor compromising the relationships between different stakeholders and rights-holders.

Written submissions and personal communication during the mission consistently suggested limited effectiveness of governance in terms of balancing competing public interests and consideration of Aboriginal Peoples. Such concerns often referred to impact assessments and environmental monitoring. Deficiencies in both areas were described to affect directly and indirectly WBNP and in particular the PAD. Specific concerns communicated to the mission included, but were not limited to:

- Severe deficiencies in meaningful involvement of Aboriginal Peoples;
- Lack of meaningful consideration of the perspectives and knowledge of Aboriginal Peoples in decision-making when consultation does take place;
- Lack of coherence and clarity in terms of respecting indigenous rights granted at various levels, including the Constitution, Treaties and specific court decisions;
- Severe deficiencies in functional mechanisms to plan land and resource use across jurisdictional boundaries;
- Particularly severe deficiencies in functional mechanisms to manage water across jurisdictional boundaries despite longstanding efforts and a wealth of existing information, including specific recommendations for enhancing governance, for example under the Mackenzie River Basin Transboundary Waters Master Agreement (MRTWMA);
- Time and resource constraints, as well as limited mandates of panels set up to review proposals of very large and complex projects;
- Exemption of proposals for very large and complex projects from fundamental components of established, and in principle legally required review process as a function of political decisions;
- Scientifically questionable definitions of potential impact areas or zones associated with major development projects;
- Limitations in coherent, adequate and independent monitoring;
- Absence of adequate assessment and management of cumulative effects;
- Absence of adequate bridges linking monitoring results with policy and decision-making.

A robust and coordinated monitoring program is essential to managing and detecting changes in the vital signs of any large ecosystem. As mentioned earlier, one priority and Parks Canada obligation, through the CNPA, is the protection or restoration of Ecological Integrity as it pertains to natural resources and processes in Canada's national parks. Therefore, ecosystem monitoring is a critical tool and obligation in both detecting change and in tracking recovery following restoration or other management actions whether construction of physical features such as weirs, or wildlife corridors or fire management. While there are several governmental, quasi-governmental monitoring programs and relevant research projects focused on WBNP, and specifically the PAD, in general these programs appear to be loosely coordinated with one another at best. In some instances, programs appear to be entirely independent of one another with no coordination or communication of findings.

The Regional Aquatic Monitoring Program (RAMP) began in the late 1990s as a small program amongst a few companies to coordinate their monitoring and reporting obligations under regulatory approvals; however, its ability to detect changes in response to development has been questioned (see Timoney 2013). The Peace-Athabasca Delta Ecological Monitoring Program (PADEMP) is a partnership between indigenous, federal, provincial, and territorial governments and grew out of concerns over the health of the PAD. As such, it merges western science with local and indigenous knowledge to understand specific problems such as the declining population of muskrats. Despite undisputed merits of its approach, this community and communications-based program seems limited in its capacity to understanding and addressing the full range of threats to the PAD. It also appears to be disconnected from policy development and decision-making.

The Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring (JOSM) is a well-funded (roughly CAD 50 million/year) program that grew out of recommendations by federal and provincial panels in 2010 and 2011, respectively, stressing the need to have world-class, coordinated and question-driven monitoring in the Alberta Oil Sands region that could address indigenous and stakeholder concerns about cumulative impacts. PADEMP and JOSM, both with strong focus on the PAD, are potentially compatible efforts, yet there seems to be little coordination between these monitoring programs. First Nations have withdrawn their initial involvement in JOSM, the last First Nation having left JOSM in 2014 "due to concerns about the engagement process, limited incorporation of traditional ecological knowledge, and lack of transparency" (2015 State of Conservation Report, see http://whc.unesco.org/en/soc/3318).

From a technical perspective, the mission notes a number of important question marks with regard to these monitoring programs. JOSM currently lacks the ability to differentiate natural weathering sources of contaminants from impacts caused by bitumen mining and upgrading, in aquatic systems downstream of the mineable oil sands region. This could be addressed through focused laboratory or mesocosm experiments to understand changing ratios in conservative tracers relative to bitumen-associated indicators. This focused experimental approach should be coupled with field-scale monitoring using control watersheds that are high in bitumen reserves but without oil sands development (e.g. Birch River or even Peace River) compared to the lower Athabasca River. More effort in tracking atmospheric versus terrestrial or aquatic sources of oil sands-derived pollutants (as suggested in Kelly et al. 2010) would also help to establish the contribution from this type of pollution. In addition, techniques looking at compound-specific markers in isotopic tracers in oil sands-derived contaminants or their degradation products should be advanced as a means to provide a more robust detection of impacts. Evidence from Jautzy et al. (2015; as cited in Schindler 2015) suggests this may be a reliable means for differentiating natural from industrial sources.

The conclusion of little or no impact of contaminant loading from the Alberta Oil Sands region to the PAD that was communicated to the mission by representatives of the Government of Alberta relied heavily on JOSM's results showing signal attenuation from its origin to the PAD.

This, they concluded, was sufficient evidence of no impact. However, declining concentrations of a contaminant with distance from a source is not evidence in support of such a conclusion. Rather, it is merely an indication that air and water are dispersing contaminants over some distance. A conclusion about the degree of contamination should be unique to each contaminant and based on its accumulation rate (even if at a low level), its residence time within a system, and duration of exposure. Mass balance studies integrating exposure over longer periods of time to attenuated or low levels of different contaminants would provide more resolution as to potential impacts from the Alberta Oil Sands region.

Besides technical question marks, JOSM has been accused of limited transparency and insufficient consideration of aboriginal perspectives, resulting in the aforementioned departure of all aboriginal JOSM partners. For all its merits and investment, it seems unlikely that JOSM can meet its ambitious objectives in a very polarized setting of openly stated mistrust. The existing governance of JOSM and impact assessment and environmental monitoring, analysis, policy and management responses regarding WBNP, and the PAD more broadly, are widely seen to be incompatible with the pace, scale and complexity of industrial development and to suffer from deficiencies in design and governance. Perhaps the most important question mark, there is an absence of a meaningful consideration of cumulative impacts, as discussed in chapter 3.4.3 in more detail. Current efforts are not accepted by key rights-holders and stakeholders and do not constitute an adequate basis for informed decision-making. Recommendations are offered in related sections under subchapter 3.3.

3.2.2 Changes in Capacity and Focus of Parks Canada Agency

Parks Canada Agency (PCA) is a well-established and highly professional protected areas agency with a longstanding institutional history. Besides the past inability to effectively respond to commercial logging within WBNP for more than two decades and past and current tensions with First Nations and Métis, most consulted by the mission expressed appreciation of the performance of WBNP staff. The PCA submissions contributing to environmental assessments are constructive, respectful of PCA's mandate and of high technical quality.

PCA's Ecological Integrity tenet is an exemplary orientation of a protected areas agency by implicitly and explicitly highlighting the need to manage protected areas within their broader context. In line with the conclusions of a distinguished Panel on Ecological Integrity (Parks Canada Agency, 2000), environmental NGOs consulted by the mission consistently raised serious concerns about PCA's current ability to live up to the high standards inherent to the Ecological Integrity approach. These concerns were underpinned by what was described as (i) a considerably reduced science capacity and (ii) a shifting from a conservation focus as part of broader governmental efforts to maximize the generation of "re-spendable revenues", namely through tourism promotion. Written submissions in support of the MCFN petition, including by retired PCA leaders, consistently make reference to one or both of the above concerns. In the wording of a comprehensive NGO report, there has been "a significant shift in Parks Canada's approach to managing our national parks, away from their legislative first priority of protecting nature, towards a more tourism and marketing focused agenda which is putting wildlife and wilderness in our national parks at risk", while suggesting that decision-making may be at odds with "existing policies and legislation specifically designed to limit development and protect ecological integrity in our national parks" (CPAWS, 2016). The concerns are in line with an open letter from a large number of former PCA staff calling for the Canadian Government to "restore science capacity in Canada's national parks and national historic sites" (see chapter 7 for link to full text).

In its Fall 2013 report, the Commissioner of Environment and Sustainable Development (Office of the Auditor General of Canada, 2013) noted "intensifying challenges" for PCA to maintain Ecological Integrity, coinciding with reduced resources. The report concludes that PCA "has not clarified how and by when, with significantly fewer resources, it will address the backlog of unfinished work, the emerging threats to ecological integrity, and the declines it has identified in the condition of many park ecosystems. Consequently, there is a significant risk that the Agency could fall further behind in its efforts to maintain or restore ecological integrity in Canada's national parks." This remarkable conclusion adds validity to consistent concerns expressed to the mission in writing and in personal communication, which some might judge as biased. While it is clear that PCA has an important role and obligation to enable visitor experiences, an excessive focus on tourism promotion and a reduced science capacity indeed appear to be incompatible with its core mandate and legal obligations.

Recommendation 2
Considering the increasing pressures on the property at this time, prioritise conservation and ensure that the State Party's science capacity enables Parks Canada's legal obligation to maintain and restore the Ecological Integrity of the property.

3.3 Overarching Concerns about Climate Change

Climate change is a pervasive, global threat to the integrity of the entire boreal region. As an overarching threat, it interacts with and adds complexity to the permanent change induced by natural factors and decades of multiple human-induced stressors. Climate has co-shaped the natural environment and existing and future impacts of climate change will have direct and lasting effects on WBNP's conservation values, including those identified as contributing to its Outstanding Universal Value. Such effects can broadly be categorized as top-down and bottom-up effects, respectively, and both can be expected to occur. From a bottom-up perspective, climate change can affect the fundamental drivers of an ecosystem such as water and nutrient availability, which affects processes regulated by microbial communities and primary producers. These changes at the bottom of the food web have continued impacts across the entire food web. From a top-down perspective, climate drivers may have direct impacts on organisms at the top of the food web through thermal tolerance (affecting aspects such as metabolism, growth, competition, and geographic range) and disease prevalence, which can have cascading effects from higher trophic levels to herbivores, plants, etc.

As part of a high latitude wetland-dominated landscape, WBNP - and particularly the PAD - are highly vulnerable to climate change. Evidence is mounting that climate change has already had a significant effect on the hydrology and ecology of the PAD, along with other natural and anthropogenic factors. However, climate change impacts involve more than just warming, which through a series of complex interactions, may also affect precipitation patterns and the overall water balance of the region. Timoney (2013) provides a useful overview of this, noting changes in everything from water quality to biodiversity in the PAD. Climate change is affecting WBNP directly through warming, drying and altered precipitation patterns. Evidence shows a substantial warming of at least 2.5°C over the past century and a clear trend in the reduction of snow pack in the Canadian Rocky Mountains where the headwaters of both the Peace and Athabasca Rivers are situated. Schindler (2015) estimated a 50% decline in runoff from the lower reach of the Athabasca River due to climate change and references studies suggesting that declines will continue throughout the century as glaciers continue to melt (Schindler et al. 2007). There is also mounting evidence of an increasingly negative water budget for the region, with evapotranspiration exceeding precipitation and an increasing trend in drought severity (Timoney 2013).

Beltaos (2014) estimated that about 1/3 of the changes in Peace River ice-jam flood frequency in the PAD has been directly attributable to climate change, while the other approximate 2/3 of change is attributable to river regulation. To add complexity, the effect of climate change induced warming on glaciers and snowpack will translate to reduced spring flows from snowmelt needed to mechanically break up ice, which is essential to the development of an ice-jam flood. Projections of future climate using the ECCC's Canadian Climate Centre General Circulation Model reveal a 3-week shortening of the ice season by the end of this century compared to the 1961-1990 period (Prowse et al. 2004). The projected warming of about 4°C would lead to further increased evaporative losses of about 35% over a roughly 30-

year period. Despite projections of increased precipitation of about 11%, this would still dramatically tip the water balance of the region toward a drier state (Prowse et al. 2006). The combination of warming, a shifting water budget and river regulation will undoubtedly put the PAD on a trajectory for drier conditions. Combined with changes in the frequency of ice-jam flooding, existing and future development projects involving water abstraction and/or additional flow regulation should be heavily scrutinized for their impacts in flow impedance.

While differing views exist, the above example – and mounting evidence of change – illustrates the need to invest in better understanding the interactions between this naturally dynamic high latitude ecosystem and climate change. As an overarching threat, climate change adds urgency and severity to the need to better understand and address the many stressors affecting WBNP and in particular the PAD. More concretely, there is a wealth of evidence of climate change impacts speaking to the importance of protecting river flows into WBNP and specifically the PAD and the importance of these flows in sustaining the highly organic peat deposits across the WBNP but also the health of the PAD. In short, with warming and drying, climate change will also continue to tip the carbon balance of WBNP towards net carbon emission rather than being a carbon sink. Considering the collective boreal peatland region, this could have a dramatic positive feedback on atmospheric greenhouse gases (GHG) and further warming of the atmosphere (Goulden et al. 1998; Davidson et al. 2006). The mission offers no specific recommendation other than fully considering climate change as a highly relevant and overarching concern in decision-making and as a potential synergistic driver of change when paired with other threats described below.

3.4 Pressures and Risks from Industrial Development

3.4.1 Existing and planned Hydropower Development

Hydropower development is experiencing a renaissance in many parts of the world, partially justified on the grounds of claimed environmental friendliness. This "clean energy" claim neglects that the scientific and technical discussion of hydropower development and its multiple environmental impacts today is much more nuanced. Besides obvious concerns related to the modification of entire river systems, the debate has moved on even in strict terms of GHG emissions from reservoirs and degraded downstream wetland areas. International initiatives, such as the World Commission on Dams (WCD) provide useful guidance on the complexity of social and environmental costs inevitably accompanying large-scale dam development. It is clear that decision-making involves extraordinarily difficult trade-offs and should therefore be based on the best possible information.

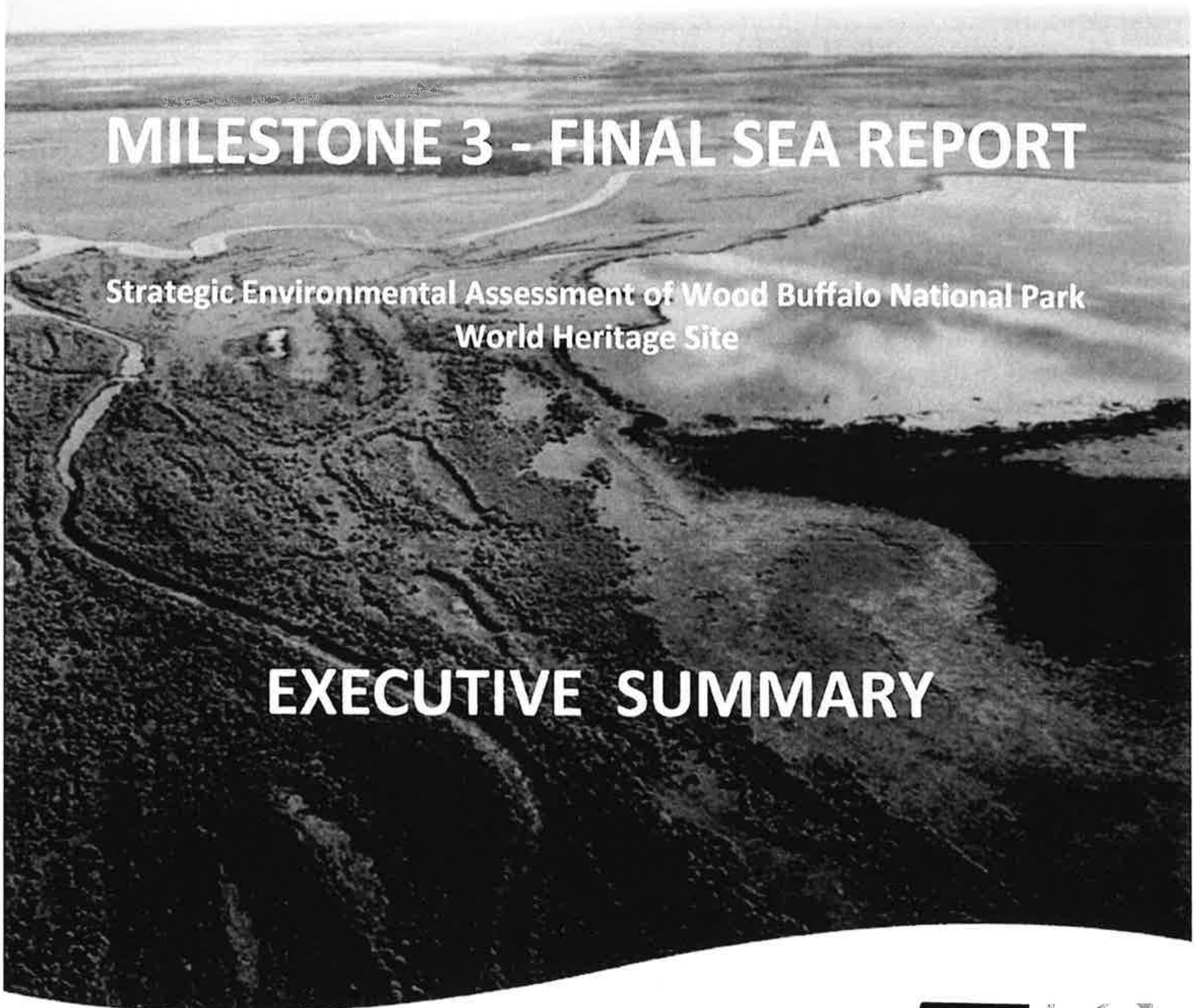
In the 1960s British Columbia (BC) took the political decision to maximise the hydropower potential of the Columbia and Peace Rivers ("Two Rivers Policy"). On the Peace River this resulted most notably in the construction of the W.A.C. Bennett Dam (hereafter Bennett Dam), a 163-meter high earth-fill dam built throughout the 1960s and beginning operation in the early 1970s. The dam created Williston Lake, the third largest reservoir in North America. The Bennett and Peace Canyon Dams capture about 53% of the runoff of the entire Peace River, from only 24% of the entire 293,000 km^2 Peace River drainage basin. This results in modified water and sediment deliveries to a substantial part of the basin. Drying conditions into the 1990s prompted a series of major hydro-ecological assessments under the Northern River Basins Study (NRBS) and the Peace-Athabasca Delta Technical Studies (PADTS). The studies found that the entire Peace-Athabasca-Slave system was influenced by the flow regulation, while also indicating influence from climate (Prowse et al. 2006, see also Peters et al. 2010 and 2001). While there are differing opinions as regards the exact relative importance of flow regulation as a contributor to change, several important effects are nevertheless well documented and widely accepted and in line with the scientific understanding of the impacts of flow regulation. The Bennett Dam set in motion an array of hydrological and ecological impacts to the Peace River and downstream ecosystems in WBNP that continue to threaten the OUV of these areas today. The Bennett Dam was followed a decade later by the Peace Canyon Dam, a run-of-river project with a 50-meter high concrete dam constructed about 23

This is Exhibit "H"
referred to in the Affidavit
of Lisa Tssessaze affirmed before me
this 17 day of Dec., 2018

Gail Gallupe

Commissioner for Taking Affidavits, etc.

Gail Gallupe
Expiry: April 7, 2020
#0742640



MILESTONE 3 - FINAL SEA REPORT

Strategic Environmental Assessment of Wood Buffalo National Park World Heritage Site

EXECUTIVE SUMMARY

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SLR

STRATOS

RAMBOLL ENVIRON

May 2018

EXECUTIVE SUMMARY


Peace-Athabasca Delta, August 2017. Photo: Parks Canada

Wood Buffalo National Park (WBNP) was established in the 1920s to protect the last remaining herds of bison in northern Canada. Straddling the boundary of northern Alberta and southern Northwest Territories, WBNP is the largest national park in Canada with an area of 44,807 square kilometres. In 1983, the global significance of WBNP was recognized with its designation as a world heritage site. The addition of WBNP to the World Heritage List recognizes the international importance of the landscapes and species that the park protects. The world heritage values include: salt plains, gypsum karst, Great Plains boreal grasslands, wolf-bison predator prey relationship, migratory waterfowl, and the Peace-Athabasca Delta (PAD).

In 2014, Mikisew Cree First Nation (MCFN) petitioned the World Heritage Committee to have WBNP added to the List of World Heritage in Danger. For Indigenous groups that rely on the Peace-Athabasca Delta (PAD), their way of life, who they are, is interconnected with the world heritage values, specifically with maintaining healthy relationships between water, vegetation, birds, animals and people. Following their obligations as stewards of their territory, MCFN's petition described observations by MCFN Elders and land-users, and other evidence that existing upstream developments have driven the waters, lands and resources in the PAD – and MCFN's way of life – to a point of crisis. In 2015, the World Heritage Committee responded to the petition by asking Canada to undertake a Strategic Environmental Assessment (SEA) of the cumulative impacts of all developments (including hydroelectric dams, oil sands development, and mining) on the world heritage values of WBNP World Heritage Site. The results of the SEA are reported in this document.

Considering the pace, scale and complexity of potential threats to WBNP, the overall objective of the SEA is to assess the cumulative impacts of all developments on the world heritage values of WBNP in a way that is inclusive of Indigenous Traditional Knowledge and science. Specific objectives are:

- To improve the identification, recognition, and management of cumulative effects impacting WBNP;
- To inform the scope and support the effectiveness of project-level environmental assessments; and,
- To influence the development and implementation of the Action Plan for the protection of the world heritage values of WBNP.

These objectives are for the interconnected purposes of protecting the world heritage values of the site, maintaining or restoring ecological integrity of WBNP, and maintaining or restoring Indigenous ways of life.

SEA Methods

As a 15-month strategic assessment that will inform ongoing action, the SEA did not initiate any new studies, either science or Indigenous Traditional Knowledge. The SEA relied on an extensive review of information and materials provided by experts, including representatives of Indigenous groups (leadership, knowledge holders, land-users, and advisors), researchers, industry, stakeholders, and federal and provincial governments. The assessment was challenged by the complexity of the ecosystem it evaluated, the volume of information, as well as by the relatively short timeline for completion of the project. The assessment was further limited because no data was collected or analysed (ITK or science). All findings are subject to the limitations of available information, much of which was originally collected in order to meet other goals.

The SEA begins by identifying desired outcomes for WBNP's world heritage values. Achievement of these outcomes is central to protecting the world heritage values, the ecological integrity (EI) of WBNP, and Indigenous ways of life. The SEA then uses existing scientific information and Indigenous Traditional Knowledge to describe the current status of the world heritage values, the pathways of effects likely to influence those values, and the current trends that have been observed. It then examines the potential impacts of reasonably foreseeable developments, and climate change, on the pathways of effects. The SEA concludes with 44 recommendations to restore objectives that are not being met and address gaps in information.

Current status, trends and pathways of effects

Wood Bison, WBNP. Photo: Parks Canada

Migratory waterfowl from four continental flyways converge in great numbers on WBNP, especially in the PAD which provides critical wetland habitat for migrating, breeding, molting and staging birds. The spring and fall migratory waterfowl are very important to the Indigenous groups, peoples and communities social, economic, cultural, and spiritual needs. Indigenous Traditional Knowledge indicates populations of waterfowl that have typically stopped in WBNP during migration have shifted their migration route to other areas. Changes in hydrological regime have also decreased the quantity and quality of habitat for waterfowl. As a result, the ability of Indigenous groups, peoples and communities to practice their traditional way of life is being negatively impacted, and desired outcomes for the world heritage values are not being met.

Evidence suggests that the desired outcomes for the karst, salt plains and Great Plains boreal grasslands are being achieved. Stable, neutral trends have been observed for these world heritage values. One observed exception to this trend is the grasslands which support bison. These grasslands are declining in extent or quality as a result of changes to the amount of water recharge occurring in the PAD. Whooping cranes are not yet at the desired population goals, but their populations are increasing so the


Peace-Athabasca Delta. Photo: Parks Canada

trend is positive. More analysis is needed to understand the current status of the wolf-bison population dynamics, but bison at their current population and distribution do not adequately support Indigenous ways of life.

The PAD is one of the world's largest inland deltas and arguably the largest boreal delta in the world. It is formed by a unique system of waterways created by the convergence of the Peace and Athabasca Rivers, along with many smaller rivers and creeks, on the west side of Lake Athabasca. The Indigenous peoples of Fort Chipewyan introduce the PAD, or *Ayapaskaw* in Cree, in a much different way. Their stories about the PAD make it clear that the PAD is their home, their grocery store, their classroom, their medicine cabinet, their church, their highway, their photo album, and the place where their happiest memories live. For many Elders and land-users, how they think and how they see the world comes from the PAD.

> *We were all born in different areas out on the land...[in] the delta, that's why I love the delta so much...this is where you're born and it's such a beautiful feeling when you go out there. It's like going home.*

In the PAD, with the exception of one unknown trend and one mixed trend, all pathways of effects and valued components are showing negative trends. In particular, flow rates in the Peace River have become less variable due to flow regulation on the river and (past) climate change, resulting in decreased summer flows and increased winter flows. Seasonal flows in the Athabasca River have declined over the past fifty years due to a combination of increased water withdrawals and (past) climate change. Flow rate changes on the Peace and reduced seasonal flows on the Athabasca, in conjunction with climate change, have decreased water levels and the extent of open water in the PAD.

While science monitoring of water quality over 6 years has shown a stable trend, Indigenous land-users in the PAD report noticeable changes in the qualities of surface water in the rivers and lakes of the PAD over the last five or six decades. Many land users who used to dip a cup into the water and drink it, now refuse to. Without the springtime flush of water through the PAD, water bodies can become stagnant. In addition, land-users are concerned about the contamination that may be coming down the rivers from municipal, agricultural and industrial development. They are also seeing deformed fish, which the people will not eat when they catch them, and mercury has also been found in high levels in fish and bird eggs, so consumption limits were set by the government, further limiting access to food sources and further eroding confidence in local food sources.

Future development, climate change and management of cumulative effects

Peace-Athabasca Delta, August 2017. Photo: Parks Canada

In order to assess the effects stemming from future development on the world heritage values of WBNP, future developments with the potential to affect the park were identified. These included existing, and reasonably foreseeable developments such as: hydroelectric development, oil sands development, pulp and paper facilities, industrial mines, forestry activities, and municipal development.

With respect to climate change, the majority of relevant literature reviewed indicated future climate changes in the PAD over the next thirty-plus years will likely cause less surface water to be available, and what will be available will reach PAD water bodies earlier in the spring than at present. Increased temperatures will potentially produce thinner snowpack in the headwater and tributary areas of the PAD, which in turn will result in reduced average annual peak, spring peak, and summer flows. Anticipated increases in air temperature may also produce mid-winter thaws, which could cause winter flows to increase from current levels and have a negative impact on ice quality both in terms of safe travel across and in the structural quality of the ice and its ability to contribute to ice jam flooding events.

Predictions for trends combining the past trends, predicted developments and climate changes were only possible for migratory waterfowl, the PAD and Whooping Crane. With the PAD and migratory waterfowl desired outcomes already not being met and predicted negative trends, the predicted trends of these desired outcomes is negative. The trend of Whooping Crane population related desired outcomes were expected to continue to be positive.

The analysis was conducted within the context of the cumulative effects tools currently being used to manage the pathways of effects. The existence of such a broad suite of cumulative effects and other environmental effects management tools is evidence of the evolving sophistication of management of cumulative effects. Only a decade ago, this breadth of tools was not available. The SEA found that though these tools were mitigating impacts to the WBNP world heritage values, many tools had either not been completed or fully implemented, or were developed without analysis to ensure they were protective of the WBNP World Heritage Values.

Conclusions

The PAD, in particular, is a very complex ecosystem and as a result, there will always be unanswered questions. However, by applying the precautionary principle, a lack of information should not prevent action. Adaptive management solutions must be advanced with the involvement of Indigenous peoples and Indigenous Traditional Knowledge. Furthermore, collaborative approaches involving all parties will be necessary to develop the best possible mitigations and increase the likelihood of success. In particular, collaboration with Indigenous peoples will be important because it is Indigenous peoples who experience the impacts most directly given their intrinsic connection to the land.

The call for immediate action was repeated throughout the course of developing this SEA, in particular from Indigenous communities who rely on the PAD. While ecological monitoring and ITK have shown that with shifts in flooding, for example, ecosystems can rebound, permanent changes to the delta environment are possible and undesirable. Permanent changes could put at risk the world heritage values of the PAD and its ecological integrity, and would be particularly undesirable for Indigenous people who transfer cultural knowledge and skills to the next generation on the land in the context of carrying out traditional activities. When this knowledge is not passed down, communities risk losing their culture and connections to the land. The more time with lack of access, or changes to the quantity and quality of resources, the higher the risk that this transfer of knowledge is interrupted or prevented.

The recommendations in this report are put forward as considerations for the responsible jurisdictions in the multi-jurisdictional Action Plan that is presently being developed for WBNP.

This is Exhibit "I"
referred to in the Affidavit
of Lisa Tssessaze affirmed before me
this 17 day of Dec., 2018

Gail Gallupe

Commissioner for Taking Affidavits, etc.

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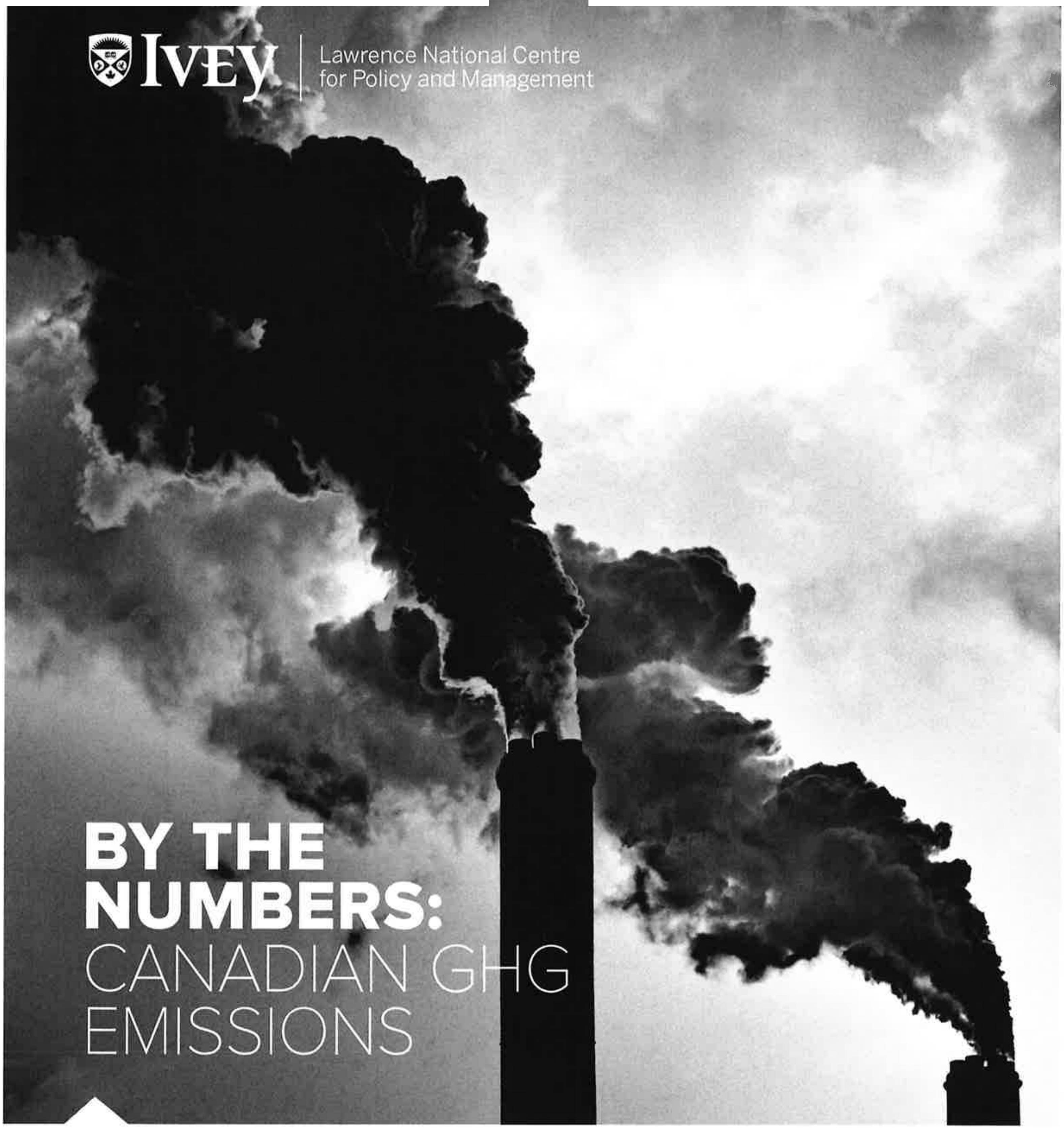

Ivey | Lawrence National Centre for Policy and Management

BY THE NUMBERS: CANADIAN GHG EMISSIONS

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This research was supported, without editorial input, by the Ontario Ministry of Environment and Climate Change.
Such support does not indicate endorsement of the contents of the paper by the Government of Ontario.

EXECUTIVE SUMMARY

PAUL BOOTHE AND FÉLIX-A. BOUDREAULT

- Canada's greenhouse gas (GHG) emissions currently represent about 1.6 percent of the global total. Canada is among the top 10 global emitters and one of the largest developed world per capita emitter of GHGs.
- Canadian federal governments have committed to reduce annual GHG emissions from the current level of 726 megatonnes (Mt) to 622 Mt in 2020 and 525 Mt in 2030.
- Within Canada, GHG emissions vary widely across provinces ranging from 267 Mt in Alberta to 1.8 Mt in PEI in 2013.
- In per capita terms, Saskatchewan and Alberta are among the developed world's largest emitters at 68 and 67 tonnes respectively. Per capita emissions in BC, Ontario, and Quebec are in the 10-14 tonne range, comparable to best performers in Western Europe.
- For provinces with announced GHG emission targets, the level of ambition varies widely. Alberta plans to increase emissions towards 2020, and then return to today's levels by 2030, while Ontario Quebec and Manitoba plan to reduce emissions by 56, 27 and 8 Mt respectively.
- Even if all provincial targets were fully achieved, Canada would still need to reduce GHG emissions by an additional 45 Mt in 2020 and 55 Mt in 2030 to meet its international commitments.

INTRODUCTION

A lot has changed recently in the world of Canadian climate change policy. With the election of new governments in Alberta and Ottawa, there is a sense that reducing greenhouse gas emissions (GHGs) is back on the policy agenda. The previous federal government's approach of ambitious targets plus policy inaction is, if one is to believe the pronouncements of federal and provincial political leaders, about to be replaced by one of ambitious targets plus vigorous policy action. Even provinces that have relatively low emissions by Canadian standards have pledged to do more. The previous government's ambitious 2030 target submitted to the United Nations Framework Convention on Climate Change (UNFCCC), the UN body responsible for climate change negotiations, has been characterized by the new government as 'a floor rather than a ceiling.' Federal and provincial officials have begun to meet to work out how they will coordinate their actions to achieve Canada's targets.

Yet, despite this flurry of activity and the promise of concrete action to reduce GHGs, citizens have relatively little understanding of the simple arithmetic of climate change targets. Given the magnitude of the challenge facing Canada and the delicate negotiations that are yet to come, it is important that everyone share a clear understanding of what will be required by individual provinces and industries if Canada is to match its new rhetoric with action.

In this paper, we lay out the simple arithmetic of GHG emissions. We begin by comparing Canada to a selection of other countries. We then disaggregate Canadian emissions by province and look at the targets that different provinces have set for 2020 and 2030. We hope that this analysis will help provide both a common understanding of the current situation and a firm foundation for tackling the challenge we face as a society.

CANADA IN THE WORLD

According to the latest statistics, Canada emits about 1.6 percent of the world's GHG emissions.[1] Despite this relatively low share, Canada is among the top 10 global emitters on an absolute basis, and stands firmly in the top 3 for emissions per capita. By way of comparison, Canada's population makes up about 0.5 percent of the world total so that our emissions' share is about 3 times our population share.[2]

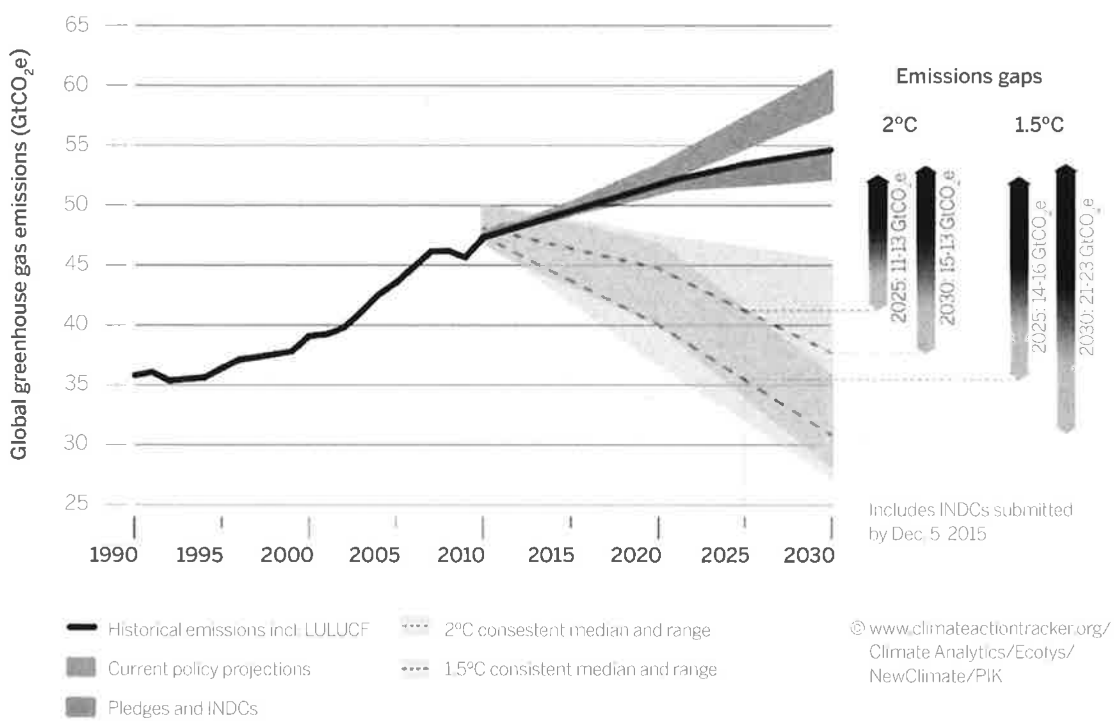
Canada played an active role in December 2015 at the Paris COP21 (21rst Conference of the Parties) which led to a global agreement on mitigation, adaptation and financing of climate change action. The new Liberal government indicated that 'Canada is back' and wants to do its part in reducing GHGs at home, and helping developing countries that are already facing hardship because of climate change.

In May 2015, the former Conservative government submitted its Intended Nationally Determined Contribution (INDC)[3] to the UNFCCC indicating an economy-wide target of reducing GHG emissions by 30 percent below 2005 levels by 2030. Following the fall 2015 election, the Liberal Government indicated that it considered the target to be a 'floor', suggesting that a consultation process with provinces would be launched to design a credible plan for Canada that might lead to an even more ambitious reduction target.

In order to assess the cumulative effect of all INDCs received before the Paris Conference, the United Nations Framework Convention on Climate Change commissioned a synthesis Report.[4] It concludes that "aggregate global emission levels resulting from the implementation of INDCs will not fall within the 2°C scenario", let alone the 1.5°C scenario that some countries, including Canada, were advocating. Some have estimated that emissions in 2025 will be 11-13 gigatonnes (Gt) higher than the 2°C scenario, and as much as 15-17 Gt higher by 2030 (see Figure 1). To put the gap in perspective, China emitted approximately 11 Gt in 2012 and 16 Gt is the equivalent of the total emissions by China and the United States for 2012.

1. **http://cait.wri.org/historical**, consulted January 2016.
2. **http://data.worldbank.org/indicator/SP.POP.TOTL**, consulted January 2016.
3. **http://www4.unfccc.int/submissions/INDC/Published%20Documents/Canada/1/INDC%20-%20Canada%20-%20English.pdf**, consulted January 2016
4. **http://unfccc.int/focus/indc_portal/items/9240.php**, consulted January 2016.

FIGURE 1 – COMPARISON OF GLOBAL EMISSION LEVELS RESULTING FROM THE INTENDED NATIONALLY CONTRIBUTIONS IN 2025 AND 2030 WITH OTHER TRAJECTORIES
(source: http://climateactiontracker.org/global/173/CAT-Emissions-Gaps.html)



In light of this gap, the international community agreed in Paris to revise their commitments every 5 years in order to close in on the level of GHG emissions that scientists say is required to limit warming to 2°C above pre-industrial levels.

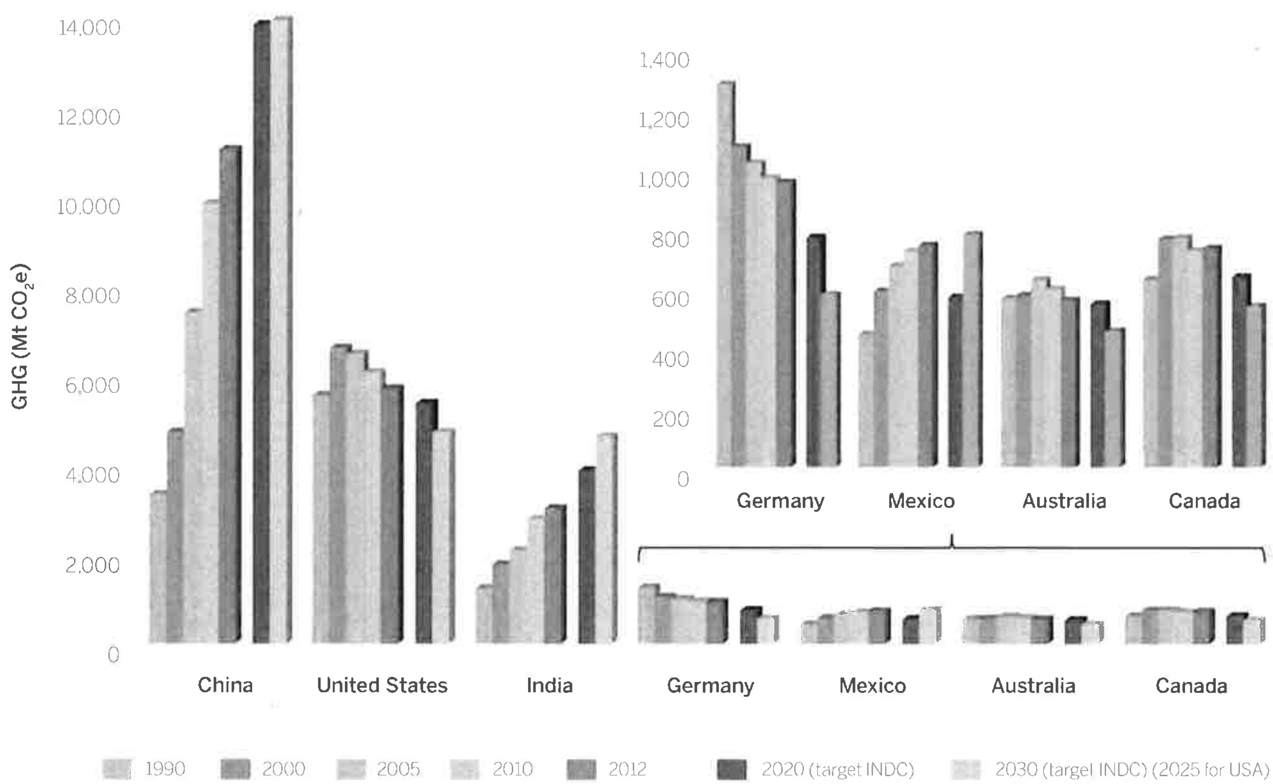
Figure 2 presents total GHG emissions for selected countries for the period 1990 to 2012 (latest global emissions data) and their respective estimated 2020 and 2030 targets submitted as part of their Copenhagen commitment (for 2020) and INDCs (for 2030, except USA, who introduced a 2025 commitment). As expected, most developed countries reached their peak emissions sometime in the past (between 1990 and 2005) whereas developing nations' emissions have yet to peak.

Simply comparing developed and developing countries' reduction pledges can be misleading since national circumstances play an important role in determining the level of effort required by a country to reduce GHG emissions. Should developing nations be allowed to increase their emissions while they pull people out of extreme economic and energy poverty? Should countries that are responsible for most of the GHGs currently in the atmosphere emissions pay for damages already incurred? These are some of the questions that bedevil international GHG reduction negotiations.

China's situation is of critical importance as they already represent a quarter of the world's emissions and would be expected to grow emissions substantially as they continue on the path to becoming the world's largest economy. Their commitment to "peak emissions by 2030 and making best efforts to peak earlier" is likely to be a very challenging goal while they simultaneously seek to raise average standards of living to developed country levels.

In contrast, India's INDC did not specify when emissions are forecast to peak. This is problematic for a country that saw its emissions triple between 1990 and 2012 and is currently the third largest global emitter. It is estimated that "if India's emissions were to peak when India reached the same per capita income as China is expected to have in 2030, the peak will not occur until about 2043".[5] Such a late peak in emissions is clearly inconsistent with moving global emissions to a downward path.

FIGURE 2 – TOTAL GHG EMISSIONS – SELECTED COUNTRIES
(source: http://cait.wri.org/historical and Environment Canada)



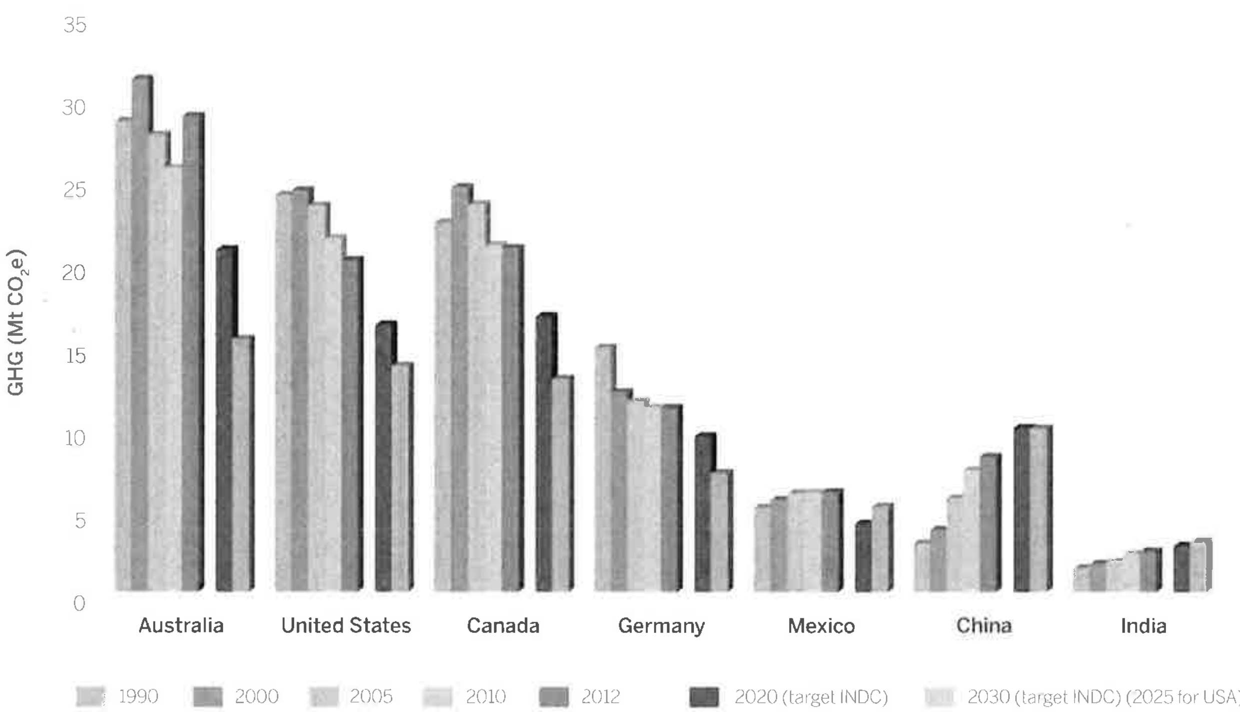
5. **http://www.brookings.edu/blogs/planetpolicy/posts/2015/12/11-india-greater-emissions-reductions-dhar**, consulted January 2016.

Comparing absolute GHG emissions between countries does not take into account differences in population. In Figure 3 we present per capita emissions for the same group of countries. At about 20.6 tonnes per capita in 2012, Canada is second behind Australia (28.5) as highest per capita emitter in this group of countries, slightly exceeding the US (20) and exceeding China (8.1) and India (2.4) by a wide margin. Turning to the INDC pledges for 2030, Canada has pledged to reduce annual emissions to 12.8 tonnes per capita, slightly lower than the US (13.4 in 2025), but well above China (9.8) and India (3.0).

To put these per capita emissions levels in context, the Deep Decarbonization Pathways Project,[6] an initiative of the United Nations Sustainable Development Solutions Network (UNSDSN) and Institute for Sustainable Development and International Relations (IDDRI), determined that in order to limit global warming to 2°C above pre-industrial levels, the target for all countries should be to reduce global GHG emissions to 1.7 tonnes per capita by 2050 from the 2012 level of about 6.2 tonnes per capita.[7] With per capita emissions in developed countries being substantially above this level and developing nations' emissions projected to increase in both absolute and per capita terms as they raise living standards, the global challenge ahead is significant.

FIGURE 3 – CPER CAPITA EMISSIONS – SELECTED COUNTRIES

(source: http://cait.wri.org/historical, Environment Canada and World Bank Population data)



6. **http://deepdecarbonization.org**, consulted January 2016
7. **http://cait.wri.org/profile/World%20(sum%20of%20all%20CAIT%20countries)**, consulted January 2016

CANADA AT HOME

The data presented in the previous section shows that while Canada contributes only about 1.6 percent of global emissions, it is one of the world's top ten emitters and also one of the its highest per capita emitters. However, these aggregate statistics mask a good deal of diversity with respect to both emissions and climate policy across the country. In this section we delve more deeply into Canadian results by province.

In the last few years, much of the action to combat climate change has come through provincial government policies. Such policies include a carbon tax in British Columbia, a newly-announced hybrid of a carbon tax and emissions trading scheme in Alberta, a cap-and-trade system in Quebec that will shortly be joined by Ontario and Manitoba, and stringent electricity regulations in Ontario to phase out coal and incentivize renewable energy. Table 1 summarizes provincial plans and commitments as of January 2016.

TABLE 1 – PROVINCIAL PLANS AND TARGETS AS JANUARY 2016

PROVINCE	2013 EMISSIONS PER CAPITA	POLICY MEASURES	2020 TARGET	2030 TARGET
Newfoundland and Labrador	8.6 Mt (16.4 t/capita)	*Climate Change Action Plan* (2011)[8] introduces progressive action on climate change into its policy, planning and programs. Focus on hydroelectricity with support of Lower Churchill Hydroelectric project.	10% below 1990	NA
Prince Edward Island	1.8 Mt (12.4 t/capita)	*Strategy for Reducing the Impacts of Global Warming* (2008)[9] outlines 49 actions to mitigate and adapt to climate change.	10% below 1990	NA
Nova Scotia	18.3 Mt (19.4 t/capita)	*Toward a Greener Future* (2009)[10] presents Nova Scotia's plan to address climate change by introducing the Environmental Goals and Sustainable Prosperity Act, notably establishing a cap on Nova Scotia Power Inc.'s emissions by 2010.	10% below 1990	NA
New Brunswick	15.7 Mt (20.8 t/capita)	*Climate Change Action Plan* 2014–2020 includes actions in various areas, including renewable energy, transportation, industrial sources, etc. mainly through voluntary measures.[11]	10% below 1990	NA

(CONTINUED ON FOLLOWING PAGE)

8. **https://www.exec.gov.nl.ca/exec/ccee/index.html**, consulted January 2016
9. **http://www.gov.pe.ca/environment/climatechange**, consulted January 2016
10. **https://climatechange.novascotia.ca**, consulted January 2016
11. **http://www2.gnb.ca/content/gnb/en/departments/elg/environment/content/climate_change.html**, consulted January 2016

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TABLE 1 – PROVINCIAL PLANS AND TARGETS AS JANUARY 2016 (CONTINUED)

PROVINCE	2013 EMISSIONS PER CAPITA	POLICY MEASURES	2020 TARGET	2030 TARGET
Quebec	82.6 Mt (10.1 t/capita)	*Climate Change Action Plan and Adaptation Strategy* (2013-2020) reaffirmed Quebec's vision to operate a Cap-and-trade system for GHG emission allowances aimed at all large emitters, which was legislated in 2013. In 2014, Quebec linked up with California's carbon market. In 2015, Ontario and Manitoba announced their intention to join in the near future.	20% below 1990	37.5% below 1990
Ontario	171.0 Mt (12.6 t/capita)	*Ontario's Climate Change Strategy (2015)*[12] *provides an update on the 2007 Action Plan. It highlights the results of the Green Energy Act of 2009 that effectively phased out the use of coal and introduced a feed-in-tariff program to promote renewable energy. In 2015, Ontario announced its intention to join the cap-and-trade system along with Quebec and California.*	15% below 1990	37% below 1990
Manitoba	21.4 Mt (16.9 t/capita)	*Climate Change and Green Economy Action Plan* (2015)[13] introduced a number of policy measures in the transportation, agriculture and energy efficiency sectors. It also indicates to Manitobans the government's plan to join the cap-and-trade system established by Quebec.	No 2020 target but had a 2012 target of 6% below 1990	33% below 2005
Saskatchewan	74.8 Mt (67.6 t/capita)	In December 2009, the government introduced a climate change legislation setting out the province's plan to meet its target. However, the legislation was never enacted due to delays of federal plan and elections.[14]	20% below 2006	NA

(CONTINUED ON FOLLOWING PAGE)

12. **https://www.ontario.ca/page/climate-change-strategy**, consulted January 2016
13. **http://www.gov.mb.ca/conservation/climate**, consulted January 2016
14. **http://environment.gov.sk.ca/climatechange**, consulted January 2016
15. **http://www.alberta.ca/climate-leadership-plan.cfm**, consulted January 2016

TABLE 1 – PROVINCIAL PLANS AND TARGETS AS JANUARY 2016 (CONTINUED)

PROVINCE	2013 EMISSIONS PER CAPITA	POLICY MEASURES	2020 TARGET	2030 TARGET
Alberta	267.0 Mt (66.6 t/capita)	*Alberta's Climate Leadership Plan* (2015)[15] presents the new strategy on climate change based on recommendations put forward by the Climate Change Advisory Panel. Details of the final strategy are being developed, but the plan covers 4 key areas: Phasing out coal-generated electricity and developing more renewable energy, implementing a new carbon price, legislated oilsands emission limit, and implementing a new methane emission reduction plan.	Implementation of the plan is expected to reduce emissions by 20Mt from business-as-usual scenario (297Mt).	Implementation of the plan is expected to reduce emissions by 50Mt from business-as-usual scenario (320Mt).
British Columbia	62.8 Mt (13.7 t/capita)	*Climate Action Plan* (2008)[16] introduces short, medium and long-term targets as well as a number of provincial legislations, including the Carbon Tax Act.	33% below 2007	40% below 2007 (target has been proposed but not adopted)
Territories	2.0 Mt (17.6 t/capita)	*Yukon Government Climate Change Action Plan* (2009),[17] *NWT's A Greenhouse Gas Strategy 2011-2015* (2011)[18] and Nunavut's *Climate Change Strategy* (2003)[19] all introduce a number of measures to mitigate but also adapt to climate change.	Yukon: Carbon neutral Government related emissions NWT: limit to +66% from 2005	NWT: Return to 2005 levels
CANADA	726.1 Mt (20.7 t/capita)	Federal measures to date include sectoral regulations (light and heavy vehicles, electricity standards for coal-fired generation, energy efficiency measures, etc.)	17% below 2005	30% below 2005

Different measures have different impacts. For example, it has been estimated that Ontario's phase out of coal-fired electricity generation helped reduce GHGs by about 30 Mt, while British Columbia's carbon tax-related reductions resulted in a reduction of about 3 Mt.[20]

Almost every Canadian province has made 2020 commitments (the exception being Manitoba). Quebec, Ontario and Manitoba have announced formal targets for 2030 while Alberta has modeled the 2030 reductions implied by its recently-announced plan. Together, these provinces represent about 75 percent of Canadian emissions.

16. **http://www2.gov.bc.ca/gov/content/environment/climate-change/policy-legislation-programs**, consulted January 2016.
17. **http://www.env.gov.yk.ca/air-water-waste/ccactionplan.php**, consulted January 2016.
18. **https:///www.enr.gov.nt.ca/programs/nwt-climate-change**, consulted January 2016.
19. **http:///climatechangenunavut.ca**, consulted January 2016.
20. **http:///www.iisd.org/pdf/2012/bc_carbon_tax.pdf**, consulted January 2016.

Figure 4 shows the wide disparity in emissions across provinces. Emissions in 2013 range from 267 Mt in Alberta to 1.8 Mt in Prince Edward Island. In order, the four largest emitting provinces are Alberta, Ontario, Quebec and Saskatchewan.

FIGURE 4 – GHG EMISSIONS PER PROVINCE, 1990 - 2013 AND PROJECTED LEVELS FOR 2020 AND 2030 TARGETS

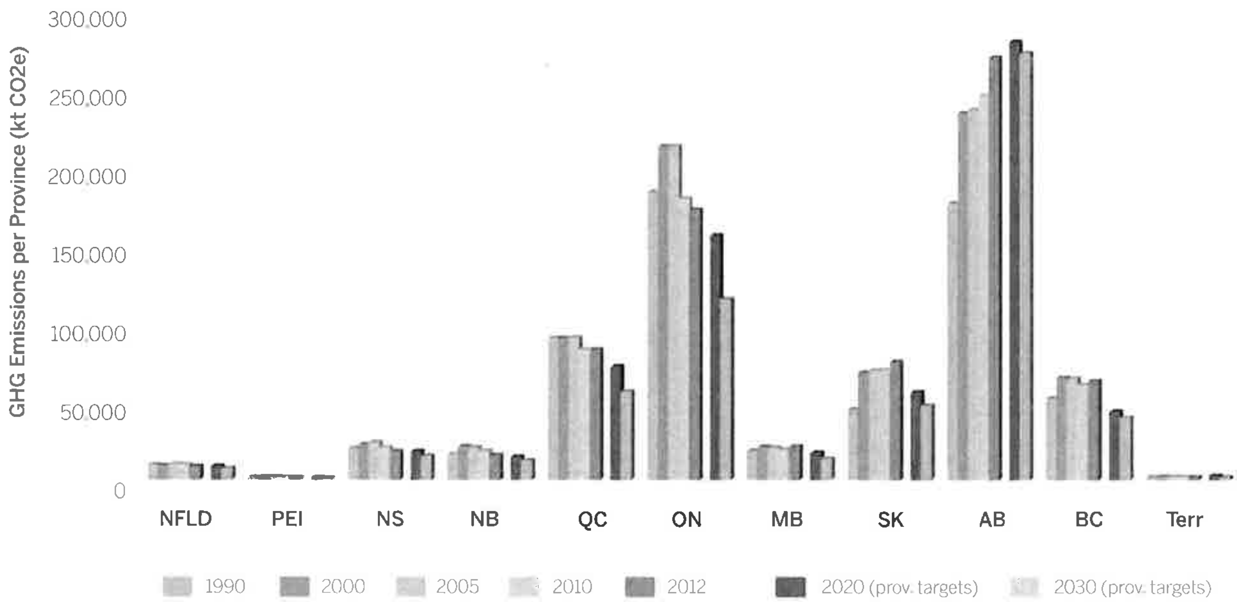

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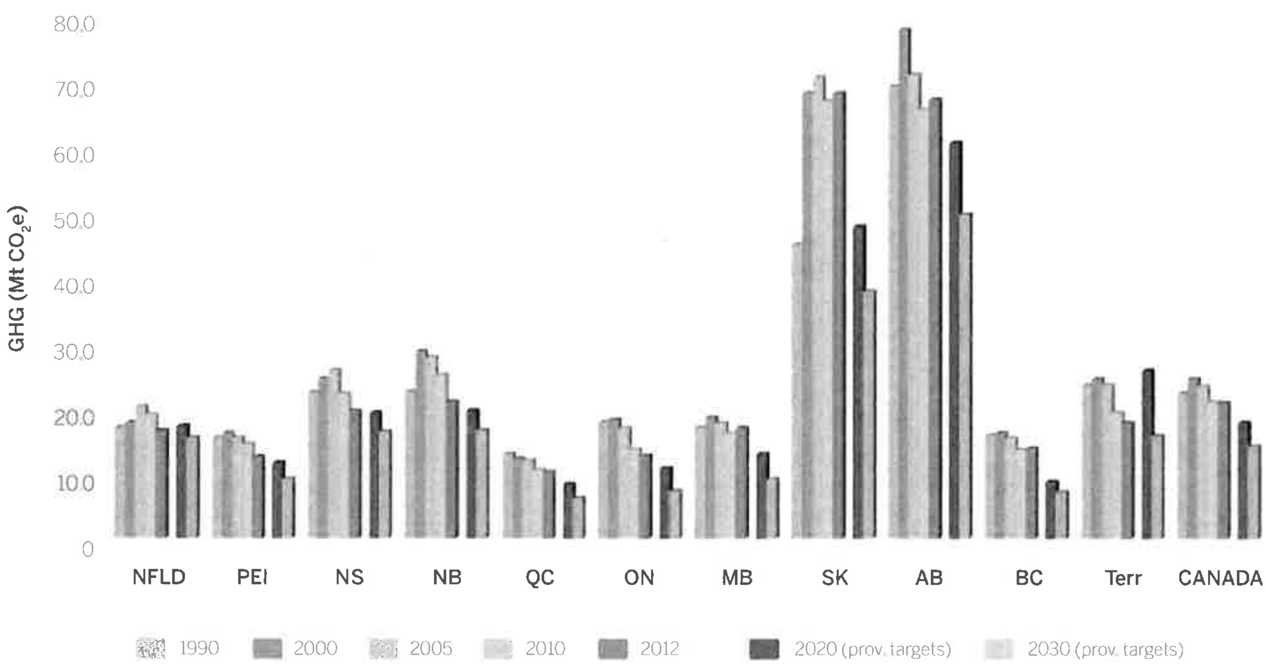
Figure 5 normalizes emissions by population to account for the different sizes of provinces. Saskatchewan and Alberta have some of the largest per capita emissions in the world at 68 and 67 tonnes respectively. BC, Ontario and Quebec weigh in at 14, 13 and 10 tonnes per person respectively, in line with best performers in Western Europe.

Saskatchewan and Alberta's high levels of per capita emissions come from their reliance on coal-fired electricity generation as well as oil sands and heavy oil production. In contrast, BC, Ontario and Quebec rely on hydro-electric or nuclear electricity generation and have relatively few large industrial emitters.

FIGURE 5 – PER CAPITA EMISSIONS PER PROVINCE FOR 1990-2013 AND PROJECTED LEVELS FOR 2020 AND 2030 TARGETS



We can also use Figures 4 and 5 to compare the 2020 and 2030 targets for the provinces. In cases where no provincial targets have been announced, either the most recent target is used (e.g. Manitoba's 2012 target is used as a proxy for 2020) or an estimate is determined based on the increased stringency (e.g. for provinces that have not announced a 2030 target, targeted emissions in 2030 have been estimated to be 15 percent lower than in 2020, which is the average stringency increase from provinces that have announced 2030 targets).

Looking first at Figure 4, we see that BC's 2020 target calls for a decline of about 20 Mt from the current level of 63 Mt and then a further decline of 3 Mt over the decade to 2030.[21] The Alberta plan has 2020 emissions growing by about 10 Mt from current levels to 277 Mt and then declining by 7 Mt over the next decade to 2030. In Ontario, emissions will need to decline by about 16 Mt to 155 Mt to reach its 2020 goal and then an additional 40 Mt over the next decade to 2030. Finally, Quebec has pledged to reduce emissions by about 11 Mt to 72 Mt in 2020 and an additional 16 Mt over the decade to 2030. Thus, provincial targets reflect substantial differences in both absolute levels and ambition.

Figure 5 shows the contrast between the plans of the four largest provinces more sharply. Of course, translating pledges of future emissions into per capita terms requires a forecast of population. For this exercise, we used the medium-growth case of Population Projections for Canada, published by Statistic Canada.[22] For the 2015-2030 period, the population projections extend recent trends: Western provinces, led by Alberta, will see faster population growth than the national average. Quebec and Ontario' populations will grow steadily with the national average, while Atlantic Canada's population will remain flat.

BC's targets have per capita emissions declining from the current level of about 14 tonnes per person to 9 in 2020 and 7 in 2030. In Alberta, aided by projected strong population growth, targeted per capita emissions decline from about 67 in 2013 to 60 in 2020 and 49 in 2030. Ontario per capita emissions, currently at 13 tonnes are pledged to fall to 11 in 2020 and 7 in 2030, while in Quebec, emission per capita are targeted to fall from 10 tonnes in 2013 to 8 in 2020 and 6 in 2030. All of this arithmetic ignores the fact that provinces may well miss their 2020 targets, making the achievement of their 2030 goals all the more difficult.

As a final exercise, it is interesting to compare the known federal commitments for 2020 (622 Mt) and 2030 (525 Mt) with the aggregate of provincial targets, assuming they are achieved. As we noted above, for provinces that have not announced targets, we generally used the average level stringency of the announced targets to develop proxy 2030 targets. Since 75 percent of Canada's emissions are covered by announced 2030 provincial targets, these proxy targets for the remaining provinces probably have only marginal effects on the overall results.

Table 2 presents the announced and proxy 2020 and 2030 targets by province. In total, the provincial targets sum to about 667 Mt in 2020 and 580 Mt in 2030. Thus, even if all provinces achieved their announced or proxy targets, Canada would still face a gap of about 45 Mt in 2020 and 55 Mt in 2030.

21. BC's target has been recommended by a government panel but not yet officially adopted.
22. **http://www.statcan.gc.ca/pub/91-520-x/91-520-x2010001-eng.htm**, consulted January 2016

TABLE 2 – PROVINCIAL TARGETS AND ESTIMATED GAPS TO MEET CANADA'S 2020 AND 2030 TARGETS

PROVINCES	2020 TARGET		2030 TARGET	
	Mt	t/per capita	Mt	t/per capita
NFLD	8.5	17.1	7.5*	15.5
PEI	1.8	11.6	1.5*	9.0
NS	18.2	19.1	15.5*	16.3
NB	14.9	19.4	12.6*	16.5
QC	71.8	8.9	56.1	6.2
ON	154.7	10.7	114.7	7.3
MB	17.6*	12.9	13.7	9.1
SK	55.5	47.4	47.2*	37.5
AB	277.0	60.1	270.0	49.2
BC	43.5	8.7	39.5*	7.2
TERRITORIES	3.1	17.7	2.0*	15.6
CANADA TOTAL	**667**	**17.7**	**580**	**14.1**
CANADA TARGET	**622**	**16.5**	**525**	**12.8**

* Estimated by authors

Parallels can be drawn between the Canadian and international situations. In both cases, economic, demographic and political circumstances that affect the distribution of emissions are at play. In Canada, natural resources are unevenly distributed among provinces.[23] This leads to widely different absolute and per capita emissions across provinces. The same is true of countries, although differences in stages of national development are probably the most important driving factor.

23. See Figure 1, **http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2386508**, consulted January 2016

CONCLUSIONS

Significant challenges lie ahead for Canada as it works to meet its GHG emission targets, and those challenges parallel the ones faced by the international community. Finding ways to equitably share the burden of GHG emission reductions and practical mechanisms to allow regional and national economies to transition to a low-carbon world will test the ingenuity and will of political leaders at home and abroad.

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This is Exhibit "J"
referred to in the Affidavit
of Lisa Tssessaze affirmed before me
this 17 day of Dec., 2018

Gail Gallupe

Commissioner for Taking Affidavits, etc.

Gail Gallupe
Expiry: April 7, 2020
#0742640

000257

Preserving and Protecting our Environment for Future Generations

A Made-in-Ontario Environment Plan

Ministry of the Environment,
Conservation and Parks

Ontario

Minister's Message

Rod Phillips
Minister of the Environment, Conservation and Parks

The people of Ontario are passionate about the great outdoors and the natural spaces our communities offer. We recognize the importance of a clean environment to our health, our wellbeing and our economic prosperity for future generations. We also recognize the important responsibility we all have to our environment.

Ontario boasts hundreds of thousands of parks, hiking trails and forests to explore with our families and friends. Ontarians can camp in protected areas like Quetico Provincial Park in Northern Ontario and see firsthand the magnificence of a moose. We can also enjoy a family picnic at Victoria Park in Kitchener and enjoy local fresh fruits, vegetables and dairy products that were grown and produced on nearby farms. Ontario is home to hundreds of thousands of lakes, rivers and waterways that are the lifeblood of our province, where people fish, kayak and swim. We also rely on our waters to transport goods, feed our crops, and have a safe, reliable source of drinking water.

These waterways are under increasing pressure as urban development expands along their shorelines, invasive species expand on land and in water, and climate change causes changing weather patterns that can bring heavier rains resulting in damage to homes, businesses and public infrastructure.

Preserving and protecting our environment begins with a new vision for Ontario. One where hardworking taxpayers are protected and respected, and where environmental stewardship connects with the people of this province.

I am pleased to present the following made-in-Ontario plan to keep our province beautiful by protecting our air, land and water, preventing and reducing litter and waste, supporting Ontarians to continue to do their share to reduce greenhouse gas emissions, and helping communities and families prepare for climate change.

This plan will ensure we balance a healthy environment with a healthy economy, and will be reviewed on a four-year basis.

This is a plan that represents a clean break from the status quo.

We understand the pressure Ontarians feel with rising costs of living as well as skyrocketing energy costs that have hurt our economy and our competitiveness. They are understandably frustrated to see their hard-earned tax-dollars being put towards policies and programs that don't deliver results.

That's why a cap-and-trade program or carbon tax that seeks to punish people for heating their home or driving their cars remains unacceptable to the people of Ontario.

When the government does invest in environmental programs, taxpayers should not have to watch their hard-earned dollars be diverted towards expensive, ineffective policies and programs that do not deliver results.

The people of Ontario deserve recognition for the sacrifices they have made and the ones they continue to pay for.

Our plan reflects our province's specific needs and opportunities, and it does not include a carbon tax. We will continue to do our share to reduce greenhouse gases and we will help communities and families prepare to address climate change. With hard work, innovation and commitment, we will ensure Ontario achieves emissions reductions in line with Canada's 2030 greenhouse gas reduction targets under the Paris Agreement.

We will tap into the resourcefulness and creativity of our diverse and thriving private sector by helping them invest in and develop clean solutions to today's environmental challenges.

We have consulted extensively with the public, receiving more than 8,000 ideas and recommendations through our online portal. These comments have been considered alongside submissions from stakeholders and information from Indigenous communities who provided feedback on fighting climate change and other areas of environmental focus. We will continue to consult and engage on the proposals contained within this plan in the coming weeks and months.

All of us have a role to play in protecting the environment, and there are many great ideas across our province and country. It will be important that we continue to have constructive dialogue with other jurisdictions to tackle these environmental challenges together. One thing that has become particularly clear over the past few months is the fact that no one solution fits all provinces, regions or communities.

Our plan describes the actions Ontario is proposing to take and the ways we will enable industry, business, communities and people to continue to do their part.

Ontario families understand that we have a personal responsibility to leave behind a province better off than the one we inherited; not just environmentally, but financially as well.

I invite you to read our plan and join with us today, and every day, to create a better future for Ontario.

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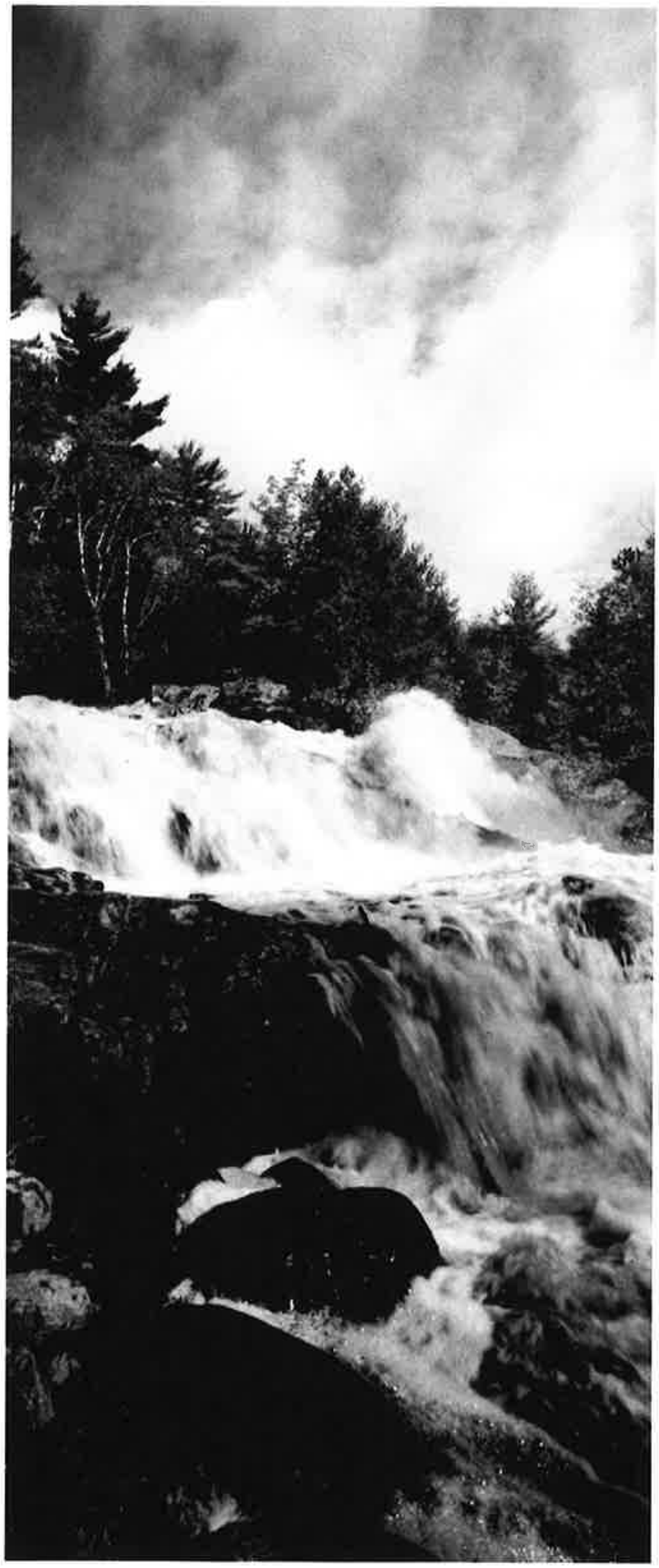


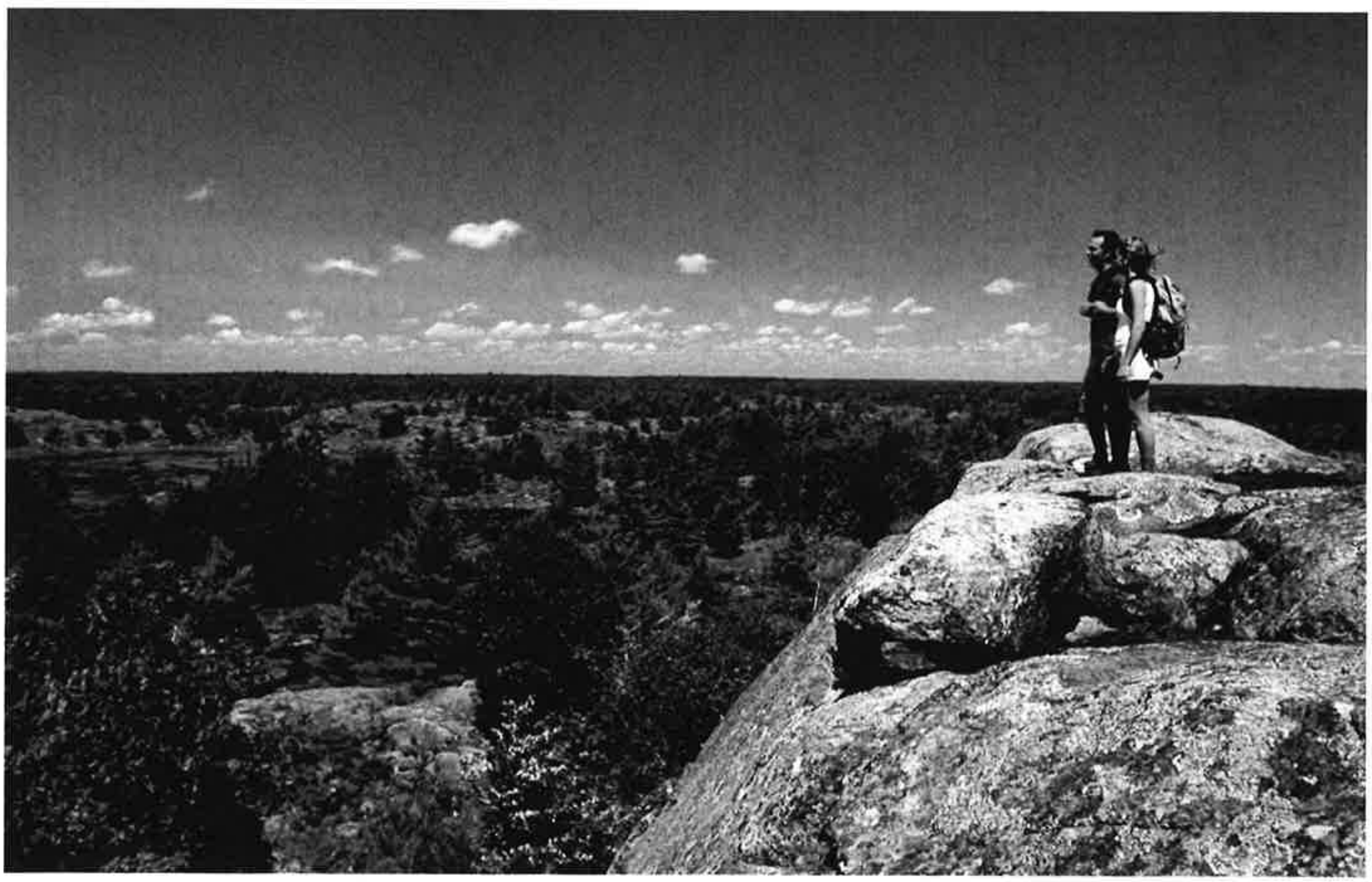
Our Province Today

Those of us who call Ontario home couldn't ask for a better place to live, work and raise a family. The quality of life in our communities and the success of our businesses depends to a great extent on the clean air we breathe, the safe water we drink, and the well-protected lands and parks we enjoy.

Today, the people of Ontario are breathing cleaner air with large reductions in levels of many harmful pollutants. In 2001, Ontario began the process of closing its coal plants and in the years since, we have significantly reduced pollutants such as nitrogen dioxide, sulphur dioxide, mercury and particulate matter.

Our Great Lakes attract millions of residents and visitors to waterfront communities around the province each year. These lakes provide safe drinking water to more than 70% of Ontarians and their watersheds are home to more than 4,000 species of fish, birds and other living things. They, along with all of our waterways and groundwater, underpin our province's economic prosperity and wellbeing – supporting Ontario's manufacturing, power generation, fisheries, tourism, agriculture and drinking water.

Parks and greenspace across our province provide individuals, families and tourists with opportunities to canoe in lakes, hike in forests and camp on protected lands.



THE CHALLENGE AHEAD

At the same time, climate change threatens these resources and our homes, communities and businesses, infrastructure, and our locally grown food and crops. It also threatens food security and road access for remote First Nations, as well as the health of ecosystems across our great province.

We can do more to protect ourselves from the extreme weather events that have flooded houses, buildings and roads, overwhelmed aging stormwater and wastewater systems, damaged crops, and brought heavy ice and wind storms that knocked out power for hundreds of thousands of people, including those who are most vulnerable.

Heat waves and recent drought conditions in some areas of the province, coupled with anticipated impacts of climate change and population growth, have intensified concerns related to water security for farmers, Indigenous communities, industry and municipalities.

We also recognize that there is much more that can still be done to keep our lands and waterways clean and free of litter. Nobody wants to see plastic and litter polluting our waterways, neighbourhoods and parks. No one wants sewage and wastewater overflowing into our lakes and rivers or salt making its way into our waterways. These issues are happening now and need to be addressed. There is also a need to address specific air quality concerns in communities that continue to face air quality challenges. True environmentalism begins with a sense of civic responsibility that we foster through meaningful action close to home.

Our environment plan reflects our government's commitment to addressing these pressing challenges. We will use the best science, real-time monitoring where available, and strong, transparent enforcement to protect our air, land and water, prevent and reduce litter and waste, support Ontarians to continue to do their share to reduce greenhouse gas emissions, and help communities and families prepare for climate change.

DOING OUR PART

In 2001, the government of the day announced the closure of the Lakeview Generating Station, setting the stage for the phase out of coal-fired electricity generation which remains the largest single greenhouse gas reduction in Canadian history. Ontario's low-emission combination of hydroelectric, nuclear, natural gas and non-hydro renewable generating capacity has enabled the province to avoid up to 30 megatonnes of annual greenhouse gas emissions, equivalent to taking up to seven million vehicles off our roads. In 2017, approximately 96% of the electricity generated in Ontario was emissions-free.

The combination of nuclear, hydro, other renewables and efficient natural gas has given Ontario one of the cleanest energy grids in North America. Ontario's supply of clean electricity is one of its unique strengths. Ontario is currently a net exporter of electricity, with our clean power offsetting a higher emitting mix of coal and natural gas generation in neighbouring states, such as Michigan and New York.

Measured against the same base year of Canada's target under the Paris Agreement (2005), the province's total greenhouse gas emissions have dropped by 22% – even while the rest of Canada saw emissions increase by 3% during that same time.

Doing Canada's heavy lifting on greenhouse gas emission reductions came at a cost that was too high for Ontario families and businesses. In 2017, prior to the introduction of the Fair Hydro Plan Act, 2017, the cost associated with transitioning to Ontario's low emission electricity system was an estimated $33 per month for a typical residential electricity consumer and about $435 per month for a small business, such as a restaurant. Since 2005, about $40 billion has been spent in capital investments to transition the province to an electricity system that is virtually emissions-free. Now is not the time to add further costs to the price of electricity that is already very clean.

We will continue to do our share to address climate change and protect our environment. We will do so in a way that protects our economy and respects the people.

We will hold polluters accountable by ensuring strong enforcement with real consequences and penalties, especially for repeat offenders.

We will also help our urban and rural communities and landscapes become more sustainable and resilient. We will help others do their part, whether it's leveraging private sector investments to drive environmental solutions or making it easier for people and companies to go the extra mile to reduce emissions, clean up their communities, protect waterways, conserve lands and restore habitats.

Ontario has a long history of working cooperatively with other provinces and territories, as well as with the federal government through formal agreements such as the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health and through intergovernmental forums such as the Canadian Council of Ministers of the Environment. There are also global environmental issues on which Ontario will continue collaborating with the federal government and participating in international meetings and agreements.

Protecting the environment is a responsibility of all of us who call Ontario home.

We will continue to work in partnership with other provinces, neighbouring jurisdictions, the federal government, municipalities, Indigenous communities, business and local partners to help protect our environment and ensure we pass on a cleaner environment to future generations.

GUIDING PRINCIPLES

Our guiding principles will help us address our most serious environmental challenges in a responsible, effective, measurable and balanced way.

- **Clear Rules and Strong Enforcement:** We will ensure that polluters are held accountable with tougher penalties, while reducing regulatory burden for responsible businesses.
- **Trust and Transparency:** We will provide Ontarians with the information and tools required – with a particular focus on real-time monitoring – to understand the current environmental challenges we face and how these challenges impact individuals, businesses and communities across the province.
- **Resilient Communities and Local Solutions:** We recognize that environmental impacts faced by communities across Ontario may be very different. We will work with these communities and use best scientific practices and other evidence-based methods to develop unique solutions to their challenges.

Protecting our Air, Lakes and Rivers

Ontario's water and air are life support systems for our province and our people. Pollution in our air and water increases healthcare costs, affects the enjoyment of our outdoors and contributes to lost economic opportunity. We will protect these critical systems by keeping our water and air clean while growing our economy.

Our plan will make it easier for people to report pollution that is impacting their lives by developing an online platform for reporting incidents that allows photos or video to be sent in, as well as reporting an incident by e-mail, phone or through an app.

Additionally, we will put in place an improved complaint response system that sets out the services Ontarians can expect from inspectors and investigators when they file a complaint, and new standards on the response time they can expect based on the type of incident they report. We will be transparent about pollution incidents and spills, and provide real-time information where it is available so that people can see if a spill or incident has already been reported, as well as the status of the ministry's response.

CLEAN AIR

Although Ontario's air quality has improved significantly, some areas of the province still experience poorer air quality due to pollution. We are committed to protecting our air, ensuring we have strong environmental standards that are protective of human health and the environment, and taking action to enforce local air quality standards.

Quick Fact: Ontario initiated the first closure of a coal plant in 2001. This action and the subsequent closure of 19 coal-fired units in five plants contributed to reducing the number of smog days in Ontario from a peak of 53 in 2005 to zero in 2017.

Actions

Improve air quality in communities by creating unique solutions to their individual challenges

- Focus on parts of the province that continue to experience air quality challenges due to pollution from transportation, industry and other sources.
- Work in partnership with municipalities, industry, public health units, other community stakeholders and Indigenous communities to address local air quality concerns and achieve clean air objectives.

Reduce emissions from heavy-duty vehicles

- Redesign the emissions testing program for heavy-duty vehicles (e.g. commercial transport trucks) and strengthen on-road enforcement of emissions standards.

Improve understanding of different sources of air pollution and their impact

- Monitor pollutants to evaluate long-term trends so we can gather the information we need to take action on air pollution.
- Increase road-side monitoring of traffic pollution and expand road-side monitoring of pollutants beyond the Greater Toronto Area to other heavily urbanized communities such as Sarnia, Sudbury and Hamilton.

Strengthen collaboration on addressing air pollution that comes from outside of Ontario's borders

- Call on the federal government to proactively address the impacts of air pollution from outside Ontario, including from the United States and international sources, and ensure continued cooperation and commitment to improve air quality.
- Expand collaboration with Michigan and Ohio to reduce the emission of contaminants of concern that impact southern Ontario, Michigan and Ohio airsheds.

Success story: Sarnia's air quality is improving

In partnership with industry, the Clean Air Sarnia and Area (CASA) advisory panel launched the website cleanairsarniaandarea.com so users could view contaminant levels from seven air monitoring stations in the Sarnia community. Air quality information is refreshed every hour on an interactive map so users can find out whether air quality is good, moderate or poor compared to provincial standards. While Ontario and industry have been monitoring air quality in the Sarnia area for decades, the CASA initiative marks the first time that data has been accessible to the public in real-time and in one location.

Ontario is also moving forward with a Sarnia Area Environmental Health Project to help address concerns about air pollution and other environmental stressors from local industries in the Sarnia area. The project will help enhance our understanding of the links between the environment and health in the community, with a focus on assessing exposures to air contaminants.

These projects are great examples of the collaborative efforts of local industry, the municipality, the Aamjiwnaang First Nation and interested community groups.

CLEAN WATER

Our lakes, waterways and groundwater are the foundation of Ontario's economic prosperity and wellbeing – supplying water to our communities, sustaining traditional activities of Indigenous peoples, supporting Ontario's economy, and providing healthy ecosystems for recreation and tourism.

Over past decades, Ontario has seen significant improvements in Great Lakes water quality due to efforts by governments and other partners. These partnerships have achieved a 90% reduction in releases of mercury, dioxins and polychlorinated biphenyls (PCBs), resulting in fish that are safer to eat, clean-up of polluted areas and the restoration of species.

Water resources in Ontario are facing many pressures. Population growth, rapid urban development, aging infrastructure and invasive species are threatening our waterways through pollution and loss of natural heritage. For example, excess road salt can damage roads, cause vehicle corrosion and be harmful to fish in our waterways. The changing climate is compounding these stresses with droughts, floods and extreme storms. Declining ice cover is causing shoreline erosion, warmer water is creating conditions for blooms of harmful algae, and shifting water conditions are changing when and where fish spawn.

Working together, we can help conserve and manage our water resources. Ontario's drinking water, for example, is among the best protected in the world as a result of the province's strong monitoring, reporting and enforcement activities and programs.

We will take strong enforcement action to protect our lakes, waterways and groundwater from pollution.

We will also work with municipalities and other partners to increase transparency through real-time monitoring of the sewage overflows from municipal wastewater systems, which too often flow into Ontario's lakes and rivers. We must step up efforts to ensure the public is aware and that proper monitoring occurs.

Quick Fact: 99.8% of more than 518,000 test results from municipal residential drinking water systems meet Ontario's strict drinking water quality standards.

Our plan focuses on key areas of action to protect our waters and keep our beaches clean for swimming, recreation, enjoyment and traditional use.

Actions

Continue work to restore and protect our Great Lakes

- Build on previous successes and continue efforts to protect water quality and ecosystems of the Great Lakes. This includes keeping coastlines and beaches clean, protecting native species and safeguarding against invasive species such as Asian carp or Phragmites, and reducing harmful algae by continuing partnerships and negotiations with the federal government under agreements and plans such as the Canada-Ontario Great Lakes Agreement (COA) and the Canada-Ontario Lake Erie Action Plan. Since signing the eighth COA in 2014, Ontario has directly invested $15.3 million per year in programs. This includes supporting the Lake Erie Action Plan and restoring geographic areas, known as areas of concern, where significant impairment or contamination has occurred as a result of human activities at the local level.
- Review and update Ontario's Great Lakes Strategy to continue to protect fish, parks, beaches, coastal wetlands and water by reducing plastic litter, excess algae and contaminants along our shorelines, and reducing salt entering waterways to protect our aquatic ecosystems.

Asian Carp: A threat to the Great Lakes Fisheries and Economy

Asian carp typically weigh two to four kilograms but can weigh up to 50 kilograms and can grow to a length of more than one metre. They consume a significant amount of food and can eat up to 20% of their body weight each day, which harms the Great Lakes ecosystem. Asian carp were introduced to aquaculture facilities in the southern U.S. in the 1970s to remove algae and suspended solids from their ponds. They escaped when the Mississippi River flooded and have spread northward in the Mississippi watershed towards the Great Lakes.

Asian carp pose a significant threat to recreational and commercial fisheries in Ontario which are worth almost $2.5 billion combined. Ontario is working with many partners including the Asian Carp Regional Coordinating Committee, a committee including all Great Lakes states and provinces, U.S. federal agencies, and Fisheries and Oceans Canada to facilitate collaboration on prevention, early detection, response, and monitoring activities.

Quick Fact: Ontario's more than 250,000 lakes, including the Great Lakes, contain about one fifth of the world's fresh water.

Continue to protect and identify vulnerable waterways and inland waters

- Build on previous successes and continue to implement the Lake Simcoe Protection Plan to protect and restore important natural areas and features of the lake. Ontario has invested annually in the implementation of the Lake Simcoe Protection Plan.
- Protect the quality of the Lake of the Woods by continuing to work with partners on reducing phosphorus that, in excessive quantities, can cause toxic blue-green algae.
- Build on the ministry's monitoring and drinking water source protection activities to ensure that environmental impacts from road salt use are minimized. Work with municipalities, conservation authorities, the private sector and other partners to promote best management practices, certification and road salt alternatives.
- Work with Indigenous communities and stakeholders, including the public, on the remediation of mercury contaminated sediments in the St. Clair and English-Wabigoon Rivers, including efforts such as:
  - ensuring clean-up of the remaining mercury contaminated sediments located in three areas downstream of the former Dow Chemical site.
  - participating in the work of the English and Wabigoon Rivers Remediation Panel to fund remediation activities from a trust that was established with $85 million under the *English and Wabigoon Rivers Remediation Funding Act, 2017*.

Action in Progress:
Protecting the Muskoka watershed

Through the Muskoka Watershed Conservation and Management Initiative, the community and province will work together to protect this vital area by identifying the issues facing the region. Ontario will invest $5 million and commit up to an additional $5 million in matching contributions.

Effective watershed management is important to the people in our communities, especially at times when watersheds are facing stresses such as increased development and flooding caused by severe weather events.

This initiative will also help us develop a more comprehensive approach to watershed management, which can inform current actions and future development.

Success story:
Celebrating recovery of freshwater fish in Lake Simcoe

Over the years, many organizations alongside the provincial and federal governments have worked hard to protect and restore the Lake Simcoe watershed against contaminants and excess nutrients like road salt and phosphorus that have had a negative effect on water quality. The Lake Simcoe ecosystem is showing encouraging signs of recovery and demonstrating that efforts to restore and protect the lake are having an impact. For example, populations of sensitive aquatic life such as lake trout, lake whitefish and cisco are trending upward.

Ensure sustainable water use and water security for future generations

- Thoroughly review the province's water taking policies, programs and science tools to ensure that vital water resources are adequately protected and sustainably used.
- Enhance how we manage water takings to ensure we have sustainable water resources in the face of a changing climate and continued population growth. We will do this by examining approaches to assessing and managing multiple water takings, establishing priorities for different water uses, and preparing and responding to drought conditions.
- Ensure the knowledge gained through the drinking water source protection program helps inform our water management programs.

Quick Fact: Thanks to local source protection committees and conservation authorities, Ontario has source protection plans being implemented across 38 watershed-based areas. These locally developed plans identify and protect areas where drinking water is vulnerable to contamination and depletion.

Help people conserve water and save money

- Promote the use of technologies and practices to ensure water is used more efficiently. This includes water conservation planning; water use tracking and reporting; improving standards for household fixtures and appliances, such as dishwashers or washing machines; and profiling provincial and broader public sector leadership in this area.

Improve municipal wastewater and stormwater management and reporting

- Increase transparency through real-time monitoring of sewage overflows from municipal wastewater systems into Ontario's lakes and rivers. Work with municipalities to ensure that proper monitoring occurs, and that the public is aware of overflow incidents.
- Update policies related to municipal wastewater and stormwater to make them easier to understand. We will consider how wastewater and stormwater financing could be updated to improve investment and support new and innovative technologies and practices.
- Encourage targeted investment and innovation in managing wastewater that overflows into our lakes and rivers.

Quick Fact: There were a total of 1,327 bypasses and/or overflows from all municipal wastewater sources in the 2017/18 fiscal year, as reported to the Ministry of the Environment, Conservation and Parks.

Success story:
City of Kingston shows environmental leadership

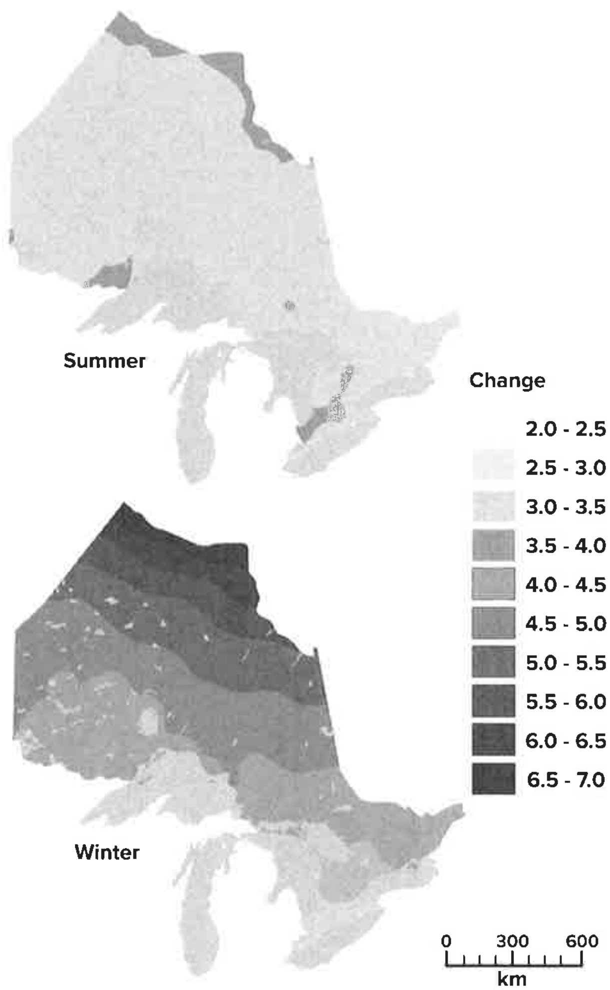
Utilities Kingston and the City of Kingston have shown leadership by providing real-time public reporting of sewage overflows, reducing pollution, and working with partners such as Swim Drink Fish Canada and the W. Garfield Weston Foundation to create the Gord Edgar Downie Pier at Breakwater Park, giving the community a new place to swim and enjoy a cleaner Lake Ontario waterfront.

Addressing Climate Change

Quick Fact: As of 2013, Canada is responsible for 1.6% of global emissions, with Ontario responsible for less than 0.4% of global emissions.

The climate is changing. Severe rain, ice and wind storms, prolonged heat waves and milder winters are much more common. Forests, waters and wildlife across the province are and will continue to be significantly impacted by these changes. People across the province – especially Northern communities – and all sectors of the economy are feeling the impacts of climate change and paying more and more for the costs associated with those impacts.

The following graph shows projected seasonal summer and winter temperature changes in Ontario by the 2050s.



Source: Ontario Climate Data Portal -- http://lamps.math.yorku.ca/OntarioClimate/index_v18.htm.
Projected seasonal (summer and winter) temperature changes by the 2050s (relative to the average of 1986-2005), under the Inter-governmental Panel for Climate Change (IPCC) 5th assessment report (AR5) business as usual emission scenario (RCP8.5).

The people of Ontario have already made significant contributions to meaningful climate action. We have played an important role in fighting climate change and mitigating the threats to our prosperity and way of life, implementing significant changes to drastically reduce our greenhouse gas emissions.

The government of the day initiated the first closure of a coal plant in 2001. This action and the subsequent closure of 19 coal fired units in five plants by 2014 led to the largest single reduction of greenhouse gas emissions, not just in Ontario, but across Canada. It was also one of the largest actions to reduce emissions in North America.

Emission-free electricity generation also plays a significant role in Ontario. Nuclear power, along with our hydroelectric fleet, continues to generate the lion's share of our clean electricity.

Today, Ontario has one of North America's cleanest electricity grids. We also have effective natural gas conservation programs, helping homeowners, businesses and industry reduce their carbon footprint.

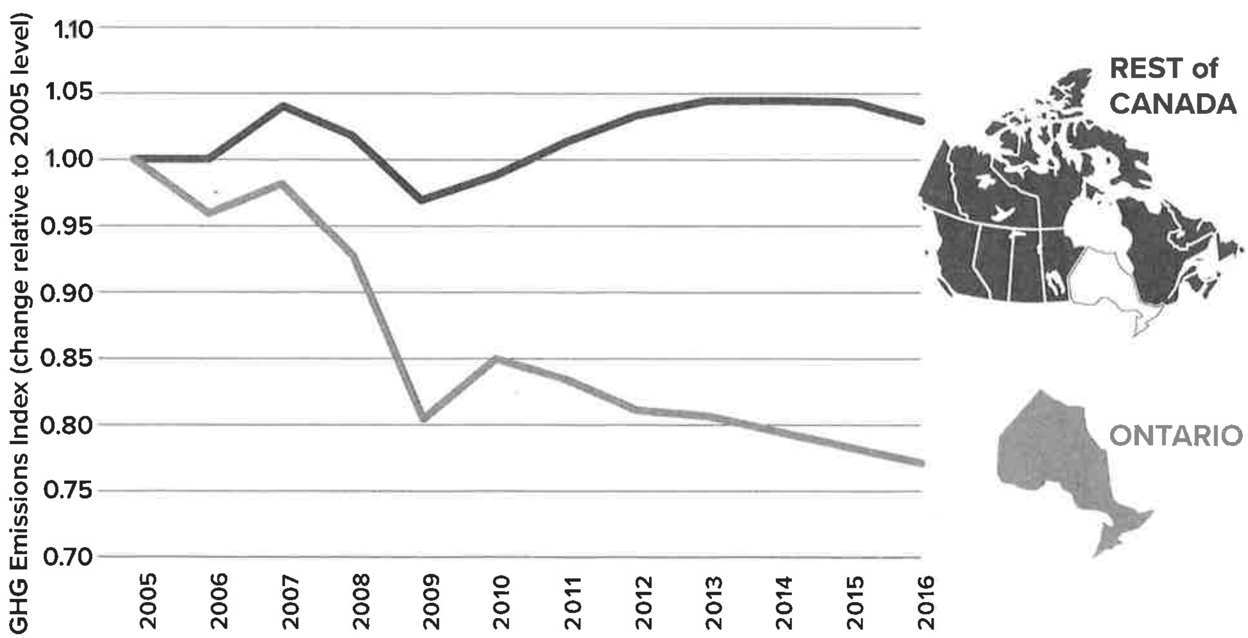
Quick Fact: Almost all of Canada's progress towards its 2030 Paris Agreement targets has been driven by Ontario.

But doing Canada's heavy lifting on greenhouse gas emission reductions has come at a cost to Ontario families. Our government understands the part that Ontarians have played and continue to play in reducing their emissions.

We have already been a leader when it comes to climate. **Indeed, we are on track to meet Canada's commitment under the Copenhagen Accord of 17% below 2005 levels by 2020.**

Now, we must look to find a balanced approach to reducing our emissions and prepare families for the impact of climate change in order to maintain both a healthy economy and healthy environment. This plan is our alternative to a carbon tax. It means finding effective and affordable ways to slow down climate change and build more resilient communities to prepare for its effects.

Ontario and the Rest of Canada's Greenhouse Gas Emissions from 2005 to 2016



We will work to unlock private capital to give Ontario businesses and residents new and more affordable ways to invest in energy efficiency, save money and reduce greenhouse gas emissions. One of the most effective ways we can combat climate change is encouraging innovation and reducing regulatory barriers to climate solutions. Through this plan, our government will focus on smart regulatory and policy approaches to facilitate and enable innovation rather than hindering it.

The following chapter of our environment plan acts as Ontario's climate change plan, which fulfills our commitment under the *Cap and Trade Cancellation Act, 2018.*

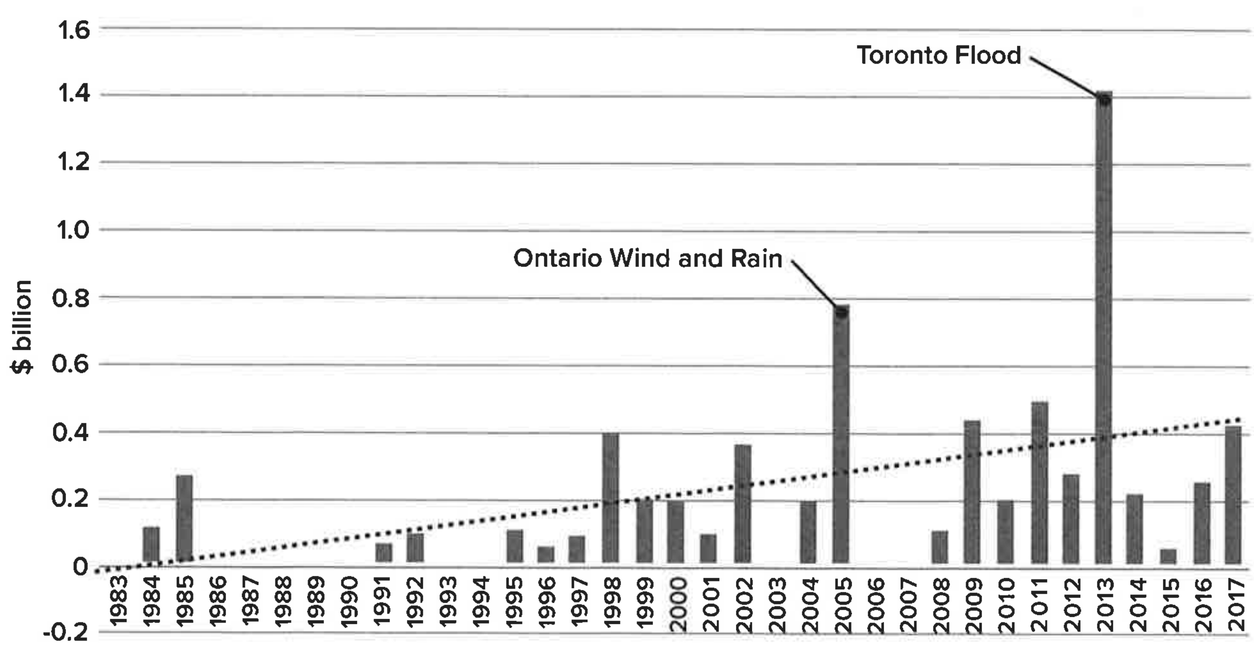
BUILDING RESILIENCE:
Helping Families and Communities Prepare

We are committed to preparing families and communities for the costs and impacts of climate change, and to protecting our natural environment, communities, businesses and municipalities.

While our actions are important in the global fight to reduce emissions, we all understand the need to strengthen our resilience to the impacts of climate change such as more frequent extreme weather events.

The following graph shows the rising costs of insured property damage in Ontario between 1983 and 2017, providing an indication of the costs of climate change. The financial costs associated with extreme weather events in Ontario have increased over this period. Chief among factors affecting the increasing costs to Ontarians is the phenomenon of flooding, and more specifically, residential basement flooding.

Costs of Insured Property Damage in Ontario Between 1983 and 2017



Source: Insurance Bureau of Canada.

Building resilience is about having the right information, tools and resources to adapt and respond to our changing climate. We will access the best science and information to better understand where the province is vulnerable and know which regions and economic sectors are most likely to be impacted. Through this enhanced understanding, the province, local communities, businesses, Indigenous communities and the public will be more prepared for the impacts of a changing climate.

Case study:
Climate change impact assessments

Ontario has never completed a provincial-level climate change impact assessment. Since 2008, the United Kingdom has conducted two assessments using best available data and an up-to-date understanding of climate science and future climate impacts. Each assessment provides detailed analysis of the risks, vulnerabilities and impacts of climate change on key economic sectors, infrastructure, the environment and societal health and well-being.

Each assessment gives the government a roadmap to "high" and "low" climate change risks now and in future years.

Actions

Improve our understanding of how climate change will impact Ontario

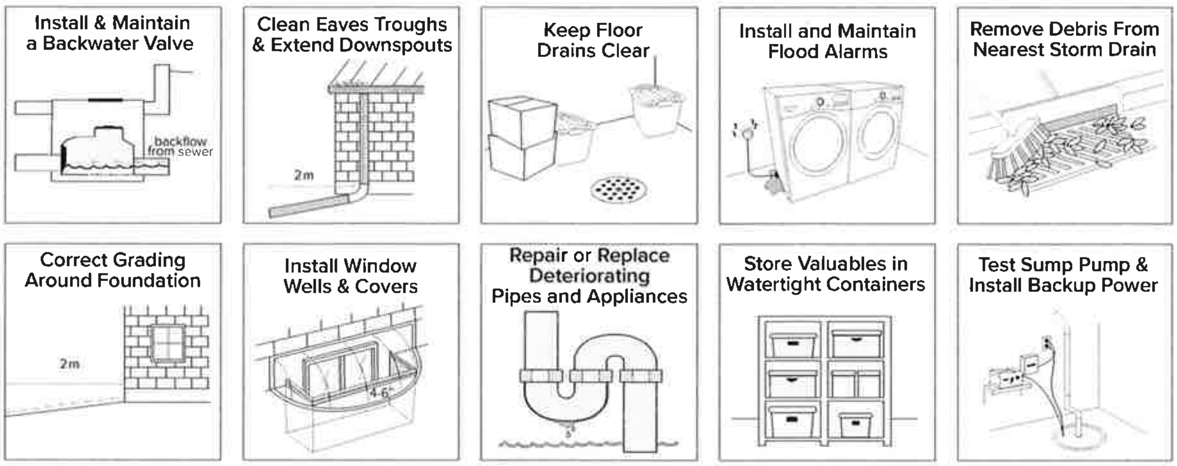
- Undertake a provincial impact assessment to identify where and how climate change is likely to impact Ontario's communities, critical infrastructure, economies and natural environment. The assessment would provide risk-based evidence to government, municipalities, businesses, Indigenous communities and Ontarians and guide future decision making.
- Undertake impact and vulnerability assessments for key sectors, such as transportation, water, agriculture and energy distribution.

Help Ontarians understand the impacts of climate change

- Develop a user-friendly online tool that makes practical climate change impact information available for the public and private sectors. This tool will help developers, planners, educators, homeowners and others understand the potential impacts of climate change in their communities.
- Work closely with climate science modelling experts, researchers, Indigenous communities, and existing climate service providers to identify and create adaptation solutions.
- Support communities by demonstrating how climate science can be applied in decision making to improve resilience.

The graphics below illustrate practical actions that homeowners can take – simply and affordably – to lower their risk of basement flooding. Home flood protection can include property level initiatives such as disconnecting downspouts from weeping tile systems, placing plastic covers over window wells, outfitting sump pumps with battery back-up supply, and installing back water valves on drain lines.

10 Ways to Prevent Home Basement Floods



Source: Home Flood Protection Program, Intact Centre on Climate Adaptation, University of Waterloo

Ontario will work with the real estate and insurance industries to raise awareness among homeowners about the increasing risk of flooding as we experience more frequent extreme weather events. Flooding damage is the leading cause of insured property damage in Ontario. The risk of home flooding is also increasingly the reason why homeowners are unable to adequately insure their homes.

Flood damages can cost homeowners tens of thousands of dollars to repair. According to the National Flood Insurance Program in the U.S., a 15-centimetre flood in a 2,000-square-foot home is likely to cause about USD $40,000 in flood damage. Once flooding occurs, securing insurance will become more difficult and may become unaffordable for individual homeowners.

However, simple steps, such as removing debris from nearby storm drains, ensuring correct grading around home foundations, clearing eaves troughs, and installing extended downspouts and window well covers can significantly mitigate basement flood risks.

Update government policies and build partnerships to improve local climate resilience

- Modernize the Building Code to better equip homes and buildings to be better able to withstand extreme weather events. This could include affordable adaptation measures such as requiring backwater valves in new homes that are at risk of backflow, which would significantly reduce the impacts of basement flooding.
- Review the Municipal Disaster Recovery Assistance program to encourage municipalities to incorporate climate resilience improvements when repairing or replacing damaged infrastructure after a natural disaster. Since the Municipal Disaster Recovery Assistance program was launched in 2016, over $2.6 million has been provided to 11 municipalities.
- Consult on tax policy options to support homeowners in adopting measures to protect their homes against extreme weather events, such as ice and wind storms and home flooding.

- Review land use planning policies and laws to update policy direction on climate resilience. This will help make the way our communities are planned and designed more responsive and adaptive to changing weather conditions, such as improving the way that stormwater is managed.
- Build resilience in the province's critical infrastructure, through better technology as well as back-up generation and energy storage options, so that our vital services and infrastructure, such as hospitals, can better withstand and remain operational during extreme weather events.
- Support improvements to existing winter roads where they may be required to replace roads that are deteriorating as a result of changing weather conditions and shortened winter seasons, and develop a strategy to enhance all-season road connections to northern communities.
- Continue to support programs and partnerships intended to make the agriculture and food sectors more resilient to current and future climate impacts. We will support on-farm soil and water quality programming and work with partners to improve agricultural management practices.

Lake Erie Action Plan and 4R Nutrient Stewardship

Ontario's farmers continue to demonstrate leadership in environmental stewardship, which is important to their livelihood. Farmers are also embracing and championing innovative farming practices, such as 4R Nutrient Stewardship (Right Source @ the Right Rate, Right Time, and Right Place®), and other initiatives under the Canada-Ontario Lake Erie Action Plan, that are designed to enhance environmental protection and improve sustainability.

CONTINUING TO DO OUR SHARE: Achieving the Paris Agreement Target

One of the key ways we are defining our vision for climate action in Ontario is by setting an achievable greenhouse gas reduction target. This will help us focus our efforts and provide a benchmark for our province to assess its progress on the climate change mitigation components of our plan.

Ontario will reduce its emissions by 30% below 2005 levels by 2030.

This target aligns Ontario with Canada's 2030 target under the Paris Agreement.

This is Ontario's proposed target for the reduction of greenhouse gas emissions, which fulfills our commitment under the *Cap and Trade Cancellation Act, 2018*.

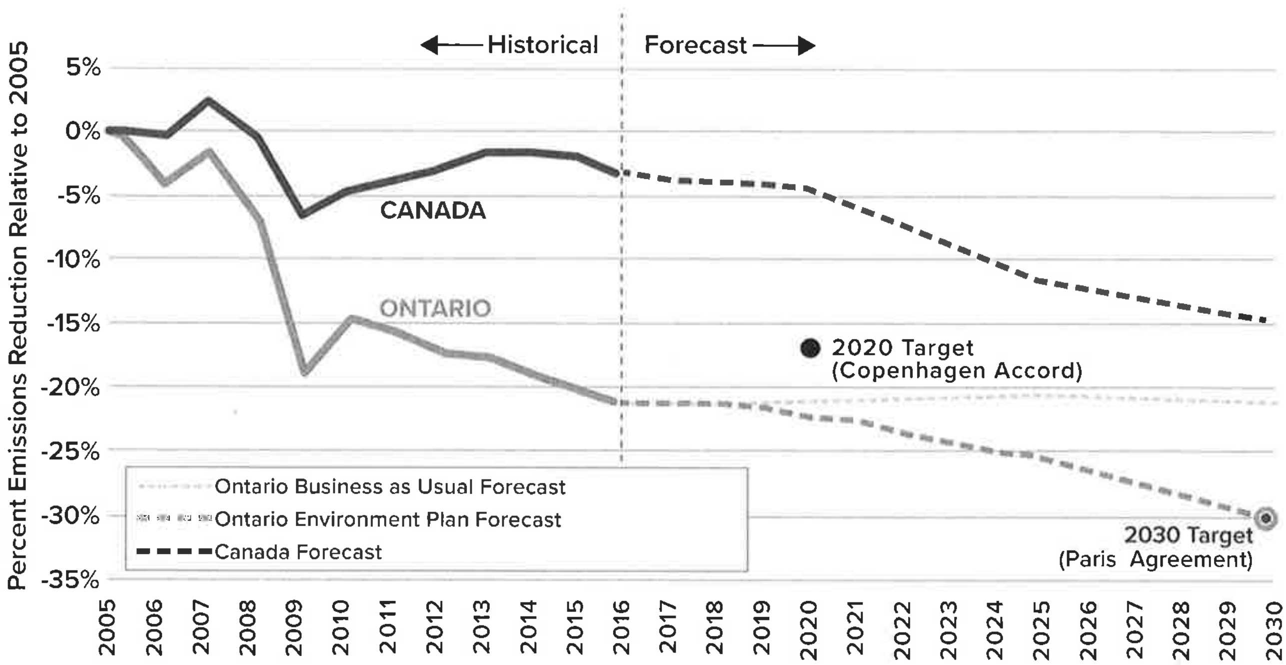
Quick Fact: The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change. Its goal is to keep the increase in global average temperature to well below 2 °C above pre-industrial levels, and pursue efforts to limit the increase even further to 1.5 °C, in order to reduce the risks and impacts of climate change.

This target takes into consideration the commitment the people of Ontario have already shown in reducing emissions, as well as our commitment to growing Ontario's economy while doing our part to tackle climate change.

There has been a steep decline in emissions from 2005, driven in large part by improvements in the electricity sector, including closing coal-fired electricity generation. As a result, we are on track to do better than the federal 2020 target set under the Copenhagen Accord in 2010.

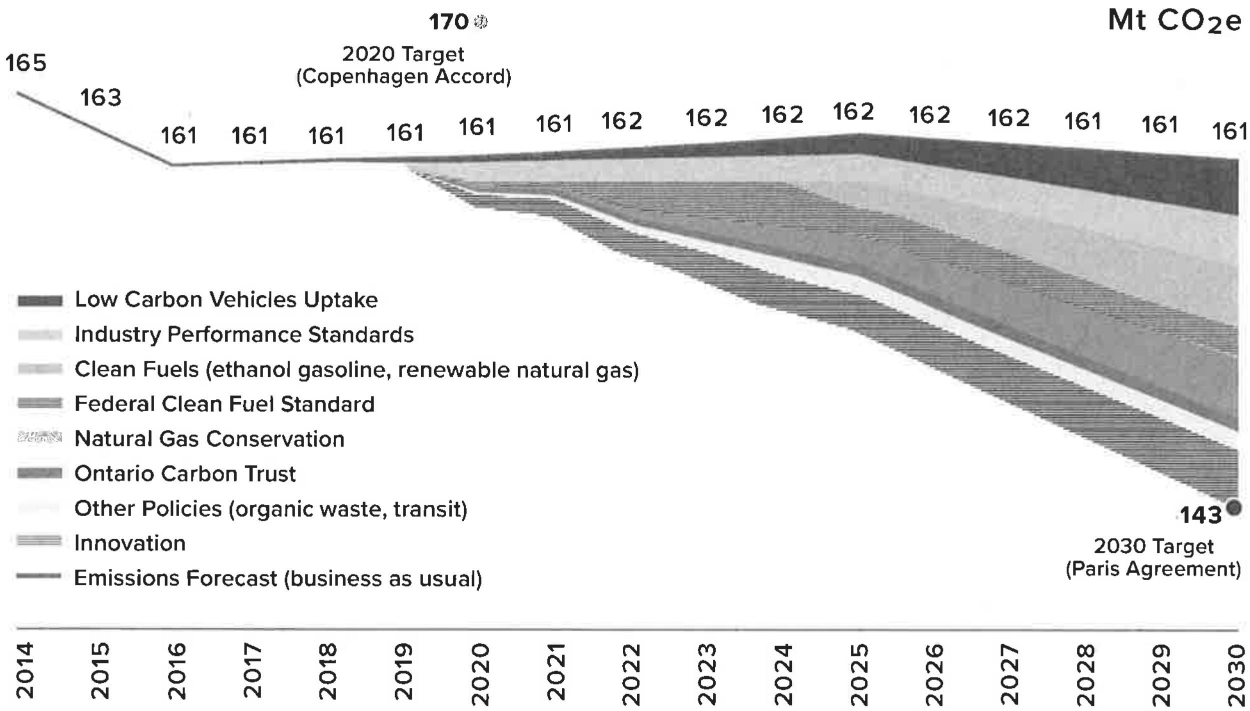
The following graph shows our 2030 target is achievable. The policies within this plan will put us on the path to meet our 2030 target, and we will continue to develop and improve them over the next 12 years. This plan will be reviewed and revised on a four-year basis.

Past and Projected Greenhouse Gas Emission Reductions for Canada and Ontario



Source: Environment and Climate Change Canada (2018) National Inventory Report 1990-2016: Greenhouse Gas Sources and Sinks in Canada. Canada 2017 Biennial Report and internal Ontario modelling.

Path to Meeting Ontario's 2030 Emission Reduction Target



The chart above shows where we expect Ontario's emissions to be if we take no action (161 megatonnes) compared to where we expect our emissions to go if we take actions in specific sectors. Our target is equivalent to 143 megatonnes in 2030 and we will need reductions in key sectors identified in the graph to get there.

The coloured portions of the chart above refer to emissions reductions we expect to see from actions in this plan and the shaded portions represent the potential we have to enhance some of those actions.

The actual reductions achieved will depend on how actions identified in our plan are finalized based on feedback we get from businesses and communities. The estimated reductions are explained in more detail below.

The **Low Carbon Vehicles** uptake portion refers primarily to electric vehicle adoption in Ontario and in small part to the expansion of compressed natural gas in trucking.

Industry Performance Standards refer to our proposed approach to regulate large emitters of greenhouse gas emissions, as described later in this plan. The final impact of this approach will depend on consultation with industry partners.

Clean Fuels refer to increasing the ethanol content of gasoline to 15% as early as 2025, and encouraging uptake of renewable natural gas and the use of lower carbon fuels.

The Federal **Clean Fuel Standard** is an estimate of the additional impact of the proposed federal standards, which could expand the use of a broad range of low-carbon fuels, energy sources and technologies, such as ethanol, renewable natural gas, greener diesel, electricity, and renewable hydrogen.

The Natural Gas Conservation action reflects programs that are well established in Ontario to conserve energy and save people money. This case assumes a gradual expansion of programs delivered by utilities, which would be subject to discussions with the Ontario Energy Board.

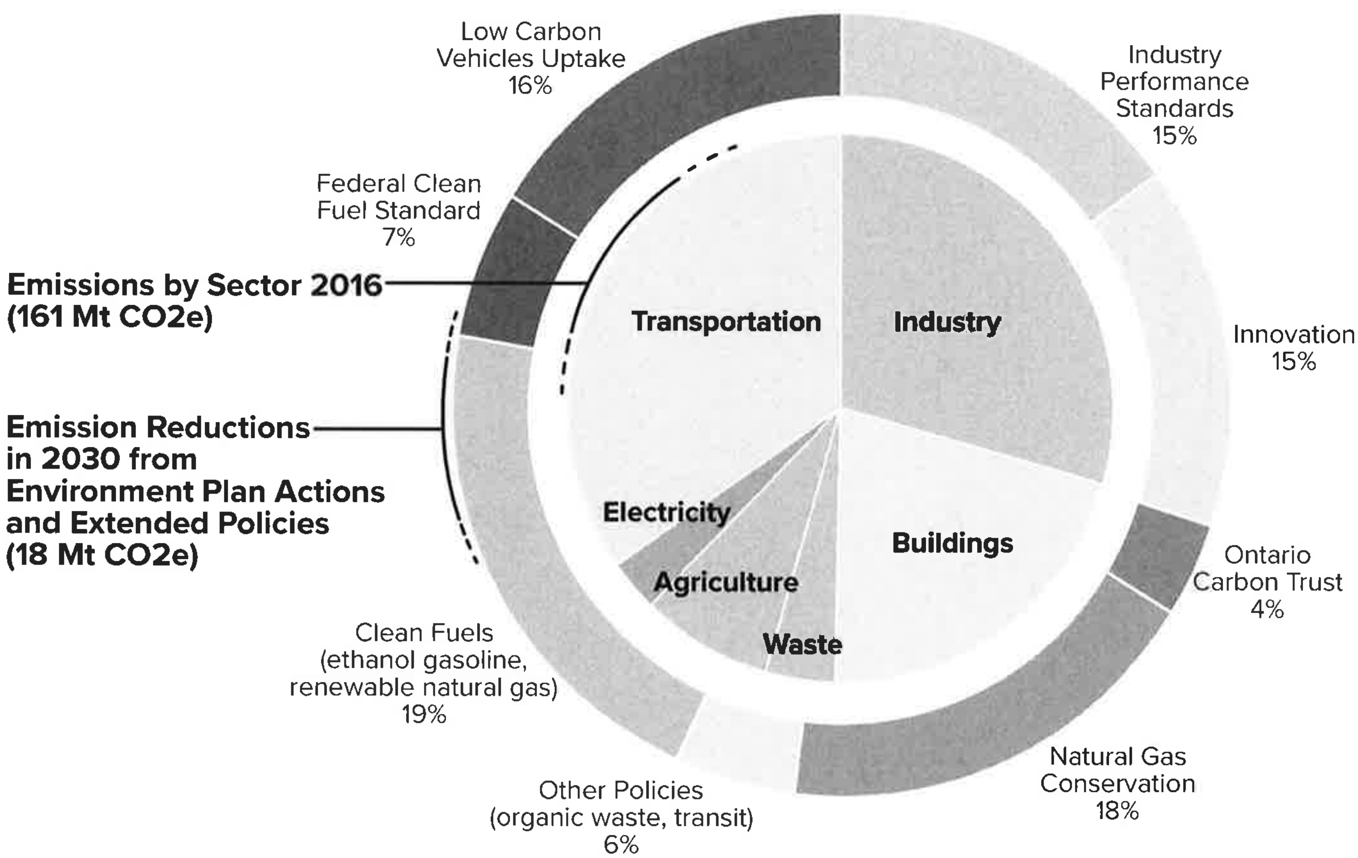
The **Ontario Carbon Trust** is an emission reduction fund that will use public funds to leverage private investment in clean technologies that are commercially viable. For this action we estimate a fund of $350 million will be used to leverage private capital at a 4:1 ratio. Estimates will depend on the final design and mandate of the trust. The estimates also include the potential emission reductions associated with a $50 million Ontario Reverse Auction designed to attract lowest-cost greenhouse gas emission reduction projects.

Other policies include the emission reductions associated with investments in public transit, and our commitment to improve diversion of food and organic waste from landfills, as described later in this plan.

Innovation includes potential advancements in energy storage and cost-effective fuel switching from high intensive fuels in buildings to electricity and lower carbon fuels.

As part of our commitment to transparency, the government is committed to updating and reporting on these estimates once program details are finalized to ensure we are making progress to the 2030 targets.

Planned Emission Reductions in 2030 by Sector



The chart above shows how the plan is tailored to address Ontario's greenhouse gas emissions. The inner pie shows the breakdown of Ontario's 2016 greenhouse gas emissions by sector. The outer ring colours show the policies from the environment plan that are targeted at reducing emissions in each sector.

The government is committed to balancing emissions reductions and economic growth. Ontario's economy has been growing, even as emissions are declining.

Tracking this improvement is an important part of Ontario's climate change plan. In coming months we will consult on the development of an economy wide carbon intensity target as a complementary metric to our absolute emissions target and to ensure that our climate change plan helps us to continue this positive trend.

The below areas are where we will focus our initiatives and actions to tackle and be more resilient to climate change and to meet our balanced target.

MAKE POLLUTERS ACCOUNTABLE

We know job creators in this province have made great strides to reduce greenhouse gas emissions, some leading their industry globally. We will ensure polluters pay their fair share for their greenhouse gas emissions, while also ensuring industry continues to make advances to help Ontario achieve its share of reductions.

Greenhouse gas emissions from the industrial sector, including smaller industrial facilities, accounted for 29% of Ontario's total emissions in 2016. We plan to regulate large emitters with a system that is tough but fair, cost-effective and flexible to the needs and circumstances of our province and its job creators. We will also ensure strong enforcement of these rules.

This system will recognize the unique situation of Canada's manufacturing and industrial heartland. Ontario depends on many industries that compete internationally. Our made-in-Ontario standards will consider factors such as trade-exposure, competitiveness and process-emissions, and allow the province to grant across-the-board exemptions for industries of particular concern, like the auto sector, as needed.

Implement emission performance standards for large emitters

We will create and establish emission performance standards to achieve greenhouse gas emissions reductions from large emitters. Each large industrial emitter will be required to demonstrate compliance on a regular basis. The program may include compliance flexibility mechanisms such as offset credits and/or payment of an amount to achieve compliance.

An emissions performance standard establishes emission levels that industrial facilities are required to meet and is tied to their level of output or production. This approach does not enforce a blanket cap on emissions across Ontario and takes into consideration specific industry and facility conditions while allowing for economic growth. It also recognizes industries in Ontario that are best-in-class while requiring improvements from sectors that have room to improve.

Case study: Saskatchewan's output-based performance standards (OBPS) system

In December 2017, Saskatchewan introduced a comprehensive Prairie Resilience climate change strategy, which included a plan to implement an OBPS system in 2019. The OBPS will apply to facilities in regulated sectors that emit more than 25,000 tonnes of greenhouse gas emissions per year. The OBPS is expected to be implemented by January 1, 2019, and the Government of Saskatchewan estimates it will cut annual emissions of covered sectors by 10% by 2030.

In addition, Saskatchewan is regulating emissions from electricity generation to achieve a 40% reduction in electricity emissions, and is regulating flared and vented methane emissions in the upstream oil and gas sector, which will lead to additional annual reductions of 40 to 45% in that sector by 2025.

ACTIVATE THE PRIVATE SECTOR

Ontario is home to the hub of the Canadian financial industry – banks, investment firms, pension funds and insurance companies. Ontario hosts the head offices of Canada's five largest banks, three of which rank among the world's largest 25 banks by market capitalization.

We recognize that our private sector has the capital, capability and know-how to transform clean technology markets and transition Ontario to a low-carbon economy. This is why we intend to help facilitate the private sector's best projects and ideas to drive emission reductions at the lowest cost to taxpayers. Our plan will ensure the prudent and responsible use of public resources to drive private sector investment.

We also want to enable consistent disclosure about financial risks associated with climate change so that companies can provide information to investors, lenders, insurers and other stakeholders.

Together, these actions will help improve the capacity of the sustainable finance sector in Ontario and position us as a global leader in this area.

Actions

Launch an emission reduction fund – The Ontario Carbon Trust – and a reverse auction to encourage private investment in clean technology solutions

Ontario will commit to ensuring funding of $400 million over four years. These funds will complement penalties paid into The Ontario Carbon Trust by polluters. This will ensure that over the next four years, The Ontario Carbon Trust should be able to leverage over $400 million to unlock over $1 billion of private capital.

If Canada's federal government returns to the Pan-Canadian Framework agreement with the people of Ontario, The Ontario Carbon Trust could be increased by $420 million through the Low Carbon Economy Leadership Fund. This would increase the fund to $820 million and unlock more than $2 billion of private capital. It would also ensure that the people of Ontario are provided the most cost-effective approach to reducing greenhouse gas emissions. Canada's commitment to partner with the people of Ontario through supporting The Ontario Carbon Trust would allow Ontario to reduce emissions beyond what is forecasted in this plan, and help Canada meet its Paris target.

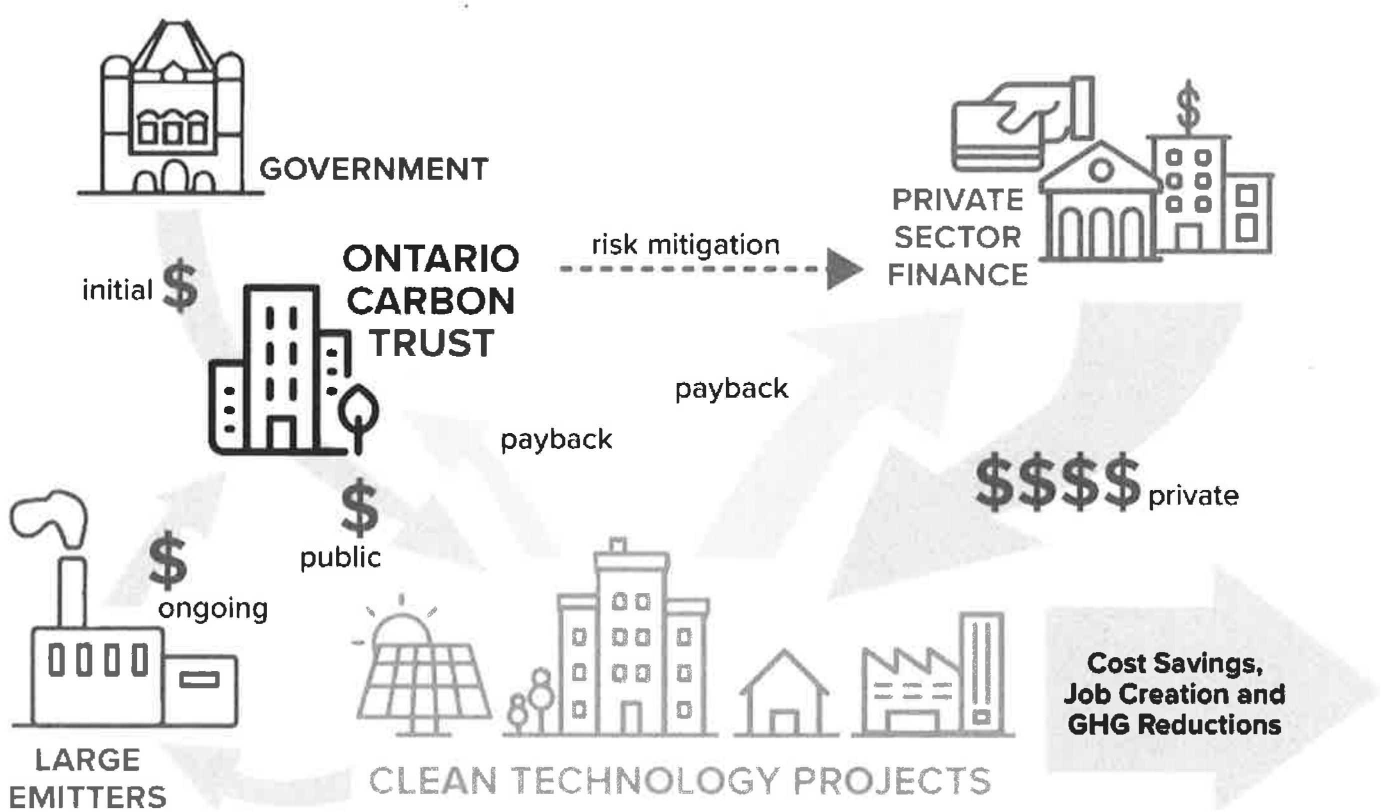
The Ontario Carbon Trust will use innovative financing techniques and market development tools in partnership with the private sector to speed up the deployment of low-carbon solutions. It will use public funds to leverage private investment in clean technologies that are commercially viable and will have a widespread presence. It will also seek to reduce energy costs for ratepayers, stimulate private sector investment and economic activity, and accelerate the transition to a low-carbon economy.

The Ontario Carbon Trust could consider investing in cost-effective projects from various sectors, such as transportation, industry, residential, business and municipal.

We will establish an independent board with the appropriate expertise, with a mandate to form The Ontario Carbon Trust, which will be tasked with working with the private sector to identify projects that will reduce emissions and deliver cost savings. We will:

- Create an emission reduction fund to support and encourage investments across the province for initiatives that reduce greenhouse gas emissions. The fund will leverage an initial investment from the government ($350 million) to attract funds from the private sector in order to drive investment in clean technologies.
- Launch an Ontario Reverse Auction ($50 million), allowing bidders to send proposals for emissions reduction projects and compete for contracts based on the lowest-cost greenhouse gas emission reductions.

The Ontario Carbon Trust



Source: Adapted from Coalition for Green Capital, Growing Clean Energy Markets with Green Bank Financing: White Paper, page 2, http://coalitionforgreencapital.com/wp-content/uploads/2015/08/CGC-Green-Bank-White-Paper.pdf.

Case study:
NY Green Bank

Created as a division of the New York State Energy Research and Development Authority, NY Green Bank is a state-sponsored, specialized financial entity that works with the private sector to increase investments in clean energy markets.

NY Green Bank's flexible approach to clean energy financing helps reduce the need for government support and increase investments into New York's clean energy markets, creating a more efficient, reliable and sustainable energy system.

By investing funds at market rates, NY Green Bank is able to cover its own costs and keep its funding base for future projects. As of September 30, 2018, NY Green Bank has committed $580.1 million to support clean energy projects with a total cost of between $1.44 and $1.68 billion.

What is a reverse auction? The buyer, in this case government, sends out a request for proposals, services or contracts. Bids are assessed and chosen based on the lowest cost, which in this case is the lowest cost per tonne of greenhouse gas emission reductions. The "bidders" in the auction compete to win the project or contract, often underbidding each other, resulting in lower costs for the buyer.

Enhance corporate disclosure and information sharing

- Work with the financial sector to promote climate-related disclosures in Ontario.
- Encourage the Ontario Securities Commission to improve guidance on climate-related disclosures.

Globally, many financial institutions are adopting the recommendations of the Task Force on Climate-Related Financial Disclosures. Ontario's financial sector is also working to improve disclosures.

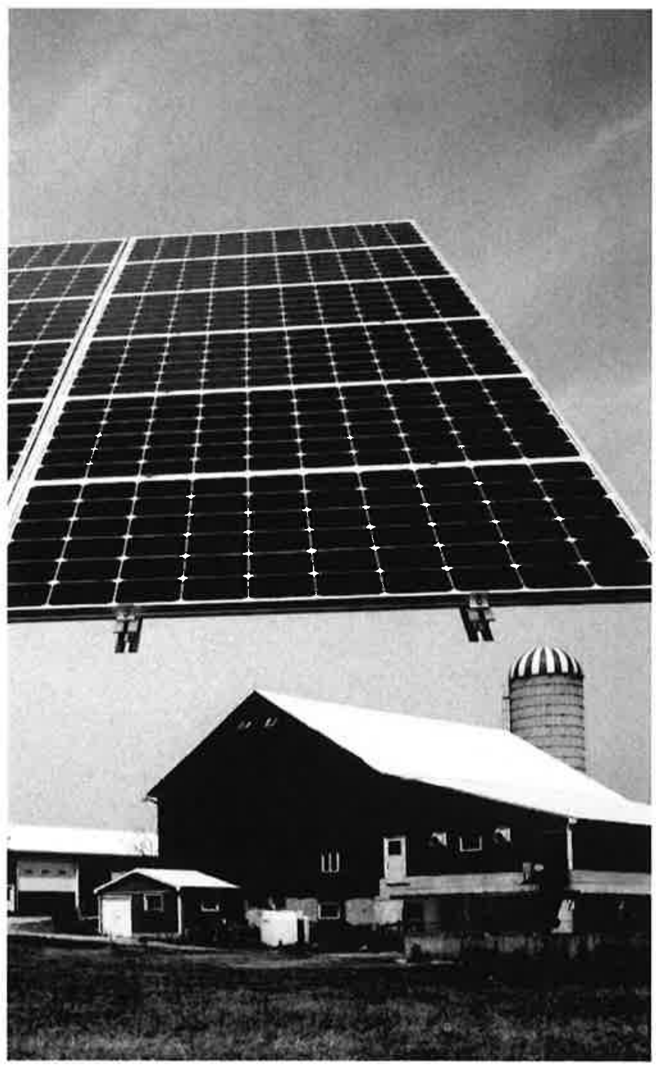
Encourage private investments in clean technologies and green infrastructure

- Ontario will parallel federal changes to the Accelerated Capital Cost Allowance, which will make technology investments in clean energy generation and energy conservation equipment more attractive.
- Work with the Ontario Financing Authority to issue Green Bonds by the end of the fiscal year, after realigning the Green Bond program to support our approach to addressing environmental challenges. This action was included in the Fall Economic Statement.
- Consider tax policy options to encourage the creation of clean technology manufacturing jobs in Ontario.

Green Bonds serve as an important tool to help finance projects that will help us address our environmental challenges. Project categories include transit initiatives, extreme-weather resistant infrastructure, and energy conservation and efficiency projects (including health and education-related projects). By capitalizing on low interest rates, Ontario's Green Bonds enable the Province to raise funds while respecting the taxpayers of Ontario and without adversely impacting businesses.

Success story:
Algae carbon capture

In 2012, Pond Technologies, an Ontario technology company, partnered with St. Marys Cement to run a pilot using CO2 generated by its cement plant to grow algae. Like plants, algae absorb carbon as they grow. Revenue generated from the sale of algae-derived bioproducts provide the economic basis for the adoption of this technology. Pond's pilot proved that reducing greenhouse gas emissions can generate revenue.

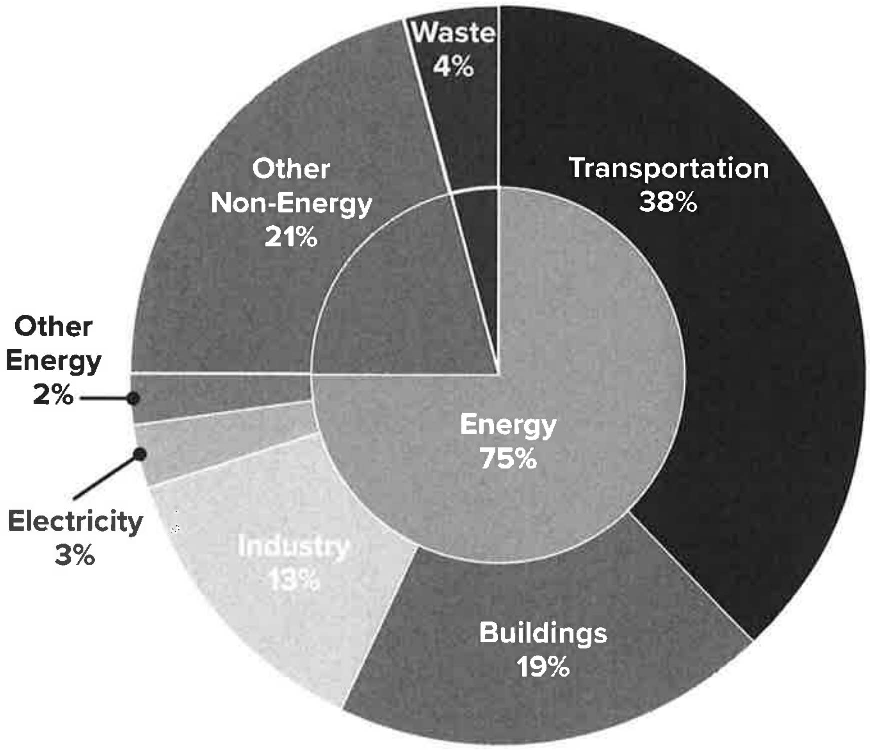


USE ENERGY AND RESOURCES WISELY

We will develop climate solutions that will save energy, resources and money.

About 75% of Ontario's greenhouse gas emissions come from using energy in our homes, buildings, vehicles and industry while 4% comes from waste.

Ontario's Energy Use by Sector



Source: Data from Environment and Climate Change Canada, 2018 National Inventory Report

We use gasoline and diesel fuel almost exclusively for transportation, while our main energy source for space and water heating is natural gas. Even though Ontario's vehicles have become more efficient, the number of vehicles on the road has increased.

Today, the transportation sector remains our largest source of emissions. That means we need to focus on using energy more efficiently, including in transportation, on expanding access to cleaner energy.

Our government will ensure the Ontario Energy Board keeps pace with consumer demands and the adoption of innovative energy solutions in this time of unprecedented technological change.

We also know that just over 60% of Ontario's food and organic waste is sent to landfills. In a landfill, it breaks down to create methane, a potent greenhouse gas that contributes to climate change. In fact, methane is 25 times more potent as a greenhouse gas than carbon dioxide. When food and organic waste is sent to landfill, opportunities are lost to preserve valuable resources that could be used to heat our homes, support healthy soils and reduce greenhouse gas emissions.

We will work with partners on ways to make it easier for residents and businesses to waste less food or reuse it for beneficial purposes such as compost.

Quick Fact: About 60% of Ontario's food and organic waste is sent to landfills which emits methane – a potent greenhouse gas – when it decomposes. Efficient diversion of household waste from landfills is an important tool in the fight against climate change. To read more about our plan to fight litter and waste, see page 40.

Actions

Conserve energy in homes and buildings to cut costs and reduce emissions

- Increase the availability and accessibility of information on energy and water consumption so that households, businesses and governments understand their energy use (e.g. collection of data related to electric vehicles, household-level energy and water consumption data). For example, provide customers with access to their energy data by working with electricity and natural gas utilities to implement the Green Button data standard. We will support water utilities to implement Green Button on a voluntary basis.
- Work with the Ontario Real Estate Association to encourage the voluntary display of home energy efficiency information on real estate listings to better inform buyers and encourage energy-efficiency measures.
- Review the Building Code and support the adoption of cost effective energy efficiency measures that can lower the cost of electricity and natural gas needed to operate buildings. Ontario is currently a leading jurisdiction in Canada when it comes to energy efficiency standards in its Building Code. Today, Ontario's Building Code ensures new homes built after 2017 use 50% less energy to heat and cool than houses built before 2005, resulting in a much lower carbon footprint than older homes.
- Work with the Ontario Energy Board and natural gas utilities to increase the cost-effective conservation of natural gas to simultaneously reduce emissions and lower energy bills.
- Ensure Ontario's energy-efficiency standards for appliances and equipment continue to be among the highest in North America.

Quick Fact: Enbridge Gas Distribution and Union Gas offer gas conservation programs that offer incentives for homeowners to complete upgrades that make their homes more energy efficient. Each dollar spent results in up to $2.67 in reduced energy bills for program participants.

Increase access to clean and affordable energy for families

- Continue to support connecting Indigenous communities in Northern Ontario to Ontario's clean electricity grid, to replace local diesel and other types of electricity generation.
- Increase the renewable content requirement (e.g. ethanol) in gasoline to 15% as early as 2025 through the Greener Gasoline regulation, and reduce emissions without increasing the price at the pump, based on current ethanol and gasoline prices.
- Encourage the use of heat pumps for space and water heating where it makes sense, as well as innovative community-based systems like district energy.
- Require natural gas utilities to implement a voluntary renewable natural gas option for customers. We will also consult on the appropriateness of clean content requirements in this space.
- Consult on tax policy options to make it easier for homeowners to increase energy efficiency and save money.
- Streamline and prioritize environmental approvals for businesses that use low-carbon technology, while maintaining high standards for environmental protection.
- Support the integration of emerging smart grid technologies and distributed resources – including energy storage – to harness and make best use of Ontario's clean electricity.
- Improve rules and remove regulatory barriers that block private investors from deploying low-carbon refueling infrastructure that will help increase the uptake of electric, hydrogen, propane, autonomous and other low-carbon vehicles without government subsidies.
- Collaborate with the private sector to remove barriers to expanding 24/7 compressed natural gas refueling stations for trucks along the 400-series highways, and maintain the existing tax exemption (gasoline and fuel tax) on natural gas as a transportation fuel. This will provide heavy-duty vehicles (such as transport trucks) with a cost-effective path to lower on-road transportation emissions.

Quick Fact: Natural gas is exempt from the fuel tax in Ontario, and natural gas trucks have a smaller carbon footprint compared to diesel trucks.

Success story:
Niagara Falls pump generating station produces zero-emissions power

Ontario Power Generation's Sir Adam Beck Pump Generating Station is an important source of flexible zero-emissions power for Ontarians. The station fills a 750-acre reservoir when demand for power is low, storing the equivalent amount of energy as 100,000 electric car batteries. The filled reservoir can then be used to generate hydroelectric power when needed, displacing 600 megawatts of fossil fuel generation for up to eight hours.

Success story:
Partnering to fuel lower-carbon heavy-duty transportation

In April 2018, Union Energy Solutions Limited Partnership, an unregulated affiliate of Union Gas Limited (an Enbridge Company), announced a partnership with Clean Energy to build three compressed natural gas fueling stations along Ontario's Highway 401. The initiative will enable heavy-duty vehicles (such as transport trucks) that use natural gas as a transportation fuel to travel and refuel along the 401, leading to lower on-road transportation emissions.

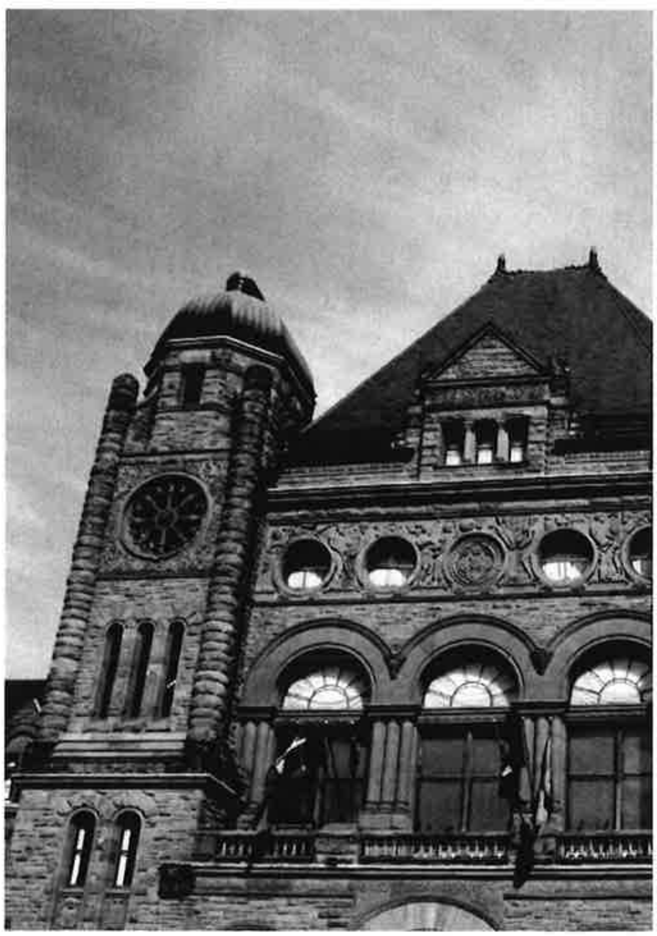
Case study:
Electrify Canada building an electric vehicle charging network

Electrify Canada is a new company that will build ultra-fast charging networks for electric vehicles across Canada, which are anticipated to be operational starting in 2019. This includes the installation of 32 electric vehicle charging sites near major highways and in major metro areas in British Columbia, Alberta, Ontario and Quebec.

DOING OUR PART: Government Leadership

Ontario is committed to doing its part to address climate change. This includes leading by example. We will encourage local leadership on climate change, including municipal governments, the broader public sector, business associations, community groups, Indigenous communities and voluntary organizations to develop and promote climate solutions for their members and communities. We will continue to engage on international climate issues by providing Ontario's perspective to Canada's international climate negotiations.

As part of the government's commitment to curriculum renewal we will explore changes that embed learning about the environment in the classroom. Learning about protecting our air, land and water, addressing climate change, and reducing the amount of litter and waste in our communities will not only raise awareness in schools, it will also enable students to pass on this knowledge to their families.



Partnering with and enabling people, businesses, municipalities and schools will help us find ways to address local issues and needs, save energy and costs, and minimize climate risks to our schools, hospitals, highways and critical infrastructure.

Actions

Make climate change a cross-government priority

- Improve our ability to consider climate change when we make decisions about government policies and operations by developing a Climate Change Governance Framework that will:
  - Establish clear responsibilities and requirements for ministries to track and report on climate change measures.
  - Consider climate change when we purchase goods and services across government, where it is cost-effective (i.e. low-carbon intensity steel and cement).
  - Explore opportunities to enhance coordination and guidance for municipalities to help them consider climate change in their decision-making.
  - Update Statements of Environmental Values to reflect Ontario's environmental plan.

- Continue to execute a high-performance building automation strategy for government buildings. This strategy uses advanced automation and integration to measure, monitor, and control operations and maintenance at the lowest cost, also reducing greenhouse gas emissions during day-to-day building operations. The strategy includes, but is not limited to, HVAC and lighting controls, security, elevators, fire protection, and life safety systems in order to improve performance and to reduce energy consumption.
- Ensure investments in future renovations of government buildings maximize energy cost savings. For instance, Ontario is building new correctional facilities to meet LEED standards, which ensures high environmental performance and will improve efficiency while saving money.
- Undertake a review of government office space, with an eye to optimizing our physical and carbon footprint. Ontario will reduce its per employee real estate footprint to reduce energy costs and emissions, as recommended in the Auditor General's 2017 Report.
- Support the adoption of low-carbon technologies and climate resilience measures by working to reduce costly and time-consuming regulatory and operational barriers.
- Encourage the federal government to ensure that climate negotiations under Article 6 of the Paris Agreement improve our cleantech sector's access to emerging global markets for low-carbon technologies. Ontario is a leader in clean technology and more access to global markets will help our local companies create new green jobs in Ontario.
- Develop tools to help decision makers understand the climate impacts of government activities. For example, we will identify and report on emissions reductions from school capital investments and enable school boards to access energy efficiency data to inform their investment decisions.
- Provide guidance to public property owners of heritage buildings to help them reduce their energy use and save on operating costs while continuing to conserve these important cultural heritage resources for future generations.
- Continue to support the purchase of electric ferries which will be in service in 2020 and 2021 connecting Wolfe and Amherst Islands to the mainland.

Quick fact: The government's annual procurement budget to purchase goods and services is $6 billion.

Success story: Ontario's private sector leads the country in cleantech

Ontario has the largest and fastest-growing cleantech sector in Canada, with $19.8 billion in annual revenues and over 5,000 companies employing 130,000 people.

Ontario is home to 35% of Canada's innovative cleantech companies.

Ontario is a leading hub for water technologies with over 900 companies and 22,000 employees.

Success story: Government building renovations to save energy and money

The Queen's Park Reconstruction Project is an eight-year initiative that involves the extensive reconstruction of the Macdonald Block Complex, which is located in downtown Toronto and includes the Macdonald Block Podium, Hearst, Hepburn, Mowat and Ferguson Towers.

The 47-year-old Macdonald Block Complex is home to the largest concentration of political and public service individuals in the province. It has never undergone a major renovation and the building's core systems, including electrical, water, cooling and heating, have reached the end of their useful life.

Following advice from an independent third-party expert panel, the government's Macdonald Block Complex is undergoing extensive reconstruction to achieve significant long-term cost and energy savings for the province over the next 50 years. Those savings will be achieved through reduced operating costs, lower energy and capital maintenance expenditures, and the reduction of costly third-party leases across the downtown Toronto core. The reconstructed Macdonald Block Complex will meet LEED silver certification.

Success story: City of Toronto Green Fleet

The City of Toronto's Green Fleet Plan focuses on reducing emissions from almost 10,000 vehicles as well as by equipment owned and operated by the city. The consolidated plan, led by the Fleet Services Division, brings together all five major City of Toronto fleets – City of Toronto Fleet Services Division, Emergency Medical Services, Toronto Fire Services, Toronto Police Service, and Toronto Transit Commission – under one plan.

As of 2017, the city had 2,091 green vehicles and pieces of equipment in its fleet, representing 24% of the total number of vehicles in the city's fleet.

Empower effective local leadership on climate change

- Work with municipalities to develop climate and energy plans and initiatives to support building climate resilience and transformation to the low-carbon future.
- Support the efforts of Indigenous communities to integrate climate action into local plans and initiatives for community power, economic development, health and sustainability.
- Encourage local leadership by forming stronger partnerships and sharing best practices with community groups and business associations.

Improve public transportation to expand commuter choices and support communities

Commit $5 billion more for subways and relief lines. Ontario will also invest in a two-way GO transit service to Niagara Falls, as part of the existing plan to build a regional transportation system.

- Establish a public education and awareness program to make people more aware of the environmental, financial and health impacts of their transportation choices.
- Develop a plan to upload the responsibility for Toronto Transit Commission (TTC) subway infrastructure from the City of Toronto to Ontario. An upload would enable the province to implement a more efficient regional transit system, and build transit faster. Moreover, this would allow the province to fund and deliver new transit projects sooner.

Support green infrastructure projects

We're also greening the government's fleet of vehicles. The Ontario Public Service currently has 1,632 hybrid, plug-in hybrid and full battery electric vehicles, which represent 70% of its entire passenger vehicle fleet.

Work with federal and municipal governments through the green stream of the Investing in Canada Infrastructure Program to invest up to $7 billion in federal, provincial and municipal funding over the next 10 years. Funding could be for projects that lower greenhouse gas emissions, reduce pollution, and help make community infrastructure more resilient. Example investments could include improvements to transit and transportation infrastructure and improved local water, wastewater and stormwater systems.

Early actions: GO Train Service Increase

This government is expanding GO service and making it easier for commuters and members of the community to move around the GTHA. More riders in seats relieves congestion on the roads. We're providing more reliable, predictable journeys across the region – greatly improving the daily transit experience. These improvements bring us a step closer to our vision to deliver two-way, all-day GO service.

Reducing Litter and Waste in Our Communities & Keeping our Land and Soil Clean

Currently, Ontario generates nearly a tonne of waste per person every year and our overall diversion rate has stalled below 30% over the last 15 years. Ontario needs to reduce the amount of waste we generate and divert more waste from landfill through proven methods like Ontario's curbside Blue Box Program, existing and emerging municipal green bin programs and other waste recovery options. Existing and emerging technologies are increasingly allowing us to recover and recycle materials back into our economy rather than sending them to landfills. This is helping us to better protect our communities and keep our air, land and water clean and healthy.

To keep our land and water clean, we will take strong enforcement action to ensure waste, including hazardous waste, is properly stored, transported, recycled, recovered or disposed.

We are looking at proposed ways to:

- Reduce the amount of waste going to landfills or becoming litter
- Increase opportunities for Ontarians to participate in efforts to reduce waste
- Increase opportunities to use technologies, such as thermal treatment, to recover valuable resources in waste
- Manage excess soil and hauled sewage
- Redevelop brownfield sites to better protect human health and the environment

REDUCE LITTER AND WASTE

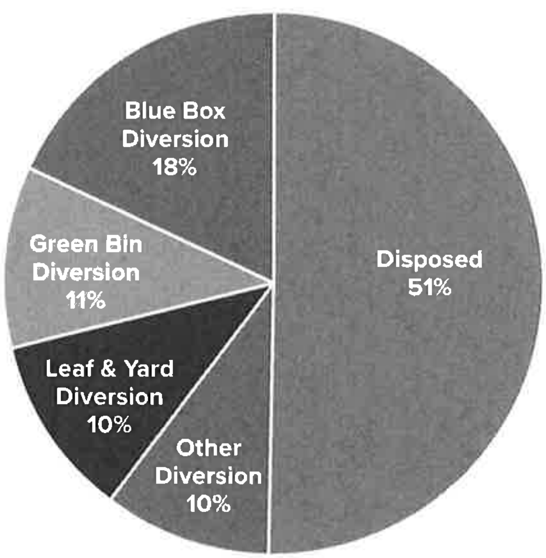
Today, some of the highest waste diversion rates in the province are in our homes. Ontarians divert almost 50% of their own household waste, through sorting what they throw away into their blue bin and, increasingly, their green bin.

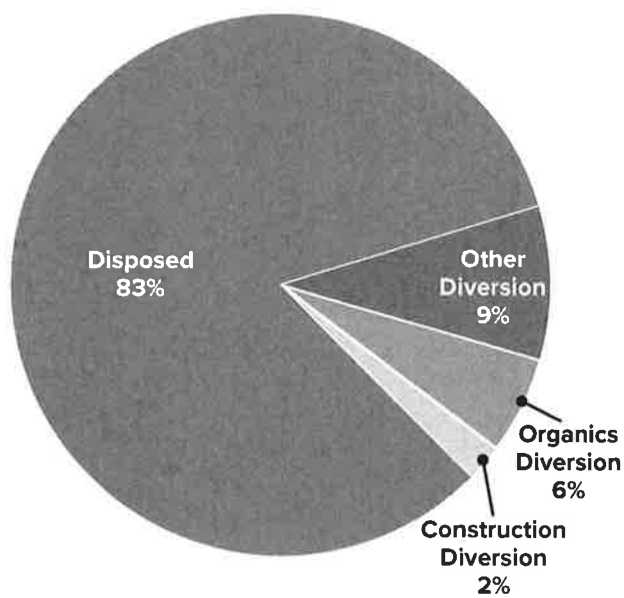
However, Ontario's general waste diversion rate (residential, commercial and industrial) has been stalled at below 30% over the past 15 years – meaning that over 70% of our waste materials continue to end up in landfills. Such heavy reliance on landfills will require the province to either focus on siting new landfills or look for new ways to reduce what we send to them.

While some individual municipalities and businesses have shown leadership, Ontarians know there is still a lot more that can be done to reduce the amount of waste we produce, recover valuable resources from our waste and better manage organics.

We believe that producers should be responsible for managing the waste they produce. Placing responsibility squarely on those who produce the waste will help unleash the creative talents and energies of the private sector. Making producers responsible for the full life-cycle of their products and the waste they produce will help companies to consider what materials they use in and to package their products, and find new and innovative cost-effective ways to recycle them and lower costs for consumers. It can also make recycling easier and more accessible right across the province, keeping it clean and beautiful.

Ontario's Residential and Industrial, Commercial and Institutional Waste Management





Residential Waste: Managed by municipalities. Includes waste generated by residents in single-family homes, some apartments and some small businesses. Mix of mandatory and voluntary diversion programs.

Business Waste: Managed by the private sector. Includes food processing sites, manufacturing facilities, schools, hospitals, offices, restaurants, retail sites and some apartments. Largely voluntary diversion programs.

Sources: Statistics Canada, Waste Management Industry Survey 2016 for non-residential data; Resource Productivity and Recovery Authority, Datacall data and residential diversion rates for residential data. Data on organic waste from 2018 study prepared for MECP by 2cg.

Reduce and divert food and organic waste from households and businesses

- Expand green bin or similar collection systems in large cities and to relevant businesses.
- Develop a proposal to ban food waste from landfill and consult with key partners such as municipalities, businesses and the waste industry.
- Educate the public and business about reducing and diverting food and organic waste.
- Develop best practices for safe food donation.

Success story:
Farmers receive support for food donations

The rescue of surplus food helps ensure food does not go to waste. Ontario supports these efforts through the following mechanisms:

- The Ontario Community Food Program Donation Tax Credit for Farmers provides tax credits up to 25% to farmers who recover and donate agricultural products to eligible programs.
- The Ontario Donation of Food Act, 1994, encourages donations, with certain limitations, and protects food donors from liability as a result of injuries caused by the consumption of donated food.

Success story:
City of Stratford turning organic waste into natural gas

Stratford, Ontario, is improving its wastewater treatment infrastructure to produce renewable natural gas from organic waste and feed it back into the local gas distribution system. Renewable natural gas is a clean, carbon-neutral energy source.

Reduce plastic waste

- Work with other provinces, territories and the federal government to develop a plastics strategy to reduce plastic waste and limit micro-plastics that can end up in our lakes and rivers.
- Seek federal commitment to implement national standards that address recyclability and labelling for plastic products and packaging to reduce the cost of recycling in Ontario.
- Work to ensure the Great Lakes and other inland waters are included in national and international agreements, charters and strategies that deal with plastic waste in the environment.

Reduce litter in our neighbourhoods and parks

Our environment plan reflects our government's commitment to keep our neighbourhoods, parks and waterways clean and free of litter and waste. When Ontarians walk their dog or take their children to the park they expect their time outdoors to be litter-free.

Ontario will establish an official day focused on cleanup of litter in Ontario, coordinated with schools, municipalities and businesses, to raise awareness about the impacts of waste in our neighbourhoods, in our waterways and in our green spaces.

- Work with municipal partners to take strong action against those who illegally dump waste or litter in our neighbourhoods, parks and coastal areas.

- Develop future conservation leaders through supporting programs that will actively clean up litter in Ontario's green spaces, including provincial parks, conservation areas and municipalities.
- Connect students with recognized organizations that encourage environmental stewardship so they could earn volunteer hours by cleaning up parks, planting trees and participating in other conservation initiatives.

Increase opportunities for Ontarians to participate in waste reduction efforts

- Work with municipalities and producers to provide more consistency across the province regarding what can and cannot be accepted in the Blue Box program.
- Explore additional opportunities to reduce and recycle waste in our businesses and institutions.

Make producers responsible for the waste generated from their products and packaging

- Move Ontario's existing waste diversion programs to the producer responsibility model. This will provide relief for taxpayers and make producers of packaging and products more efficient by better connecting them with the markets that recycle what they produce.

Explore opportunities to recover the value of resources in waste

- Investigate options to recover resources from waste, such as chemical recycling or thermal treatment, which have an important role – along with reduction, reuse and recycling – in ensuring that the valuable resources in waste do not end up in landfills.
- Encourage increased recycling and new projects or technologies that recover the value of waste (such as hard to recycle materials).

Provide clear rules for compostable products and packaging

- Ensure new compostable packaging materials in Ontario are accepted by existing and emerging green bin programs across the province, by working with municipalities and private composting facilities to build a consensus around requirements for emerging compostable materials.
- Consider making producers responsible for the end of life management of their products and packaging.

Success story: Making products compostable to reduce waste

Club Coffee makes a compostable coffee pod used by brands including Loblaw Companies Limited (President's Choice), Ethical Bean, Muskoka Roastery, Melitta Canada and Jumping Bean. Club Coffee works with municipalities so coffee drinkers can put these pods in their green bins; however they are not yet accepted in every program. We will work to support businesses that are trying to do the right thing and with leading municipalities that are working to reduce waste going to landfills. This will include working with industry and municipal partners to help ensure contamination of the Blue Box and green bin programs is minimized and that the public is provided with accurate information on how to properly manage compostable products and packaging.

Support competitive and sustainable end-markets for Ontario's waste

- Cut regulatory red tape and modernize environmental approvals to support sustainable end markets for waste and new waste processing infrastructure.
- Provide municipalities and the communities they represent with a say in landfill siting approvals. While we work to reduce the amount of waste we produce, it is recognized that there will be a need for landfills in the future. The province will look for opportunities to enhance municipal say while continuing to ensure that proposals for new and expanded landfills are subject to rigorous assessment processes and strict requirements for design, operation, closure, post-closure care and financial assurance.

CLEAN SOIL

Rural and urban communities benefit from healthy soil and land. Soils with contaminants need to be cleaned up to ensure new home owners or property users are safe, and contaminated soils are not relocated to farms where our food is grown. Having clear rules and standards around how extra soil from construction projects is managed, relocated and reused makes it easier for construction businesses to know what soils they can reuse and what soils need to be disposed of or treated before reusing.

Proper management of excess soil can reduce construction costs and unnecessary landfilling while ensuring soil from construction projects is safe for the environment and human health. By clarifying what soil can be reused locally, we can also reduce greenhouse gas emissions generated by trucking soil from place to place unnecessarily.

Redevelopment of underused, often contaminated sites (brownfields) also provides an opportunity to clean up historical contamination and put vacant prime land back into good use.

Actions

Increase the redevelopment and clean-up of contaminated lands in Ontario to put land back into good use

- Revise the brownfields regulation and the record of site condition guide to reduce barriers to redevelop and revitalize historically contaminated lands, putting vacant prime land back to good use.

Make it easier and safer to reuse excess soil

- Recognize that excess soil is often a resource that can be reused. Set clear rules to allow industry to reduce construction costs, limit soil being sent to landfill and lower greenhouse gas emissions from trucking by supporting beneficial reuses of safe soils.

- Work with municipalities, conservation authorities, other law enforcement agencies and stakeholders to increase enforcement on illegal dumping of excess soil.

Economic benefits of reusing soil

Traditional excess soil management using "dig and dump" approaches is substantially more expensive than using best practices for reusing soil from construction. According to a recent industry study, projects that use excess soil management best practices for reuse experienced an average of 9% in cost savings (Ontario Society of Professional Engineers, Greater Toronto Sewer and Watermain Contractors Association, Residential and Civil Construction Alliance of Ontario). Savings are due to reduced hauling distances and diverting soils away from landfills.

Improve management of hauled sewage

- Consider approaches for the management and spreading of hauled sewage to better protect human health and the environment (including land and waterways) from the impacts of nutrients and pathogens.

Conserving Land and Greenspace

People travel from around the world to experience the natural wonders that we often take for granted in the province of Ontario. The natural spaces across Ontario, such as forests, wetlands and parks purify our air and water, protect biodiversity and natural heritage, provide recreational opportunities and support Indigenous traditional practices.

We as Ontarians have a long history of putting a strong focus on expanding Ontario's parks and protected areas. In 1999, Ontario's Living Legacy Land Use Strategy was announced. A clear and major goal of this plan was to complete Ontario's system of parks and protected areas. Our government remains dedicated to maintaining the natural beauty of our province.

As mentioned earlier in the plan, we know that climate change poses a serious threat to Ontario's natural areas and that conservation of these areas can play an important role in mitigating and adapting to climate change. We will protect and enhance our natural areas, support conservation efforts, continue to conserve species at risk, develop adaptation strategies, and promote the importance of healthy natural spaces for future generations to use and enjoy.

Quick Fact: Ontario's Living Legacy commitment was one of the greatest expansions of Ontario's provincial parks and conservation reserves in recent history. Over the immediate years that followed, the commitment resulted in the creation of 58 new provincial parks and 268 new conservation reserves, a total area of 1,996,214 hectares.

Action Areas

Improve the resilience of natural ecosystems

- Collaborate with partners to conserve and restore natural ecosystems such as wetlands, and ensure that climate change impacts are considered when developing plans for their protection.
- Strengthen and expand grassland habitats by implementing the province's Grassland Stewardship Initiative that supports on-farm conservation activities to benefit grassland birds at risk.
- Protect against wildland fire incidents through the ongoing development of Community Wildfire Protection Plans and update technical guidance to protect people and property from flooding and water-related hazards.
- Work with leaders in land and water conservation, like Ducks Unlimited Canada and the Nature Conservancy of Canada, to preserve areas of significant environmental and ecological importance.

Success story:
Innovative Wetland in Middlesex County protects Lake Erie

Ducks Unlimited Canada, the Municipality of Southwest Middlesex, Ontario NativeScape and the Ministry of Natural Resources and Forestry built three retention ponds to capture water draining from more than 200 acres of farmland. The wetland acts as a filter to reduce excess nutrients (such as phosphorus that can create harmful algal blooms in water) reaching the Thames River and eventually Lake Erie.

Forest fires increase in Ontario in 2018

Prolonged dry conditions throughout Ontario made 2018 one of the most active forest fire seasons in recent years, with more than 1,300 forest fires burning over 265,000 hectares of forest, nearly double the 10-year average. While the number and intensity of fires varies greatly from year to year and it is difficult to connect any given forest fire to the effects of climate change, most research suggests that Ontario will experience more fires and longer fire seasons in the years ahead. While forest fires pose a serious threat to public safety, communities, and infrastructure, they are also an important natural process in Ontario's forest ecosystems. Managing forest fires in Ontario is about balancing the benefits of forest fires, and protecting public safety and communities.

Support conservation and environmental planning

- Work in collaboration with municipalities and stakeholders to ensure that conservation authorities focus and deliver on their core mandate of protecting people and property from flooding and other natural hazards, and conserving natural resources.
- Look to modernize Ontario's environmental assessment process, which dates back to the 1970s, to address duplication, streamline processes, improve service standards to reduce delays, and better recognize other planning processes.
- Protect vulnerable or sensitive natural areas such as wetlands and other important habitats through good policy, strong science, stewardship and partnerships.
- Improve coordination of land use planning and environmental approval processes by updating ministry guidelines to help municipalities avoid the impacts of conflicting land uses.

The Ontario government is committed to protecting the Greenbelt for future generations. The Greenbelt consists of over two million acres of land in the Greater Golden Horseshoe including farmland, forests, wetlands and watersheds. It includes the Oak Ridges Moraine and the Niagara Escarpment, and provides resilience to extreme weather events by protecting its natural systems and features.

Promote parks and increase recreational opportunities

- Support the creation of new trails across the province.
- Provide Ontario families with more opportunities to enjoy provincial parks and increase the number of Ontarians taking advantage of parks by 10% or approximately one million more visitors while protecting the natural environment.
- Look for opportunities to expand access to parks throughout the province, but ensure Ontario Parks has the tools it needs to conduct its business and create a world-class parks experience.
- Work to ensure that all fish and wildlife licence fees, fines and royalties collected in the Special Purpose Account go towards its stated purpose of conservation, with transparency for hunters and anglers in Ontario.
- Promote the link between nature and human health by supporting the worldwide movement for Healthy Parks Healthy People through Ontario Parks' events, education, and the development of a discussion paper to engage the public.
- Review management of provincial parks and conservation reserves to ensure effectiveness by exploring internationally recognized tools and best practices.
- Share the responsibility of conserving Ontario's protected lands by continuing to partner with municipalities, conservation authorities, Indigenous communities, conservation organizations and other community groups such as trail groups.

Conservation of Ontario's rich biodiversity and natural resources is a shared responsibility - success relies on Ontario working together with First Nation and Métis communities, hunters and anglers, conservation groups and other partners to achieve positive outcomes for our environment.

Quick Fact: Ontario manages and protects 340 provincial parks and 295 conservation reserves totalling 9.8 million hectares or 9% of the province – an area larger than the entire province of New Brunswick. In 2018, Ontario celebrated the 125th anniversary of the provincial parks system and of Algonquin Provincial Park.

Sustainable Forest Management

- Work with Indigenous organizations, the forestry industry and communities involved in managing Ontario's forests under sustainable forest management plans. Ontario will support forest managers to further reduce emissions and increase carbon storage in forests and harvested wood products. Ontario's sustainable forest management provides for the long-term health of Ontario's forests by providing potential opportunities to reduce and store greenhouse gases as trees capture and store carbon dioxide.
- Promote the use of renewable forest biomass, for example, in the steel industry and as heating fuel for northern, rural and Indigenous communities.
- Improve data and information, informed by Indigenous Traditional Knowledge where offered, on greenhouse gas emissions and carbon storage from forests, the changing landscape and permafrost.
- Increase the use of Ontario timber in building, construction and renovation to reduce emissions and increase long-term carbon storage.

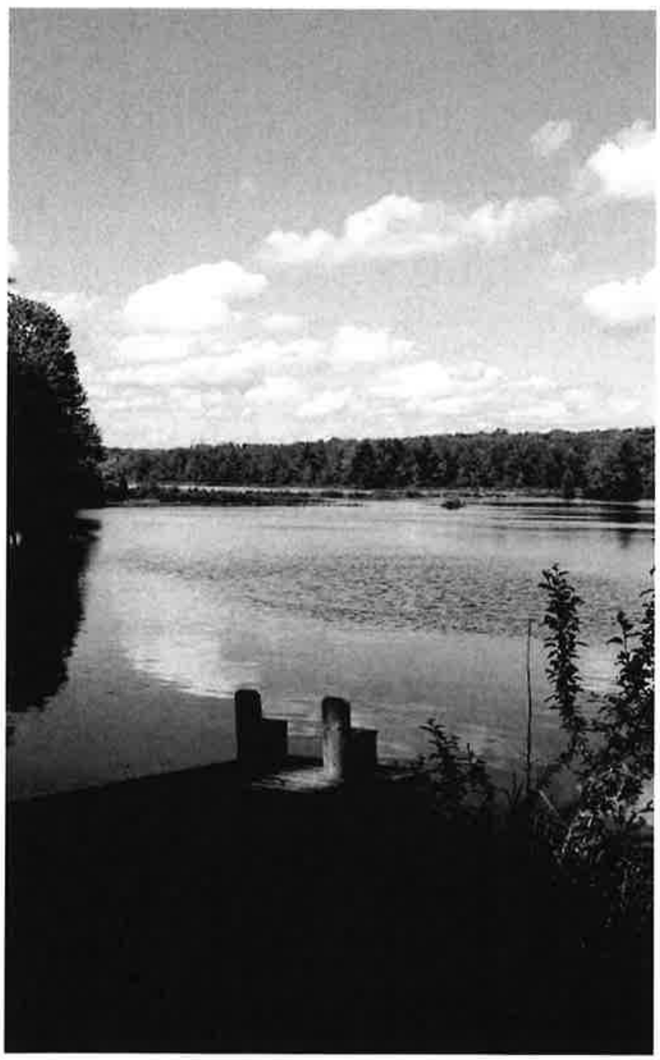
What is carbon storage? Carbon storage refers to capturing carbon dioxide – and other greenhouse gases in the atmosphere – through vegetation and soils. Practices that remove carbon dioxide from the atmosphere include sustainable forest management, conserving and restoring natural ecosystems, and enhancing soil carbon in agriculture.

Forests begin to emit greenhouse gases as the trees age and die, while younger forests that are growing vigorously sequester carbon from the atmosphere. Sustainable forestry practices can encourage forests to grow and to increase carbon stored in forests and harvested wood products.

Quick Fact: Sandbanks Provincial Park is one of the busiest parks in the province, welcoming over 750,000 visitors every summer. To meet a growing demand for camping, Ontario Parks opened a new campground in Sandbanks Provincial Park in May 2017, featuring 75 campsites.

Protect species at risk and respond to invasive species

- Reaffirm our commitment to protect species at risk and their habitats, as we mark the 10th anniversary of Ontario's Endangered Species Act. We are committed to ensuring that the legislation provides stringent protections for species at risk, while continuing to work with stakeholders to improve the effectiveness of the program.
- Protect our natural environment from invasive species by working with partners and other governments and using tools to prevent, detect and respond to invasions.



Invasive species impact fish and wildlife, and hurt Ontario's economy

Invasive species like the emerald ash borer are killing our trees, phragmites (a type of grass) are taking over wetlands, and zebra mussels are clogging water intakes for industry and cottagers. Second to habitat loss, invasive species are recognized as the second leading global cause to the loss of biodiversity. In addition, invasive species are impacting our recreational opportunities such as boating, swimming, angling, and hunting, and their economic costs are staggering. A recent study estimated impacts of invasive species in Ontario at \$3.6 billion annually with municipalities spending at least \$38 million in 2017/18.

Preventing invasive species from arriving and establishing themselves is the single most effective and least costly method to manage invasive species. Ontario is working with a number of conservation partners to coordinate prevention, control, research and management activities to help address this serious threat. Raising public awareness and engaging individuals in taking preventive action is key in preventing new species from arriving and surviving.

Next Steps

IMPLEMENTING OUR PLAN

Ontario's environment plan presents new direction for addressing the pressing challenges we face to protect our air, land and water, clean up litter and waste, build resiliency and reduce our greenhouse gas emissions.

Our plan includes proposed incentives to stimulate growth in clean technologies, enhance leadership and collaboration to build a province-wide commitment to protecting the environment, and take action on climate change.

Our plan will help people and businesses across Ontario take actions that will save money, enhance communities, create new jobs and grow the economy.

Next steps

As part of our work on this plan, we are also undertaking several important steps to finalize our environment actions for Ontario. Over the coming months, we will:

- **Continue to consult with the public and engage with Indigenous communities**
  Throughout the environment plan we have identified areas of action and key initiatives. These are areas where we are engaging with stakeholders and Indigenous communities to develop new approaches that support our common goals for environmental and climate leadership.

- **Establish an advisory panel on climate change**
  An advisory panel on climate change will be established to provide advice to the Minister on implementation and further development of actions and activities in our plan specific to climate change.

- **Begin implementing priority initiatives**
  In the plan we have identified a number of priority initiatives. Some of these initiatives are already underway and we will begin implementation of the remaining initiatives following consultation.

- **Measure and report on progress**
  We want Ontarians to see how our plan is helping them save money and improve the quality of their lives and communities. We are committed to reporting regularly on the progress we make on our plan and to developing key indicators of progress because we believe that transparency is important to the success of this plan. We are also committed to reviewing the environment plan every four years.

Our consultations and engagement with various stakeholders, Indigenous communities and the public will help refine our environment initiatives by incorporating valuable insights that ensure the actions we adopt reflect the needs of Ontarians.

Comments, ideas and suggestions on the actions and initiatives in Ontario's plan to protect the environment can be made on the Environmental Registry.

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IN THE MATTER OF A REFERENCE to the Court of Appeal pursuant to section 8 of the *Courts of Justice Act*, RSO 1990, c. C.34, by Order-in-Council 1014/2018 respecting the constitutionality of the *Greenhouse Gas Pollution Pricing Act*, Part 5 of the *Budget Implementation Act, 2018, No. 1,* SC 2018, c. 12

Court of Appeal File No.: C65807

COURT OF APPEAL FOR ONTARIO

PROCEEDINGS COMMENTED AT TORONTO

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(Affidavit of Lisa Tssessaze, affirmed December 17, 2018)

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