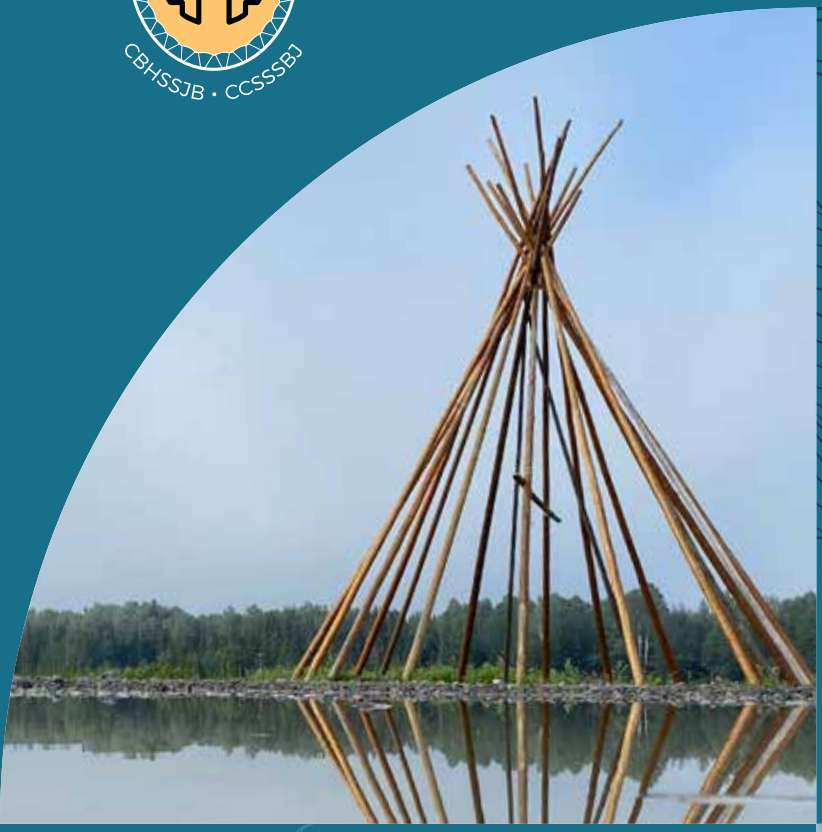

EEYOU ISTCHEE **CLIMATE CHANGE VULNERABILITY** AND **RISK ASSESSMENT** (VRAC)

Cree Board of Health and Social Services of James Bay - **Health Region 18**

Plan pour une économie verte

Québec

PRODUCTION AND DISTRIBUTION

Public Health Direction
Cree Board of Health and Social Services of James Bay (CBHSSJB)
168 Main Street
Mistissini, QC, G0W 1C0
Canada

MANAGEMENT

Alain Poirier, Public Health Director
Isabelle Duguay, Assistant Director
Justine Daoust-Lalande, Health Protection Coordinator

AUTHORS

Haylee Petawabano, Social Aide
Imi Khailat, Planning Programming and Research Officer (PPRO)
Maya Côté, PPRO
Anna Manore, Field Epidemiologist
Catherine Dickson, Public Health and Preventive Medicine Specialist

CONTRIBUTORS

Reggie Tomatuk, PPRO
Vincent Gautier-Doucet, former PPRO

EDITING

Isabelle Duguay
Natasha Courtenay, PPRO

GRAPHIC DESIGN AND PHOTOGRAPHY

Communications Department of the CBHSSJB

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"Eeyou have a responsibility to preserve and protect their heritage. An important and essential part of Eeyou heritage is the Eeyou homeland – Eeyou Istchee – that is essential and central for Eeyou "Miyupimaatisiiwin" or holistic well-being. The Eeyou use and occupation of Eeyou Istchee and their presence in their hunting territories contribute to their spiritual, physical and psychological well-being. For Eeyou, their presence in their hunting territories mean far more than the pursuit of wild game and fish. The Eeyou unique and central relationship with Eeyou Istchee – its waters, its forests, its plants, its animals, its fish, its spirit – and what Eeyou have become as a result – that's part of the nature of being Eeyou"

(Cree Trappers' Association, 2009, p. 1)

EXECUTIVE SUMMARY

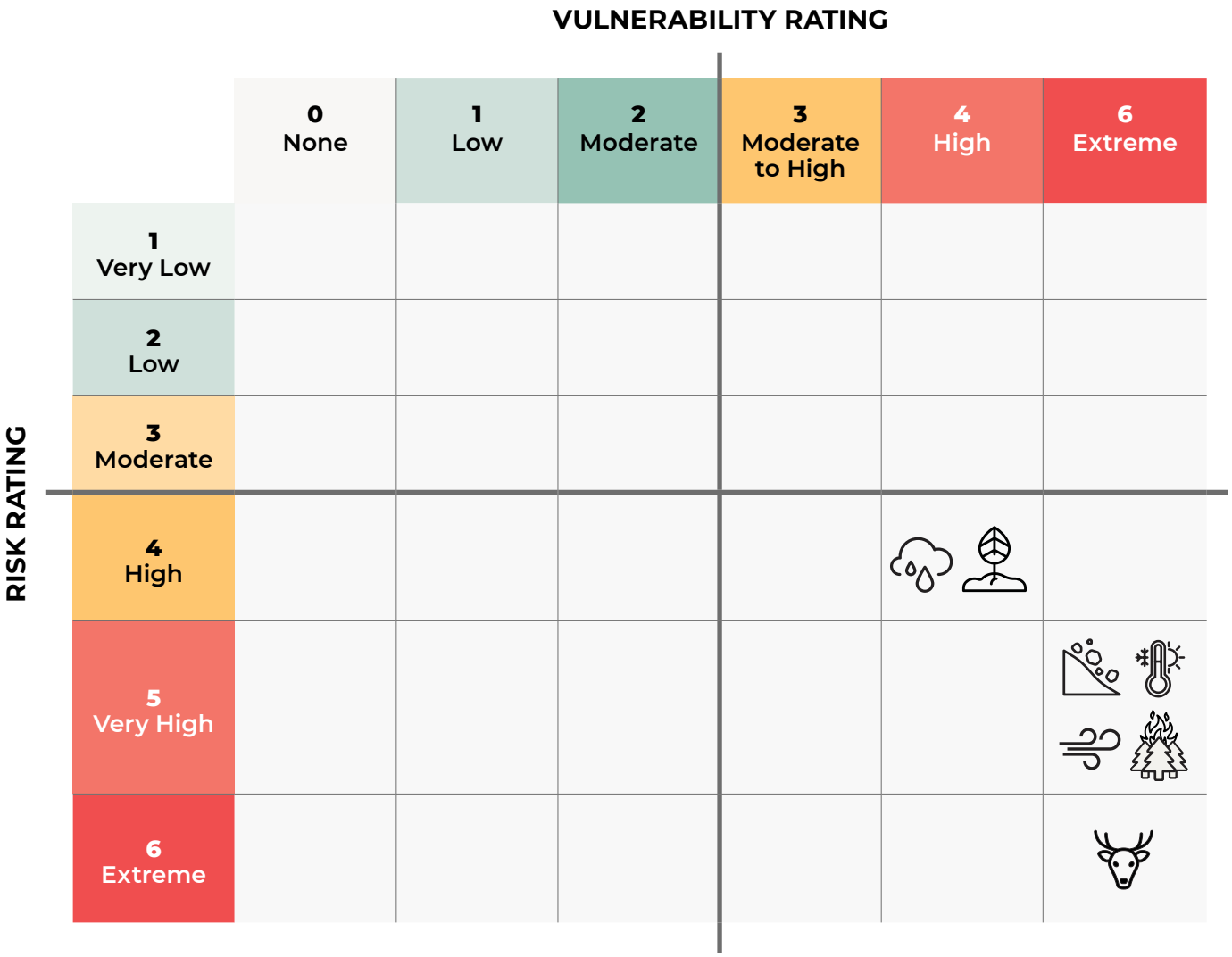
This is the first report written by the public health department of the Cree Board of Health and Social Services of James Bay (CBHSSJB) on the health impacts of climate change on the people of Eeyou Istchee. Eeyou Istchee (the Peoples' Land) is the traditional territory of the Eeyouch/Eenouch also known as the Eastern James Bay Cree. The approximately 20,000 people that compose the population of Eeyou Istchee are mostly distributed in nine communities: **Whapmagoostui, Chisasibi, Wemindji, Eastmain, Waskaganish, Nemaska, Waswanipi, Oujé-Bougoumou** and **Mistissini** over a territory of 275,000 km^2, located between the 49th and 50th parallel.

The first step of the vulnerability and risk assessment is the identification of the priority climate hazards. Climate hazards were included and characterized based on a literature review and consultations with regional and community partners. The following hazards were identified as particularly likely or severe for Eeyou Istchee: **changes in temperature, changes in precipitation, forest fires, changes in wind patterns, landslides and erosion, changes to wildlife populations and changes in vegetation**. These hazards are all closely intertwined, and changes in one can have cascading impacts to all others. Indeed, the high degree of interconnectedness, within and across ecosystems and all aspects of life in Eeyou Istchee, is a common theme throughout this report, demonstrating the importance of these relationships to the Cree way of life. Central to this report is the concept of *Miyupimaatisiiun*— "being alive well"— which frames health as inseparable from the wellbeing of land, water and animals.

A set of assessment tools were then applied to characterize the vulnerability and risk linked to each climate hazard by evaluating the magnitude of exposure, the likelihood (probability of occurrence), the severity of impacts (consequence), and the ability of the region and of communities to adapt to these hazards. The assessments of **exposure (hazard intensity and likelihood), impact severity, and response (adaptive capacity)** were assigned numerical values, and then used to calculate a vulnerability rating between 0 (None) and 5 (Extreme). Additionally, a **risk matrix** was employed to calculate the level of risk, between 0 (Very low) and 6 (Extreme) based on the likelihood and impact severity of each hazard.

TABLE 1. RISK AND VULNERABILITY COMPARISON TOOL

SYMBOL	HAZARD	SYMBOL	HAZARD
	Changes in temperature		Changes in wind patterns
	Changes in vegetation		Landslides and erosion
	Changes in precipitation		Forest fires
	Changes to wildlife populations		



Finally, a **comparison tool** was employed to summarize and visually compare hazards to each other based on their respective vulnerability and risk ratings (**Table 1**). Changes in precipitation and vegetation were rated **High** for both risk and vulnerability, while changes in temperature, changes in wind patterns, forest fires, and landslides and erosion were all assigned **Very High** risk and **Extreme** vulnerability. Changes to wildlife populations was rated Extreme for both vulnerability and risk. All seven hazards fall into the **High** to **Extreme** range, highlighting the urgent need for health-centred response while recognizing the resilience of Eeyouch/Eenouch.

This vulnerability and risk assessment highlights three interrelated areas where climate-driven hazards are already affecting—and will continue to affect—the health and wellbeing of the Eeyouch/Eenouch:

- **Food and water safety and security**: Shifts in temperature and precipitation disrupt berry-picking, hunting and fishing, forcing greater dependence on expensive, less-nutritious imported foods—contributing to rising rates of diabetes and other chronic diseases. These shifts also contribute to plant and animal species migrations, altering traditional ways of preparing and storing traditional foods and impacting traditional water sources.
- **Public health and safety**: Warmer, wetter and more variable conditions increase the risk of flooding, erosion and infrastructure damage —threatening travel routes, access to traplines, traditional activities, housing, and public facilities. More frequent extreme heat events heighten forest fire danger and contribute to poor air quality, increasing exposure and risk of respiratory and cardiovascular diseases. Forest fires are also associated with an increased risk of evacuations, loss of land, and infrastructure. Moreover, shifting ecosystems due to temperature and precipitation changes may increase the risk and prevalence of waterborne and vector-borne diseases in Eeyou Istchee.
- **Mental health and cultural continuity**: Environmental degradation and loss of safe access to traditional lands have been linked to elevated stress, *eco-anxiety* and *solastalgia*—particularly among Elders, land-users and youth—undermining Cree identity, knowledge sharing and overall community wellbeing.

The findings of this report will inform the co-development of a Regional Health Adaptation Plan (PARC) involving each community, supporting local capacity and safeguarding health in a changing climate.

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GLOSSARY

Anadromous species: fish that are born in freshwater and migrate to the ocean to grow and mature and then return to freshwater to spawn.

Biogenic carbon: carbon sequestered from the atmosphere and stored in biological materials. It can be released back into the environment through combustion or decomposition.

Biome: a distinct geographical region that includes a specific climate, fauna and flora.

Carbon flux: the amount of carbon exchanged between Earth's carbon pools - the oceans, atmosphere, land, and living things - and is typically measured in units of gigatonnes of carbon per year (GtC/yr).

Catadromous species: Fish that live in freshwater but migrate to the ocean to reproduce.

Ceremony: is a fundamental way of connecting to the Land, all of Creation, and one's responsibilities within these relationships. It is place-based, takes many forms, and serves as a means of transferring knowledge, remembering reciprocal responsibilities, and affirming belonging to family, community, the Land, and the Sacred. Rooted in Natural and Sacred Law, Ceremony is both a way of life and a guiding framework for decision-making, embodying principles of respect, balance, and renewal. Many diverse Ceremonial and governance practices exist. This definition is adapted from Alec et al. (2024).

Category I land: are for the exclusive use and benefit of JBNQA beneficiaries.

Category II land: JBNQA beneficiaries have exclusive hunting, fishing and trapping rights, the land can be accessed and used for development purposes, although the JBNQA beneficiaries share in land and resource management for hunting, fishing and trapping, tourism development, and forestry.

Category III land: are a unique type of provincial public lands. Anyone may hunt and fish on these lands, although the JBNQA beneficiaries have exclusive rights to certain species (except migratory birds and marine animals). JBNQA beneficiaries participate in land administration and development. The province, the James Bay Energy Corporation, Hydro Québec, and the James Bay Development Corporation have specific rights to develop resources on Category III lands. However, depending on the jurisdictional nature of the project, either the federal and/or the provincial government must undertake an environmental impact assessment.

Climate adaptation: activities with the intention of reducing the negative effect of climate change.

Climate change: long term changes in weather and temperature patterns due to human activity and natural phenomena.

Climatic Debt: in ecology, it is an integrative measure of the lag of reorganization of plant communities due to climate change, but also by the environmental context and biotic, anthropogenic and other abiotic determinants that may interfere with this process.

CMIP6: The Coupled Model Intercomparison Project (CMIP) is an international initiative enabling scientists to collaborate on climate modelling. CMIP6 data, representing 49 climate modelling groups running 100 climate models, is the latest global climate model information accessible. The samedata is used for the Intergovernmental Panel on Climate Change's Sixth Assessment Reports (IPCC) (ClimateData, n.d.-b).

Disturbance regimes: short-term changes to the landscape that can have significant impacts on ecosystems

Dry days: the number of days in a year without rain or snow.

Eco-anxiety: extreme worry about current and future harm to the environment caused by human activity and climate change

Eco-grief: a sense of loss and mourning that arises from experiencing or learning about environmental destruction or climate change.

Ectotherm: animal dependent on external environment to regulate its body temperature.

Eeyou/Eenou: (singular and adjective) and Eeyouch/Eenouch (plural): refers to the Cree people of Eeyou Istchee, used interchangeably with Cree and Crees. Eeyouch (Coastal Crees), Eenouch (Inland Crees).

Eeyou Istchee: Loosely translated to "the People's Land" refers to the traditional land of the James Bay Crees.

Elders: respected members of Indigenous communities, recognized not by age but by the wisdom, harmony, and balance they bring to their teachings. They are deeply committed to sharing knowledge, guiding others, and teaching respect for the natural world, encouraging people to attune to the rhythms of the elements and seasons.

Evapotranspiration: Phenomenon combining evaporation (transfer of water from the land and water bodies to the atmosphere) and transpiration (transfer of water from plants to the atmosphere).

Fire cycle: the number of years required for a given zone to burn an area equal to its entire surface area.

Fire regime: the pattern in which fires naturally occur in an ecosystem.

Frost-free season: the approximate length of the growing season, during which there are no freezing temperatures to kill or damage plants.

Greening: the process of increased plant growth and vegetation in the Arctic and Subarctic due to climate change.

Growing Degree Days: used to estimate the growth and development of plants and insects during the growing season.

Greenhouse Gas Emissions (GHG): include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), fluorinated gases (such as HFCs, PFCs, SF_6, and NF_3), and water vapor (H_2O), all of which contribute to the greenhouse effect and climate change.

Hazards: environmental effects of climate change that could impact community health and wellness.

Heavy precipitation days (10 mm): the number of days in a year during which at least 10 mm of rain or frozen precipitation falls.

Humidex: a measure used to describe how people experience hot humid weather. It combines temperature and humidity into one number.

Icing days: the number of days in a year during which the air temperature does not go above freezing (0 °C).

Isotherm: is a line on a map or chart that connects points with the same temperature at a given time or on average over a given period. Isotherms are used in meteorology and climatology to visualize temperature distributions and patterns across different geographical areas.

Keystone Species: any organism that has a significant and unique influence on its ecosystem, far beyond what would be expected from its population size. These species are essential in maintaining the structure and stability of an ecological community, as they affect many other organisms and help shape the overall environment. Removal of addition of such species can have.

Land user: anybody who engages with the land to perform traditional activities (e.g., hunting, trapping, gathering).

Mean temperature: the average temperature of the day calculated as the average of the daily temperature maximum and the day temperature minimum.

Miyupimaatisiiun: loosely translated to “being alive well”, reflects a holistic concept of health and well-being rooted in land-based practices. It encompasses the ability to hunt, trap, and engage with the land, access to nutritious traditional foods, warmth, and an active role in community life.

Nishiiyuu: traditional ways of the Eeyou and Eenou people.

Phenology: the study of phenomena as it is applied to the recording and study of the dates of recurrent natural events (such as the flowering of a plant or the first or last appearance of a migrant bird) in relation to seasonal climatic changes.

Risk: a concept that integrates both the likelihood that an event will occur and its impact if the event does occur.

Solastalgia: Refers to emotional distress caused by environmental changes that directly impact people who are personally associated to their home environment.

SSP2-4.5 (shared socio-economic pathways 2 - Middle of the road): the projection model paradigms to reflect the climate effects over time with a moderate decrease in emissions until the end of the century (2100).

SSP3-7 (shared socio-economic pathways 3 - A rocky road): the projection model paradigms to reflect the climate effects over time with no changes in emissions until the end of the century (2100).

SSP5-8.5 (shared socio-economic pathways 5 - Taking the highway): a scenario that assumes that economic growth will continue to rely on fossil-fuels and would lead to a very high increase in emissions until the end of the century (2100).

Survivance: While resilience has been used to describe a response to trauma, the terms survivance, introduced by Anishinaabe scholar Gerald Vizenor in 1994, combines survival and resistance and refers to the historical trauma of colonialism endured by Indigenous Peoples, as well as ongoing racist socio-political structures. It is a term aiming to display active resistance through generations (Sun et al., 2022; Vizenor, 2009).

Tallyman: a Cree person recognized by a Cree community as being responsible for supervising harvesting activities on a Cree trapline.

Thermophilous: refers to species that thrive in warm or high-temperature environments.

Traditional Ecological Knowledge (TEK): the accumulated knowledge, philosophies, and practices of Indigenous and local communities, rooted in intergenerational transmission, sustainable interactions, and stewardship of the natural environment.

Two-Eyed seeing: also known as Etuaptmumk is an Indigenous framework introduced by Mi'kmaq Elders Albert and Murdena Marshall which allows for centering Indigenous approaches while bringing together diverse worldviews.

Very hot days: number of days in a year when the maximum temperature reaches 30°C or higher.

Vulnerability: the susceptibility of a person or population to potential harm from an exposure.

Wet days: the number of days in a year with rain or snow.

01

ABOUT
THIS REPORT

ABOUT THIS REPORT

The present document provides an assessment of vulnerabilities and risks related to climate change, with a focus on the health, culture, and well-being of the Cree population. It represents the first step toward identifying and prioritizing adaptation measures, which will be developed in a second phase through a collaborative and participatory process leading to the creation of a Regional Climate Change Adaptation Plan tailored to Eeyou Istchee. This report acknowledges that climate change is one of the most urgent challenges that the world is facing today. *Greenhouse gas emissions* (GHG) have been steadily increasing despite the immediate emission reduction calls made by the Intergovernmental Panel on Climate Change (IPCC), the annual global temperatures are projected to rise by 2.8°C by 2100 (Assembly of First Nations, 2023; IPCC, 2021). Globally, Indigenous populations experience distinct exposures and vulnerabilities to climate change due to their traditional livelihoods and cultural practices being deeply connected to the land, water, and all the living and non-living beings that inhabit them. Many Indigenous communities also reside in areas experiencing rapid environmental and socioeconomic shifts. These factors contribute to unique risk profiles that vary between Indigenous and non-Indigenous populations, as well as among different Indigenous groups (Ford, 2012).

The magnitude and consequences of temperature increases are expected to be greater in Northern Canada compared to the rest of the world (Assembly of First Nations, 2023; IPCC, 2021). According to the Assembly of First Nations' Climate Strategy report (2023), the consequences of such an increase will be most felt by Northern Indigenous peoples and ecosystems. First Nations Elders and Knowledge Keepers have been ringing the alarm for decades and have shared their observed changes in species migrations, weather patterns, and impacts to land and waters (Assembly of First Nations, 2023). Indigenous Knowledges and perspectives are central to this report, especially those of the *Eeyouch/Eenouch* whose lives, health and traditions are likely to be severely impacted by current and projected changes in climate.

1.1 AUTHORS' POSITIONALITY STATEMENT

Anna Manore (she/her) is a white settler whose ancestors came to Turtle Island from Europe. She has lived her life on unceded Indigenous territories, and thankfully acknowledges the original stewards of these lands. She currently resides in Tiohtià:ke/Montréal, unceded territory where the Kanien'ke-há:ka Nation is recognized as stewards of the lands and waters, and historically known as a gathering place for many First Nations. Anna joined the CBHSSJB in 2024, where she is placed as part of the Public Health Agency of Canada's Canadian Field Epidemiology Program. Anna is committed to employing her training in epidemiology to support the health and wellbeing of Eeyouch/Eenouch according to Cree values and priorities.

Dr. Catherine Dickson (she/her) is a white settler who grew up in Tiohtià:ke/Montreal. She is a medical doctor with a specialization in Public Health and Preventive Medicine and graduate degrees in Epidemiology and Human Kinetics. Catherine has had the priviledge to work as a medical advisor environmental health and occupational health at the Cree Board of Health and Social Services of James Bay for the past 4 years. She previously worked with the Public Health Agency of Canada, where she completed the Canadian Field Epidemiology Program at the Saskatchewan Public Health Observatory. Catherine is passionate about empowering the communities that she works with with knowledge and skill-development.

Haylee Petawabano (she/her) is a Cree from Chisasibi, QC, currently pursuing a Bachelor's degree in Environmental Studies with a minor in Indigenous Studies at Carleton University, located on the unceded territory of the Anishinabe Algonquin peoples. She has worked for the CBHSSJB since 2019 in various roles and is currently employed as a Social Aide with the Environmental Health team. As an Eeyou who grew up in Eeyou Istchee, she has strong ties to the land, culture, and language, and seeks to integrate Cree values into this report by strengthening Eeyou/Eenou voices and knowledge, and supporting efforts to decolonize research practices at the Cree Health Board.

Imi Khailat (she/her) is a migrant of Shilha origin and a member of the Amazigh diaspora (Indigenous North African). She holds ancestral ties to the Souss Valley, Anti-Atlas mountains, and Sahara

desert. Until recent decades, her family lived in close relationship with the land and waters of Tamazgha (North Africa), following a nomadic lifestyle rooted in traditional values.

She has lived on the traditional territory of the Kanien'kehà:ka Nation for over a decade and holds a Master of Public Health from the University of Victoria, specializing in Indigenous Peoples' health. Over the past two years, she has worked with the CBHSSJB, alongside many Eeyouch/Eenouch who have shared with her teachings on Indigenous sovereignty, pride, and resilience.

With a background in urban planning, geography, and public health, she is committed to advancing Indigenous self-determination and approaches to health that reflect the deep interconnection between people, animals, and the environment. While her Indigeneity falls outside the borders of Turtle Island, she considers herself an ally committed to Indigenous sovereignty and self-determination worldwide.

Maya Côté (she/her) is a settler living in Tiohtià:ke/Montreal. She holds a Master of Science degree in Public Health and a Bachelor's degree in Environmental Sciences from McGill University, which is located on land that has long served as a site of meeting and exchange amongst Indigenous peoples, including the Haudenosaunee and Anishinabeg Nations. Sensitive to socio-environmental and racial/ethnic inequities, she acknowledges her place of privilege in this world and is committed to using her voice and profes-sional work to support Indigenous sovereignty and climate mitigation in the face of climate change. Maya has integrated the CBHSSJB last year and has since been learning from Indigenous colleagues about relationships to the land, resilience and survivance, and the importance of advocacy.

02

AIMS AND **OBJECTIVES**

AIMS AND OBJECTIVES

As part of the provincial VRAC project (*Évaluation des vulnérabilités régionales aux changements climatiques*), the present report provides an assessment of vulnerabilities and risks related to climate change, with a focus on the health, culture, and well-being of the Cree population. It represents the first step toward identifying and prioritizing adaptation measures, which will be developed in a future phase through a collaborative and participatory process leading to the creation of a Regional Climate Change Adaptation Plan (PARC - *plans d'adaptation régionaux au climat*) tailored to Eeyou Istchee. The VRAC-PARC project intends to inform adaptation efforts intended to reduce the health impacts (and social health inequalities) of climate change in Eeyou Istchee.

Although mandated and funded by the Government of Québec, this report aims to recognize and centre Indigenous, and more precisely, Cree perspectives and experiences concerning climate change. Ultimately, the hope is for this report to inform future policy and research while also providing relevant information to Eeyouch/Eenouch to counter the impacts of climate change.

The present report (VRAC) supports several aims of the broader VRAC-PARC project, namely:

- Develop, integrate and apply the knowledge and skills of the health network in climate adaptation by assessing the regional vulnerability of the population and climate-related risks and determining the consequent adaptation measures;
- Set the foundation for the development of an Indigenous-led, health-centred climate change adaptation plan and set guidelines for its implementation in collaboration with regional key partners;
- Promote collaboration within the health network and with regional key partners to benefit from each other's expertise, avoid duplication of efforts and complement existing climate change initiatives;
- Raise awareness among regional partners of the effects of climate change on health and the role of the health system in this area.

Within the context of Eeyou Istchee, the objectives of the VRAC report have been further adapted to improve and document CBHSSJB understanding of:

- Climate-related hazards affecting the Cree territory;
- Impacts of climate-related hazards on the land, environment, and people;
- Interactions between climate-related hazards and social determinants of health such as culture, housing, income, and healthcare access;
- Populations that are most vulnerable to health impacts of climate change, such as Elders, children, and those with specific health conditions;
- Adaptation measures that should be implemented to strengthen the protection, resilience, and overall well-being of Cree communities.

Within the population of interest were identified as being either particularly vulnerable to the health effects of climate change or as having increased exposure to hazards related to climate change:

- People living with chronic disease
- Outdoor workers
- Land-users
- Elders
- Pregnant women
- Youth

This list is not intended to be exhaustive, and the team recognizes that some individuals may be part of multiple subpopulations. Understanding the health impacts of climate change on these subpopulations in Eeyou Istchee is crucial for mitigating and adapting to these climate hazards.

The following logic model (**Figure 1 -** *see on page 26*) illustrates the expected outcomes related to the aims and objectives of this report.

FIGURE 1. VRAC-PARC LOGIC MODEL

INPUTS	› Historical and projected Climate date from Ouranos and ECCC › Regional public health and democraphic data › Cree Ecological Knowledge (CEK) › Indigenous Health determinants › Federal and provincial funding › Suport from MSSS and INSPQ				
ACTIVITIES	Identification of relevant climate hazards	Assessment of impacts and exposure to climate hazards incorporating information from a broad range of sources (e.g., literature, reviews, data described above, CEK)	Identification of climate vulnerabilities and risks: considering both direct climate impacts and how they interact with social determinants like culture, housing, income, and healthcare access	Community consultations (climate Change Advisory Committee, Cree Regional Climate Forum)	
OUPUTS	VRAC report	PARC report (public health adaptation plan)	Creation of relevant and up-to-date climate knowledge translation material (e.g., infographics, videos) for Eeyou Istcee	Recommendations for a broader regional health adaptation strategy	Collaboration and engagement with local and regional partners
SHORT-TERM OUTCOMES	› Increase awareness of regional vulnerabilities and of climate impacts on health within Eeyou Istchee and at provincial and federal levels › Strengthening of inter-regional partnerships in climate research and planning › Knowledge exchange and expertise building amongregional public health, other regional entities and Cree communities				
INTERMEDIATE OUTCOMES	› Alignment of regional and local climate adaptation planning › Increase cooperation between regional actors and Cree communities › Increase local and regional capacity for climate resilience				
LONG-TERM OUTCOMES	› Creation of a culturally-informed, indigenous-led regional health adaptation strategy › Inclusion of climate chnage consideration into long-terme public health planning				
IMPACT	› Increase climate resilience and improved health outcomes for Eeyouch/Eenouch				

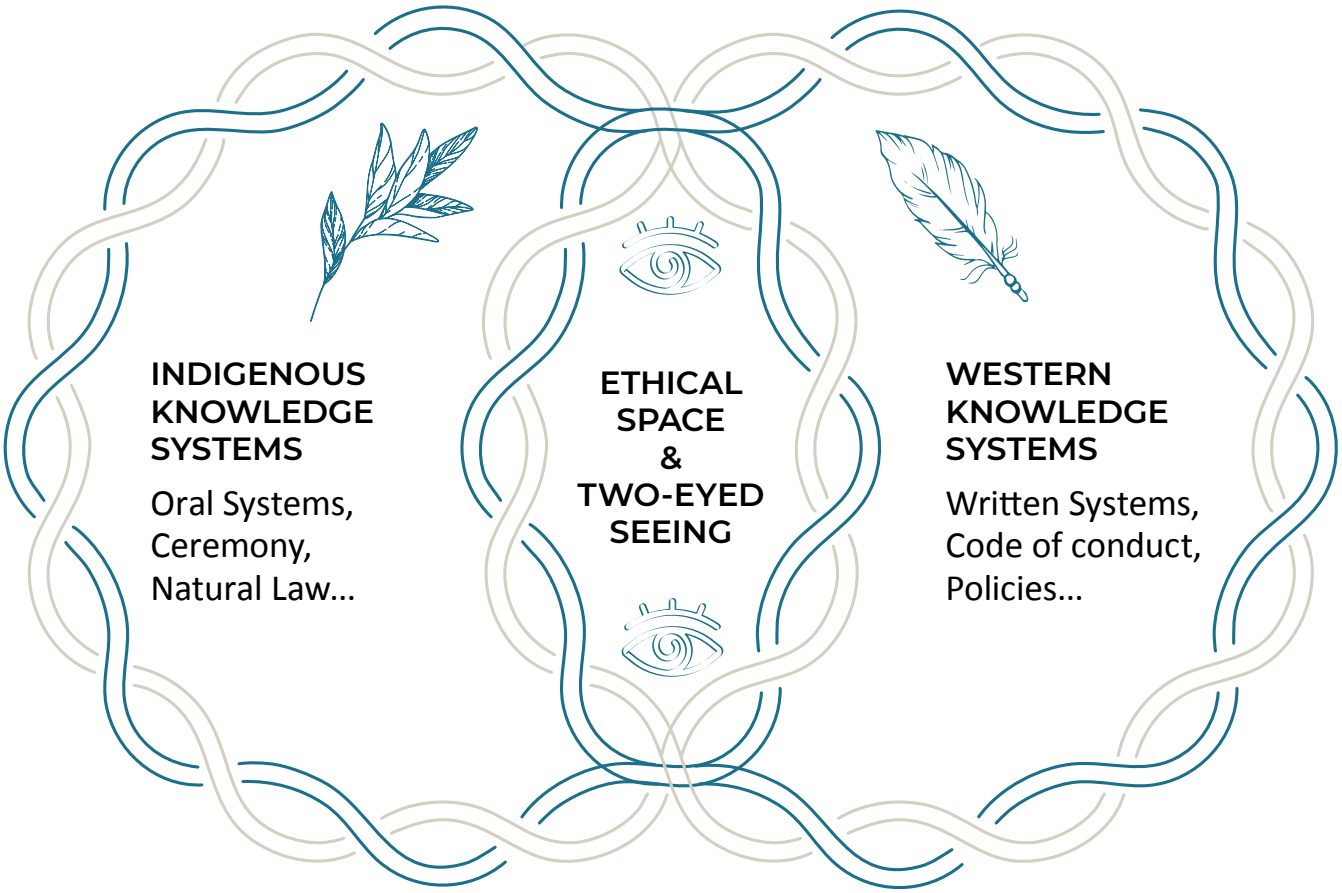
2.1 APPROACH

The purpose of assessing vulnerability and risks is not to categorize populations as inherently vulnerable to climate change health impacts. Rather, the goal is to explore how exposure (hazard intensity and likelihood), impact severity, and response to these impacts can intersect with existing social determinants of health. In addition to documenting vulnerability and risks, this report intends to showcase the strength and resilience of Eeyouch/Eenouch in the face of climate change.

In respecting Cree oral tradition and the wealth of knowledge that exists within Eeyou Istchee in story and conversation, this report cites both published and peer-reviewed literature as well as case studies, stories, and conversations that took place during regional and community-based climate consultations. As representatives of a Cree-led government body, it is our responsibility to situate our work within an Indigenous research paradigm that empowers Indigenous ways of knowing and being and does not discredit sources of knowledge that fall outside the standards set by Western academia (Kovach, 2021; Wilson, 2008). Our approach is grounded in the principles of Ethical Space and Two-Eyed Seeing (Etuaptmumk), which recognize that multiple knowledge systems —each with their own histories, practices, and limitations—can coexist in respectful dialogue (Bartlett et al., 2012; Ermine, 2007). In this report, Indigenous and Western knowledge are complementary lenses through which to understand climate change and its impacts on health. By creating space for Cree land-based knowledge, language, and traditions alongside Western tools and data, we want to encourage an approach rooted in mutual respect, relational accountability, and a shared commitment to understanding and caring for the changing environment.

Figure 2 *(see on page 28)* is a visual representation of the conceptual framework that underscores this report.

FIGURE 2. MULTIPLE KNOWLEDGE SYSTEMS UNDERPINNING THE PARADIGM THAT GUIDED THE REGION 18 VRAC REPORT.



In recent years, several reports by other organizations have addressed various aspects of climate change impacts in Eeyou Istchee. The present report focuses on the potential health effects on Eeyouch/Eenouch, for whom relationship to the land and natural environment are extremely important for cultural identity, physical, spiritual and mental health and well-being. This project is an opportunity to build on previous reports and inform short and long-term climate change adaptation, mitigation, and surveillance work in our region currently led by the Cree Nation Government (CNG) and other Cree entities.

03

SCOPE

SCOPE

This report will refer to the territory as Eeyou Istchee—the name given by its original inhabitants and custodians. The designation of region 18, *Terres-Cries-de-la-Baie-James*, was assigned to Eeyou Istchee by the Government of Quebec following the signing of the James Bay and Northern Quebec Agreement (JBNQA).

Eeyou Istchee (loosely translated to the Peoples' Land) is the traditional territory of the Eeyouch/ Eenouch, also known as the Eastern James Bay Cree. The approximately 20,000 people that compose the population of Eeyou Istchee are mostly distributed in nine communities: Mistissini, Eastmain, Nemaska, Chisasibi, Wemindji, Waswanipi, Whapmagoostui, Waskaganish and Oujé-Bougoumou, over a territory of 275,000 km^2, located between the 49th and 56th parallel.

The Crees are represented regionally by the Grand Council of the Crees and the associated CNG. Eeyou Istchee is also divided into over 300 traplines (*indoho istchee*) (**Figure 3**). Each trapline is overseen by a Cree tallyman, whose primary role is to maintain and protect the health and abundance of wildlife and other species harvested on the land, while also ensuring the safety of *land-users* (BC2 Inter-Nation Collaboration, 2021a). The terms *tallyman* and trapline evolved from the creation of the beaver reserves in the 1930s and were further solidified after the signing of the JBNQA as a form of land management. Prior to contact, there were no traplines or tallymen, land was entrusted to experienced hunters (*Kiniwaapimaakin*) (BC2 Inter-Nation Collaboration, 2021b; Pachano, 2011).

The CBHSSJB provides health and social services to all residents of the nine communities. However, the CNG recognizes eleven Cree communities, including Washaw Sibi, located north of Amos, Québec, and MoCreebec, whose membership comprises Eeyouch residing in Moose Factory and Moosonee, Ontario. Both Washaw Sibi and MoCreebec continue to seek formal recognition as part of Eeyou Istchee from provincial and federal governments (Cree Nation Government, n.d.-b), but are not currently included in the JBNQA. Therefore, they fall outside of CBHSSJB jurisdiction (CBHSSJB, 2022), and specific information on Washaw Sibi and MoCreebec has not been included in this report.

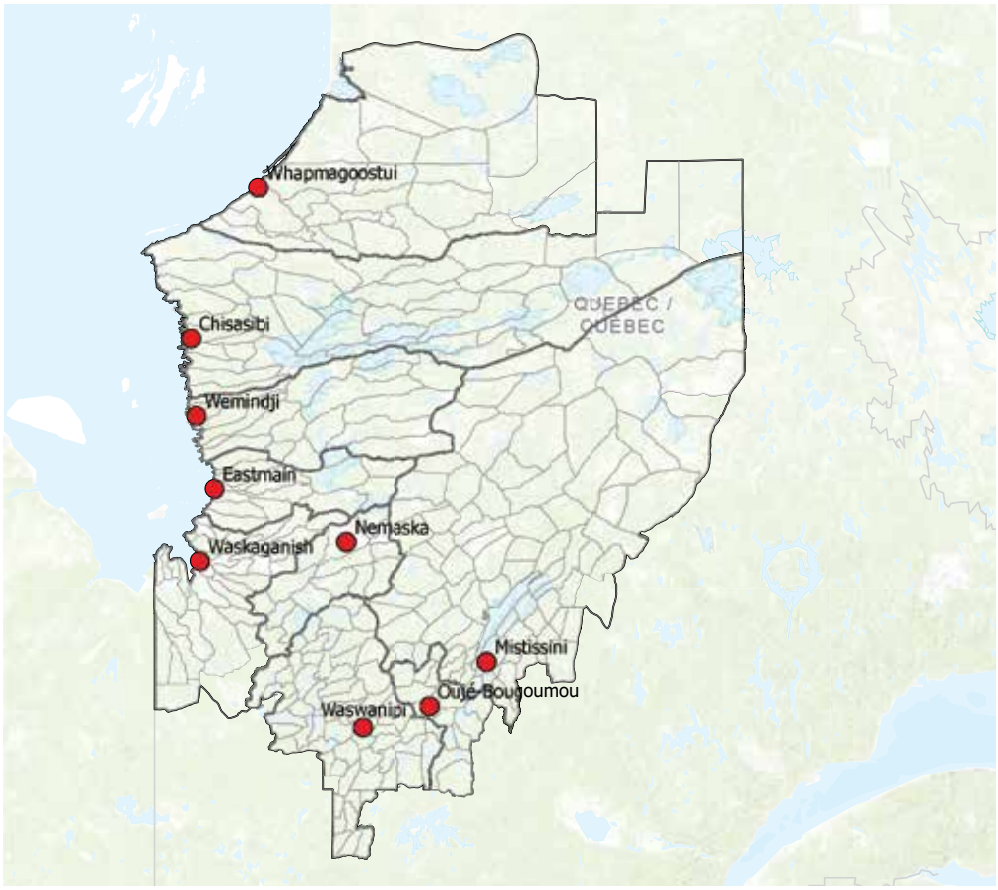
As noted in **Figure 3**, Eeyou Istchee geographically overlaps with most of health region 10 (Nord-du-Québec). While there are many similarities between the two regions, their demographic composition and socio-cultural context differ significantly (Institut de la statistique du Québec, 2024). As such, both differences and commonalities can be noted between this report and that produced by the *Nord-du-Québec* region.

Considerable social and environmental variability exists within Eeyou Istchee and must be taken into account in the context of this vulnerability assessment.

First, from north to south, a vegetation gradient can be observed from shrub tundra to boreal forest-taiga. A similar vegetation gradient can be observed from west to east, but on a smaller scale on the territories of Wemindji and Chisasibi.

A second gradient can be observed from west to east based on socio-environmental differences between coastal communities – *winipawkiiyiyuuch* (Waskaganish, Eastmain, Wemindji, Chisasibi and Whapmagoostui) – and inland communities – *nuchimiiyiyuuch* (Nemaska, Waswanipi, Oujé-Bougoumou and Mistissini). While traditional activities linked to marine environments are unique to coastal communities, the distribution and harvesting of other wildlife and fish species can vary significantly across Eeyou Istchee. These differences are important to consider when assessing the impacts of climate change.

FIGURE 3. MAP OF EEYOU ISTCHEE, ITS NINE COMMUNITIES AND TRAPLINES



Note: Image extracted by CNG Climate Unit (2025).

04

METHODS

METHODS

This work has consisted of a review and summary of existing literature, of historical weather data and existing climate projections as well as consultations with regional and community partners. This review was then used to inform a vulnerability and risk assessment. The list of climate hazards identified through the literature review by the Environmental Health team was then validated and complemented through consultations with regional and community partners. Both internal and external consultations on climate hazards took place, within the Eeyou Istchee public health team and with CNG's Climate Change Advisory Committee (CCAC) respectively.

A set of vulnerability and risk assessment tools described below were used to further the analysis of the exposure and impacts on health of each climate hazard. **Figure 4** *(see on page 34)* provides an overview of the methodological steps of this report.

FIGURE 4. OVERVIEW OF THE METHODOLOGY

Identify Climate Hazards

Consulation within CBHSSJB and regional partners

Historical & Projected Climate Data

Ouranos projections
Consultation with community members
Literature review

Exposure Analysis (Hazard Intensity & Likehood)

Environmental Health team rating

Heath-Related Impacts

Consultation with community members
Literature review

Impact Severity Assessment

Environmental Health team rating

Response (Adaptative Capacity) Assessment

Climate Change Advisory Committee
Consultations with Fire Chiefs and Public Safety Officers Cree Regional Climate Forum Consultion

Confidence Scale

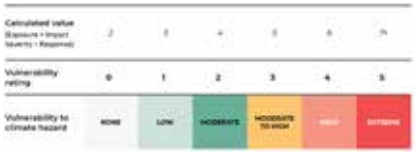
Confidence in exposure, impact severity, and response rating

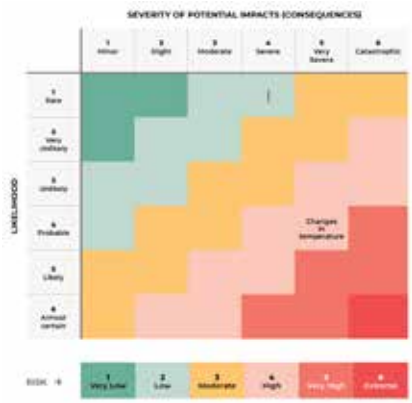
Vunerability Assessement

(Exposure Rating) +
(Impact Severity Rating) -
(Response Rating)

Risk Assessement

Risk & Vunerability Comparison Tool





4.1 HAZARD IDENTIFICATION AND ANALYSIS

Climate hazards were identified and characterized by reviewing the existing literature and by consulting with local and regional partners.

Literature review

Four different types of documents from grey and scientific literature were used to identify and characterize the climate hazards described in the vulnerability and risk assessment:

- **Climate change adaptation plans** from communities and regional organizations in Eeyou Istchee;
- **Reports** from public consultation activities, workshops and individual interviews with community members;
- **Ethnographies** focusing on the impacts of the effects of climate change on Cree land-users and their families;
- **Scientific literature** on climate change in Eeyou Istchee and the Canadian North.

Although these reports did not focus specifically on the health aspects of climate change, many potential impacts to human health informed this vulnerability and risk assessment.

Consultations

- Extensive consultations with Cree land-users and community members on the impact of the effects of climate change were conducted starting in 2010 by Cree regional organizations, individual Cree communities and research scientists.
- Additional consultations were carried out by the Environmental Health team to characterize the hazards listed in this report (**see Section 4.2 – Consultations**).

Because the Cree families of Eeyou Istchee rely on territorial resources harvested and stewarded since time immemorial, many of the climate hazards and potential impacts shared by participants during consultations originate from a significant knowledge of the territory and a profound understanding of ecosystems, wildlife behavior and climate patterns, rooted in Cree Traditional Ecological Knowledge (TEK).

The hazards identified as a priority were reviewed by the CCAC and the Environmental Health Team. The hazards were then described using available historical climate data, climate projection models and scientific literature to further the assessment of vulnerabilities and potential impacts. When available, socioeconomic, biocultural and geographical particularities within Eeyou Istchee were integrated to take into consideration the diversity in natural and social environments across the vast territory of Eeyou Istchee.

Five initial climate hazards were identified and included in the vulnerability and risk assessment due to their significance described in previous reports on climate change in the region. The importance of these hazards was confirmed in discussions during CCAC meetings:

- Changes in temperature
- Changes in precipitation
- Forest fires
- Changes in natural systems:
  - Changes in wildlife
  - Changes in vegetation

Following consultation with local and regional experts within the CCAC, two additional hazards were added to address community-based concerns:

- Weather-related events:
  - Landslides and erosion
  - Changes in wind patterns

While seven climate hazards in total were included in this assessment, changes in temperature and precipitation remain the primary drivers as they create the conditions favourable for all the other hazards to occur. These seven were selected not only for their likelihood and potential consequences, but because they pose a direct threat to the Cree way of life and the health and well-being of Eeyouch/Eenouch. It is important to note that some hazards were excluded from the broader analysis. Permafrost thaw, while relevant to certain parts of Eeyou Istchee, was not included as a standalone hazard in the assessment. Instead, it is addressed in **Section 7.1 – Changes in Temperature** due to its close linkage with rising temperatures. Extreme cold temperatures were also not retained for analysis. The population of Eeyou Istchee is generally accustomed to extreme cold, with warnings only issued at -48°C or lower for at least two hours, compared to -38 °C elsewhere in the province (Gouvernement du Québec, 2022). Moreover, both historical and projected trends show a decline in the frequency and severity of extreme cold events. Due to a lack of data specific to Eeyou Istchee, pollen allergies were also excluded from the report and only briefly discussed in **Section 7.7 – Changes in Vegetation**.

4.2 CONSULTATIONS

The CBHSSJB Environmental Health team led this vulnerability and risk assessment. Their expertise, knowledge, and experience were essential in contextualizing and evaluating the climate hazards that emerged from the consultations. The team includes:

- A public health and preventative medicine specialist
- Two climate change and environment Planning, Programming and Research Officers (PPRO)
- An environmental health social aide
- An environmental contaminant and toxicology PPRO
- An environmental and community health specialist PPRO
- A field epidemiologist placed with the CBHSSJB Regional Public Health Department

The consultation process for the VRAC involved a range of partners, including representatives from local and regional organizations, subject matter experts, and community members with lived experience of climate impacts.

Next is a list of consultations that informed this report.

4.2.1 Cree Nation Government's Climate Change Adaptation Committee (CCAC)

The findings of the vulnerability and risk assessment were presented to the CNG's CCAC for validation and additional input in early 2023. During a consultation held in January of 2024, CCAC members were asked to identify existing adaptation activities and propose additional ones that could be adopted in the region to reduce the impact of each hazard.

4.2.2 Presentation at 2024 Regional Fire Chiefs and Public Safety Officers Meeting

A consultation on response to climate change hazards was conducted in March 2024 at a regional meeting for community fire chiefs and public safety officers. Each hazard was presented with preliminary information and projections gathered for the VRAC. Attendees were asked to identify adaptation activities currently in place and to propose additional adaptation activities that could be adopted to reduce the impact of climate change in the region.

4.2.3
Cree Regional Climate Forum (CRCF)

On April 9-11th 2024, the Cree Regional Climate Forum (CRCF), hosted by the CNG, was held in Oujé-Bougoumou. Over 100 participants attended, representing each Cree community, including Elders, youth and community leaders. Representatives from federal and provincial government departments were also in attendance.

During the forum, the team held two consultations that were used to inform the VRAC. In the first, attendees were broken into small groups. Each small group was assigned one hazard, presented with preliminary information and projections for that hazard, and asked to identify regional adaptation activities currently in place. The second consultation, held the following day, used the results from the previous day to begin drafting community adaptation plans.

In addition, the team conducted short-form interviews (Vox Pop) with 13 participants recruited from attendees of the CRCF. The goal of the Vox Pop was to capture opinions relating to climate change perceptions and adaptation strategies from Elders, land-users, tallymen and youth from across Eeyou Istchee.

4.2.4
Public Health Consultation

Internal conversations on regional climate change vulnerabilities were also held among the CBHSSJB public health department Environmental Health team.

4.2.5
Joint Northern Quebec Consultations

The team also participated in the Regional Climate Change Working Group lead by the VRAC-PARC team organized by region 10 (Nord-du-Québec) through the *Conférence administrative régionale* (CAR) Nord-du-Québec.

4.3 TERRITORIES

Given the significant social and environmental diversity across Eeyou Istchee, the analysis was designed to reflect the varied impacts of climate change by examining data at three distinct geographic scales:

- A regional scale (region 18/Eeyou Istchee);
- A quadrant scale derived from Ouranos' latest climate platform dividing Eeyou Istchee into four climate quadrants or tiles (**Figure 5**):
  - North-West of James Bay: Eastmain, Wemindji, Chisasibi, Whapmagoostui;
  - North-East of James Bay: (no communities, but traplines associated with multiple communities);
  - South-West of James Bay: Waskaganish, Nemaska, Waswanipi, Oujé-Bougoumou;
  - South-East of James Bay: Mistissini.
- A community scale, including 6 by 10 km^2 around each of the nine Cree communities.

The community of Whapmagoostui is situated in the southern portion of a fifth tile - South-West of Nunavik - which was not included in this climate data projection because it was considered that Whapmagoostui's climate situation was closer to the North-West of James Bay tile rather than the average values of the South-West of Nunavik tile.

While community-based data has informed this report, the focus remains regional in scope, in recognition of each community's autonomy and the importance of respecting local governance and self-determination.

FIGURE 5. MAP OF THE FOUR QUADRANTS AS SHOWN IN OURANOS (2024)

Note: Image adapted from Ouranos (2024)

4.4 CLIMATE SCENARIOS AND TEMPORAL HORIZON

Using climate projections from the latest version of the Coupled Model Intercomparison Project (CMIP6), which collates 14 international climate models, the Environmental Health team projected relevant climate data for each of the climate hazards.

Two platforms were used to collect climate projections for both the region as a whole and larger subregions, and for each of the nine Cree communities. Despite some overlap in climate indicators, both platforms were selected to inform this vulnerability and risk assessment because each has useful indicators and displays data over relevant territorial scales for this project.

The CMIP6 presents a range of climate scenarios based on different projected trajectories of global GHG emissions which we refer to as ''scenarios''. Each platform displays climate projections using different emission scenarios from the CMIP6:

- The Ouranos platform Portraits climatiques was used to obtain climate projections for Eeyou Istchee or larger subregions within Eeyou Istchee. Depending on the climate indicator, available climate projections are based on emission scenarios SSP2-4.5 and SSP3-7.0. On this platform, projections from the CMIP6 for Eeyou Istchee are available in 4 adjacent tiles.
- The Climate Data Canada platform Climate Data for a Resilient Canada was used to obtain information for individual communities and, depending on climate indicator, for Eeyou Istchee as a whole. Available climate projections are based on emission scenarios SSP2-4.5 and SSP5-8.5. Only SSP2-4.5 and SSP5-8.5 were used for the vulnerability and risk assessment due to the unavailability of SSP3-7.0 at the time of writing this report.

The Cadre d'évaluation de la vulnérabilité régionale en matière de santé publique, recommends using two climate scenarios to contextualize the climate hazards identified as significant for public health. However, as climate scenarios available on the Ouranos and Climate Data Canada were different, the team chose, whenever possible, to present the combination of climate scenarios SSP2-4.5 and SSP3-7.0 when discussing Eeyou Istchee, and climate scenarios SSP2-4.5 and SSP5-8.5 when presenting community-specific data (and occasionally regional data). **Table 2** *(see on page 41)* is an example of how the information was presented in each section.

TABLE 2. EXAMPLE OF THE PRESENTATION OF CLIMATE PROJECTIONS

CLIMATE INDICATORS	TIMING	LOCATION	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5-8.5
Climate indicator	Annual or seasonal	**Eeyou Istchee**				
		Whapmagoostui				
		Chisasibi				
		Wemindji				
		Eastmain				
		Waskaganish				
		Nemaska				
		Waswanipi				
		Oujé-Bougoumou				
		Mistissini				

These three climate scenarios assume different trajectories in GHG emissions:

- **SSP2-4.5:** Assumes a moderate reduction of emissions by the end of the century;
- **SSP3-7.0:** A scenario where no significant climate policies are implemented, leading to a significant increase of emissions by the end of the century;
- **SSP5-8.5:** A scenario that assumes economic growth will continue to rely on fossil-fuels, leading to a very high increase in emissions by the end of the century.

The current emissions patterns worldwide correspond to the SSP3-7.0 scenario.

Where possible, a 50-year projected time horizon was used. When data for a 50-year time horizon was not available, the closest available time frames were used. Climate projections obtained from the CMIP6 data are presented as averages for the 2041 to 2070 period.

4.5 VULNERABILITY ASSESSMENT

One of the main objectives of the VRAC is to identify and evaluate the climate vulnerability for Eeyou Istchee. In the context of climate change, vulnerability is defined as:

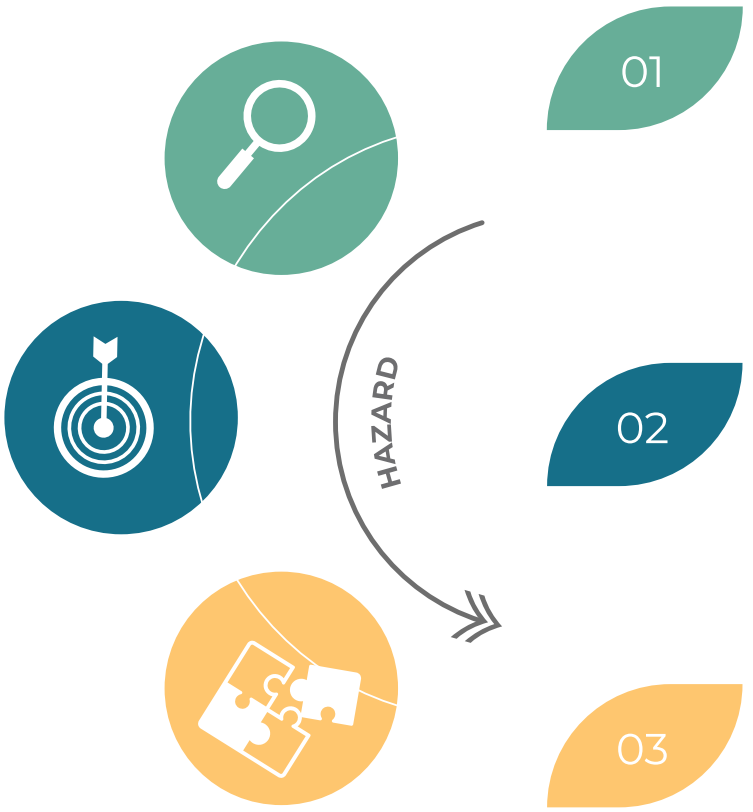
"The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change. It is a function of the character, magnitude and rate of change to which a system is exposed and the sensitivity and adaptive capacity of that system. [...]"

(IPCC, 2007, p. 6).

The vulnerability assessment is comprised of three primary elements: an exposure analysis, an impact severity assessment and a response (adaptation capacity) assessment (**Figure 6 -** *see on page 43*).

Understanding vulnerability aids in interpreting health outcomes influenced by climate change and pinpointing where resources and adaptation efforts are most crucial. Nevertheless, it is important to recognize that labeling individuals or groups as "vulnerable" can be stigmatizing, often perpetuating a victimization narrative (Schnitter & Berry, 2022). The purpose osf this vulnerability assessment is not to categorize populations as vulnerable but to explore how health equity intersects with exposure, impact severity, and response, shaping vulnerability to climate change. While this discussion focuses on the determinants of health and health equity in the context of climate change vulnerability, it also brings forward the systemic nature of health inequities that create the conditions contributing to vulnerability.

FIGURE 6. VULNERABILITY ASSESSMENT PROCESS



EXPOSURE
Spatial and temporal exposure analysis. Also referred to as hazard intensity and likelihood. The degree to which a climate hazard is likely to affect a region or community, due to its geographic extent and duration. Reflects the presence of people, infrastructure, services, resources, and land-based practices potentially adversely impacted by said hazard.

IMPACT SEVERITY
The degree to which a region or community will be impacted by a given climate hazard.

RESPONSE (Adaptative Capacity)
The ability of a system to adjust to changes, manage damages or cope with the consequences of a climate hazard.

Vulnerabilities to climate hazards are identified when exposure and potential impacts cannot be overcome by the adaptive capacity (response) of a region or a community. The relationship between these elements is expressed through the following formula:

Exposure + Impact Severity – Response (Adaptive Capacity) = Vulnerabilities to climate hazard

This vulnerability assessment process reflects an emergency management approach, shaped by tools and frameworks commonly used in that field. While the above formula was adapted from the Climate Change Vulnerability Index (CCVI), sensitivity was replaced with impact severity or consequence to align with the methodology used in the Risk Assessment Workbook (HIRAW) developed by Emergency Management Ontario (2012). Adaptation capacity is also used interchangeably with response, which is a term preferred by the 2025 VRAC framework but is less commonly used in English literature.

4.5.1
Hazard Exposure Analysis

The exposure analysis used multiple indicators to determine the exposure to each climate hazard for the region, as well as for each community (**Table 3**). It was partly adapted from the HIRAW by Emergency Management Ontario (2012). The temporal aspects of exposure (frequency, duration of exposure over a set period and probability of occurrence) were partially taken from the HIRAW. For the purposes of this report, probability of occurrence and likelihood will be used interchangeably. Additional criteria inspired by the *Cadre de référence* VRAC (2019) were added to the notation grid to consider the spatial dimension of exposure (exposure over a set area). All criteria were rated from 1 to 6 and added up to give a score ranging in value from 4 to 30.

TABLE 3. EXPOSURE ANALYSIS NOTATION GRID

		1	2	3	4	5	6
Temporal exposure		**RARE**	**VERY UNLIKELY**	**UNLIKELY**	**PROBABLE**	**LIKELY**	**ALMOST CERTAIN**
Frequency of occurrence		Hazards with return periods **>100 years.**	Occurs every **50 – 100 years** and includes hazards that have not occurred but are reported to be more likely to occur in the near future.	Occurs **every 20 – 50 years**	Occurs **every 5 – 20 years**	Occurs **every 5 years** or less	The hazard occurs **annually**.
Probability of occurrence		**Less than a 1%** chance of occurrence in any year.	**Between a 1-2%** chance of occurrence in any year.	**Between a 2 – 10%** chance of occurrence in any year.	**Between a 10 – 50%** chance of occurrence in any year.	**Between a 50 – 100%** chance of occurrence in any year.	**100%** chance of occurrence in any year.
Duration of exposure (over the course of a given year)		**Less than a day**	**<5 days**	**5 to 10 days**	**10 to 20 days**	**Season**	**Continuous**
Spatial exposure		**NONE**	**VERY LIMITED**	**LIMITED**	**MODERATE**	**HIGH**	**VERY HIGH**
Extent of exposure	**Across the region**	**Very localized** (a few individuals)	**Localized** (neighborhood or sector of a community)	**One** communities	**Multiple** communities	Either **all coastal** or **all inland** communities	**All** of Eeyou Istchee
	Commu-nities	Less than **5%** of the community	**5 to 10%** of the community	**10 to 25%** of the community	**25 to 50%** of the community	**50% to 75%** of the community	**More than 75%** of the community

A final exposure rating from 1 to 6 was assigned according to the conversion shown in **Table 4**. Newer frameworks of the VRAC-PARC use the term *hazard intensity and likelihood* for this section; however, we will refer to it as exposure analysis for this report.

TABLE 4. CONVERSION TABLE FOR REGIONAL AND COMMUNITY HAZARD EXPOSURE

TOTAL COMPOSITE VALUE GROUPS	EXPOSURE RATING	DESCRIPTION
4	1	**No exposure**
5-9	2	**Very limited exposure**
10-12	3	**Limited exposure**
13-15	4	**Moderate exposure**
16-18	5	**High exposure**
19+	6	**Very high exposure**

4.5.2 Impact Severity Assessment

The impact assessment also followed the HIRAW developed by Emergency Management Ontario and it was selected for its accessible and structured approach. This tool allowed consultation participants to evaluate eachhazard's consequences using predefined categories and impact severity ratings (**Table 5**) This step was necessary in establishing the severity of impacts (or consequence) of each climate hazard. Regional and local partners and experts reviewed each hazard during consultations, and consensus was reached on the expected impacts based on preselected categories (fatalities, injuries, evacuation, property damage, critical infrastructure, environmental impact, business/financial impact, psychosocial impacts). While the impact of fatalities and injuries are directly linked to health, other categories can also have trickle down consequences on health and well-being. For instance, property damage due to extreme weather events such as floods or forest fires can undermine health if homes or essential facilities fail to provide safe and healthy environments to individuals. Business and financial impacts of climate change can also affect individual and populational health through the socio-economic determinants of health (National Collaborating Centre for Aboriginal Health, 2017).

TABLE 5. IMPACT SEVERITY SCALE USED IN THE HAZARD IDENTIFICATION AND RISK ASSESSMENT WORKBOOK DEVELOPED BY EMERGENCY MANAGEMENT ONTARIO (2012)

	0	1	2	3	4
	NONE	**MINOR**	**MODERATE**	**SEVERE**	**CATASTROPHIC**
FATALITIES	Not likely to result in fatalities within the community.	Could result in fewer than five fatalities within the community.	Could result in 5 –10 fatalities within the community.	Could result in 10 –50 fatalities within the community.	Could result in +50 fatalities within the community.
INJURIES	Not likely to result in injuries within the community.	Could injure fewer than 25 people within community.	Could injure 25 –100 people within the community.	Could injure +100 people within the community.	
EVACUATION	Not likely to result in an evacuation shelter-in-place orders, or people stranded.	Could result in fewer than 100 people being evacuated, sheltered-in-place or stranded.	Could result in 100 -500 people being evacuated, sheltered-in-place or stranded.	Could result in more than 500 people being evacuated, sheltered-in-place or stranded.	
PROPERTY DAMAGE	Not likely to result in property damage within the community.	Could cause minor and mostly cosmetic damage.	Localized severe damage (a few buildings destroyed).	Widespread severe damage (many buildings destroyed).	
CRITICAL INFRASTRUCTURE SERVICE DOMAIN	Not likely to disrupt critical infrastructure services.	Could disrupt 1 critical infrastructure service.	Could disrupt 2 –3 critical infrastruc-ture services.	Could disrupt more than 3 critical infrastructure services.	
ENVIRONMENTAL IMPACT	Not likely to result in environmental damage.	Not likely to result in environmental damage.	Could cause major but reversible damage. Full clean up difficult.	Could cause severe and irreversible environmental damage. Full clean up not possible.	
BUSINESS/ FINANCIAL IMPACT	Not likely to disrupt business/financial activities.	Could result in losses for a few businesses.	Could result in losses for an industry.		
PSYCHOSOCIAL IMPACT	Not likely to result in significant psychosocial impacts.	Significant psychosocial impacts including limited panic, hoarding, self-evacuation and long-term psychosocial impacts.	Widespread psychosocial impacts, e.g. mass panic, widespread hoarding and self-evacuation and longterm psychological impacts.		

The results obtained for each category were added up into a score expressed by a single rating as demonstrated in **Table 6**. In cases where consensus could not be reached between two or more scores, the most conservative value was used to inform the final impact severity rating.

TABLE 6. CONVERSION TABLE FOR REGIONAL AND COMMUNITY IMPACT SEVERITY TO CLIMATE HAZARDS

TOTAL SCORE GROUPS	IMPACT SEVERITY RATING	DESCRIPTION
≤4	1	**Minor**
5-6	2	**Slight**
7-8	3	**Moderate**
9-10	4	**Severe**
11-12	5	**Very Severe**
≥13	6	**Catastrophic**

4.5.3 Response Assessment

The lack of recorded data onclimate vulnerabilities and adaptation initiatives for Eeyou Istchee led the Environmental Health team to rely primarily on recent consultations with regional and community stakeholders and experts to determine regional response. The information obtained is qualitative in nature but was transformed in a semi-quantitative rating. In the context of this vulnerability assessment, the term response is used as a synonym of adaptive capacity which is defined as *"...the ability to design and implement effective adaptation strategies, or to react to evolving hazards and stresses so as to reduce the likelihood of the occurrence and/or the magnitude of harmful outcomes resulting from climate-related hazards* [...]" (Brooks & Adger, 2004, p. 168). The criteria used to determine the response for each community and for the region were based on this general rule and the method proposed by Brooks and Adger (2004).

Climate projections and potential impacts for each climate hazards were presented by the Environmental Health team to regional experts

as well as representatives of each community. The individuals consulted take on different roles in each community including Public Safety Officers (PSO), Public Health Officers (PHO), Emergency Coordinators, Land and Environment Officers, Community Miyupimaatisiiun Centre Local Directors. A discussion was initiated around their knowledge and experience of the potential health impacts of each climate hazard as well as their experience and/or capacity to answer to them. They were asked to describe their community or region's level of preparedness to each climate hazards. The response rating given for each climate hazard is based on an evaluation from the authors and therefore remains subjective. However, certain indicators were used as guidelines to document the exercise and justify each rating:

- Knowledge and experience implementing adaptation and mitigation measures related to climate change health impacts;
- Infrastructure resilience, including air conditioning, ventilation systems, and back-up generators for critical infrastructure;
- Availability of food security programs and initiatives addressing climate-related vulnerabilities;
- Systems in place for communicating acute climate-related information (e.g., air quality warnings, heat advisories, storm alerts, ice thickness reports).

The region was given an overall rating between 0 and 5 for each climate hazard (**Table 7**). A rating of 0 would indicate that a community has no response measures in place to manage the health impacts of climate change and a rating of 5 would represent extensive regional experience adapting to climate change health impacts. Although some communities, such as Waskaganish, Mistissini, and Whapmagoostui, have climate adaptation plans, the absence of such plans at the community level for most Cree Nations led the team to assessresponse level at the regional scale rather than individually. A more detailed assessment of each Cree Nation's response will be included in the PARC report, which will be focused on climate adaptation planning.

TABLE 7. RESPONSE ASSESSMENT RATING GRID

	0	1	2	3	4	5
	NONE	VERY LOW	LOW	MODERATE	MODERATE TO HIGH	HIGH
Response level	The region does not have any response plan to the climate hazard	The region has some knowledge of response measures to the climate hazard, but no experience in mitigating health impacts	The region has limited experience implementing response measures connected to the health impacts of the climate hazards.	The region has some experience implementing response measures connected to the health impacts of the climate hazard	The region has experience implementing response measures related to health impacts of the climate hazard.	The region has extensive experience implementing response measures related to health impacts of the climate hazard.

4.6 CONFIDENCE SCALE

A confidence rating is assigned to each of the three assessment steps—exposure, impact severity, and response—according to the quantity, quality and consistency of available information. Because these intermediate ratings feed directly into the overall vulnerability and risk calculations, a higher or lower confidence at any stage will proportionally strengthen or weaken confidence in the final results. **Table 8** displays the rating grid used to assess the confidence scale for each assessment step.

TABLE 8. CONFIDENCE SCALE RATING

ACCURACY AND QUALITY OF DATA	CONFIDENCE SCALE
Knowledge is limited. Few community voices or expert perspectives have been documented. Monitoring and research data are scarce. Insights may exist but are fragmented or not yet validated.	LOW
Some evidence is available from both Indigenous knowledge holders and scientific sources. A mix of community experience, expert input, and monitoring data is present, though there may still be gaps or inconsistencies.	MODERATE
Strong and consistent information from multiple sources, including lived community experience, Indigenous knowledge systems, expert assessments, and monitoring data. There is alignment across these sources, increasing confidence in the information.	HIGH

4.7 REGIONAL VULNERABILITY RATING TABLE

The vulnerability of Eeyou Istchee was expressed by calculating the relationship between the values obtained from the exposure, impact severity and response assessments, according to the vulnerability assessment formula. This formula would produce a value between **2** and **7+**, which is then expressed by a vulnerability rating between **0-None** to **5-Extreme** (**Table 9**). The vulnerability rating helped determine which climate hazard Eeyou Istchee is most vulnerable to and identify relevant adaptation measures already in place or that should be implemented throughout the region.

TABLE 9. CLIMATE HAZARD VULNERABILITY RATING GRID

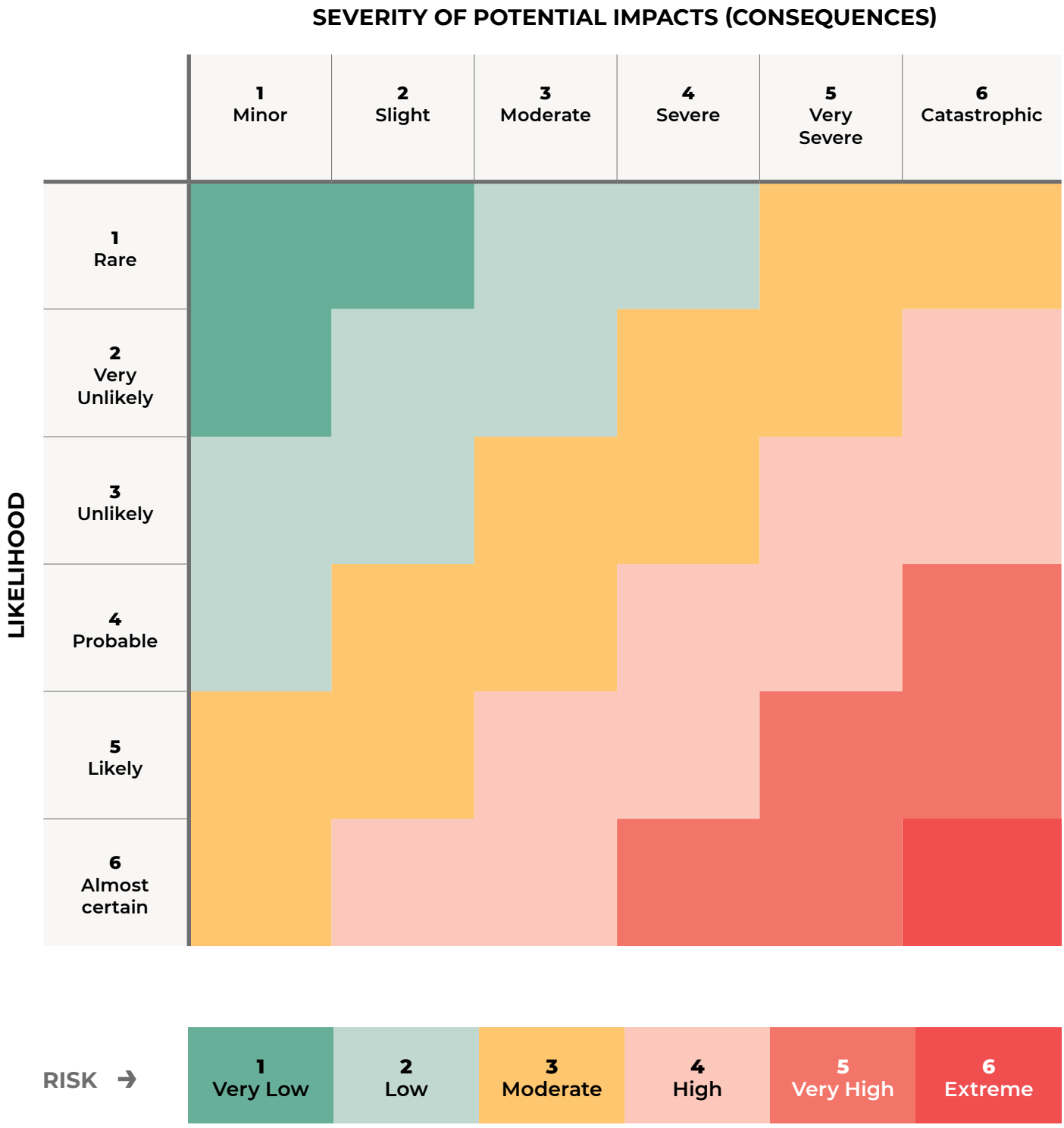
Calculated value (Exposure + Impact Severity – Response)	*2*	*3*	*4*	*5*	*6*	*7+*
Vulnerability rating	**0**	**1**	**2**	**3**	**4**	**5**
Vulnerability to climate hazard	**NONE**	**LOW**	**MODERATE**	**MODERATE TO HIGH**	**HIGH**	**EXTREME**

4.8 RISK ASSESSMENT

Risk is defined as the potential for harm derived from a specific hazard (National Capital Commission, 2022). A risk matrix (**Table 10**) was used to establish the potential for a hazard to cause negative consequences. This was obtained by intersecting likelihood or probability of occurrence (y-axis) with the severity of potential impacts or consequence (x-axis). As likelihood increases, the risk moves upward; as impact severity increases, the risk moves rightward. The probability of occurrence was assessed during the exposure analysis, whereas impact severity was determined through a separate evaluation process; both steps are part of the overall vulnerability assessment. This risk matrix was inspired by the one used in the Climate Change Vulnerability and Risk Assessment by the National Capital Commission (2022). The colour scheme, however, was modified to align with standard risk matrix conventions.

The top-left corner of the matrix corresponds to events that are both unlikely and have minimal consequences—these are low-priority risks. In contrast, the bottom-right corner represents highly likely and severe events, which are critical and require immediate attention. Each cell is color-coded to reflect the overall level of risk: dark green for **1-Very low**, light green for **2-Low**, yellow for **3-Moderate**, orange for **4-High**, light red for **5-Very high** and dark red for **6-Extreme** risk. This visual tool can help decision-makers identify which hazards pose the most significant threats and require urgent adaptive measures or increased resource allocation.

TABLE 10. RISK ASSESSMENT MATRIX



4.9 RISK AND VULNERABILITY COMPARISON TOOL

Finally, a risk and vulnerability comparison tool (**Table 11**) was used as a framework to compare hazards. As the last step, this comparison contextualizes each hazard with respect to both their risk and vulnerability ratings.

TABLE 11. RISK AND VULNERABILITY COMPARISON TOOL TEMPLATE

RISK RATING \ VULNERABILITY RATING	0 None	1 Low	2 Moderate	3 Moderate to High	4 High	6 Extreme
1 Very Low						
2 Low						
3 Moderate						
4 High						
5 Very High						
6 Extreme						

05

POPULATIONAL PORTRAIT

POPULATION PORTRAIT

The population covered in this project refers to those living in the nine Cree communities of Eeyou Istchee, the traditional Cree territory near the Eastern shore of James Bay. The population of Eeyou Istchee is largely First Nation (Eeyouch/Eenouch) but also includes a small number of Inuit and non-Indigenous people. For example, in addition to Eeyouch/Eenouch, the population of the Cree Nation of Chisasibi (or Mailasik in Inuktitut) includes approximately 150 Nunavimmiut – Inuit beneficiaries of the JBNQA, represented by the Makivik Corporation and their own community administration. Further North, Whapmagoostui (Kuujjuarapik in Inuktitut), is a shared community between Inuit and Eeyouch/Eenouch, both possessing distinct authorities and governmental systems.

The Eeyouch/Eenouch have an extremely close relationship with the land. Culture and family life are tied to land-based practices. Due to this relationship, climate change can have a significant impact on the health and wellness of this population by impacting their capacity to take part in traditional activities. The Eeyouch/Eenouch also have higher rates of several chronic diseases (e.g., diabetes, kidney disease, hypertension, asthma) that can make members of the population more vulnerable to the effects of climate change. While this section outlines these health disparities, it is essential to adopt a critical approach to fully understand the underlying factors contributing to these differences.

5.1 CULTURE

For generations, Eeyouch/Eenouch have maintained an intimate and reciprocal relationship with the natural environment. However, the effects of climate change on cultural identity, as well as mental, physical health, and overall well-being, have raised concern. Traditional practices, which are integral to the four pillars of well-being – the physical, mental, emotional, and spiritual well-being or Miyupimatisiuun "living well"– are particularly vulnerable, highlighting the critical need to preserve these practices despite the growing challenges posed by climate change. Recognizing that Cree culture inherently strengthens resilience, sustainability, and resurgence is essential for promoting health and well-being in the face of climate change and related health challenges.

This perspective shifts from a damage-centered approach that focuses on harm and vulnerability to a strengths-based framework that highlights resilience, community assets, and pathways to health and well-being (Tuck, 2009). Although the climate crisis impacts Eeyou/Eenou culture (affecting the health of the environment, health of communities, food security, land access, TEK, and more), practices such as traditional hunting, trapping, fishing, and harvesting plants and medicines remain fundamentally sustainable. It is essential to remember that engaging with the land is not only inherently sustainable or physically beneficial, but also culturally and spiritually significant, emphasizing that damage to the land directly impacts both well-being and health of the Cree population.

Historically, the Cree population lived as nomads, holding a deep belief in the spiritual interconnectedness of living and non-living entities, both of which were seen as equally important. Central to the Eeyou/Eenou worldview was the belief in a higher spirit—the Creator—which shaped Eeyouch/Eenouch perspectives on life and land (Pachano, 2011). This belief system formed the foundation of Cree values, emphasizing the balance and holistic well-being embodied in Miyupimaatisiiun. As Radu and House (2015) explains, Miyupimaatisiiun extends beyond the biomedical concept of health (the absence of disease) by connecting the body to the land and identity, recognizing the land as a source of healing and overall well-being.

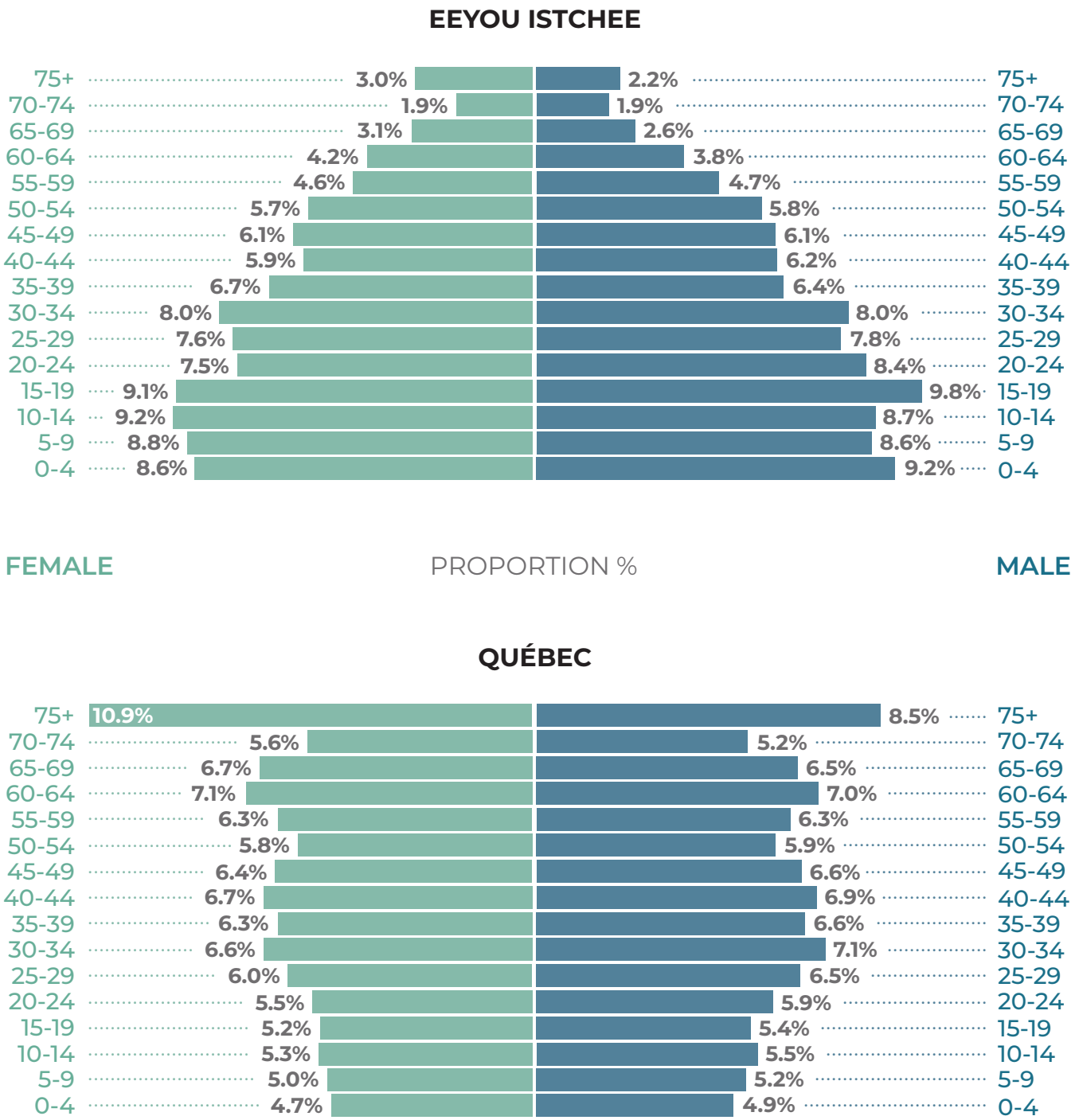
Despite experiencing significant cultural erosion, Eeyouch/Eenouch maintain strong ties to traditional practices and land. It is important to note that each Cree community has unique ways of knowing and being, with distinct cultural protocols and customs passed down through TEK. TEK not only informs how Eeyouch/Eenouch interact with the land but also emphasizes values such as respect, care, balance, and reciprocity. McGregor (2018) describes TEK as “not merely descriptive knowledge about the environment, knowledge gained by experience in a place, but also prescriptive—that is, it provides an account of how people ought to act in a relationship to nature” (p. 110). Cree culture thus encompasses not only the mindful practice of traditional activities such as harvesting medicines, hunting, fishing, and trapping but also the philosophies and values that support a reciprocal and harmonious relationship with the land.

5.2 DEMOGRAPHIC OVERVIEW

As of 2024, the resident population of Eeyou Istchee was estimated to include 21,442 individuals, including 20,177 Cree registered JBNQA beneficiaries along with 1,265 Inuit and non-Indigenous residents (Institut de la statistique du Québec & Ministère de la Santé et des Services sociaux, 2024a; Ministère de la Santé et des Services sociaux, n.d.-a, n.d.-c, 2024; Statistics Canada, 2017, 2022). Cree is widely spoken across Eeyou Istchee, with 91.5% of the population reporting speaking Eastern James Bay Cree, and 79.5% reporting Cree as their first language (Statistics Canada, 2017, 2022). There are two official dialects spoken in the region; a northern dialect that is primarily spoken in northern and coastal communities (Whapmagoostui, Chisasibi, Wemindji, Eastmain and Waskaganish) and a southern dialect commonly used inland and in the more southerly communities (Nemaska, Waswanipi, Oujé-Bougoumou, Mistissini). Per census data regarding official languages of Canada, the majority of the population (74.4%) is conversational in English only, and 21.3% are conversational in both French and English (Statistics Canada, 2017, 2022).

In addition to differences in indigeneity and language, Eeyou Istchee has higher proportions of younger people, and lower proportions of older people than elsewhere in Québec. Population pyramids allow for visualization of these differences (**Figure 7 -** *see on page 59*). The population in Eeyou Istchee is evidently different than regions elsewhere in Québec, and public services, including public health, are therefore adapted to meet the needs of the majority Cree population.

FIGURE 7. AGE COMPOSITION (2024) OF THE POPULATIONS OF EEYOU ISTCHEE (N=19 343) AND QUÉBEC (N= 8 933 379).



Source: (Institut de la statistique du Québec & Ministère de la Santé et des Services sociaux, 2024b)

The *Institut de la statistique du Québec* (ISQ)'s population estimates are produced based on the Statistics Canada censuses. They are then corrected for the undercounting of certain age groups during the census and for the annual movement of the population using the Fichier d'inscription des personnes assurées of the Régie de l'assurance maladie du Québec. The MSSS uses these numbers for all their statistics on Eeyou Istchee. Despite the adjustments made to account for undercounting in the census, population estimates remain slightly underestimated in this data source as they have been for several decades (Lejeune & Torrie, 2015). The count based on the JBNQA beneficiary list is slightly higher, and for this reason, that list is used for the purposes of planning and programming. When comparing Eeyou Istchee to Québec or using statistics produced directly from the MSSS, the ISQ population estimates are used. In this report, the latter is primarily used.

The population of Eeyou Istchee is also growing rapidly – increasing by 13.7 per 1000 from 2017 to 2021, an increase of 150% compared to the overall Québec population (8.9 per 1000). Based on estimates and projections of the ISQ, the population of Eeyou Istchee has grown by 67.6% since 1996, increasing from 11,539 individuals to 19,343 in 2024, while the population of Québec increased by 23% over the same time period (from 7,246,897 to 8,933,379). Indeed, population growth in Eeyou Istchee has been greater than elsewhere in Québec sincethe 1980s.

The rapid population growth and high proportion of young people in Eeyou Istchee are driven in part by a high birth rate. In 2022, the average annual birth rate was estimated to be approximately double that of Québec. (Institut de la statistique du Québec & Ministère de la Santé et des Services sociaux, 2024a). Mothers in Eeyou Istchee tend to be younger than mothers elsewhere in Québec. This has been consistent for many years – since the 1980s, the average age of mothers in Eeyou Istchee has been 3-4 years less than the average age of mothers across Québec, and the fertility rate among mothers aged 15-19 in Eeyou Istchee has been significantly greater than the fertility rate among mothers aged 15-19 across Québec (Institut de la statistique du Québec & Ministère de la Santé et des Services sociaux, 2024b).

Pregnancies in Eeyou Istchee are accompanied by a high proportion of diabetes. In 2018-2021, 61.5% of hospital deliveries were accompanied by a diabetes diagnosis (52.4% had a gestational diabetes diagnosis, and 9.1% had a diagnosis of type 1, type 2, or unspecified diabetes *(Ministère de la Santé et des Services sociaux*, n.d.-b). Elsewhere in Québec over the same time period (2018-2021), 13.3% of all deliveries were accompanied by a diagnosis of diabetes (12.4% gestational diabetes, and 0.8% other diabetes diagnoses (Ministère de la Santé et des Services sociaux, n.d.-b).

These population differences between Eeyou Istchee and elsewhere in Québec (namely, a high proportion of youth including infants and young children, pregnant people, and those living with chronic diseases like diabetes) indicate that the population of Eeyou Istchee may experience the impacts of climate change differently than other populations in Québec. For example, infants, young children, and pregnant people may experience more severe effects from heat and smoke caused by forest fires. Those living with chronic illnesses such as diabetes may be more severely impacted by climate events impacting supply chains of medications, increasing the cost, or decreasing the reliability and safety of transportation to receive medical care.

5.3 SOCIO-ECONOMIC PORTRAIT

Although incomes in Eeyou Istchee are generally high when compared to elsewhere in Québec, these are accompanied by higher costs of living including food, goods, and transportation due to the distance of the region to main urban centres. Median household income in Eeyou Istchee is estimated to be $109,000; greater than the median household income in Québec ($63,200) or Canada ($73,000). Similarly, a greater proportion of Eeyou Istchee households had after-tax income of $100,000 or over (56.6%) than in Québec (23.8%) or Canada (31.9%) (Statistics Canada, 2017, 2022).

While median household income in Eeyou Istchee overall appears high, this estimate varies widely among the nine individual communities ($73,000-$127,000), as does the proportion of households with after-tax income of $100,000 or greater (35.4%-65.4%). Households in Eeyou Istchee also include, on average, 4.2 individuals, compared to 2.2 in Québec and 2.4 in Canada. Household incomes may therefore be divided among more people in Eeyou Istchee than elsewhere, further offsetting what appear to be high incomes at the household level. Indeed, more dwellings in Eeyou Istchee (15.9%) could be considered crowded (i.e. more than one person per room) than in Québec (1.3%) or Canada (2.4%), and more dwellings in Eeyou Istchee are in need of major repairs (25.2%) than in either Québec or Canada (6.3% and 6.1%, respectively) (Statistics Canada, 2017, 2022).

Larger households have implications for numerous aspects of public health response to climate change-related events. Community evacuations due to forest fires must consider the feasibility, logistics, and implications of keeping larger families or households together in the context of evacuation travel and accommodations. Dwellings in need of repair may be also more susceptible to further damage or destruction from severe weather (e.g. strong winds or storms).

The population of Eeyou Istchee also differs from elsewhere in Québec and Canada with respect to education and employment. In Eeyou Istchee, 61.3% of the population 25 to 64 has a high school diploma (or equivalency) or higher – compared to 88.2% of the population of Québec (Statistics Canada, 2017, 2022). Measures related to Western systems of education must be interpreted in the specific context and history of Eeyou Istchee. Academic milestones rooted in Western traditions do not capture other measures of success more

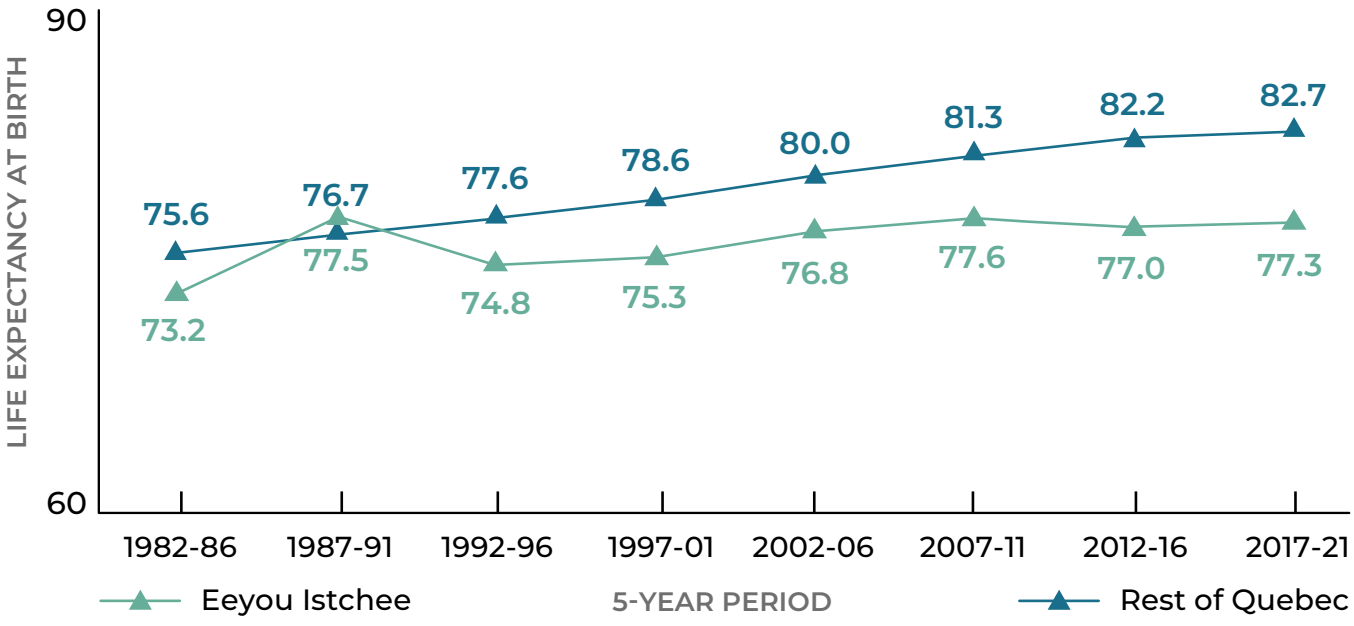
in line with Indigenous worldviews. While some college, CEGEP and university programs are available in communities or in a hybrid format, many post-secondary programs require students to live away from their home communities, which is a significant logistical and financial barrier. Furthermore, many Eeyouch/Eenouch are residential school survivors. Events like Residential School Gatherings include activities to promote healing and reflection. While survivors in Eeyou Istchee are resilient, the pain and trauma of those experiences is still keenly felt and impacts the next generations.

While the level of employment in Eeyou Istchee (55.6% of the labour force) is similar to levels of employment across Québec (59.3%) and Canada (57.1%), the distribution of occupations across industries differs greatly. Occupations in social science, education, government services, and religion make up approximately 25% of the labour force in Eeyou Istchee, double the 12% reported across Québec (Statistics Canada, 2017, 2022). Occupations related to natural resources also appear to be more prevalent in Eeyou Istchee (4% compared to 2% across Québec). On the other hand, health-related occupations make up only 4% of the Eeyou Istchee labour force compared to 8% across Québec (Statistics Canada, 2017, 2022). This may reflect the high proportion of healthcare staff who work in Eeyou Istchee, but permanently reside elsewhere.

5.4 HEALTH PORTRAIT

The health portrait of Eeyou Istchee varies compared to general trends seen in Québec. While this section focuses on health discrepancies, it is crucial to recognize the resilience and survivance of Eeyou/Eenou communities to historical and ongoing health inequities. The populations of Eeyou Istchee have an average life expectancy slightly lower than the provincial average for Québec in general (**Figure 8**). Between 2017 and 2021, the average life expectancy in Eeyou Istchee was 77.3 years, with females living longer (79.7 years) than males (74.9 years). A similar gap among sex is also visible for the rest of Québec.

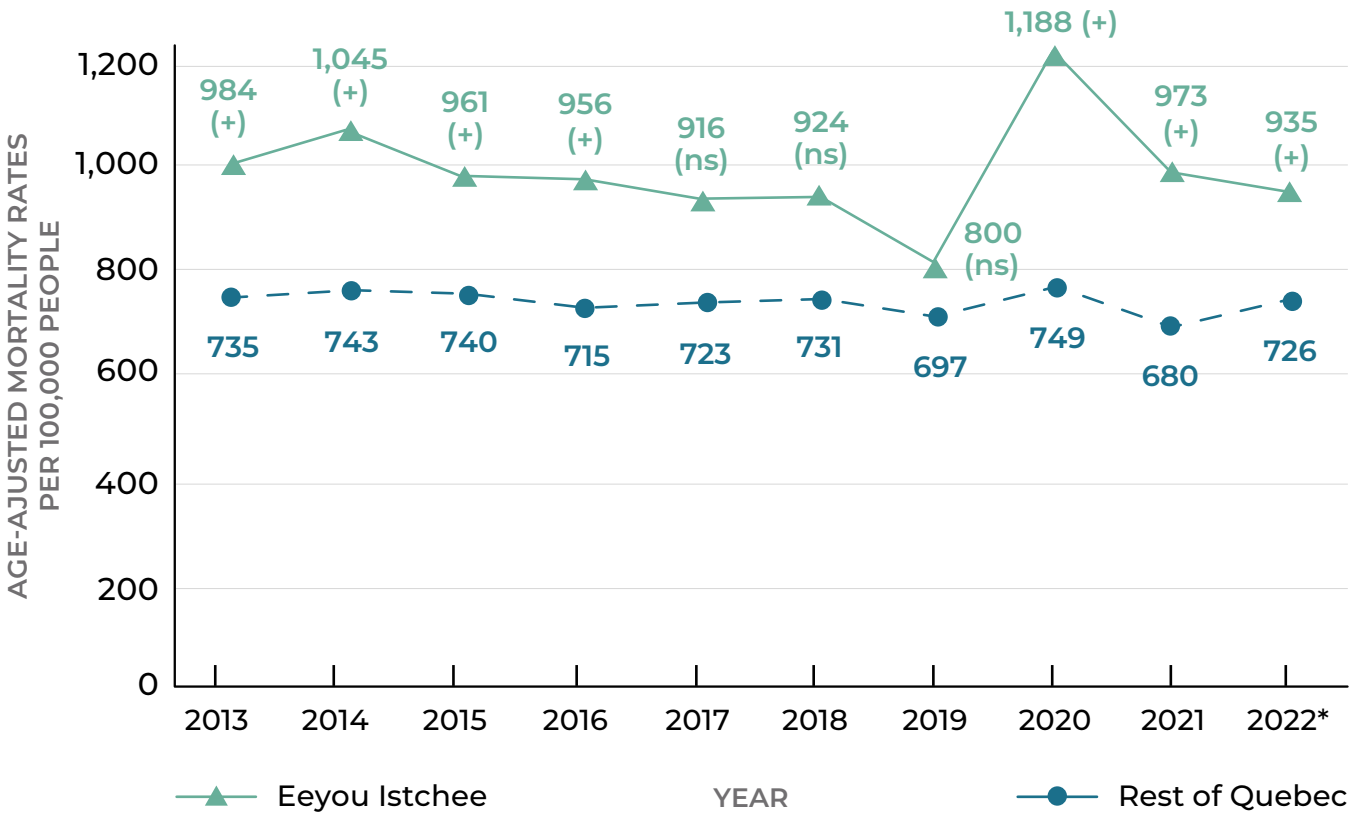
FIGURE 8. LIFE EXPECTANCY AT BIRTH IN EEYOU ISTCHEE AND REST OF QUÉBEC, BY 5-YEAR PERIODS (1982-86 TO 2017-21)



Note: Extraction 2024-10-24 (Institut national de santé publique du Québec, 2024).

In terms of mortality, all-cause crude mortality rates are generally lower in Eeyou Istchee (471 deaths per 100,000 in 2021) as compared to the crude mortality rate in Québec (816 deaths per 100,000 in 2021); however, **Figure 9** shows that after adjustment for age, mortality rates in Eeyou Istchee remain mostly significantly higher compared to the province of Québec over the period of 2013 to 2022. Likewise, rates of avoidable mortality were significantly higher for Eeyou Istchee (120 per 100,000 for the period 2017-2021) than the rest of Québec (70 per 100,000 for the same period). Overall, these higher mortality rates could be driven by and illustrate an important burden of chronic disease in the region.

FIGURE 9. ANNUAL AGE-ADJUSTED MORTALITY RATE FOR ALL CAUSES PER 100,000 PEOPLE, EEYOU ISTCHEE AND QUÉBEC, 2013 TO 2022*



Source: (Ministère de la Santé et des Services sociaux, n.d.-c). Age-adjusted incidence has been standardized using Québec's 2011 population data, to account for the younger age structure in Eeyou Istchee.

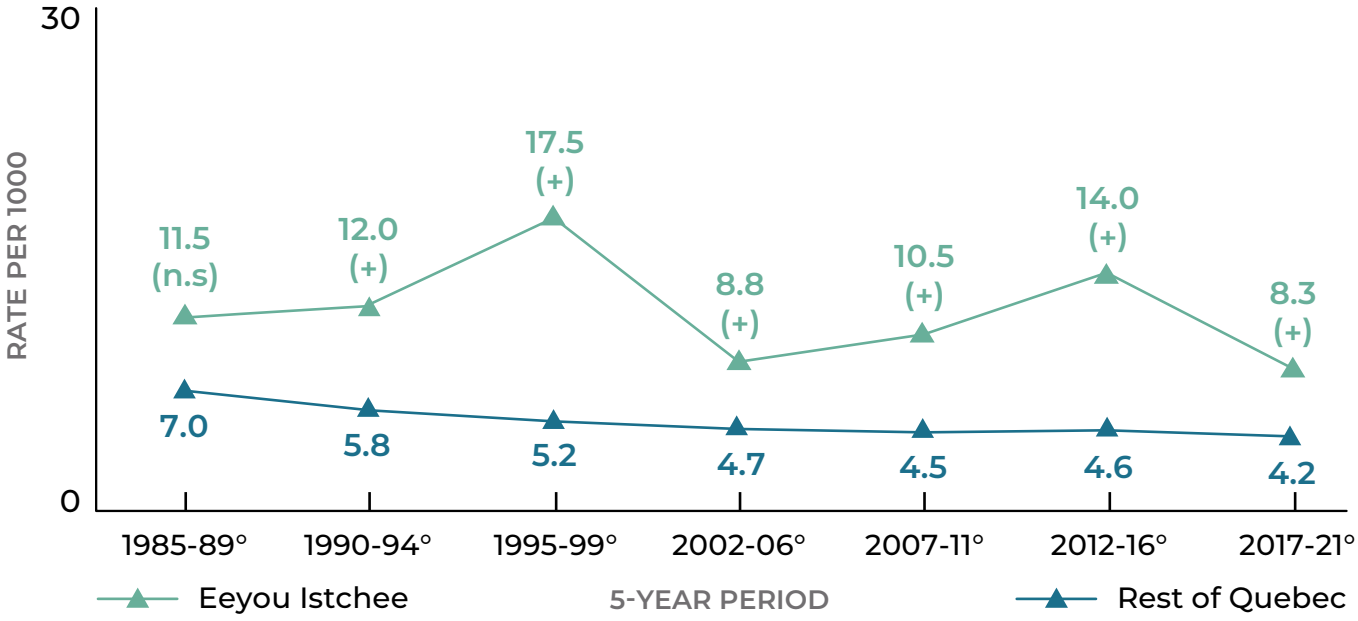
Note: (+) indicates that the rate was significantly higher than the rest of Québec, and (n.s.) indicates no difference.
**Data for 2022 is preliminary.*

Additionally, infant mortality per 1,000 live births was significantly higher in the region as compared to the rest of Québec from 1990 until 2021 (**Figure 10**). However, given the high coefficient of variation for each period, any interpretation should be made with caution, as this suggests a degree of variability that may affect the reliability of the data. For the most recent period (2017-2021), the primary causes of infant mortality were chromosomal and congenital malformations—probably related to Cree Leukoencephalopathy (CLE) and Cree Encephalitis (CE), two severe neurodegenerative diseases with high carrier rates in Eeyou Istchee—followed by sudden infant death syndrome.

Eeyou Istchee had recorded fewer than five cases of mortality during pregnancy, childbirth, or the puerperium, as compared to 87 cases in Québec, from 2002 to 2021. Premature live births accounted for 9.4% of all live births in the region between 2020-2022, which is slightly above the proportion in Québec (7.1%) during the same period. Given the difference in population sizes, it is difficult to assess the full impact of these statistics on public health.

In general, the annual average hospitalization rate for pregnancy, childbirth, and puerperium was 3,799 per 100,000 women in Eeyou Istchee between 2020 and 2023; a rate significantly higher compared to 2,161 in Québec for the same period, all age-adjusted to Québec's 2011 population data. However, there were no significant differences in annual average of hospitalization rates for congenital conditions in Eeyou Istchee and Québec, adjusting for age according to Québec's 2011 population data.

FIGURE 10. RATE OF INFANT MORTALITY, PER 1,000 LIVE BIRTHS, IN EEYOU ISTCHEE AND THE REST OF QUÉBEC, BY 5-YEAR PERIODS (1982-86 TO 2017-21)



Note: Extraction 2024-10-24 (Institut national de santé publique du Québec, 2024). (+) indicates that the rate was significantly higher than the rest of Québec, and (n.s.) indicates no difference. (°) means the coefficient of variation is high, interpret with caution.

In terms of *Maladies à déclaration obligatoire* (MADO), Eeyou Istchee has reported fewer than five hospitalizations related to zoonotic diseases from 2008 to 2023, and there were fewer than five total reported cases of zoonotic and vector-borne infections between 2012 and 2023. In comparison, there were a total of 5,633 reported zoonotic and vector-borne cases since 2012 in Québec, with an incidence rate varying between 3-9 cases per 100,000 inhabitants per year.

Similarly, the incidence rate of enteric, food, and waterborne infections in Eeyou Istchee (32 new cases per 100,000 for the fiscal years 2021-2023) is lower than the rate for Québec (62 new cases per 100,000 for the same period) and has been steadily declining since 2015. It is important to note that while these baseline trends are relatively low, there may be an underreporting of mild infections. In addition, the future impacts of climate change, such as rising temperature, could broaden the territory of ticks and mosquitoes and alter the prevalence of zoonotic and vector-borne diseases.

The health profile of Eeyou Istchee is marked by a significant burden of chronic diseases: cardiovascular diseases, endocrine, nutritional and metabolic diseases, cancers, and respiratory tract diseases. Climate change will likely exacerbate the health outcomes of individuals with chronic conditions.Regarding hospitalizations for heart disease, the Eeyouch/Eenouch have experienced higher annual rates of hospitalizations than the rest of Québec over the period of 2008 to 2023. For instance, ischemic heart disease hospitalization rates varied between 853 to 1,216 hospitalizations per 100,000 people as compared to rates in Québec ranging between 268 to 450 per 100,000 over the same period while adjusting for age. Additionally, hospitalization rates related to heart failure and pulmonary edema in Eeyou Istchee declined, reaching 393 hospitalizations per 100,000 people for the period of 2020-2023; however, these rates remain over Québec's annual rates of 143 hospitalizations per 100,000 people for the same years, all age-adjusted using Québec's 2011 population data.

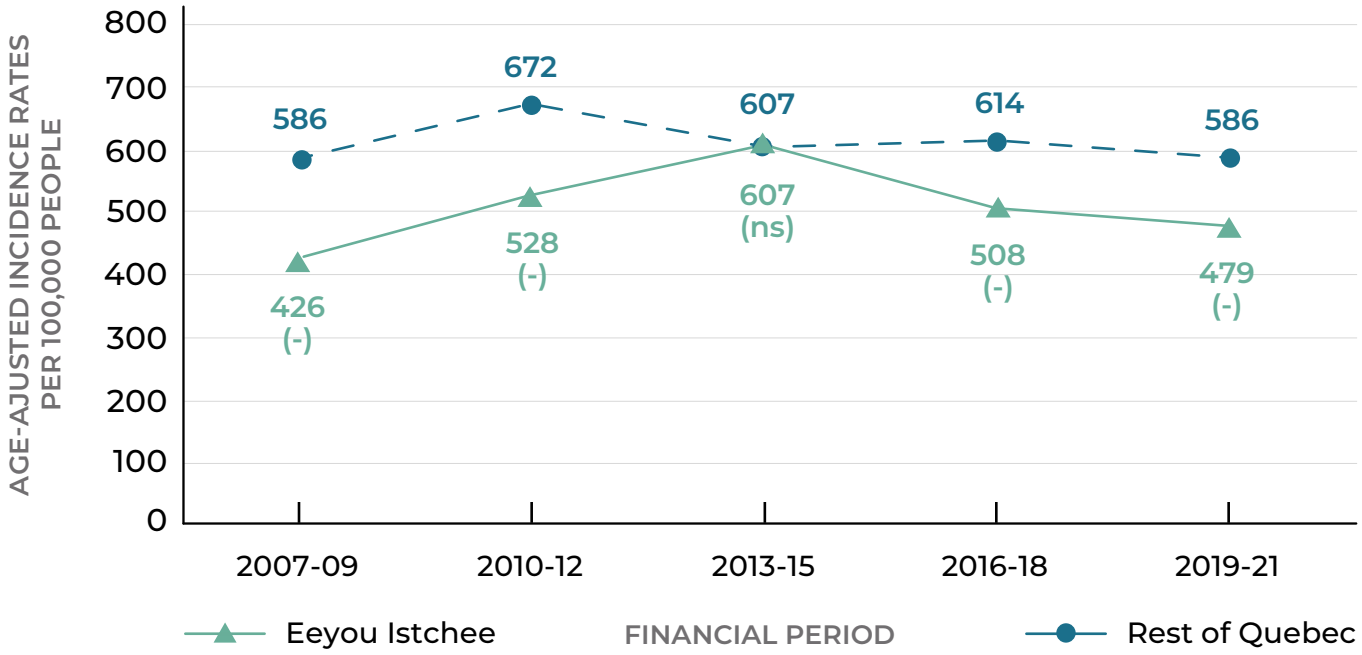
Between 2020 and 2023, the crude rate of hospitalization for endocrine, nutritional and metabolic diseases was 320 per 100,000 people in Eeyou Istchee. However, when adjusting to Québec's 2011 population age for comparison, Eeyou Istchee has 436 hospitalizations per 100,000 compared to 83 for in Québec, for the same period. Diabetes impacts nearly 1 in 3 adults in Eeyou Istchee, including 36% of females over the age of 20 (CBHSSJB, 2024). In 2021, and after adjusting for the younger population of Eeyou Istchee, diabetes was 4.4 times more prevalent than in the rest of Québec. The high occurrence of diabetes in Eeyou Istchee exists in the context of colonization, industrial development, and the JBNQA. Notably, the first case of diabetes in Eeyou Istchee was recorded in 1978, shortly following the 1975 signing of the JBNQA. This time period was accompanied by significant changes to the Cree way of life, including reduced consumption of traditional foods. Food security in Eeyou Istchee is tied to the practice of traditional activities and the access to fresh and healthy market foods. These two elements are impacted by climate change and are also directly shaped by current political and institutional systems. For example, following hydroelectric development, fish was identified as a source of exposure to mercury among Eeyouch/Eenouch, and reduced fish consumption may have led to increased reliance on store-bought foods (Schoen & Robinson, 2005).

Between 2007 and 2021 inclusively, the region recorded 176 new cases of dialysis patients. These individuals were a priority in evacuation procedures during the summer 2023 wildfire evacuations. However, maintaining access to treatment proved challenging in affected communities, requiring patients to be readily transported to other locations for safe and

adequate care. The reliability of dialysis treatment during extreme weather-related events, such as forest fires and associated road closures, highlights significant vulnerabilities in the region's healthcare infrastructure. Thus, it has been observed that the impacts of climate change have critical implications for the Eeyou/Eenou population, as dialysis is often a lifelong treatment, making consistent access essential for their health.

While cancer mortality in Eeyou Istchee is similar to that in Québec, the annual average incidence rate of all cancers, excluding skin cancers other than melanoma, has been generally significantly lower in Eeyou Istchee between 2007 to 2021. **Figure 11** illustrates the average annual incidence rate for all cancers in Eeyou Istchee and Québec. For the most recent period between 2019 and 2021 inclusively, the average annual incidence rate of cancers in Eeyou Istchee was 479 cancers per 100,000 individuals, compared to 586 cancers per 100,000 in Québec, all age-adjusted according to Québec's 2011 population data.

FIGURE 11. AVERAGE ANNUAL AGE-ADJUSTED INCIDENCE RATE FOR ALL CANCERS PER 100,000 PEOPLE IN EEYOU ISTCHEE AND QUÉBEC, BY 3-YEARS PERIOD, 2007 TO 2021.



Note: (Institut de la statistique du Québec & Ministère de la Santé et des Services sociaux, 2024b). All cancers excluding skin cancers other than melanoma. Incidence rates are presented per 100,000 people-year. (+) indicates the rate was significantly higher than the rest of Québec; (n.s.) indicates no difference.

From 2008 to 2023, average annual age-adjusted hospitalization rates related to lower respiratory tract diseases (i.e., bronchitis, asthma, bronchiectasis, etc.) were significantly higher in Eeyou Istchee compared to Québec. During the financial period of 2020-2023, there were 343 lower respiratory tract disease-related hospitalizations annually per 100,000 people in Eeyou Istchee, compared to 175 per 100,000 in Québec, all age-adjusted to Québec's 2011 population data. The high burden of respiratory chronic disease could reflect the impacts of current housing conditions, and co-morbidities in the region. Lower respiratory tract annual hospitalization rates have been declining since the period 2014-2017 but remain significantly higher than annual rates in Québec. Furthermore, extreme weather-related events, such as forest fires, also put individuals affected with chronic respiratory disease at higher risk and could exacerbate the burden of disease on the region.

In sum, Eeyou Istchee has a distinctive health portrait as compared to the rest of Québec. Current trends reflect the great resilience and survivance of Eeyou/Eenou communities throughout history and in the face of ongoing challenges. The region bears a higher burden of chronic disease and experiences greater sensitivity to hospitalizations, with these conditions likely to be further exacerbated by the local impacts of climate change. It is essential to understand how socio-determinants of health affect health outcomes in the region, while also recognizing historical events and their intergenerational impacts.

06

ORGANIZATIONAL PORTRAIT

6.1 CREE BOARD OF HEALTH AND SOCIAL SERVICES OF JAMES BAY

CBHSSJB is a Cree-led health entity, with a mission to provide health and social services to the nine Communities of the Cree Nation of Eeyou Istchee in collaboration with the Government of Québec. Its vision is for all individuals, families and communities to achieve Miyupimaatisiiun reflective of Nishiiyuu. The CBHSSJB is guided by a commitment to incorporate Cree values and traditions into its health and social services delivery systems (CBHSSJB, 2022).

6.1.1 Regional Public Health

The public health department within the CBHSSJB offers services at the regional level in health promotion, prevention of diseases, health protection (including communicable disease, occupational health, environmental health, and emerging threats), surveillance, evaluation, and knowledge translation. The department also houses the CBHSSJB's research office. The department is currently going through a reorganization with the intent to build more local capacity to deliver programs and services and to have a greater presence in each community.

The Regional Public Health Climate Change team is situated in the Health Protection Department, within the CBHSSJB Regional Public Health Environmental Health Team. The Climate Change Team consists of one full time PPRO, two part time employees (one PPRO and one social aide), and the part time support of an environmental and occupational health medical advisor and a field epidemiologist.

6.1.2 Organizational Climate Change Initiatives

Within the CBHSSJB, regional public health is involved in several initiatives related to climate change. Aside from public health's involvement in VRAC PARC, three members of the Environmental Health team sit on the CNG's regional CCAC. The team has supported CNG in planning the CRCF that took place in Oujé-Bougoumou in April 2023. The team has also supported the planning of the Eeyou Istchee Climate Change Adaptation and Environmental Emergency Preparedness workshop organized by CNG in early 2025. During the CRCF, the team led an interactive session where

participants co-created the regional climate change declaration titled ᐊᓂᔑᑲᑲᐁᐦ | *WANISHKAAKWH | Wake Up* (**Appendix E**), which has been adopted by regional government and is currently being circulated for Cree entities to sign onto. The team also participates, along with the public health climate change teams from regions 10 and 17 in the climate change working group, hosted by the Nord du Québec Conférence Administrative Régionale.

The Environmental Health team have been very active in responding to the 2023 forest fires in the region, and in preparations and planning for future fire events. During the fire season, the team conducted daily smoke monitoring and gave regular updates on smoke with health recommendations to community and health partners. The team also provided technical assistance to community partners in planning and establishing clean air shelters, offering residents safe indoor spaces to escape hazardous smoke and poor air quality. Team members offered guidance on health impacts of smoke exposure and provided support for cleaning homes and fire-damaged camps after evacuations, assisting community partners, the public, and decision-makers.

The public health nutrition team has played an active role in addressing climate-related issues, particularly due to the significant impact of climate change on food security in the region. They collaborated in coordinating food deliveries during the forest fires, helping to ensure continued access to essential supplies when prolonged road closures disrupted regular delivery routes. This team also contributed to climate change-related food security initiatives by supporting community garden and greenhouse projects that take advantage of longer growing seasons. Following the summer 2023 evacuations, the public health nutrition team has developed guidance on food safety and healthy food options at evacuations sites following concerns about available food options.

Outside of public health, other teams of the CBHSSJB are involved in climate change-related activities. The *Conseil des médecins, dentistes et pharmaciens* (CMDP) has recently started an environmental health committee, which is largely focusing its activities on climate change mitigation.

The Material Resources Department is participating in MSSS *Plan pour une économie verte* (PEV) infrastructure project, intended to review the current climate vulnerabilities of buildings and infrastructures in the regional health system and to prioritize improvements.

The health infrastructure for region 18 is spread out across Eeyou Istchee with most buildings concentrated in Chisasibi and Mistissini. It includes 44 services or administration buildings located across the nine communities, including a regional hospital in Chisasibi. In addition, 592 employee lodging units as well as administrative offices in Val d'Or, Montréal and Chibougamau are part of the CBHSSJB properties.

During the forest fires, several departments within the CBHSSJB played a critical role in emergency response efforts. This included preparing evacuation lists, coordinating the logistics for evacuating the most vulnerable patients, providing care and support for individuals with complex health needs, and assisting with broader community evacuations. Since the fires, significant work has been undertaken to strengthen emergency, and evacuation plans and to clarify roles and responsibilities across departments.

6.2

OVERVIEW OF COMMUNITY AND REGIONAL ORGANIZATIONS AND THEIR CLIMATE CHANGE INITIATIVES

6.2.1
Cree Nation Government (CNG)

The CNG has a regional leadership role in climate change in Eeyou Istchee through its Climate Change Unit, situated within their environmental and remedial works department (Cree Nation Government, n.d.-a). Other departments within CNG are involved in climate change-related issues to a smaller extent. The CNG leads many regional climate change-related initiatives, including:

Community mobilization, education, and information sharing

- Organizing the regional CCAC;
- Facilitating community participation at climate change events (e.g., Adaptation Futures 2023, Canadian Emergency Preparedness and Climate Adaptation Convention 2024);
- Organizing regional climate change events including the CRCF and the Eeyou Istchee Climate Change Adaptation and Environmental Emergency Preparedness workshop;
- Adopting the regional climate change declaration called *ᐗᓂᔥᑳᒄᐦ | WANISHKAAKWH | Wake Up* and inviting other Cree entities to sign it;
- Organizing several activities related to clmate change adaptation with regional fire marshals including forest fire fighters training, emergency preparedness activities (including providing support for communities in updating emergency plans), and FireSmart programs (FireSmart Canada, n.d.) to build community resilience to fires.

Monitoring and information gathering

- Cree Weather network involving the installation of seven new weather stations in three Cree communities and the centralization of existing weather and climate data on a CNG platform;
- Ice monitoring pilot project in Mistissini, in collaboration with McGill University;
- Wildlife monitoring expansion project where weather stations may receive Automatic Recording Units and Motus antennas to keep track of wildlife presence and migrations.

6.2.2
Cree Nations

Each of the nine Cree communities of Eeyou Istchee (Whapmagoostui, Chisasibi, Wemindji, Eastmain, Waskaganish, Nemaska, Waswanipi, Oujé-Bougoumou, and Mistissini) holds a degree of autonomy in their local governance under the JBNQA (Cree Nation Government, n.d.-b).

Each community is represented on the CCAC and has a local environmental department, which addresses local environmental concerns and initiatives. In addition, each Nation has its own Emergency Committee to lead local emergency planning and management.

Three communities (Whapmagoostui, Waskaganish, and Mistissini) have previously developed climate adaptation plans (Cuciurean et al., 2011). The extent to which these plans have been implemented is unclear.

Each community is responsible for developing and updating community emergency plans (Indigenous Services Canada, 2024). A regional contract is currently in place for an Indigenous emergency management specialist to work with each community to update their emergency response plan.

6.2.3
Cree Trappers Association (CTA)

The Cree Trappers Association (CTA) was incorporated in 1978 in accordance with the JBNQA (Cree Trappers Association, n.d.-a). The CTA's mandate is "protecting and promoting the interests and values of Eeyou/Eenou trappers, traditional pursuits, and governance of hunting territories in Eeyou Istchee. This mandate extends to the management of territory and wildlife resources and of environmental matters" (Cree Trappers Association, n.d.-b).

The main goals of the Association are "to foster, promote, protect and assist in preserving the way of life, values, activities and traditions of the Eeyou/Eenou trappers of Québec and to safeguard the traditional system of Eeyou/Eenou traplines" (Cree Trappers Association, n.d.-b).

The CTA works with its members to monitor and report on animals in the region and their migration patterns as well as traditional food harvests. They are a key entity in the region for gathering information on the effects of climate change as well as in providing information to their members.

6.2.4
The Eeyou Marine Region Wildlife Board (EMRWB)

The Eeyou Marine Region Wildlife Board (EMRWB) was established in 2011 under the Eeyou Marine Region Land Claims Agreement, an agreement between the James Bay Cree of Québec, Government of Canada, and the Government of Nunavut, for the islands and resources within eastern James Bay and part of southeastern Hudson Bay. The EMRWB is responsible for wildlife management and regulation of access to wildlife in the Eeyou Marine Region (Eeyou Marine Region Wildlife Board, n.d.), which positions them as key partner for adaptation planning and climate change mitigation.

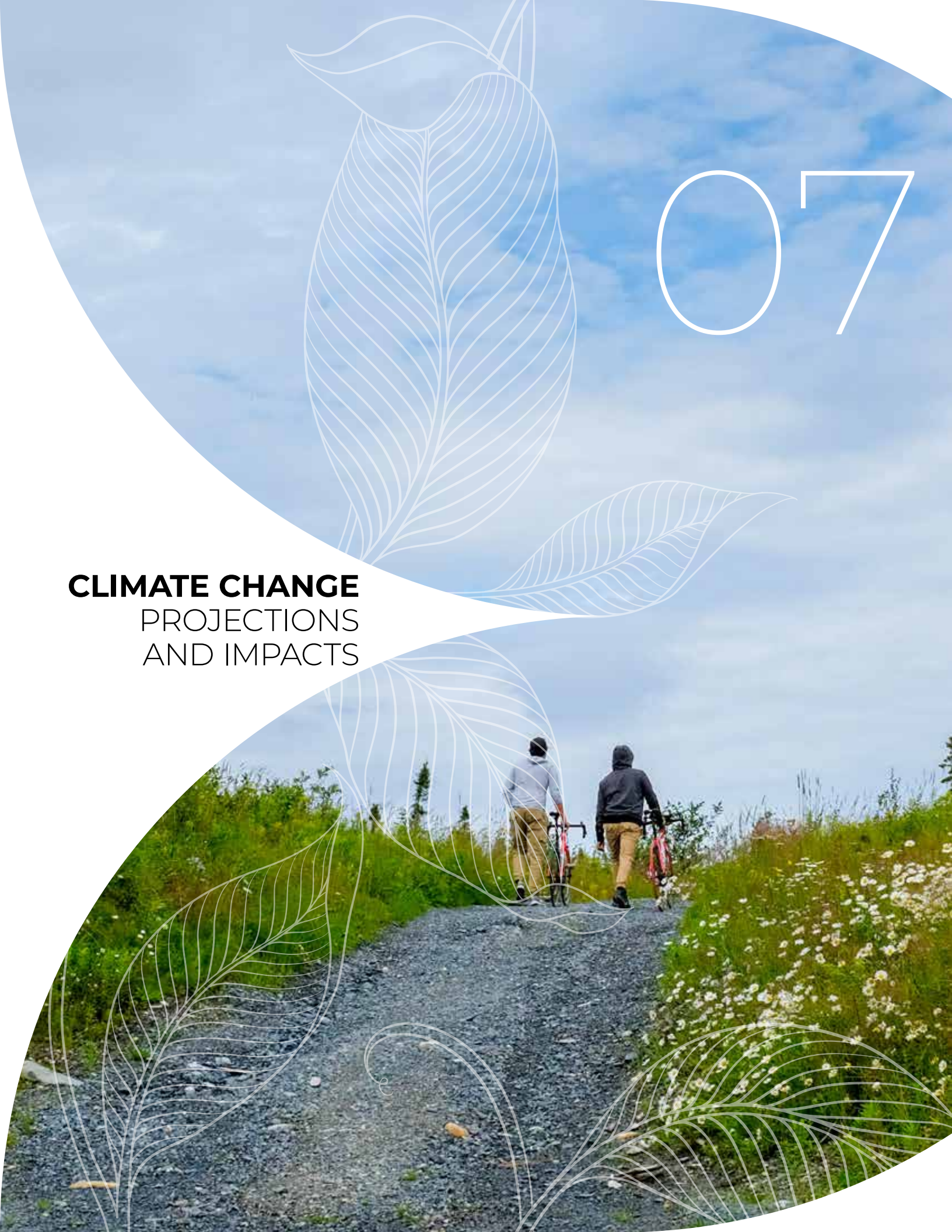
6.2.5
Cree School Board (CSB)

The Cree School Board (CSB) was established in 1978 as a result of the JBNQA. Its purpose is to "serve the Cree living in iiyiyiu aschii and to empower us to take control of our own education system as well as to protect our language, culture, and traditional pursuits" (Cree School Board, n.d.). CSB offers primary and secondary school education in all nine Cree communities. In addition, they offer adult education and post-secondary training

in the region, as well as social and financial support for students pursuing post-secondary education outside of Eeyou Istchee. Cree culture, language and traditional teachings are integrated into the CSB curriculum (Cree School Board, n.d.). The importance of passing traditional knowledge to younger generations and incorporating Two-Eyed Seeing has been highlighted in many discussions with Cree partners as key to addressing climate change in Eeyou Istchee (CNG & CBHSSJB, personal communication, April 11, 2024; CRCF Vox Pop, 2024). The CSB has policies that work with the changing climate, such as scheduling flexible dates for Goose Break, the school holiday scheduled around the spring goose hunt, which is subject to the arrival of migratory birds (Cree School Board, 2011).

07

CLIMATE CHANGE
PROJECTIONS
AND IMPACTS



CLIMATE CHANGE PROJECTIONS AND IMPACTS

The following sections describe climate hazards relevant to Eeyou Istchee and their impacts on Eeyouch/Eenouch. Recorded data on climate indicators is limited for the region: the north of Québec is in fact characterized by a scarcity of weather stations relative to the vastness of its territory, which generally produces less detailed climate projections than the ones available in the southern half of the province. Weather stations in northern Canada are often located at over 1000km from each other (Bush & Lemmen, 2019). However, Environment and Climate Change Canada's Regional Deterministic Reforecast System (RDRS v2.1), which integrates multi-variable meteorological and precipitation data, is considered to increase the reliability of the projections and provide an appreciable level of detail even in less monitored regions of North America (Hennigs & Bleau, 2017). Due to this, the subsequent sections draw upon a comprehensive review of both peer-reviewed and grey literature, as well as extensive consultations with Cree land-users, regional experts, and community key partners.

7.1 CHANGES IN TEMPERATURE

Annual mean temperatures have been rising across the arctic and subarctic, including Eeyou Istchee, for the past 100 years, with this pattern accelerating considerably in recent decades (Desjarlais & Blondot, 2010). However, temperature records exhibit considerable year-to-year fluctuations, driven by major atmospheric patterns which play a key role in shaping Eastern Canada's climate. Studies indicate that current climate models have difficulty accurately representing this variability, often showing discrepancies when compared to real-world observations (Hennigs & Bleau, 2017). These discrepancies highlight the importance of local observations in understanding and tracking temperature changes accurately. Therefore, all throughout this report, official data is complemented with information gathered during consultations with land-users and local experts.

Changes in temperature encompass multiple climate hazards, each with distinct effects. This section will focus on two crucial sub-hazards for Eeyou Istchee:

1. Warming summer temperatures
2. Changing ice conditions

This section also considers the crucial role of seasonality in the Cree way of life, eeyou pimatseewin. Eeyou/Eenou traditional activities are practiced across six seasons (**Figure 12**): Pipun (winter), Siikun (breakup – early spring), Miyuskamin (thaw season – late spring), Niipin (summer), Waastepikun (early fall) and Tikwaatin (freeze up – late fall) (Natural Resources Defense Council, 2020). Temperature shifts affect both overall climates, and the traditional Cree harvesting cycle, which is inextricably linked to physical, spiritual, mental health and well-being (Hennigs & Bleau, 2017).

FIGURE 12. THE SIX CREE SEASONS

Pipun (WINTER)

JANUARY → FEBRUARY

- Fur is top quality;
- Intensification of trapping of furbearing animals, primarily beaver, otter, marten and mink.

Siikun (BREAKUP)

MARCH → APRIL - EARLY SPRING

- Snow crust season;
- Hard snow makes travel on snow easier;
- Rise of moose hunting activities;
- Migration to spring camps to prepare for goose hunt.

Miyuskamin (SPRING)

MAY → JUNE - SPRING THAW

- School recess for goose break;
- Preparing for waterfowl hunting;
- Migration from camp to camp until subsistence hunters arrive at the community.

Niipin (SUMMER)

JULY → AUGUST

- Blueberry and fishing season.

Waastepikun (FALL)

SEPTEMBER → OCTOBER - EARLY FALL

- Intense moose, bear and small game hunting;
- Families move to their traplines and fall hunting camps.

Tikwaatin (FREEZE-UP)

NOVEMBER → DECEMBER - LATE FALL

- Limited activity due to thin ice;
- Trapping activities near camps;
- Pre-winter preparation period e.g. building winter camps or making winter clothing or snowshoes.

Note: Figure adapted from (Hennigs & Bleau, 2017).

Multiple climate indicators must be considered to understand regional vulnerabilities to a warming climate (**Appendices A** and **B**).

The indicators included in the analysis of vulnerabilities to **warming summer temperature** include:

- Mean annual temperature,
- Mean summer temperature,
- Number of days with maximum temperature over 30°C,
- Number of days with maximum Humidex over 30°C,

The indicators included in the analysis of vulnerabilities to **changing ice conditions** include:

- Mean spring temperature,
- Mean winter temperature,
- Mean autumn temperature,
- Freeze-thaw events,
- Number of days with minimum temperature below -25°C,
- First fall frost,
- Last spring frost,
- Annual frost days.

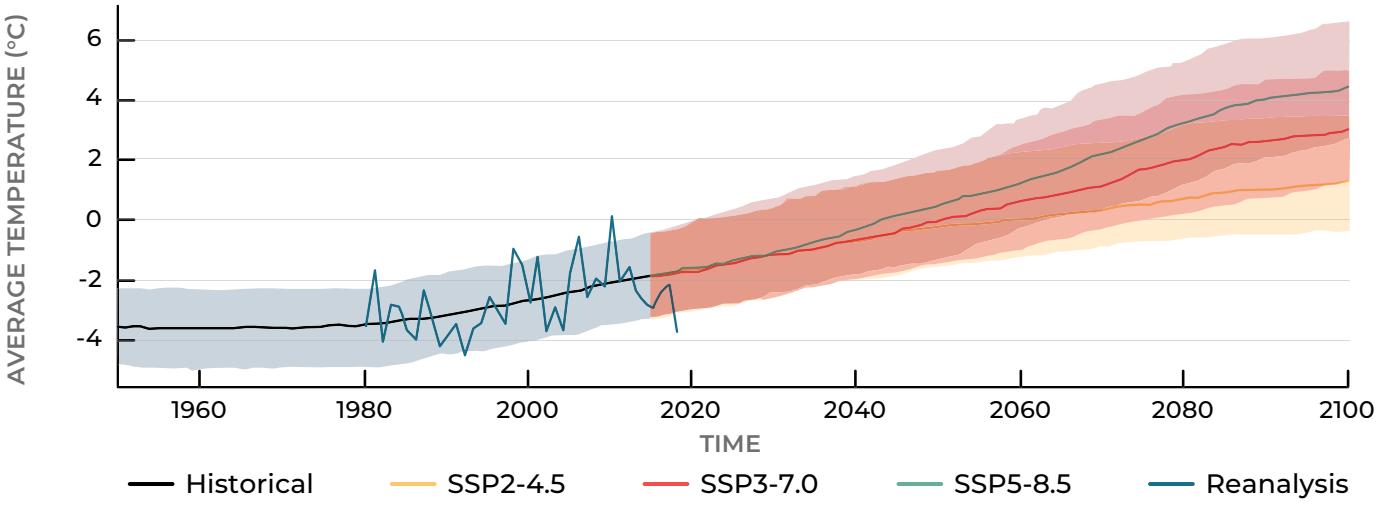
The regional historical climate data for each indicator listed as well as their projection over the 2041-2070 time period are presented in **Appendix A (Table A1)**.

7.1.1 Historical and Projected Data

Climate projections from the CMIP6 show that a general increase in temperature in Eeyou Istchee, will continue over the next 50 years and beyond (**Figure 13**). Annual mean temperature is expected to increase by 2.4 to 3.6°C from 2041-2070 (**Appendix A, Table A1**).

Although all communities are expected to experience a similar trend, climate indicators included in this analysis generally show more extreme changes in northern communities (Whapmagoostui, Chisasibi, Wemindji, Eastmain).

FIGURE 13. HISTORICAL (1991-2020) AND PROJECTED ANNUAL MEAN TEMPERATURES IN EEYOU ISTCHEE



Note: Data from Ouranos (2025).

Climate Projections for Warming Temperature

Summer temperatures in Eeyou Istchee are expected to increase from a mean value of 13.7°C (1991-2020) to between 15.7°C and 16.7°C in 2041-2070 (SSP2-4.5 and SSP5-8.5). On average, an additional 4 to 6 days with maximum temperatures over 30°C are expected each summer (SSP2-4.5 and SSP5-8.5) (**Appendix A, Table A1**). These projections apply to the entire territory of Eeyou Istchee. Community-specific projections show a faster trend of warming in some communities; up to 16 additional days above 30°C considering the SSP5-8.5 scenario (**Appendix A, Table A3**).

Similarly, regional projections indicate the average number of days with maximum Humidex over 30°C is likely to increase from 5 days to between 12 and 17 days per year (SSP2-4.5 and SSP5-8.5). Community-specific projections indicate this increase will be most significant in southern communities; with individual communities experiencing up to an additional 21 days of Humidex over 30°C (SSP5-8.5).

CMIP6 projections do not suggest that Eeyou Istchee will experience heat waves as defined by the *Direction de la Santé publique* (Gouvernement du Québec, 2023). However, additional heat exposure in summer months is significant as the population of Eeyou Istchee is generally not acclimatized to warm temperatures.

Eeyou Istchee experiences a distinct climate, with short but intense summer heat events that could pose risks to vulnerable populations, especially land-users and Elders. Following recommendations from the CBHSSJB public health department, Environment and Climate Change Canada has recently lowered the heat wave thresholds for Eeyou Istchee (daytime maximum temperature of 28 °C or higher and a nighttime minimum temperature of 16 °C or higher, for two consecutive days) (CBHSSJB, 2025). This marks an important step toward developing a heat warning system tailored to the realities of Eeyou Istchee.

Moreover, in Cree communities, high rates of chronic disease such as diabetes represent a populational vulnerability to heat (Kovats & Hajat, 2008). With warming annual mean temperature, annual *growing-degree days* will also increase by at least 28% (SSP2-4.5) in the region with important implication for vegetation and wildlife, notably an increase in invasive species (Hennigs & Bleau, 2017).

Climate Projections for Changing Ice Conditions

Between October and June, many Cree families travel by snowmobile to their traplines, which can be located hundreds of kilometres from their home communities. Cold weather is essential to maintain the quality of ice and snow necessary for safe travel. Rising temperatures and changes in precipitation are anticipated to impact both the quality of ice and snow, and the duration of safe travel periods. These changes are already impacting the ability of Eeyouch/Eenouch to travel and practice traditional activities, which in turn affects physical, mental, and spiritual wellbeing.

In Eeyou Istchee, mean temperatures across the territory are anticipated to increase in all seasons. Mean autumn temperatures are anticipated to increase by 2.0 to 3.0°C, mean winter temperature by 3.4 to 4.8°C, and mean spring temperature by 2.6 to 3.2°C (based on SSP2-4.5 and SSP5-8.5).

Community-specific projections show warming patterns greater than the regional average, in particular in the winter, when mean temperatures for some communities are expected to increase up to 6.4°C according to SSP2-4.5 and up to 7.9°C according to SSP5-8.5 (**Appendix A, Table A2**).

The length of time during which Cree families will safely have access to their territory by snowmobile is likely to diminish considerably in the upcoming 50 years (Joly et al., 2011; Senneville & St-Onge-Drouin, 2013). Across Eeyou Istchee, the first fall frost is projected to occur 14 to 17 days later than the historical average, and the last spring frost is projected to occur 9 to 14 days earlier (based on SSP2-4.5 and SSP5-8.5, respectively). At the community-specific level, the first fall frost is projected to occur up to 16 days later, and the last spring frost up to 20 days earlier (based on SSP5-8.5). Projections of the number of frost days show a similar decline (**Appendix A, Table A5**). Senneville and St-Onge (2013), estimate that during the 2041-2070 period, ice formation in eastern Hudson Bay and James Bay could be delayed by between 25 and 30 days and ice breakup could be advanced by 22 to 24 days. The same authors suggest that water temperature in James Bay may warm by around 1.26°C on average for the 2041-2070 period and foresee that winter ice thickness could be reduced between 30 and 50%.

Days when the minimum temperature falls below -25°C, which play a critical role in the thickening of ice, are projected to decrease by 21 to 27 days annually across the region, particularly in the communities of Whapmagoostui, Chisasibi, Wemindji, Eastmain, Waskaganish, and Nemaska. Under a high-emissions scenario (SSP5-8.5), this reduction becomes even more pronounced (**Appendix A4**).

Ice quality is not only impacted by temperature but also by changes in precipitation. Thin ice, slush and ice roughness are the main concerns for ice travellers. The increase in fall and spring liquid precipitation (rain) jointly with mild temperatures may contribute to the formation of slush over the ice. Most notably, projected winter liquid precipitations show an increase of 60 to 71% on average in the region for the 2041-2070 period. Solid precipitations (snow), which can have an insulating effect hindering ice thickness, are not projected to increase significantly over the next 50 years (**see Section 7.2 – Changes in Precipitation**) Ice conditions are typically analyzed through the lens of temperature and precipitation, but ice safety can also be influenced by other indicators for which no projections are available, such as warming waters from river plumes extending under sea ice (Beckmann, 2020).

Projections suggest that changes in the ice coverage in the region (a longer ice-free season and a decline of ice conditions) are likely to happen annually and gradually worsen over time. All communities could experience this sub-hazard, although coastal communities, reliant on sea ice travel, may experience it differently because of oceanographic changes induced by climate change that are unique to James Bay (Fink-Mercier et al., 2024). The faster rate of warming in the northern half of Eeyou Istchee also suggests that the communities of Whapmagoostui, Chisasibi, Wemindji and Eastmain may be more exposed to changing ice conditions.

7.1.2 Exposure Analysis

Climate projections for both sub-hazards show trends that could put the population of Eeyou Istchee at risk every season and every year over the next 50 years. The region and communities will be exposed to more frequent extreme heat events in the summer and changing ice conditions in autumn, winter and spring. The climate scenarios, the literature, as well as the consultations with regional experts led the Environmental Health team to assign this hazard a score of **30** and rate the intensity and likelihood of changes in temperatures in Eeyou Istchee as **6 – Very high** (**Table 12**). Every community was also rated individually, equaling a rating of **6**, as shown in **Table 13**.

TABLE 12. EXPOSURE TO TEMPERATURE CHANGES AT REGIONAL AND COMMUNITY LEVELS

		1	2	3	4	5	6
Temporal exposure		**RARE**	**VERY UNLIKELY**	**UNLIKELY**	**PROBABLE**	**LIKELY**	**ALMOST CERTAIN**
Frequency of occurrence		Hazards with return periods **>100 years.**	Occurs every **50 – 100 years** and includes hazards that have not occurred but are reported to be more likely to occur in the near future.	Occurs **every 20 – 50 years**	Occurs **every 5 – 20 years**	Occurs **every 5 years** or less	**The hazard occurs annually.**
Probability of occurrence		**Less than a 1%** chance of occurrence in any year.	**Between a 1-2%** chance of occurrence in any year.	**Between a 2 – 10%** chance of occurrence in any year.	**Between a 10 – 50%** chance of occurrence in any year.	**Between a 50 – 100%** chance of occurrence in any year.	**100% chance of occurrence in any year.**
Duration of exposure (over the course of a given year)		**Less than a day**	**<5 days**	**5 to 10 days**	**10 to 20 days**	**Season**	**Continuous**
Spatial exposure		**NONE**	**VERY LIMITED**	**LIMITED**	**MODERATE**	**HIGH**	**VERY HIGH**
Extent of exposure	**Across the region**	**Very localized** (a few individuals)	**Localized** (neighborhood or sector of a community)	**One** communities	**Multiple** communities	Either **all coastal** or **all inland** communities	**All of Eeyou Istchee**
	Commu-nities	Less than **5%** of the community	**5 to 10%** of the community	**10 to 25%** of the community	**25 to 50%** of the community	**50% to 75%** of the community	**More than 75% of the community**

TABLE 13. EXPOSURE RATING TO TEMPERATURE CHANGES FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

LOCATION	FREQUENCY OF OCCURRENCE	PROBABILITY OF OCCURRENCE	DURATION OF EXPOSURE (over the course of a given year)	EXTENT OF EXPOSURE	EXPOSURE RATING
Eeyou Istchee	**6** **The hazard occurs annually**	**6** **100% chance of occurrence in any year**	**6** **Continuous**	**6** **More than 100 individuals**	**6** **VERY HIGH**
Whapmagoostui	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**6** Continuous	**6** More than 100 individuals	**6** Very high
Chisasibi	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**6** Continuous	**6** More than 100 individuals	**6** Very high
Wemindji	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**6** Continuous	**6** More than 100 individuals	**6** Very high
Eastmain	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**6** Continuous	**6** More than 100 individuals	**6** Very high
Waskaganish	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**6** Continuous	**6** More than 100 individuals	**6** Very high
Nemaska	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**6** Continuous	**6** More than 100 individuals	**6** Very high
Waswanipi	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**6** Continuous	**6** More than 100 individuals	**6** Very high
Oujé-Bougoumou	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**6** Continuous	**6** More than 100 individuals	**6** Very high
Mistissini	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**6** Continuous	**6** More than 100 individuals	**6** Very high

7.1.3
Potential Health-Related Impacts

Several types of impacts connected to changes in temperature induced by climate change have been identified for Eeyou Istchee:

- Impacts of heat exposure,
- Impacts on traditional activities,
- Impacts on culture,
- Impacts connected with changes to wildlife populations,
- Impacts related to water safety and security,
- Impacts related to vector-borne infections,
- Impacts related to infrastructure and property damage.

Impacts of Heat Exposure

During the summer months, warm temperatures can have negative impacts on a population not acclimatized to heat (Royer, 2016).

Many buildings in Eeyou Istchee, built in recent decades, were not designed with high heat management in mind. Air conditioning is uncommon in both homes and public spaces, leaving vulnerable populations without cooling options during heat events. Additionally, factors like higher humidity, lower wind speeds, and an earlier onset of warm temperatures in spring, when people are less acclimated to heat, could exacerbate these challenges as the climate continues to change.

Warmer temperatures may lead to heat-related disorders (including, in order of severity: heat cramps, heat exhaustion, and heat stroke) that can affect all populational groups (Health Canada, 2011). However, some people are more sensitive to the effects of heat (e.g., infants and young children, elders, and people with chronic conditions) or are at greater risk of heat injury because of their activities (e.g., land-users, outdoor workers, or people taking part in athletic activities) (Ebi et al., 2021; Health Canada, 2011). Heat exposure can also aggravate symptoms of existing chronic diseases, particularly respiratory and cardiovascular illness, diabetes, and renal disease (Kenny et al., 2010; Sarofim et al., 2016). During consultations held by the CCAC, participants raised concerns about potential small-scale heat-related health incidents. They also noted that with the rise in extreme heat events less adapted communities (e.g., communities not built to incorporate shade and few buildings with air conditioning) may need to displace vulnerable community members (e.g., elders and people with chronic conditions) to cooling shelters.

POTENTIAL IMPACT	▸ Heat-related disorders (in order of severity: heat cramps, heat exhaustion, and heat stroke) ▸ Aggravation of chronic medical conditions
TYPE OF IMPACT	▸ Injuries, aggravated symptoms for vulnerable groups, fatalities
VULNERABLE POPULATION	▸ Population not acclimated to heat, populational groups with chronic medical conditions, infants and young children, elderly population, people working or spending time outdoors

Impacts on the safety of traditional activities

During the winter months, Eeyouch/Eenouch travel across the ice on snowshoes or snowmobiles to access their camps and traditional resources, relying on specific ice conditions (thickness, roughness, ductility, etc.) to travel safely. Eeyouch /Eenouch rely on intergenerational TEK to know when and where it is safe to travel. Warming temperatures can cause slush to form over the ice, late fall ice formation, and earlier spring break up. Cree land-users reported greater numbers of injuries and fatalities from individuals falling through unexpectedly thin ice, during earlier than expected melts or later than expected freezes (Hennigs & Bleau, 2017; Royer, 2016). Ice under snow cover thickens best with very cold air temperatures, however the average numbers of days below -25°C in Eeyou Istchee is projected to decrease between 43 to 47% (SSP2-4.5, SSP5 8.5). Impacts for families occupying inland and coastal traplines may differ because sea ice conditions may also vary based on cumulative effects of climate change such as changing currents, tidal forces, wind patterns and water salinity (U.S. EPA, n.d.). Similarly, participants to CCAC consultations noted the risk of evacuation of people becoming stranded due to sudden melts or significant weather shifts.

POTENTIAL IMPACT	▸ Decrease in ice safety ▸ Changes in snow conditions on traditional travelling routes (slush, etc.)
TYPE OF IMPACT	▸ Injuries, hypothermia, drowning, fatalities ▸ Injuries, fatalities, psychosocial impacts
VULNERABLE POPULATION	▸ Land-users and their families

Impacts on Culture

Eeyou/Eenou land-users have reported that they can no longer rely on traditional methods to assess the ice conditions (Foro et al., 2013; Royer, 2016). Land-users' loss of a sense of safety while travelling through their ancestral territory and using their cultural knowledge, as they have since times immemorial, is reported to affect their sense of identity as stewards of the land and as providers for their families (Cuciurean et al., 2011). In this context, changes in temperature, in addition to other changes to the environment (e.g. forestry, mining), contribute to a general feeling of **solastalgia** that is defined by Albrecht as "*the pain or sickness caused by the loss or lack of solace and the sense of isolation connected to the present state of one's home and territory*" (Albrecht et al., 2007). The inability to freely move through the land and perform culturally important activities is particularly felt by land-users and especially land-users who are youth and elders and rely on traditional knowledge to safeguard and protect the land for future generation.

POTENTIAL IMPACT	▸ Decrease in the reliance on Cree traditional knowledge
TYPE OF IMPACT	▸ Psychosocial impacts, loss of cultural identity, loss of opportunities to pass on knowledge and skills to future generations, solastalgia
VULNERABLE POPULATION	▸ Land-users, youth, elders

Impacts Connected with Changes to Wildlife Populations

Warmer annual temperatures across Eeyou Istchee could impact the health, quality and distribution of some wildlife species on which Cree land-users rely for their sustenance. More southern species may take advantage of the warmer climate to extend their distribution further north, which could lead to a replacement of the northern indigenous species (Cuciurean et al., 2011).

With the increase in number and extent of forest fires, the ecosystems of significant wildlife for Cree hunters may also be impacted. For example, Cree land-users report that the occurrence of a forest fire reduces the quality of nearby fish populations for a period of 5 to 10 years. This can lead to a decrease in the accessibility and quality of traditional foods for Cree families with implications to their physical, spiritual health and well-being (Cuciurean et al., 2011). Temperature is but one hazard that may have impacts on wildlife populations significant for subsistence. This topic will be elaborated more thoroughly in **Section 7.6 – Changes to Wildlife Populations**.

POTENTIAL IMPACT	▸ Changes in distribution of wildlife species important for subsistence ▸ Migration of new species from the south
TYPE OF IMPACT	▸ Decrease in food security, psychosocial impacts, loss of opportunities to pass on knowledge and skills to future generations. Shifts in the timing of harvesting Changes to species availability
VULNERABLE POPULATION	▸ Land-users and their families

Food and Water Safety and Security

Warmer temperatures will affect food security in a variety of ways. James (2023) expects that increased ambient temperatures will contribute to disruptions in food supply cold chains. Most of Eeyou Istchee is connected to the road network, but at a considerable distance from food distributors. The community of Whapmagoostui, however, is only accessible by plane year-round and by boat in the summer which poses many challenges to the food supply cold chains in the warm months. Increased ambient temperatures impact the food supply cold chain during the harvest and pre-cooling step and during commercial transportation. Disruptions to the food supply cold chains present risks for foodborne pathogenic bacteria, mostly during the summer months, particularly with unrefrigerated cargo holds transported by plane (James, 2023). Spoilage of food on route to Eeyou Istchee, due to prolonged transport during warmer conditions could also limit the availability of food in grocery stores in Eeyou Istchee and drive up already high prices (Vinet-Lanouette & Godin, 2024).

Moreover, a warming climate is shifting the timing of harvesting seasons and altering ecosystems and habitats in ways that impact species reproduction. This has led to declines or even extinction of species that are integral to traditional livelihoods and has profound repercussions on physical and mental health and well-being (*Climate Forum Vox Pop*, 2024).

The CCAC also raised the issue of elevated surface water temperature increasing the risk of different microbiological growths. This is of particular concern because many Crees collect their own water from alternative water sources at their camps or to use at home instead of the available tap water.

POTENTIAL IMPACT	▸ Foodborne illness due to an impact on cold supply chain ▸ Contamination of alternative and traditional water supplies
TYPE OF IMPACT	▸ Food and water related illnesses, fatalities
VULNERABLE POPULATION	▸ All populational groups

Impacts Related to Vector-Borne Infections

With annual mean temperatures projected to increase by 2.4 to 3.6°C as well as an increase in the number of growing degree days between 28% and 45% depending on climate scenario (SSP2-4.5, SSP5-8.), new animal and insect species currently limited to southern Québec may extend their distribution north bringing with them vector-borne diseases such as Lyme disease and West Nile virus (WNV) currently not present in the region. The black-legged tick (*Ixodes scapularis*) is responsible for the propagation to humans of the bacteria

responsible for several diseases including Lyme disease, Anaplasmosis and Babesiosis. Predictive modelling varies with regards to the time for *Ixodes scapularis* to enter Eeyou Istchee. Ripoche et al.'s model suggests it becoming established in the whole region by 2045-2050 (Ripoche et al., 2022) while another model predicts that the ticks could be established in southern parts of the region by 2080, with the extent of the region varying greatly between SSP2-4.5 and SSP3-7.0 scenarios (INSPQ, 2024a).

Although the main burden of WNV has been seen in the south of the province, positive human cases have been reported in residents of neighbouring regions Saguenay Lac St-Jean and Abitibi-Temiscamingue (INSPQ, 2024b). It should be noted that place of residence may not necessarily align with place of transmission. However, small numbers of birds positive for WNV have also been reported in recent years in Saguenay Lac St-Jean and Abitibi-Temiscamingue (INSPQ, 2023, 2024c). The presence of WNV in neighbouring regions may currently be explained by human movement or bird migration, rather than the local presence of infected vectors in Eeyou Istchee. Warmer climates and increased precipitation may, nonetheless, make parts of northern Canada, including Eeyou Istchee, habitable to species of mosquitos that carry WNV in the future (Rosenkrantz, 2022). One mosquito known to carry WNV, *Cx. restuans*, has previously been detected near the community of Waskaganish (Canadian Biodiversity Information Facility, n.d.).

Changes in the distribution of harmful insects have a dual impact on the Eeyou Istchee population, affecting the health of humans and of the wildlife Cree families rely upon for sustenance and culture. For example, the winter tick (*Demacentor albipictus*), while not harmful to humans, adversely impacts moose and caribou populations, important to the Cree way of life (Canadian Wildlife Health Cooperative, n.d.). Land users, including youth and elders as well as outdoor workers, are more likely to be negatively impacted by these shifts due to their prolonged and regular presence on the land, which increases their exposure to disease-carrying insects and the broader ecological impacts of these changes. Additionally, new dangerous species might discourage people from using their traditional territories for fear of infection. These issues will be further detailed in **Section 7.6 - Changes to Wildlife Populations**.

POTENTIAL IMPACT	▸ Changes in the distribution of invasive insects and vector-borne illness
TYPE OF IMPACT	▸ Infectious disease, food security, psychosocial impacts
VULNERABLE POPULATION	▸ Land-users, elders, youth, outdoor workers

Impacts Related to Infrastructure and Property Damage

Changing temperatures may also have negative effects on all types of infrastructure in Eeyou Istchee. With regards to property damage, warm temperatures and rapid snow melts were noted to lead to potential flooding, power outages, or the development of mould (Indigenous Climate Hub, n.d.-a). With increasing total precipitation and mean annual temperature, a general increase in humidity may be witnessed over the 2041-2070 period. High humidity contributes to the proliferation of airborne fungus spores and other allergens and increases the survival time of other pathogens, such as bacteria and viruses (ClimateData, n.d.-a).

Higher humidity may increase the occurrence of mould in homes, classrooms and public buildings. Poor indoor air quality and mould are an ongoing issue in northern communities (Kovesi et al., 2022), where overcrowding along with high daily temperature amplitudes and a lack of proper ventilation systems cause condensation in buildings. The higher proportions of dwellings where major repairs are needed and of dwellings with more than one person per room in Eeyou Istchee compared with the rest of Québec have already been discussed in **Section 5 – Populational Portrait**.

Furthermore, a general lack of maintenance contributes to mould growth and poor indoor air quality, which can be especially detrimental to children, youth, elders, pregnant women and people with existing respiratory conditions (Kovesi et al., 2022; National Collaborating Centre for Aboriginal Health, 2017). Children and youth, whose respiratory and immune systems are still developing, are especially susceptible to mould-related allergies and respiratory illnesses (U.S. EPA, 2024).

In addition to respiratory illness, mould, overcrowding and inadequate housing can be a source of psychosocial distress (National Collaborating Centre for Aboriginal Health, 2017). In regions where housing is limited and where public buildings are important community gathering spaces, closing buildings for mould mitigation can be extremely disruptive (Clark et al., 2022). Health and social services may also be impacted if the facilities they operate in are temporarily closed and overcrowding may worsen if people need to relocate or stay with relatives while mould remediation is underway.

POTENTIAL IMPACT	▸ Increased humidity of buildings ▸ Increase in the occurrence of mould in public buildings, healthcare buildings and residential homes
TYPE OF IMPACT	▸ Property damage, infectious diseases, mould allergies and respiratory illness ▸ Property damage, mould allergies and respiratory illness
VULNERABLE POPULATION	▸ All populational groups ▸ Elders, children and youth, people with chronic conditions

7.1.4
Severity of Potential Impacts

The Environmental Health team rated the consequences of changes in temperature as presented in **Table 14**. This gave an overall score of **9**, which translates to a rating of **4 – Severe**.

TABLE 14. SEVERITY OF POTENTIAL IMPACTS TO CHANGES IN TEMPERATURE

	0	1	2	3	4
	NONE	**MINOR**	**MODERATE**		
FATALITIES		Could result in fewer than five fatalities within the community.			
INJURIES		Could injure fewer than 25 people within community.			
EVACUATION			Could result in 100-500 people being evacuated, sheltered-in-place or stranded.		
PROPERTY DAMAGE		Could cause minor and mostly cosmetic damage.			
CRITICAL INFRASTRUCTURE SERVICE DOMAIN		Could disrupt 1 critical infrastructure service.			
ENVIRONMENTAL IMPACT			Could cause major but reversible damage. Full clean up difficult.		
BUSINESS/ FINANCIAL IMPACT	Not likely to disrupt business/financial activities.				
PSYCHOSOCIAL IMPACT		Significant psychosocial impacts including limited panic, hoarding, self-evacuation and long-term psychosocial impacts.			

7.1.5
Regional Response to Changes in Temperature

Regional response plans to changes in temperature was rated based primarily on consultations with regional and community partners. Existing measures addressing changes in temperature, along with most recommendations for improvement, primarily tackle heat response and ice safety.

Climate Change Advisory Committee Consultation

During this consultation, the committee identified the following initiatives as already existing in the region.

Heat response:

- Notifications on heat events providing advice on how to stay cool.
- Modifying the hunting season by scheduling a floating week of school holidays for the goose hunt (i.e., Goose Break) to adapt to changing weather conditions and timing of the goose migration.
- Preparing for longer and more intensive fire seasons by offering FireSmart programs, seasonal fire fighter training, and improving warning systems from fire departments to the affected communities.
- Community gardens and greenhouses to leverage longer growing seasons.

Ice safety:

- Ice monitoring during spring and along the coast in fall and winter.
- Ice safety programs to help community members detect thin or unsafe ice.
- Ice rescue training programs.
- CTA-ran air transportation (airplane or helicopter) program to help land-users unable to access their traditional hunting grounds by road or snowmobile during Goose Break.

CCAC members also proposed a series of strategies and interventions to strengthen regional capacity to adapt to temperature changes, including:

- Enhancing weather forecasting and monitoring systems.
- Establishing early warning systems for extreme weather events.
- Preparing for increased frequency and severity of extreme heat events through:
  - Raising public awareness on symptoms of heat-related illness, such as heat-stroke.
  - Increasing community access to drinking water (e.g., installing more water fountains, or providing free access to drinking water or spring water).
  - Expanding access to air conditioning by offering subsidies for home air conditioning units and installing air conditioning systems in schools and other public buildings.
  - Setting up cooling stations during heat waves.
  - Implementing programs to check on elders and other vulnerable community members during extreme heat events.
- Providing additional first aid training in communities.
- Improve capacity to establish public shelters during extreme weather.
- Allocating relief funding for disasters such as fires and floods.
- Supporting additional agriculture and farming initiatives in the region.

Consultation with Fire Chiefs and Public Safety Officers

Consultations with this group focused on concerns about the storage of flammable materials, such as propane tanks. They expressed concerns about whether current storage in the region was suitable for increasingly hot summers. To prevent accidents, installing shading over tanks or moving tanks to cooler shaded areas was suggested as a possible response strategy.

Cree Regional Climate Forum Consultation

Rising temperatures were noted to impact wildlife, vegetation and precipitation patterns. In response to these changes, people have adopted several strategies. Participants reported shifting modes of transportation (e.g. using boats or helicopters instead of snowmobiles) and their activities for safety concerns. Helicopters are increasingly used for safe transportation in coastal areas,

while boats are preferred in southern regions. Activities like scraping moose hides are now done late at night or early in the morning to avoid heat. During Goose Break, supplies are transported earlier in the season when ice and snow conditions are more stable. Smoking fish and meat have become a more common practice to prevent contamination from insects. Community members stress the importance of listening to Elders, whose knowledge of the land and traditional practices offers guidance in adapting to environmental changes. Spending more time on the land has also been emphasized as a way to strengthen connections with the environment and gain the necessary knowledge to navigate these shifts.

The region's response to climate change and health impacts was rated as **3 – Moderate** (**Table 15**), reflecting a growing awareness and response to temperature changes but also highlighting areas for improvement to better address the challenges of a warming climate.

TABLE 15. REGIONAL RESPONSE RATING TO CHANGES IN TEMPERATURE

	0	1	2	3	4	5
RESPONSE	NONE	VERY LOW	LOW	MODERATE	MODERATE TO HIGH	HIGH
Eeyou Istchee				◆		

7.1.6 Confidence Scale

The confidence in exposure to changes in temperature is rated as **high** for Eeyou Istchee. There is robust evidence that the temperature has been rapidly increasing in the region.

The confidence in severity of impacts due to changes in temperature is rated as **high** for Eeyou Istchee and its communities since temperature affects all the climate hazards listed in this report. The confidence in the response to changes in temperature is rated **high** for Eeyou Istchee since the region has some experience implementing adaptation measures to counter temperature-related health impacts such as heat waves and accidents due to dangerous ice conditions.

7.1.7
Assessment of Regional Vulnerabilities to Changes in Temperature

By applying the risk assessment formula (**Table 16**), the Environmental Health team arrived at a vulnerability rating of 5-Extreme based on the following formula **Exposure (6) + Impact Severity (4) - Response (3) = 7**. This rating indicates extreme regional vulnerability to temperature changes. In other words, while some adaptation strategies are already in place to mitigate the effects of these changes, these are limited in the face of the combined exposure to and severity of the hazard. This final rating highlights the urgent need to increase support for regional response measures to address the significant impacts temperature changes are expected to have on the health and well-being of the population of Eeyou Istchee.

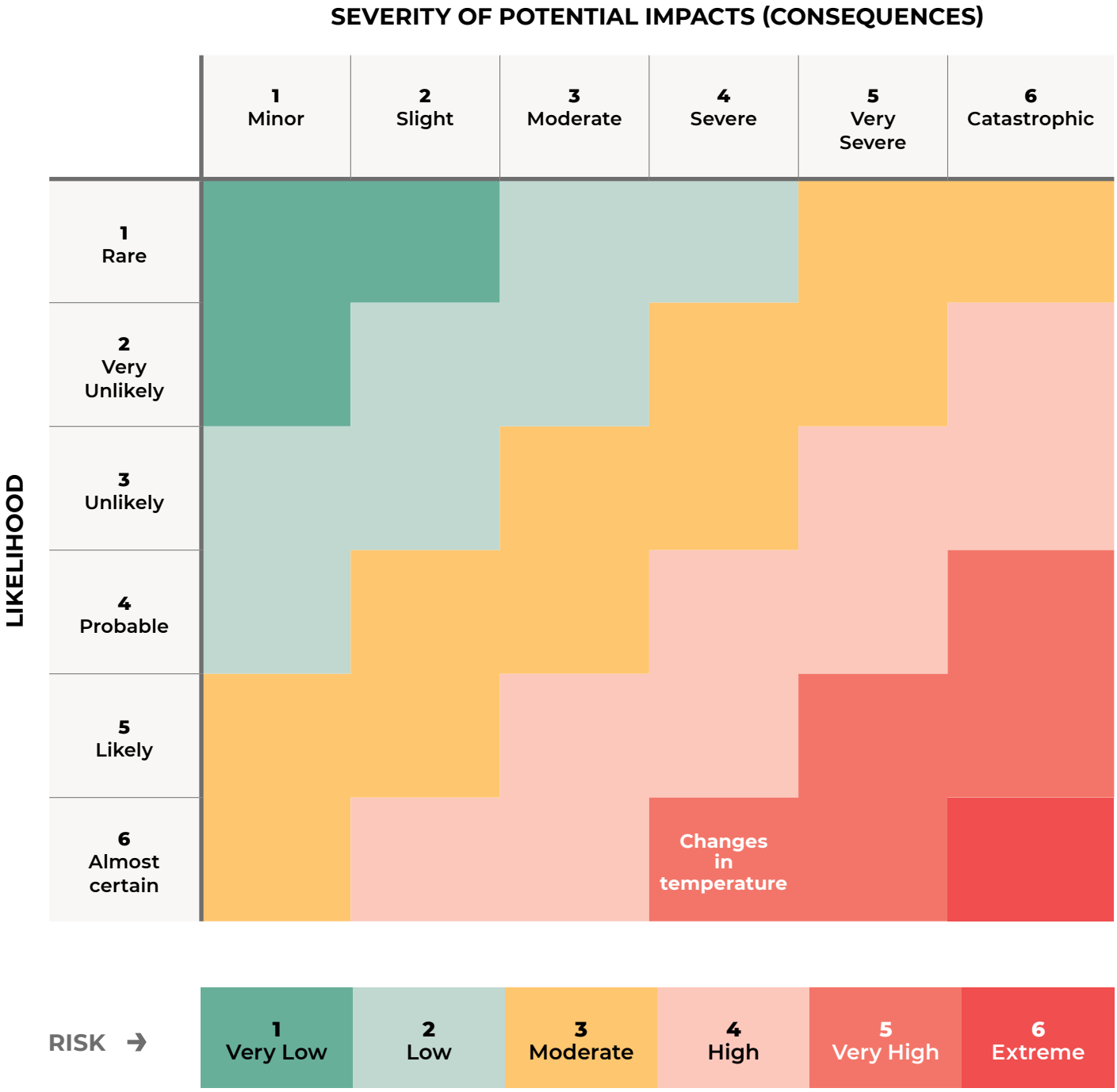
TABLE 16. CLIMATE HAZARD VULNERABILITY RATING OF TEMPERATURE CHANGES

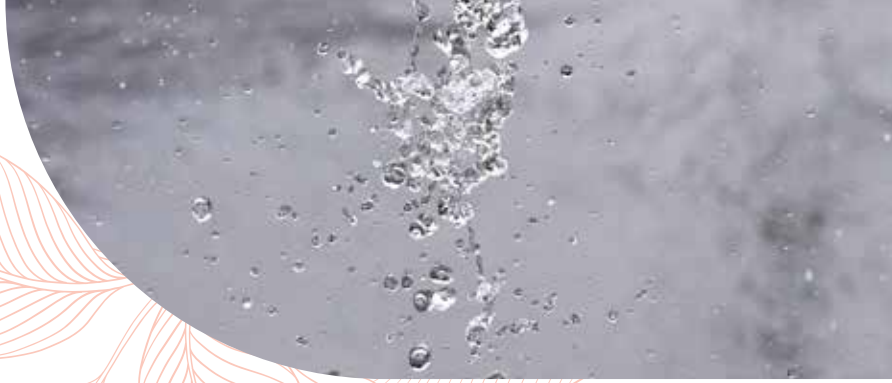
Calculated value (Exposure + Impact Severity – Response)	*2*	*3*	*4*	*5*	*6*	***7+***
Vulnerability rating	**0**	**1**	**2**	**3**	**4**	**5**
Vulnerability to climate hazard	**NONE**	**LOW**	**MODERATE**	**MODERATE TO HIGH**	**HIGH**	**EXTREME**

7.1.8
Risk Assessment

Based on the likelihood (**6 - Almost certain**) and impact severity (**4 - Severe**) calculated above, the risk associated to changes in temperature was identified as **5-Very high** (**Table 17**).

TABLE 17. RISK ASSESSMENT OF CHANGES IN TEMPERATURE





7.2 CHANGES IN PRECIPITATION

Projected changes in precipitation over the next 50 years in Eeyou Istchee are expected to influence a wide range of other climate hazards, including forest fires, landslides and erosion, shifts in wildlife populations, and changes in vegetation. Due to the high degree of interconnectedness between these hazards, some of the impacts introduced here are explored in greater detail in other sections of this report.

7.2.1 Historical and Projected Data

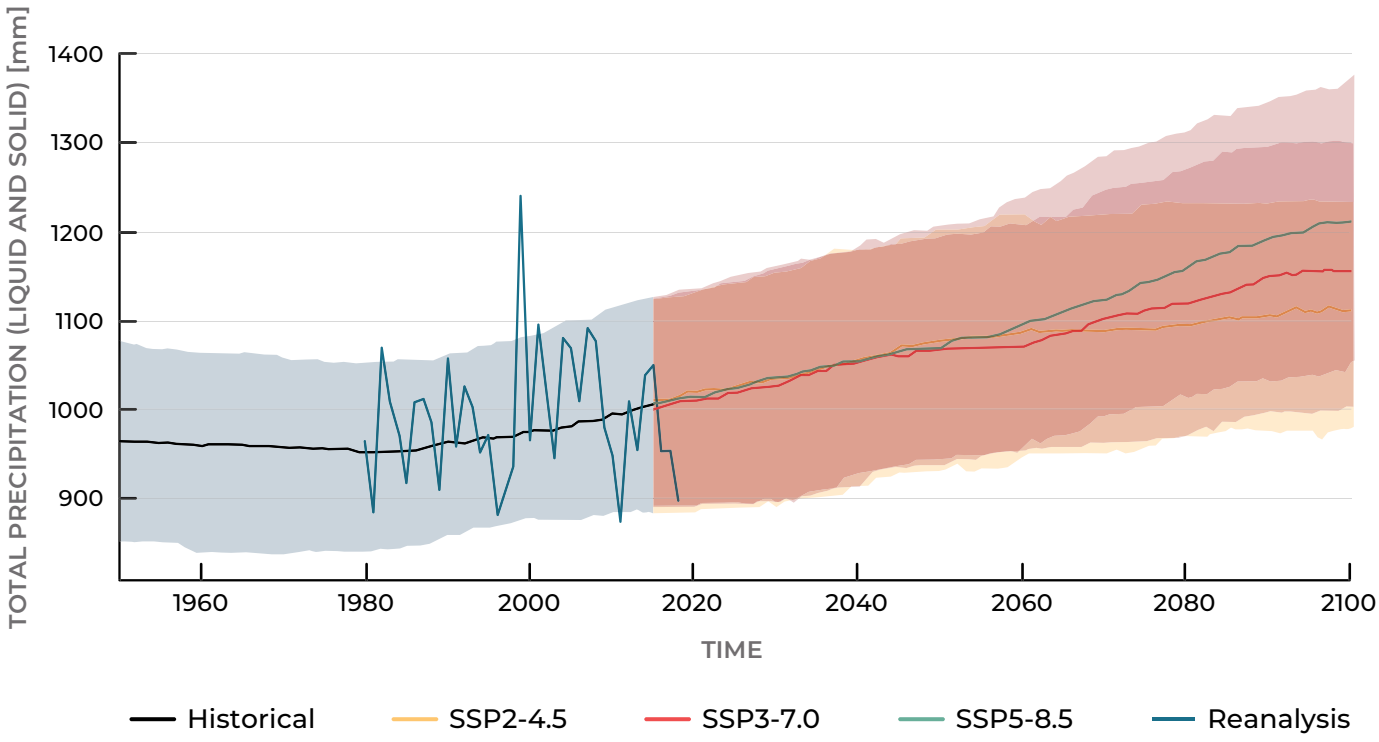
Due to limited resources on historical precipitation data, historical precipitation patterns are difficult to assess. Only three regional meteorological stations have data spanning over more than 25 years (Niemi et al., 2016). The territory is ocated in the subarctic climate zone and is characterized by “low average” precipitation around 765 mm annually (Royer, 2016). The region generally receives snow from late October to the end of April (Royer et al., 2013). Previous research on impacts of climate change on the region recorded an increase in rainfall, decrease in snowfall and an increase in unpredictable extreme weather events (flooding, thunderstorm) as compared to the past decades (Hennigs & Bleau, 2017).
To assess the regional climate vulnerability, ten climate indicators were used to illustrate the changes in precipitation patterns expected to happen over the next 50 years in Eeyou Istchee and Eeyou communities in the context of climate change, they can be found in **Appendix B**:

- Total annual precipitation,
- Total annual liquid precipitation (regional scale only),
- Total annual solid precipitation (referring to snow, regional scale only),
- Total winter precipitation,
- Wet days with more than 10 mm of precipitation,
- Wet days with more than 20 mm of precipitation,
- Maximum precipitation in 1 day,
- Maximum 5-day precipitation,
- Maximum number of consecutive dry days,
- Number of periods with more than 5 consecutive dry days.

The climate indicators above were extracted from the CMIP6 and generally show mean conditions over a 30-year period (historical or between 2041 and 2070). The regional historical climate data for each precipitation indicator listed, as well as their projection over the 2041-2070 time period, are presented in **Appendix B** (**Table B1**). Community-specific projections for the same precipitation indicators are available in the following tables of **Appendix B**. They may, however, not be good indicators of extreme events such as prolonged droughts or heavy rainstorms. To bridge this gap, a literature review of studies that specifically target droughts and storm occurrences in the region over the next 50 years was undertaken.

Overall, Eeyou Istchee James Bay territory is projected to experience increased rainfalls, an increase in the occurrence and intensity of storms and change in snowfall and characteristics (Hennigs & Bleau, 2017). The total annual precipitation in Eeyou Istchee is projected to increase by 10 to 12% over the 2041-2070 period, depending on the climate scenario SSP2-4.5 or SSP5-8.5 (**Appendix B, Table B1**). Regardless of scenario, increase in total annual precipitation are projected to occur over most of the region (**Figure 14**). Nevertheless, northern coastal communities are projected to receive the least amount of total precipitation of the region, as compared to inland communities.

FIGURE 14. HISTORICAL (1991-2020) AND PROJECTED TOTAL ANNUAL LIQUID AND SOLID ANNUAL PRECIPITATION IN EEYOU ISTCHEE



Note: Data from Ouranos (2025). The maps only display SSP5-8.5, 50th percentile projection. The blue rectangle shows an approximation of Eeyou Istchee's territory.

Annual liquid precipitations (rain) show a higher increase (approx. 12 to 13%) than annual solid precipitations (snow) which stay relatively constant on average over time across the region (**Appendix B, Table B2**). Winter total precipitation is expected to increase significantly (9% in SSP2-4.5 to 25% in SSP5-8.5) with the warming of winter temperatures (**Appendix B, Table B1**). Moreover, liquid precipitation in winter, which has historically been very low in the region, is projected to increase (**Appendix B, Table B1**). Royer (2016) has also observed an increased juxtaposition of liquid and solid precipitation during winter months. This, connected to an increase in freeze-thaw events in winter could lead to an increase in rain-on-snow events. The number of wet days with total precipitation over 1mm in winter will also increase by between 13 to 18% (SSP2-4.5 and SSP5- 8.5 respectively) (**Appendix B, Table B1**). The maximum 1-day precipitation indicator suggests that the intensity of heavy rain and snow events may increase by 12% (SSP2-4.5) to 19% (SSP5- 8.5) on average in the region. Additionally, the maximum 5-day precipitation indicator supports this data by showing an increase of 8 % (SSP2-4.5) to 10% (SSP5- 8.5) on average annually in Eeyou Istchee (**Appendix B, Tables B1 and B3**).

Community-specific projections follow similar trends. The occurrence of days with precipitation above 10 mm will increase by 21% (SSP2- 4.5) to 29% (SSP5 - 8.5) and days with precipitation over 20 mm will increase by 0 to 50% throughout the region for the same climate scenarios (**Appendix B, Table B4**), suggesting that heavy precipitation events will become gradually more likely over the next 50 years.

The literature suggests that the increase in annual snow loads between 1957 and 2003 in northern Québec has been a cause in the acceleration of permafrost thaw (Payette et al., 2004). While it is unclear how projected changes in precipitation patterns will influence permafrost thaw, since available projections indicate solid precipitation will stay relatively constant over the next 50 years in Eeyou Istchee, warmer temperatures may also contribute to the disappearance of permafrost in Eeyou Istchee.

Table B2 (**Appendix B**) shows the main increase in rain is primarily observed for fall (18 to 19%), winter (60 to 71%) and spring (26 to 27%), rather than summer (4%) based on SSP2 4.5 and SSP3-7. As hotter summer temperatures are also expected, evapotranspiration may cause more frequent droughts. An increase in water availability due to snow melt and a greater occurrence of precipitation could contribute to accelerating tree growth. According to Tables B4 and B5 (**Appendix B**), the projections for average maximum number of dry days (0 to -7%) and number of periods of at least 5 consecutive dry days (-13% across scenarios) appear to suggest a reduction in the risk of drought. However, these are mean conditions over 30 years and may hide the probability of occurrence of acute drought events. Conversely, the literature rather suggests a relative increase in drying in Eeyou Istchee and in most parts of Canada until the end of the century (Tam et al., 2018) which will be driven by warmer temperature rather than by changes in precipitation patterns. The implications of droughts in the context of this project and its impact on wildfires will be discussed in **Section 7.3 - Forest Fires**.

7.2.2 Exposure Analysis

Under SSP4.5 and SSP8.5, exposure to precipitation changes mainly involves more frequent heavy rainfall and droughts over the next 50 years. Warmer winters are also expected to shift snowfall into rainfall, changing overall precipitation patterns. The intensity and likelihood of changes in precipitation is assessed using climate indicators from **Appendix B** (**Tables B3 to B5**), which include Maximum 1-day and 5-day precipitation, Number of days with precipitation above 20 mm, Maximum number of consecutive dry days, and

Number of periods with at least 5 consecutive dry days. Data from these indicators suggest a significant increase in heavy rain and snow events across the region and all nine communities. While **Table B5** (**Appendix B**) shows a reduction in consecutive dry days, scientific literature indicates that rising temperatures—rather than precipitation trends—are the main drivers of drought, and their occurrence is expected to increase (**see Section 7.1– Changes in Temperature**).

The climate scenarios, the literature, as well as the consultations with regional experts led the Environmental Health team to assign this hazard a score of 24 and rate the exposure of Eeyou Istchee to changes in precipitation as **5 – High exposure** (**Table 18**). Because the climate indicators show little variability across each community, the same rating was proposed for all nine com-munities, as shown in **Table 19**.

TABLE 18. EXPOSURE TO PRECIPITATION CHANGES AT REGIONAL AND COMMUNITY LEVELS

		1	2	3	4	5	6
Temporal exposure		**RARE**	**VERY UNLIKELY**	**UNLIKELY**	**PROBABLE**	**LIKELY**	**ALMOST CERTAIN**
Frequency of occurrence		Hazards with return periods **>100 years.**	Occurs every **50 – 100 years** and includes hazards that have not occurred but are reported to be more likely to occur in the near future.	Occurs **every 20 – 50 years**	Occurs **every 5 – 20 years**	Occurs **every 5 years** or less	The hazard occurs **annually**.
Probability of occurrence		**Less than a 1%** chance of occurrence in any year.	**Between a 1-2%** chance of occurrence in any year.	**Between a 2 – 10%** chance of occurrence in any year.	**Between a 10 – 50%** chance of occurrence in any year.	**Between a 50 – 100%** chance of occurrence in any year.	**100%** chance of occurrence in any year.
Duration of exposure (over the course of a given year)		**Less than a day**	**<5 days**	**5 to 10 days**	**10 to 20 days**	**Season**	**Continuous**
Spatial exposure		**NONE**	**VERY LIMITED**	**LIMITED**	**MODERATE**	**HIGH**	**VERY HIGH**
Extent of exposure	**Across the region**	**Very localized** (a few individuals)	**Localized** (neighborhood or sector of a community)	**One** communities	**Multiple** communities	Either **all coastal** or **all inland** communities	**All** of Eeyou Istchee
	Commu-nities	Less than **5%** of the community	**5 to 10%** of the community	**10 to 25%** of the community	**25 to 50%** of the community	**50% to 75%** of the community	**More than 75%** of the community

TABLE 19. RATINGS OF EXPOSURE TO CHANGES IN PRECIPITATION FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

LOCATION	FREQUENCY OF OCCURRENCE	PROBABILITY OF OCCURRENCE	DURATION OF EXPOSURE (over the course of a given year)	EXTENT OF EXPOSURE	EXPOSURE RATING
Eeyou Istchee	**5** **Occurs every 5 years or less**	**4** **Between a 10 – 50% chance of occurrence in any year.**	**3** **5 to 10 days**	**6** **More than 100 individuals**	**5** **HIGH**
Whapmagoostui	**5** Occurs every 5 years or less	**5** Between a 10 – 50% chance of occurrence in any year.	**3** 5 to 10 days	**6** More than 100 individuals	**5** **High**
Chisasibi	**5** Occurs every 5 years or less	**5** Between a 10 – 50% chance of occurrence in any year.	**3** 5 to 10 days	**6** More than 100 individuals	**5** **High**
Wemindji	**5** Occurs every 5 years or less	**5** Between a 10 – 50% chance of occurrence in any year.	**3** 5 to 10 days	**6** More than 100 individuals	**5** **High**
Eastmain	**5** Occurs every 5 years or less	**5** Between a 10 – 50% chance of occurrence in any year.	**3** 5 to 10 days	**6** More than 100 individuals	**5** **High**
Waskaganish	**5** Occurs every 5 years or less	**5** Between a 10 – 50% chance of occurrence in any year.	**3** 5 to 10 days	**6** More than 100 individuals	**5** **High**
Nemaska	**5** Occurs every 5 years or less	**5** Between a 10 – 50% chance of occurrence in any year.	**3** 5 to 10 days	**6** More than 100 individuals	**5** **High**
Waswanipi	**5** Occurs every 5 years or less	**5** Between a 10 – 50% chance of occurrence in any year.	**3** 5 to 10 days	**6** More than 100 individuals	**5** **High**
Oujé-Bougoumou	**5** Occurs every 5 years or less	**5** Between a 10 – 50% chance of occurrence in any year.	**3** 5 to 10 days	**6** More than 100 individuals	**5** **High**
Mistissini	**5** Occurs every 5 years or less	**5** Between a 10 – 50% chance of occurrence in any year.	**3** 5 to 10 days	**6** More than 100 individuals	**5** **High**

7.2.3
Potential Health-related Impacts

Based on the literature review and consultations with stakeholders, five types of impact connected to changes in precipitation were identified for Eeyou Istchee:

- Impacts of heavy snowfall,
- Impacts related to water safety and security,
- Impacts on traditional activities,
- Impacts on mental health,
- Impacts related to infrastructure and property damage.

Impacts of Heavy Snowfall

Informed by prior consultations with stakeholders and historical and projected data, which suggested an increase in precipitation intensity (**Appendix B, Tables B2 and B3**) and a slight increase of risk in heavy snowfalls, health impacts related to heavy snowfalls are a growing concern for the region. These weather events are known to be disruptive of human activities and could lead to injuries and fatalities. Indigenous Peoples are twice as likely as the Canadian population to be unintentionally injured or to die in a motor vehicle crash (Short et al., 2013). Considering that the main modes transport in Eeyou Istchee are by snowmobile or cars (Hamadani, 2014), local populations could face higher risks of injuries during heavy snowfalls, especially land-users or workers who drive long distances during the winter months. Mortality rates of mobile-vehicle accidents in the past decades were all lower than 5 per 100,000 people (Ministère de la Santé et des Services sociaux, n.d.). Additionally, the physical constraints of heavy snowfall may impede quick and efficient health care delivery, either at home or in Community Miyupimaatsiiun Centers (CMC) and hospitals. The occurrence of such extreme and unpredictable weather events also affects the availability and accessibility of healthcare workers and services, as well as medical evacuations.

Finally, the link between snow shoveling and cardiovascular disease is well established (Stewart et al., 2017). In fact, an increase in the prevalence of heavy snowfall events could contribute to increase the risk of cardiovascular incidents, especially among the elderly and those suffering from cardiovascular diseases. While some studies have found link between number of snow days on incidence of cardiovascular-related admission in hospitals (Persinger et al., 1993; Polcaro-Pichet et al., 2019; Southern et al., 2006), others have indeed observed an increase in cardiovascular admissions during snowstorm days (Auger et al., 2017; Blindauer et al., 1999; Spitalnic et al., 1996). It is difficult to infer if the risk of cardiovascular incidents in Eeyou Istchee would be significantly impacted by the potential increasing occurrence of severe snowstorms. Average mortality rates for ischemic heart diseases in Eeyou Istchee were similar to Québec's rates, with no significant difference between both regions in the past decade (Ministère de la Santé et des Services sociaux, n.d.-c).

Consultations within the CCAC also discussed injuries and deaths related to snowstorms (e.g., motor vehicle accidents or cardiac events linked to shovelling) but felt uncertain about the expected number of injuries or deaths.

POTENTIAL IMPACT	HEALTH IMPACTS	VULNERABLE POPULATION
▸ Motor vehicle accidents	▸ Injuries, fatalities	▸ All groups, especially those most likely to be driving long distances during snowstorms (e.g., land-users, people who drive between communities or to remote sites, such as mines, for work)
▸ Stranded communities and school closures. ▸ Inability to access healthcare services	▸ Psychosocial impacts	▸ All groups
▸ Injuries and cardiac episodes during snow shovelling	▸ Injuries, fatalities	▸ Individuals with cardiovascular illnesses, Elders

Impacts Related to Water Safety and Security

Changing precipitation patterns would also impact bodies of water and water distribution on the territory, potentially affecting people's health in Eeyou Istchee. In the Hudson Bay, increased precipitation patterns are associated with higher streamflow in the Arctic (Champagne et al., 2023). Though not directly applicable to James Bay and Eeyou Istchee, a similar relationship may occur in the region, impacting wildlife, vegetation and ecosystems (Weltzin et al., 2003) (see **Section 7.6 - Changes to Wildlife Populations and Section 7.7 - Changes in Vegetation**). (Hennigs & Bleau, 2017), rated the sensitivity of watersheds to climate change as moderate but emphasised the lack of sufficient data for the region and hypothesizes that altered water levels and ecosystems due to changes in precipitation may impact populational health in Eeyou Istchee. CRCF 2024 Vox pop participants expressed concern about water accumulation in ditches (*CRCF Vox Pop*, 2024). They also noticed reduced water levels in reservoirs, on the land and along the shore, which have rendered some nautical areas unsuitable for boats.

Moreover, the ensuing ecological shifts in the region could have consequences on water availability, traditional activities, food security and traditional medicine. The health of the populations living on the territory is likely to be impacted by these changes, potentially resulting in an increased risk of water-borne disease, changing drinking water sources availability and challenges to access clean water for consumption (Belanger, 2021; NCCIH, 2022).

Although existing literature has examined the relationship between changing temperature patterns and enteric diseases associated with water safety, there is a notable lack of data on

the effects of changing precipitation patterns on safe drinking water. Disparity is mostly due to the varying rainfall impacts on the ecosystems, highlighting the need for more localized investigations (Hales, 2019). Duchenne-Moutien & Neetoo's review on climate change and emerging food safety issues (2021) illustrated that both reduction and increase in rainfall could have negative consequences on water safety, notably due to sewage runoff into freshwater sources. While affecting all populational groups, this could be particularly concerning for land-users and their families who may rely on traditional water sources (spring water) for extended periods of time while at their camps.

POTENTIAL IMPACT	**HEALTH IMPACTS**	**VULNERABLE POPULATION**
▸ Lower water levels	▸ Food insecurity, drinking water safety	▸ All populational groups
▸ More water accumulation	▸ Water-borne disease, drinking water safety	▸ All populational groups

Impacts on Mental Health

Given that Eeyou/Eenou identity and wellbeing are tied to their physical environment, the modification of weather patterns due to the climate crisis and subsequent potential environmental impacts would likely affect their mental health. There are potential psychosocial impacts of changing precipitations on traditional activities and food security, ice and snow-related fatalities, and potential flooding events, which could negatively affect the mental state and wellbeing. This is reflected in global trends and Canada specific studies indicating that climate change poses challenges related to ecological grief and anxiety (Middleton et al., 2020). The practice of traditional activities linked to food security such as harvesting and sharing food has been associated with improved mental health among Indigenous Peoples (Middleton et al., 2020). Specifically, land-based practices have been linked with better cultural pride, healing, and self-confidence among 20 to 30-year-old Eeyouch/Eenouch (Linklater-Wong, 2021). However, changes in traditional practices due to changes in precipitation and subsequent ecological impacts would likely have an impact on both mental health and Indigenous well-being.

Vecchio et al.'s review on global Indigenous mental health stated that direct and cumulative environmental changes due to climate change such as variability in rainfall, ice and snow coverage were linked to "expression of sadness, worry, fear, decreased sense of self-worth and emotional distress" (Vecchio et al., 2022). Downing & Cuerrier (2011) also note that reduced time spent on the land may adversely affect First Nations' ability to communicate in their native languages, as much of the vocabulary is closely related to the land. These consequences would have repercussions on one's cultural identity and mental health.

Psychological and behavioural impacts of people and communities affected by intense flooding events, and subsequent loss of personal property and belongings, the necessity to evacuate or relocate, and the financial burden and lengthy process to rebuild following a flood have been reported over short and long-term (Glenn & Myre, 2022), such as depression (Belcher, 2023; Gawrych, 2022), substance abuse, suicide and suicidal ideation (Middleton et al., 2020), post-traumatic stress disorder, feelings of isolation, family discord, and financial strain. According to the National Collaborating Centres for Public Health (NCPPH), long term evacuations are associated with social isolation, cultural dislocation, with Elders being particularly vulnerable (NCCPH, 2021). Belcher (2023) also emphasized how gradual climate change impacts can progressively affect mental health over time, and how increased morbidity and infectious disease resulting from extreme climate events can affect people's mental state. It is important to acknowledge that flooding events in Eeyou Istchee could have heavier psychological impacts due to the historic trauma of the large-scale flooding of the territory caused by James Bay Hydroelectric complex. Nemaska and Chisasibi have been relocated in the past, in anticipation of the expected floods caused by the hydroelectric projects during the 1970s and 80s (Pachano, 2011). By the end of the 1980s, more than 13,000 km^2 of land was flooded (Denton et al., 2018) including flooding of ancestral gravesites in the Eastmain and Rupert River watersheds (Huberman, 2022) and loss of major hunting territories (Cree Nation Government, n.d.-c). Eeyouch/Eenouch of several generations had and are still experiencing the psychological impacts of these forced relocations. Based on flooding events in other First Nation communities, it is important to note that addressing mental health impacts often becomes a second priority if essential needs, such as transportation and infrastructure, are not addressed (Belcher, 2023).

POTENTIAL IMPACT	▸ Changes in the territory
HEALTH IMPACTS	▸ Property damage, evacuation, displacement from home or community, stress and mental health issues
VULNERABLE POPULATION	▸ All groups

Impacts on Traditional Activities

Eeyouch/Eenouch's identity is intricately connected to their physical environment, with many social practices, traditions, and values derived from their ancestral lands. Increased solid precipitation in winter has implications for ice formation on water bodies used by land-users to access their territories. This could lead to more snow accumulation and present a barrier to the development of thick ice underneath. Royer et al. (2013) found that an increase in mean precipitation in winter and fall could lead to the formation of snow ice, which has a lower density and bearing capacity as compared to congelation ice. This, in addition to warming winter temperatures, will have negative effects for ice safety and the pursuit of traditional activities on the territory (Cuciurean et al., 2011).

The rate of snowmobile-related drownings for Indigenous Peoples is eight times higher than non-Indigenous in Canada (Canadian Red Cross, 2006; Durkalec et al., 2015). Royer (2017) highlighted the deep impact such fatal accidents could have among close-knit communities. It is important to note that numerous Eeyou/Eenou hunters are knowledgeable on local snow, ice, and weather patterns due to their personal experience (Royer et al., 2013). A 2010 report from the CBHSSJB revealed that drowning due to snowmobile accidents on ice was rare based on records between 1986-2006, but that since 2006 related fatalities increased, so did the general population concern on the matter (CBHSSJB, 2010). Rain-on-snow events, which are projected to increase during months when Eeyou/Eenou land-users are highly active on the land could also lead to travellers becoming stranded along travel routes when using snowmobiles. As Cree hunters are forced to abandon more traditional travel routes and rely less on traditional knowledge (Royer et al., 2013), access to traditional foods may become restricted, generating food insecurity (Royer, 2016; Royer et al., 2013).

Changing weather such as precipitation and snow fall could influence animal species related to Eeyou/Eenou food security. For instance, caribou has been observed to change its migration patterns based on snow accumulation (Hennigs & Bleau, 2017). Engaging in traditional activities is a way to ensure food security and maintain health. Previous interview in Nemaska highlighted the importance of access to traditional food for Eeyouch/Eenouch's wellbeing: "*I remember in Old Nemaska some people receive a few sicknesses, and they want to eat real food. When they eat real food, in two days the pain is gone*" (Royer et al., 2013).

Key informants have linked changing precipitation patterns to shifts in vegetation and wildlife distribution, including moss drying, impacts on fish spawning and migration, and a decline in beaver lodges (*CRCF Vox Pop, 2024*). Changes in precipitation affect vegetation coverage, which in turn influences wildlife and insect populations distribution (see **Section 7.7 - Changes in Vegetation and Section 7.6 - Changes to Wildlife Populations**).

These alterations in wildlife and vegetation may cause indirect health impacts in Eeyou Istchee, such as disruption of traditional diet and medicine and emergence of new illnesses (Hennigs & Bleau, 2017). Due to the close relationship Eeyouch/Eenouch have with their environment, and in particular land-users, the potential disruption of wildlife, watersheds and ecosystems would impede their traditional way of life, food systems and further exacerbate health disparities (Middleton et al., 2020).

POTENTIAL IMPACT	HEALTH IMPACTS	VULNERABLE POPULATION
▸ Decrease in ice safety	▸ Injuries, hypothermia, drowning fatalities, food insecurity	▸ Land-users
▸ Decrease on the reliance on Eeyou/Eenou traditional knowledge	▸ Psychosocial impacts, solastalgia, food insecurity	▸ Land-users, youth, elders, all groups
▸ Changes in snow conditions on traditional travelling routes (slush, etc.)	▸ Injuries, fatalities, psychosocial impacts	▸ Land-users, youth, elders
▸ Altered ecosystems and wildlife	▸ Food insecurity, solastalgia, impact on Eeyou/Eenou traditional knowledge and medicine	▸ Land-users, elders, all groups

Impacts Related to Infrastructure and Property Damage

Increased precipitation could lead to building and infrastructure damage through flooding, power outages and, in some cases, mould growth. As noted in **Section 7.1 – Changes in Temperature**, mould in infrastructure remains a problem following heavy rainfall or flooding events, as it is associated to allergic reactions and severe asthma (D'Amato et al., 2020; Rorie & Poole, 2021).

Run-off management could become a serious issue in some communities such as Whapmagoostui, which has experienced a major landslide event in 2021 (Durand et al., 2019). It has been found that severe rain events are more frequent during periods of heavy rain and during the spring, causing damage to streets, infrastructures (Downing & Cuerrier, 2011; Durand et al., 2019), and displacement of populations. CCAC members also observed that diminished snow accumulation can exacerbate flooding events due to intensified ground freezing. Similarly, participants from Eastmain's Regional Forum on Climate Change in 2018 raised concerns about poor housing quality, and the vulnerability to extreme weather events such as flooding. It has been found that rapid thaw and poor drainage was the origin of several basement floodings across the region (Cree Nation Government, 2019).

Essential health infrastructure may also be impacted by flooding or power outage events. The Environmental Health team ranked the individual resilience of transportation and access to important health infrastructures (CSLS/CMCs and hospitals) ranging between ***Marginal*** to ***Functional***. Energy distribution infrastructure, such as the electrical transmission lines, and the production plants could be impacted by flooding, severe storms and ice events (Hennigs & Bleau, 2017). Power outage was a concern for participants of the 2018 Forum in Eastmain (Cree Nation Government, 2019). CCAC members noted that precipitation changes would increase land erosion (e.g.: Erosion along the La Grande River in Chisasibi).

In the case of potential evacuation, the NCCPH noted that prolonged evacuations heighten the risk of developing addictions, negatively impact relationships, and can lead to increased intimate partner violence. Additionally, they are associated with a higher risk of chronic physical conditions, such as asthma and diabetes, as well as infectious diseases like tuberculosis and sexually transmitted and blood-borne infections (NCCPH, 2021).

POTENTIAL IMPACT	**HEALTH IMPACTS**	**VULNERABLE POPULATION**
▸ Spring flooding	▸ Property damage, evacuation, displacement from home or community, stress and mental health issues	▸ All groups
▸ Mould (post-flooding)	▸ Respiratory illnesses, allergies	▸ Children and youth, elderly, individuals with respiratory illnesses

7.2.4
Severity of Potential Impacts

The Environmental Health team rated the consequences of changes in precipitation as summarized in **Table 20**. This gave an overall score between **11** and **13**, which translates to a rating of **5 – Very Severe**.

TABLE 20. SEVERITY OF POTENTIAL IMPACTS OF CHANGES IN PRECIPITATION

	0	1	2	3	4
		MINOR	MODERATE	SEVERE	
FATALITIES		Could result in fewer than five fatalities within the community.	Could result in 5 –10 fatalities within the community.		
INJURIES		Could injure fewer than 25 people within community.	Could injure 25 –100 people within the community.		
EVACUATION				Could result in more than 500 people being evacuated, sheltered-in-place or stranded.	
PROPERTY DAMAGE		Could cause minor and mostly cosmetic damage.			
CRITICAL INFRASTRUCTURE SERVICE DOMAIN		Could disrupt 1 critical infrastructure service.			
ENVIRONMENTAL IMPACT			Could cause major but reversible damage. Full clean up difficult.		
BUSINESS/ FINANCIAL IMPACT		Could result in losses for few businesses.			
PSYCHOSOCIAL IMPACT		Significant psychosocial impacts including limited panic, hoarding, self-evacuation and long-term psychosocial impacts.			

7.2.5
Regional Response to Changes in Precipitation

Regional response to changes in precipitation (**Table 21**) was rated based primarily on consultations with regional and community partners. Existing response measures and recommendations primarily address snow removal, water irrigation and flood mitigation strategy.

Climate Change Advisory Committee Consultation

Consultations with the CCAC noted that several activities related to change in precipitation already existed. For instance, the Chisasibi High Ground has been established as a place where community members can gather in case of a flood affecting the community, which is located close to sea level but did not have specialized on-site infrastructures. Consultations also revealed that communities had culverts and drainage systems, provided updates on road conditions or road closure, and increased budgets for snow clearing operations. This list is not exhaustive but rather represents initiatives that the committee was aware of.

Although these response measures have not been implemented, the committee recommended the following additional activities as part of a future regional adaptation plan:

- More information about flood risk and water levels:
  - Getting access to existing information collected by other parties (e.g.: Hydro Québec) that could be relevant to the communities.
  - Collecting new data through studies on water levels in the lakes and in James Bay,
- Accounting for increasing flood risk and higher water levels in zoning plans and community planning.
- Protecting wetlands due to their important role in storm water and flood management.
- Preparedness for floods by:
  - Offering swimming lessons and water rescue training,
  - Setting up the Chisasibi High Ground to be an effective evacuation site by setting up infrastructure at the location,
- Preparing for snow and freezing rain through:
  - Identifying better strategies for de-icing roads,
  - Improving the quality of snow removal equipment and ensuring that there are resources (trained workers or funds to bring in external resources) to repair equipment when it breaks.
- Royer et al. 2013 also reported that the Vice-President of CTA in 2011 called for the implementation of new security and safety awareness programs to prevent accidents on ice.

Consultation and Fire Chiefs and Public Safety Officers Meeting

Participants noted a rise in road closures caused by flooding and icy conditions. They emphasized the importance of quickly sharing road condition updates with users and ensuring communities are equipped with enough supplies to remain self-sufficient for extended periods, a minimum of 7 to 10 days, during prolonged closures.

Cree Regional Climate Forum Consultation

Following the CRCF workshop on current and potential adaptation strategies, discussions highlighted a wide range of perceived impacts of increased precipitation — including changes to water bodies, weather patterns, landscapes, and wildlife. These changes were seen as directly affecting land travel, as well as harvesting and hunting seasons. In response to erosion and reduced land access due to higher precipitation, participants suggested digging ditches as a mitigation strategy. Other proposed adaptations included modifying water navigation practices in spring and winter to improve ice safety.

The region's response to precipitation changes was assessed as **3 – Moderate** (**Table 21**), reflecting a growing awareness and reaction to this climate hazard but also highlighting areas for improvement to better address the challenges of a warming climate.

TABLE 21. RESPONSE ASSESSMENT RATING

	0	1	2	3	4	5
RESPONSE	NONE	VERY LOW	LOW	MODERATE	MODERATE TO HIGH	HIGH
Eeyou Istchee				◆		

7.2.6 Confidence Scale

The confidence in assessment of exposure to change in precipitation patterns is rated as **moderate** for Eeyou Istchee and its communities, due to the unpredictability of weather events with existing models, and uncertainties surrounding the number of injuries/fatalities for precipitation-related events.

The confidence in the rating of severity of impacts due to change in precipitation patterns is rated as **high** for Eeyou Istchee and its communities.

The confidence in the response assessment to changes in precipitation is rated **moderate** for Eeyou Istchee. The region has implemented some strategies in response to heavy precipitations and dangerous ice conditions, but the scope of the measures is localized and may vary across communities.

7.2.7
Assessment of Regional Vulnerabilities to Changes in Precipitation

By applying the risk assessment formula (**Table 22**), the Environmental Health team arrived at a vulnerability rating of 5-Extreme. The vulnerability rating is calculated as follows: **Exposure (6) + Impact Severity (5) - Response (3) = 8**. Similar to vulnerability to temperature changes, while some adaptation strategies are already in place to mitigate the impacts of climate change, these are limited in the face of the combined exposure to and severity of the hazard. This final rating highlights the urgent need to increase support for regional adaptive measures to address the significant impacts precipitation changes are expected to have on the health and well-being of the population of Eeyou Istchee.

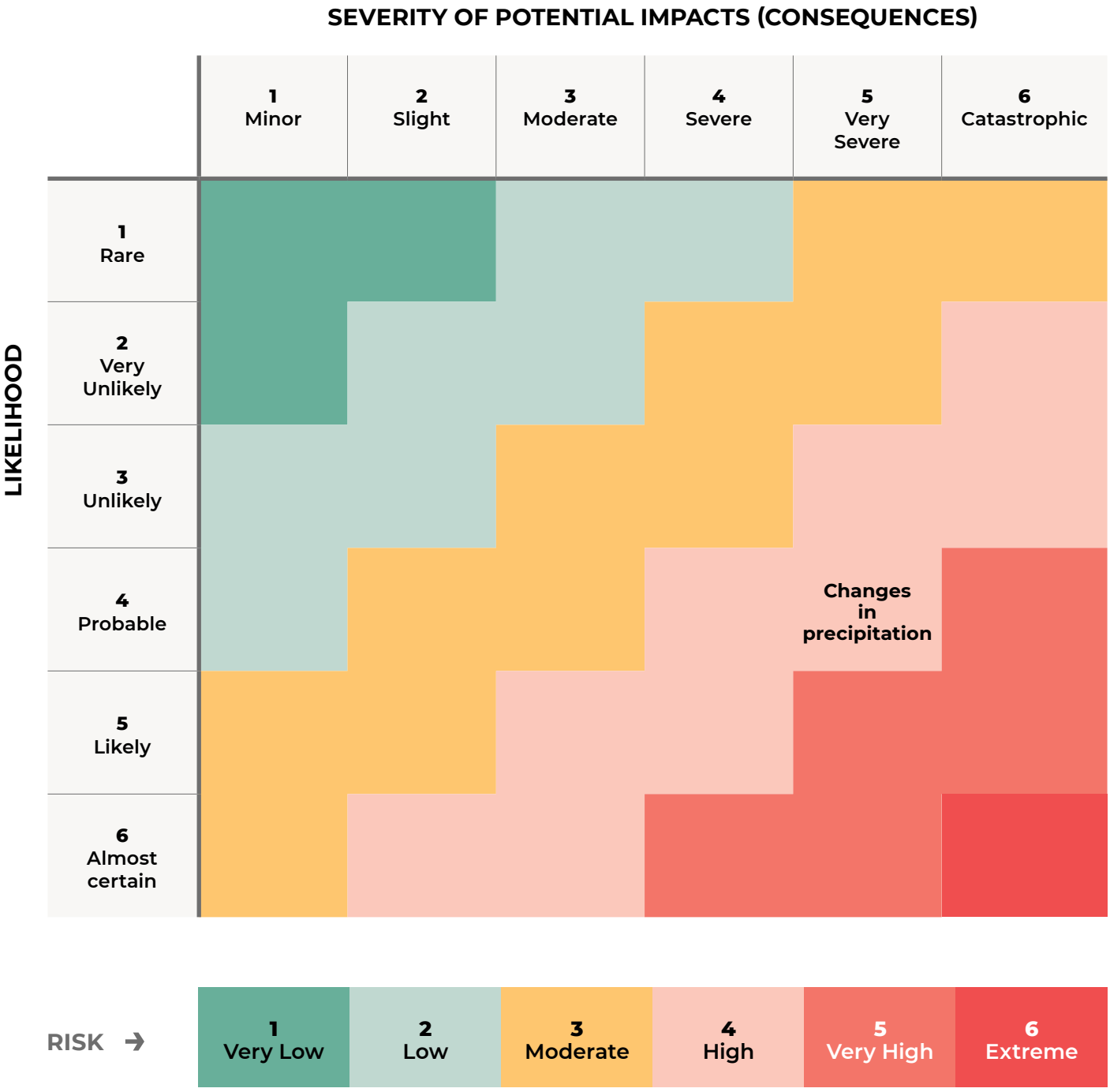
TABLE 22. CLIMATE HAZARD VULNERABILITY RATING OF CHANGES IN PRECIPITATION

Calculated value (Exposure + Impact Severity – Response)	*2*	*3*	*4*	*5*	*6*	***7+***
Vulnerability rating	**0**	**1**	**2**	**3**	**4**	**5**
Vulnerability to climate hazard	**NONE**	**LOW**	**MODERATE**	**MODERATE TO HIGH**	**HIGH**	**EXTREME**

7.2.8
Risk Assessment

Based on the likelihood (**4 - Probable**) and impact severity (**5 - Very severe**) calculated above, the risk associated to changes in temperature was identified as **4-High** (**Table 23**).

TABLE 23. RISK ASSESSMENT OF CHANGES IN PRECIPITATION



7.3 FOREST FIRES

Forest fires are one of the most important natural disturbances in Canada. The boreal forest in Eeyou Istchee is characterized by a short fire cycle ranging from 50 to 200 years, and some successional processes in trees and plant species are controlled by forest fire disturbances (Foro et al., 2013). As forests are the main source of fuel for wildfires, and are anticipated to remain so, this chapter will employ the term forest fires, rather than the broader term wildfires.

Fire management in northern Québec

For activities related to forest fire prevention and extinction, public forests in Québec are divided into two zones: the **Intensive Zone** andthe **Nordic Zone**, as described in the Loi sur l'aménagement durable du territoire forestier (Loi sur l'aménagement durable du territoire forestier, 2010). These two zones are separated by the **Territorial Line of Attribution**, which cuts across the province of Québec between the 50th and 52nd parallel (see the location of the line in **Figure 15**). Forests located in the **Intensive Zone**, south of the line, are subject to management practices by the relevant governments and forestry companies, requiring forest-fire mitigation efforts (Loi sur l'aménagement durable du territoire forestier, 2010; SOPFEU, 2019). In forest fire management, all forests in the **Intensive Zone** are considered as priority assets, and fires in this zone will be fought by the *Société de protection des forêts contre le feu* (SOPFEU) to the extent that firefighting resources allow. This non-profit public-private organization provides aerial firefighting and forest fire protection services across Québec.

Most of Eeyou Istchee lies in the **Nordic Zone**, where firefighting occurs only near critical assets (e.g., within 20km of communities, or pieces of infrastructure with socioeconomic value). While SOPFEU prioritizes the **Intensive Zone**, Cree communities value all traplines, including those outside designated protection areas, for cultural, ecological, and subsistence reasons. *The classification of Category 1, 2,* and *3* lands does not fully align with Cree values regarding land importance. Traplines outside Category 1 lands are considered just as vital to the Cree population, as they contribute to the land's overall health, intergenerational connections to land, and forest preservation—deeply embedded in Cree traditions. What is prioritized by the provincial government and SOPFEU, an organization operating under Québec legislation, often differs from the Cree perspective which values the land as essential to health, subsistence, and sustainability.

FIGURE 15. TERRITORIAL LIMIT OF ATTRIBUTION IN QUÉBEC

Note: Map obtained from SOPFEU (2025)

7.3.1
Historical and Projected Climate Data

Between 1960 and 2010 the hectares of land burned due to forest fires have been steadily increasing (Natural Resource Canada, 2015). Fire strongly shapes landscape diversity and productivity (Payette, 1992), and influences *carbon flux* in boreal forest ecosystems (Bond-Lamberty et al., 2007).

Because forest fires are affected by a conjunction of climate phenomena (low precipitation, high heat, low humidity, etc.) as well as regional conditions such as fuel availability, the age of trees, tree species, etc., they are very difficult to predict on a large and heterogeneous territory like Eeyou Istchee.

To better understand how climate change will influence fire regimes in the region, multiple climate indicators from the CMIP6 were used to complement scientific literature and community consultations. The climate indicators used are listed below, they can be found in **Appendices A** and **B**:

- Mean annual temperature,
- Mean spring temperature,
- Mean summer temperature,
- Mean autumn temperature,
- Mean annual precipitation,
- Mean spring precipitation,
- Mean summer precipitation,
- Mean autumn precipitation,
- Annual number of wet days (precipitation above 1 mm),
- Number of wet days in spring (precipitation above 1 mm),
- Number of wet days in summer (precipitation above 1 mm),
- Number of wet days in autumn (precipitation above 1 mm),
- Number of periods with more than 5 consecutive dry days,
- Maximum number of consecutive dry days.

The climate indicators used represent mean values over 30-year periods (historical or between 2041 and 2070). As averages over long periods of time, these indicators may not capture acute climate events which could also create conditions favourable to forest fires (e.g., droughts, low humidity, high winds and high temperatures). Additionally, community-specific indicators were not considered to be relevant for understanding changes in forest fires. Rather, the four quadrants proposed by Ouranos were preferred to display regional differences.

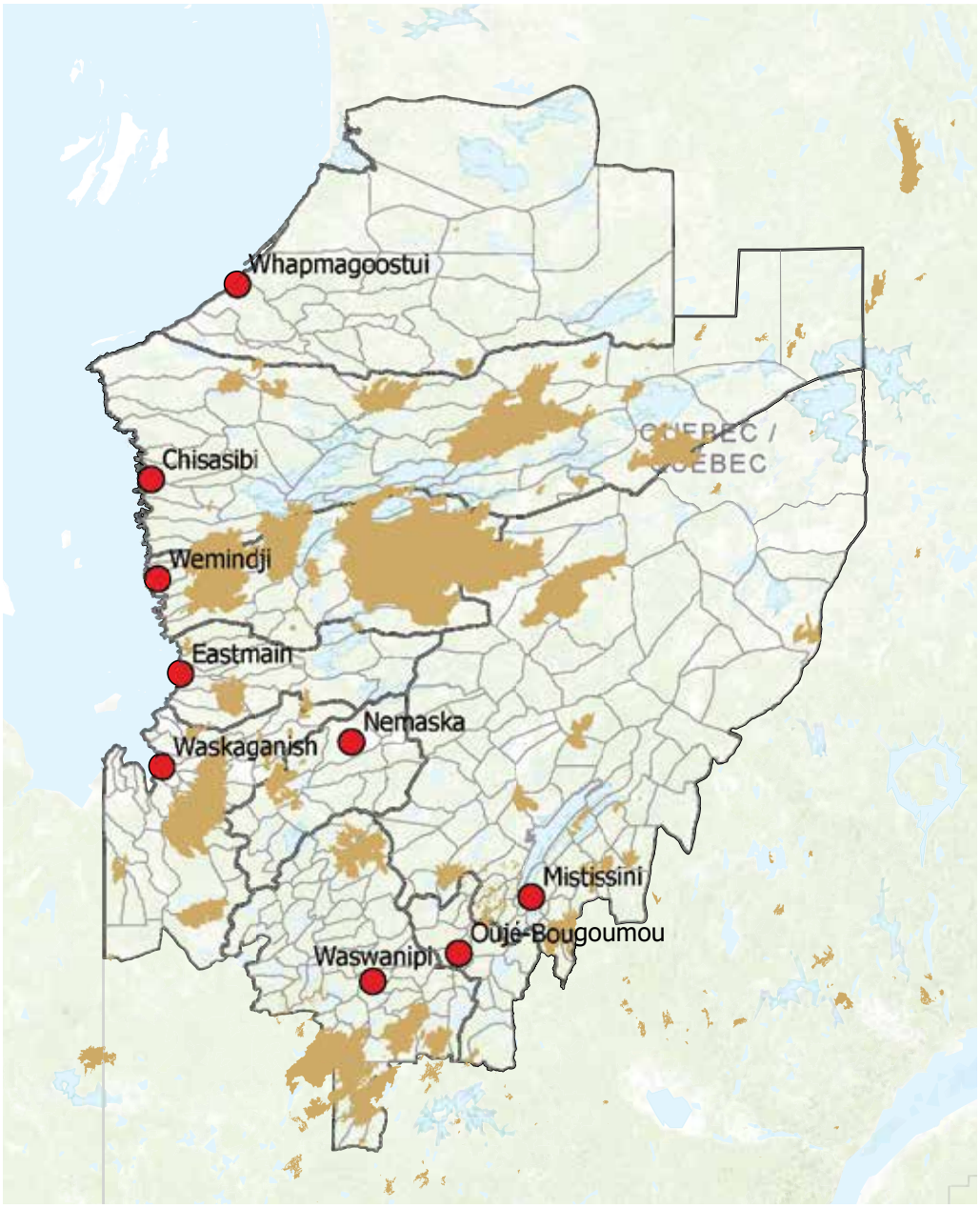
Global climate change is driving climate conditions that accelerate forest fire cycles in Eeyou Istchee. Scientists agree that the increase in mean temperature, which is projected to increase by 2.4 and 3.6°C (SSP2-4.5, SSP5-8.5) in Eeyou Istchee, will be the main driver towards more frequent drought. Although total precipitation will increase throughout the year (10% SSP2- 4.5 and 12% SSP5 8.5), adding to water availability on the territory, the warmer temperature and a more modest increase in precipitation in the summer will be sufficient to overcome any positive impacts to the boreal forest. This is likely to cause an increase in evapotranspiration, itself increasing the intensity and duration of drought (Tegos et al., 2017).

Using the Standardized Precipitation *Evapotranspiration* Index to model future climate conditions, Tam (2018) projects that warming temperatures during the spring-to-summer transition will lead to widespread drying across Canada, except for the Atlantic coast region (Scheff & Frierson, 2015). In Eeyou Istchee, these warmer and dryer conditions are expected to shorten fire cycles and lengthen the forest fire season, with fires starting earlier in spring and persisting later into autumn (Boulanger et al., 2014).

CASE STUDY Forest Fire Extents and its Impact on the Cree Population

During the 2023 wildfire season, approximately 43,004.7 km^2 of trapline areas were affected, accounting for 10.5% of Eeyou Istchee (Cree Trappers Association, 2023). By October 23, 2023, the affected area had increased to 45,045.1 km^2, representing 11.0% of the territory (**Figure 16**). Various evacuations over the summer contributed to overall feelings of distress, anxiety, and grief that suggest an increased presence of mental health challenges among the Cree Nation of Eeyou Istchee (*CRCF Vox Pop*, 2024).

FIGURE 16. FOREST FIRE EXTENTS IN EEYOU ISTCHEE FROM MAY 1ST TO OCTOBER 1ST, 2023.



Note: Image extracted by CNG Climate Unit (2025).

Although limited research exists on forest fires and their psychosocial impacts in the territory, Usher et al. (2019) suggest that climate change-induced weather events and natural disasters can lead to mental health issues such as depression, anxiety, stress, and post-traumatic stress disorder. In Eeyou Istchee, the restrictions on land access due to forest fires have resulted in grief over the loss of approximately 150 cabins in 2023 (Bell et al., 2023; Blacksmith, 2024). The fires have caused the loss of irreplaceable items and infrastructure (Bell et al., 2023). Beyond material losses, traplines are deeply connected to ancestral lands, and the fires have disrupted these connections. The Crees' intimate relationship with the environment, grounded in TEK, faces significant challenges due to the changing environment. Though the full spectrum of climate-related emotional distress is not yet fully understood, concepts like eco-anxiety and eco-grief capture the psychological toll of environmental degradation and climate change (Qiu & Qiu, 2024).

7.3.2
Exposure Analysis

Based on existing studies of projected fire regimes in the Canadian boreal forest and regional climate projection from the CMIP6, Eeyou Istchee is expected to face a dramatic increase in forest fire intensity and likelihood over the next 50 years. Both the occurrence and intensity of forest fires are projected to rise, with two primary exposure pathways: direct flame contact and widespread smoke dispersion. While exposure levels will vary across the territory depending on local forest flammability, smoke plumes will likely affect all communities across the territory.

Under these gradually shifting climate patterns, the length of the forest fire season will also be significantly increased, potentially extending from May to October. This extended window of risk coincides with a projected increase in Annual Area Burned (AAB), suggesting that fires will consume larger land areas on average (Boulanger et al., 2014).

Scientific studies confirm that current changes in forest fire regimes are connected to climate change (Balshi et al., 2009; Flannigan et al., 2005; Wotton et al., 2010), with projections indicating a drastic rise in AAB across the subarctic boreal forest - a trend signalling more intense fires (Boulanger et al., 2014). For the 2041-2070 period, the AAB is projected to increase more than 4-fold across the Eastern James Bay region, with fire occurrence concentrated between June and August (Boulanger et al., 2014). These changing climate patterns may also shorten fire cycles to an unprecedented level, exceeding any observed in the territory during the Holocene epoch (Bergeron et al., 2010; Boulanger et al., 2023).

Boulanger (2014) presents historical patterns of AAB and fire occurrence and suggests that most of the region shows relative forest fire regime homogeneity (Boulanger et al., 2013, 2014). The northernmost part of Eeyou Istchee, which includes the communities of Chisasibi and Whapmagoostui, and the northern half of Mistissini's traplines show historical lower AAB (<1%) than the rest of the region (0.5-1%), as well as lower fire occurrence (0-2 fires/100,000 km^2 per year vs. 5-10 fires/100,000 km^2 per year).

As the dominant biome in Eeyou Istchee, the boreal forest is crucial for local livelihoods, a key forestry resource, and plays an important role in regulating climate through energy and water exchanges. Additionally, the boreal forest acts as a carbon sink, although climate change may shift it to a carbon source (Bradshaw & Warkentin, 2015). The boreal forest has a low diversity of tree species but nevertheless supports thousands of living organisms, many of which contribute to the subsistence of Eeyou/Eenou families both directly and indirectly.

Fire regimes vary significantly throughout the territory based on climate patterns, forest types and landscapes. Different models provide relative fire regime zoning based on these variations and offer some understanding of differences across Eeyou Istchee (Boulanger et al., 2014; Couillard et al., 2022). Little information is available about the regional variabilities in fire-cycle lengths in the region for its northern half, which corresponds to the Nordic Zone above the Territorial Limit of Attribution. However, studies clearly show that forests in the Nemaska, Waswanipi, Oujé-Bougoumou and Mistissini traplines have the shortest fire cycles (120 years) amongst the southern communities (Couillard et al., 2022) Traplines dominated with spruce-lichen stands such as those associated with Eastmain, Wemindji and Chisasibi, may have similar fire-cycles (100-150 years) (Frégeau, 2013; Parisien & Sirois, 2003).

The spruce-moss stand characterizing the southern forests of Eeyou Istchee – located south of Lake Mistassini, around Lake Chibougamau and south of Waskaganish – shows a historically longer fire cycle (220 to 300 years) and may be less exposed to forest fires than the northern spruce-moss stand. The community of Whapmagoostui and its traplines, characterized by open woodlands and tundra vegetation, face lower forest fire risks compared to southern traplines with denser boreal forest cover.

Table 24 below summarizes historical fire cycle lengths and dominant forest types across the region. Note that with changes in temperature and precipitation/dryness, fire cycles may shorten, and forest types may also change.

TABLE 24. FOREST TYPES AND HISTORICAL FIRE CYCLE LENGTHS IN EEYOU ISTCHEE

GEOGRAPHIC REGION	DOMINANT FOREST TYPE	HISTORIC FOREST FIRE CYCLE LENGTH
▸ Forests in the Nemaska, Waswanipi, Oujé-Bougoumou and Mistissini traplines.	▸ Jack pine and black spruce.	▸ The shortest fire cycles (120 years) amongst the southern part of the province.
▸ Forests in the Eastmain, Wemindji, and Chisasibi traplines.	▸ Spruce-lichen stands.	▸ Fire cycles of 100-150 years.
▸ Most southern forests of Eeyou Istchee, such as the ones south of Lake Mistassini and around Lake Chibougamau as well as forest south of Waskaganish	▸ Spruce-moss stands.	▸ Fire cycles of 200 (in lower altitudes where he dominant species are Jack Pine (*Pinus banksiana*), Black Spruce (*Picea mariana*) to 300 years (in higher altitudes where the dominant species is Balsam fir (*Abies balsamea)*)
▸ Forests around Whapmagoostui and in its traplines.	▸ Open woodlands and tundra.	▸ Less prone to forest fire.

Taking into consideration available climate projections, recent scientific studies, and consultation with regional and community partners, the Environmental Health Team assigned forest fires an intensity and likelihood score of **26**, corresponding to a rating of **6 – Very high** (**Table 25**). During consultations, community participants emphasized that forest fires impact the region every year, both through local fires and smoke from more distant fires in other regions. They reported increasing frequency of fires near communities or threatening access roads, surpassing levels observed during major fire events like Eastmain's 2013 fire and fires across Eeyou Istchee in 2023.To address these risks, community-specific intensity and likelihood ratings were suggested to account for (1) direct threats to traplines and infrastructure from flames and (2) health and mobility impacts from prolonged smoke exposure (**Table 26**).

TABLE 25. EXPOSURE TO FOREST FIRES AT REGIONAL AND COMMUNITY LEVELS

		1	2	3	4	5	6
Temporal exposure		**RARE**	**VERY UNLIKELY**	**UNLIKELY**	**PROBABLE**	**LIKELY**	**ALMOST CERTAIN**
Frequency of occurrence		Hazards with return periods **>100 years.**	Occurs every **50 – 100 years** and includes hazards that have not occurred but are reported to be more likely to occur in the near future.	Occurs **every 20 – 50 years**	Occurs **every 5 – 20 years**	Occurs **every 5 years** or less	The hazard occurs **annually**.
Probability of occurrence		**Less than a 1%** chance of occurrence in any year.	**Between a 1-2%** chance of occurrence in any year.	**Between a 2 – 10%** chance of occurrence in any year.	**Between a 10 – 50%** chance of occurrence in any year.	**Between a 50 – 100%** chance of occurrence in any year.	**100%** chance of occurrence in any year.
Duration of exposure (over the course of a given year)		**Less than a day**	**<5 days**	**5 to 10 days**	**10 to 20 days**	**Season**	**Continuous**
Spatial exposure		**NONE**	**VERY LIMITED**	**LIMITED**	**MODERATE**	**HIGH**	**VERY HIGH**
Extent of exposure	**Across the region**	**Very localized** (a few individuals)	**Localized** (neighborhood or sector of a community)	**One** communities	**Multiple** communities	Either **all coastal** or **all inland** communities	**All** of Eeyou Istchee
	Communities	Less than **5%** of the community	**5 to 10%** of the community	**10 to 25%** of the community	**25 to 50%** of the community	**50% to 75%** of the community	**More than 75%** of the community

TABLE 26. EXPOSURE RATING OF FOREST FIRES FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

LOCATION	FREQUENCY OF OCCURRENCE	PROBABILITY OF OCCURRENCE	DURATION OF EXPOSURE (over the course of a given year)	EXTENT OF EXPOSURE	EXPOSURE RATING
Eeyou Istchee	**5** **Occurs every 5 years or less**	**4** **Between a 10 – 50% chance of occurrence in any year.**	**4** **10 to 20 days**	**5** **Multiple communities**	**5** **HIGH**
Whapmagoostui	**5** Occurs every 5 years or less	**4** Between a 10 – 50% chance of occurrence in any year.	**4** 5 to 10 days	**6** More than 100 individuals	**6** Very High
Chisasibi	**5** Occurs every 5 years or less	**4** Between a 10 – 50% chance of occurrence in any year.	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very High
Wemindji	**5** Occurs every 5 years or less	**4** Between a 10 – 50% chance of occurrence in any year.	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very High
Eastmain	**5** Occurs every 5 years or less	**4** Between a 10 – 50% chance of occurrence in any year.	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very High
Waskaganish	**5** Occurs every 5 years or less	**4** Between a 10 – 50% chance of occurrence in any year.	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very High
Nemaska	**5** Occurs every 5 years or less	**4** Between a 10 – 50% chance of occurrence in any year.	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very High
Waswanipi	**5** Occurs every 5 years or less	**4** Between a 10 – 50% chance of occurrence in any year.	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very High
Oujé-Bougoumou	**5** Occurs every 5 years or less	**4** Between a 10 – 50% chance of occurrence in any year.	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very High
Mistissini	**5** Occurs every 5 years or less	**4** Between a 10 – 50% chance of occurrence in any year.	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very High

7.3.3
Potential Health-Related Impacts of Forest Fires

Six major fire impacts were identified for Eeyou Istchee, some of which pose direct threats to community health:

- Infrastructure and property damage;
- Evacuations, stranded communities & essential infrastructure failure;
- Impacts related to cardiovascular, respiratory health, human life;
- Impacts related to traditional activities and territorial well-being;
- Impacts related to traditional food security;
- Impacts related to mental health.

Infrastructure and Property Damage

The destructive effects of forest fires present an obvious risk for the entire population of Eeyou Istchee, both in the communities and on the land. The risk for built infrastructure in the communities will rise significantly with the increase in frequency and spread of forest fires from late spring into the fall months. Camps and other traditional dwellings spread out across Eeyou Istchee will be even more at risk of burning. Most traditional dwellings are located above the northern limit of managed forests. As most traditional dwellings are situated in remote locations away from the communities and other infrastructure identified as priority assets, they may not be subject to fire suppression activities.

POTENTIAL IMPACT	TYPE OF IMPACT	VULNERABLE POPULATION
▸ Destruction of property in communities	▸ Psychosocial impacts, loss of shelter, economic impacts	▸ All individuals
▸ Destruction of traditional dwellings on traplines	▸ Psychosocial impacts, solastalgia, economic impacts, impacts on access to traditional activities and food.	▸ Land-users

Evacuation, Stranded Communities & Essential Infrastructure Failure

In the summer of 2023, eight of the nine Eeyou Istchee communities were subject to at least one partial evacuation due to forest fires, with 11 evacuations in total. Full evacuations were ordered for Oujé-Bougoumou, Mistissini, and Eastmain due to fire threats or access issues (see **Appendix C**). Most evacuees had to leave the region entirely, disrupting access to services and healthcare, often compounded by language and cultural barriers. Concerns raised included chaotic evacuation conditions, family separations, and the inability to bring companion animals, which can all contribute to psychosocial stress. Community leaders expressed frustration with limited fire-fighting capacity, as much of the region lies outside SOPFEU's Intensive Zone, receiving fewer resources. Eeyou/Eenou firefighters, trained but restricted to category 1 lands, were unable to respond more broadly. Witnessing this loss and being unable to act, particularly for those equipped with the skills to respond, often leads to moral injury. Moral injury is defined as "*the damage done to one's conscience or moral compass when that person perpetrates, witnesses, or fails to prevent acts that transgress one's own moral beliefs, values, or ethical codes of conduct*" (Syracuse University, n.d. para. 1). Moral injury, while being less discussed than related issues such as PTSD, can cause serious distress and depression, impacting a person's ability to function.

Patients requiring regular treatment, such as hemodialysis and chemotherapy, faced dangerous interruptions when forest fires isolated communities. Fires also disrupted essential infrastructure and closed major roads, leaving some communities stranded, delaying supply deliveries, and forcing reliance on costly air transport. Emergency air transport proved severely constrained by multiple factors: most local runways could only accommodate small aircraft (primarily 32-seat Dash-8s), limited availability of planes and crews, and simultaneous competition from other fire-affected regions conducting evacuations.

Telecommunications were also impacted by the forest fires. Most notably, a fibreoptic cable along the Waskaganish service road was burnt in July 2023 and it was not possible to bring in a repair crew for over a week due to the intensity of the fires. This cut off internet access and limited the ability to transmit important information about the fires to community members and for community members to reach one another.

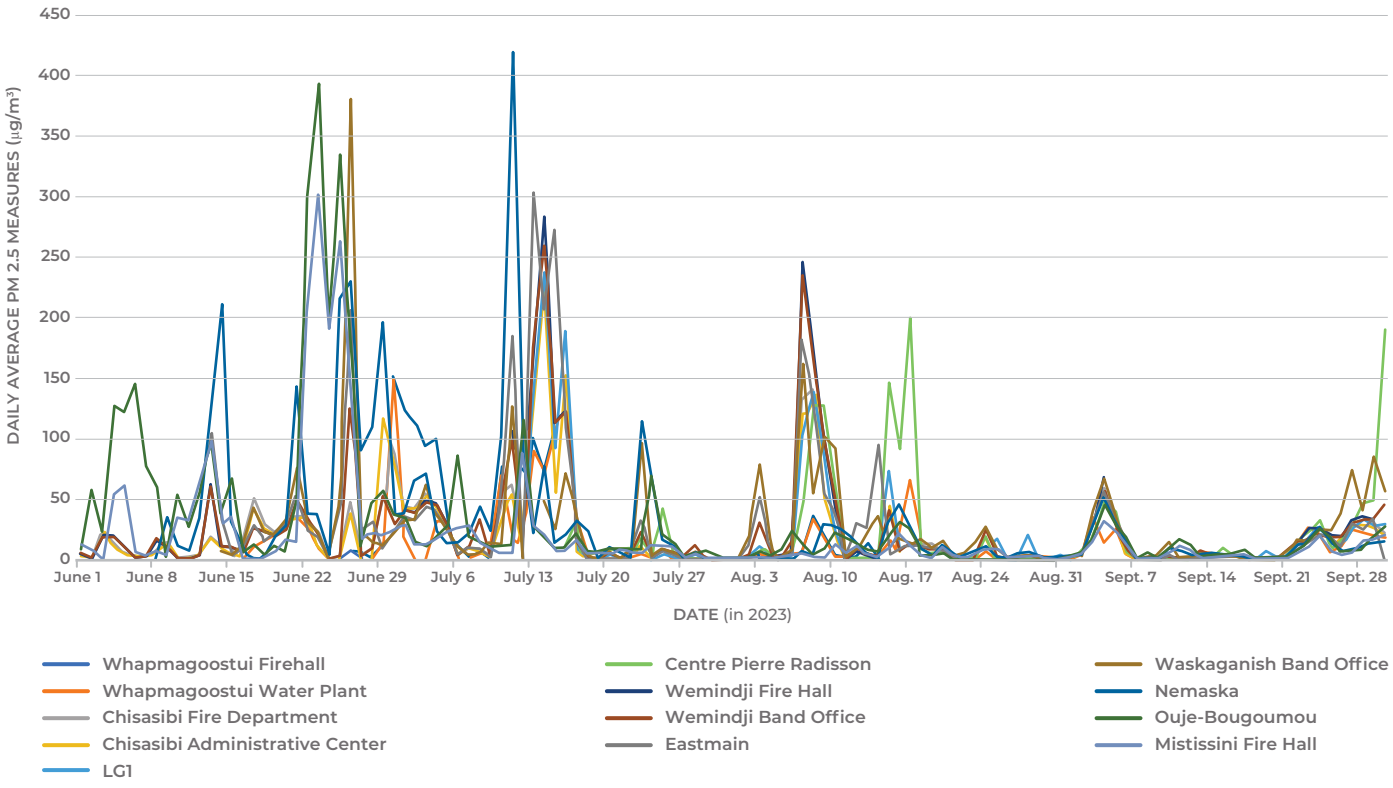
POTENTIAL IMPACT	TYPE OF IMPACT	VULNERABLE POPULATION
▸ Partial community evacuations	▸ Psychosocial impacts, loss of shelter, deterioration of health conditions, potential separation of family units	▸ Individuals with respiratory and cardiovascular illnesses, infants, elders, pregnant women, individuals with pre-existing health conditions, hemodialysis patients, oncology patients
▸ Complete community evacuations	▸ Psychosocial impacts, partial or total loss of shelter, deterioration of health conditions, communicable disease transmission in evacuation centres, potential separation of family units,	▸ All individuals
▸ Stranded communities	▸ Psychosocial impacts, illnesses, deterioration of health conditions, food insecurity and running out of essential supplies, fatalities	▸ Hemodialysis and oncology patients, all individuals
▸ Critical infrastructure and essential services Interruptions	▸ Injuries, fatalities, food insecurity, psychosocial impacts	▸ All individuals

Impacts Related to Cardiovascular, Respiratory Health and Human Life

Particulates released in the air by forest fires, namely particles smaller than 10µm and 2.5µm (PM10 and PM 2.5), pose a severe risk for the human respiratory system. Individuals with pre-existing respiratory illnesses or cardiovascular conditions are particularly prone to experience severe reactions when exposed to these particles. Other vulnerable subgroups include as infants, pregnant women, and elders. For the rest of the population, prolonged high levels of PM2.5 in the air can also cause short, medium- or long-term health effects (Kloog et al., 2013).

Throughout much of the summer of 2023, the whole region of Eeyou Istchee was affected by periods of heavy smoke. **Figure 18** shows the average daily fine particulate matter (PM 2.5) levels from measurement devices spread throughout Eeyou Istchee. These periods of heavy smoke restricted visibility on roads and for flying, making movement through the region challenging. Many regularly scheduled flights were cancelled due to low visibility and major roads were frequently closed due to smoke conditions. Prolonged smoke exposure can have serious health impacts and has been shown in a recent meta-analysis to be related to increases in all-cause mortality, hospitalizations for respiratory causes, hospitalizations for cardiovascular causes, and emergency department visits for respiratory causes (Gould et al., 2024).

FIGURE 18. LINE GRAPH OF DAILY AVERAGE PM 2.5 MEASURES (µg/m³) BY LOCATION, EEYOU ISTCHEE, JUNE 1 TO SEPTEMBER 30, 2023



Data source: University of Northern British Columbia, cyclone map https://aqmap.ca/aqmap.
Data extracted: October 1, 2023.

POTENTIAL IMPACT	TYPE OF IMPACT	VULNERABLE POPULATION
▸ Short- and medium-term effects of exposure to high levels of PM 2.5 and PM 10: • Throat, eye and lung irritation • Fatigue • Headache	▸ Illnesses	▸ All individuals
▸ Prolonged exposure to high levels of PM 2.5 and PM 10. All individuals, people who drive long distances for work, patients requiring medical transportation, land-users. • Effects on cardiovascular function • Effects on respiratory function	▸ Illnesses, injuries, fatalities	▸ All individuals
▸ Respiratory (bronchospasm) and cardiovascular events or deterioration of pulmonary and cardiovascular conditions	▸ Illnesses, fatalities	▸ Elders, individuals with respiratory or cardiovascular illnesses.
▸ Exacerbation of symptoms of pre-existing respiratory illnesses (asthma, emphysema, bronchitis, pneumonia, etc.)	▸ Illnesses, fatalities	▸ Individuals with respiratory or cardiovascular illnesses.
▸ Poor visibility due to smoke on or near roads	▸ Motor vehicle accidents, flight cancellations, injuries, fatalities	▸ All individuals, people who drive long distances for work, patients requiring medical transportation, land-users.

Impacts Related to Traditional Activities and Territorial Well-Being

Cree land-users have experienced forest fires in Eeyou Istchee and have adapted since time immemorial to temporary natural disturbances imposed by natural fire cycles. Changes to these cycles which may hinder the capacity of forests to regenerate after fire events could have negative impacts on traditional activities along Cree traplines and affect the land's historical capacity to sustain the Cree community. These changes are linked to psychosocial impacts among Cree land-users. In fact, participants to the Vox Pop at the CRCF expressed concerns regarding physical, mental, emotional, and spiritual health, as well as the effects of forest fires on the local economy and infrastructure (*CRCF Vox Pop*, 2024). Changes in seasonality, weather patterns, migration patterns, increased temperatures, and snow accumulation have directly impacted traditional subsistence activities. These shifts have cascading effects on Cree trapping, hunting, fishing, and harvesting practices due to the effects of climate change (particularly those related to forest fires) on land access, flora, and fauna (*CRCF Vox Pop*, 2024).

Eeyouch/Eenouch have relied on TEK for subsistence activities for centuries. However, increasing drought and higher temperatures have made forest fires more aggressive, creating barriers to transmitting this knowledge to future generations (*CRCF Vox Pop*, 2024). The CRCF's Vox Pop noted that these interruptions have made it significantly difficult for land-users, such as Elders and Tallymen, to apply their knowledge of local ecosystems due to the disruption, uncertainty, and unpredictability following the forest fires (*CRCF Vox Pop, 2024*). Safety concerns related to land access and the ability to engage in cultural practices due to forest fires have notably impacted social, physical, and mental health (Ahmed et al., 2021; Gone, 2013; Johnson-Jennings et al., 2020). Cultural, social, and spiritual connections to the land are continuously being disrupted by the climate crisis, making it challenging to partake in cultural subsistence activities in a changing environment. This is particularly crucial to the Eeyou/Eenou nation because land is inseparable from the culture, the communities, and spiritual identities (*CRCF Vox Pop, 2024*).

For instance, traditional land-based activities such as Goose Break, a major part of the Eeyou/Eenou culture occurring every spring, strengthens overall health, well-being, and prevents chronic illness by encouraging physical fitness and mental health. Other studies focusing on land-based activities in Indigenous contexts outside and within Canada confirm these findings (Ahmed et al., 2021). While there are no specific studies found in Eeyou Istchee related to land-based activities, cultural practices among the locals, such as Goose Break and Moose Break, also known as harvesting seasons, encourage feelings of harmony, support, and well-being and facilitate overall health, as well as the transmission of TEK.

POTENTIAL IMPACT	TYPE OF IMPACT	VULNERABLE POPULATION
▸ Ecological changes post-fire season	▸ Psychosocial impacts, food security, ecological grief, solastalgia, cultural loss, mental health, physical health	▸ Land-users, Elders, pregnant women, Tallymen
▸ Reduced land access and safety due to fire risk	▸ Safety, mental health, spiritual well-being, access to traplines	▸ All individual but especially land-users
▸ Interruption of subsistence activities and cultural practices	▸ Cultural continuity, intergenerational knowledge loss, identity impacts.	▸ Land-users, youth, Elders

Impacts on Food Security

Wildlife in Eeyou Istchee was significantly impacted by the 2023 forest fire season, both directly and indirectly. Although many species inhabit Eeyou Istchee, specific wildlife such as moose, caribou, beavers, waterfowl (Canadian geese, ducks), landfowl (grouse and partridge), and fish (cisco, lake sturgeon, sucker, northern pike, burbot, walleye, whitefish, lake trout, and arctic char) are vital to the Cree diet and culture, making their preservation a primary concern for Eeyou/Eenou land-users. Traditional game offers immense health benefits for the physical well-being of Eeyouch (Proust et al., 2016). High rates of chronic illnesses and food security challenges in Eeyou Istchee highlight the critical need of ensuring adequate land access to improve overall health and well-being in the region. To address the Cree Nation's concerns about the potential effects on wildlife, Montpetit, a wildlife biologist with the CNG, proposed integrating mindful harvesting practices by fostering awareness within the communities and limiting hunting activities in the coming years (Montpetit, 2023 slide 23). While this perspective emphasizes the health and vitality of ecosystems, particularly the importance of preserving wildlife, it is essential to recognize that cultural practices like hunting are integral to Cree values and traditions. These practices provide nutritious traditional foods for Eeyouch/Eenouch, contributing to a healthier diet compared to store-bought alternatives. Not only does it provide nutrition, but it is also deeply connected to spiritual identity and strengthens practices that support improved mental and physical health.

Three keystone species — **caribou**, **moose**, and **beaver** — were selected for analysis due to their ecological vulnerability to forest fires, cultural significance for Eeyou/Eenou communities, and direct impacts on physical and mental health through traditional subsistence activities.

Caribou

According to Montpetit, various fauna exhibit different levels of vulnerability and resilience to forest fire-related challenges (Montpetit, 2023 slide 11). For instance, the caribou, crucial to the Cree diet, is classified as a threatened species within Cree territory and is expected to experience a substantial population reduction (Bell, 2022). This decline is primarily due to the caribou's heightened vulnerability to disturbances, particularly changes in their main food sources in areas heavily impacted by forest fires (DeMars et al., 2019). Eeyouch have observed a decrease in the caribou population over the years, with studies suggesting that the aftereffects of forest fires and habitat changes contribute to alterations in migration patterns in northern coastal and inland areas of Eeyou Istchee (Grand Council of the Crees (Eeyou Istchee) / Cree Nation Government, n.d.). These declines threaten not only ecological balance but also community health, as reduced access to caribou disrupts traditional nutrition, cultural practices, and food security, which are key determinants of physical and mental wellbeing in Eeyou Istchee.

Moose

In contrast, the moose population is projected to be less affected, as moose demonstrate the capability to adjust to post-fire habitats. This observation is supported by broader research conducted in other regions of Canada, where an increase in moose density has been noted as a response to fire (DeMars et al., 2019). However, Cree Tallymen in Eeyou Istchee have expressed concerns about the declining moose population in specific areas. Notably, the moose population in Zone 17 and the southern part of Zone 22, located in the southern coastal and inland portions of Eeyou Istchee, decreased by 35% in 2021 (Bell, 2022). Zone 17 includes Waskaganish, Oujé-Bougoumou, Waswanipi, and the non-Indigenous municipalities of Chibougamau, Chapais, Matagami, and Lebel-sur-Quévillon (Government of Quebec, n.d.). While the majority of Eeyouch reside within the Cree communities, mosttraplines in the inland areas of Eeyou Istchee located in proximity to areas like Matagami, Chibougamau, and Lebel-sur-Quévillon are used for harvesting moose, especially during hunting seasons.

Beaver

The beaver holds particular importance in Eeyou Istchee as both a resilient ecological architect and a vital traditional food source. Unlike more fire-sensitive species, beavers enhance habitat diversity and ecosystem recovery after wildfires through their dam-building activities (Hood & Bayley, 2008). Their ecological role provides dual benefits: creating fire-resistant wetlands that mitigate climate impacts (Rozhkova-Timina et al., 2018) while sustaining a reliable, nutrient-rich food source for Cree communities. Though local nutritional studies are limited, beaver meat aligns with the well-documented health advantages of traditional foods - lean, high in protein, and lower in saturated fats compared to store-bought alternatives (Kuhnlein & Receveur, 2007; Lambden et al., 2006), making its continued availability important for both cultural continuity and community health.

POTENTIAL IMPACT	TYPE OF IMPACT	VULNERABLE POPULATION
▸ Changes to the availability and quality of natural resources	▸ Solastalgia, eco-anxiety, ecological grief, food security, mental health	▸ Land-users
▸ Loss of ecosystem functions	▸ Solastalgia, eco-anxiety, ecological grief, food security, mental health	▸ Land-users
▸ Temporary restricted access to traplines	▸ Food security, eco-anxiety, ecological grief, mental health, physical health	▸ Land-users

7.3.4
Severity of Potential Impacts

In views of the impacts identified above and the impact analysis, the Environmental Health team rated the consequences of forest fires as summarized in **Table 27**. This gave an overall score of **18** which translates to a rating of **6 – Catastrophic**.

TABLE 27. SEVERITY OF POTENTIAL IMPACTS OF FOREST FIRES

	0	1	2	3	4
		MINOR	MODERATE	SEVERE	
FATALITIES			Could result in 5 –10 fatalities within the community.		
INJURIES			Could injure 25 –100 people within the community.	Could injure +100 people within the community.	
EVACUATION				Could result in more than 500 people being evacuated, sheltered-in-place or stranded.	
PROPERTY DAMAGE				Widespread severe damage (many buildings destroyed).	
CRITICAL INFRASTRUCTURE SERVICE DOMAIN				Could disrupt more than 3 critical infrastructure services.	
ENVIRONMENTAL IMPACT			Could cause major but reversible damage. Full clean up difficult.		
BUSINESS/ FINANCIAL IMPACT		Could result in losses for few businesses.			
PSYCHOSOCIAL IMPACT			Widespread psychosocial impacts, e.g. mass panic, widespread hoarding and self-evacuation and longterm psychological impacts.		

Participants to the consultation noted that injuries and fatalities would mostly be indirect events due to PM2.5 and PM10 in smoke. Depending on the location of the fire, severe consequences could occur with regards to evacuation as well as property and infrastructure damage. The environment would be affected, though burning of forests would be part of the normal life cycle of forests. More serious environmental consequences would be seen if man-made structures were burnt, releasing chemicals into the environment (e.g., plastics, treated wood). The logging industry was noted to be potentially affected by forest fires. The team also noted that severe psychosocial impacts could occur with forest fires.

At the CNG's Eeyou Advisory Committee on Climate Change Monitoring consultation, members noted that, even if it is a natural cycle, forest fires have major impacts on both large and small game hunting, reducing community members' access to traditional food. It was also noted that forest fires can also disrupt reforestation activities.

7.3.6 Regional Response to Forest Fire Impacts

Regional response to forest fire impacts in Eeyou Istchee was given a value of **4 - moderate to high** because of current measures in place for fire response, prevention, and safety strategies based on consultations with regional and community collaborators (**Table 28**). These existing adaptation measures and proposed recommendations for improvement include mitigation strategies that prioritize Cree knowledge and values, especially in relation to the importance of keeping both critical infrastructure (bush camps) and the natural environment safe from this potential climate hazard.

Climate Change Advisory Committee Consultation

During this consultation, the committee identified the following adaptation measures as already existing in the region.

Fire Response, Prevention, and Safety:

- Experienced fire brigades in communities;
- Increased fire prevention and awareness campaigns from regional and local fire departments;
- Fire barriers set up around communities;
- Preparedness for smoke by equipping community buildings with air purifiers and establishing Clean Air Spaces during heavy smoke conditions;
- Improved evacuation plans, applying lessons learned from 2023;
- Cleaning up debris around buildings and camps to remove potential fuel sources for fires;
- Adjusting harvesting practices post-fire season to allow wildlife populations time to recover.

CCAC members also proposed a series of strategies and interventions to strengthen regional capacity to adapt to forest fire impacts, including:

- Prevention activities, including prescribed burns and enhanced annual cleaning efforts in communities and camps to remove flammable debris;
- Public information and awareness through educational programs, instructional videos, public campaigns, and improved information sharing on current fire conditions (e.g., a forest fire app);

- Change firefighting priorities to prioritize infrastructures identified as essential to the Crees;
- Increasing local firefighting capacity (e.g., a Cree Nation Forest Fire Division, Cree Nation water bomber);
- Enhancing safety plans for first responders who stay in communities during evacuations;
- Improving smoke preparedness by ensuring all buildings have air purifiers;
- Enhancing airport infrastructure to accommodate larger aircraft or increase capacity for evacuations and external aid transport;
- Improving clean-up capacity (techniques and tools) and considering fire prevention strategies when rebuilding burnt camps.

Consultation and Fire Chiefs and Public Safety Officers Meeting

During this consultation, participants outlined the planned training for the upcoming spring to prepare local firefighters. They also discussed the establishment of a regional emergency core group aimed at strengthening emergency response, enhancing information sharing among partners, and keeping community members informed during emergencies such as forest fires.

Cree Regional Climate Forum Consultation

Following the CRCF workshop on existing and potential adaptation strategies, several regulation ideas for camps and forest management practices were mentioned to mitigate forest fires, such as bush cutting, establishing fire lines, and keeping flammable substances away from infrastructures. Participants also expressed interest in fire mitigation workshops. Discussions included bush-cutting (slashing) around camps and homes, adapting harvesting practices to follow wildlife movement, regulating bonfires and campfires (especially during dry seasons), and establishing fire lines around communities. Other key strategies involved prohibiting smoking in the bush and promoting smoking cessation, adapting firewood sourcing, following SOPFEU guidelines, and sharing information on fire risks. Additionally, participants emphasized the importance of training and skill maintenance for fire prevention, equipping trained individuals with firefighting tools, and exploring underground water sources for emergency use. Safe storage of flammable materials such as oil, gas, and propanol away from camps and buildings was also highlighted. Prevention programs at camps, cleaning up burnable materials, and organizing fire prevention workshops were considered critical measures. Further discussions addressed the need for pits to contain cooking fires, preparedness plans for evacuation (such as go-bags and packed trucks), improved forest management practices, and youth training through scouting programs. The group also stressed the importance of proactive measures, home safety checks, personal protective equipment like masks, fire extinguishers, ongoing land monitoring, and ensuring camps are set in safe locations to reduce fire risks.

TABLE 28. REGIONAL RESPONSE RATING TO FOREST FIRES

	0	1	2	3	4	5
RESPONSE	NONE	VERY LOW	LOW	MODERATE	MODERATE TO HIGH	HIGH
Eeyou Istchee					◆	

7.3.7 Confidence Scale

Based on availability and quality of data, the confidence rating for the exposure and severity of potential impacts of forest fires is high, due to a large evidence base demonstrating the current and future exposure of Eeyou Istchee to forest fires. The confidence for response to forest fires assessment is also rated as high, given the considerable resources, training and preparations that followed the forest fires season of 2023.

7.3.8 Assessment of Regional Vulnerabilities to Forest Fire Impacts

By applying the risk assessment formula (**Table 29**), the Environmental Health team calculated a vulnerability rating of **5 - Extreme** based on the following formula: **Exposure (6) + Impact Severity (6) - Response (4) = 8**. This rating indicates extreme regional vulnerability to forest fire impacts. This is mostly because forest fires are likely to cause immediate, severe consequences as well as long-term changes to the natural environment. Despite Eeyou Istchee's overall moderate to high capacity to adapt to such impacts, the catastrophic nature of forest fires makes the region extremely vulnerable to this hazard.

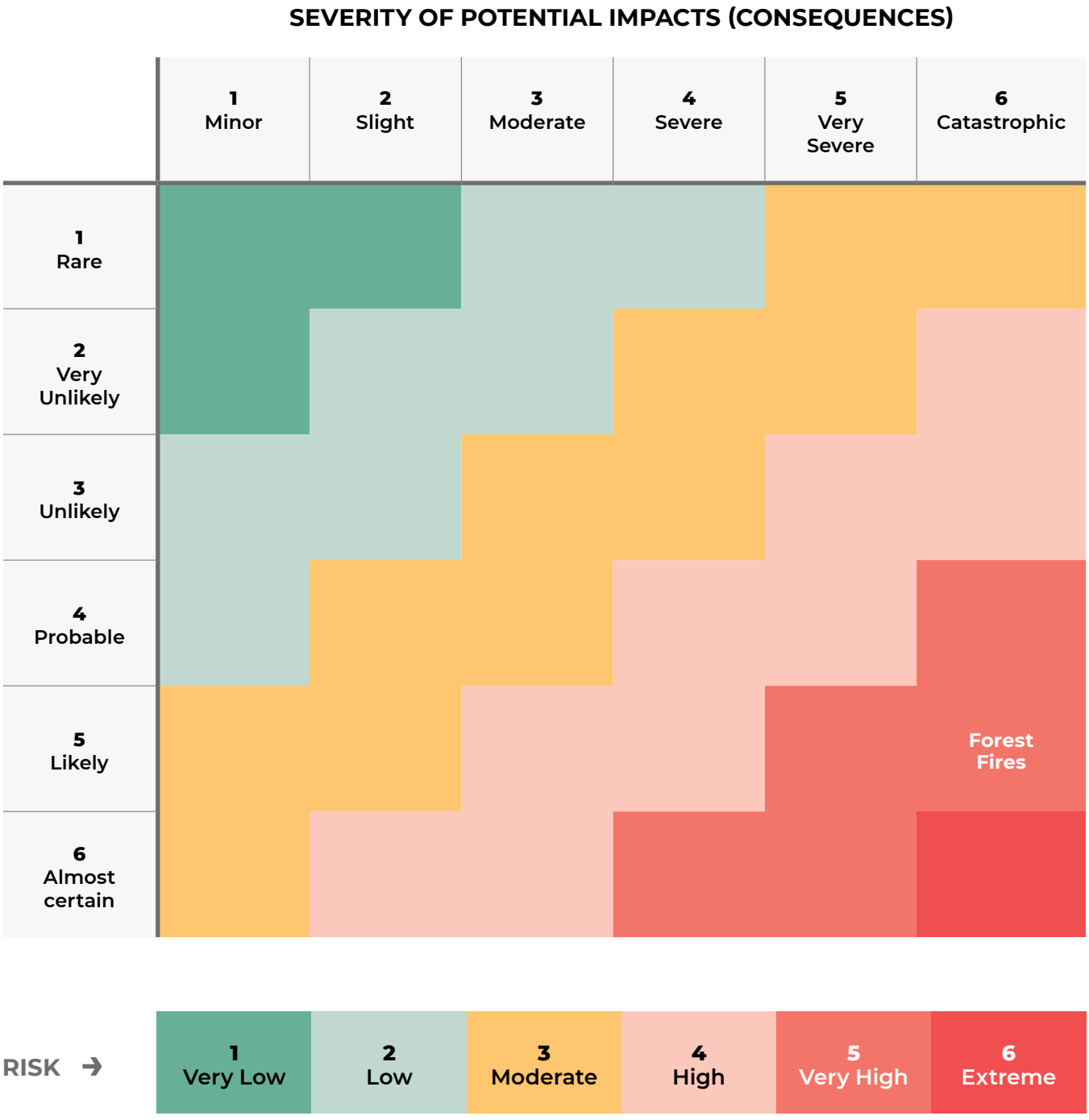
TABLE 29. CLIMATE HAZARD VULNERABILITY RATING OF FOREST FIRES

Calculated value (Exposure + Impact Severity – Response)	*2*	*3*	*4*	*5*	*6*	***7+***
Vulnerability rating	**0**	**1**	**2**	**3**	**4**	**5**
Vulnerability to climate hazard	NONE	LOW	MODERATE	MODERATE TO HIGH	HIGH	EXTREME

7.3.9
Risk Assessment

Based on the likelihood (**5 - Likely**) and impact severity (**6 - Catastrophic**) calculated above, the risk associated to forest fires was identified as **5-Very high** (**Table 30**).

TABLE 30. RISK ASSESSMENT OF CHANGES IN FOREST FIRES



7.4 CHANGES IN WIND PATTERNS

This section outlines projected wind pattern changes for Eeyou Istchee. Wind pattern changes have seldom been included in global climate change discussions but were added to the list of climate hazards following the CRCF in April 2024. Community consultations highlighted growing concerns about changing wind patterns and their impact on traditional subsistence activities, particularly waterfowl harvesting, which relies heavily on predictable wind conditions. This hazard was deemed important by local community members due to its direct effect on these practices and broader implications for overall health, safety, and cultural continuity.

Wind is the movement of air caused by differences in air pressure which originate from uneven heating of the Earth's surface due to features like hills, oceans, and variation in solar input between polar regions and the equator. The Earth's rotation further influences this movement, causing the “prevailing westerly” wind patterns in North America (McCabe, 2023; U.S. National Weather Service, n.d.). These winds are slowly moving poleward, which may be attributed to climate change (Abell et al., 2021; U.S. National Science Foundation, 2021).

At the localized scale, wind speed and direction are influenced by topography; with winds accelerating or slowing as they move up or down slopes, or through narrow valleys. Forests or other obstacles can slow down winds, and temperature differences between land and large bodies of water can also change local wind speeds. Despite these localized effects, wind patterns are largely governed by global weather systems (Government of Northwest Territories, n.d.).

According to the 2021 IPCC report (IPCC, 2023), climate change is expected to cause a substantial reduction in wind speeds across many regions globally. However, this trend may not be uniform, and the general level of confidence for wind direction changes is low for North America (IPCC, 2021). The impacts of wind speed alterations are complex and multifaceted, affecting various aspects of the environment and society.

7.4.1
Historical and Projected Climate Data

The Cree have relied on their deep relationship with the land to forecast wind patterns since time immemorial, and have witnessed changes to wind patterns that have, in some cases, influenced their ability to safely practice traditional activities such as fishing and hunting. For example, Eeyou/Eenou reported changes in prevailing wind directions as well as occurrences of trees uprooted by wind (windthrows) (Hennigs & Bleau, 2017).

Historical indicators and projections directly related to wind in Eeyou Istchee were not available. However, wind patterns and speed may be linked to heat distribution (University of Hawai'i, n.d.). Indicators related to temperature are presented in **Section 7.1 - Changes in Temperature**.

Projections for 2050 and beyond indicate that average wind speeds may change slightly, although there is a high degree of uncertainty regarding these changes. Climate change contributes to either increases or decreases in wind speeds (Harvey & E&E News, 2019; S. H. Li, 2023; Robbins, 2022; Yao et al., 2012). Additionally, there is no clear information available on how wind direction may be affected.

While forecasting wind patterns is challenging, especially over large land expanses like Eeyou Istchee, wind gusts are expected to increase significantly, particularly during the summer months. Wind gusts across Canada have been increasing between 1953 and 2009 and could increase by as much as 50% at the La Grande Rivière station by 2100 (Hennigs & Bleau, 2017).

7.4.2
Exposure Analysis

It is widely expected that all of North America, including Eeyou Istchee, will experience alterations in wind regimes as they are closely tied to the anticipated rise in temperatures in the region. However, predicting changes in wind patterns is challenging due to the complex interplay of global and local conditions, and there is low confidence in the specifics of how these patterns will shift (Hennigs & Bleau, 2017).

Still, such changes in wind can have profound effects on ecosystems and human activities reliant on predictable weather conditions. For instance, changes to prevailing wind patterns such as the jet stream from a melting Arctic Ocean may contribute to more sporadic but intense periods of rainfall, as opposed to more frequent but less intense rainfall (Arctic Council, 2024; McCrystall et al., 2021).

Evidence regarding the potential nature of changes in wind is unclear, with some sources indicating significant increases in wind gusts, but others indicating a reduction in wind speeds. These varying projections of changes in wind patterns pose challenges for anticipating the impacts of these changes. An assessment of exposure to changes in wind patterns at the regional and community levels has been completed in anticipation of increased wind gusts based on (**Table 31**). Briefly, the exposure to changes in wind patterns was assigned a score of **28** which equals a rating of **6 - Very high** for Eeyou Istchee and for each community (**Table 32**).

TABLE 31. EXPOSURE TO CHANGES IN WIND PATTERNS AT THE REGIONAL AND COMMUNITY LEVELS

		1	2	3	4	5	6
Temporal exposure		**RARE**	**VERY UNLIKELY**	**UNLIKELY**	**PROBABLE**	**LIKELY**	**ALMOST CERTAIN**
Frequency of occurrence		Hazards with return periods **>100 years.**	Occurs every **50 – 100 years** and includes hazards that have not occurred but are reported to be more likely to occur in the near future.	Occurs **every 20 – 50 years**	Occurs **every 5 – 20 years**	Occurs **every 5 years** or less	The hazard occurs **annually**.
Probability of occurrence		**Less than a 1%** chance of occurrence in any year.	**Between a 1-2%** chance of occurrence in any year.	**Between a 2 – 10%** chance of occurrence in any year.	**Between a 10 – 50%** chance of occurrence in any year.	**Between a 50 – 100%** chance of occurrence in any year.	**100%** chance of occurrence in any year.
Duration of exposure (over the course of a given year)		**Less than a day**	**<5 days**	**5 to 10 days**	**10 to 20 days**	**Season**	**Continuous**
Spatial exposure		**NONE**	**VERY LIMITED**	**LIMITED**	**MODERATE**	**HIGH**	**VERY HIGH**
Extent of exposure	**Across the region**	**Very localized** (a few individuals)	**Localized** (neighborhood or sector of a community)	**One** communities	**Multiple** communities	Either **all coastal** or **all inland** communities	**All** of Eeyou Istchee
	Commu-nities	Less than **5%** of the community	**5 to 10%** of the community	**10 to 25%** of the community	**25 to 50%** of the community	**50% to 75%** of the community	**More than 75%** of the community

TABLE 32. EXPOSURE RATING TO CHANGES IN WIND PATTERNS FOR REGION AND NINE COMMUNITIES

LOCATION	FREQUENCY OF OCCURRENCE	PROBABILITY OF OCCURRENCE	DURATION OF EXPOSURE (over the course of a given year)	EXTENT OF EXPOSURE	EXPOSURE RATING
Eeyou Istchee	**6** **The hazard occurs annually**	**6** **100% chance of occurrence in any year**	**4** **10-20 days**	**6** **All of Eeyou Istchee**	**6** **VERY HIGH**
Whapmagoostui	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very high
Chisasibi	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very high
Wemindji	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very high
Eastmain	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very high
Waskaganish	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very high
Nemaska	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very high
Waswanipi	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very high
Oujé-Bougoumou	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very high
Mistissini	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**4** 10 to 20 days	**6** More than 100 individuals	**6** Very high

7.4.3
Potential Health-Related Impacts

The Cree communities in Eeyou Istchee Baie-James have observed shifts in prevailing wind directions and increased occurrences of windthrows, where trees are uprooted due to strong winds. Both inter-annual and intra-annual variations in seasons have hindered accurate weather forecasting, impacting traditional practices and daily life (CNG & CBHSSJB, personal communication, April 11, 2024). Changes in wind patterns can disrupt culturally important activities such as fishing, hunting, as well as tourism and other economic activities in the territory (Savard, 2016). Both increased and reduced wind speeds can have far-reaching consequences, as both can in different ways elevate wildfire risks, worsen drought conditions, and pose dangers to natural and built environments. Changes in wind patterns could also affect the likelihood of coastal storm surges.

The health and well-being of Eeyouch/Eenouch are strongly connected to the stability of ecosystems, infrastructure (i.e. road access, personal homes or camps) and the state of wildlife populations. Furthermore, those who spend most time on the land and waters and Knowledge Keepers could be the most impacted by changing wind patterns. Four types of health-related impacts connected to changes in wildlife induced by climate change have been identified for Eeyou Istchee:

- Impacts on Traditional Activities
- Impacts on Forest Fires
- Impacts on Vegetation and Wildlife
- Impacts on Health, Safety, and Infrastructure

Impacts on Traditional Activities

During the CRCF, Cree land-users from across Eeyou Istchee shared their observations of significant wind changes in recent years. They noted stronger, more unpredictable winds that shift from the south and west. They also noted stronger wind gusts contributing to faster snowmelt and earlier ice melt, impacting animal migration patterns. These changes have practical impacts: people living by lakes notice faster, more intense storms, leading to altered fishing practices for safety. These alterations have led to more unpredictable weather conditions and sudden temperature changes, making navigation, such as on Lake Mistassini, more challenging and less predictable. Moreover, hunters may not be able to predict animal behaviour and harvest food, and experience harsher weather conditions causing windburns. Some people noted, however, that these changes in wind patterns could also present opportunities for Cree-owned wind farms to harness this energy (CNG & CBHSSJB, personal communication, April 11, 2024).

Impacts on Forest Fires

Winds play a crucial role in influencing forest fires. The stronger the wind, the more rapidly a fire can spread. Wind supplies additional oxygen to the fire, flattens the flames, pre-heats nearby fuel, and carries sparks and embers ahead, creating spot fires in new areas (Government of Northwest Territories, n.d.). These alterations in wind patterns make it easier for the distribution and intensity of forest fires to occur, creating mental and physical health issues, economic uncertainty, potential damage to infrastructure, and lack of access to land-based activities. Consequently, unpredictable wind and forest fires would affect people requiring medical transportation, people with chronic conditions as well as whole communities in the case of evacuations.

Impacts on Vegetation and Wildlife

With the potential for increased wind gusts in Eeyou Istchee James Bay, the damage to forest ecosystems could be substantial, as has already been observed in Nova Scotia and British Columbia (Lemmen & Warren, 2014; Price et al., 2013). Strong winds can significantly impact forest ecosystem dynamics. In addition to uprooting trees, wind plays a key role in tree growth and range expansion, particularly in the transition zone between taiga and tundra by influencing seed dispersal. The nature of future impacts on seed dispersal due to changes in wind patterns will depend on the future ranges of individual plant species, which depend in turn on complex and interconnected factors (Kling & Ackerly, 2020). These factors discussed in more detail in sections **7.1 - Temperature**, **7.2 - Precipitation** and **7.3 - Forest Fire**s. At the same time, too-strong winds can increase soil erosion and the displacement of snow, removing the insulation seedlings rely on for survival (Holtmeier & Broll, 2010). These alterations in wind patterns deeply impact the distribution, availability, and quality of vegetation and wildlife species creating direct and indirect influences on mental and physical health, food insecurity, uncertainty during harvesting seasons, changes in animal migration, and less reliance on TEK.

Impacts on Health, Safety, and Infrastructure

High winds can cause extensive damage to buildings, roofs, and transportation infrastructure such as roads and power lines. They can strip off roofs, damage building exteriors, topple trees, and create hazardous falling debris, all of which result in substantial infrastructure repair costs, as well as economic costs linked to building and road closures (Ouranos, n.d.). In Eeyou Istchee, where a larger proportion of infrastructure is older and in need of repairs when compared to the rest of Québec, high winds can have devastating impacts to the built environment and people's safety (Ouranos, n.d.).

High winds can lead to injuries or serious accidents and create hazardous driving and flying conditions. These impacts that may be particularly severe in Eeyou Istchee given the remote geography and the large distances travelled by car, air, or snow-mobile between communities and traditional camps. Road closures compromise an already fragile supply chain, and impact food security. Moreover, changes in wind patterns could affect air quality by increasing the spread of pollutants, allergens and PM 2.5 from forest fire smoke (Environment and Climate Change Canada, 2024).

POTENTIAL IMPACT	TYPE OF IMPACT	VULNERABLE POPULATION
▸ Stronger, unpredictable wind patterns altering traditional activities	▸ Hunting predictability, altering fishing practices, navigation impacts, animal migration, shifts in weather, economic impacts	▸ Land-users
▸ Increase in the distribution, intensity, and occurrence of forest fires	▸ Psychosocial impacts, solastalgia, economic impacts, damage to infrastructure, impacts on access to traditional activities and food.	▸ All individuals
▸ Changes in distribution, availability and quality of vegetation and wildlife species	▸ Alterations in harvesting seasons, changes in animal migration, less reliance on TEK, psychosocial impacts, impacts on food security	▸ Land-users, Tallymen, Elders, Knoweledge Keepers
▸ Impacts on health, safety, and infrastructure	▸ Damage to infrastructure and transportation, economic uncertainty, cause of injuries and accidents, hazardous flying and driving conditions, impacts on food security, poor air quality	▸ All individuals

7.4.4
Severity of Potential Impacts

Limited research exists on the impacts of wind patterns in Eeyou Istchee. However, the severity of potential impacts is typically assessed based on worst-case wind speed scenarios. An increase in wind speeds within the territory could have significant implications for traditional subsistence activities, critical infrastructure, and surrounding ecosystems.

The Environmental Health team rated the consequences of the potential impacts causes by changes in temperature in bulk. The values for each domain are presented in **Table 33**. This gave an overall score of **12**, which translates to a rating of **5 – Very Severe**. Changes in wind patterns will likely have serious implications for Eeyouch/ Eenouch, with the severity of impacts depending on how and where these changes will occur.

TABLE 33. SEVERITY OF POTENTIAL IMPACTS OF CHANGES IN WIND PATTERNS

	0	1	2	3	4
		MINOR	MODERATE	SEVERE	
FATALITIES		Could result in fewer than five fatalities within the community.			
INJURIES		Could injure fewer than 25 people within community.			
EVACUATION				Could result in more than 500 people being evacuated, sheltered-in-place or stranded.	
PROPERTY DAMAGE			Localized severe damage (a few buildings destroyed).		
CRITICAL INFRASTRUCTURE SERVICE DOMAIN			Could disrupt 2 – 3 critical infrastructure services.		
ENVIRONMENTAL IMPACT		Not likely to result in environmental damage.			
BUSINESS/ FINANCIAL IMPACT		Could result in losses for a few businesses.			
PSYCHOSOCIAL IMPACT		Significant psychosocial impacts including limited panic, hoarding, self-evacuation and long-term psychosocial impacts.			

7.4.5 Regional Response to Changes in Wind Patterns

Climate Change Advisory Committee Consultation

Although the consultation did not specifically discuss changes in wind patterns, participants identified adaptation activities for other hazards that may also serve as adaptations to changes in wind patterns. This overlap further underscores the interrelated nature of climate change impacts in Eeyou Istchee. For example, improved weather monitoring and forecasting was discussed as an adaptation to changes in temperature but may also provide information on future wind events.

Consultation and Fire Chiefs and Public Safety Officers Meeting

Although participants did not discuss specific adaptation strategies for wind, they noted recent tornado warnings in the region as well as tornados in neighbouring areas, noting that these are new and unusual.

The region's response to changes in wind patterns was assessed as **1 – Very low** (**Table 34**), reflecting an absence of strategies implemented but also highlighting the overlap with various potential response plans to other climate hazards (e.g., improving weather monitoring station).

TABLE 34. REGIONAL RESPONSE RATING TO CHANGES IN WIND PATTERNS

	0	1	2	3	4	5
RESPONSE	NONE	VERY LOW	LOW	MODERATE	MODERATE TO HIGH	HIGH
Eeyou Istchee		◆				

7.4.6 Confidence Scale

Based on availability and quality of data, confidence in the exposure to changes in winds patterns is rated as high, while it is not possible to determine what the impacts of these changes will be the literature agrees that winds pattern changes will occur and affect North America, including Eeyou Istchee.

The confidence rating for the severity of impacts of changes in wind patterns is low. Large climate models predict a wide range of potential changes to wind, and community members report they have already observed changes in their communities. However, evidence regarding the nature of changes in wind is unclear and contradictory.

The confidence rating for the regional response to changes in wind patterns is rated as very low due to the unpredictability of these changes.

7.4.7
Assessment of Regional Vulnerabilities

By applying the risk assessment formula (**Table 35**), the Environmental Health team arrived at a vulnerability rating of 5 - Extreme based on the following formula: **Exposure (6) + Impact Severity (5) - Response (1) = 10**. This rating indicates extreme regional vulnerability to changes in wind patterns. Some adaptation strategies already in place to mitigate the effects of other changes may also mitigate the effects of changes in wind. However, this final rating highlights the urgent need to increase support for regional adaptive measures to address the widespread impacts changes in wind patterns are expected to have on the health and well-being of the population of Eeyou Istchee.

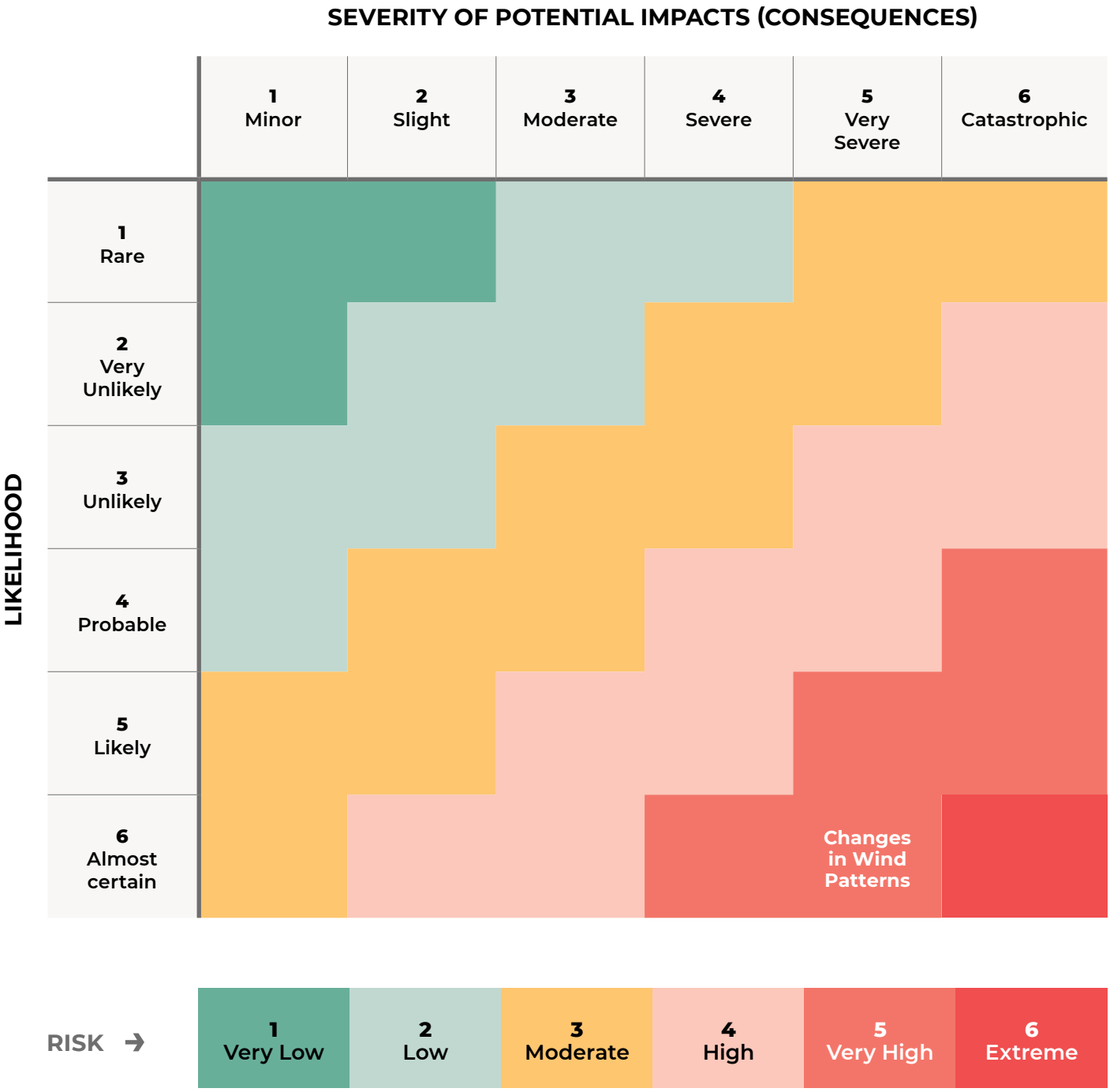
TABLE 35. CLIMATE HAZARD VULNERABILITY RATING OF CHANGES IN WIND PATTERNS

Calculated value (Exposure + Impact Severity – Response)	*2*	*3*	*4*	*5*	*6*	***7+***
Vulnerability rating	**0**	**1**	**2**	**3**	**4**	**5**
Vulnerability to climate hazard	**NONE**	**LOW**	**MODERATE**	**MODERATE TO HIGH**	**HIGH**	**EXTREME**

7.4.8
Risk Assessment

Based on the likelihood (**6 - Almost certain**) and impact severity (**5 - Very severe**) calculated above, the risk associated to changes in wind patterns was identified as **5-Very high** (**Table 36**).

TABLE 36. RISK ASSESSMENT OF CHANGES IN WIND PATTERNS



7.5 LANDSLIDES AND EROSION

Landslides are defined as the movement of earth, rock and debris in mass down a slope (Hermanns, 2018), whereas erosion refers to the gradual geological process where soil and other materials are worn down and moved by natural forces like wind or water (Brady, 2018). Erosion can allow for both greater movement of materials down slopes and greater volumes of material involved in landslides (Pudasaini & Krautblatter, 2021).

Generally, landslides and erosion can be influenced by climate change due to previously mentioned effects such as increase in air temperature, increase in intensity and frequency of heavy rain, reduced summer precipitations (Z. Li & Fang, 2016; Mauger et al., 2015). Human activity is also a major driver of erosion and landslides through land use, resource extraction, and by affecting vegetation coverage (Mauger et al., 2015), wildlife occurrence, and insect infestations (Jakob, 2022). In Eeyou Istchee, dams and mines are two main human activities of concern for local erosion.

Landslide and erosion events may affect the population of Eeyou Istchee in the immediate term via injuries or fatalities, and in the short to medium term via soil or water contamination leading to infectious diseases, as well as through impacts on traditional activities and mental health.

7.5.1 Historical and Projected Climate Data

There is a lack of historical data related to erosion and landslide monitoring for the specific region of Eeyou Istchee. However, some Eeyou/Eenou have experienced erosion and landslide in their communities.

In the 1980s, the northern coastal community of Chisasibi relocated from Fort George Island to the mainland due to anticipated erosion from increased river outflow related to the La Grande hydroelectric complex (Royer, 2016). While over 200 homes were relocated and Chisasibi continues to expand on the mainland, the projected erosion of Fort George Island did not occur as anticipated (Cree Nation of Chisasibi, 2024).

Eeyou research contributors from Chisasibi and Wemindji have reported riverbank erosion due to increased discharge from La Grande River, which is associated with hydro development (Idrobo et al., 2024). The study also linked erosion and

sediment release to the decline of eelgrass in the area; eelgrass is a staple food for geese hunted by community members.

Both more gradual erosion and large landslide events are occurring in Eeyou Istchee, including the second-largest landslide in Québec in the last 150 years. In April 2021, the equivalent of 45 million cubic metres of debris surged into the Great Whale River 8km from the communities of Whapmagoostui and Kuujjuarapik, covering an area 1.8 kilometres long and 500 metres wide (Grand Council of the Crees (Eeyou Istchee) / Cree Nation Government, 2021). Fortunately, no casualties were reported.

The risk of erosion and landslides remain etched in the collective memory of the community, with even smaller landslides serving as unsettling reminders and prompting conversations on social media in Chisasib (Cree Nation of Chisasibi Public Safety Department, 2023). Local initiatives, including recent advocating for restricted logging in Waswanipi (Skene, 2020), could limit deforestation and thereby reduce the occurrence of these erosion and landslides (Jakob, 2022).

Both erosion and landslides are linked to the indicators discussed in **Section 7.1 – Changes in Temperature** and **Section 7.2** – Changes in Precipitation. To assess the regional climate vulnerability, the following indicators (**Appendix A - Table A1** and **Appendix B - Table B1**) were identified as potentially affecting projected erosion and landslide events:

- Mean temperature,
- Number of freeze-thaw events,
- Total precipitation,
- Wet days,
- Number of periods with at least 5 consecutive dry days,
- Maximum number of consecutive dry days.

As discussed in **Section 7.1 – Changes in Temperature**, annual and seasonal mean temperatures are projected to increase over the next 50 years. Rising temperatures are expected to increase permafrost thaw and reduce ice and snow cover, both of which can leave soil more vulnerable to erosion. Ouranos' 2017 report noted that camps in Eeyou Istchee have already experienced erosion as a result of diminished snow cover (Hennigs & Bleau, 2017).

Meanwhile, predictions regarding future precipitation patterns introduce uncertainties about expected snow precipitation levels. Considering SSP4.5 and SSP8.5 precipitation projections, changes in mean conditions show a shift in precipitation patterns primarily in the winter as warming temperatures result in less solid/frozen precipitation (snow) and more liquid precipitation (rain). This shift in precipitation patterns coupled with a potential increase in windspeed may contribute to erosion by leaving soil uncovered (see **Section 7.4 – Changes in Wind Patterns**). Moreover, forest fires increase the vulnerability of landscapes to landslides and erosion through loss of tree root strength and impacts on vegetation coverage (Hennigs & Bleau, 2017; Jakob, 2022). Altered vegetation coverage due to climate change and human activity can also impact erosion and landslides (Owczarek et al., 2020). The circular nature of these influences serves as one example of the intricate web connecting climate hazards with human life and activity. Even small changes can tip the delicate balance, leading to far-reaching and unpredictable consequences.

7.5.2
Exposure Analysis

Coastal erosion resulting from the rise of sea levels is expected to increase globally (IPCC, 2019). In Eeyou Istchee, there are projected increased risks of coastal surges, permafrost degradation (thaw), and rising sea levels – all of which can contribute to increased erosion and landslides

(Ford & Smit, 2004; Hennigs & Bleau, 2017). Both erosion and landslides are the result of many complex and interconnected factors, and specific outcomes are therefore unpredictable (Cloutier et al., 2016).

In addition to conventional erosion and landslides that result in the loss of soil or landmass, areas of Eeyou Istchee and the neighbouring Nunavik region, are experiencing glacial isostatic rebound, where land previously compressed by glaciers returns to its original height (Anselmi, 2019; Tsuji et al., 2009). This gain in land volume can result in the extension of shorelines and apparent sea level fall (Boisson & Allard, 2020). Despite this, exposed land that was once under water is more brittle and may erode easily (Higman et al., 2019).

In addition to climate-related changes or events, human disturbance can also have significant impacts on local risks of landslide. Indeed, an IPCC report indicates that human disturbance may have greater impact on landslide risk than some climate events (e.g. extreme rainfall) (IPCC, 2019).

Mining is a human activity of particular relevance to erosion and landslide risk in Eeyou Istchee. Over two hundred mining companies have active claims in Eeyou Istchee, including two Eeyou/Eenou-owned companies, and there are nearly 500 abandoned exploration sites in northern Québec Cree and James Bay territory (Bell, 2024; Larbi et al., 2024). The region holds potential for gold, diamond, uranium, lithium and iron resource extraction (Larbi et al., 2024), and current and future use of these resources raises concerns related to environmental impacts, particularly risks of erosion and landslide.

Landslides resulting from mining activities may occur when a slope lacks sufficient shear strength, which is influenced by factors such as steepness and soil composition (WSP Canada Inc., 2021). Leakage and accidental spills can lead to the contamination of soils, groundwater, surface waters, and sediments, particularly in areas with increased precipitation - as is projected for Eeyou Istchee (Highland & Geertsema, 2019). Given that uranium is a resource of potential interest in Eeyou Istchee, there is concern around the potential for radioactive spill related to landslides at uranium exploitation sites.

The literature review indicates that there are very few studies assessing landslide and erosion vulnerability in the region, and nearly all of them are linked to the industry of resource extraction. Current research on soil erosion is developed in Chisasibi, in partnership with the community, MAAMUU, and Hydro Québec. Additionally, Québec's Ministry of Public Security and researchers from Laval University are currently investigating the soil in the northern region as part of Québec's Disaster Prevention Program, which will also cover the James Bay area (Quinn, 2024). The few environmental impact assessment projects publicly available online do include consideration for erosion mitigation - the Gua AO Lithium and the James Bay Lithium Mine projects being one example. However, there are uncertainties about accumulated impacts of these various projects.

Landslides are large, discrete events that are easier to evaluate in terms of frequency and severity, while erosion is more gradual and, in Eeyou Istchee, is likely to be driven more by development than climate change. The extent of exposure within communities is difficult to define, as impacts will depend on the exact location of an event. While community-wide impacts are unlikely, localized events could affect traditional camps or other culturally significant areas, quickly impacting a community as a whole (Tsuji et al., 2007).

An assessment of the temporal and spatial exposure to major landslides and impacts of erosion is shown in **Table 37**. The climate scenarios as well as the consultation with regional experts led the authors to give the regional exposure to landslide and erosion a score of **15** which gives a final rating of **4 – Moderate exposure**. Two communities were also rated individually, as shown in **Table 38**; however, most communities could not be rated due to insufficient data.

TABLE 37. EXPOSURE TO MAJOR LANDSLIDE EVENTS AND EROSION AT THE REGIONAL AND COMMUNITY LEVELS

		1	2	3	4	5	6
Temporal exposure		**RARE**	**VERY UNLIKELY**	**UNLIKELY**	**PROBABLE**	**LIKELY**	**ALMOST CERTAIN**
Frequency of occurrence		Hazards with return periods **>100 years.**	Occurs every **50 – 100 years** and includes hazards that have not occurred but are reported to be more likely to occur in the near future.	Occurs **every 20 – 50 years**	Occurs **every 5 – 20 years**	Occurs **every 5 years** or less	The hazard occurs **annually**.
Probability of occurrence		**Less than a 1%** chance of occurrence in any year.	**Between a 1-2%** chance of occurrence in any year.	**Between a 2 – 10%** chance of occurrence in any year.	**Between a 10 – 50%** chance of occurrence in any year.	**Between a 50 – 100%** chance of occurrence in any year.	**100%** chance of occurrence in any year.
Duration of exposure (over the course of a given year)		**Less than a day**	**<5 days**	**5 to 10 days**	**10 to 20 days**	**Season**	**Continuous**
Spatial exposure		**NONE**	**VERY LIMITED**	**LIMITED**	**MODERATE**	**HIGH**	**VERY HIGH**
Extent of exposure	**Across the region**	**Very localized** (a few individuals)	**Localized** (neighborhood or sector of a community)	**One** communities	**Multiple** communities	Either **all coastal** or **all inland** communities	**All** of Eeyou Istchee
	Communities	Less than **5%** of the community	**5 to 10%** of the community	**10 to 25%** of the community	**25 to 50%** of the community	**50% to 75%** of the community	**More than 75%** of the community

TABLE 38. EXPOSURE RATING FOR MAJOR LANDSLIDE EVENTS AND EROSION FOR REGION AND NINE COMMUNITIES

LOCATION	FREQUENCY OF OCCURRENCE	PROBABILITY OF OCCURRENCE	DURATION OF EXPOSURE (over the course of a given year)	EXTENT OF EXPOSURE	EXPOSURE RATING
Eeyou Istchee	**2** **Occurs every 50 – 100 years**	**4** **Between a 10 – 50% chance of occurrence in any year.**	**5** **Seasonal**	**2-4** **Multiple communities**	**4** **MODERATE EXPOSURE**
Whapmagoostui	**2** Occurs every 50 – 100 years	**4** Between a 10 – 50% chance of occurrence in any year.	**5** Seasonal	**2-4** More than 100 individuals	**4** **Moderate exposure**
Chisasibi	**2** Occurs every 50 – 100 years	**4** Between a 10 – 50% chance of occurrence in any year.	**5** Seasonal	**2-4** More than 100 individuals	**4** **Moderate exposure**
Wemindji	**2** Occurs every 50 – 100 years	**4** Between a 10 – 50% chance of occurrence in any year.	**5** Seasonal		
Eastmain	**2** Occurs every 50 – 100 years	**4** Between a 10 – 50% chance of occurrence in any year.	**5** Seasonal		
Waskaganish	**2** Occurs every 50 – 100 years	**4** Between a 10 – 50% chance of occurrence in any year.	**5** Seasonal		
Nemaska	**2** Occurs every 50 – 100 years	**3** 5 to 10 days	**5** Seasonal		
Waswanipi	**2** Occurs every 50 – 100 years	**3** 5 to 10 days	**5** Seasonal		
Oujé-Bougoumou	**2** Occurs every 50 – 100 years	**3** 5 to 10 days	**5** Seasonal		
Mistissini	**2** Occurs every 50 – 100 years	**3** 5 to 10 days	**5** Seasonal		

7.5.3
Potential Health-Related Impacts of Landslides and Erosion

Based on the literature review and consultations with stakeholders the following health-related impacts were identified as being potentially realted to landlsides and erosion:

- Injuries and fatalities,
- Impacts related to contaminated soil, water and air pollution,
- Impacts on traditional activities,
- Impacts on mental health.

Injuries and Fatalities

While there have been no reported injuries or fatalities following major landslide events in the region, future landslides could pose a risk of injury to individuals in camps and in the community. Injuries related to landslides include lacerations and contusions, and concussions and fractures (Highland & Geertsema, 2019). Moreover, impacts of landslides and erosion on infrastructure, can put a financial burden on communities due to costs of replacement, rebuilding, repair, or maintenance resulting from direct landslide-caused damage to property or installations.

Mining operations have a significant presence in Eeyou Istchee, and land erosion linked to mining can have severe impacts on landslides. This report does not offer a comprehensive review of mining's impacts on human health; however, it is essential to consider the existing evidence on the subject. El Krekshi (2009) provides a more thorough summary of the health and social impacts of a large mining project in Eeyou Istchee. Impacts identified by community members were wide-ranging and included aspects of environmental damage (e.g. loss and destruction of lands, water, and animals), health impacts (e.g. cancer and infectious diseases), as well as socio-cultural impacts and infringement on Indigenous rights. Given these far-reaching impacts of mining, El Krekshi (2009) stresses the importance of decolonized decision-making processes and free, and prior informed consent.

Impacts Related to Contaminated Soil, Water and Air Pollution

Humans are at risk of ingestion, inhalation and dermal absorption of contaminated soil following a landslide event (Sena & Ebi, 2020). There is an increased risk of bacterial growth in water and gastrointestinal illness following landslides events, particularly in cases where water supplies or waste management are disrupted (Highland & Geertsema, 2019). In these instances, landslides can lead to boil-water advisories (Highland & Geertsema, 2019), which already occur with some regularity in the region. While previous boil-water advisories in Eeyou Istchee have not been linked to landslides, the necessity of these measures may indicate vulnerability of community drinking water systems to failure in the event of potential future landslides.

In addition to impacts on drinking water systems, surface water accumulation that follows landslides has been linked to increased mosquito populations and incidence of mosquito-borne diseases (Highland & Geertsema, 2019). While reported cases of vector-borne disease are currently rare in Eeyou Istchee, the range of these illnesses is anticipated to spread northward with increasing temperature. The impact of increasing temperature on vector-borne disease incidence in Eeyou Istchee is further discussed in section **7.1 – Changes in Temperature**.

Dust in the air following landslides may also carry pathogens or harmful materials and affect populations via inhalation. This dust could be composed of fine mineral particulates and biological pollutants such as spores, bacteria, fungi and allergens. Mineral dust is associated with various cancers, renal failure and osteoporosis (Highland & Geertsema, 2019; Sena & Ebi, 2020). All these findings suggest landslides pose a threat to human health, depending on the concerned area and magnitude of the event.

Impacts on Traditional Activities

According to the IPCC, soil erosion would cause soil carbon loss, which is estimated to reduce land productivity (IPCC, 2019). Abandoned mines and mineral processing facilities contribute to the loss of land for hunting, trapping, and fishing, to the degradation of groundwater, and pollution of surface water through accumulation of sediment and salts. They also harm wildlife through contaminated sediments, disruption of river courses and ecosystems, and have potential to pollute the air with dust and toxic gases (UNDRR, 2023). Due to the close relationship Eeyouch/Eenouch have with their environment, and in particular land-users, the potential disruption of wildlife, watersheds and ecosystems would impede their traditional way of life, food systems and further exacerbate health disparities (Middleton et al., 2020).

Furthermore, as noted in **Section 7.7 – Changes in Vegetation**, sediment erosion can diminish the resilience of eelgrass meadows, which are crucial for food sovereignty by supporting populations of geese—an important traditional food source for Eeyouch/Eenouch. In turn, these meadows offer vital ecosystem services, including protection against coastal erosion and carbon storage (Fink-Mercier et al., 2024; Idrobo et al., 2024). Their decline could create a negative feedback loop, threatening food security, traditional hunting practices thus impacting mental health.

Impacts on Mental Health

As previously discussed, the psychological impacts of loss of land can profoundly affect communities of Eeyou Istchee, given their spiritual connection with the land. The loss of infrastructure, homes, loved ones and animals are also sources of concern. Experiencing a landslide event is associated with serious mental health impacts (Highland & Geertsema, 2019). Generally, similar to other extreme weather events, various forms of psychological consequences, including anxiety, distress, depression, post-traumatic stress disorder and suicide have been linked to land degradation (Talukder et al., 2021). Moreover, ongoing discussions about eroding land and residential displacement intensify anxiety surrounding this issue. This underscores the necessity for preventive interventions now, and mental health evaluations after such events (Highland & Geertsema, 2019).

POTENTIAL IMPACT	HEALTH IMPACTS	VULNERABLE POPULATION
▸ Landslides in camp or residential areas	▸ Injuries and fatalities, psychosocial impacts, anxiety, solastalgia	▸ All groups
▸ Altered ecosystems, contamination	▸ Food insecurity, water and vector borne diseases, solastalgia, impact on Eeyou/Eenou traditional knowledge and medicine	▸ Land-users, elders, all groups
▸ Residential displacement due to land degradation, landslides or erosion	▸ Psychosocial impacts, anxiety, solastalgia	▸ All groups

7.5.4
Severity of Potential Impacts

Landslides will likely have impacts occurring at the local level and on a smaller scale, and the severity of their impacts will likely depend on their magnitude and location. However, potentially far-reaching impacts related to air and water contamination should not be underestimated.

Areas impacted by mining are of potential concern for landslides and erosion. One environmental impact assessment rates landslide as an event of high severity, but low probability (WSP Canada Inc., 2021). Another environmental impact assessment related to draining existing mine pits anticipates minimal erosion due to the nature of the nearby soil (Troilus Gold Corp, 2019). Despite these assessments, it is important to recognize that impacts assessments associated with industrial exploitation may not fully represent the vulnerability of the entire region, as they are often limited to local areas and primarily emphasize labour nd economic consequences.

Additionally, Indigenous interaction with their environment and interconnectedness with the land will alter the perceived severity of impacts of landslide (Harmsworth & Raynor, 2005). Elders, land-users, tallymen and their families would be particularly affected by the impacts of landslide and erosion on the land. These cultural differences are important to understand Cree risk perception regarding erosion and landslide, as well as regarding all other climate change hazards presented.

Eeyou Istchee's remoteness relative to main Québec urban centres and limited road access increase the severity of landslide and erosion impacts, especially for evacuation and critical infrastructure. A single road closure can isolate

entire communities and cut off essential services. Given the large proportion of youth and people with chronic conditions requiring medical support (e.g., dialysis), limited road access due to landslides and erosion could be catastrophic for the region. The Environmental Health Team assessed consequences based on a worst-case scenario—a large landslide within a community—though actual impacts would vary by size and location. In Whapmagoostui, anxiety has been reported following recent nearby landslides. CCAC members also noted erosion along the La Grande River in Chisasibi, likely worsened by hydroelectric projects and climate change, and landslides near Cold Water Lake, which have altered river flow and increased sandbar formation.

Due to these considerations, the Environmental Health team summarized the consequences of landslides and erosion in **Table 39** with an overall score of **23**, which translates to a rating of **6 – Catastrophic**.

TABLE 39. SEVERITY OF POTENTIAL IMPACTS TO LANDSLIDES AND EROSION

	0	1	2	3	4
			MODERATE	SEVERE	CATASTROPHIC
FATALITIES					Could result in +50 fatalities within the community.
INJURIES				Could injure +100 people within the community.	
EVACUATION				Could result in more than 500 people being evacuated, sheltered-in-place or stranded.	
PROPERTY DAMAGE				Widespread severe damage (many buildings destroyed).	
CRITICAL INFRASTRUCTURE SERVICE DOMAIN				Could disrupt more than 3 critical infrastructure services.	
ENVIRONMENTAL IMPACT				Could cause severe and irreversible environmental damage. Full clean up not possible.	
BUSINESS/ FINANCIAL IMPACT			Could result in losses for an industry.		
PSYCHOSOCIAL IMPACT			Widespread psychosocial impacts, e.g. mass panic, widespread hoarding and self-evacuation and longterm psychological impacts.		

7.5.5 Regional Response to Landslides and Erosion

The regional response to landslide and erosion **(Table 40**) was rated based primarily on literature review and consultations with regional and community partners. However, consultations were limited since the CCAC did not address this issue. Adaptation measures and recommendations to address landslide and erosion revolved around monitoring landslides and change in slope, mostly around homes and along rivers. The following section is not meant to be a comprehensive portrait of the adaptation plans of the region; each community has their own decentralized adaptation strategy.

Consultation and Fire Chiefs and Public Safety Officers Meeting

Although participants did not come up with adaptation strategies, they questioned whether earthquakes could also be linked to climate change and whether there might be more earthquakes in the region in the future. Indeed, some research suggests that climate change or large weather events can trigger earthquakes in areas along existing fault lines (McGuire, 2012, 2016; Sadhukhan et al., 2021). However, Eeyou Istchee is in a zone of low risk for seismic activity, and major earthquakes (i.e. those causing significant damage to homes or communities) are not anticipated in the region (Natural Resources Canada, 2015).

Cree Regional Climate Forum Consultation

Following the CRCF workshop on existing and potential adaptation strategies, participants suggested monitoring and stabilizing the land slope, specifically along rivers using rocks, and along homes (CNG & CBHSSJB, personal communication, April 11, 2024). Precipitation was another climate hazard recognized to influence landslide and erosion, particularly though its effects on water levels for riverside dwellings, impact on trees and ice thickness changes. French drains and wider storm drains could be response strategies as well in reaction to the interaction between precipitation and erosion. Additionaly, concerns about the impacts of tides and wind reflected the interconnectedness of other climate hazards and erosion.

The region's response to landslide and erosion was assessed as **1-Very Low** (**Table 40**), reflecting a concern for erosion of the land and a lower number of reported adaptive strategies as compared to other climate hazards. The compounded effects of other climate hazards on landslide and erosion as revealed by discussions would also require response strategies to be more comprehensive.

TABLE 40. REGIONAL RESPONSE RATING TO LANDSLIDE AND EROSION

	0	1	2	3	4	5
RESPONSE	NONE	VERY LOW	LOW	MODERATE	MODERATE TO HIGH	HIGH
Eeyou Istchee		◆				

7.5.6
Confidence Scale

Both the confidence of the exposure and severity of impacts of climate-related changes in major landslides or erosion have been rated as low. The specific locations, and therefore impacts, of climate-related changes in landslides and erosion are challenging to anticipate. At the same time, changes to landslides and erosion influenced by development and industrial activities are potentially more predictable in location and impact.

The confidence of regional response rating to landslide and erosion is high due to limited data on regional adaptation strategies focused on landslide and erosion management and prevention.

7.5.7
Assessment of Regional Vulnerabilities to Landslide and Erosion

By applying the risk assessment formula, the Environmental Health team arrived at a vulnerability rating of **5 - Extreme** (**Table 41**). The vulnerability score is calculated as follows: **Exposure (4) + Impact Severity (6) - Response (1) = 9** This score indicates a rating of extreme regional vulnerability to landslide and erosion. Few adaptation strategies are already in place to mitigate the effects of the hazard. The situation emphasizes the urgent need for increased support to implement regional adaptive measures addressing the potential impacts of landslides and erosion. This is important given the compounded exposure to other climate-related hazards, which amplify the probability of occurrence and severity of these risks.

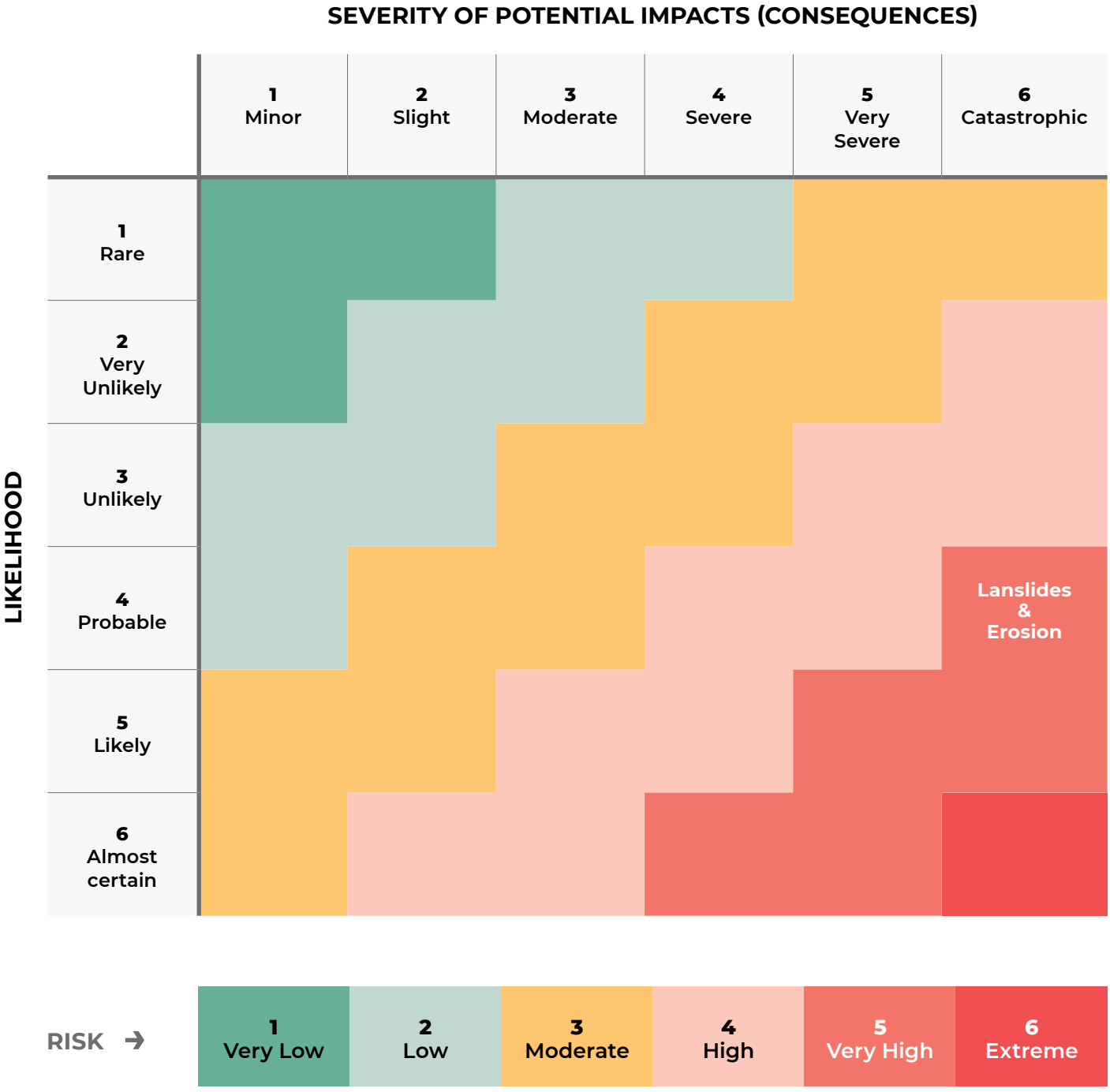
TABLE 41. CLIMATE HAZARD VULNERABILITY RATING OF LANDSLIDES AND EROSION

Calculated value (Exposure + Impact Severity – Response)	*2*	*3*	*4*	*5*	*6*	***7+***
Vulnerability rating	**0**	**1**	**2**	**3**	**4**	**5**
Vulnerability to climate hazard	**NONE**	**LOW**	**MODERATE**	**MODERATE TO HIGH**	**HIGH**	**EXTREME**

7.5.8
Risk Assessment

Based on the likelihood (**4 - Probable**) and impact severity (**6 - Catastrophic**) calculated above, the risk associated to Landslides and Erosion was identified as **5-Very high** (**Table 42**).

TABLE 42. RISK ASSESSMENT OF CHANGES IN LANDSLIDES AND EROSION



7.6 CHANGES TO WILDLIFE POPULATIONS

The relationships between wildlife species and Eeyouch/Eenouch take on widely different meanings across the territory and present distinct exposures to changing climates. The “changes in wildlife populations” climate hazard takes into consideration two aspects of change:

1) Changes to the state of wildlife populations (e.g., health status, population, distribution);

2) Changes in their access by Eeyou/Eenou land-users performing their traditional harvesting activities (e.g., wildlife migration patterns; wildlife behavior);

3) The impact of other climate hazards (temperature, precipitation, forest fires, wind and erosion/landslides) on the ability to safely access traditional hunting and ishing grounds.

7.6.1 Historical and Projected Climate Impacts on Wildlife Populations

This section aims to provide an overview of the impacts of future climate conditions on cultural *keystone species* rather than detailed accounts of climate process. Some detailed examples were, however, drawn from the literature to illustrate how multiple climate modifications can interact together. Fifty-year projections for changes in wildlife populations are significantly influenced by other hazards discussed in this document, such as temperature, precipitation and forest fires, demonstrating their interconnectedness. Climate indicators contributing to understanding how changing climate may contribute to changes in wildlife populations can be found in **Appendices A** and **B**, and include the following:

- Mean annual temperature,
- Mean spring temperature,
- Mean summer temperature,
- Mean fall temperature,
- Annual number of frost days,
- Growing degree days,
- Mean annual precipitations,
- Maximum number of consecutive dry days.

Impacts of climate change vary significantly according to existing ecosystems and have both direct and indirect effects on wildlife species. Ropars et al. (2022) exemplify this as such:

> […] *in northern terrestrial ecosystems, landscape greening may be directly beneficial to some species such as ptarmigan, caribou and moose, but indirectly detrimental through the positive effects on some predators.* […] *with these interactions, it is difficult to predict the net impact and complexity of the ecological response to climate change*.
> (Ropars et al., 2022 p.17).

Findings from the *Climate Change Impacts on Key Wildlife Species of Local Indigenous Food Systems in Northern Québec* are included in this chapter. Ropars et al. (2022) describe the impacts of climate change on the abundance, distribution, and health of 32 wildlife species and species groups identified as key to Cree and Inuit food systems of northern Québec.A shorter list of interest to Eeyouch/Eenouch was identified for the current project and guided the assessment of climate induced changes that may impact Eeyou Istchee and its people. This section only highlights key impacts of climate change on terrestrial and aquatic wildlife generally but details on 26 species identified can be found in **Appendix D**.

Since 1850, anthropogenic-induced climate change (IPCC, 2013) has resulted in the displacement of terrestrial isotherm species towards higher latitudes and altitudes, creating shifts in phenology and biome distribution (Sirois-Delisle et al., 2024). As suitable habitats are reduced and become less connected, the projected effects include northward displacements of historical distribution, contraction and fragmentation of wildlife populations (Ropars et al., 2022). While some species may benefit from these changes, many high-latitude species, such as ones significant for Cree sustenance, are at risk. The greening of the arctic and the subarctic tundra is a good example of the isotherms' northward displacement. While it represents additional food sources and shelter for beavers and ptarmigans, this phenomenon also has negative effects by holding snow above ground and creating more difficult travelling conditions for large game such as moose and caribou (Ropars et al., 2022).

Additionally, important species to the Crees, such as caribou and migratory birds, rely on synchronizing key life events (migration, breeding or calving) with peak plant productivity. However, climate projections suggest earlier springs may cause plants to bud and flower earlier, disrupting this timing. Such mismatches can reduce juvenile survival, lower body mass, and impair migration (Ropars et al., 2022).

Climate change effects, such as increasing temperatures, changing ice conditions, and organic input from terrestrial biomes, are also anticipated to impact marine ecosystems of James Bay. Anticipated increases in water temperature in early summer (see **Section 7.1 - Changes in Temperature**) will have a major impact on lakes' conditions and reduce suitable habitats for many fish species important to Cree subsistence. Because fish are highly vulnerable to temperature changes, they will shift their distribution, mainly northward, to find suitable thermal habitats. This is currently observed with the rainbow smelt, an invasive species, along the eastern James Bay and connecting rivers. Consequently, a partitioning of resources may occur between emerging species and native species, which may cause major variations in Cree harvest yields.

Low dissolved oxygens levels due to increasing temperatures would stress cold water fish species (Arctic char, lake trout, and whitefish) by affecting their metabolic function and increase energy needs for feeding, eventually leading to a decrease in body mass (Ropars et al., 2022). Additionally, increased dissolved organic carbon (DOC) from leaching organic inputs from soil decomposition can further reduce water oxygenation and affect cold-water habitats. Conversely, some lakes may become more nutrient-rich and productive, benefitting the growth and survival of other species. Nevertheless, all these changes could shift fish distributions and behavior—potentially reducing migrations of anadromous species and creating barriers for Cree fishing access.

Declining sea ice in the Arctic—projected to drop 12–46% by 2100— and projected ice-free summer by 2099 (Overpeck et al., 2006) will boost productivity in James Bay, benefiting some species like harbor seals but harming ice-dependent species such as polar bears and ringed seals. These ecological shifts are already being observed and are expected to continue. Further details are summarized in **Appendix D** (Ropars et al., 2022).

7.6.2
Exposure to Changes in Wildlife Populations

Changes in wildlife populations is a complex hazard for which projections rely on a multitude of indicators of various nature. However, the available information from any scientific studies, based on climate modelling comparable to the CMIP6 shows that most, if not all, species that sustain Cree subsistence and way of life will be directly or indirectly impacted, both in positive and negative ways.

This led the Environment Health team to give this hazard a score of **24** corresponding to a rating of **6 – Very high exposure** (**Table 43 -** *see on next page*). This rating gives an overall appreciation of the significance of the changes that are projected for the region's wildlife. Not all species on which Crees rely on to maintain their traditional livelihood will be impacted at the same level but, as Eeyouch/Eenouch harvest a wide variety of species from various habitats (boreal forest, rivers, wetlands, tundra, marine, etc.), it is suggested that they will experience these changes annually over the next 50 years, at each season and across the territory. Extent of exposure for communities was left blank, since this would depend on the proportion of community members who directly interact with wildlife (e.g. by hunting, harvesting, or consuming traditional foods). The community-level exposure table is also omitted, as most interaction with wildlife will occur outside communities, and wildlife populations are distributed across the territory and not tied to specific community locations.

TABLE 43. EXPOSURE TO CHANGES IN WILDLIFE POPULATIONS AT THE REGIONAL AND COMMUNITY LEVELS

		1	2	3	4	5	6
Temporal exposure		**RARE**	**VERY UNLIKELY**	**UNLIKELY**	**PROBABLE**	**LIKELY**	**ALMOST CERTAIN**
Frequency of occurrence		Hazards with return periods **>100 years.**	Occurs every **50 – 100 years** and includes hazards that have not occurred but are reported to be more likely to occur in the near future.	Occurs **every 20 – 50 years**	Occurs **every 5 – 20 years**	Occurs **every 5 years** or less	The hazard occurs **annually**.
Probability of occurrence		**Less than a 1%** chance of occurrence in any year.	**Between a 1-2%** chance of occurrence in any year.	**Between a 2 – 10%** chance of occurrence in any year.	**Between a 10 – 50%** chance of occurrence in any year.	**Between a 50 – 100%** chance of occurrence in any year.	**100%** chance of occurrence in any year.
Duration of exposure (over the course of a given year)		**Less than a day**	**<5 days**	**5 to 10 days**	**10 to 20 days**	**Season**	**Continuous**
Spatial exposure		**NONE**	**VERY LIMITED**	**LIMITED**	**MODERATE**	**HIGH**	**VERY HIGH**
Extent of exposure	**Across the region**	**Very localized** (a few individuals)	**Localized** (neighborhood or sector of a community)	**One** communities	**Multiple** communities	Either **all coastal** or **all inland** communities	**All** of Eeyou Istchee
	Commu-nities	Less than **5%** of the community	**5 to 10%** of the community	**10 to 25%** of the community	**25 to 50%** of the community	**50% to 75%** of the community	**More than 75%** of the community

7.6.3
Potential Health-Related Impacts of Changes in Wildlife

The health and well-being of Eeyouch/Eenouch are strongly connected to the stability of ecosystems and the state of wildlife populations. Two types of health-related impacts connected to changes in wildlife induced by climate change have been identified for Eeyou Istchee:

- Impacts on food security.
- Impacts connected to traditional activities.

Impacts on Food Security

In addition to ensuring food security, some of these species play central roles within Cree social systems, a relationship often coined through the term cultural keystone species. Garibaldi and Turner (2004) explain this relationship in the following way:

Keystone species may serve a particular culture materially in a host of different ways: as a staple food or a crucial emergency food, in technology, or as an important medicine. As well, such a cultural keystone species may be featured in narratives or have important ceremonial or spiritual roles. It would also likely be highly represented in a culture's language and vocabulary. [...] the specific role a particular species plays in a culture may vary considerably, its designation as a cultural keystone species lies in its high cultural significance.

(Garibaldi & Turner, 2004, p.4).

The previous sections show that climate change could impact the access to wildlife species that exists as staple food sources for the Crees such as cold-water fish species, large mammals (caribou and moose) and migratory birds that may shift northward or reduce their distribution to fewer areas. Other significant species, such as beavers, are, however, expected to increase in density within their current distribution. These changes have the potential to decrease harvesting success and threaten traditional food procurement networks on which a large portion of community members rely on.

Even when wildlife population levels and distribution remain stable, the decrease in the perceived quality for land-users impacts the reliance of Cree families on traditional food sources. Fat content, or body mass, which is typically considered to be the primary criterion used by Cree land-users to evaluate the quality of the fish and game harvested (Chisasibi Eeyou Resource and Research Institute, n.d.), could be significantly impacted by environmental stressors. In fact, increased summer temperature, more frequent extreme weather events and mismatch between peak plant productivity and migration timing, have detrimental effects on wildlife feeding behaviors. Lower quality wildlife food could be exacerbated by the introduction of new parasitic insects or zoonotic diseases which follow the northward displacement of isotherms (Ropars et al., 2022). The increase in the levels of pollutants, notably in freshwater ecosystems could also contribute to the decrease in Cree harvests as wildlife resources become increasingly perceived as unsafe.

Mental Health & Traditional Activity by Land-Users

Traditional harvesting activities and the capacity of individuals to sustain their families' livelihoods on the Cree traplines are widely connected to a perception of well-being and self-determination in Eeyou Istchee. Decreased reliance on wildlife

resources due to changing climates would contribute to lifestyle changes and higher reliance on store bought food. Beyond the obvious effects on food security, threats to the capacity of Eeyou/Eenou land-users to harvest natural resources they have relied on since time immemorial could contribute to a feeling of solastalgia, or distress caused by the environmental changes occurring in their ancestral lands.

In addition, changes in distribution of large predatory animals increase their chances of encounters with land-users. In the coastal regions of Eeyou Istchee, decrease in spring ice cover could push polar bears towards the coast where Cree land-users dwell. Elsewhere, the increase in wolf populations resulting from increased predation success on large mammals, permitted by a general thicker snow cover in winter and rain over snow events in the spring, may also contribute to more frequent encounters with humans in and around communities.

POTENTIAL IMPACT	**TYPE OF IMPACT**	**VULNERABLE POPULATION**
▸ Changes in distribution, availability and quality of wildlife species	▸ Food security, solastalgia, eco-anxiety	▸ Land-users and their families
▸ Increase in the distribution of invasive species	▸ Food security, solastalgia, eco-anxiety	▸ Land-users and their families
▸ Increase in emerging parasites and zoonotic diseases	▸ Food security, solastalgia, infectious diseases	▸ Land-users
▸ Increase in encounters with large predatory species (Polar bears, wolves)	▸ Injuries, death	▸ Land-users

7.6.4
Severity of Potential Impacts

Available climate projections predict major environmental modifications that will significantly impact wildlife species significant for Eeyouch/ Eenouch. Changes in migratory behaviour, feeding behavior and populations distribution could significantly impact traditional Cree harvesting practices. Modifications in the ecosystems will directly lead to changes in the way and the frequency in which traditional activities are performed. This will negatively impact the capacity of Eeyouch/Eenouch to supply themselves with traditional foods.

The team observed that interactions with predatory species, such as wolves and polar bears, could become more dangerous as these animals move closer to communities or camps due to environmental changes. These events might lead to the entire community sheltering in place for safety. Bears or invasive insects were noted as potential sources of minor property or infrastructure damage. Due to climate change's impact on ecosystems, it is suggested that environmental impact would range from moderate to severe. The business and financial impact was noted to be severe as it could impact food security of community members who rely on hunting and fishing as an important source of food, particularly with the high cost of store-bought food in northern communities.

Committee members expressed concerns about the impact these changes could have on migratory pathways of other species and the availability of wild game. Consultations with the CCAC provided several anecdotes to illustrate the impacts they have noted on the wildlife populations. For example, black bears have been sighted in the north during the winter, suggesting that their hibernation schedule has been disrupted. In addition, increased reports of bear sightings and human interactions with black bears were noted. Animals such as white-tailed deer, cougars, and skunks have been reported moving northward into territories where they were not previously seen, including inland areas like Mistissini, Waswanipi, Oujé-Bougoumou, and Nemaska. Additionally, moose and beavers are also reported to be migrating further north, where they were once found in specific coastal and inland areas except Whapmagoostui.

Considering the impacts listed in the previous section and the results of the consultation with regional experts, the Environmental Health team rated the consequences of changes to the wild animal population as summarized in **Table 44** (*see on next page*). This gave an overall score of **13-14**, which translates to a rating of **6 – Catastrophic**.

TABLE 44. SEVERITY OF POTENTIAL IMPACTS OF CHANGES IN WILDLIFE POPULATION

	0	1	2	3	4
		MINOR	MODERATE	SEVERE	
FATALITIES		Could result in fewer than five fatalities within the community.			
INJURIES		Could injure fewer than 25 people within community.			
EVACUATION				Could result in more than 500 people being evacuated, sheltered-in-place or stranded.	
PROPERTY DAMAGE		Could cause minor and mostly cosmetic damage.			
CRITICAL INFRASTRUCTURE SERVICE DOMAIN		Could disrupt 1 critical infrastructure service.			
ENVIRONMENTAL IMPACT			Could cause major but reversible damage. Full clean up difficult.	Could cause severe and irreversible environmental damage. Full clean up not possible.	
BUSINESS/ FINANCIAL IMPACT			Could result in losses foran industry.		
PSYCHOSOCIAL IMPACT			Widespread psychosocial impacts, e.g. mass panic,widespread hoarding and self-evacuation and longterm psychological impacts.		

7.6.5
Regional Response to Changes in Wildlife Populations

The level of regional response to changes in wildlife (**Table 45**) was rated **4 - Moderate to high** based primarily on consultations with regional and community partners. Existing adaptation measures to changes in wildlife, along with most recommendations for improvement, primarily address wildlife monitoring, local knowledge and training, and adapting forest management and harvesting activities.

Climate Change Advisory Committee Consultation

During this consultation, the following activities related to changes in wildlife that the group noted to already exist in the region:

- Research to document and understand how changes related to climate change are affecting wildlife in the region. This includes a study on eelgrass and geese, as well as a study on fish.
- Wildlife monitoring activities through various forms of tracking. Land-users can report wildlife using the CTA App.
- The necropsy program offered by the CTA among coastal communities to monitor parasites and zoonotic diseases. Since the time of the consultation, the program has expanded to also include the inland communities.
- Wildlife protection and habitat restoration activities.
- The incorporation of Elders knowledge and traditional hunting practices in activities related to wildlife monitoring and conservation.
- Changes to hunting practices including hunting restrictions to allow wildlife populations to recover, reducing harvesting after large forest fires, and hunting in the south of Québec and Ontario further from the communities.
- The work of public safety officers to manage predators found near communities.
- Local trainings on polar bear encounters and deterrence.

Recommendations for additional adaptation activities included:

- Protecting more of Eeyou Istchee wildlife and habitats through establishing parks and conservation areas,
- Implementing habitat enrichment projects,
- Collaborating with other First Nations on wildlife monitoring and tracking projects,
- Collaborating with scientific and research institutions so that policy development and decision making can be done adapting to the Cree way.

Cree Regional Climate Forum Consultation

Following the CRCF workshop on existing and potential adaptation strategies, emphasis was put on local engagement, impact assessment and collaboration between governing bodies to monitor and mitigate wildlife changes. Participants suggested hiring local climate change coordinators, implementing citizen science monitoring activities, creating wildlife directives such as a forestry management plan for moose, doing cumulative impact assessments to consider the impacts of climate and human activities (e.g., forestry and mining) on wildlife, and hosting land-based training to enhance food harvesting skills.

TABLE 45. REGIONAL RESPONSE RATING TO CHANGES IN WILDLIFE POPULATION

	0	1	2	3	4	5
RESPONSE	NONE	VERY LOW	LOW	MODERATE	MODERATE TO HIGH	HIGH
Eeyou Istchee					◆	

7.6.7 Confidence Scale

The confidence of regional exposure to wildlife population changes is rated as high due to a large body of evidence.

The confidence of severity of impacts to wildlife population changes is rated as moderate. There is limited information on impacts in Eeyou Istchee ecosystems and the complexity of indirect impacts on the population of Eeyou Istchee (e.g. food security, cultural impacts).

The confidence in regional response to changes in temperature is rated high for Eeyou Istchee since the region has several entities highly engaged in monitoring wildlife changes and adapting cultural activities and harvesting in response to these changes.

7.6.8 Assessment of Regional Vulnerabilities to Changes in Wildlife

By applying the risk assessment formula (**Table 46**), the Environmental Health team arrived at a vulnerability rating of **5 - Extreme**. This is calculated using the following formula: **Exposure (6) + Impact severity (6) - Response (4) = 8**. This rating indicates extreme regional vulnerability of the population of Eeyou Istchee to changes in wildlife. In other words, while some adaptation strategies are already in place to mitigate the effects of these changes, these are limited in the face of the combined exposure to and severity of the hazard. This final rating highlights the urgent need to increase support for regional adaptive measures to address the significant impacts wildlife changes are expected to have on the health and well-being of the population of Eeyou Istchee.

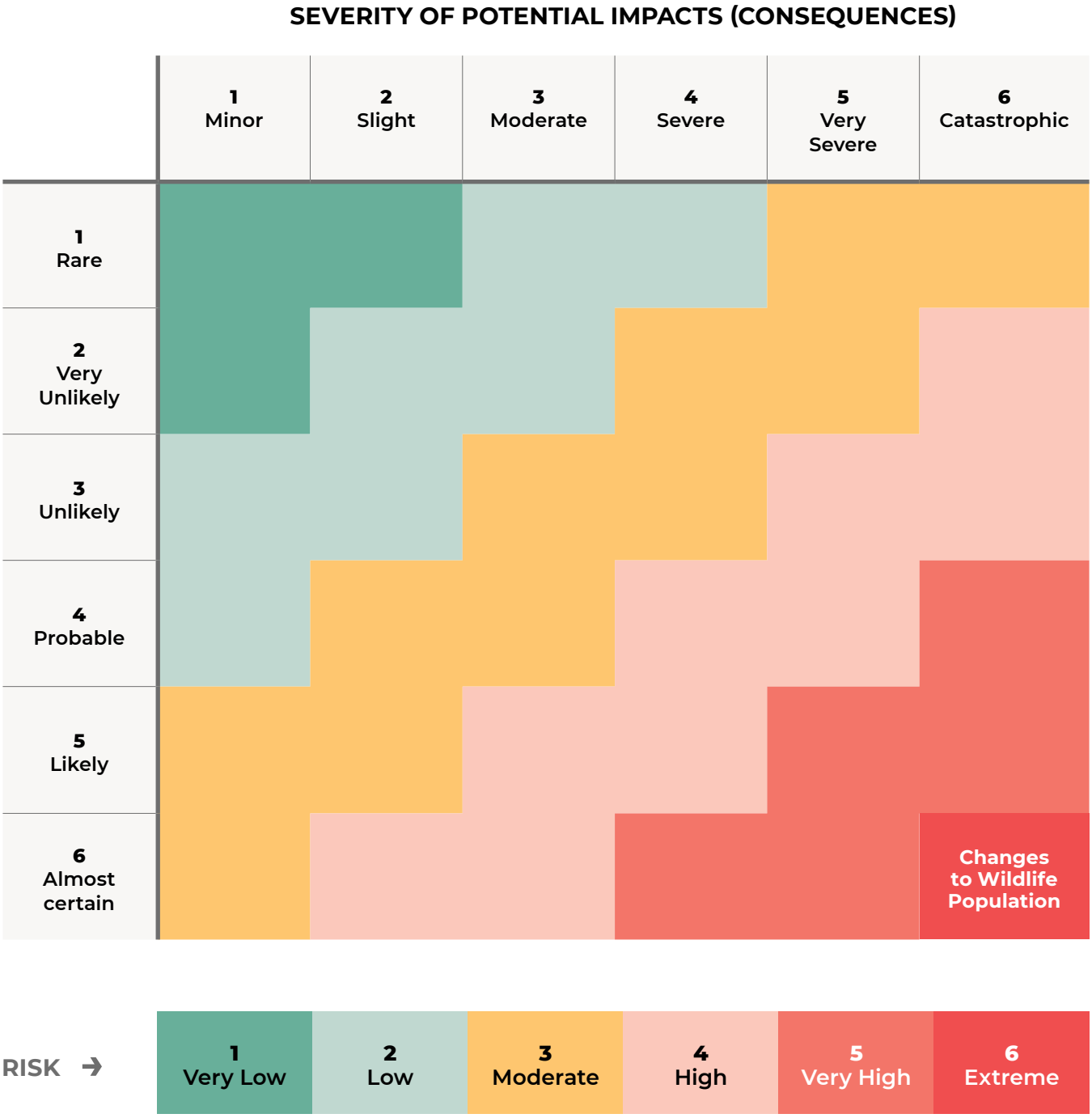
TABLE 46. CLIMATE HAZARD VULNERABILITY RATING OF CHANGES IN WILDLIFE POPULATION

Calculated value (Exposure + Impact Severity – Response)	*2*	*3*	*4*	*5*	*6*	***7+***
Vulnerability rating	**0**	**1**	**2**	**3**	**4**	**5**
Vulnerability to climate hazard	NONE	LOW	MODERATE	MODERATE TO HIGH	HIGH	EXTREME

7.6.9
Risk Assessment

Based on the likelihood (**6 - Almost certain**) and impact severity (**6 - Catastrophic**) calculated above, the risk associated to changes in wildlife populations was identified as **6-Extreme** (**Table 47**).

TABLE 47. RISK ASSESSMENT OF CHANGES IN WILDLIFE POPULATIONS



7.7 CHANGES IN VEGETATION

Understanding how climate change affects plant life is vital for grasping its broader impact on Eeyouch/Eenouch. Plants are essential not just for food and medicine but also for cultural practices and identity. Similarly to wildlife species, certain plant and tree species can be considered cultural keystone species for the Crees due to their high cultural significance. This section provides an overview of the type of vegetation found in the region and delves into the relationship between vegetation and Cree culture and livelihood amidst changing climate conditions. Many plant species can be currently found in the two main vegetation types of Eeyou Istchee, wetlands and forests (BC2 Inter-Nation Collaboration, 2021a).

Wetlands

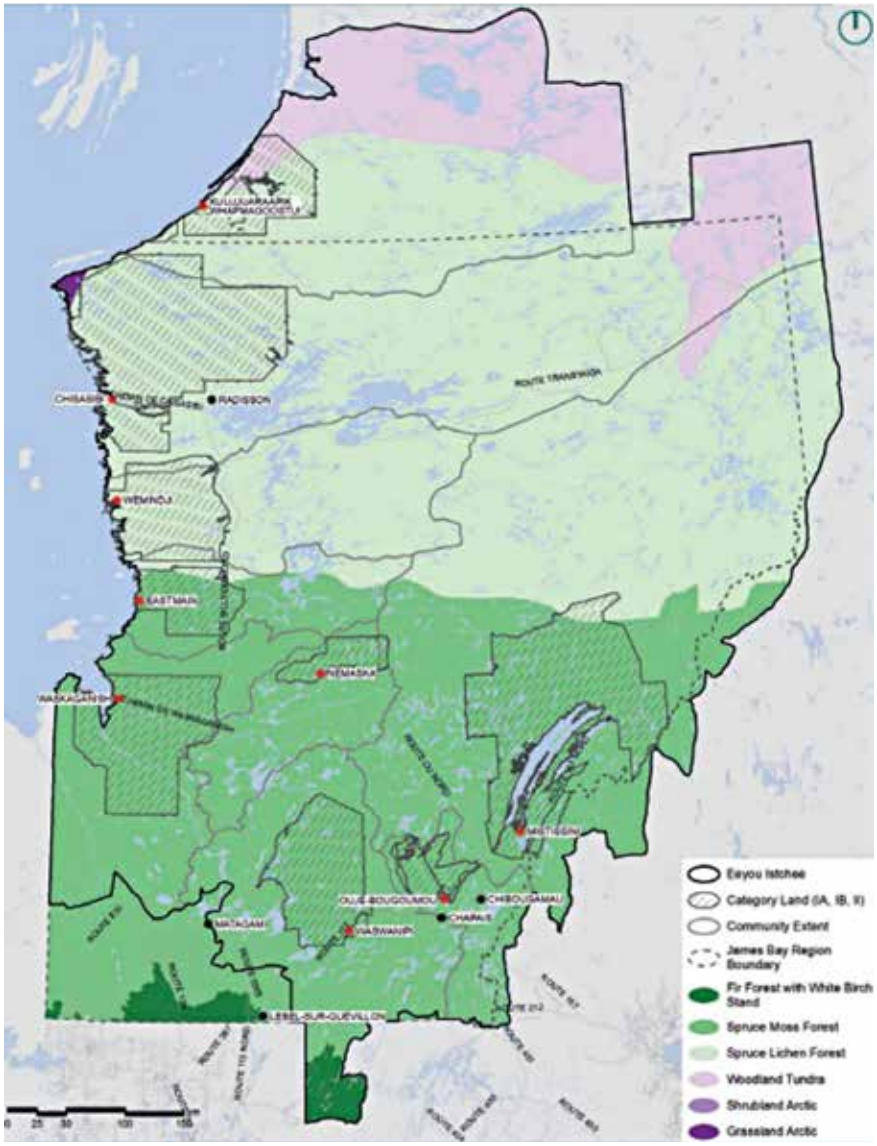
Wetlands provide a key ecosystem maintenance function which includes water purification and supply, flood and erosion control, carbon storage and sequestration, and habitat for biodiversity. Eeyou Istchee's vast territory spans a wide range of wetlands including peatlands (fen and forested bogs), swamps, salt marshes, and shallow water (BC2 Inter-Nation Collaboration, 2021a). These areas represent important reservoirs for biodiversity and carbon sequestration; thus, their preservation is crucial to climate change adaptation (The Grand Council of the Crees, 2022). The James and Hudson Bay Lowlands are some of the largest peatlands in the world and constitute some of the greatest global carbon sinks. However, it is uncertain how their role will be affected by changes in climate (Hennigs & Bleau, 2017).

Forests

Eeyou Istchee features two primary forest types: the spruce moss forest (Boreal tundra woodland) in the south and the spruce lichen forest (Boreal coniferous) in the north (Figure 19). Other less widespread forests include the woodland tundra in the north, fir forest with white birch in the south, and a grassland Arctic tundra between Chisasibi and Whapmagoostui along James Bay (BC2 Inter-Nation Collaboration, 2021a). **Figure 19** presents the distribution of forest types across the region. The territory is mainly covered by coniferous species, with smaller areas of tundra, boreal heath, and subarctic heath in the north, and mixed trees in the south. Mixedwood stands are culturally significant to the Eeyou/Eenou population, providing diverse habitats, materials,

medicines, and serving as landmarks for Cree tallymen. Boreal forest plants have historically supplied Eeyouch/Eenouch with essential nutrients like vitamins and minerals. Although plant use has evolved, certain species, such as blueberries, raspberries, cloudberries, cranberries, and various barks and plants, remain important for beverages and aromatic substances (BC2 Inter-Nation Collaboration, 2021a).

FIGURE 19. MAP OF EEYOU ISTCHEE'S FOREST TYPES



Source: Image adapted from BC2 Inter-Nation Collaboration (2021a).

7.7.1
Historical and Projected Climate Data

To better understand how climate change will influence changes in vegetation for Eeyou Istchee, climate indicators related to changes in temperature and precipitation were used to complement scientific literature and community consultations. The climate indicators used are listed below, regional and community data can be found in **Appendices A** and **B**:

- Mean annual temperature,
- Mean spring temperature,
- Mean summer temperature,
- Mean fall temperature,
- Total annual precipitation,
- Total spring precipitation,
- Total summer precipitation,
- Total fall precipitation,
- Annual number of wet days,
- Number of spring wet days,
- Number of summer wet days,
- Number of fall wet days,
- Annual number of periods with at least 5 consecutive dry days,
- Annual number of consecutive wet days.

Impacts on Wetlands

Climate modeling indicates that changes in vegetation are expected to mirror shifts observed in wildlife populations, with a gradual northward movement of plant distributions (Gauthier et al., 2015). Wetlands in parts of northern Québec are expanding because of erosion and permafrost thawing (Ropars et al., 2022). Limited literature exists on the effect of climate change on these ecosystems in Canada but changes in water discharge, groundwater table, length of the growing season and winter snow cover are known to have modifying effects on subarctic peatland (Schouten et al., 1992). James Bay peatlands may be both positively and negatively affected by changes in climate. The vicinity of Eastmain and La Grande complex registered higher peat accumulation rates due to higher temperatures. Peatlands' high humidity and lower forest density may provide an effective fire barrier (Garneau et al., 2014), and carbon fixation could increase in peatlands north of the 51st parallel. However, the quality of the important ecological functions provided may be negatively impacted by changes in temperature, water input or nutrient levels (Hennigs & Bleau, 2017), with peatlands located on permafrost likely to disappear with higher temperatures (Ropars et al., 2022). Turetsky et al. (2015) emphasize how climate-induced drought and drainage increase peatlands' vulnerability to fires, resulting in the release of significant GHG emissions. More research is needed to establish whether these combined changes will amplify peatland carbon sink functions or become a source of carbon emissions (Hennigs & Bleau, 2017).

Another noticeable climate-induced alteration in vegetation, the greening of landscapes, is expected to particularly impact the Arctic and subarctic tundra, and open woodlands. A warming climate and prolonged growing seasons have spurred the rapid spread of shrub species like dwarf birch (Betula glandulosa Michaux) across Northern Québec (Ropars & Boudreau, 2012; Tremblay et al., 2012). The colonization of shrub species can induce significant change, such as altering light and temperature conditions for other plant communities and modifying soil thermal and moisture regimes, subsequently influencing microbial activity (Myers-Smith et al., 2011). Experimental studies indicate that increased shrub cover generally results in a decrease in plant species richness and coverage (Klein et al., 2004).

Impacts on Forests

Regarding forests, the gradual northward migration has been observed among deciduous trees species towards boreal zones, although their migration speed does not match the quick change of climate zone (Boisvert-Marsh et al., 2014). Extreme summer weather, such as drought, could lead to forest cover thinning in the boreal forest and may cause closed forests to transition to lower-productivity woodlands (Gauthier et al., 2015). The current composition of the boreal forest stands to be strongly impacted by the effect of climate change in a relatively short timeframe. By 2100, strong climate forcing could hinder the growth of spruce, pine, larch, balsam fir and other boreal species. This decline in productivity may lead to a climatic debt (Taylor et al., 2017) due to the increased growth of thermophilous species not fully offsetting losses in boreal species (Boulanger et al., 2023). Boulanger et al. (2023), suggest that two major climate-change-related natural disturbances will impact Québec's forests: wildfires and spruce budworm (Choristoneura fumiferana) outbreaks. Spruce budworm outbreaks were shown to last on average 6 years longer with 15% greater defoliation for the 2081-2100 period (Gray, 2008).

Impacts on Non-Timber Vegetation

Berteaux et al. (2014) note that climate change has been linked to changes in plant phenology in Québec and globally. However, it is important to note that Eeyouch/Eenouch harvest medicinal plants and wild berries in climate-sensitive areas like peatlands. Honeycutt (1995) observed that freeze-thaw cycles could result in microbial die-off and nutrient flushes, hindering certain plant species from capitalizing on them during the growing season. Additionally, warmer winters may lead to the loss of insulating snow for cold-sensitive species, triggering widespread effects like ice encasement and delayed budburst in flower production (Bokhorst et al., 2011; Rixen et al., 2022; Ropars et al., 2022). Plants have been observed to flower on average two to five days earlier each year. These changes are bound to impact pollinators and affect the length of the growing season, which has already been observed to start earlier in the spring and to be several days longer (Samson, 2012). Length of a growth season for many plant species will be consistent with the length of the frost-free season, or the number of days where the temperature remains above 0°C. The length of frost-free seasons across the region is projected to increase over time (Cuciurean et al., 2011).

Coastal areas and estuaries also represent productive ecosystems and ideal habitats for multiple plant and animal species. Increases in temperatures and a decrease in ice cover affect wave amplitude, current, salinity intrusion, sediment transportation processes and residual circulation in the estuary, which in turn impact local flora and fauna (Wang et al., 2012). Eelgrass is a coastal plant species affected by climate change because it depends on light, temperature, and nutrients for its survival and growth (Kaldy, 2014). As expressed by land-users during consultations, a reduction in eelgrass is often correlated with a decrease in geese populations along the coastline. See **section 7.6 - Changes in Wildlife Populations** for more information on the effects of climate change on wildlife species.

7.7.2 Exposure Analysis

The Environmental Health team assigned this hazard a score of 29 and rated the exposure of Eeyou Istchee to changes in vegetation as **6 - Very high** (**Table 48**). Our team found the frequency scale less relevant for this issue which would most likely be reflected as gradual changes in growing seasons and growing regions. This corresponds to an exposure rating of 6 - Very high exposure for both the region and the communities (**Table 49**).

TABLE 48. EXPOSURE TO VEGETATION CHANGES AT THE REGIONAL AND COMMUNITY LEVELS

		1	2	3	4	5	6
Temporal exposure		**RARE**	**VERY UNLIKELY**	**UNLIKELY**	**PROBABLE**	**LIKELY**	**ALMOST CERTAIN**
Frequency of occurrence		Hazards with return periods **>100 years.**	Occurs every **50 – 100 years** and includes hazards that have not occurred but are reported to be more likely to occur in the near future.	Occurs **every 20 – 50 years**	Occurs **every 5 – 20 years**	Occurs **every 5 years** or less	The hazard occurs **annually**.
Probability of occurrence		**Less than a 1%** chance of occurrence in any year.	**Between a 1-2%** chance of occurrence in any year.	**Between a 2 – 10%** chance of occurrence in any year.	**Between a 10 – 50%** chance of occurrence in any year.	**Between a 50 – 100%** chance of occurrence in any year.	**100%** chance of occurrence in any year.
Duration of exposure (over the course of a given year)		**Less than a day**	**<5 days**	**5 to 10 days**	**10 to 20 days**	**Season**	**Continuous**
Spatial exposure		**NONE**	**VERY LIMITED**	**LIMITED**	**MODERATE**	**HIGH**	**VERY HIGH**
Extent of exposure	**Across the region**	**Very localized** (a few individuals)	**Localized** (neighborhood or sector of a community)	**One** communities	**Multiple** communities	Either **all coastal** or **all inland** communities	**All** of Eeyou Istchee
	Commu-nities	Less than **5%** of the community	**5 to 10%** of the community	**10 to 25%** of the community	**25 to 50%** of the community	**50% to 75%** of the community	**More than 75%** of the community

TABLE 49. EXPOSURE RATING TO VEGETATION CHANGES FOR REGION AND NINE COMMUNITIES

LOCATION	FREQUENCY OF OCCURRENCE	PROBABILITY OF OCCURRENCE	DURATION OF EXPOSURE (over the course of a given year)	EXTENT OF EXPOSURE	EXPOSURE RATING
Eeyou Istchee	**6** **The hazard occurs annually**	**6** **100% chance of occurrence in any year**	**5** **Seasonal**	**6** **All of Eeyou Istchee**	**6** **VERY HIGH**
Whapmagoostui	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**5** Seasonal	**6** More than 100 individuals	**6** Very high
Chisasibi	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**5** Seasonal	**6** More than 100 individuals	**6** Very high
Wemindji	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**5** Seasonal	**6** More than 100 individuals	**6** Very high
Eastmain	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**5** Seasonal	**6** More than 100 individuals	**6** Very high
Waskaganish	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**5** Seasonal	**6** More than 100 individuals	**6** Very high
Nemaska	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**5** Seasonal	**6** More than 100 individuals	**6** Very high
Waswanipi	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**5** Seasonal	**6** More than 100 individuals	**6** Very high
Oujé-Bougoumou	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**5** Seasonal	**6** More than 100 individuals	**6** Very high
Mistissini	**6** The hazard occurs annually	**6** 100% chance of occurrence in any year	**5** Seasonal	**6** More than 100 individuals	**6** Very high

7.7.3
Potential Health-Related Impacts of Changes in Vegetation

Health-related impacts connected to changes in vegetation due to climate change have been identified below for Eeyou Istchee:

- Impacts on Cree culture and food security

Impacts on Cree Culture and Food Security

Changes in vegetation across Eeyou Istchee are likely to disrupt cultural continuity and impact the ability of Eeyouch/Eenouch to forage for traditional plants and pass these important teachings to future generations (Indigenous Climate Hub, n.d.-b). Sacred sites and Ceremonies that depend on specific locations or resources, such as medicinal plants, herbs and barks face significant threats from climate change as their distribution and availability is altered (Indigenous Climate Hub, n.d.-b). Medicinal plants have been reported to be used in the management of conditions common in Eeyou Istchee, such as diabetes, and have been studied for their antidiabetic potential. A targeted ethnobotanical study identified 18 plant species prioritized for their potential to treat symptoms associated with type 2 diabetes, illustrating the importance of preserving traditional knowledge and resources for sustainable alternative therapies (Leduc et al., 2006). Changes in vegetation are also associated to changes in animal behaviour which has cascading impacts on local food systems and affects the ability of Eeyouch/Eenouch to source nutritious, affordable and culturally appropriate foods in their territory (Cree Nation Mistissini & Cree Nation Government, 2018). Elders, land-users, tallymen and their families could be confronted to the effects of changing vegetation more often but ultimately all socio-demographic groups would be impacted.

7.7.4
Severity of Potential Impacts

The team noted that changes in vegetation would have little direct impact on fatalities, injuries, evacuations, or damage to buildings and infrastructure. However, concerns were raised about increased pollen allergies and the risks posed by invasive plants like giant hogweed. Environmentally, the impact was expected to be considerable. Since vegetation forms the foundation of the food chain, any disruption could have ripple effects on ecosystems and wildlife. Similar to changes in animal populations, shifts in vegetation could also threaten food security, creating economic challenges for those who rely on the land for sustenance. Beyond the

POTENTIAL IMPACT	TYPE OF IMPACT	VULNERABLE POPULATION
▸ Decrease on the reliance on Eeyou/Eenou traditional knowledge	▸ Psychosocial impacts, solastalgia, food insecurity	▸ Land-users, Elders, youth, all groups
▸ Altered ecosystems and wildlife	▸ Food insecurity, solastalgia, impact on Eeyou/Eenou traditional knowledge and medicine	▸ Land-users, elders, all groups

physical impacts, the Environmental Health team recognized that changes in vegetation could lead to heightened stress and anxiety. The loss of familiar landscapes and disruptions to traditional practices may contribute to a deeper sense of uncertainty and distress within communities. Elders, land-users, tallymen and their families could experience the effects of changing vegetation more strongly.

The Environmental Health team rated the consequences of changes to the vegetation as summarized in **Table 50**. This gave an overall score of **8**, which translates to a rating of **3 – Moderate**.

TABLE 50. SEVERITY OF POTENTIAL IMPACTS OF CHANGES IN VEGETATION

	0	1	2	3	4
	NONE	**MINOR**	**MODERATE**	**SEVERE**	
FATALITIES	Not likely to result in fatalities within the community.				
INJURIES		Could injure fewer than 25 people within community.			
EVACUATION	Not likely to result in an evacuation shelter-in-place orders, or people stranded.				
PROPERTY DAMAGE	Not likely to result in property damage within the community.				
CRITICAL INFRASTRUCTURE SERVICE DOMAIN	Not likely to disrupt critical infrastructure services.				
ENVIRONMENTAL IMPACT				Could cause severe and irreversible environmental damage. Full clean upnot possible.	
BUSINESS/ FINANCIAL IMPACT			Could result in losses for an industry.		
PSYCHOSOCIAL IMPACT			Widespread psychosocial impacts, e.g. mass panic, widespread hoarding and self-evacuation and longterm psychological impacts.		

7.7.5 Regional Response to Changes in Vegetation

The regional response of Eeyou Istchee to changes in vegetation, has been assessed as **3-Moderate** (**Table 51** - see on next page), reflecting ongoing efforts to adapt to changes in vegetation. Through various consultations, community partners have identified current practices and future opportunities to strengthen resilience to this hazard.

Climate Change Advisory Committee Consultation

During discussions within the CCAC, participants highlighted several measures already in place to address changes in vegetation. These include:

- Researching and monitoring of vulnerable plant species, such as eelgrass;
- Adapting traditional diets to include more species that are thriving with changes in vegetation seen in the region (e.g., ptarmigan which thrives due to the growing presence of willows);
- Adopting more local agriculture practices as growing seasons expand through local gardening, community greenhouses, and agriculture programs, in order to promote food security and sustainability.

Additional adaptation activities that were recommended include:

- Monitoring programs for changes in berry harvest over time;
- Training programs in gardening and composting to increase local capacity for food production;
- Subsidies to support the production of healthy foods.

Consultation and Fire Chiefs and Public Safety Officers Meeting

This consultation explored agricultural opportunities linked to longer growing seasons. Participants recognized the potential to expand food production in the region as the climate becomes more conducive to farming. Discussions emphasized the importance of preparing for a future where agriculture plays a greater role in supporting the community, especially in addressing food security and reducing reliance on external resources.

Cree Regional Climate Forum Consultation

At the CRCF, participants reflected on existing and potential strategies for adapting to vegetation changes. Many expressed interests in expanding agriculture across the region. Promoting native species, such as eelgrass, was identified as a priority to support wildlife, particularly geese, whose feeding habitats depend on these plants. Concerns about the impact of climate change on berry harvests were a recurring theme. Participants noted that berries are now smaller, mushy, less sweet, and harder to pick. The blueberry picking season has also shortened significantly, disrupting both traditional practices and community food systems. Shifts in medicinal plants, increased shrub growth in the tundra, and the spread of invasive species were also noted, with participants emphasizing the need for strategies to manage these ecological changes.

7.7.6 Confidence Scale

Confidence of exposure to changes in vegetation due to increasing temperature and precipitation was rated as high.

Confidence of the severity of impacts of climate-related changes in vegetation has been rated as moderate. An understanding of the effects that

TABLE 51. REGIONAL RESPONSE RATING TO CHANGES IN VEGETATION

	0	1	2	3	4	5
RESPONSE	NONE	VERY LOW	LOW	MODERATE	MODERATE TO HIGH	HIGH
Eeyou Istchee				◆		

the changed growth season will have on the region, and on specific plants of value to the Crees is limited but in development.

Confidence of regional response to changes in vegetation is moderate. Adaptive measures at the community level help mitigate the negative effects of vegetation changes, but regional coordination remains limited.

7.7.7 Assessment of Regional Vulnerabilities to Changes in Vegetation

By applying the risk assessment formula (**Table 52**), the Environmental Health team arrived at a vulnerability rating of **4 – High** based on the following formula: **Exposure (6) + Impact Severity (3) - Response (3) = 6**. This rating indicates high regional vulnerability to vegetation changes. This is slightly lower than the vulnerability to other climate hazards which has been rated extreme. This difference is partly because, while having serious implications on the health of Eeyouch/Eenouch, vegetation changes are less likely to cause acute health impacts such as injury or death. As a result, the Environmental Health team rated the severity of these impacts slightly lower in comparison. Moreover, it is important to note that many adaptation strategies are already in place across the territory to mitigate the effects of these changes, such as a focus on northern agriculture and the creation of greenhouses to promote local food production. This final rating shows the need to increase support for regional adaptive measures to address the impacts vegetation changes are expected to have on the health and well-being of the population of Eeyou Istchee.

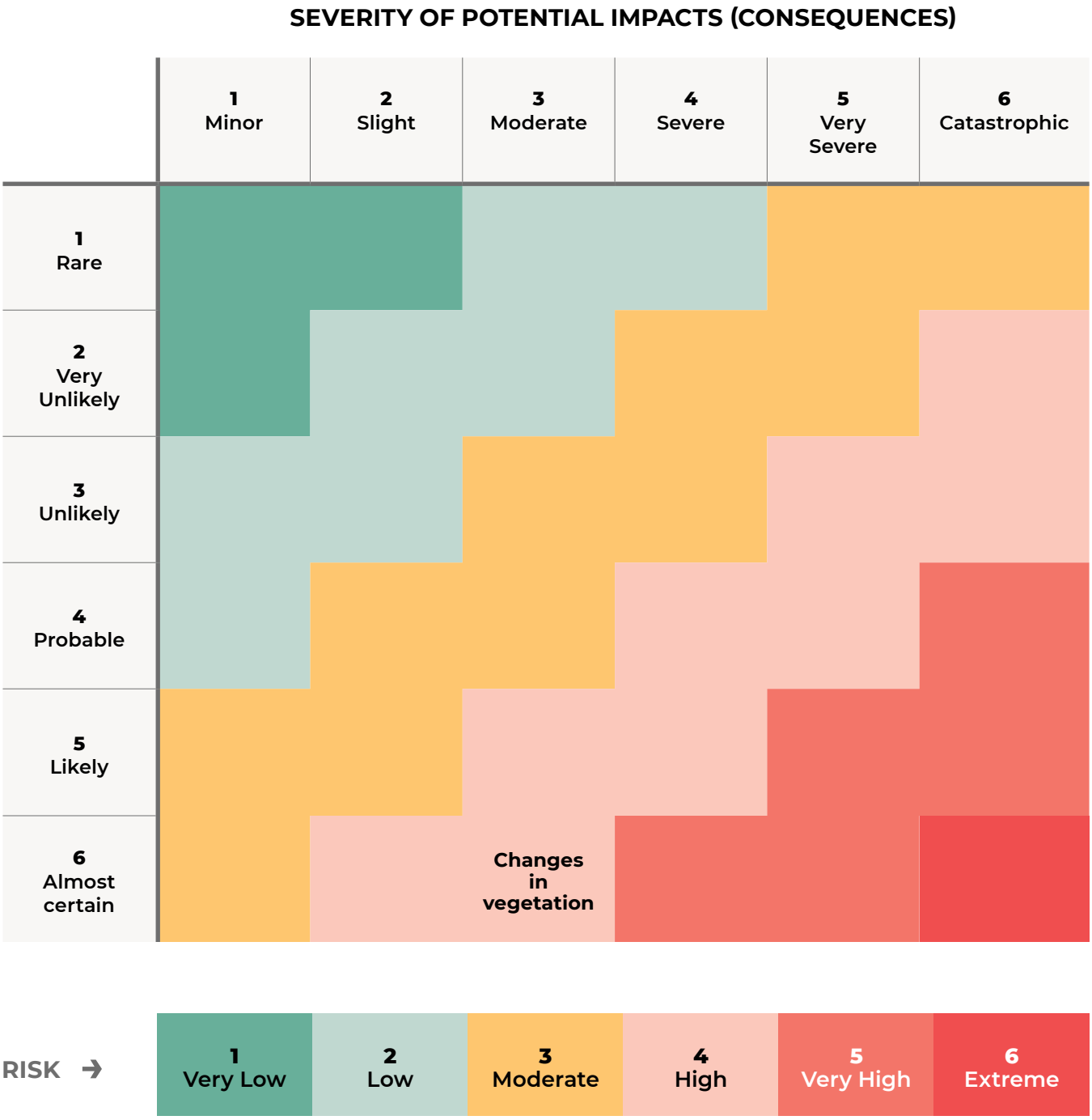
TABLE 52. CLIMATE HAZARD VULNERABILITY RATING OF CHANGES IN VEGETATION

Calculated value (Exposure + Impact Severity – Response)	*2*	*3*	*4*	*5*	***6***	*7+*
Vulnerability rating	**0**	**1**	**2**	**3**	**4**	**5**
Vulnerability to climate hazard	NONE	LOW	MODERATE	MODERATE TO HIGH	HIGH	EXTREME

7.7.8
Risk Assessment

Based on the likelihood **(6 – Almost certain**) and impact severity (**3 – Moderate**) calculated above, the risk associated to changes in vegetation was identified as **4-High** (**Table 53**).

TABLE 53. RISK ASSESSMENT OF CHANGES IN VEGETATION



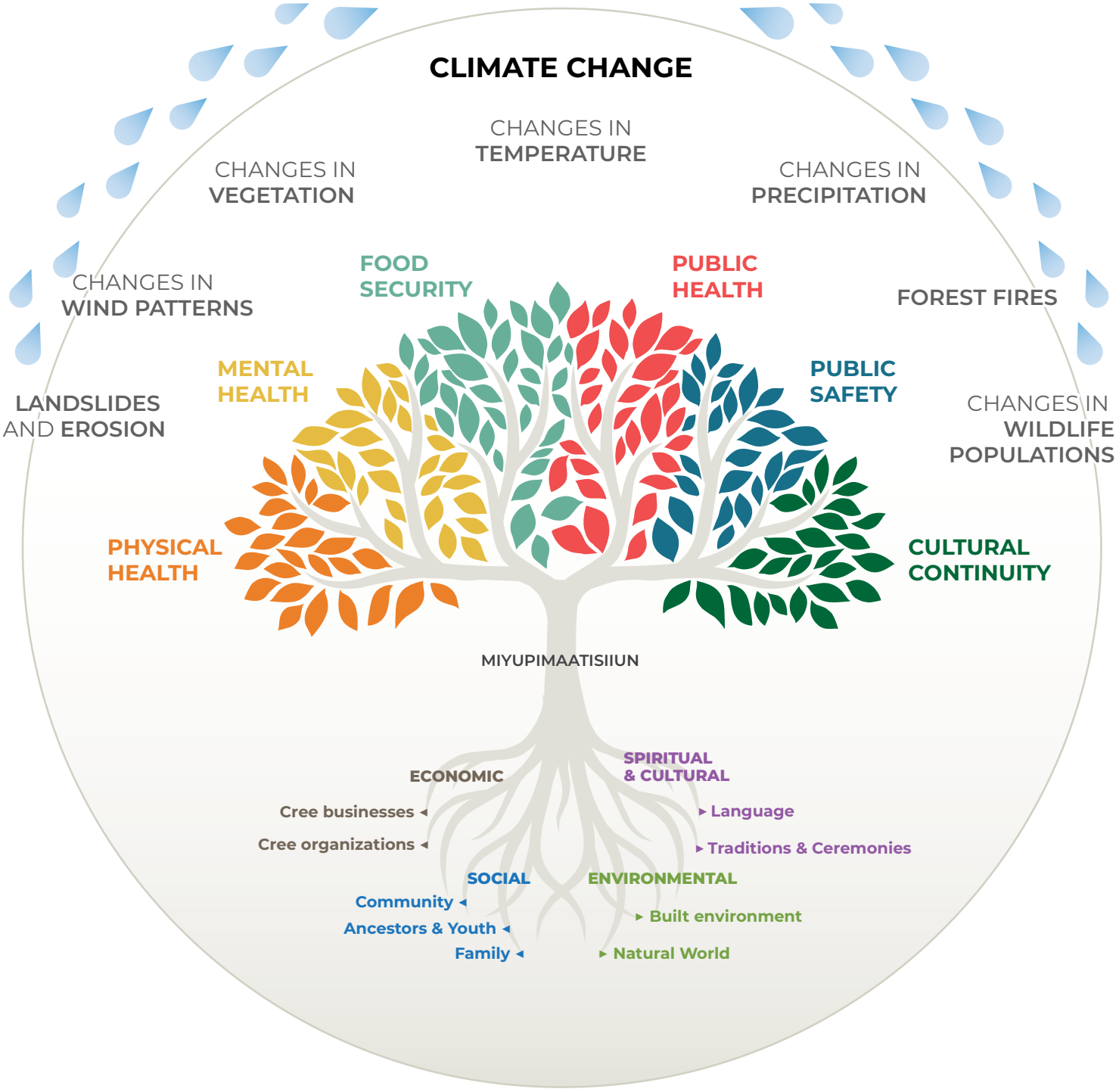
08

RESULTS

8.1 INTERCONNECTEDNESS OF ECOSYSTEMS

The report highlights the high degree of interconnectedness that exists within and across ecosystems and all aspects of life in Eeyou Istchee, demonstrating the importance of these relationships to the Cree way of life (**Figure 20** - *see on next page*). Eeyouch/Eenouch know that Miyupimaatisiiun, being alive well, is not limited to physical health but inevitably links an individual, a community, a Nation's health and well-being to that of the land, the waters and the animals (Gonet, 2024; Radu & House, 2015). The close interdependence of ecosystems may amplify each climate hazard's impact severity and even produce compound climate risks (Clain, 2023). This interconnectedness spans across domains and it is often captured with the pan-Indigenous expression All My Relations, which recognizes not only the deep connection among all aspects of life but also the responsibility that each one of us holds towards each other and everything that is (Government of Alberta, 2004).

FIGURE 20. INTERCONNECTEDNESS OF ECOSYSTEMS



Note: Adapted from First Nations Holistic Lifelong Learning Model https://firstnationspedagogy.ca/interconnect.html

8.2 RISK AND VULNERABILITY COMPARISON TOOL

A vulnerability assessment and a risk assessment were performed for each climate hazard. Vulnerability assessments combine measures of exposure, impact severity, and response, while risk assessments consider the likelihood of occurrence and potential impact severity.

The vulnerability and risk assessment ratings for each hazard were then visualised on a two-dimensional matrix (**Table 1 -** *see on next page*). However, this matrix should not be considered a quantitative comparison or ranking of hazards. Since likelihood of occurrence is taken into account when calculating both vulnerability and risk, a quantitative comparison of these two ratings inappropriate and lead to a double count.

All climate hazards discussed in this report were assigned a rating ranging from **High** to **Extreme** in terms of both risk and vulnerability.

This approach provided a visual overview of the most concerning hazards at the regional scale in terms of both vulnerability and risk. While all hazards are likely to affect Eeyouch/Eenouch, they will do so to a varying degree, making some hazards more urgent than others when it comes to adaptation.

TABLE 1. RISK AND VULNERABILITY COMPARISON TOOL

SYMBOL	HAZARD	SYMBOL	HAZARD
	Changes in temperature		Changes in wind patterns
	Changes in vegetation		Landslides and erosion
	Changes in precipitation		Forest fires
	Changes to wildlife populations		

VULNERABILITY RATING

RISK RATING	0 None	1 Low	2 Moderate	3 Moderate to High	4 High	6 Extreme
1 Very Low						
2 Low						
3 Moderate						
4 High						
5 Very High						
6 Extreme						

As can be seen on the matrix, changes to wildlife populations is rated **5** (**Extreme**) with respect to both Risk and Vulnerability. Shifts in species distribution and abundance threaten both ecosystem integrity and the traditional livelihoods of Eeyouch/Eenouch. Collaboration with communities, regional entities such as CTA and ministries such as the Quebec *Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs* may support the implementation of community-led monitoring programs and strengthen local capacity to prevent and/or adapt to shifts in ecosystems.

Weather-related hazards, namely **changes in temperature**, **forest fires**, **changes in wind-patterns** and **landslides & erosion**. Each of these hazards were assigned a vulnerability rating of **5** (**Extreme**) and a risk of **4** (**Very High**). These threats call for robust rapid-response planning: regional evacuation routes and protocols that are co-developed with communities, early-warning systems (from ground sensors to satellite alerts), land-use planning integrating firebreaks, slope stabilization measures, erosion-control infrastructure, adaptations to public buildings and homes for passive cooling, and improved insulation to reduce direct heat exposure.

Changes in precipitation and **changes in vegetation** were both assigned vulnerability and risk ratings of **4** (**High**). These hazards warrant concerted action, such as: smart drainage, flood preparedness as well as plant monitoring and restoration.

8.3 SUMMARY OF FINDINGS

The findings of this report help validate observations from community members and land-users; seasonal patterns are changing, wildlife behaviors are shifting, and weather events are becoming more severe and unpredictable. These changes are not just environmental; they have tangible effects on the overall health of Eeyouch/Eenouch by damaging infrastructure, impacting food security, and undermining cultural continuity (**Table 54**). The following themes have been identified as a common thread across climate hazards and a priority in the context of climate action:

FOOD AND **WATER** SECURITY

Food security is central to climate change conversations in Eeyou Istchee. All climate hazards identified have been linked to altered or decreased access to traditional foods, impacting everything from berry picking to the migration of wildlife species. These impacts result in greater dependence on imported foods, which are expensive and often lack the nutritional benefits of traditional diets. This dietary transition has very direct health consequences for Eeyouch/Eenouch, leading to increased rates of diabetes and otherchronic diseases. Drastic changes to the ways people access traditional foods inevitably undermine cultural identity, knowledge sharing, and overall community well-being (Idrobo et al., 2024; Radu & House, 2015).

PUBLIC HEALTH AND SAFETY

Increases in temperature and changes in precipitation patterns heighten the risk of flooding, erosion and infrastructure damage, threatening essential travel routes, access to services and the safety of homes and public buildings (Bush & Lemmen, 2019). Increased frequency and severity of extreme heat events pose a threat to health by increasing risk of heat-related illnesses including respiratory and cardiovascular disease. Increased heat also impacts public safety by increasing the risk of forest fires. Shifting ecosystems due to temperature and precipitation changes are also increasing the risk of waterborne and vector-borne diseases becoming more prevalentin Eeyou Istchee.

MENTAL HEALTH
AND CULTURAL CONTINUITY

Beyond the physical effects, the mental health toll of climate change is also a growing concern for Eeyouch/Eenouch. The loss of traditional lands due to environmental degradation and extreme weather events has been linked to increased stress and anxiety and may contribute to psycho-social issues. These impacts are particularly felt by Elders, land-users and youth whose past, present and future are closely tied to the land (NCCIH, 2022).

TABLE 54. SUMMARY OF POTENTIAL HEALTH-RELATED IMPACTS

POTENTIAL IMPACT	CAUSE(S) OF IMPACTS (climate projections, specific vulnerabilities, etc.)	POTENTIAL HEALTH CONSEQUENCES	INTERCONNECTED WITH OTHER HAZARDS
Increased heat exposure	▸ Warmer annual mean temperature, ▸ Warmer summer temperature, ▸ Absence of physical heat acclimatation of population in Eeyou Istchee.	Heat-related disorders such as heat cramps, heat exhaustion and heat stroke. Aggravation of chronic illness including r;espiratory and cardiovascular illnesses, injuries, fatalities.	Temperature
Decrease in ice safety	▸ Warmer mean autumn, winter and spring temperature, ▸ Late fall freeze-up and early spring weather, ▸ Changes in weather patterns and high variability of ice conditions	Injuries, hypothermia, drowning, fatalities, psychosocial impacts.	Precipitations, temperature, landslides
Changes in snow conditions on traditional travelling routes (slush, etc.)	▸ Warmer winter temperature and early spring weather. ▸ Changes in weather patterns and high variability of ice conditions, ▸ Decrease in the applicability of Cree traditional knowledge related to ice conditions.	Injuries, fatalities, psychosocial impacts.	Precipitations, temperature
Decrease on the reliance of Cree traditional knowledge	▸ Warmer winter temperature and early spring weather. ▸ Changes in weather patterns and high variability of ice conditions, ▸ Decrease in the applicability of Cree traditional knowledge related to ice conditions.	Injuries, fatalities, psychosocial impacts, loss of opportunities to pass on knowledge and skills to future generations, loss of cultural identity, solastalgia.	Precipitations, temperature
Changes in wildlife availability, behavior and distribution	▸ Warmer annual temperature, ▸ Longer frost-free season. ▸ Increase in annual growing-degree days.	Decreased activity on the land, psychosocial impacts, food insecurity (traditional foods), shifts in the timing of harvesting, changes to species availability (invasive species).	Temperature, precipitation, changes in wildlife population, changes in vegetation, forest fires
Foodborne illness due to an impact on cold supply chain	▸ Warmer fall, summer and spring temperatures.	Food related illnesses, fatalities.	Temperature
Contamination of alternative and traditional water supplies	▸ Warmer temperature (increased microbial reproduction)	Water related illnesses, fatalities.	Precipitation, Temperature.
Invasive insects (e.g. ticks) and vector-borne infections	▸ Warmer annual temperature.	Injuries, infections, food insecurity (traditional food).	Temperature, Changes in wildlife population.
Property damage	▸ Flooding from early spring thaw, ▸ Warmer spring and summer temperature.	Injuries, psychosocial impacts, mould allergies and respiratory illness.	Temperature, precipitation, landslide and erosion, forest fires.

09

LIMITATIONS

LIMITATIONS

Many knowledge gaps exist regarding climate data in Eeyou Istchee. Climate research centred on Indigenous populations in Canada remains unequal with some geographic locations, such as the Arctic, being overrepresented (NCCIH, 2022) and others, such as the subarctic, being overlooked. The following are the main limitations to this climate vulnerability and risk assessment:

Lack of climate data

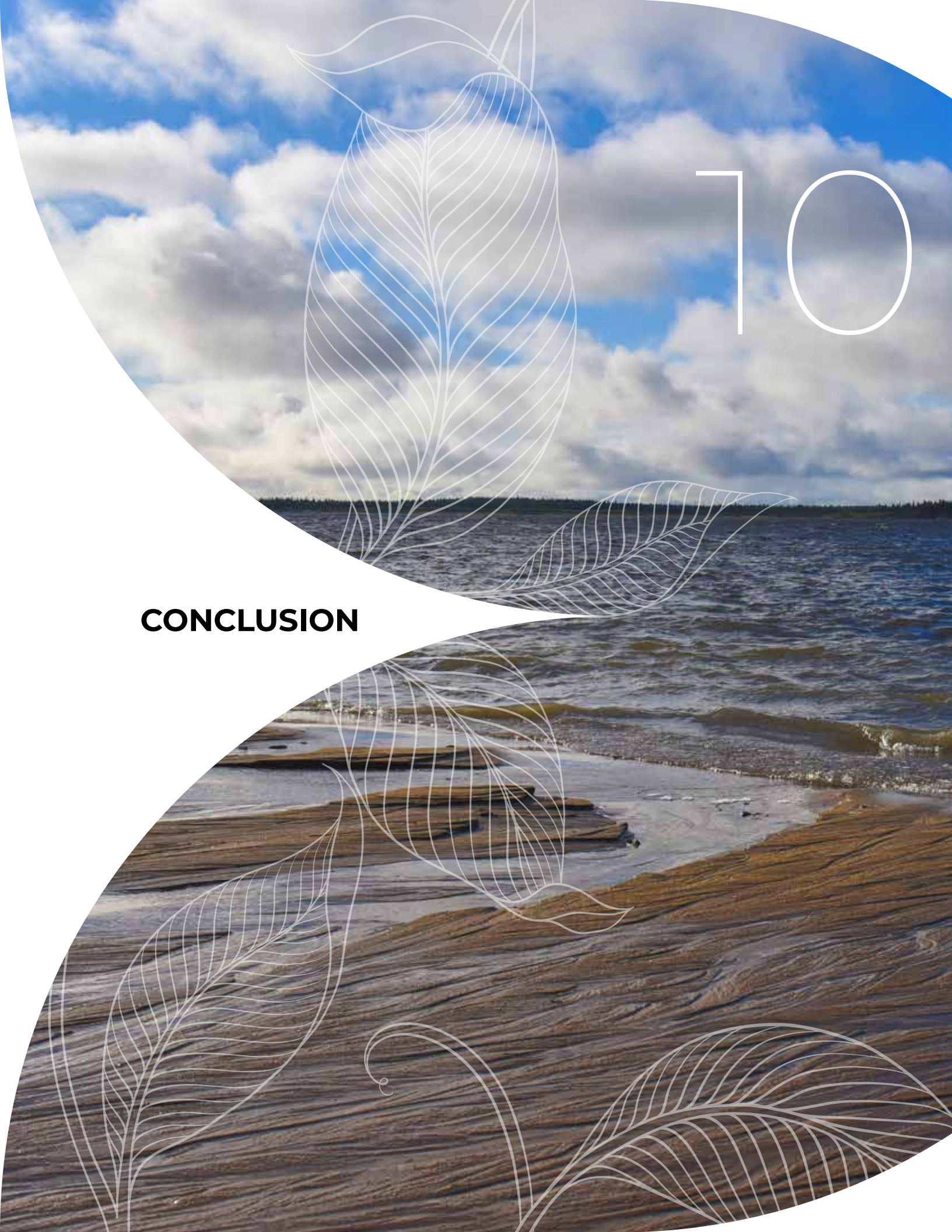
Climate data specific to Eeyou Istchee is extremely limited. Climate data by hazard is not always accessible at the local level, and the distance between communities, combined with the scarcity of meteorological stations, has required a more regional rather than localized analysis, which may fail to capture community-level specificities.

Subjective nature of assessment

While the team aimed to conduct an unbiased analysis of regional climate vulnerability and risk, this process involves a certain degree of subjectivity. The team strived to involve all communities in equal measure. However, participation was uneven both within and across communities, which resulted in this regional assessment reflecting some community or individual realities more than others.

Challenges in assessing cumulative risks

The combined impact of multiple climate hazards and social determinants of health is difficult to quantify. There is a lack of studies analyzing the intersection of social determinants of health and climate vulnerabilities, particularly in Indigenous contexts.



10

CONCLUSION

CONCLUSION

This vulnerability and risk assessment confirm that Eeyou Istchee is facing increasing and interconnected climate change related challenges. The increased risks posed by forest fires, land-slides and erosion, changing wind patterns, rising temperatures, and changes in wildlife populations rank as the most critical climate hazards due to their high probability and severe or catastrophic impacts. Shifts in precipitation and forest ecosystems also present significant concerns.

To address these challenges, and in accordance with the CNG's Climate Change Declaration and Call to Action ᐙᓂᔥᑳᒁᐦ | *WANISHKAAKWH | Wake Up* which emerged from the CRCF (**Appendix E**), the team identified three priority areas for adaptation: **access to the land and cultural preservation, physical and mental health, and infrastructure**:

- **Climate change adaptation efforts should guarantee the unimpeded access of all Eeyouch/Eenouch to their traditional territory to preserve cultural continuity.**
- **Climate change adaptation strategies should support traditional activities in a rapidly changing environment to limit exposure to potential risks (i.e., changing ice conditions, vector-borne diseases) thus guaranteeing their beneficial effects on Cree physical, mental and spiritual health and well-being.**
- **Climate change adaptation strategies should address public safety needs by ensuring all infrastructure in the territory can withstand extreme weather events and climate-related environmental changes.**

This assessment aligns with the key priority areas of the 2024 CRCF, which emphasized the urgency of climate adaptation, the necessity of Cree-led action, and the centrality of integrating both TEK and scientific expertise; focusing particularly on education and intergenerational knowledge-sharing. These priority areas will serve as the foundation for the Regional Climate Adaptation Plan (PARC), guiding actions to promote resilience, sovereignty and protect the health, safety, and well-being of all Eeyouch/Eenouch.

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REFERENCES

Abell, J. T., Winckler, G., Anderson, R. F., & Herbert, T. D. (2021). Poleward and weakened westerlies during Pliocene warmth. *Nature*, 589(7840), 70–75. https://doi.org/10.1038/s41586-020-03062-1

Ahmed, F., Zuk, A. M., & Tsuji, L. J. S. (2021). The Impact of Land-Based Physical Activity Interventions on Self-Reported Health and Well-Being of Indigenous Adults: A Systematic Review. *International Journal of Environmental Research and Public Health*, 18(13), 7099. https://doi.org/10.3390/ijerph18137099

Albrecht, G., Sartore, G.-M., Connor, L., Higginbotham, N., Freeman, S., Kelly, B., Stain, H., Tonna, A., & Pollard, G. (2007). Solastalgia: The Distress Caused by Environmental Change. *Australasian Psychiatry,* 15(1_suppl), S95–S98. https://doi.org/10.1080/10398560701701288

Alec, E., Day, R., Roger, J., Nadeau, M., Derickson, C., & Pengilley, L. (2024). *Ceremony is for Us, for Mother Earth*. Canadian Climate Institute. https://climateinstitute.ca/publications/decolonizing-climate-policy-british-columbia/

Anselmi, E. (2019, October 31). *Nunavik gaining ground where other coastlines erode*. Nunatsiaq News. https://nunatsiaq.com/stories/article/nunavik-gaining-ground-where-other-coastlines-erode/

Arctic Council. (2024, October 28). *Shifting Winds: How a wavier polar jet stream causes extreme weather events*. Arctic Council. https://arctic-council.org/news/shifting-winds-how-a-wavier-polar-jet-stream-causes-extreme-weather-events/

Assembly of First Nations. (2023). *National Climate Strategy*. https://afn.bynder.com/m/77556e1d-9da51db7/original/2023-Climate-Strategy-Report.pdf

Auger, N., Potter, B. J., Smargiassi, A., Bilodeau-Bertrand, M., Paris, C., & Kosatsky, T. (2017). Association between quantity and duration of snowfall and risk of myocardial infarction. *Canadian Medical Association Journa*l, 189(6), E235–E242. https://doi.org/10.1503/cmaj.161064

Balshi, M. S., McGUIRE, A. D., Duffy, P., Flannigan, M., Walsh, J., & Melillo, J. (2009). Assessing the response of area burned to changing climate in western boreal North America using a Multivariate Adaptive Regression Splines (MARS) approach. *Global Change Biology*, 15(3), 578–600. https://doi.org/10.1111/j.1365-2486.2008.01679.x

Bartlett, C., Marshall, M., & Marshall, A. (2012). Two-Eyed Seeing and other lessons learned within a co-learning journey of bringing together indigenous and mainstream knowledges and ways of knowing. *Journal of Environmental Studies and Sciences*, 2(4), 331–340. https://doi.org/10.1007/s13412-012-0086-8

BC2 Inter-Nation Collaboration. (2021a). *Regional Portrait of Eeyou Istchee*. Eeyou Planning Commission, Cree Nation Government. https://repertoireouq.com/wp-content/uploads/2022/05/8262002M_20210818_Rapport_Reg_Ress_Dvl_Plan_FINAL_LowRes.pdf

BC2 Inter-Nation Collaboration. (2021b, August 6). *TERRITORY AND HISTORY*. ArcGIS StoryMaps. https://storymaps.arcgis.com/stories/0da51ef9b4024dbe9cf977dd1e28a006

Beckmann, J. (2020). Water plumes are tickling the Greenland ice sheet. In *EGU Blogs: Cryospheric Sciences*. https://blogs.egu.eu/divisions/cr/2020/01/31/water-plumes-are-tickling-the-greenland-ice-sheet/

Belanger, R. J. (2021). *Climate change impacts on the health and livelihoods of Indigenous communities in Northern Ontario* [Master Thesis, Lakehead University]. https://lurepository.lakeheadu.ca/bitstream/handle/2453/4824/Belangerr2021m-1a.pdf?sequence=1&isAllowed=y

Belcher, K. M. (2023). *FIRST NATIONS LED MENTAL HEALTH RECOVERY IN THE FACE OF ENVIRONMENTAL AND FLOODING JEOPARDY* [Master Thesis, University of Saskatchewan]. https://harvest.usask.ca/server/api/core/bitstreams/c33e835f-ea54-4425-b38f-5f7e6a5520b9/content

Bell, S. (2022, February 10). Declines in Moose population a concern for Quebec Cree. *CBC News*. https://www.cbc.ca/news/canada/north/cree-moose-indigenous-bay-james-conservation-decline-population-1.6344246

Bell, S. (2024, September 17). New regulations, proposed changes to Quebec's Mining Act target exploration sector. *CBC News*. https://www.cbc.ca/news/canada/north/cree-exploration-mining-reform-indigenous-land-rights-1.7325031

Bell, S., Kitty, M., & Longchap, B. (2023, July 14). Lost in Flames. *CBC News*. https://www.cbc.ca/news-interactives/features/lost-in-flames

Bergeron, Y., Cyr, D., Girardin, M. P., & Carcaillet, C. (2010). Will climate change drive 21st century burn rates in Canadian boreal forest outside of its natural variability: Collating global climate model experiments with sedimentary charcoal data. *International Journal of Wildland Fire*, 19(8), 1127. https://doi.org/10.1071/WF09092

Berteaux, D., Casajus, N., & De Blois, S. (2014). *Changements climatiques et biodiversité du Québec*. Presses de l'Université du Québec. https://www.puq.ca/catalogue/themes/changements-climatiques-biodiversite-quebec-2258.html

Blacksmith, V. (2024, May 5). Wildfires and climate change are shifting the way some Cree hunt. *CBC News*. https://www.cbc.ca/news/canada/north/goose-break-forest-fores-quebec-cree-hunt-1.7191978

Blindauer, K. M., Rubin, C., Morse, D. L., & McGeehin, M. (1999). The 1996 New York blizzard: Impact on noninjury emergency visits. *The American Journal of Emergency Medicine*, 17(1), 23–27.

Boisson, A., & Allard, M. (2020). Morphological and evolutionary patterns of emerging arctic coastal landscapes: The case of northwestern Nunavik (Quebec, Canada). *Arctic Science*, 6(4), 488–508. https://doi.org/10.1139/as-2020-0002

Boisvert-Marsh, L., Périé, C., & De Blois, S. (2014). Shifting with climate? Evidence for recent changes in tree species distribution at high latitudes. *Ecosphere*, 5(7), 1–33. https://doi.org/10.1890/es14-00111.1

Bokhorst, S., Bjerke, J. W., Street, L. E., Callaghan, T. V., & Phoenix, G. K. (2011). Impacts of multiple extreme winter warming events on sub-Arctic heathland: Phenology, reproduction, growth, and CO2 flux responses. *Global Change Biology*, 17(9), 2817–2830. https://doi.org/10.1111/j.1365-2486.2011.02424.x

Bond-Lamberty, B., Peckham, S. D., Ahl, D. E., & Gower, S. T. (2007). Fire as the dominant driver of central Canadian boreal forest carbon balance. *Nature*, 450(7166), 89–92. https://doi.org/10.1038/nature06272

Boulanger, Y., Gauthier, S., & Burton, P. J. (2014). A refinement of models projecting future Canadian fire regimes using homogeneous fire regime zones. *Canadian Journal of Forest Research*, 44(4), 365–376. https://doi.org/10.1139/cjfr-2013-0372

Boulanger, Y., Gauthier, S., Gray, D. R., Le Goff, H., Lefort, P., & Morissette, J. (2013). Fire regime zonation under current and future climate over eastern Canada. *Ecological Applications*, 23(4), 904–923. https://doi.org/10.1890/12-0698.1

Boulanger, Y., Puigdevall, J. P., Bélisle, A. C., Bergeron, Y., Brice, M.-H., Cyr, D., De Grandpré, L., Fortin, D., Gauthier, S., Grondin, P., Labadie, G., Leblond, M., Marchand, M., Splawinski, T. B., St-Laurent, M.-H., Thiffault, E., Tremblay, J. A., & Yamasaki, S. H. (2023). A regional integrated assessment of the impacts of climate change and of the potential adaptation avenues for Quebec's forests. *Canadian Journal of Forest Researc*h, 53(8), 556–578. https://doi.org/10.1139/cjfr-2022-0282

Bradshaw, C. J. A., & Warkentin, I. G. (2015). Global estimates of boreal forest carbon stocks and flux. *Global and Planetary Change*, 128, 24–30. https://doi.org/10.1016/j.gloplacha.2015.02.004

Brady, R. H. (2018). Erosion. In P. T. Bobrowsky & B. Marker (Eds.), *Encyclopedia of Engineering Geology* (pp. 302–307). Springer International Publishing. https://doi.org/10.1007/978-3-319-73568-9_114

Brooks, N., & Adger, W. N. (2004). Assessing and enhancing adaptive capacity. In B. Lim & E. S.-Siegfried (Eds.), *Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies, and Measures* (pp. 165–181). Cambridge University Press.

Bush, E., & Lemmen, D. S. (Eds.). (2019). *Canada's Changing Climate Report. Government of Canada.* https://changingclimate.ca/CCCR2019/

Canadian Biodiversity Information Facility. (n.d.). *Canadian National Collection (CNC) of Insects, Arachnids and Nematodes.* [Dataset]. Vectormap. Retrieved October 25, 2023, from https://experience.arcgis.com/experience/5f95c3edfbea4634b8347fec0bd1dcd6/

Canadian Red Cross. (2006). Drownings and Other Water-Related Injuries in Canada, 1991–2000. Module 2: Ice and Cold Water. *Canadian Red Cross.* Retrieved October, 6, 2020.

Canadian Wildlife Health Cooperative. (n.d.). *Winter tick.* https://www.cwhc-rcsf.ca/docs/fact_sheets/winter_tick.pdf

Champagne, O., Arain, A., Wang, S., & Leduc, M. (2023). Future change in amplitude and timing of high-flow events in a Canadian subarctic watershed. *Cold Regions Science and Technology*, 209, 103807. https://doi.org/10.1016/j.coldregions.2023.103807

Chisasibi Eeyou Resource and Research Institute. (n.d.). *Traditional knowledge and ecology of eelgrass (Zostera marina L.)*. Chisasibi Eeyou Resource and Research Institute. Retrieved May 15, 2025, from https://www.cerri.ca/cree-tek-and-the-james-bay-eelgrass

Clain, G. (2023). *What are compound climate risks and how might they impact companies?* | EcoAct. EcoAct. https://eco-act.com/blog/compound-risks-climate/

Clark, D. G., Coffman, D., Ness, R., Bujold, I., & Beugin, D. (2022). *Due North: Facing the costs of climate change for northern infrastructure* (p. 85). Canadian Climate Institute. https://climateinstitute.ca/wp-content/uploads/2022/06/Due-North.pdf

ClimateData. (n.d.-a). *Climate Data for a Resilient Canada*. ClimateData.Ca. Retrieved January 8, 2025, from https://climatedata.ca/

ClimateData. (n.d.-b). *CMIP6 FAQ*. https://climatedata.ca/resource/cmip6-faq/4o

Cloutier, C., Locat, J., Geertsema, M., Jakob, M., & Schnorbus, M. (2016). Potential impacts of climate change on landslides occurrence in Canada. In K. Ho (Ed.), *Slope safety preparedness for impact of climate change*. CRC Press/Balkema.

CNG & CBHSSJB. (2024, April 11). *Cree Regional Climate Forum: Community consultations on climate change - Oujé-Bougoumou* [Consultations].

Couillard, P.-L., Bouchard, M., & Hébert, F. (2022). *Zonage des régimes de feux du Québec méridional* (Mémoire de Recherche Forestière No189, p. 23). Gouvernement du Québec, ministère des Forêts, de la Faune et des Parcs, Direction de la recherche forestière. https://mffp.gouv.qc.ca/nos-publications/zonage-regimes-feux-quebec-meridional/

CRCF Vox Pop. (2024, April). [Video recording]. https://msss365.sharepoint.com/teams/MED-EnvironmentalHealthTeam/Shared%20Documents/Forms/AllItems.aspx?csf=1&web=1&e=pyE1VK&ovuser=06e1fe28%2D5f8b%2D4075%2Dbf6c%2Dae24be1a7992%2Cmaya%2Ecote%40ssss%2Egouv%2Eqc%2Eca&OR=Teams%2DHL&CT=1730315078067&clickparams=eyJBcHBOYW1lIjoiVGVhbXMtRGVza3RvcCIsIkFwcFZlcnNpb24iOiI0OS8yNDA5MTIyMTMxOCIsIkhhc0ZlZGVyYXRlZFVzZXIiOmZhbHNlfQ%3D%3D&CID=c40f5fa1%2D00a3%2D6000%2Dadb1%2D36e0dd8272c7&cidOR=SPO&FolderCTID=0x012000ED235167A2965F4CBCA8DA1571EB012F&id=%2Fteams%2FMED%2DEnvironmentalHealthTeam%2FShared%20Documents%2FGeneral%2FClimate%20Change%2FVox%20POP

Cree Board of Health and Social Services of James Bay. (2010, August). *Drowning in Eeyou Istchee*. Cree Board of Health and Social Services of James Bay. https://www.creehealth.org/sites/default/files/Drowning%20factsheet.pdf

Cree Board of Health and Social Services of James Bay. (2022, June 2). *Our Mission*. https://www.creehealth.org/about-us/our-mission

Cree Board of Health and Social Services of James Bay. (2024). P*revalence and Incidence of Type 2 Diabetes Mellitus in Eeyou Istchee Brief Statistical Update*. https://creehealth.org/sites/default/files/2024-03/CBHSSJB_DiabetesBriefStatisticalUpdate_v6b_page_0.pdf

Cree Board of Health and Social Services of James Bay. (2025). H*ot weather: How to stay healthy*. Cree Board of Health and Social Services of James Bay. https://creehealth.org/health-tips/how-stay-healthy-during-hot-weather

Cree Nation Government. (n.d.-a). *Climate Change*. Retrieved December 20, 2024, from https://www.cngov.ca/environment/climate-change/

Cree Nation Government. (n.d.-b). *The Eeyou of Eeyou Istchee*. Retrieved December 19, 2024, from https://www.cngov.ca/community-culture/communities/

Cree Nation Government. (n.d.-c). *Timeline: The Crees of Yesterday and Today…*. The Grand Council of the Crees (Eeyou Istchee). Retrieved August 7, 2024, from https://www.cngov.ca/community-culture/timeline/

Cree Nation Government. (2019). *Envisioning Responses to Climate Change in Eeyou Istchee: Report on the Regional Forum on Climate Change* (p. 23). Cree Nation Government. https://www.cngov.ca/wp-content/uploads/2019/07/eastmain-climate-change-report_pdf3.pdf

Cree Nation Mistissini & Cree Nation Government. (2018, March). *Community Proposal: Climate Change Adaptation Action Plan*. InsightShare. https://www.cngov.ca/wp-content/uploads/2018/05/climate-change-adaptation-action-plan_community-proposal_mistissini_march-2018_fv.pdf

Cree Nation of Chisasibi. (2024). *History & Geography—Cree Nation of Chisasibi*. Cree Nation of Chisasibi - Welcome to the Great River. https://chisasibi.ca/about-chisasibi/history-geography/

Cree Nation of Chisasibi Public Safety Department. (2023, November 14). *Public Notice—Landslide Warning*. Cree Nation of Chisasibi - Welcome to the Great River. https://chisasibi.ca/wp-content/uploads/2023/11/landslide-warning_public-notice_november-14-2023.pdf

Cree School Board. (n.d.). *Who we are*. Retrieved December 19, 2024, from https://eeyoueducation.ca/org/who-we-are

Cree School Board. (2011, January 4). *Administrative Policy and Procedures on School Calendars*. https://eeyoueducation.ca/docs/policies/youth-ed/151-edu-05-school-calendars/file

Cree Trappers Association. (n.d.-a). *History*. Retrieved December 19, 2024, from https://creetrappers.ca/about/history

Cree Trappers Association. (n.d.-b). *Mandate*. Retrieved December 19, 2024, from https://creetrappers.ca/about/mandate

Cree Trappers' Association. (2009). E*EYOU INDOH-HOH WEESHOU-WEHWUN | TRADITIONAL EEYOU HUNTING LAW*. Cree Trappers' Association. https://www.creegeoportal.ca/wp-content/uploads/2022/06/CTAHuntingLaw.pdf

Cree Trappers Association. (2023). *Forest Fire Map and Statistics* (Unpublished Internal Document No. Cree Trappers Association).

Cuciurean, R., Tomatuk, R., Saganash, N., Rodon, T., Lussier, C., Reid, J., & Blazevic, V. (2011). *Climate change in the Eeyou Istchee: Identification of impacts and adaptation measures for the Cree hunters, trappers, and communities*. https://www.creegeoportal.ca/wp-content/uploads/2022/06/FinalReportDMv5-coul.pdf

DeMars, C. A., Serrouya, R., Mumma, M. A., Gillingham, M. P., McNay, R. S., & Boutin, S. (2019). Moose, caribou, and fire: Have we got it right yet? *Canadian Journal of Zoology,* 97(10), 866–879. https://doi.org/10.1139/cjz-2018-0319

Denton, D., Izaguirre, D., Casault, K., & Izaguirre-Falardeau, G. (2018). Avant les inondations: Archéologie communautaire et projets hydroélectriques des années 2000 à Eeyou Istchee Baie-James. *Recherches Amérindiennes Au Québec*, 48(3), 57–80. https://doi.org/10.7202/1062134ar

Desjarlais, C., & Blondot, A. (2010). *Savoir s'adapter aux changements climatiques.* http://numerique.banq.qc.ca/

Downing, A., & Cuerrier, A. (2011). *A synthesis of the impacts of climate change on the First Nations and Inuit of Canada*. 10(1), 57–70. https://nopr.niscpr.res.in/bitstream/123456789/11066/1/IJTK%2010(1)%2057-70.pdf

Duchenne-Moutien, R. A., & Neetoo, H. (2021). Climate Change and Emerging Food Safety Issues: A Review. *Journal of Food Protection*, 84(11), 1884–1897. https://doi.org/10.4315/JFP-21-141

Durand, Y., Dumont, A., & Beaulac, I. (2019). *Drainage Challenges in the Whapmagoostui First Nation Community: A Case Study*. 238–245.

Durkalec, A., Furgal, C., Skinner, M. W., & Sheldon, T. (2015). Climate change influences on environment as a determinant of Indigenous health: Relationships to place, sea ice, and health in an Inuit community. *Social Science & Medicine*, 136–137, 17–26. https://doi.org/10.1016/j.socscimed.2015.04.026

Ebi, K. L., Capon, A., Berry, P., Broderick, C., De Dear, R., Havenith, G., Honda, Y., Kovats, R. S., Ma, W., Malik, A., Morris, N. B., Nybo, L., Seneviratne, S. I., Vanos, J., & Jay, O. (2021). Hot weather and heat extremes: Health risks. *The Lancet*, 398(10301), 698–708. https://doi.org/10.1016/S0140-6736(21)01208-3

Eeyou Marine Region Wildlife Board. (n.d.). *Mandate, Functions and Responsibilities*. Retrieved December 19, 2024, from https://www.emrwb.ca/mandate-functions-and-responsibilities/

El Krekshi, L. (2009). *Indigenous Peoples' Perspectives on Participation in Mining: The Case of James Bay Cree First Nation in Canada* [KTH, Department of Urban Planning and Environment]. https://www.diva-portal.org/smash/get/diva2:353620/FULLTEXT01.pdf

Emergency Management Ontario. (2012). *Hazard identification and risk assessment workbook*.

Environment and Climate Change Canada. (2024, August 21). *Air quality and weather. Government of Canada*. https://www.canada.ca/en/environment-climate-change/services/air-quality-health-index/weather.html

Ermine, W. (2007). The Ethical Space of Engagement. *Indigenous Law Journa*l, 6(1), Article 1. https://jps.library.utoronto.ca/index.php/ilj/article/view/27669

Fink-Mercier, C., Leblanc, M. L., Noisette, F., O'Connor, M., Idrobo, J., Bélanger, S., del Giorgio, P. A., de Melo, M., Ehn, J. K., Giroux, J.-F., Gosselin, M., Leblon, B., Neumeier, U., Sorais, M., Humphries, M. M., Peck, C., Davis, K. E., Guzzi, A., Galindo, V., … Kuzyk, Z. Z. A. (2024). Cree-driven community-partnered research on coastal ecosystem change in subarctic Canada: A multiple knowledge approach. *Arctic Science*, 10(4), 731–748. https://doi.org/10.1139/as-2023-0061

FireSmart Canada. (n.d.). *FireSmart Canada*. Retrieved December 19, 2024, from https://firesmart-canada.ca/

Flannigan, M. D., Logan, K. A., Amiro, B. D., Skinner, W. R., & Stocks, B. J. (2005). Future Area Burned in Canada. *Climatic Change*, 72(1–2), 1–16. https://doi.org/10.1007/s10584-005-5935-y

Ford, J. D. (2012). Indigenous health and climate change. *American Journal of Public Health*, 102(7), 1260–1266. https://doi.org/10.2105/AJPH.2012.300752

Ford, J. D., & Smit, B. (2004). A Framework for Assessing the Vulnerability of Communities in the Canadian Arctic to Risks Associated with Climate Change. *ARCTIC*, 57(4), 389–400. https://doi.org/10.14430/arctic516

Foro, A., Béziers, L., Robinson, E., & Torrie, J. E. (2013). *Perceptions of the leaders and professionals of Eeyou Istchee in regard to climate change and its effects on human health: Report on the consultations*.

Frégeau, M. (2013). *Dynamique de la pressière à mousses au nord de la région du lac Saint-Jean (Quebec)* [Master Thesis, Université de Laval]. https://corpus.ulaval.ca/entities/publication/0e7672d4-dadb-46a7-aa61-fe5060c8dc35

Garibaldi, A., & Turner, N. (2004). Cultural Keystone Species: Implications for Ecological Conservation and Restoration. *Ecology and Society*, 9(3). https://doi.org/10.5751/es-00669-090301

Garneau, M., van Bellen, S., Magnan, G., Beaulieu-Audy, V., Lamarre, A., & Asnong, H. (2014). Holocene carbon dynamics of boreal and subarctic peatlands from Québec, Canada. *The Holocene*, 24(9), 1043–1053. https://doi.org/10.1177/0959683614538076

Gauthier, S., Bernier, P., Kuuluvainen, T., Shvidenko, A. Z., & Schepaschenko, D. G. (2015). Boreal forest health and global change. *Science*, 349(6250), 819–822. https://doi.org/10.1126/science.aaa9092

Gawrych, M. (2022). Climate change and mental health: A review of current literature. *Psychiatria Polska*, 56(4), 903–915. https://doi.org/10.12740/PP/OnlineFirst/131991

Glenn, N., & Myre, M. (2022). *Post-flooding community-level psychosocial impacts and priorities in Canada: A preliminary report*. National Collaborating Centre for Environmental Health (NCCEH). https://ncceh.ca/sites/default/files/Post%20flooding%20community%20level%20psychosoical%20impacts%20Nov%2021%202022_0.pdf

Gone, J. P. (2013). Redressing First Nations historical trauma: Theorizing mechanisms for indigenous culture as mental health treatment. *Transcultural Psychiatry*, 50(5), 683–706. https://doi.org/10.1177/1363461513487669

Gonet, J. (2024). Worldview violence and Non-Human People in (conservation) science. *Ecology and Society*, 29(4). https://doi.org/10.5751/ES-15501-290411

Gould, C. F., Heft-Neal, S., Johnson, M., Aguilera, J., Burke, M., & Nadeau, K. (2024). Health Effects of Wildfire Smoke Exposure. *Annual Review of Medicine,* 75(1), 277–292. https://doi.org/10.1146/annurev-med-052422-020909

Gouvernement du Québec. (2022, November 30). *Preventing the harmful effects of cold temperatures*. Gouvernement Du Québec. https://www.quebec.ca/en/health/advice-and-prevention/health-and-environment/preventing-the-harmful-effects-of-cold-temperatures

Gouvernement du Québec. (2023). *Chaleur extrême*. https://www.quebec.ca/securite-situations-urgence/urgences-sinistres-risques-naturels/quoi-faire-avant-pendant-apres-urgence-sinistre/chaleur-extreme

Government of Alberta. (2004). *All My Relations. Aboriginal Perspective*. Nelson Education. https://www.learnalberta.ca/content/aswt/well_being/documents/all_my_relations.pdf

Government of Northwest Territories. (n.d.). *Wildfire science*. Environment and Climate Change; Government of the Northwest Territories. Retrieved May 13, 2025, from https://www.gov.nt.ca/ecc/en/services/wildfire-operations/wildfire-science

Government of Quebec. (n.d.). *Hunting zone maps*. Gouvernement Du Québec. Retrieved April 2, 2025, from https://www.quebec.ca/en/tourism-and-recreation/sporting-and-outdoor-activities/sport-hunting/hunting-zone-maps

Grand Council of the Crees (Eeyou Istchee) / Cree Nation Government. (n.d.). *Regional Climate Change Report*. The Grand Council of the Crees (Eeyou Istchee). Retrieved November 22, 2024, from https://www.cngov.ca/environment/climate-change-report/

Grand Council of the Crees (Eeyou Istchee) / Cree Nation Government. (2021, April 29). *Quebec's second largest landslide near Whapmagoostui and Kuujjuaraapik remains under close observation*. Grand Council of the Crees (Eeyou Istchee) / Cree Nation Government. https://cngov.ca/quebecs-second-largest-landslide-near-whapmagoostui-and-kuujjuaraapik-remains-under-close-observation/?highlight=erosion

Gray, D. R. (2008). The relationship between climate and outbreak characteristics of the spruce budworm in eastern Canada. *Climatic Change*, 87(3–4), 361–383. https://doi.org/10.1007/s10584-007-9317-5

Hales, S. (2019). Climate change, extreme rainfall events, drinking water and enteric disease. *Reviews on Environmental Health*, 34(1), 1–3. https://doi.org/10.1515/reveh-2019-2001

Hamadani, F. (2014). *Demographic and population-based analysis of traumatic injury transport outcomes and health-care infrastructure in Northern Québec's rural communities* [Master Thesis, McGill University]. https://escholarship.mcgill.ca/concern/theses/wh246w21v

Harmsworth, G., & Raynor, B. (2005). Cultural Consideration in Landslide Risk Perception. In T. Glade, M. Anderson, & M. J. Crozier (Eds.), *Landslide Hazard and Risk*. J. Wiley.

Harvey, C. & E&E News. (2019, November 19). *The World's Winds Are Speeding Up*. Scientific American. https://www.scientificamerican.com/article/the-worlds-winds-are-speeding-up/

Health Canada. (2011). *Extreme Heat Events Guidelines: Technical Guide for Health Care Workers*. Water, Air and Climate Change Bureau, Healthy Environments and Consumer Safety Branch, Health Canada. https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/climate-change-health/extreme-heat-events-guidelines-technical-guide-health-care-workers.html

Hennigs, R., & Bleau, S. (2017). *State of Climate Change and Adaptation Knowledge for the Eeyou Istchee James Bay Territory* (No. 520018; p. 64). Ouranos. https://www.ouranos.ca/en/projets-publications/synth%C3%A8se-connaissances-eeyou-istchee-baie-james

Hermanns, R. L. (2018). Landslide. In P. T. Bobrowsky & B. Marker (Eds.), *Encyclopedia of Engineering Geology* (pp. 579–580). Springer International Publishing. https://doi.org/10.1007/978-3-319-73568-9_183

Highland, L., & Geertsema, M. (2019). Human Health Effects of Landslides. In *Encyclopedia of Environmental Health* (2nd ed., pp. 554–557). Elsevier. https://doi.org/10.1016/B978-0-12-409548-9.11577-5

Higman, B., Coil, D., McKittrick, E., & Lester, E. (2019). *As the Beaches Wash Away—Global Warming and Coastal Erosion* [Educational nonprofit]. Ground Truth Alaska. https://groundtruthalaska.org/articles/Global-warming-coastal-erosion-malaspina-glacier/

Holtmeier, F.-K., & Broll, G. (2010). Wind as an Ecological Agent at Treelines in North America, the Alps, and the European Subarctic. *Physical Geography*, 31(3), 203–233. https://doi.org/10.2747/0272-3646.31.3.203

Honeycutt, C. (1995). Soil Freeze-Thaw Processes: Implications for Nutrient Cycling. *Journal of the Minnesota Academy of Science*, 59(2), 9–14. https://digitalcommons.morris.umn.edu/jmas/vol59/iss2/4

Hood, G. A., & Bayley, S. E. (2008). Beaver (Castor canadensis) mitigate the effects of climate on the area of open water in boreal wetlands in western Canada. *Biological Conservatio*n, 141(2), 556–567. https://doi.org/10.1016/j.biocon.2007.12.003

Huberman, I. (2022). From the Floodland: Countering Extraction, Remembering Relations in Eeyou Istchee. *Studies in American Indian Literatures*, 34(3), 27–49. https://muse-jhu-edu.proxy3.library.mcgill.ca/pub/17/article/896042

Idrobo, C. J., Leblanc, M.-L., & O'Connor, M. I. (2024). The "Turning Point" for the Fall Goose Hunt in Eeyou Istchee: A Social-Ecological Regime Shift from an Indigenous Knowledge Perspective. *Human Ecology*, 52(3), 617–636. https://doi.org/10.1007/s10745-024-00499-0

Indigenous Climate Hub. (n.d.-a). *Effects of climate change on community infrastructure*. https://indigenousclimatehub.ca/climate-change-on-community-infrastructure

Indigenous Climate Hub. (n.d.-b). *The impacts of climate change of Climate Change of Climate Change on Indigenous communities*. Indigenous Climate Hub. https://indigenousclimatehub.ca/effects-on-indigenous-communities/#:~:text=Sacred%20sites%20and%20ceremonies%2C%20which,which%20plants%20grow%20and%20where.

Indigenous Services Canada. (2024, October 18). *Roles and responsibilities during emergencies*. https://www.sac-isc.gc.ca/eng/1309372584767/1535120244606

INSPQ. (2023, June 8). *Résultats annuels de surveillance intégrée du VNO et des autres arbovirus: Année 2022*. https://www.inspq.qc.ca/zoonoses/vno/surveillance/2022

INSPQ. (2024a, May 6). *Cartes de répartition actuelle et future des tiques Ixodes scapularis en contexte de changements climatiques*. https://www.inspq.qc.ca/zoonoses/cartes/tiques#future

INSPQ. (2024b, June 18). *Virus du Nil occidental (VNO): Tableau des cas humains—Archives 2002 à 2023*. https://www.msss.gouv.qc.ca/professionnels/zoonoses/virus-du-nil-occidental-vno/tableau-des-cas-humains-archives/

INSPQ. (2024c, June 19). *Résultats annuels de surveillance des maladies transmises par les moustiques: 2023*. https://www.inspq.qc.ca/zoonoses/moustiques/surveillance/2023

Institut de la statistique du Québec. (2024). *Principaux indicateurs sur le Québec et ses régions [Government agency]. Institut de la statistique du Québec*. https://statistique.quebec.ca/fr/vitrine/region/10/mrc/993

Institut de la statistique du Québec & Ministère de la Santé et des Services sociaux. (2024a). Births for 2023: ISQ, *Naissances, décès, accroissement naturel et mariages par MRC, Québec, 2002-2022* [Dataset]. https://statistique.quebec.ca/fr/produit/tableau/naissances-deces-accroissement-naturel-et-mariages-par-mrc-quebec#tri_phe=5&tri_ra=00&tri_mrc=AAA

Institut de la statistique du Québec & Ministère de la Santé et des Services sociaux. (2024b). *Estimations et projections de population comparables* (1996-2041) [Dataset]. https://publications.msss.gouv.qc.ca/msss/document-001617/

Institut national de santé publique du Québec. (2024). *Infocentre Extraction, 2024-10-24* [Dataset].

Intergovernmental Panel on Climate Change. (2019). Land Degradation. In *Climate Change and Land: IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems* (1st ed.). Cambridge University Press. https://doi.org/10.1017/9781009157988

Intergovernmental Panel on Climate Change (IPCC). (2007). Climate Change 2007: Impacts, Adaptation and Vulnerability (p. 976). https://www.ipcc.ch/site/assets/uploads/2018/03/ar4_wg2_full_report.pdf

Intergovernmental Panel on Climate Change (IPCC). (2021, August 9). *Climate change widespread, rapid, and intensifying – IPCC*. https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/

Intergovernmental Panel on Climate Change (IPCC). (2023). *Climate Change 2021 – The Physical Science Basis: Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press; Cambridge Core. https://doi.org/10.1017/9781009157896

Jakob, M. (2022). Landslides in a changing climate. In *Landslide Hazards, Risks, and Disasters* (pp. 505–579). Elsevier. https://doi.org/10.1016/B978-0-12-818464-6.00003-2

James, K. (2023). *Climate change impacts on Canada's food supply cold chain*. National Collaborating Centre for Environmental Health (NCCEH). https://ncceh.ca/sites/default/files/Climate%20change%20impacts%20on%20Canada%27s%20food%20supply%20cold%20chain%202023.02.14%20FINAL.pdf

Johnson-Jennings, M., Billiot, S., & Walters, K. (2020). Returning to Our Roots: Tribal Health and Wellness through Land-Based Healing. *Genealogy*, 4(3), 91. https://doi.org/10.3390/genealogy4030091

Joly, S., Senneville, S., Caya, D., & Saucier, F. J. (2011). Sensitivity of Hudson Bay sea ice and ocean climate to atmospheric temperature forcing. *Climate Dynamics*, 36(9–10), 1835–1849.

Kaldy, J. E. (2014). Effect of temperature and nutrient manipulations on eelgrass Zostera marina L. from the Pacific Northwest, USA. *Journal of Experimental Marine Biology and Ecology*, 453, 108–115. https://doi.org/10.1016/j.jembe.2013.12.020

Kenny, G. P., Yardley, J., Brown, C., Sigal, R. J., & Jay, O. (2010). Heat stress in older individuals and patients with common chronic diseases. *CMAJ, 182*(10), 1053–1060. https://doi.org/10.1503/cmaj.081050

Klein, J. A., Harte, J., & Zhao, X. (2004). Experimental warming causes large and rapid species loss, dampened by simulated grazing, on the Tibetan Plateau. *Ecology Letters*, 7(12), 1170–1179. https://doi.org/10.1111/j.1461-0248.2004.00677.x

Kling, M. M., & Ackerly, D. D. (2020). Global wind patterns and the vulnerability of wind-dispersed species to climate change. *Nature Climate Change*, 10(9), 868–875. https://doi.org/10.1038/s41558-020-0848-3

Kloog, I., Ridgway, B., Koutrakis, P., Coull, B. A., & Schwartz, J. D. (2013). Long- and Short-Term Exposure to PM2.5 and Mortality: Using Novel Exposure Models. *Epidemiology*, 24(4), 555–561. https://doi.org/10.1097/EDE.0b013e318294beaa

Kovach, M. (2021). *Indigenous Methodologies: Characteristics, Conversations, and Contexts* (2nd ed.). University of Toronto Press. https://utppublishing.com/doi/book/10.3138/9781487525644

Kovats, R. S., & Hajat, S. (2008). Heat stress and public health: A critical review. *Annual Review of Public Health*, 29, 41–55.

Kovesi, T., Mallach, G., Schreiber, Y., McKay, M., Lawlor, G., Barrowman, N., Tsampalieros, A., Kulka, R., Root, A., Kelly, L., Kirlew, M., & Miller, J. D. (2022). Housing conditions and respiratory morbidity in Indigenous children in remote communities in Northwestern Ontario, Canada. *Canadian Medical Association Journal*, 194(3), E80–E88. https://doi.org/10.1503/cmaj.202465

Kuhnlein, H. V., & Receveur, O. (2007). Local Cultural Animal Food Contributes High Levels of Nutrients for Arctic Canadian Indigenous Adults and Children. *The Journal of Nutrition*, 137(4), 1110–1114. https://doi.org/10.1093/jn/137.4.1110

Lambden, J., Receveur, O., Marshall, J., & Kuhnlein, H. (2006). Traditional and market food access in Arctic Canada is affected by economic factors. *International Journal of Circumpolar Health*, 65(4), 331–340. https://doi.org/10.3402/ijch.v65i4.18117

Landaverde, E., Olivier Leclerc, & Demers-Bouffard, D. (2019, Mai). *Cadre méthodologique d'appréciation des risques climatiques en santé publique | Avis et recommandations*. Institut national de santé publique du Québec.

Larbi, Y., Baribeau, A., & MacKinnon, M. (2024). *Eeyou Istchee—Mineral Exploration Activities For the Year 2024* (p. 206). The Cree Mineral Exploration Board. https://www.cmeb.org/assets/2024_EXPLORATION_ACTIVITY_REPORT_EAR.pdf

Leduc, C., Coonishish, J., Haddad, P., & Cuerrier, A. (2006). Plants used by the Cree Nation of Eeyou Istchee (Quebec, Canada) for the treatment of diabetes: A novel approach in quantitative ethnobotany. *Journal of Ethnopharmacology*, 105(1–2), 55–63. https://doi.org/10.1016/j.jep.2005.09.038

Lejeune, P., & Torrie, J. E. (2015). *Public health department analysis paper: The current and projected eeyou population*. https://www.creehealth.org/sites/default/files/Current%20and%20Projected%20Eeyou%20Population%20November%202015.pdf

Lemmen, D. S., & Warren, F. J. (2014). *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation* (p. 286). Government of Canada. https://natural-resources.canada.ca/climate-change/canada-changing-climate/canada-changing-climate-sector-perspectives-impacts-adaptation

Li, S. H. (2023). Impact of climate change on wind energy across North America under climate change scenario RCP8.5. *Atmospheric Research, 288, Article 106722*. https://doi.org/10.1016/j.atmosres.2023.106722

Li, Z., & Fang, H. (2016). Impacts of climate change on water erosion: A review. *Earth-Science Reviews*, 163, 94–117. https://doi.org/10.1016/j.earscirev.2016.10.004

Linklater-Wong, P. (2021). *Nohcimihk"—On the land": A study of traditional harvesting practices and their effects on the perceived mental health of Indigenous youth in the James Bay area* [Master Thesis, Nipissing University]. https://hdl.handle.net/1807/108286

Loi sur l'aménagement durable du territoire forestier, RLRQ, c. A-18.1 Titre VI Chapter 1 (2010). https://www.legisquebec.gouv.qc.ca/fr/document/lc/A-18.1

Mauger, G. S., Casola, J. H., Morgan, H. A., Strauch, R. L., Jones, B., Curry, B., Binder, L. W., Krosby, M. B., & Snover, A. K. (2015). *State of Knowledge: Climate Change in Puget Sound*. University of Washington. https://data.cig.uw.edu/picea/mauger/ps-sok/PS-SoK_2015.pdf

McCabe, K. (2023, January 27). *What is wind?* Royal Meteorological Society. https://www.rmets.org/metmatters/what-wind

McCrystall, M. R., Stroeve, J., Serreze, M., Forbes, B. C., & Screen, J. A. (2021). New climate models reveal faster and larger increases in Arctic precipitation than previously projected. *Nature Communications*, 12(1), 6765. https://doi.org/10.1038/s41467-021-27031-y

McGregor, J. (2018). Toward a Philosophical Understanding of TEK and Ecofeminism. In M. K. Nelson & D. Shilling (Eds.), *Traditional Ecological Knowledge* (1st ed., pp. 109–128). Cambridge University Press. https://doi.org/10.1017/9781108552998.008

McGuire, B. (2012). *Waking the giant: How a changing climate triggers earthquakes, tsunamis, and volcanoes* (Vol. 1–1 online resource (xiv, 303 pages) : illustrations, maps). Oxford University Press; WorldCat. http://site.ebrary.com/id/10545882

McGuire, B. (2016, October 16). *How climate change triggers earthquakes, tsunamis and volcanoes*. How Climate Change Triggers Earthquakes, Tsunamis and Volcanoes | Natural Disasters and Extreme Weather | The Guardian. https://www.theguardian.com/world/2016/oct/16/climate-change-triggers-earthquakes-tsunamis-volcanoes

Middleton, J., Cunsolo, A., Jones-Bitton, A., Wright, C. J., & Harper, S. L. (2020). Indigenous mental health in a changing climate: A systematic scoping review of the global literature. *Environmental Research Letters*, 15(5), 053001. https://doi.org/10.1088/1748-9326/ab68a9

Ministère de la Santé et des Services sociaux. (n.d.-a). *MSSS Births Dataset 2019-2022* [Dataset].

Ministère de la Santé et des Services sociaux. (n.d.-b). *MSSS MED-ECHO Databases 2018-2021* [Dataset].

Ministère de la Santé et des Services sociaux. (n.d.-c). *MSSS Mortality Databases 2019-2022* [Dataset].

Ministère de la Santé et des Services sociaux. (2024). *MSSS, JBNQA Cree benficiary lists, July 2024* [Dataset].

Montpetit, J. (2023). *Wildlife and Habitat Effects—Wildfires Spring/Summer 2023*.

Myers-Smith, I. H., Forbes, B. C., Wilmking, M., Hallinger, M., Lantz, T., Blok, D., Tape, K. D., Macias-Fauria, M., Sass-Klaassen, U., Lévesque, E., Boudreau, S., Ropars, P., Hermanutz, L., Trant, A., Collier, L. S., Weijers, S., Rozema, J., Rayback, S. A., Schmidt, N. M., … Hik, D. S. (2011). Shrub expansion in tundra ecosystems: Dynamics, impacts and research priorities. *Environmental Research Letters*, 6(4), 045509. https://doi.org/10.1088/1748-9326/6/4/045509

National Capital Commission. (2022). *Climate Change Vulnerability & Risk Assessment*. https://ncc-website-2.s3.amazonaws.com/documents/Climate-Vulnerability-Risk-Assessment.pdf

National Collaborating Centre for Aboriginal Health. (2017). *Housing as a social determinant of First Nations, Inuit and Métis health*. https://www.ccnsa-nccah.ca/docs/determinants/FS-Housing-SDOH2017-EN.pdf

National Collaborating Centre for Indigenous Health (NCCIH). (2022). Climate Change and Indigenous Peoples' Health in Canada. In P. Berry & R. Schnitter (Eds.), *Health of Canadians in a Changing Climate: Advancing our Knowledge for Action. Government of Canada*. https://www.nccih.ca/Publications/Lists/Publications/Attachments/10367/Climate_Change_and_Indigenous_Peoples_Health_EN_Web_2022-03-22.pdf

National Collaborating Centres for Public Health (NCCPH). (2021). *Health and social impacts of long-term evacuation due to natural disasters in First Nations communities: A summary of lessons for public health* (p. 14). National Collaborating Centres for Public Health. http://www.nccid.ca/long-term-evacuees-lessons

Natural Resource Canada. (2015, September 16). *Fire regime*. https://natural-resources.canada.ca/climate-change/climate-change-impacts-forests/fire-regime

Natural Resources Canada. (2015). *Simplified seismic hazard map for Canada, the provinces and territories.* Canada.Ca. https://www.seismescanada.rncan.gc.ca/hazard-alea/simphaz-en.php

Natural Resources Defense Council. (2020, June 18). *Remembering Eeyou Pimatseewin, the Cree Life*. https://www.nrdc.org/stories/remembering-eeyou-pimatseewin-cree-life

Ouranos. (n.d.). *Winds and storms—Impacts*. Ouranos. Retrieved January 15, 2025, from https://www.ouranos.ca/en/climate-phenomena/winds-and-storms-impacts

Ouranos. (2024, November 18). *Climate Portraits unveils three new spatial division options and nearly 20 additional climate indicators*. Ouranos. https://www.ouranos.ca/en/news/2024-11-26/climate-portraits-update

Ouranos. (2025). *Portraits climatiques*. Ouranos. https://portraits.ouranos.ca/en/spatial?a=0&c=0&discrete=1&e=CMIP6&i=prcptot&p=50&r=0&s=annual&scen=ssp585&w=0&yr=2041

Owczarek, P., Opała-Owczarek, M., Boudreau, S., Lajeunesse, P., & Stachnik, Ł. (2020). Re-activation of landslide in sub-Arctic areas due to extreme rainfall and discharge events (the mouth of the Great Whale River, Nunavik, Canada). *Science of The Total Environment*, 744, 140991. https://doi.org/10.1016/j.scitotenv.2020.140991

Pachano, J. (2011, June). *The Cree and Social Impacts of Historic Events in James Bay.* Cree Board of Health and Social Services.

Parisien, M.-A., & Sirois, L. (2003). Distribution and dynamics of tree species across a fire frequency gradient in the James Bay region of Quebec. *Canadian Journal of Forest Research*, 33(2), 243–256. https://doi.org/10.1139/x02-182

Payette, S. (1992). Fire as a controlling process in the North American boreal forest. In H. H. Shugart, R. Leemans, & G. B. Bonan (Eds.), *A Systems Analysis of the Global Boreal Forest* (1st ed., pp. 144–169). Cambridge University Press. https://doi.org/10.1017/CBO9780511565489.006

Payette, S., Delwaide, A., Caccianiga, M., & Beauchemin, M. (2004). Accelerated thawing of subarctic peatland permafrost over the last 50 years. *Geophysical Research Letters*, 31(18), 2004GL020358. https://doi.org/10.1029/2004GL020358

Persinger, M. A., Ballance, S. E., & Moland, M. (1993). Snow fall and heart attacks. *The Journal of Psychology*, 127(2), 243–252.

Polcaro-Pichet, S., Kosatsky, T., Potter, B. J., Bilodeau-Bertrand, M., & Auger, N. (2019). Effects of cold temperature and snowfall on stroke mortality: A case-crossover analysis. *Environment International*, 126, 89–95. https://doi.org/10.1016/j.envint.2019.02.031

Price, D. T., Alfaro, R. I., Brown, K. J., Flannigan, M. D., Fleming, R. A., Hogg, E. H., Girardin, M. P., Lakusta, T., Johnston, M., McKenney, D. W., Pedlar, J. H., Stratton, T., Sturrock, R. N., Thompson, I. D., Trofymow, J. A., & Venier, L. A. (2013). Anticipating the consequences of climate change for Canada's boreal forest ecosystems. *Environmental Reviews*, 21(4), 322–365. https://doi.org/10.1139/er-2013-0042

Proust, F., Johnson-Down, L., Berthiaume, L., Greffard, K., Julien, P., Robinson, E., Lucas, M., & Dewailly, É. (2016). Fatty acid composition of birds and game hunted by the Eastern James Bay Cree people of Québec. *International Journal of Circumpolar Health*, 75(1), 30583. https://doi.org/10.3402/ijch.v75.30583

Pudasaini, S. P., & Krautblatter, M. (2021). The mechanics of landslide mobility with erosion. *Nature Communications*, 12(1), 6793. https://doi.org/10.1038/s41467-021-26959-5

Qiu, S., & Qiu, J. (2024). From individual resilience to collective response: Reframing ecological emotions as catalysts for holistic environmental engagement. *Frontiers in Psychology*, 15, 1363418. https://doi.org/10.3389/fpsyg.2024.1363418

Quinn, E. (2024, October 7). Study underway to better understand landslides in northern Quebec. *Eye on the Arctic*. https://www.rcinet.ca/eye-on-the-arctic/2024/10/07/study-underway-to-better-understand-landslides-in-northern-quebec/

Radu, I., & House, L. (2015). Miyupimaatisiiun in Eeyou Istchee: Indigenous healing and community engagement in health and social services delivery. In *Toolbox on the Research Principles in an Aboriginal Contex*t. DIALOG. https://reseaudialog.ca/wp-content/uploads/2021/01/Radu-et-House_Chisasibi-mental-health_en.pdf

Ripoche, M., Bouchard, C., Irace-Cima, A., Leighton, P., & Thivierge, K. (2022). Current and future distribution of Ixodes scapularis ticks in Québec: Field validation of a predictive model. *PLoS One, 17*(2), 0263243. https://doi.org/10.1371/journal.pone.0263243

Rixen, C., Høye, T. T., Macek, P., Aerts, R., Alatalo, J. M., Anderson, J. T., Arnold, P. A., Barrio, I. C., Bjerke, J. W., Björkman, M. P., Blok, D., Blume-Werry, G., Boike, J., Bokhorst, S., Carbognani, M., Christiansen, C. T., Convey, P., Cooper, E. J., Cornelissen, J. H. C., … Zong, S. (2022). Winters are changing: Snow effects on Arctic and alpine tundra ecosystems. *Arctic Science*, 8(3), 572–608. https://doi.org/10.1139/as-2020-0058

Robbins, J. (2022, 09). *Global 'Stilling': Is Climate Change Slowing Down the Wind? - Yale E360* [Online Magazine]. Yale Environment 360. https://e360.yale.edu/features/global-stilling-is-climate-change-slowing-the-worlds-wind

Ropars, P., & Boudreau, S. (2012). Shrub expansion at the forest–tundra ecotone: Spatial heterogeneity linked to local topography. *Environmental Research Letters*, 7(1), 015501. https://doi.org/10.1088/1748-9326/7/1/015501

Ropars, P., Landry-Cuerrier, M., & Humphries, M. (2022). Impacts des changements climatiques sur les espèces fauniques clés des systèmes alimentaires autochtones locaux du nord du Québec. In M. Humphries & M. Landry-Cuerrier, *Récolte faunique et sécurité alimentaire traditionnelle dans l'Arctique québécois* (pp. 17–167). Centre pour l'Environnement et la Nutrition des Peuples Autochtones, Université McGill. https://mffp.gouv.qc.ca/documents/faune/RA_recolte_alimentation_arctique_quebecois_MFFP.pdf

Rosenkrantz, L. (2022). I*mpacts of Canada's changing climate on West Nile Virus vectors.* National Collaborating Centre for Environmental Health.

Royer, M.-J. S. (2016). *Climate, environment and Cree observations: James Bay Territory, Canada* (Vol. 1–1 online resource (xi, 83 pages) : color illustrations). Springer; WorldCat. https://link.springer.com/book/10.1007/978-3-319-25181-3

Royer, M.-J. S. (2017). "The ice shards are gone": Traditional ecological knowledge of climate and culture among the Cree of the Eastern James Bay, Canada. In *Cultural Histories, Memories and Extreme Weather: A Historical Geography Perspective* (1st ed., p. 21). https://www.taylorfrancis.com/chapters/edit/10.4324/9781315461458-8/ice-shards-gone-marie-jeanne-royer

Royer, M.-J. S., Herrmann, T. M., Sonnentag, O., Fortier, D., Delusca, K., & Cuciurean, R. (2013). Linking Cree hunters' and scientific observations of changing inland ice and meteorological conditions in the subarctic eastern James Bay region, Canada. *Climatic Change*, 119(3), 719–732. https://doi.org/10.1007/s10584-013-0773-9

Rozhkova-Timina, I. O., Popkov, V. K., Mitchell, P. J., & Kirpotin, S. N. (2018). Beavers as ecosystem engineers – a review of their positive and negative effects. *IOP Conference Series: Earth and Environmental Science, 201*, 012015. https://doi.org/10.1088/1755-1315/201/1/012015

Sadhukhan, B., Mukherjee, S., Sarkar, D., & Samanta, R. K. (2021). Investigating the relationship between earthquake occurrences and global temperature fluctuation patterns. *Arabian Journal of Geosciences, 14*(18). https://doi.org/10.1007/s12517-021-08296-5

Samson, J. (2012). *Atlas de la biodiversite du Québec nordique: Effets des changements climatiques sur la biodiversité*. Ouranos. https://www.ouranos.ca/fr/projets-publications/atlas-de-la-biodiversite-du-quebec-nordique-volet-sur-les-changements

Sarofim, M. C., Saha, S., Hawkins, M. D., Mills, D. M., Hess, J., Horton, R., Kinney, P., Schwartz, J., & St. Juliana, A. (2016). Ch. 2: Temperature-Related Death and Illness. In *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment* (pp. 43–68). U.S. Global Change Research Program. https://doi.org/10.7930/J0MG7MDX

Savard, J.-P. (2016). *Impacts des changements climatiques sur le régime des tempêtes et les niveaux d'eau extrêmes dans la baie d'Hudson, la Baie James et le détroit d'Hudson* (Nos. 520010–000; p. 82). Ouranos. https://www.ouranos.ca/sites/default/files/2022-07/proj-201419-enord-savard-rapportfinal.pdf

Scheff, J., & Frierson, D. M. W. (2015). Terrestrial Aridity and Its Response to Greenhouse Warming across CMIP5 Climate Models. *Journal of Climate*, 28(14), 5583–5600. https://doi.org/10.1175/JCLI-D-14-00480.1

Schnitter, R., & Berry, P. (Eds.). (2022). National Collaborating Centre for Indigenous Health (NCCIH). In *Health of Canadians in a changing climate*.

Schoen, D., & Robinson, E. (2005). *Mercury Studies among the Cree of Eeyou Istchee*. Cree Board of Health and Social Services of James Bay. https://www.creehealth.org/sites/default/files/54.pdf

Schouten, M. G. C., Streefkerk, J. G., & Van Der Molen, P. C. (1992). Impact of climatic change on bog ecosystems, with special reference to sub-oceanic raised bogs. *Wetlands Ecology and Management*, 2(1–2), 55–61. https://doi.org/10.1007/bf00178135

Sena, A., & Ebi, K. (2020). When Land Is Under Pressure Health Is Under Stress. *International Journal of Environmental Research and Public Health*, 18(1), 136. https://doi.org/10.3390/ijerph18010136

Senneville, S., & St-Onge-Drouin, S. (2013). *Rapport final: Étude de la variation des glaces dans le système couplé océan—Glace de mer de la baie d'Hudson*.

Short, M. M., Mushquash, C. J., & Bédard, M. (2013). Motor vehicle crashes among Canadian Aboriginal people: A review of the literature. *Canadian Journal of Rural Medicine, 18*(3), 86–98. ProQuest Central; ProQuest One Academic; SciTech Premium Collection. https://pubmed.ncbi.nlm.nih.gov/23806432/

Skene, J. (2020, July 12). Five Years Later, Waswanipi Is Still Waiting on Quebec. NRDC. https://www.nrdc.org/bio/jennifer-skene/five-years-later-waswanipi-still-waiting-quebec

Société de protection des forêts contre le feu. (2019, August 9). *L'intervention de la SOPFEU dans les différentes zones de protection*. https://sopfeu.qc.ca/lintervention-de-la-sopfeu-dans-les-differentes-zones-de-protection/

Société de protection des forêts contre le feu. (2025). *Fire Danger Index, Restrictions & Active Wildfires | SOPFEU*. Société de Protection Des Forêts Contre Le Feu. https://www.sopfeu.qc.ca/en/map/

Southern, D. A., Knudtson, M. L., & Ghali, W. A. (2006). Myocardial infarction on snow days: Incidence, procedure use and outcomes. *Canadian Journal of Cardiology*, 22(1), 59–61. https://doi.org/10.1016/S0828-282X(06)70240-9

Spitalnic, S. J., Jagminas, L., & Cox, J. (1996). An association between snowfall and ED presentation of cardiac arrest. *The American Journal of Emergency Medicine*, 14(6), 572–573.

Statistics Canada. (2017). *Census 2016* [Dataset].

Statistics Canada. (2022). *Census 2021* [Dataset]. https://www12.statcan.gc.ca/datasets/Index-eng.cfm?Temporal=2021

Stewart, S., Keates, A. K., Redfern, A., & McMurray, J. J. V. (2017). Seasonal variations in cardiovascular disease. *Nature Reviews Cardiology, 14*(11), 654–664. https://doi.org/10.1038/nrcardio.2017.76

Sun, J., Goforth, A. N., Nichols, L. M., Violante, A., Christopher, K., Howlett, R., Hogenson, D., & Graham, N. (2022). Building a space to dream: Supporting indigenous children's survivance through community-engaged social and emotional learning. *Child Development, 93*(3), 699–716. https://doi.org/10.1111/cdev.13786

Syracuse University. (n.d.). *The Moral Injury Project* [Online post]. https://moralinjuryproject.syr.edu/#:~:text=Moral%20injury%20is%20the%20damage,or%20ethical%20codes%20of%20conduct.

Talukder, B., Ganguli, N., Matthew, R., vanLoon, G. W., Hipel, K. W., & Orbinski, J. (2021). *Climate change-triggered land degradation and planetary health: A review. Land Degradation & Development, 32*(16), 4509–4522. https://doi.org/10.1002/ldr.4056

Tam, B. Y., Szeto, K., Bonsal, B., Flato, G., Cannon, A. J., & Rong, R. (2018). CMIP5 drought projections in Canada based on the Standardized Precipitation Evapotranspiration Index. *Canadian Water Resources Journal / Revue Canadienne Des Ressources Hydriques, 44*(1), 90–107. https://doi.org/10.1080/07011784.2018.1537812

Taylor, A. R., Boulanger, Y., Price, D. T., Cyr, D., McGarrigle, E., Rammer, W., & Kershaw, J. A. (2017). Rapid 21st century climate change projected to shift composition and growth of Canada's Acadian Forest Region. *Forest Ecology and Management, 405*, 284–294. https://doi.org/10.1016/j.foreco.2017.07.033

Tegos, A., Malamos, N., Efstratiadis, A., Tsoukalas, I., Karanasios, A., & Koutsoyiannis, D. (2017). Parametric Modelling of Potential Evapotranspiration: A Global Survey. *Water, 9*(10), 795. https://doi.org/10.3390/w9100795

The Grand Council of the Crees. (2022). *A New Path Forward: Honouring our Past and Building Collaborative Relations for the Future* (p. 256). https://cngov.ca/aga-2022/

Tremblay, B., Lévesque, E., & Boudreau, S. (2012). Recent expansion of erect shrubs in the Low Arctic: Evidence from Eastern Nunavik. *Environmental Research Letters, 7*(3), 035501. https://doi.org/10.1088/1748-9326/7/3/035501

Troilus Gold Corp. (2019). *Évaluation environnementale Dénoyage des fosses J-4 et 87* (p. 536). https://comexqc.ca/wp-content/uploads/Troilus-Etude-dimpact-pour-denoyage-des-fosses-FR.pdf

Tsuji, L. J., Manson, H., Wainman, B. C., Vanspronsen, E. P., Shecapio-Blacksmith, J., & Rabbitskin, T. (2007). Identifying potential receptors and routes of contaminant exposure in the traditional territory of the Ouje-Bougoumou Cree: Land use and a geographical information system. *Environmental Monitoring and Assessment, 127*, 293–306. https://doi.org/10.1007/s10661-006-9280-z

Tsuji, L. J. S., Gomez, N., Mitrovica, J. X., & Kendall, R. (2009). Post-Glacial Isostatic Adjustment and Global Warming in Subarctic Canada: Implications for Islands of the James Bay Region. *Arctic, 62*(4), 458–467. https://www.jstor.org/stable/40513336

Tuck, E. (2009). Suspending Damage: A Letter to Communities. *Harvard Educational Review, 79*(3), 409–428. https://doi.org/10.17763/haer.79.3.n0016675661t3n15

Turetsky, M. R., Benscoter, B., Page, S., Rein, G., Van Der Werf, G. R., & Watts, A. (2015). Global vulnerability of peatlands to fire and carbon loss. *Nature Geoscience, 8*(1), 11–14. https://doi.org/10.1038/ngeo2325

United Nation Office for Disaster Risk Reduction (UNDRR). (2023, June 7). *Mining Hazards*. United Nation Office for Disaster Risk Reduction. https://www.undrr.org/understanding-disaster-risk/terminology/hips/tl0033

University of Hawai'i. (n.d.). *Wind Formation. Exploring Our Fluid Earth*. https://manoa.hawaii.edu/exploringourfluidearth/physical/atmospheric-effects/wind-formation

U.S. EPA. (n.d.). *Climate Change in Coastal Communities* [Government agency]. United States Envionmental Protection Agency. https://www.epa.gov/cre/climate-change-coastal-communities

U.S. EPA. (2024). *Mold Exposure and Respiratory Conditions in Young Children*. United States Envionmental Protection Agency. https://www.epa.gov/children/mold-exposure-and-respiratory-conditions-young-children

U.S. National Science Foundation. (2021, January 12). Will warming bring a change in the winds? Dust from the deep sea provides a clue | NSF - National Science Foundation. https://new.nsf.gov/news/will-warming-bring-change-winds-dust-deep-sea

U.S. National Weather Service. (n.d.). *Prevailing Winds.* Weather. Gov. https://www.weather.gov/source/zhu/ZHU_Training_Page/winds/Wx_Terms/Flight_Environment.htm

Usher, K., Durkin, J., & Bhullar, N. (2019). Eco-anxiety: How thinking about climate change-related environmental decline is affecting our mental health. *International Journal of Mental Health Nursing, 28*(6), 1233–1234. https://doi.org/10.1111/inm.12673

Vecchio, E. A., Dickson, M., & Zhang, Y. (2022). Indigenous mental health and climate change: A systematic literature review. *The Journal of Climate Change and Health, 6*, 100121. https://doi.org/10.1016/j.joclim.2022.100121

Vinet-Lanouette, C., & Godin, C. (2024). *Access to a Nutritious and Affordable Food Basket in Eeyou Istchee—2021 Update* (p. 52). Cree Board of Health and Social Services of James Bay in collaboration with Montreal Diet Dispensary.

Vizenor, G. R. (2009). *Native liberty: Natural reason and cultural survivance* (Vol. 1–1 online resource (ix, 321 pages)). University of Nebraska Press; WorldCat. http://site.ebrary.com/id/10340980

Wang, R., McCullough, G. K., Gunn, G. G., Hochheim, K. P., Dorostkar, A., Sydor, K., & Barber, D. G. (2012). An observational study of ice effects on Nelson River estuarine variability, Hudson Bay, Canada. *Continental Shelf Research, 47*, 68–77. https://doi.org/10.1016/j.csr.2012.06.014

Weltzin, J. F., Loik, M. E., Schwinning, S., Williams, D. G., Fay, P. A., Haddad, B. M., Harte, J., Huxman, T. E., Knapp, A. K., Lin, G., Pockman, W. T., Shaw, M. R., Small, E. E., Smith, M. D., Smith, S. D., Tissue, D. T., & Zak, J. C. (2003). Assessing the Response of Terrestrial Ecosystems to Potential Changes in Precipitation. *BioScience, 53*(10), 941. https://doi.org/10.1641/0006-3568(2003)053[0941:ATROTE]2.0.CO;2

Wilson, S. (2008). *Research Is Ceremony: Indigenous Research Methods*. Fernwood Publishing.

Wotton, B. M., Nock, C. A., & Flannigan, M. D. (2010). Forest fire occurrence and climate change in Canada. International Journal of Wildland Fire, 19(3), 253. https://doi.org/10.1071/WF09002

WSP Canada Inc. (2021). *Chapter 9: Accident Risk Management* (Environmental Impact Assessment Nos. 201-12362–00; James Bay Lithium Mine: Environmental Impact Assessment). Galaxy Lithium (Canada) Inc. https://comexqc.ca/wp-content/uploads/201-12362-00_EIE-V2_ENG_VP_CH9_20210727-2.pdf

Yao, Y., Huang, G. H., & Lin, Q. (2012). Climate change impacts on Ontario wind power resource. *Environmental Systems Research, 1*(1), 2. https://doi.org/10.1186/2193-2697-1-2

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APPENDICES

APPENDIX A

APPENDIX A – TEMPERATURE

Indicators and data for all historical and projected values come from Ouranos (extracted 2023)

TABLE A1. SUMMARY OF HISTORICAL TEMPERATURE INDICATORS AND PROJECTIONS FOR 2041-2100 IN EEYOU ISTCHEE

HISTORICAL TEMPERATURE INDICATORS AND PROJECTIONS FOR 2041-2070 FOR EEYOU ISTCHEE

CLIMATE INDICATORS	TIMING	1991-2020	2041-2070		
		HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
Mean temperature	Annual	-1.2	1.2 (+2.4)		2.4 (+3.6)
	Summer	13.7	15.7 (+2)		16.7 (+3)
	Spring	-3.4	-0.8 (+2.6)		-0.2 (+3.2)
	Winter	-17.7	-14.3 (+3.4)		-12.9 (+4.8)
	Autumn	2.4	4.4 (+2)		5.4 (+3)
Number of days with Tmax >30°C	Annual	2 days	6 days (+4)		8 days (+6)
Numbers of days with Humidex >30°C	Annual	5 days	12 days (+7)		17 days (+12)
Freeze thaw-events	Annual	62 events	57 events (-5)		55 events (7)
Number of days below -25°C	Annual	49 days	28 days (-21)		22 days (-27)
First fall frost	Annual	September 20	October 4 (+15 days)		October 7 (+18 days)
Last spring frost	Annual	June 8	May 30 (-7 days)		May 25 (-17 days)
Frost days	Annual	218 days	198 days (-20)		192 (-26 days)
Number of Tropical Nights (Mean temperature over 18°C)	Annual	1 day	4 days (+3)		6 days (+5)

TABLE A2. HISTORICAL TEMPERATURE INDICATORS AND PROJECTIONS FOR 2041-2070 FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
MEAN TEMPERATURE	ANNUAL	**EEYOU ISTCHEE**	**-1.2**	**1.2 (+2.4)**		**2.4 (+3.6)**
		Whapmagoostui	-2.2	0.7 (+2.9)		2.4 (+4.6)
		Chisasibi	-0.9	1.9 (+2.8)		3.8 (+4.5)
		Wemindji	-0.3	2.3 (+2.7)		4.2 (+4.3)
		Eastmain	0.2	2.7 (+2.5)		4.4 (+4.1)
		Waskaganish	0.9	2.6 (+1.7)		3.3 (+2.3)
		Nemaska	0.1	2.4 (+2.3)		3.9 (+3.8)
		Waswanipi	1.7	3.8 (+2.1)		5.3 (+3.6)
		Oujé-Bougoumou	1.3	3.4 (+2.1)		5.0 (+3.6)
		Mistissini	0.7	2.9 (+2.2)		4.3 (+3.6)

TABLE A2. HISTORICAL TEMPERATURE INDICATORS AND PROJECTIONS FOR 2041-2070 FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
MEAN TEMPERATURE	SUMMER	**EEYOU ISTCHEE**	**13.7**	**15.7 (+2.0)**		**16.7 (+3.0)**
		Whapmagoostui	10.8	13.3 (+2.5)		14.3 (+3.5)
		Chisasibi	12.9	15.5 (+2.6)		16.7 (+3.8)
		Wemindji	13.7	16.2 (+2.5)		17.4 (+3.8)
		Eastmain	14.3	16.7 (+2.4)		17.8 (+3.5)
		Waskaganish	15.0	17.3 (+2.3)		18.3 (+3.3)
		Nemaska	14.3	16.5 (+2.2)		17.3 (+3.0)
		Waswanipi	15.8	17.9 (+2.1)		18.8 (+3.0)
		Oujé-Bougoumou	15.5	17.6 (+2.1)		18.5 (+3.0)
		Mistissini	15.2	17.3 (+2.1)		18.1 (+2.9)
	SPRING	**EEYOU ISTCHEE**	**-3.4**	**-0.8 (+2.6)**		**-0.2 (+3.2)**
		Whapmagoostui	-6.4	-3.8 (+2.6)		-2.6 (+3.7)
		Chisasibi	-4.3	-1.8 (+2.5)		-0.6 (+3.7)
		Wemindji	-3.4	0.2 (+3.6)		1.8 (+5.2)
		Eastmain	-2.6	1.0 (+3.6)		2.5 (+5.1)
		Waskaganish	-2.6	-0.1 (+2.5)		1.0 (+3.6)
		Nemaska	-2.6	-0.2 (+2.4)		0.9 (+3.4)
		Waswanipi	-0.1	2.3 (+2.3)		3.2 (+3.3)
		Oujé-Bougoumou	-0.5	1.8 (+2.3)		2.8 (+3.2)
		Mistissini	-1.1	1.2 (+2.3)		2.1 (+3.2)

TABLE A2. SUMMARY OF HISTORICAL TEMPERATURE INDICATORS AND PROJECTIONS FOR 2041-2100 IN EEYOU ISTCHEE

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
MEAN TEMPERATURE	WINTER	**EEYOU ISTCHEE**	**-17.7**	**-14.3 (+3.4)**		**-12.9 (+4.8)**
		Whapmagoostui	-18.0	-12.9 (+5.1)		-10.9 (+7.1)
		Chisasibi	-17.8	-13.0 (+4.8)		-11.1 (+6.6)
		Wemindji	-17.4	-11.1 (+6.4)		-9.5 (+7.9)
		Eastmain	-16.9	-11.1 (+5.8)		-9.7 (+7.1)
		Waskaganish	-16.9	-12.8 (+4.1)		-11.1 (+5.7)
		Nemaska	-17.3	-13.6 (+3.7)		-12.1 (+5.2)
		Waswanipi	-15.2	-12.0 (+3.3)		-10.6 (+4.6)
		Oujé-Bougoumou	-15.7	-12.4 (+3.2)		-11.0 (+4.6)
		Mistissini	-16.4	-13.1 (+3.3)		-11.7 (+4.8)
	AUTUMN	**EEYOU ISTCHEE**	**2.4**	**4.4 (+2.0)**		**5.4 (+3.0)**
		Whapmagoostui	2.4	4.6 (+2.3)		5.5 (+3.1)
		Chisasibi	3.0	5.3 (+2.2)		6.1 (+3.1)
		Wemindji	3.4	5.6 (+2.2)		6.4 (+3.1)
		Eastmain	3.8	6 (+2.2)		6.8 (+3.0)
		Waskaganish	5.7	8.2 (+2.5)		9.4 (+3.7)
		Nemaska	2.8	5 (+2.2)		5.8 (+3.0)
		Waswanipi	3.9	6.1 (+2.2)		6.9 (+3.0)
		Oujé-Bougoumou	3.4	5.6 (+2.2)		6.4 (+3.0)
		Mistissini	3.1	5.3 (+2.2)		6.1 (+3.0)

TABLE A3. HISTORICAL HEAT INDICATORS AND PROJECTIONS FOR 2041-2070 FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
NUMBER OF DAYS WITH TMAX >30°C	ANNUAL	**EEYOU ISTCHEE**	**2**	**6 (+4)**		**8 (+6)**
		North-East James Bay	0	1 (+1)	1 (+1)	
		Nord-West James Bay	1	2(+1)	2 (+1)	
		South-West James Bay	2	5 (+3)	5 (+3)	
		South-East James Bay	1	2 (+1)	2 (+1)	
		Whapmagoostui	1	3.7 (+2.7)		6 (+5)
		Chisasibi	2	7 (+5)		12 (+10)
		Wemindji	3	11 (+8)		17 (+14)
		Eastmain	4	11 (+7)		18 (+14)
		Waskaganish	6	13 (+7)		21 (+15)
		Nemaska	3	8 (+5)		13 (+10)
		Waswanipi	5	13 (+8)		21 (+16)
		Oujé-Bougoumou	4	11 (+7)		18 (+14)
		Mistissini	3	8 (+5)		14 (+11)
GROWING DEGREE DAY	ANNUAL	**EEYOU ISTCHEE**	**1055**	**1354 (+28%)**		**1529 (+45%)**
		North-West James Bay	1070	1354 (+27%)		1385 (+29%)
		North-east James Bay	939	1180 (+26%)		1207 (+28%)
		South-West James Bay	1359	1663 (+22%)		1701 (+25%)
		South-East James Bay	1168	1460 (+25%)		1477 (+26%)

TABLE A3. HISTORICAL HEAT INDICATORS AND PROJECTIONS FOR 2041-2070 FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
NUMBER OF TROPICAL NIGHTS (Mean temperature over 18°C)	ANNUAL	**EEYOU ISTCHEE**	**1**	**4 DAYS (+3)**		**6 DAYS (+5)**
		Whapmagoostui	0	2 (+2)		4 (+4)
		Chisasibi	0	3.8 (+4)		7 (+7)
		Wemindji	1	5 (+4)		8 (+7)
		Eastmain	1	6 (+4)		9 (+8)
		Waskaganish	2	7 (+5)		10 (+8)
		Nemaska	1	4 (+3)		6 (+5)
		Waswanipi	2	7 (+5)		11 (+9)
		Oujé-Bougoumou	2	4 (+2)		10 (+8)
		Mistissini	1	4 (+3)		8 (+7)
DAYS WITH HUMIDEX >30°C	ANNUAL	**EEYOU ISTCHEE**	**5**	**12 (+7)**		**17 (+12)**
		Whapmagoostui	0	4 (+3)		6 (+6)
		Chisasibi	0	1 (+1)		3 (+3)
		Wemindji	1	6 (+5)		10 (+9)
		Eastmain	3	12 (+9)		16 (+13)
		Waskaganish	16	30 (+14)		37 (+21)
		Nemaska	6	17 (+11)		22 (+16)
		Waswanipi	10	23 (+13)		31 (+21)
		Oujé-Bougoumou	7	18 (+11)		24 (+17)
		Mistissini	5	14 (+9)		19 (+14)

TABLE A4. HISTORICAL COLD INDICATORS AND PROJECTIONS FOR 2041-2070 FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
FREEZE THAW-EVENTS (DAYS)	ANNUAL	**EEYOU ISTCHEE**	**62**	**57 (-5)**		**69 (-7)**
		Whapmagoostui	50	46 (-4)		43 (-7)
		Chisasibi	58	53 (-5)		51 (-7)
		Wemindji	60	56 (-4)		70 (+10)
		Eastmain	63	58 (-5)		74 (+11)
		Waskaganish	63	59 (-4)		58 (-5)
		Nemaska	63	59 (-4)		57 (-6)
		Waswanipi	67	60 (-7)		58 (-9)
		Oujé-Bougoumou	66	59 (-7)		57 (-10)
		Mistissini	67	60 (-7)		58 (-9)
NUMBER OF DAYS BELOW -25°C	ANNUAL	**EEYOU ISTCHEE**	**49**	**28 (-21)**		**22 (-27)**
		Whapmagoostui	41	14 (-27)		7 (-34)
		Chisasibi	42	14 (-26)		7 (-34)
		Wemindji	39	16 (-23)		7 (-32)
		Eastmain	40	18 (-22)		10 (-30)
		Waskaganish	37	18 (-19)		10 (-27)
		Nemaska	41	22 (-19)		13 (-28)
		Waswanipi	33	17 (-15)		10 (-23)
		Oujé-Bougoumou	34	19 (-15)		11 (-23)
		Mistissini	40	25 (-15)		16 (-24)

TABLE A5. HISTORICAL COLD SEASON INDICATORS AND PROJECTIONS FOR 2041-2070 FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
FIRST FALL FROST	ANNUAL	EEYOU ISTCHEE	SEPTEMBER 20	OCTOBER 4 (+14)		OCTOBER 7 (+17)
		Whapmagoostui	October 2	October 16 (+14)		October 19 (+17)
		Chisasibi	October 2	October 16 (+14)		October 19 (+17)
		Wemindji	September 29	October 14 (+14)		October 18 (+18)
		Eastmain	September 26	October 12 (+16)		October 16 (+20)
		Waskaganish	September 26	October 12 (+16)		October 17 (+20)
		Nemaska	September 23	October 7 (+13)		October 12 (+18)
		Waswanipi	September 21	October 5 (+14)		October 11 (+19)
		Oujé-Bougoumou	September 20	October 4 (+14)		October 9 (+18)
		Mistissini	September 20	October 4 (+13)		October 8 (+17)
LAST SPRING FROST	ANNUAL	EEYOU ISTCHEE	JUNE 8	MAY 30 (-9)		MAY 25 (-14)
		Whapmagoostui	June 16	June 5 (-10)		May 29 (-17)
		Chisasibi	June 11	June 1 (-10)		May 24 (-18)
		Wemindji	June 10	May 30 (-11)		May 22 (-20)
		Eastmain	June 10	May 29 (-12)		May 22 (-18)
		Waskaganish	June 7	May 26 (-12)		May 21 (-17)
		Nemaska	June 7	May 28 (-10)		May 24 (-14)
		Waswanipi	May 31	May 19 (-12)		May 15 (-15)
		Oujé-Bougoumou	June 1	May 20 (-11)		May 16 (-15)
		Mistissini	June 2	May 20 (-12)		May 17 (-16)
FROST DAYS	ANNUAL	EEYOU ISTCHEE	218	198 (-20)		192 (-26)
		Whapmagoostui	222	199 (-23)		189 (-33)
		Chisasibi	214	193 (-21)		184 (-30)
		Wemindji	211	190 (-21)		181 (-30)
		Eastmain	207	186 (-20)		178 (-29)
		Waskaganish	203	184 (-19)		176 (-27)
		Nemaska	213	194 (-19)		186 (-27)
		Waswanipi	202	182 (-20)		174 (-28)
		Oujé-Bougoumou	205	184 (-20)		176 (-29)
		Mistissini	208	187 (-20)		179 (-29)

APPENDIX B

APPENDIX B – PRECIPITATION

Precipitation indicators and data for all historical and projected values come from Ouranos (extracted 2024).

TABLE B1. SUMMARY OF HISTORICAL PRECIPITATION INDICATORS AND PROJECTIONS (2024-2070) FOR EEYOU ISTCHEE

CLIMATE INDICATORS	TIMING	1991-2020	2041-2070		
		HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
Total precipitation (mm)	Annual	747	821 (+10%)		833 (+12%)
	Winter	137	149 (+9%)		171 (+25%)
Total liquid precipitation (mm)	Annual	682.5	772.2 (+13%)	765.4 (+12%)	
	Autumn	242.4	286.7 (+18%)	287.8 (+19%)	
	Winter	6.4	10.3 (+60%)	10.9 (+71%)	
	Spring	86.7	109.5 (+26%)	110.2 (+27%)	
	Summer	348.0	363.7 (+4%)	362.3 (+4%)	
Total solid precipitation (mm)	Annual	333.9	339.7 (+2%)	334.0 (+0%)	
Maximum 1-day precipitation (mm)	Annual	26	29 (+12%)		31 (+19%)
Maximum 5-day precipitation (mm)	Annual	51	55 (+8%)		56 (+10%)
Wet days (minimum of 1 mm precipitation)	Annual	170	177 (+4%)		178 (+5%)
	Summer	46	45 (-2%)		45 (-2%)
	Autumn	53	54 (+2%)		53 (0%)
	Winter	39	44 (+13%)		46 (+18%)
	Spring	32	34 (+6%)		34 (+6%)
Wet days with over 10 mm of rain	Annual	14	17 (+21%)		18 (+29%)
Wet days with over 20 mm of rain	Annual	2	2 (+0%)		3 (+50%)
Number of periods with at least 5 consecutive dry days	Annual	8	7 (-13%)		7 (-13%)
Maximum number of consecutive dry days	Annual	14	14 (0%)		13 (-7%)

TABLE B2. HISTORICAL PRECIPITATION ACCUMULATION BY TYPE AND PROJECTIONS (2041-2070) FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
TOTAL PRECIPITATION (mm)	ANNUAL	**EEYOU ISTCHEE**	**747**	**821 (+10%)**		**836 (+12%)**
		Whapmagoostui	615	687 (+12%)		706 (+15%)
		Chisasibi	582	639 (+10%)		656 (+13%)
		Wemindji	611	669 (+9%)		694 (+14%)
		Eastmain	657	714 (+9%)		742 (+13%)
		Waskaganish	674	723 (+7%)		749 (+11%)
		Nemaska	725	791 (+9%)		811 (+12%)
		Waswanipi	879	959 (+9%)		963 (+10%)
		Oujé-Bougoumou	938	1028 (+10%)		1033 (+10%)
		Mistissini	900	986 (+10%)		998 (+11%)
	WINTER	**EEYOU ISTCHEE**	**137**	**149 (+9%)**		**171 (+25%)**
		North-West James Bay	134	162 (+21%)	162 (+21%)	
		North-East James Bay	148	175 (+18%)	176 (+19%)	
		South-West James Bay	162	186 (+15%)	191 (+13%)	
		South-East James Bay	178	206 (+16%)	210 (+18%)	
		Whapmagoostui	109.8	140.5 (+28%)		157.1 (+31%)
		Chisasibi	103.8	127.1 (+22%)		137.5 (+25%)
		Wemindji	109.1	132.3 (+21%)		142.2 (+23%)
		Eastmain	113.7	134.5 (+18%)		142.5 (+25%)
		Waskaganish	118.1	137.5 (+16%)		146 (+24%)
		Nemaska	134	157.4 (+17%)		167.2 (+25%)
		Waswanipi	163.6	188 (+15%)		200.4 (+18%)
		Oujé-Bougoumou	178.7	204.5 (+14%)		219.7 (+19%)
		Mistissini	178.6	203.5 (+14%)		218.9 (+18%)

TABLE B2. HISTORICAL PRECIPITATION ACCUMULATION BY TYPE AND PROJECTIONS (2041-2070) FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
TOTAL LIQUID PRECIPITATION (mm)	ANNUAL	**EEYOU ISTCHEE**	**682.5**	**772.2 (+13%)**	**772.2 (+13%)**	
		North-West James Bay	588.2	663.2 (+13%)	663.2 (+13%)	
		North-East James Bay	654.7	754.7 (+15%)	754.7 (+15%)	
		South-West James Bay	719.3	802.7 (+12%)	802.7 (+12%)	
		South-East James Bay	767.6	868.3 (+13%)	868.3 (+13%)	
	AUTUMN	**EEYOU ISTCHEE**	242.4	286.7 (+18%)	286.7 (+18%)	
		North-West James Bay	223.1	261.7 (+17%)	261.7 (+17%)	
		North-East James Bay	223.9	270.9 (+21%)	270.9 (+21%)	
		South-West James Bay	255.5	296.7 (+16%)	296.7 (+16%)	
		South-East James Bay	266.9	317.2 (+19%)	317.2 (+19%)	
	WINTER	**EEYOU ISTCHEE**	**6.4**	**10.3 (+60%)**	**10.3 (+60%)**	
		North-West James Bay	2.3	5.8 (+148%)	5.8 (+148%)	
		North-East James Bay	2	3.8 (+90%)	3.8 (+90%)	
		South-West James Bay	12	17.4 (+44%)	17.4 (+44%)	
		South-East James Bay	9.1	13.8 (+52%)	13.8 (+52%)	
	SPRING	**EEYOU ISTCHEE**	86.7	109.5 (+26%)	109.5 (+26%)	
		North-West James Bay	63.1	78.5 (+24%)	78.5 (+24%)	
		North-East James Bay	62.5	83.2 (+33%)	83.2 (+33%)	
		South-West James Bay	114.1	139 (+22%)	139 (+22%)	
		South-East James Bay	107.1	137.1 (+28%)	137.1 (+28%)	
	SUMMER	**EEYOU ISTCHEE**	**348.0**	**363.7 (+4%)**	**363.7 (+4%)**	
		North-West James Bay	301.4	315 (+5%)	315 (+5%)	
		North-East James Bay	365.7	383.4(+5%)	383.4(+5%)	
		South-West James Bay	340	354 (+4%)	354 (+4%)	
		South-East James Bay	385	402.4 (+5%)	402.4 (+5%)	

TABLE B2. HISTORICAL PRECIPITATION ACCUMULATION BY TYPE AND PROJECTIONS (2041-2070) FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
TOTAL SOLID PRECIPITATION (mm)	ANNUAL	**EEYOU ISTCHEE**	**333.9**	**339.7 (+2%)**	**334.0 (+0%)**	
		North-West James Bay	299.5	307.8 (+3%)	304.1 (+2%)	
		North-East James Bay	380.0	389.7 (+3%)	383.1 (+1%)	
		South-West James Bay	291.7	291.9 (+0%)	285.9 (-2%)	
		South-East James Bay	364.4	369.3 (+1%)	362.8 (-0.5%)	
TOTAL PRECIPITATION (liquid and solid) (mm)	WINTER	**EEYOU ISTCHEE**	**137**	**159 (+16%)**		**171 (+25%)**
		Whapmagoostui	109.8	140.5 (+28%)		157.1 (+31%)
		Chisasibi	103.8	127.1 (+22%)		137.5 (+25%)
		Wemindji	109.1	132.3 (+21%)		142.2 (+23%)
		Eastmain	113.7	134.5 (+18%)		142.5 (+25%)
		Waskaganish	118.1	137.5 (+16%)		146 (+24%)
		Nemaska	134	157.4 (+17%)		167.2 (+25%)
		Waswanipi	163.6	188 (+15%)		200.4 (+18%)
		Oujé-Bougoumou	178.7	204.5 (+14%)		219.7 (+19%)
		Mistissini	178.6	203.5 (+14%)		218.9 (+18%)

TABLE B3. HISTORICAL PRECIPITATION INTENSITY INDICATORS AND PROJECTIONS (2041-2070) FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
MAXIMUM 1-DAY PRECIPITATION (mm)	ANNUAL	**EEYOU ISTCHEE**	**26**	**29 (+12%)**		**31 (+19%)**
		Whapmagoostui	33	36 (+9%)		38 (+15%)
		Chisasibi	26	29 (+12%)		30 (+15%)
		Wemindji	26	28 (+8%)		29 (+12%)
		Eastmain	26	29 (+12%)		30 (+15%)
		Waskaganish	25	28 (+12%)		29 (+16%)
		Nemaska	21	24 (+14%)		25 (+19%)
		Waswanipi	30	34 (+13%)		35 (+17%)
		Oujé-Bougoumou	37	41 (+11%)		42 (+14%)
		Mistissini	36	42 (+17%)		42 (+17%)
MAXIMUM 5-DAY PRECIPITATION (mm)	ANNUAL	**EEYOU ISTCHEE**	**51**	**55 (+8%)**		**56 (+10%)**
		Whapmagoostui	56	62 (+11%)		62 (+11%)
		Chisasibi	48	53 (+10%)		52 (+8%)
		Wemindji	48	52 (+8%)		53 (+10%)
		Eastmain	48	53 (+10%)		55 (+15%)
		Waskaganish	49	53 (+8%)		54 (+10%)
		Nemaska	45	49 (+9%)		50 (+11%)
		Waswanipi	59	64 (+8%)		64 (+8%)
		Oujé-Bougoumou	66	73 (+11%)		72 (+9%)
		Mistissini	63	70 (+11%)		70 (+11%)

TABLE B4. HISTORICAL ANNUAL WET DAYS AND PROJECTIONS (2041-2070) FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
WET DAYS WITH A MINIMUM OF 1 mm PRECIPITATION (number of days)	ANNUAL	**EEYOU ISTCHEE**	**170**	**177 (+4%)**		**178 (+5%)**
		Whapmagoostui	170	177 (+4%)		178 (+5%)
		Chisasibi	139	148 (+6%)		151 (+9%)
		Wemindji	137	144 (+5%)		146 (+7%)
		Eastmain	143	151 (+6%)		152 (+6%)
		Waskaganish	150	155 (+3%)		157 (+5%)
		Nemaska	154	159 (+3%)		161 (+5%)
		Waswanipi	173	178 (+3%)		180 (+4%)
		Oujé-Bougoumou	171	175 (+2%)		174 (+2%)
		Mistissini	171	174 (+2%)		174 (+2%)
	SUMMER	**EEYOU ISTCHEE**	**46**	**45 (-2%)**		**45 (-2%)**
	AUTUMN	**EEYOU ISTCHEE**	**53**	**54 (-2%)**		**53 (0%)**
	WINTER	**EEYOU ISTCHEE**	**39**	**44 (+13%)**		**46 (+18%)**
	SPRING	**EEYOU ISTCHEE**	**32**	**34 (+6%)**		**34 (+6%)**

TABLE B4. HISTORICAL ANNUAL WET DAYS AND PROJECTIONS (2041-2070) FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
WET DAYS WITH OVER 10 mm OF PRECIPITATION (number of days)	ANNUAL	**EEYOU ISTCHEE**	**14**	**17 (+21%)**		**18 (+29%)**
		Whapmagoostui	12	14 (+17%)		14 (+17%)
		Chisasibi	11	12 (+9%)		13 (+18%)
		Wemindji	11	13 (+18%)		14 (+27%)
		Eastmain	13	14 (+8%)		16 (+23%)
		Waskaganish	13	15 (+15%)		15 (+15%)
		Nemaska	12	14 (+17%)		15 (+25%)
		Waswanipi	21	24 (+14%)		25 (+19%)
		Oujé-Bougoumou	24	27 (+13%)		28 (+17%)
		Mistissini	22	25 (+14%)		26 (+18%)
WET DAYS WITH OVER 20 mm OF PRECIPITATION (number of days)	ANNUAL	**EEYOU ISTCHEE**	**2**	**2 (+0%)**		**3 (+50%)**
		Whapmagoostui	2	3 (+50%)		3 (+50%)
		Chisasibi	1	2 (+100%)		2 (+100%)
		Wemindji	1	2 (+100%)		2 (+100%)
		Eastmain	1	2 (+100%)		2 (+100%)
		Waskaganish	1	2 (+100%)		2 (+100%)
		Nemaska	1	1 (+0%)		2 (+100%)
		Waswanipi	3	4 (+33%)		4 (+33%)
		Oujé-Bougoumou	5	6 (+20%)		6 (+20%)
		Mistissini	4	5 (+25%)		5 (+25%)

TABLE B5. HISTORICAL ANNUAL DRY DAYS AND PROJECTIONS (2041-2070) FOR EEYOU ISTCHEE AND ITS NINE COMMUNITIES

CLIMATE INDICATORS	TIMING	LOCATIONS	1991-2020	2041-2070		
			HISTORICAL	SSP2-4.5	SSP3-7	SSP5 -8.5
NUMBER OF PERIODS WITH AT LEAST 5 CONSECUTIVE DRY DAYS	ANNUAL	**EEYOU ISTCHEE**	**8**	**10 (-9%)**		**7 (-13%)**
		Whapmagoostui	11	11 (-8%)		10 (-9%)
		Chisasibi	12	10 (-9%)		11 (-8%)
		Wemindji	11	9 (-10%)		10 (-9%)
		Eastmain	10	9 (-10%)		10 (0%)
		Waskaganish	10	7 (-13%)		9 (-10%)
		Nemaska	8	7 (-13%)		7 (-13%)
		Waswanipi	8	7 (-13%)		7 (-13%)
		Oujé-Bougoumou	8	7 (-13%)		7 (-13%)
		Mistissini	8	14 (0%)		7 (-13%)
MAXIMUM NUMBER OF CONSECUTIVE DRY DAYS	ANNUAL	**EEYOU ISTCHEE**	**14**	**17 (-11%)**		**13 (-7%)**
		Whapmagoostui	19	18 (-5%)		17 (-11%)
		Chisasibi	19	17 (-6%)		17 (-11%)
		Wemindji	18	16 (0%)		16 (-11%)
		Eastmain	16	15 (0%)		15 (-6%)
		Waskaganish	15	13 (-7%)		14 (-7%)
		Nemaska	14	13 (0%)		13 (-7%)
		Waswanipi	13	13 (0%)		13 (0%)
		Oujé-Bougoumou	13	13 (0%)		12 (-8%)
		Mistissini	13	13 (0%)		13 (0%)

APPENDIX C

APPENDIX C – TIMELINE 2023

KEY DATES AND EVENTS OF FOREST FIRE

Below is a timeline of key dates and events during the 2023 forest fire season in Eeyou Istchee.

Week of May 29

Initial reports of fires in and near region.

June 2

Activation of emergency response within Cree Health Board and with Civil Security ORSC. Waswanipi CMC flood – impacted regular clinical activities.

Week of June 5

June 6

Oujé-Bougoumou full Evacuation (Phase 1-3) to Lac St-Jean area (Chicoutimi).

June 6 and 7

Waswanipi medical evacuation (Phase 1-2) to Québec City.

June 7

Mistissini medical evacuation (dialysis patients, vulnerable patients, children, pregnant women) to Montreal.

Week of June 12

Return of Waswanipi and Oujé-Bougoumou evacuees (phased approach) over the week.

June 13

Temporary relocation of evacuated patients and caregivers out of Espresso hotel due to Grand Prix weekend hotel bookings.

Week of June 19

June 21

Mistissini evacuation of vulnerable patients (Phase 1 and 2) to Québec City.

June 22

Mistissini announces general evacuation (Phase 3) to Chicoutimi (with satellite clinic) starting morning of June 23. A skeleton crew of essential workers stayed behind.

June 23

Waswanipi announces medical evacuation of vulnerable patients (Phase 1 and “2a”) on June 24 to Trois Rivieres (with satellite clinic).

June 23

Oujé-Bougoumou medical evacuation (Phase 1) to Jonquiere (with satellite clinic).

Week of June 26

Return to Mistissini, Oujé-Bougoumou and Waswanipi (phased approach)

Week of July 10

Closure of access roads to Waskaganish, Eastmain, and Wemindji – impacts people and supplies getting in and out of communities.

Waskaganish lost internet connection due to fire damage to fiber optic cable. This also impacted internet speed across the region.

July 12
Nemaska medical evacuation (Phase 1) to Québec City.

July 13
Wemindji and Eastmain start medical (Phase 1) evacuations by air to Rouyen Noranda (Eastmain) and Québec City (Wemindji).

Week of July 17

July 18
Fiber optic cable repaired and Waskaganish internet repaired.

July 19-22
Temporary restricted reopening of Billy Diamond highway and access roads.

July 19
Eastmain announces phased return to community for Phase 3 (July 19) and 2 (July 20) by bus.

July 20
Nemaska Phase 1 evacuees begin to return home.

July 21
Chisasibi Phase 1 evacuees begin return home.

July 22
Waskaganish Phase 1 evacuees begin return home.

July 22
Eastmain Phase 1 evacuees begin return home.

July 23
Wemindji Phase 2 evacuees begin return home.

Week of July 24

July 24
Wemindji Phase 1 evacuees begin return home.

July 26
Restricted road access reopens (Billy Diamond highway and access.

Week of July 31

August 5
Closure of Billy Diamond Highway from km 394 to 590 and Wemindji access road.

Week of August 7

August 10
Restricted road access reopens (Billy Diamond highway and Wemindji access road).

August 13
Wemindji access road closure.

Week of August 14

August 14
Closure of Billy Diamond Highway from km 394 to 590. Intermittent reopening with restricted access of Billy Diamond Highway from km 394 to 590 and Wemindji access road when fire and smoke conditions allow.

August 16
Wemindji Phase 1 evacuation to Chisasibi by air.

August 17
Road closures: Billy Diamond Highway km 50 to 590, Waskaganish access road and Route du Nord between Old Nemaska turn off and Billy Diamond Highway.

August 18
All roads reopened with restricted access.

August 18
Wemindji evacuees begin to return home.

Week of August 21

August 24
Roads reopened with unrestricted access.

August 27-28
Closure of Billy Diamond Highway from km 394 to 544 and Wemindji access road.

Week of September 27

Dry weather conditions lead to remaining fires becoming more active. Smokey periods along the coast impacting road conditions. Intermittent closures of Wemindji access road.

APPENDIX D

APPENDIX D – TWENTY-SIX WILDLIFE SPECIES

SIGNIFICANT FOR CREE SUBSISTENCE AND ASSOCIATED CHANGES IN THE CONTEXT OF CLIMATE CHANGE

(Adapted from (Ropars et al., 2022))

FUR-BEARING TERRESTRIAL MAMMALS	
BEAVER *(Castor canadensis)*	▸ Under milder climate and the expansion of shrub vegetation northward and along shorelines, beaver distribution is projected to expand into tundra habitat (beaver populations have been expanding into Nunavik over the last two decades). ▸ With rising temperatures, open water below the ice in the winter will become more available northward and contribute to the expansion of beaver populations ▸ Beaver population density is likely to increase within its current distribution.
MIGRATORY WATERFOWL	
LESSER SNOW GEESE *(Anser caerulescens)*	▸ Increase in reproductive effort is projected in connection with warmer spring temperatures. ▸ Possible mismatch between the hatching of goslings and the availability of plants at their peak nutritive potential could decrease juvenile survival rates and capacity of goslings to complete their first fall migration. ▸ Warmer temperature in winter could have negative effects on plant species significant for snow goose feeding.
CANADA GOOSE *(Branta canadensis)*	▸ Evidence suggests that Canada goose can adapt to earlier spring conditions by adjusting their hatch date. ▸ Early spring could cause higher reproductive effort. ▸ Earlier springs and the delayed onset of winter could cause a northward expansion of the species' range.
COMMON EIDER *(Somateria mollissima)*	▸ Increase in summer temperature could lead to higher breeding success.

APPENDIX D – TWENTY-SIX WILDLIFE SPECIES SIGNIFICANT FOR CREE SUBSISTENCE AND ASSOCIATED CHANGES IN THE CONTEXT OF CLIMATE CHANGE (Adapted from (Ropars et al., 2022))

LARGE GAME	
MOOSE *(Alces alces)*	▸ Moose reached the 53rd parallel in the 1950s and the 57th parallel in the 1970 (Brassard et al. 1974). The northward expansion of moose distribution will continue with warming temperature and the expansion of shrub species in the tundra. ▸ Increase in forest fire intensity could increase winter habitat for moose that prefer open areas. ▸ Higher summer temperature can represent a stressor for moose and could affect their feeding behavior and reduce fecundity and survival rates. ▸ Increase in snowfall could advantage light-bodied predators such as wolves. ▸ Shorter winters are favorable to the incidence of parasites (Winter ticks, Onchocerca cervipedis, Setaria tundra, O. cervipedi) and diseases detrimental to moose populations.
BLACK BEAR *(Ursus americanus)*	▸ Newly available plant species north of the Black bear's historical distribution will cause its northward expansion already underway).
CARIBOU *(Rangifer tarandus)*	▸ Since 1850, anthropogenic disturbances of caribou habitat are responsible for the contraction of its distribution towards the north. Climate change is considered to play a smaller role than human-induced disturbances (roads, dams, mining, forestry, etc.) ▸ Shrub species eaten by caribou will benefit from milder climates which could increase summer food resources. ▸ Caribou have a relative flexibility for timing their migration with earlier plant productivity (peak nutrition potential) that may come with earlier springs. ▸ Warmer temperature could cause parasitic insects to be more prevalent in habitat used by caribou populations and could be detrimental to them.

APPENDIX D – TWENTY-SIX WILDLIFE SPECIES SIGNIFICANT FOR CREE SUBSISTENCE AND ASSOCIATED CHANGES IN THE CONTEXT OF CLIMATE CHANGE (Adapted from (Ropars et al., 2022))

LARGE GAME

RINGED SEAL *(Pusa hispida)*	▸ The projected decrease in pack ice in James Bay and Hudson Bay is expected to cause decrease in feeding and breeding habitat in some regions, leading to poorer body condition and breeding success. ▸ As food resources concentrate at the ice-edge, with gradually retreating summer sea –ice, ringed seal must spend more energy searching for food, which could lead to changes in distribution and population decline. ▸ Increasing rain events in spring leave seal pups more vulnerable to predators and harsh weather as their lairs become exposed. ▸ Warming events, which are projected to increase in occurrence, are associate in high stress levels (cortisol levels), low ovulation rate and low pregnancy rate. ▸ Negative impacts of climate change on ringed seal could be offset with higher ecosystem productivity and overall higher abundance of prey.
HARBOR SEAL *(Phoca vitulina)*	▸ Longer open-water season is known to benefit harbor seal population and is likely to continue with warming fall and spring temperatures.
POLAR BEAR *(Ursus maritimus)*	▸ Reduction in ice thickness, duration and extent could cause a loss of habitat for polar bear and reduce access to available prey. ▸ Reduction in sea ice in early fall and late spring will cause polar bear to increasingly rely on terrestrial areas, which has already been observed to lead to declining birthrates and physical fitness. ▸ Rather than an overall decline in polar bear habitat, climate change may cause more variation in ecosystem productivity year to year.

APPENDIX D – TWENTY-SIX WILDLIFE SPECIES SIGNIFICANT FOR CREE SUBSISTENCE AND ASSOCIATED CHANGES IN THE CONTEXT OF CLIMATE CHANGE (Adapted from (Ropars et al., 2022))

SMALL GAME	
PTARGMIGAN *(Lagopus species)*	▸ Higher summer temperature could cause a restriction in suitable habitat for ptarmigan species which are highly sensitive to climate. ▸ The projected increase in shrub growth (distribution and height) could cause be beneficial to all ptarmigan species as a winter food source. ▸ Willow ptarmigan populations could be advantaged over Rock ptarmigan with the increase in shrub extent while available breeding habitat for rock ptarmigan will decrease. ▸ Milder temperature causing rain-over-snow events could prevent ptarmigan from accessing food sources and finding shelter (i.e. snow tunneling) during high winds. ▸ Earlier spring and later winter could cause a mismatch between complete molt (seasonal color change) and snow cover, increasing predation risk
SPRUCE GROUSE *(Falcipennis canadensis)*	▸ Future climate conditions at the southern limit of the boreal forest may cause coniferous forest partitioning and increase the fragmentation of the population's distribution.
SNOWSHOE HARE *(Lepus americanus)*	▸ Increased shrub density and shrub height could be beneficial to snowshoe hare as a food resource and as protection from predators. ▸ Snowshoe hare is projected to expand northward with the increase in coverage of shrub species. ▸ The mismatch between molt (seasonal color-change) and snow cover increases predation success. Southern populations have already contracted north due to the delayed onset of winter and earlier spring.
PORCUPINE *(Erethizon dorsatum)*	▸ Porcupine distributions in Eeyou Istchee currently follow the northward expansion of white spruce.

APPENDIX D – TWENTY-SIX WILDLIFE SPECIES SIGNIFICANT FOR CREE SUBSISTENCE AND ASSOCIATED CHANGES IN THE CONTEXT OF CLIMATE CHANGE (Adapted from (Ropars et al., 2022))

FISH	
LAKE STURGEON *(Acipenser fulvescens)*	▸ Lake sturgeon is currently under threat in Eeyou Istchee from anthropogenic disturbances which could be heightened by the effects of climate change. ▸ Warmer water temperatures are a stressor during egg incubation and hatching, which are known to cause decreases in Lake sturgeon populations. ▸ Warmer water temperature could cause a contraction of the species' habitat as they would seek refuge in larger and deeper bodies of water.
SUCKER *(Catostomus commersoni)*	▸ Warmer water temperature could shift their distribution northward.
NORTHERN PIKE *(Esox lucius)*	▸ Northern pike has a high tolerance to warmer water temperatures. ▸ Earlier spring could affect egg survivability in shallow waters with cause a contraction of their spawning habitat towards cooler water bodies. ▸ Warmer water temperature could have indirect effects on Northern pike by affecting their prey species' food on the southern fringe of its distribution.
BURBOT *(Lota lota)*	▸ Burbot have low mobility and low tolerance to warm water which leaves them exposed to extreme temperatures in summer which could lead to die-off events in shallow lakes with little to no thermal tratification.
WALLEYE *(Sander vitreus)*	▸ Warmer water temperatures will benefit walleye as it pursues its northward expansion. ▸ Walleyes are overall a resilient species in face of climate change.

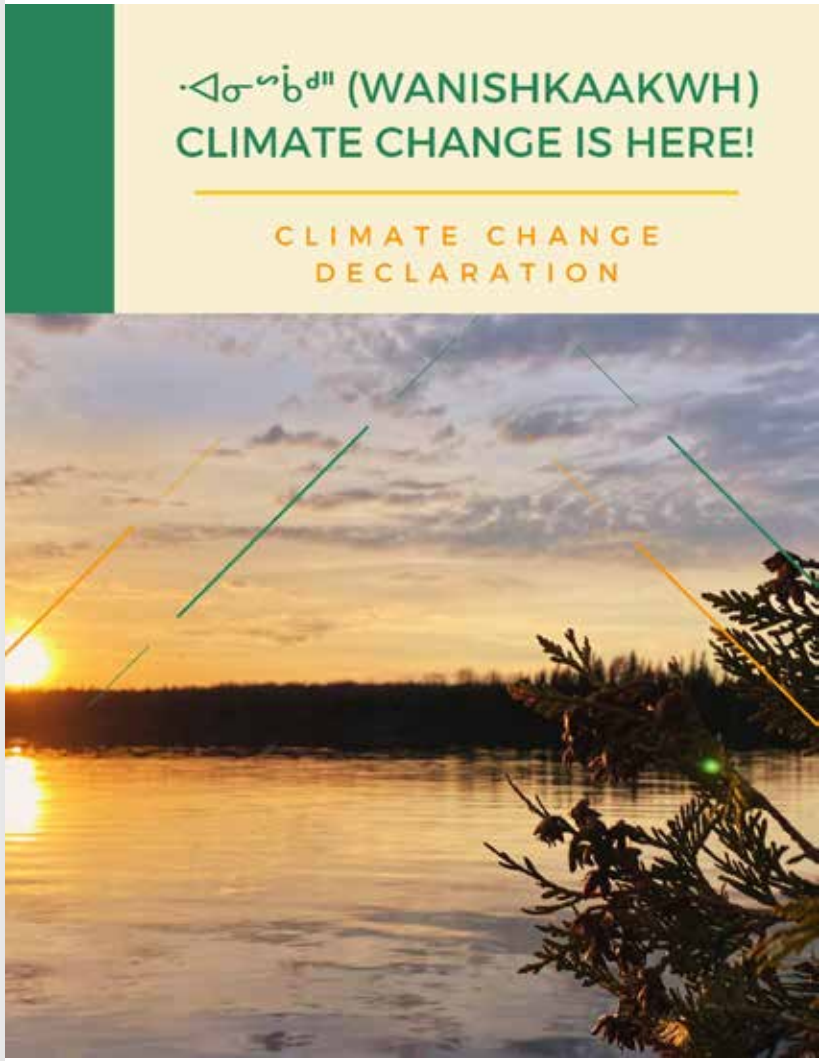
APPENDIX D – TWENTY-SIX WILDLIFE SPECIES SIGNIFICANT FOR CREE SUBSISTENCE AND ASSOCIATED CHANGES IN THE CONTEXT OF CLIMATE CHANGE (Adapted from (Ropars et al., 2022))

FISH	
WHITEFISH *(Coregonus species)*	▸ Increases in fall temperature could cause whitefish spawning to happen later in the fall. ▸ Overall distribution of the species could move northward. ▸ Decrease in dissolved oxygen during warmer months could cause a significant increase in mortality in late summer in the southern range of the species' distribution. ▸ An important threat to whitefish is the invasion of cold-water rainbow smelt (Osmerus mordax) into its habitat. ▸ The reduction in ice cover in the spring could leave whitefish and cisco eggs exposed earlier before hatching.
LAKE TROUT *(Salvelinus namaycush)*	▸ Warmer fall temperature could have catastrophic impacts on embryo survival. ▸ Because lake trout has low thermal tolerance, its distribution should shift towards deeper, colder and larger waterbodies. ▸ Warmer water temperature negatively affects lake trout feeding behaviour causing limited growth. ▸ Warming water and lower levels of dissolved oxygen is projected to affect Lake Trout reproduction, growth and survival in populations living in shallow lakes.
ARCTIC CHAR *(Salvelinus alpinus)*	▸ Southern populations will experience substantial decline because of the low tolerance to increasing water temperatures and the decreasing levels of dissolved oxygen in shallow arctic waters. ▸ The distribution of Arctic char population is projected to decrease by 63% in Canada by 2050 (Chu et al. 2005). ▸ Increased food availability in freshwater habitat caused by more productive habitats (longer ice-free period) during the summer could cause a gradual reduction in migration behaviour..
BROOK/SPECKLED TROUT *(Salvelinus fontinalis)*	▸ Brook trout has high habitat plasticity and some thermal tolerance. Climate projections however suggest that its current distribution will decrease by 49% in Canada by 2050 (Chu et al., 2005). ▸ Prolonged extreme temperature events are known to cause Brook trout die-offs.

APPENDIX E

APPENDIX E – ᐊᓂᔑᓇᐯᒧᐎᓐ | WANISHKAAKWH

SWAKE UP CLIMATE CHANGE DECLARATION AND CALLS TO ACTION



ᐊᓂᔑᓇᐯᒧᐎᓐ | WANISHKAAKWH | Wake Up

Declaration on Climate Change in Eeyou Istchee

"Climate change in Eeyou Istchee is occurring more rapidly than we realize [...] and it's an area in which we need to be innovative in our response."

– Grand Chief Mandy Gull-Masty

1. Context

We, a well-rounded and variegated group of representatives from Eeyou Istchee, gathered in Oujé-Bougoumou in April 2024 for the **Cree Regional Climate Forum** to respond to the issue of climate change. Recognizing its impact on our way of life, we commit to holistic solutions guided by traditional knowledge and supported by all levels of governance through regulation and policy.

We abide with natural law because this is how we, the Cree of Eeyou Istchee, have lived through the life cycle since time immemorial. Climate change compromises every aspect of our use and experiences of the land, and thus our vital traditional practices. Acting now, rather than merely reacting, will protect our future generations.

2. Definition

Climate change refers to long term shifts in temperature and weather patterns. These shifts can be both natural and anthropogenic. We, the Cree Nation, experience climate change through the full cycle of life and are impacted generation to generation. Climate change impacts Cree ways of life, knowledge and traditional understanding, and everyday activities related to both sustenance and cultural identity.

3. Vision & Mission

We agree on the following:

Our **vision** is that of a sustainable and resilient Eeyou Istchee that thrives by following the Traditional Knowledge of our ancestors while integrating innovative practices to protect our lands, waters and communities— today and for generations to come. A trailblazing Nation leading the way for Indigenous climate policy, setting the standard for effective adaptation and balance in the face of climate change impacts.

Our **mission** is to mobilize Eeyou Istchee and parties with interest in collaborative action to combat the impacts of Climate change, employing traditional knowledge and modern science to protect, preserve and maintain our way of life, to live in harmony with nature through the challenges of a changing climate, with careful forethought for future generations.

4. Guiding Principles

The pursuit of our vision must be based on the following principles:

- Climate initiatives are Eeyou-led, integrating Eeyou traditional and scientific knowledge.
- Effective collaboration with partners (including other Indigenous entities, industries, governments, and NGOs) is essential.
- Prioritize education and knowledge transmission within Cree communities.
- Pay special attention to the protection of wildlife, lands, and waters across our territory.

5. Goals

Based on the principles stated above, the Cree Nation will aspire to:

- Enhance climate change awareness and empower communities through education and engagement.
- Ensure meaningful community involvement at all stages of climate action projects.
- Expand climate and wildlife monitoring/research using a blend of traditional and scientific methods.
- Strengthen collaboration between governments and Indigenous entities on climate action.
- Improve climate change preparedness and reduce Eeyou Istchee's carbon footprint.
- Secure carbon rights on land while supporting Indigenous-led conservation finance initiatives.
- Uphold Indigenous sovereignty and establish a permanent Climate Change Advisory Committee.
- Integrate climate change considerations into the James Bay and Northern Quebec Agreement in alignment with UNFCCC principles.
- Empower youth through learning opportunities and facilitate knowledge sharing between generations.
- Raise awareness of climate change impacts and opportunities while implementing practical solutions.

6. Commitments

In a coordinated effort to achieve these goals, we commit to:

- Empower youth through increased learning opportunities.
- Facilitate knowledge sharing between Elders, youth, and institutions.
- Expand existing wildlife and environmental monitoring programs.
- Provide climate change information in the Cree language.
- Involve community members, particularly youth, in projects.
- Foster collaboration between governments and learn from other Indigenous communities.
- Formalize a permanent Climate Change Advisory Committee with a clear mandate and powers.
- Establish strategic action plans for communities and a regional adaptation plan.
- Implement improved recycling infrastructure and raise awareness.
- Increase awareness of GHG emissions' impact and ways to reduce them.

7. Signatories

We collectively agree that this declaration will lead to working together to mobilize Eeyou Istchee and parties with interest in collaborative action to combat the impacts of Climate change. Efforts will be spearheaded by the new Climate Change Advisory Committee (CCAC), in collaboration with the Cree entities below, and backed by the Grand Council of the Crees.

The detailed contributions from participants of the 2024 Cree Regional Climate Forum will go toward shaping the CCAC's Regional Climate Change Adaptation Plan, which will guide the effective delivery of the various goals set forth in this declaration.

Cree Nation Government	Date: March 27 25
Cree Nation of Chisasibi	Date: March 27, 2025
Cree Nation of Eastmain	Date: March 27, 2025
Cree Nation of Mistissini	Date: March 27, 2025
Me[illegible]youd	Date: March 27, 2025
Cree Nation of Nemaska	Date: Mar 27/2025
Oujé-Bougoumou Cree Nation	Date: March 27/25
Washaw Sibi Eeyou	Date: March 27/25
Cree Nation of Waskaganish	Date: March 27, 2025
Cree First Nation of Waswanipi	Date: March 27, 2025
Cree Nation of Wemindji	Date: March 27, 2025
Whapmagoostui First Nation	Date

And members of the Cree Climate Advisory Committee...

Cree Trappers' Association	Date
CBHSSJB	March 27, 2025. Date
Cree School Board	March 27/2025 Date
Cree Women of Eeyou Istchee Association	Date
Nishiiyuu Council of Elders	Date
Cree Nation Youth Council	March 27/25 Date

ANNEXES
(Supporting Documents)

26 Proposed Climate Calls to Action

As climate change action requires active participation and cooperation across all sectors and levels of government, we call upon all elected officials, Cree leadership and decision-makers, community members, partners and stakeholders to join us on this journey.

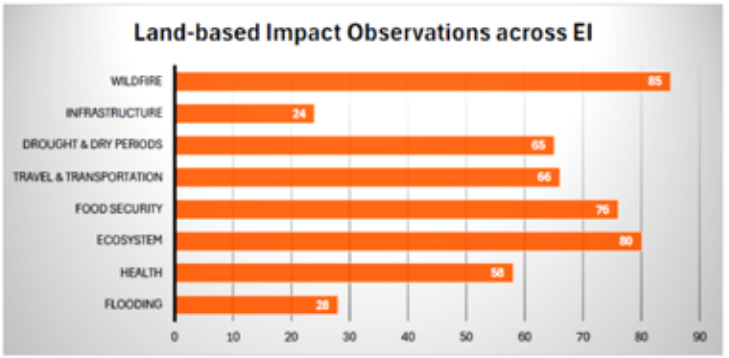
		CREE							STAKEHOLDERS			
		Leadership	Regional Entities	Community members	Schools & Educators	Elders	Youth	All Decision-Makers	Federal Gov.	Provincial Gov.	Inuit & First Nations	KRG, ARBG
EDUCATION & TRANSMISSION OF KNOWLEDGE												
1	Provide learning opportunities on climate change, the environment, and traditional knowledge				X							
2	Share knowledge and experiences with younger generations					X						
3	look for opportunities to learn from elders and knowledge-holders and engage in them						X					
PROTECTION OF WILDLIFE, LAND & WATERS												
4	Consider the cumulative effects of climate change and development when considering or planning new projects on ancestral lands.	X							X	X		X
5	Re-evaluate and implement forestry practices through a climate lens, beginning with increasing buffers around water bodies in the Cree Nation's territory	X							X	X		X
LANGUAGE & PROTECTION OF CULTURE												
6	Keep the Cree language alive by speaking it among ourselves.			X								
7	Continue to engage in discussions on climate change and advocate for the inclusion of the Cree language in these discussions.			X								
8	Support initiatives aiming to gather and safeguard Eeyou knowledge, oral history and vocabulary on the changing climate.							X				
9	Ensure that official documents be accessible in Cree language and reflect Cree culture							X				
COMMUNITY												
10	Assume individual responsibility of lifestyle choices regarding climate change adaptation and mitigation			X								
11	Integrate climate change into various conversations (e.g., health, education, housing, forestry, etc.).	X						X				
12	*Listen* to community members and make decisions in line with the needs they express	X						X				
13	Facilitate youth involvement at every level through various opportunities: conference observers and participants, jobs, school projects, etc.	X						X				

		CREE							STAKEHOLDERS			
		Leadership	Regional Entities	Community Members	Schools & Educators	Elders	Youth	All Decision-Makers	Federal Gov.	Provincial Gov.	Inuit & First Nations	KRG, ARBG
INTERGOVERNMENTAL COLLABORATION												
14	Include other Northern Indigenous communities in policy making								X	X		
15	Hold shared forums on climate change with neighbouring Indigenous Nations	X									X	X
INDIGENOUS SOVEREIGNTY												
16	Ensure active participation and permanence of a Climate Change Advisory Committee	X	X									
17	Recognize that Tallymen are an influential part of community-led decisions								X	X		
18	Respect all previously signed agreements								X	X		
19	Consider a new or updated agreement on Climate change								X	X		
20	Implement United Nations Declaration on the rights of Indigenous People's principles								X	X		
EMERGENCY MEASURES/STRATEGIC PLAN												
21	Plan and act on emergency measures proactively and with a sense of urgency	X		X				X				
22	Implement climate change adaptation and mitigation measures with a long-term horizon (including infrastructure development: impact of climate change on new building/homes, etc.).	X		X				X				
ENERGY/RESOURCE MANAGEMENT AND DEVELOPMENT												
23	To reduce greenhouse gases emissions, encourage local economy and services			X								
24	Reduce energy consumption and move towards more renewable energy sources.	X						X				
25	Move away from fossil fuel-powered vehicles and equipment (explore battery or electric-powered alternatives).	X						X				
26	Promote agriculture and greenhouses	X						X				
27	Consider innovative approaches for land development, hunting, fishing, gathering, and crafts, and explore new paradigms for economic development	X						X				

Priority Climate-Related Issues Identified By Community

Summary of Climate Adaptation exercise from Day 2 at the 2024 Cree Regional Climate Forum

	Coastal						Inland				
	Whapmagostui	Chisasibi	Wemindji	Eastmain	Waskaganish	Mocreebec	Nemaska	Ouje-Bougoumou	Waswanipi	Washaribi	Mistissini
Flooding							X				X
Health*			X					X		X	
Ecosystem Shift		X	X				X	X			
Food security			X		X					X	
Travel & Transportation	X	X		X	X		X		X		X
Drought & Dry Periods				X							
Infrastructure				X							
Forest Fires		X	X		X				X	X	X



**Health is considered a cross-cutting issue*

Detailed Land-Based Observations
By Community

Summary of Climate Adaptation exercise from Day 2 at the 2024 Cree Regional Climate Forum showcasing the level of importance for each land-based observations of climate related impacts.

Flooding

Impacts observed on you Traditional Lands	Whapmagostui	Chisasibi	Wemindji	Eastmain	Waskaganish	MoCreebec	Nemaska	Ouje-Bougoumou	Waswanipi	Washashibi	Mistissini
Flooding From Heavy rain storms									1		
Flooding from spring melt				2	1		1	1	1		
Flooding more severe than in the past							1				
Flooded ditches and storm drains in the community		1							1		2
Community roads flooded or washed-out	1	2						1	1		2
Flooded basement / buildings in the community	1				1		1		1		2
Flooded areas on the land		1			1		2		1		
Flooded from lakes / rivers overflowing their banks									1		1
Flooded caused by ice-jams		4									1
Flooding causing community evacutation											
Total	**2**	**8**	**0**	**2**	**3**	**0**	**5**	**2**	**7**	**0**	**8**

Health

Impacts observed on you Traditional Lands	Whapmagostui	Chisasibi	Wemindji	Eastmain	Waskaganish	MoCreebec	Nemaska	Ouje-Bougoumou	Waswanipi	Washashibi	Mistissini
Hotter Summer days and nights impacting community members		1					2		1		1
More heat waves than iin the past							1		1		2
Hot weather impacting cultural activities		1					1		2		
New Animal can bring new Diseases (Mosquitos West Nile Virus or blacklegged ticks Lyme disease		1					1			1	1
Mold growth in homes	1	2		2	1		2	1	2	1	1
emotional distress from climate impacts on the land and cultural activities		2					1		1	1	
Stress/Fear around extreme events (flood,Wildfires, Evacuations,etc)			1		1			1	2	1	2
Problem with seasonal allergies									1	1	2
Water quality concerns e.g. Algal Bloom or in swimming area				1			1	1		1	1
Changes in air quality (Wildfire smoke, exhaust from equipment generators		2	1				1	1	2	1	1
Other Observations											
Total	**1**	**9**	**2**	**3**	**2**	**0**	**10**	**4**	**12**	**7**	**11**

Ecosystem

Impacts observed on you Traditional Lands	Whapmagostui	Chisasibi	Wemindji	Eastmain	Waskaganish	MoCreebecbec	Nemaska	Ouje-Bougoumou	Waswanipi	Washashibi	Mistissini
New type of plants and animals	1			1			2	1	1		2
seeing fewer of some animals		2			1		1	1	3		1
seeing more of some animals											1
Changing health of animals		3	1					1	1		1
Change in migration (geese,Duck)	1	4		3	2		2	1	1		2
Bears out earlier	1				1		1	1	1		2
Polar bear spending more time on the land	1	2		2	1				1		
Permafrost Thawing, more permafrost ponds	1	2					1				1
Hotter summers mean plants don't grow well		3		1			2	1	4		2
Changing fish species		2	1				2	1	1		1
Total	**5**	**18**	**2**	**7**	**5**	**0**	**11**	**7**	**13**	**0**	**13**

Food security

Impacts observed on you Traditional Lands	Whapmagostui	Chisasibi	Wemindji	Eastmain	Waskaganish	MoCreebec	Nemaska	Ouje-Bougoumou	Waswanipi	Washashibi	Mistissini
Fewer Berries or berries are harder to find		1		1					1	1	1
Berries smaller or poor quality		3			2		1		1	1	
Diseases/ pests affecting plants harvested for food or medecine		1									
Harder to harvest traditional foods than it used to be		1			3		1		1	1	1
fewer people eating traditional foods		2	1	1	1			1	2	1	1
fewer ducks, geese, or other commonly harvested small animals		4			2		1			1	
Fewer Caribou		4			2		1	1	1	1	
Warmer fall weather makes it harder to keep harvest cool		2			1			1			1
Quality of harvested meat is lower than it used to be		3		1	1		1	1		1	
Changes in fish (num bers, types, location, health,etc)		3		1	5		2			1	1
Other observation											
Total	**0**	**24**	**1**	**4**	**17**	**NA**	**7**	**4**	**6**	**8**	**5**

Wildfire											
Impacts observed on you Traditional Lands	Whapmagostui	Chisasibi	Wemindji	Eastmain	Waskaganish	MoCreebec	Nemaska	Ouje-Bougoumou	Waswanipi	Washashibi	Mistissini
More Wildfire than in the past					1		1	1	3	1	1
More severe wildfires		4		1	4		1	1	1	1	1
wildfire happening in months they didnt happen before		1									
More lightning storms	1	1		1	1		2	1	2	1	1
Higher risk of wildfire with dryer land		1	1	1			1	1	3	1	1
Wildfire smoke in the community		1		1	2		1	1	4	1	1
Wildfire close enough to threatened community buildings				1	2						
Wilfire threatening hunt camps		2	1		3		1		1	1	1
Wildfire impacting water as ash, sediment or debris washed into lake and rivers		1		1	2		1				1
Wildfire causing community evacuations		3			2		1	1	1	1	1
Other observations											
Total	**1**	**14**	**2**	**6**	**17**	**0**	**9**	**6**	**15**	**7**	**8**

Infrastructutre											
Impacts observed on you Traditional Lands	Whapmagostui	Chisasibi	Wemindji	Eastmain	Waskaganish	MoCreebec	Nemaska	Ouje-Bougoumou	Waswanipi	Washashibi	Mistissini
Thawing permafrost damaging homes or other buildings								1	1		1
Roads Washed out happening more often		2			1		1	1			
Damage to roads from water or freeze-thaw cycles									2		1
Sewers/wastewater systems overflowing in rain with spring melt	1		1								
Concerns about drinking water				1			2	1	1		1
Roof damage from strong winds		1							1		1
Heavy snow of roofs damaging homes or other buildings									1		1
Damage or power outages from freezing rain or ice storms											
Power outages from extreme weather or extreme events (likeWildfire)											
More power outages in winter											
Other observations											
Total	**1**	**3**	**1**	**1**	**1**	**0**	**3**	**3**	**6**	**0**	**5**

Drough and Dry periods											
Impacts observed on you Traditional Lands	Whapmagostui	Chisasibi	Wemindji	Eastmain	Waskaganish	MoCreebec	Nemaska	Ouje-Bougoumou	Waswanipi	Washashibi	Mistissini
Weeks of dry weather more common than in the past		1	1	1	1		2	1	2		2
Land dryer around the community than used to be		2					1	1	2		2
Trees and plants affected by drought and dry weather		2		1			2		3		2
Fish and other animals affected by drought and dry weather				1			2		2		1
Small creeks drying up				1			2				1
Wetland or ponds drying up		1	1						1		1
Lower water in lakes and rivers	1	1		1			2		3		2
Concerns that drought could impact drinking water supply		1		1			2				
Dusty conditions in the community				1			1		2		2
Gardens in the community impacted by drought and dry weather									1		
Total	**1**	**8**	**2**	**7**	**1**	**0**	**14**	**2**	**16**	**0**	**13**

Travel and Transportation											
Impacts observed on you Traditional Lands	Whapmagostui	Chisasibi	Wemindji	Eastmain	Waskaganish	MoCreebec	Nemaska	Ouje-Bougoumou	Waswanipi	Washasibi	Mistissini
Thinner/ less predictable ice can make travel risk	1	4		1	4		1	1	1		1
Shorter ice season/shorter winter making traditional travel harder	1	4	1	1	5		1	1	1		1
Changing snowpack making travel over snow more difficult				1			1				1
Unpredictable /severe weather can make travel risky		1		1	2		1				1
Traditional routes and access roads cut-off		1			2		1	1	2		1
More fallen trees blocking trails									1		
Changing water levels makes travel by boat more difficult	1	2		1	1		1	1	1		1
flight in/ out of the community impacted by weather or changing conditions	1	2		1							
Harder to get goods into community	1	1		1							
Winter road season shorter							1				
Other observations											
Total	**5**	**15**	**1**	**7**	**14**	**0**	**7**	**4**	**6**	**0**	**6**