Government of Gouvernement des
Northwest Territories
Territoires du Nord-Ouest

Shared Resilience
to a Changing Climate in the NWT

NWT Climate Change Risks and Opportunities Assessment

Évaluation des risques et des possibilités liés au changement climatique aux TNO

October 2024 Octobre

Renforcer notre capacité d'adaptation
au changement climatique aux TNO commune

K’áhshó got’ı̨ne xədə k’é hederı ɔedı̨htl’é yerınıwę nı dé dúle.
Dene Kədá

ʔerıhtł’ís Dëne Sųłıné yatı t’a huts’elkër xa beyáyatı theɔą ɔat’e, nuwe ts’ën yółtı.
Dëne Sųłıné

Edı gondı dehgáh got’ı̨e zhatıé k’ę́é edatł’éh enahddhę nıde naxets’é edahłí.
Dene Zhatıé

Jii gwandak izhii ginjìk vat’atr’ijąhch’uu zhit yinohthan jì’, diits’àt ginohkhìi.
Dinjii Zhu’ Ginjik

Uvanittuaq ilitchurisukupku Inuvialuktun, ququaqluta.
Inuvialuktun

ᑲᑦᓂᐊ ᑎᑎᕐᒃᑲᐃᑦ ᐱᓕᒍᐃᖅᑎᑦ ᐃᓄᒃᑎᑐᓕᕐᓂᒪᓗᑎᒃ, ᐅᖃᖅᑎᓯᓄᑦ ᐅᕙᓪᓕᓴᐅᓚᑎᑦ.
Inuktitut

Hapkua titiqqat pijumagupkit Inuinnaqtun, uvaptinnut hivajarlutit.
Inuinnaqtun

kīspin ki nitawihtīn ē nīhīyawihk ōma ācimōwin, tipwāsinān.
nēhiyawēwin

Tłı̨chǫ yatı k’ę̀è. Dı wegodı newǫ dè, gots’o gonede.
Tłı̨chǫ

Indigenous Languages
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Acknowledgement

The GNWT would like to thank:

- **The Climate Risk Institute** team. The project team contracted the Climate Risk Institute to assist in the development and completion of the Assessment, including engagement activities. *The Climate Risk Institute (CRI) is a non-profit, academically affiliated organization focused on advancing practice and delivering services related to climate change risk assessment, adaptation planning, policy evaluation and resiliency. CRI works collaboratively with a range of players in Canada and internationally to mobilize knowledge and build capacity for improved climate resiliency practices across professions and sectors.*
- The **NWT Climate Change Council** members that provided guidance and feedback throughout this project.
- All participants, from survey respondents to event and workshop participants, who shared their knowledge and expertise.

About the Illustrator

All of the illustrations in the Assessment were drawn by Alison McCreesh, a Yellowknife graphic artist. Since 2009, Alison McCreesh has been working as a visual artist, cartoonist and illustrator in Yellowknife. As part of her business, Alison offers her services doing live large-scale graphic recording and taking visual notes at meetings and conferences, as well as creating infographics, visual summaries and animated explainer videos. Alison enjoys the challenge of combining visuals and illustrations to communicate at-times-dense content in a way that is accessible and engaging. While we all know in-depth written reports are important, there are many times where an image is worth a thousand words!

Executive summary

This first NWT Climate Change Risks and Opportunities Assessment (the Assessment) aims to provide a shared understanding of the most pressing climate change risks that Northwest Territories (NWT) residents and communities will face in the next decade.

It is a roadmap that outlines shared climate change adaptation priorities, where better collaboration, coordination and pooling of resources could lead to meaningful and impactful adaptation and preparedness for a changing climate.

The Assessment is the outcome of a two-year engagement process across the NWT with residents, and public servants, and elected officials from local governments, Indigenous governments, and Indigenous organizations, as well as representatives from civil society, youth, federal agencies, and academia through a number of engagement activities. Representatives from the NWT Climate Change Youth Council were directly engaged, and the NWT Climate Change Council provided guidance throughout the project. Quotes from engagement activities are included throughout the report.

The Assessment is not a scientific, peer-reviewed publication, rather it is a prioritization of known risks and opportunities that is meant to guide NWT decision makers. To interpret the results of the Assessment, it is important to keep in mind its scope, assumptions and limitations.

The Assessment adopts a values-based approach, focusing on the experiences and perspectives of those most affected by climate change, including what is worth preserving and achieving, and what the goals of adaptation should be. In building climate change resilience in the NWT, values that matter most to residents were identified during the engagement. These values can be summarized as follows: ecosystems; health and well-being; connection to the land and culture; access to essential services and infrastructure; and business and economy. These values capture what matters the most to the 'Northern way of life' and are essential to building climate change resilience in the NWT.

Seven groups of climate change hazards were identified during the engagement: climate and weather changes; vegetation and wildlife changes; freshwater changes; marine and coastal changes; wildfire; permafrost thaw; and river erosion. The NWT values provide a reference to assess the impacts of climate hazards so we can identify the most concerning climate change risks – those that have the highest potential to compromise or threaten the NWT's climate change resilience.

Overall, climate change is negatively impacting the NWT. The Assessment identified 16 key risks and one opportunity. Some risks are already a reality, while others will become more pressing in the coming decades. In addition, the Assessment highlights how climate change

increases current vulnerabilities in the NWT: resource, labour and capacity shortages; unequal impacts for certain communities and groups; limited climate monitoring data; and gaps in historical climate data.

The Assessment also highlights the ways the NWT is already, and can continue, building resilience and preparing for the changing climate. It uses the concept of 'adaptation pathways', highlighting that numerous adaptation options are on the table, each leading to a different possible future for the NWT. An adaptation pathway is the result of step-by-step choices and a series of decisions made by NWT residents and communities that can be reassessed over time as the climate and social values change. These choices balance short-term and long-term goals, as well as climate change uncertainty. The Assessment outlines four elements of a possible made-in-the-NWT adaptation pathway.

Building on the most concerning climate change risks, the NWT values, and elements of made-in-the-NWT pathways identified in this report, the GNWT will be guided by this Assessment, and will work closely with the federal government, community governments, Indigenous governments and Indigenous organizations, co-management boards, industry, academia, non-government organizations, the NWT Climate Change Council, other NWT stakeholders as well as the public to collaborate, coordinate and pool resources to advance shared climate change adaptation priorities to meaningfully adapt and prepare for a changing climate.

Introduction

"Things have changed. You don't need a global climate model to tell you that."

"We are such a small jurisdiction, the size of a small town. And we have this huge, enormous problem."

"We must collectively overcome these colonial policies that are barriers. … Small number of greedy people are primarily responsible for climate change and ruining things for all of us."

Participants' quotes

The impacts of climate change have been a reality in past decades in the Northwest Territories (NWT): the North has been warming up to four times faster than the rest of the world. This creates, and will continue to create, rapid, significant and irreversible impacts on NWT ecosystems and landscapes, as well as on NWT communities and residents.

Preparing and adapting to this unprecedented challenge requires, and will continue to require, a significant and sustained level of resources, expertise and hard work. This can only be achieved through coordination, collaboration and planning among multiple levels of government and many organizations. Finding agreement on where we need to work together and focus our efforts can result in meaningful adaptation and preparedness actions across the NWT that increases our collective resilience to climate change.

This NWT Climate Change Risks and Opportunities Assessment (the Assessment) attempts to build a shared understanding of the most concerning climate change risks in the NWT over the next ten years, and where to focus efforts, resources and collaborative efforts across the NWT. The Assessment aims to answer the following questions:

- What are the most concerning climate change risks in the NWT?
- How do they impact residents, communities and the land?
- What are adaptation priorities that could benefit from collaboration among the different levels of government and organizations and additional federal funding support?

The Assessment provides a high-level picture of the most pressing climate change risks facing the NWT and will be reviewed in five years and updated in 10 years. It is meant to be used as general guidance for decision-makers and to inform shared priorities and collaboration across the NWT. It is not a scientific, peer-reviewed publication. To properly interpret the results of the Assessment, it is important to keep in mind its scope, the assumptions and the limitations.

Many other Canadian jurisdictions, such as Yukon, British Columbia, Nova Scotia and Prince Edward Island, have already completed similar climate assessments to inform their climate change adaptation priorities and encourage collaboration. Each jurisdiction adopted its own approach and methodology.

This Assessment is the result of a two-year engagement process with NWT residents and partners. Partners included the federal government, community governments,

Indigenous governments and Indigenous organizations, industry, academia, non-government organizations, the NWT Climate Change Council, co-management boards and other NWT stakeholders as well as the public. People representing various age groups, organizations, expertise, and interests across NWT were engaged to inform the results, and quotes throughout the Assessment capture the richness of these contributions.

The framework developed for the Assessment was shaped by the unique context of the NWT, including advancing the commitment to implement the United Nation's Declaration of the Right of Indigenous People, as well as socio-economic considerations such as cost of living, food insecurity, affordable housing, cultural continuity, education, and mental health. The Assessment also acknowledges the ongoing initiatives of NWT residents, communities, businesses and governments to build Northern resilience by preparing and adapting to the impacts of climate change.

Section 1 of this report presents an overview of values-based approach that informed this Assessment and the results. **Section 2** provides an overview of the process and methodology used to identify and prioritise the most concerning climate change risks. **Section 3** presents the limitations and some considerations when interpreting the results of the Assessment. **Section 4** details the most concerning climate change risks in the NWT in relation to the five NWT values. It also highlights examples of actions underway to address these risks in the NWT. **Section 5** presents current vulnerabilities increased by climate change. Finally, **Section 6** provides some context for the next steps to advance climate change adaptation in the NWT.

Sommaire

Cette première évaluation des risques et des possibilités liés au changement climatique aux TNO (l'évaluation) vise à permettre une compréhension commune des risques les plus pressants liés au changement climatique auxquels les résidents et les collectivités des Territoires du Nord-Ouest (TNO) feront face au cours de la prochaine décennie.

Il s'agit d'une feuille de route qui présente les priorités communes en matière d'adaptation au changement climatique, pour lesquelles une meilleure collaboration, coordination et mise en commun des ressources pourrait conduire à une adaptation et à une préparation pertinentes et efficaces face à un climat changeant.

L'évaluation est le résultat d'échanges menés sur deux ans dans l'ensemble des TNO avec des résidents, des fonctionnaires et des élus des administrations locales, des gouvernements et des organisations autochtones, ainsi que des représentants de la société civile, de la jeunesse, des organismes fédéraux et du monde universitaire. Des représentants du Conseil jeunesse sur le changement climatique des TNO ont été directement sollicités, et le Conseil sur le changement climatique des TNO a formulé des conseils tout au long du projet. Des citations tirées des échanges sont incluses dans le rapport.

L'évaluation n'est pas une publication scientifique évaluée par des pairs. Il s'agit plutôt d'un classement par ordre de priorité des risques et des possibilités connus, destiné à guider les décideurs des TNO. Pour interpréter les résultats de l'évaluation, il est important de garder à l'esprit sa portée, ses hypothèses et ses limites.

L'évaluation adopte une approche fondée sur les valeurs, en se concentrant sur les expériences et les opinions des personnes les plus touchées par le changement climatique, notamment sur ce qui vaut la peine d'être préservé et réalisé, et sur ce que devraient être les objectifs de l'adaptation. Afin de renforcer la capacité d'adaptation au changement climatique aux TNO, les éléments, ou valeurs, qui comptent le plus pour les résidents ont été définis pendant les échanges avec le public. Il s'agit notamment des écosystèmes, de la santé et du bien-être, du lien avec la terre et la culture, de l'accès aux services et infrastructures essentiels, des entreprises et de l'économie. Ces valeurs reflètent ce qui compte le plus pour le « mode de vie nordique » et sont essentielles pour renforcer la capacité d'adaptation au changement climatique aux TNO.

Sept groupes de risques liés au changement climatique ont été répertoriés au cours des échanges avec le public, soit les changements climatiques et phénomènes météorologiques,

les changements au niveau de la végétation et de la faune, les changements au niveau de l'eau douce, les changements au niveau marin et côtier, les feux de forêt, le dégel du pergélisol, et l'érosion fluviale. Les valeurs des TNO constituent une référence pour évaluer les conséquences des risques climatiques afin que nous puissions déterminer les risques les plus préoccupants liés au changement climatique, c'est-à-dire ceux qui sont les plus susceptibles de compromettre ou de menacer la capacité d'adaptation des TNO face au changement climatique.

Dans l'ensemble, le changement climatique a des répercussions négatives sur les TNO. L'évaluation a permis de recenser 16 risques clés et une possibilité. Certains risques sont déjà bien réels, tandis que d'autres deviendront plus évidents au cours des prochaines décennies. Par ailleurs, l'évaluation souligne comment le changement climatique accroît les vulnérabilités actuelles aux TNO : pénuries de ressources, de main-d'œuvre et de capacités, conséquences inégales pour certaines collectivités et certains groupes, insuffisance des données de surveillance du climat et lacunes dans les données historiques sur le climat.

L'évaluation met également en évidence les moyens mis en œuvre par les TNO pour renforcer la capacité d'adaptation et se préparer à l'évolution du climat, et pour continuer à le faire. Elle utilise le concept de « voies d'adaptation », et montre les nombreuses solutions d'adaptation envisagées, chacune menant à un avenir différent pour les TNO. Une voie d'adaptation est le résultat de choix progressifs et d'une série de décisions prises par les résidents et les collectivités des TNO, qui peuvent être réévalués au fil du temps en fonction de l'évolution du climat et des valeurs sociales. Ces choix tiennent compte des objectifs à court et à long terme, ainsi que des incertitudes liées au changement climatique. L'évaluation présente quatre éléments d'une éventuelle voie d'adaptation propre aux TNO.

Sur la base des risques liés au changement climatique les plus préoccupants, des valeurs des TNO et des éléments des voies propres aux TNO définis dans le présent rapport, le GTNO s'inspirera de cette évaluation et collaborera avec le gouvernement fédéral, les administrations communautaires, les gouvernements et les organisations autochtones, les conseils de cogestion, l'industrie, le monde universitaire, les organisations non gouvernementales, le Conseil sur le changement climatique des TNO, d'autres intervenants ténois ainsi que le public afin de collaborer, et de coordonner et mettre en commun les ressources pour s'occuper des priorités communes en matière d'adaptation au changement climatique afin de s'adapter et de bien se préparer à l'évolution du climat.

Présentation

« Les choses ont changé. Pas besoin d'un modèle climatique mondial pour le savoir. »

« Nous sommes une petite administration, de la taille d'une petite ville. Et nous sommes confrontés à ce problème énorme, gigantesque. »

« Nous devons collectivement surmonter ces politiques coloniales qui sont autant d'obstacles. … Un petit nombre de personnes cupides est principalement responsable du changement climatique et de la détérioration de la situation pour nous tous. »

Commentaires de participants

Les conséquences du changement climatique sont bien réelles depuis quelques décennies aux Territoires du Nord-Ouest (TNO) : le Nord se réchauffe jusqu'à quatre fois plus vite que le reste du monde. Cette situation a et continuera d'avoir des conséquences rapides, importantes et irréversibles sur les écosystèmes et le territoire des TNO, ainsi que sur les collectivités et les résidents.

La préparation et l'adaptation à ce défi sans précédent exigent, et continueront d'exiger, un niveau important et soutenu de ressources, d'expertise et de travail assidu. Cet objectif ne peut être atteint que par la coordination, la collaboration et la planification entre plusieurs ordres de gouvernement et de nombreuses organisations. Il faut s'entendre sur les domaines dans lesquels nous devons collaborer et concentrer nos efforts, afin d'élaborer des mesures d'adaptation et de préparation concrètes dans l'ensemble des TNO et d'accroître ainsi notre capacité d'adaptation collective au changement climatique.

Cette évaluation des risques et des possibilités liés au changement climatique aux TNO vise à favoriser une compréhension commune des risques liés au changement climatique les plus préoccupants au cours des dix prochaines années, et à déterminer où concentrer les efforts et les ressources aux TNO. L'évaluation vise à réponde aux questions suivantes :

- Quels sont les risques liés au changement climatique les plus préoccupants aux TNO?
- Quelles sont leurs répercussions sur les résidents, les collectivités et le territoire?
- Quelles priorités en matière d'adaptation bénéficieraient d'une collaboration entre les différents ordres de gouvernement et les organismes, ainsi que d'un soutien financier fédéral accru?

L'évaluation présente une vue d'ensemble des risques les plus pressants liés au changement climatique auxquels sont confrontés les TNO. Elle sera réexaminée dans cinq ans et mise à jour dans dix ans. Elle est destinée à servir d'orientation générale aux décideurs, ainsi qu'à étayer les priorités communes et à favoriser la collaboration dans l'ensemble des TNO. Il ne s'agit pas d'une publication scientifique évaluée par des pairs. Pour interpréter correctement les résultats de l'évaluation, il est important de garder à l'esprit sa portée, ses hypothèses et ses limites.

De nombreuses autres administrations canadiennes, comme le Yukon, la Colombie-Britannique, la Nouvelle-Écosse et l'Île-du-Prince-Édouard, ont déjà réalisé des évaluations

climatiques semblables afin de déterminer leurs priorités en matière d'adaptation au changement climatique et d'encourager la collaboration. Chaque administration a adopté sa propre approche et sa propre méthodologie.

Cette évaluation est le résultat d'échanges menés sur deux ans avec les résidents des TNO et des partenaires. Ces partenaires comprenaient le gouvernement fédéral, les administrations communautaires, les gouvernements et les organisations autochtones, l'industrie, le milieu universitaire, les organismes non gouvernementaux, le Conseil sur le changement climatique des TNO, les conseils de cogestion et d'autres intervenants des TNO, ainsi que le public. Des personnes représentant diverses tranches d'âge, organisations, compétences et intérêts dans l'ensemble des TNO ont participé à l'élaboration des résultats, et les citations figurant dans l'évaluation témoignent de la richesse de ces contributions.

Le cadre élaboré pour l'évaluation a été façonné par le contexte unique des TNO, notamment l'engagement à mettre en œuvre la Déclaration des Nations Unies sur les droits des peuples autochtones, ainsi que des considérations socioéconomiques telles que le coût de la vie, l'insécurité alimentaire, le logement abordable, la continuité culturelle, l'éducation et la santé mentale. L'évaluation reconnaît également les initiatives en cours des résidents des TNO, des collectivités, des entreprises et des gouvernements pour renforcer la capacité d'adaptation du Nord en se préparant et en s'adaptant aux conséquences du changement climatique.

La **section 1** de ce rapport présente une vue d'ensemble de l'approche fondée sur les valeurs qui a servi de base à cette évaluation et à ses résultats. La **section 2** donne un aperçu du processus et de la méthodologie utilisés pour déterminer les risques liés au changement climatique les plus préoccupants et les classer par ordre de priorité. La **section 3** montre les limites de l'évaluation et quelques éléments à considérer lors de l'interprétation de ses résultats. La **section 4** détaille les risques liés au changement climatique les plus préoccupants aux TNO par rapport aux cinq valeurs des TNO. Elle cite également des exemples de mesures prises pour faire face à ces risques aux TNO. La **section 5** présente les vulnérabilités actuelles aggravées par le changement climatique. Enfin, la **section 6** présente le contexte dans lequel s'inscrivent les prochaines étapes de l'adaptation au changement climatique aux TNO.

Abbreviations

CCAG Climate Change Advisory Group

CRI Climate Risk Institute

ECC Environment and Climate Change (GNWT Department)

ECCC Environment and Climate Change Canada (Federal Department)

EMO Emergency Management Organization

FMA Forest Management Agreements

GNWT Government of the Northwest Territories

IPACs Indigenous Protected and Conserved Areas

MACA Municipal & Community Affairs (GNWT Department)

NRCan Natural Resources Canada (Federal Department)

NWT Northwest Territories

NWTAC Northwest Territories Association of Communities

WLU Wilfried Laurier University

BOX 1. WHAT IS CLIMATE CHANGE AND HOW IT IS DIFFERENT FROM WEATHER?

Climate and weather are intimately connected. As the climate changes, it has a dramatic impact on the weather.

We are all familiar with how **weather** can be hot or cold, wet or dry, windy or calm—sometimes all in the same day. One of the things we know to expect about weather is that it changes often and sometimes very rapidly. By contrast, **climate** is not about the moment-to-moment conditions, but rather it refers to average conditions over a longer period of time (generally 30 years). Therefore, climate stays relatively stable over a long period time. Climate is also different from region to region.

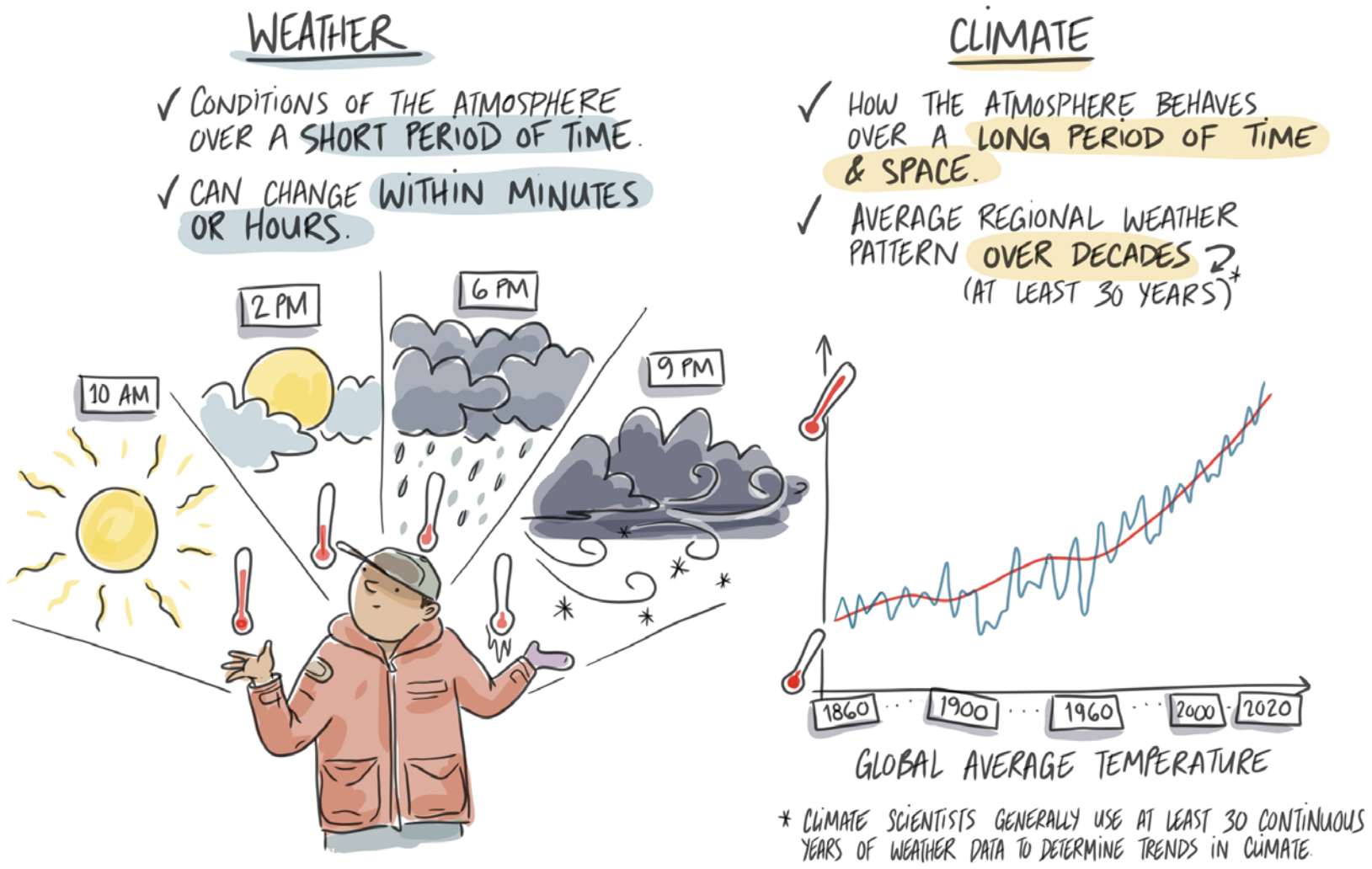
Climate change refers to long-term shifts in variables such as temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. However, since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas.

Burning fossil fuels generates greenhouse gas emissions, like carbon dioxide, that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures.

A common misunderstanding is to think that climate can vary in the same way as weather. This is not the case. Changes that seem small when we think in terms of weather are significant when it applies to climate. Normally, changes in climate occur over a very long time. For instance, the average temperature on Earth was 4°C colder during the last Ice Age, 20,000 years ago. At this time, Canada was almost entirely buried in glaciers and ice sheets up to thousands of metres thick.

The current pace of global warming is significant: we're seeing changes over a few decades that would otherwise have happened over thousands of years. The average temperature of the Earth's surface is now about 1.1°C warmer than it was in the late 1800s . Throughout 2023, temperatures were on average 1.5°C warmer than the pre-industrial average. This is warmer than at any time in the last 100,000 years.

*Adapted from Climate Atlas of Canada's Climate vs. Weather (**climateatlas.ca/climate-vs-weather**) and United Nations explainer What is Climate Change? (**un.org/en/climatechange/what-is-climate-change**)*


WEATHER
✓ CONDITIONS OF THE ATMOSPHERE OVER A SHORT PERIOD OF TIME.
✓ CAN CHANGE WITHIN MINUTES OR HOURS.
10 AM
2 PM
6 PM
9 PM
CLIMATE
✓ HOW THE ATMOSPHERE BEHAVES OVER A LONG PERIOD OF TIME & SPACE.
✓ AVERAGE REGIONAL WEATHER PATTERN OVER DECADES (AT LEAST 30 YEARS)*
1860
1900
1960
2000
2020
GLOBAL AVERAGE TEMPERATURE
* CLIMATE SCIENTISTS GENERALLY USE AT LEAST 30 CONTINUOUS YEARS OF WEATHER DATA TO DETERMINE TRENDS IN CLIMATE.

1. Overview of results

1.1 A values-based framework

Building a shared understanding of climate change and identifying priorities to respond to its impacts requires an understanding of the impacts of climate change on those affected. This values-based approach puts at the core of the framework the following considerations:

- NWT residents' experience of climate change impacts
- NWT residents' perspectives on what the goals of adaptation should be (e.g., what is worth preserving and achieving)

Five core values that matter most to NWT residents for making NWT resilient to climate change were identified during the engagement activities. These values which capture what matters the most to the 'Northern way of life' are called 'NWT values for climate change resilience' (NWT values). They are presented in **Table 1.**

Resilience refers to the capacity to recover quickly from difficulties. Imagine how an elastic can quickly spring back into its shape. Building climate change resilience is similar. It means understanding the possible climate change risks we face and making changes to how we do things, so when a risk becomes a reality there is less damage, and we can recover more quickly.

Seven categories of climate change hazards were also identified during the engagement: climate and weather changes; vegetation and wildlife changes; freshwater changes; marine and coastal changes; wildfire; permafrost thaw; and river erosion. **Section 6** provides more information on each hazard category.

The NWT values provide a reference for assessing the impacts of various climate hazards and for identifying the most concerning climate change risks – those that have the highest potential to compromise or threaten climate change resilience in the NWT.

Table 1. NWT Values for Climate Change Resilience (NWT Values)

	**Ecosystems (Land, Water and Wildlife).** NWT ecosystems and sustainable livelihoods are thriving.
	**Health and Well-Being.** The health and well-being of NWT residents are strong, and their communities are safe and sustainable.
	**Connection to the Land and Culture**. Indigenous knowledge, culture and identity are valued and passed to new generations. NWT residents connect with and experience the land in ways that are meaningful to them.
	**Infrastructure and Access to Essential Services.** NWT communities and residents have access to affordable, reliable, and sustainable essential services and public infrastructure.
	**Business and Economy.** Economic self-sufficiency promotes a positive economic environment in the NWT for profit-based and traditional economic activities.

1.2 Summary of most concerning climate change risks

Table 2 presents a summary of the most concerning climate change risks across the NWT through the lens of NWT values. **Section 4** provides more details on these risks. These risks were identified during the engagement activities presented in **Section 2**.

Overall, climate change is negatively impacting the NWT. Some listed risks have, in fact, already become a reality, while others will become more pressing in the coming decades. The severity of these risks may be reduced or eliminated if adequate preparedness and adaptation measures are put in place.

Table 2. Summary of most concerning climate change risks in the NWT.

	**Risks to ecosystems (Land, Water and Wildlife).** • Permafrost thaw is changing NWT landscapes. • NWT biodiversity is impacted by warming temperatures, changing precipitation patterns, and extreme weather. • The quality and quantity of surface and groundwater in the NWT are being impacted by climate change. • Longer and intense wildfire seasons are likely to alter NWT landscapes, vegetation, and wildlife habitat. • Permafrost thaw, larger wildfires, and longer wildfire seasons are likely to increase carbon dioxide emissions from the landscape.
	**Risks to health and well-being.** • The safety and well-being of many NWT communities is threatened by flooding and wildfires. • Climate change is affecting physical health conditions for some NWT residents. • Climate change is threatening the mental well-being of some NWT residents. • Climate change is increasing food insecurity challenges in the NWT.
	**Risks to connection to the land and culture**. • Less predictable weather and ice conditions are affecting people's ability to access the land safely. • Climate change is having a profound impact on Indigenous knowledge, culture, and identity. • Culturally important places and heritage sites are being threatened by thawing permafrost, wildfires, erosion, sea-level rise, and flooding.
	**Risks to infrastructure and access to essential services.** • Supply chains in the NWT are being disrupted as the impacts of climate change intensify. • Without mitigation planning and action, shoreline infrastructure and buildings will likely be at risk from more rapid erosion processes and flooding. • Increasing extreme weather events, changes in precipitation (e.g. snow conditions), and in some cases, changes in soil conditions due to permafrost thaw, bring new risks that need to be considered when building, maintaining and operating infrastructure.
	**Risks to business and economy.** • The high cost to adapt and respond to climate change and climate-related disasters can cause financial losses or constraints for governments, businesses, and residents, affecting economic resilience in the NWT.

1.3 Increasing existing vulnerabilities

The consequences of climate changes span beyond their impacts on the five NWT values. They lead to cascading effects, adding stressors to other issues that the NWT is facing. **Table 3** presents existing vulnerabilities exacerbated by climate change.

Table 3. Vulnerabilities exacerbated by climate change.

	• Efforts to reduce and adapt to the impacts of climate change may be slowed by limited resources and capacity shortages and a lack of adequate processes and/or governance mechanisms to respond efficiently. • Climate change risks can amplify existing inequities and disproportionately affect certain communities and groups. • Lack of robust historical climate data in the NWT, and limited climate monitoring and ways to share data, can challenge informed decision-making in the NWT.

CLIMATE RISKS AND IMPACTS TO RESILIENCE VALUES:

ECOSYSTEMS

CONNECTION TO THE LAND AND CULTURE

BUSINESS & ECONOMY

HEALTH & WELL-BEING

INFRASTRUCTURE & ESSENTIAL SERVICES

CROSS-CUTTING CLIMATE VULNERABILITIES

1.4 Made-in-the-NWT adaptation pathways

NWT residents and communities have the ability to adapt and adjust to the risks caused by climate change. The people of the North are resilient, and they can, and already are, adapting to the changing climate.

Numerous adaptation options are on the table, each leading to a different possible future for the NWT. This range of possible futures are called 'adaptation pathways'. An adaptation pathway is the result of step-by-step choices and series of decisions made by residents and communities, reassessed over time as the climate and social values change. These choices balance short-term and long-term goals, as well as climate change uncertainty.

Building on what was heard, made-in-NWT Adaptation Pathways can strengthen the five NWT values. The Assessment identifies four possible elements of a made-in-the-NWT pathway:

- A pathway braiding reconciliation and self-determination
- A pathway balancing opportunities that arise from climate change
- A pathway that integrates social and economic equity
- A pathway that further builds the NWT as a climate change research centre, integrating multiple ways of knowing.

2. The process of building a shared picture of key climate change risks

This section presents the activities and methodology used throughout the engagement process to build a shared picture of the most concerning climate change risks and adaptation priorities across the NWT.

2.1 Engagement

The Assessment is the outcome of a two-year engagement process across the NWT. Quotes from the engagement activities are included throughout the report.

The project team engaged with staff and elected officials from local governments, Indigenous Governments, and Indigenous Organizations, as well as representatives from civil society, youth, federal agencies, and academia through a number of engagement activities. Representatives from the NWT Climate Change Youth Council and the NWT Climate Change Council were also involved (see **Box 2** for more information). **Appendix A** provides a detailed list of organizations engaged in the Assessment.

Key engagement activities included:

- The first and the second NWT Climate Change Advisory Group (CCAG) gatherings held in October 2021 and October 2022;
- A series of five thematic workshops held in March 2023;
- Seven climate hazard specific surveys (one for each hazard category[1]) targeted at subject matter experts.

In addition, the project team gathered perspectives during events organized by partners, such as the Northwest Territories Association of Communities (NWTAC) 2022 annual general meeting.

A public survey was conducted in November and December 2022. Over 190 residents from across NWT's five administrative regions responded. Many of the quotes in this Assessment are taken from responses to this survey. Here are some statistics about the respondents:

- Over two-thirds have lived in the NWT for more than 15 years;
- Almost one third identified as Indigenous;
- 12% spend over half of their time living on the land;
- Over 40% of respondents were under 40 years old, including 6% who were under 25 years.

Finally, the project team regularly reported back to the NWT Climate Change Council for guidance on the project (see **Box 2**).

BOX 2. WHAT IS THE NWT CLIMATE CHANGE COUNCIL AND THE CLIMATE YOUTH COUNCIL?

The NWT Climate Change Council is a formal forum for the sharing of information, for collaboration, and for engagement between non-elected staff of Indigenous governments and Indigenous organizations, representatives of NWT communities and the GNWT, with input from external partners. The Council provides guidance and advice to inform and advance GNWT climate change and environment programs in alignment with Indigenous governments and Indigenous organizations and community perspectives, interests, and knowledge. Further, the Council provides an opportunity to build on and strengthen relationships, shared understandings, and trust, which supports the GNWT's commitment to move towards implementation of the United Nations Declaration on the Rights of Indigenous Peoples.

The Climate Change Youth Council brings together the critical perspectives of youth from all NWT regions and provides input and advice to the NWT Climate Change Council on all matters pertaining to climate change.

The goals of the Climate Change Youth Council are to understand the key climate-related issues and challenges, to develop youth priorities, and to empower its group members to influence and mobilize other youth to act. The CCYC goals also include amplifying the voices of NWT youth to influence policy and action by decision-makers; and overall, to build the capacity, experience and networks of engaged youth to be the next generation of NWT climate leaders. See the ***NWT Climate Change Council website*** for more information on the Council and its members: ***gov.nt.ca/ecc/en/services/climate-change/climate-change-council***

[1] River erosion likelihood was assessed using a workshop addressing similar questions as the other hazard themes surveys.

2.2 Approach to identify the most concerning climate change risks

The GNWT project team worked closely with the Climate Risk Institute (CRI) to develop and conduct the Assessment. The CRI is a well-established, not-for-profit organization with expertise in climate change risk assessment and policy.

The project team decided to adopt a values-based approach to conduct the assessment. A values-based based approach thrives to understand what the effects of climate change mean to those affected. A values-based approach contributes to building a shared understanding of climate priorities by putting the following considerations at the core of the framework:

- NWT residents' experience of climate change impacts
- NWT residents' perspectives on what the goals of adaptation should be (e.g., what is worth preserving and achieving)

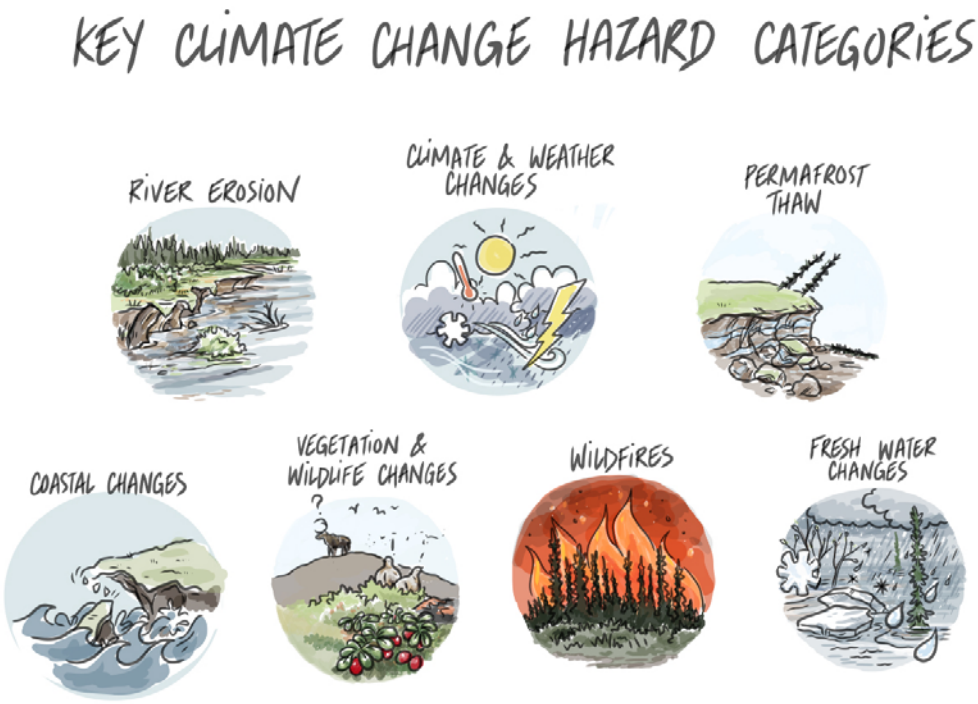
A framework was developed during the first phase of the project through literature review and inputs gathered during the first and second CCAG gatherings, held respectively in October 2021 and 2022.

During these gatherings, values that capture what matters the most to the 'Northern way of life' and are essential to make the NWT resilient to climate change were identified. These values are called 'NWT values for climate change resilience' (NWT values) and can be summarized in five categories:

1. Ecosystems
2. Health and Well-Being
3. Connection to the Land and Culture
4. Infrastructure and Essential Services
5. Business and Economy

Seven key climate change hazard categories were also identified during these gatherings:

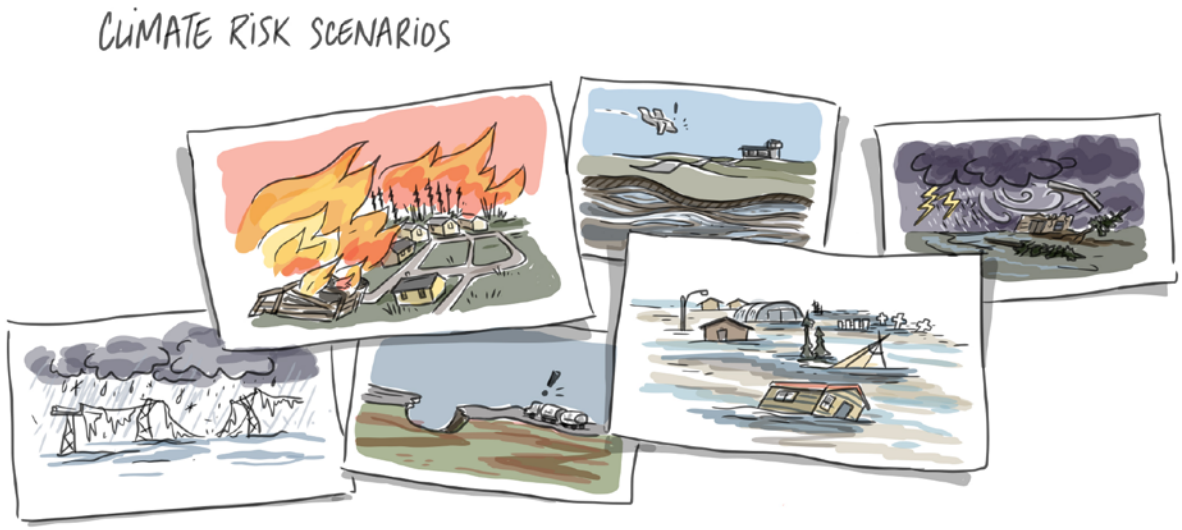
1. Climate and weather changes
2. Vegetation and wildlife changes
3. Freshwater changes
4. Marine and coastal changes
5. Wildfire
6. Permafrost thaw
7. River erosion



The framework of the Assessment connects the NWT values with the climate hazards. The NWT values provide a reference for assessing the impacts of various climate hazards and for identifying the most concerning climate risks – those that have the highest potential to compromise or threaten climate change resilience in the NWT.

For each category of hazard, both historical climate trends and future changes under climate change were considered. Data limitations, as well as research and monitoring needs, are summarized in **Section 6**.

From here, a list of 37 climate change risks scenarios were developed, which are found in **Appendix B**. A scenario describes a possible event. Such events are difficult and complex to forecast, as there are several variables and processes at play, creating strong uncertainty. In the end, these possible events may or may not occur, and it is difficult to have a full picture of the consequences.



The second phase of the project aimed to assign two scores to each scenario to assess their level of severity:

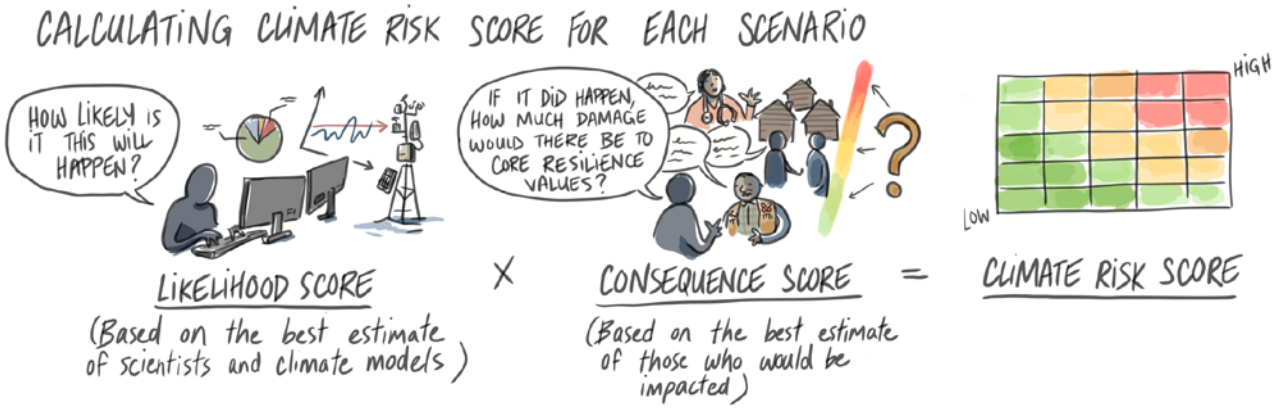
1. A likelihood score, to rank how likely it is for this scenario to occur.
2. A consequence score, to assess the level of threat this scenario could pose in relation to the NWT values, if the scenario was to occur.

For the likelihood score, participants were mainly subject matters experts and researchers who used quantitative data such as climate data and results from climate modeling.[2] They were engaged through a survey. For the consequence score, participants included representatives from different levels of governments (local, regional, territorial and federal governments), Indigenous governments and Indigenous organizations, non-governmental organizations, industry, NWT Youth Climate Group, and the NWT Climate Change Council. They provided qualitative data such as lived and work experience, what they have heard from community members and peers, and local knowledge and expertise from living in the NWT. They were engaged through the five thematic workshops.

[2] To inform this risk assessment, the GNWT engaged Climalogik to develop a dataset of historical and modelled (projected) future climate variables for the NWT.

Appendix D presents the scoring criteria used by participants to assign a likelihood and a consequence score to each scenario.

The final climate change risks score was the result of the combination of the likelihood score and the consequence score.



Two sets of scores were developed: one for 1971-2000 (baseline) and another for 2040-2070 (the 2050s). Likelihood scores for the 2050s incorporated climate projections developed by Climalogik. The scores tended to be higher in the future (2050s) for two reasons: first, because climate hazards are expected to be more intense in the future; and second, because we did not account for preparedness and adaptation actions that could reduce the consequences of the climate change risks.

The scores were used to rank the scenarios. The results are presented in heat maps (also known as risk matrix maps) for each resilience value for the present time and for 2040-2070 in **Appendix C.**

During the last phase, the results were reviewed and validated by the NWT Climate Change Council, other NWT partners and GNWT climate experts during meetings and workshops. During this validation phase:

- An additional risk to ecosystems was identified: "Permafrost thaw and larger and longer wildfire seasons are likely to increase carbon dioxide emissions from the landscape." There was no scenario associated to this risk and it was not ranked like the others.
- An additional climate hazard was identified: river erosion. As a result, a new scenario was developed (Scenario #5) and its scoring followed a different methodology. A separate workshop was held in March 2024 to score the likelihood. For the scoring of the consequences, the scoring of Scenario 22 was used as the impacts of coastal erosion on communities and infrastructure is relatively similar.

Finally, assessing climate change risks and opportunities is an ongoing process. For it to be relevant and accurate, it should be updated on a regular basis and integrate new climate sciences and knowledge, as well as consider the effects of adaptation measures. Indeed, the next iteration of the Assessment will be able to highlight new significant risks, as it will use updated climate projections. Similarly, risks identified as high in this iteration of the Assessment may rank medium or low in the future, due to the successful implementation of adaptation and preparedness measures.

3. Caution: How to interpret the results

As much as the methodology of the Assessment strives to build on quantitative and qualitative data, the ranking of climate change risks remains a challenging and subjective exercise due to data limitations and different perspectives on, and experiences resulting from, climate change impacts.

3.1 Geographical and temporal scope

The climate change risks identified in the Assessment are territory wide. Climate change risks specific to certain regions or sectors may not be fully captured. Where risk changes regionally, the highest risk in the territory has been considered.

The engagement activities to score the risks were completed in March 2023. This means the 2023 wildfire season that led to the evacuation of two-thirds of the NWT population was not accounted for, nor were the record low water levels in 2023 and 2024 that created barging issues.

3.2 Limitations and challenges

Inclusion of Indigenous knowledge

The first challenge relates to the inclusion of Indigenous knowledge. There is no one way of knowing and producing knowledge. The methodology of the Assessment is rooted in Western ways of knowing and uses a quantitative approach to score risks. The Assessment framework is therefore not an ideal framework to incorporate Indigenous knowledge. While Elders, along with staff from Indigenous governments and Indigenous organizations, and Indigenous representatives from the Climate Change Council were invited to engagement activities (including the thematic workshops), the framing of the questions and the quantitative nature of the scoring are some of the factors that limited the incorporation of Indigenous knowledge. The next iteration of the Assessment could better integrate Indigenous knowledge by engaging specifically with the Climate Change Council on this topic and building more connections with other GNWT programs that work closely with Elders and knowledge keepers.

Scoring

The second set of challenges relates to the process of scoring. As much as we try to rely on quantitative and qualitative data, the scoring exercise is tricky and remains subjective, in part because of the following challenges:

1. **Different levels of vulnerability and exposures to the impacts of climate change**. Individuals experience the impacts of climate change differently, depending on *where they live* (some regions are more exposed to certain risks than others), their *occupation*

(people carrying out on the land activities and relying on country foods are more exposed to the impacts of climate change), or their *personal experience* (some have already seen their property damaged or health affected by climate hazards). Some *groups* are also more vulnerable than others. Indigenous people are more vulnerable to the impacts of climate change as it greatly changes their relationship to the land and their culture. Studies also shown that youth are more vulnerable to the impacts of climate change, as well as low-income households due to climate change increasing the cost of living (e.g. food, housing, insurance).

2. **Navigating complexity and uncertainty**. Climate science is complex, and many mechanisms are not yet well understood nor modeled. For instance, it is difficult to model ecosystem change due to climate change as there are a range of complex, overlapping variables, which includes both biological impacts on living organisms and physical impacts on environmental structures. Moreover, it is difficult to model the combined impact of climate change and other human impacts such as development.
3. **Dealing with incomplete or unreliable data.** A further challenge in the North is the lack of robust environmental monitoring data, which is required to determine environmental trends and for climate modeling. The NWT is vast, with few climate stations, resulting in large gaps in climate monitoring coverage. Additionally, some of the historical climate monitoring data, particularly for snowfall, is unreliable due to measurement challenges. Gaps in monitoring coverage also applies to permafrost, where very little monitoring has taken place.

Within the Assessment, subject matters experts did their best to assign a score, but they still need to cope with inconsistent, uncertain, and incomplete data. As knowledge of climate change, as well as monitoring of climate change, continue to improve, the ranking of climate change risks may change, too.

BOX 3: WHAT THE GNWT IS DOING TO DETERMINE CLIMATE CHANGE RESEARCH AND MONITORING PRIORITIES?

In 2022-23, the GWNT Department of Environment and Natural Resources (now Environment and Climate Change) contracted PlanIt North to develop an NWT research and monitoring summary document. Once completed, climate change research and monitoring priorities and gaps can be identified. Interviews with key internal and external stakeholders took place to identify priorities. In addition, the Wilfrid Laurier University (WLU) - GNWT partnership planning led to 40 research programs focused on climate change metrics, impacts of climate change on resources or communities in the NWT, and developing capacity to lead research programs.

3.3 Transparency and assumptions

A way to deal with uncertainty, limited data and different perspectives is to be transparent and upfront about them to the readers and decision makers and be clear about assumptions made.

When reading the Assessment, here are some considerations to keep in mind:

1. **Each scenario is associated with a level of confidence.** The likelihood scoring of 18 of the scenarios has a low level of confidence: they are marked with an asterisk in the list of scenarios in **Appendix B**. A low level of confidence indicates that there was a lack of historical climate data, high uncertainty and/or weak consensus among participants who scored them.
2. **Use of other resources to complement the Assessment.** To have a more granular understanding of the impact of climate change, this Assessment can be used hand-in-hand with other thematic, regional, and/or community scale risk assessments in a changing climate.
3. **The Assessment adopts a precautionary approach.** This approach considers that we need to prepare for the most severe consequences of climate change even if there is still a high level of uncertainty. The precautionary approach was used as follows:
   - Each time there was no consensus among participants about the scoring, the highest scores were used to ensure that hazard risks were not underestimated.
   - Where risk changes regionally, the highest risk in the territory has been considered.
   - The scoring of the scenarios for 2040-2070 considered a conservative carbon emissions pathway in which global average temperatures are likely to increase by 4ºC by 2100.[3] However, if sound actions to reduce carbon pollution are taken globally, the level of emissions should be lower, reducing the global increase in temperature as well as the impacts of climate change.
4) **The effects of potential adaptation actions were not considered.** The scoring of future climate change risks (2040-2070) presented in **Appendix C** does not consider the effects of adaptation and preparedness actions. In the case where adaptation measures are put in place in the coming years, some risks that are ranked high today may be ranked low or medium in the next risk assessment. This is why it is important to update the Assessment on a regular basis.
5) **The complexity of climate processes was simplified.** To come up with a single, straightforward score, only one climate variable was considered to score the likelihood of scenarios. Where many variables were involved in a scenario, the most significant climate variable—the variable with the most adverse impact—was included in the likelihood scoring. Climate variables are indicators or measures of environmental factors such as average or maximum temperature, precipitation over a certain period, wind speed, sea rise levels, or others. In reality, multiple climate variables are at play and interact with one another. It may be problematic to only pick one variable as being the main driver to assess the occurrence of the scenario. For example, river erosion can be the result of both permafrost thaw as well as hydrological changes. This is one of the reasons that some scenarios have a low level of confidence. Future risk climate change assessments may include complex modelling of climate hazards such as river erosion or permafrost using many climate variables. Such modelling was not possible for most of the scenarios for this risk assessment, as input baseline and modelled data are generally not available for the NWT at this time.

[3] The emission pathway used for the assessment is the RCP8.5, one of the scenarios developed by the United Nation's Intergovernmental Panel on Climate Change (IPCC) in their Firth Assessment Report. RCP 8.5 represents a high emissions scenario or worst-case scenario with maximum warming.

4. What we heard: NWT's most concerning climate change risks

As explained in **Section 2**, values that matter most to NWT residents for making the NWT resilient to climate change were identified.

These values, called NWT values for climate change resilience (NWT values), were used as a reference to evaluate the impacts of climate change and identify the most concerning climate change risks, which are those that have the highest potential to compromise and threaten climate change resilience in the territory.

For simplicity, a particular climate change risk was associated with only one value. In some cases, picking a value was not easy: some risks impact multiple values. For example, the risk of supply chain disruption has been associated with the value related to infrastructure and access to essential services. But this risk also impacts the values related to business and economy. Likewise, most of the climate change risks associated with health and well-being also overlap with connection to the land and culture.

The severity of each risk can be reduced if preparedness and adaptation measures are put in place. Examples of actions already underway to address identified climate change risks are presented under each category.

Most Concerning Climate Change Risks

4.1 Risks to Ecosystems: Land, water and wildlife

"As an Indigenous northern resident, I feel impacted by climate change a great deal. I spend a lot of time on the land and rivers to witness the changes to our environment, lands, waters, animals, and migration patterns. Climate change affects the wildlife population; wild animals evolving to give birth earlier in warmer climate. Migration patterns are shifting further north in the last 20-40 past years or more. Climate change has affected the weather patterns and (is) disrupting the usual balance of nature."

"It is the second year we have no cranberries or wild mushrooms."

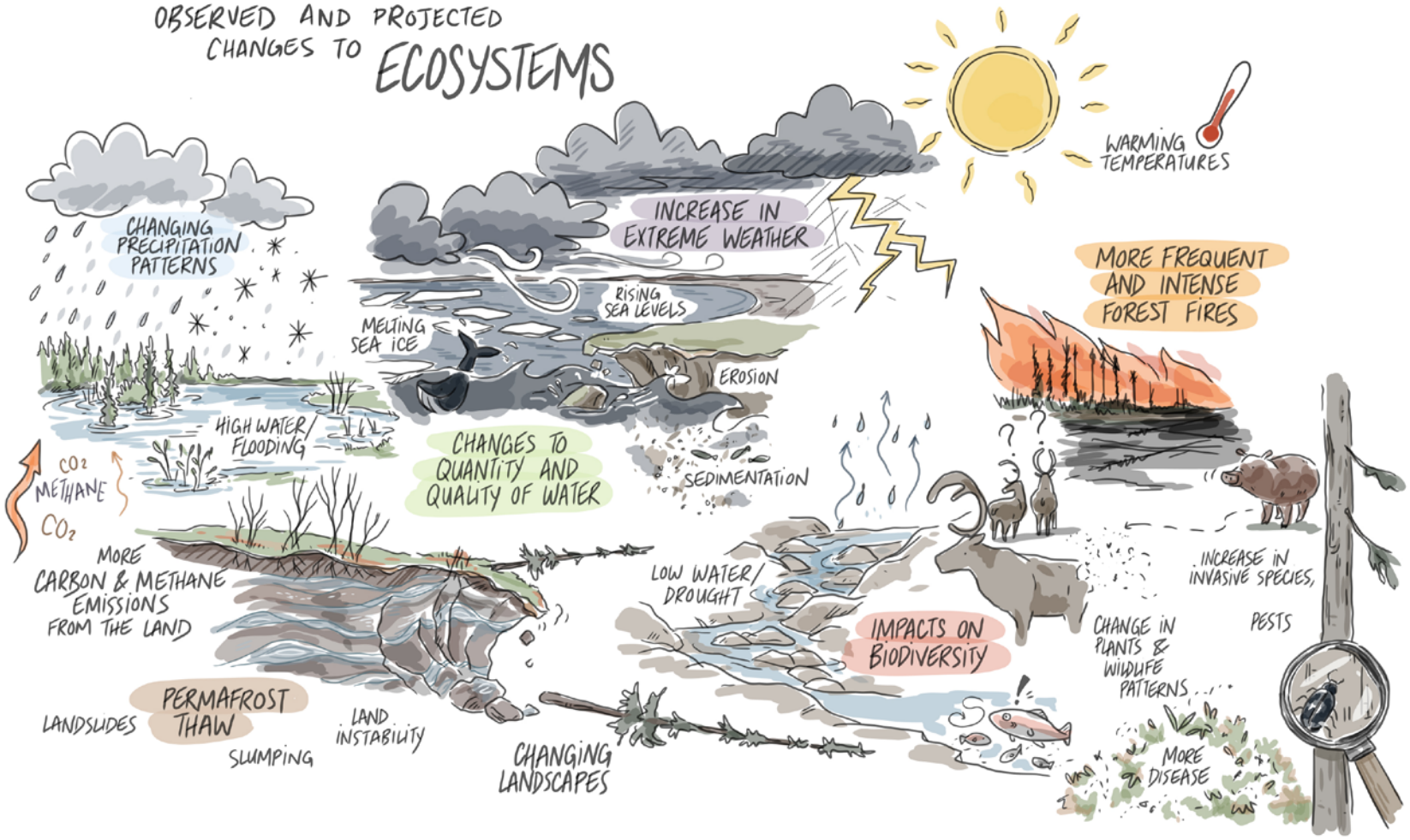
"Climate change has impacted our way of life in so many ways. (It) affects the land water, plant and animals and the land we live on. Very similar to how the food chain works, once the chain is affected so then everything down the line is affected."

Participants' quotes

The ecosystem value refers to thriving NWT ecosystems and sustainable livelihoods. **Table 4** presents the most concerning climate change risks that threaten the ecosystem value.

Table 4. Ecosystems: Most concerning climate change risks.

Permafrost thaw is changing NWT landscapes.	In some regions of the NWT, permafrost thaw is contributing to land instability, slumping, landslides, erosion, and changes to hydrology and vegetation.
NWT biodiversity is impacted by warming temperatures, changing precipitation patterns, and extreme weather.	Key observed and predicted changes include changes to rivers and lakes along with forests, wetlands, and other vegetation communities, with related impacts on the abundance, distribution, and health of land and aquatic wildlife. Arrivals and increased prevalence of invasive species, pests, and pathogens is an emerging risk. Certain species and ecosystems are more vulnerable to the impacts of climate change, and some might benefit from a changing climate.
The quality and quantity of surface and ground water in the NWT are being impacted by climate change.	Melting of sea ice, sea level rise, rising water temperatures, permafrost thaw, fluctuating water levels, and increased sedimentation are climate change impacts that can influence changes in the natural water system.
Longer and intense wildfire seasons are likely to alter NWT landscapes, vegetation, and wildlife habitat.	While wildfires are a natural part of forest and habitat renewal and forest health, climate change is likely contributing to longer wildfire seasons and greater wildfire severity. These new wildfire patterns impact in new ways the distribution and abundance of vegetation and wildlife species impacted by wildfire.
Permafrost thaw and larger and longer wildfire seasons are likely to increase carbon dioxide emissions.	The land has the ability to store and capture carbon emissions. Climate change in the NWT increases emissions from the land due to permafrost thaw and forest fires. In turn, these emissions, also called land-based emissions, contribute to climate change. Land-based emission management, nature-based solutions and conservation management practices can reduce these emissions and even help remove carbon from the atmosphere.


OBSERVED AND PROJECTED CHANGES TO ECOSYSTEMS
WARMING TEMPERATURES
INCREASE IN EXTREME WEATHER
CHANGING PRECIPITATION PATTERNS
RISING SEA LEVELS
MELTING SEA ICE
EROSION
MORE FREQUENT AND INTENSE FOREST FIRES
HIGH WATER/ FLOODING
CHANGES TO QUANTITY AND QUALITY OF WATER
SEDIMENTATION
CO2
METHANE
CO2
MORE CARBON & METHANE EMISSIONS FROM THE LAND
LOW WATER/ DROUGHT
INCREASE IN INVASIVE SPECIES,
PESTS
IMPACTS ON BIODIVERSITY
CHANGE IN PLANTS & WILDLIFE PATTERNS
PERMAFROST THAW
LANDSLIDES
SLUMPING
LAND INSTABILITY
CHANGING LANDSCAPES
MORE DISEASE

CURRENT ACTIONS

Here are some actions currently happening in the NWT to address climate change risks that threaten the value of ecosystems:

- Conservation network planning is a nature-based solution to climate change. Establishing a network of protected areas and conservation areas contributes to provide refuge for increasingly threatened species and ecosystems and to counter the impacts of ecosystem fragmentation, providing a greater resilience in the face of a changing climate. Ts'udé Niljné Tuyeta, Thaidene Nëné and Edéhzhíe are three Indigenous Protected and Conserved Areas (IPCAs) that have been co-designated as federal or territorial protected areas, resulting in legal protection. IPCAs are lands and waters where Indigenous governments and Indigenous organizations have the primary role in protecting and conserving ecosystems through Indigenous laws, governance, and knowledge systems. Culture and language are also fundamental to these areas. To learn more you can read the Healthy Land, Healthy People is the Northwest Territories' plan (***gov.nt.ca/ecc/en/healthy-land-healthy-people-gnwt-priorities-nwt-conservation-network***).

- *Northern Voices, Northern Waters: NWT Water Stewardship Strategy* (***nwtwaterstewardship.ca***) is a made-in-the-North strategy developed collaboratively with water partners in the NWT. The Action Plan includes a broad range of activities that are led by organizations across the NWT. Some actions address the impacts of climate change on NWT water systems.

4.2 Risks to health and wellbeing

"Forest fires are close to home, and forest fire smoke is making it difficult to breathe."

"My niece was evacuated from Hay River due to flooding and stayed with us till she could return. The event was very traumatising to her."

"The 2021 Flood residents are still recovering, the mental strain on the impact still exists."

"Drought years cause more dangers in the lake due to low water."

"I am worried about ice when travelling on the land."

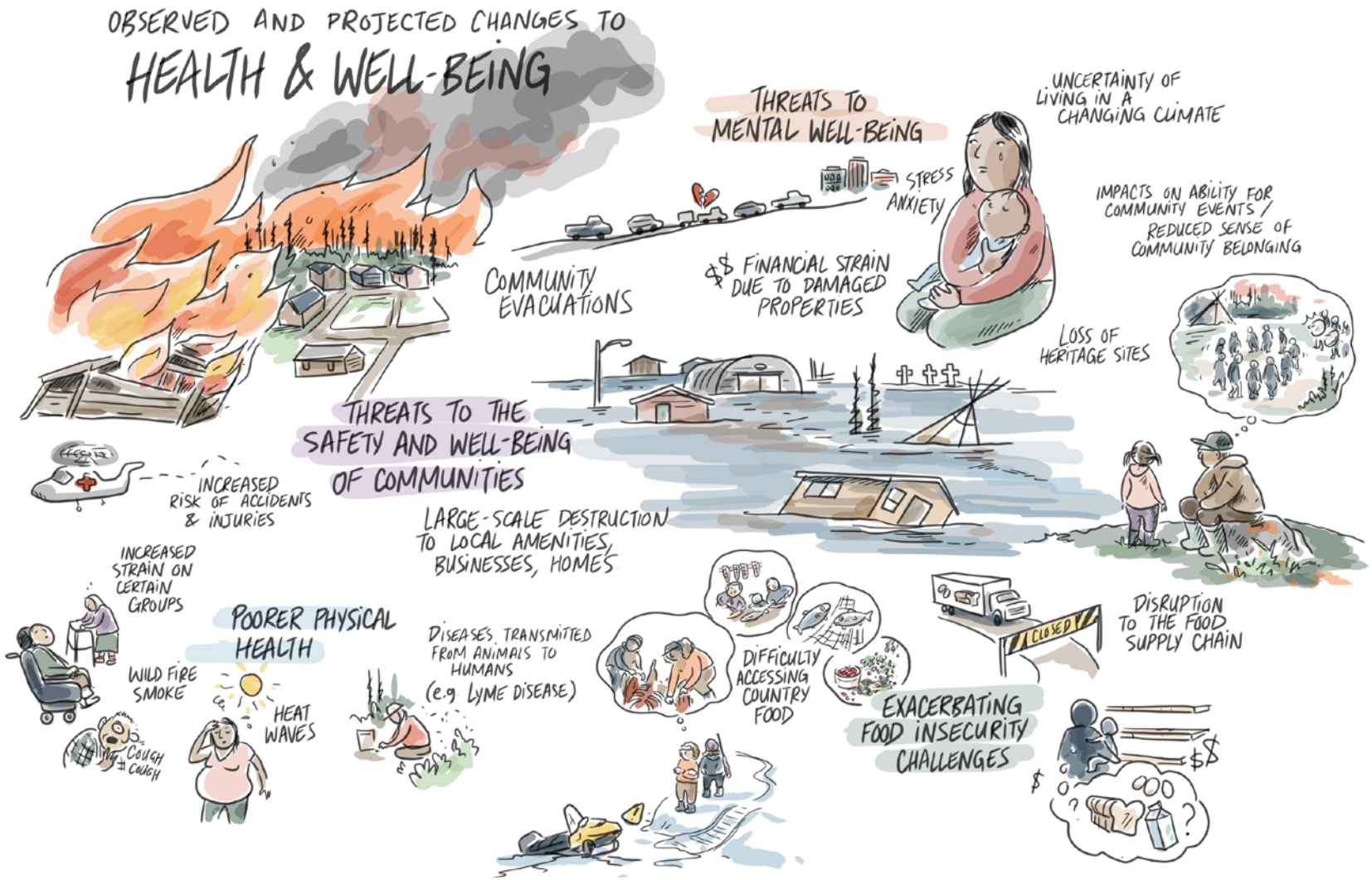
Participants' quotes

The value of health and well-being means that the health and well-being of NWT residents are strong, and their communities are safe and sustainable. **Table 5** presents the most concerning climate change risks that threaten the value of health and well-being.

Not all NWT communities are exposed to the same level or types of climate change risks. There are 29 NWT communities exposed to risks of wildfire and 10 NWT communities at increased risk of annual flooding, which includes Hay River; Kátł'odeeche First Nation; Fort Simpson; Jean Marie River; Fort Liard; Nahanni Butte; Tulita; Fort Good Hope; Fort McPherson; and Aklavik. It is important to note that risk of flooding may exist for all communities with nearby waterways.

Table 5. Health and well-being: Most concerning climate change risks.

The safety and well-being of many NWT communities are threatened by flooding and wildfires.	Flooding and wildfires are disrupting community life and social structures. Evacuation and large-scale destruction to local amenities, businesses and homes limit the ability for community events, reduce the sense of community belonging. It also increases risk of accidents, injuries, and may also result in fatalities.
Climate change is affecting physical health conditions for some NWT residents.	Increasing exposure to wildfire smoke and to more frequent heat waves are negatively impacting the health of NWT residents. Changes in freshwater systems will likely have ecosystem level changes. The potential spread of vector-borne disease (e.g., Lyme disease) may also emerge as an important climate-related health risk in the future. Some groups in the NWT, such as elders, land users and people with chronic health issues, are more vulnerable to these impacts.
Climate change is threatening the mental well-being of some NWT residents.	Disruptions to traditional ways of life, loss of heritage sites, community evacuations and financial strain due to damaged properties, as well as uncertainty of living in a changing climate are causing stress, anxiety, further deteriorating the mental health of NWT residents.
Climate change is increasing food insecurity challenges in the NWT.	Changes in ecosystems are disrupting traditional food systems. NWT communities and residents that rely on country foods as a main source of nutritious food are more at risk. The risk of disruption to the food supply chain is anticipated to increase. This can lead to increase in food price and/or supply shortage.


OBSERVED AND PROJECTED CHANGES TO
HEALTH & WELL-BEING
THREATS TO MENTAL WELL-BEING
STRESS
ANXIETY
UNCERTAINTY OF LIVING IN A CHANGING CLIMATE
IMPACTS ON ABILITY FOR COMMUNITY EVENTS / REDUCED SENSE OF COMMUNITY BELONGING
COMMUNITY EVACUATIONS
$$ FINANCIAL STRAIN DUE TO DAMAGED PROPERTIES
LOSS OF HERITAGE SITES
THREATS TO THE SAFETY AND WELL-BEING OF COMMUNITIES
INCREASED RISK OF ACCIDENTS & INJURIES
LARGE-SCALE DESTRUCTION TO LOCAL AMENITIES, BUSINESSES, HOMES
INCREASED STRAIN ON CERTAIN GROUPS
POORER PHYSICAL HEALTH
WILD FIRE SMOKE
HEAT WAVES
COUGH
DISEASES TRANSMITTED FROM ANIMALS TO HUMANS (e.g. LYME DISEASE)
DIFFICULTY ACCESSING COUNTRY FOOD
CLOSED
DISRUPTION TO THE FOOD SUPPLY CHAIN
EXACERBATING FOOD INSECURITY CHALLENGES

CURRENT ACTIONS

Here are some actions currently happening in the NWT to address climate change risks that threaten the value of health and well-being:

- The PurpleAir citizen science initiative (***purpleair.com***) provides access to publicly available, real-time data on air quality across the NWT. These sensors complement the larger, existing GNWT air quality stations. The NWT now has almost 50 sensors tracking air quality data across the territory. This information can be used to make health decisions such as limiting the activity duration or intensity level of time spent outdoors during poor air quality events, including during wildfire season.

- Natural Resources Canada (NRCan) has also allocated $28.6 Million to support the Government of the Northwest Territories with increased fire personnel, training for fire crews and additional equipment through the *Fighting and Managing Wildfires in a Changing Climate Program* Further, NRCan has provided $560,000 in funding under the *Two Billion Tree Program* over a three-year period.

- A partnership between the NWTAC and the GNWT secured approximately $20 million from the federal Disaster Mitigation and Adaptation Fund for projects across the territory that will increase protection from wildfires in the 29 fire-prone communities. This funding will allow the NWTAC and the GNWT to work with small and remote communities to create fuel breaks and implement fire fuel reduction strategies for over 1,200 hectares of land.

- GNWT's Department of Municipal and Community Affairs (MACA) works with NWT communities to review and update their emergency plans and offers community emergency planning workshops and tabletop exercise workshops to all community governments. MACA also developed the Emergency Management Organization (EMO) Portal for community governments to access all tools and templates developed by the EMO to assist with community emergency management programs. The EMO Portal includes a Community Flood Preparedness Package to guide as well as an updated template for a "Community Emergency Plan".

ONGOING ACTIONS TO ADDRESS RISKS TO HEALTH & WELL-BEING

PROVIDE COMMUNITIES WITH MAPS THAT HELP THEM IDENTIFY CLIMATE RISKS TO WHICH THEY ARE EXPOSED AND TAKE ACTION. IN THE CASE OF WILDFIRES, FOR INSTANCE, THESE MAPS CAN GUIDE THE LOCATION OF FIRE BREAKS (FUEL BREAKS).

4.3. Risks to connection to the land and culture

"Sharing advice and knowledge is becoming challenging. People are less and less willing to share knowledge because of the fear that the knowledge may no longer be reflective of the changes we are seeing."

"Loss of language and traditional skillsets connected to spending time on the land is no longer possible due to climate change."

"The elders need to be acknowledged in how we practice our culture and traditions. I think it's through leadership. We have to find solutions to share that with youth. And solutions have to be found by Indigenous people. In our language, it takes me longer to comprehend in English. I know that we're losing our language and it's really easy to learn."

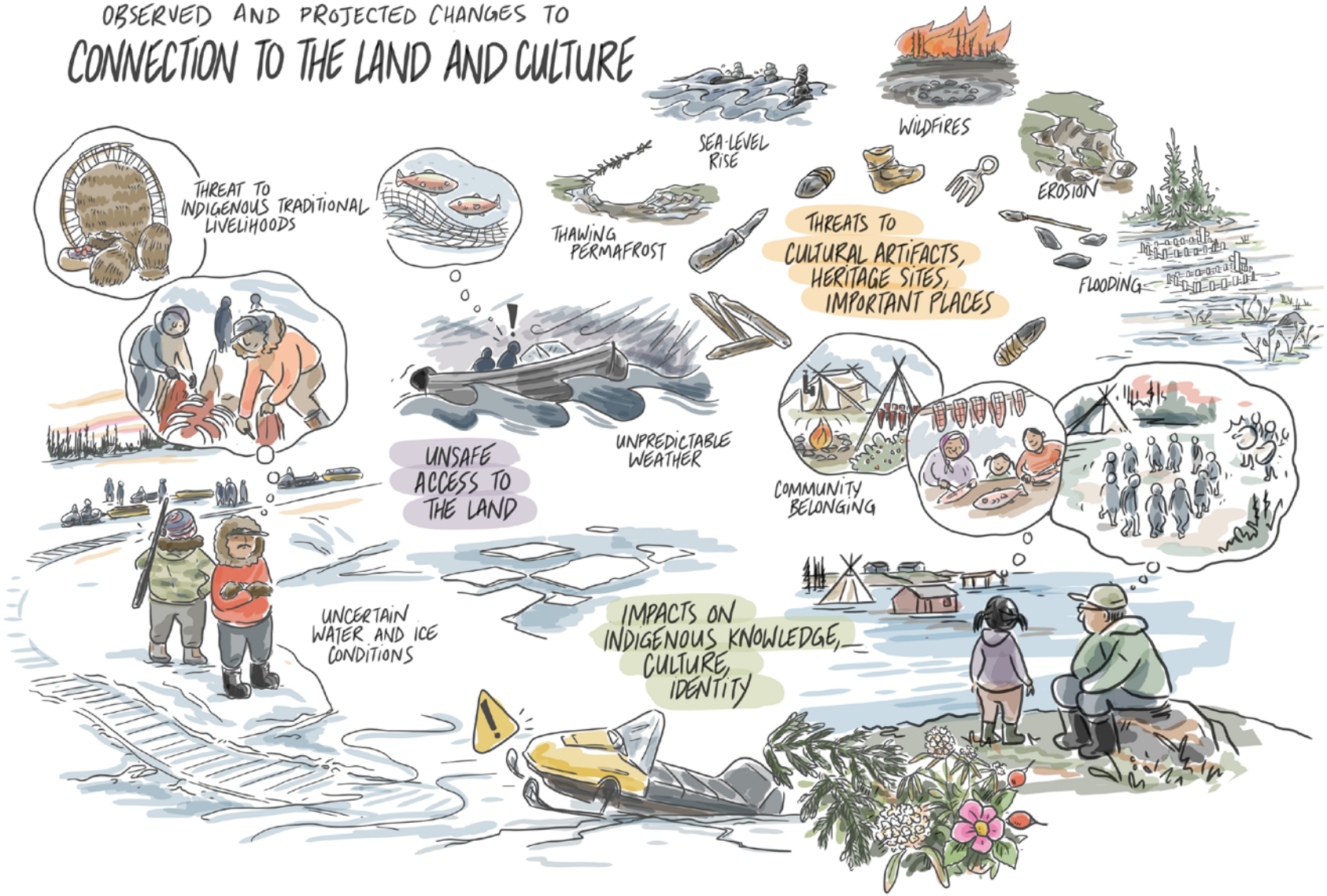
"Indigenous Peoples, who are deeply connected to the land and facing ongoing legacies of colonialism, are disproportionately experiencing the impacts of climate change. Mental health and getting people out on the land is very important and must be centered in any climate work."

Participants' quotes

The value of connection to the land and culture means that Indigenous knowledge, culture and identity are held strong and passed to new generations. NWT residents connect with and experience the land in ways that are meaningful to them. **Table 6** presents the most concerning climate change risks that threaten the value of connection to the land and culture.

Table 6. Connection to the Land and Culture: Most concerning climate change risks.

Less predictable weather conditions and ice conditions are affecting people's ability to access the land safely.	Landscape changes, unpredictable weather, and uncertainty in water and ice conditions are emerging risks that can threaten on-the-land safety.
Climate change is having profound impact on Indigenous knowledge, culture, and identity.	Climate change impacts are threatening Indigenous traditional livelihoods, community belonging, and inter-generational knowledge transfer. For instance, it is more difficult to pass along traditional knowledge of country foods and medicinal plants due to changing ecosystems.
Culturally important places and heritage sites are being threatened by thawing permafrost, wildfires, erosion, sea-level rise, and flooding.	These impacts threaten the spiritual and historical connection Indigenous Peoples have with the land.


OBSERVED AND PROJECTED CHANGES TO
CONNECTION TO THE LAND AND CULTURE
SEA-LEVEL RISE
WILDFIRES
EROSION
THREAT TO INDIGENOUS TRADITIONAL LIVELIHOODS
THAWING PERMAFROST
THREATS TO CULTURAL ARTIFACTS, HERITAGE SITES, IMPORTANT PLACES
FLOODING
UNPREDICTABLE WEATHER
UNSAFE ACCESS TO THE LAND
COMMUNITY BELONGING
UNCERTAIN WATER AND ICE CONDITIONS
IMPACTS ON INDIGENOUS KNOWLEDGE, CULTURE, IDENTITY

CURRENT ACTIONS

Here are some actions currently happening in the NWT to address climate change risks that threaten the value of connection to the land and culture:

- ***GNWT's Hunters and Trappers' Disaster Compensation program*** provides compensation to traditional harvesters in the NWT who have suffered loss or damage to equipment or assets because of extreme weather events often related to climate change. ***GNWT'S Take a Kid Trapping program*** introduces school age youth in the NWT to the traditional harvesting practices of hunting, trapping, fishing and outdoor survival. The program is delivered through schools and Indigenous organizations. Instructors incorporate visits to trap lines and hands-on experience setting traps, snares and fishnets. These activities teach traditional life skills, conservation and best practices in the preparation of pelts for market. More information on these programs here: ***www.gov.nt.ca/ecc/en/service-categories***.

- The take a Family on the Land program supports land-based activities and food security. The Berry Research Project is implemented through collaborative knowledge gathering to improve understanding of the NWT's environment, inform environmental stewardship actions, and contribute to an increase in Indigenous Knowledge-led research in the territory.

- Coastal erosion risk assessments are being undertaken to better understand how Inuvialuit cultural and archaeological sites are being impacted by climate change. The work focuses on mapping and documenting cultural landscapes and climate change impacts in the Beaufort Delta Region, where coastal erosion and permafrost loss are causing the archaeological record to be washed away into the ocean at rates of up to 10 metres of land per year. Results from this work are shared with local communities such as Tuktoyaktuk and Sachs Harbour. Community members can then use this information to decide how they want to move forward. Options discussed include excavating sites to study the archaeological and cultural components in a safer location, community members participating in on-the-ground knowledge exchange at the archaeological sites or allowing nature to take its course with coastal erosion.

- A partnership with SmartICE, Tuktoyaktuk Community Government Council, the Tłı̨cho Government, and Łutsël K'é Dene First Nation to provide equipment and training to 20 Indigenous operators/Guardians to monitor sea and lake ice thickness on traditional trails and winter roads for their communities to promote safe travel on the land as environmental conditions shift due to climate change. The ice monitoring data were made available to all communities through local media and online through SIKU (***siku.org***), the Indigenous Knowledge Social Network.

ONGOING ACTIONS TO ADDRESS RISKS TO CONNECTION TO THE LAND AND CULTURE

TRAIN AND EQUIP INDIGENOUS OPERATORS AND GUARDIANS TO MONITOR ICE THICKNESS ON TRADITIONAL TRAILS AND WINTER ROADS TO INCREASE SAFE TRAVELS.

4.4 Risks to infrastructure and access to essential services

"We have a traditional cabin up the Liard River. Over the past 15 years we have had to move our cabin further away from the river. After we moved it 4 times this past winter, we had extreme snow. The snow collapsed the roof and we lost almost everything in there. … Then we found a big sink hole in the middle of the old abandon road that we use. This was shocking and disturbing to see not to mention dangerous."

"Strong winds and waves have caused erosion around my shoreline as much as 12 feet which is causing concern about the safety and location of our home. Boating dock was destroyed over time."

"When flooding happens in the communities, it cuts off the supply chain and puts a lot of strain on social systems in the communities. There are trickle down impacts on all aspects of life."

"I see sinking infrastructure, like bridges and buildings."

Participants' quotes

The value of infrastructure and access to essential services means that NWT communities and residents have access to affordable, reliable, and sustainable essential services and infrastructure such as transportation, housing, and energy and telecommunications infrastructure, which make essential services accessible. **Table 7** presents the most concerning climate change risks that threaten the value of infrastructure and essential services.

Table 7. Infrastructure and essential services: Most concerning climate change risks.

Supply chains in the NWT are disrupted as the impacts of climate change intensify.	The risk of disruption of critical supply chains has increased and can lead to rising costs of essential goods, services, and re-supply (e.g., food, fuel, energy, etc.) in many NWT communities. Expected variability in water levels may increasingly challenge barging; shorter frozen seasons are likely to reduce winter road seasons; and more intense and longer wildfire seasons may result in increased maintenance costs for transportation infrastructure. This could lead to increased prices and/or supply shortages.
Without mitigation planning and action, shoreline infrastructure and buildings will likely be at risk from more rapid erosion processes and flooding.	Infrastructure and private buildings located along the Beaufort Delta coast are at risk from coastal erosion and sea level rise. Some infrastructure, cemeteries, and buildings in communities situated along riverbanks are also at risk from erosion as well as flooding.
Increasing extreme weather events, changes in precipitation (e.g., snow conditions), and in some cases, changes in soil conditions due to permafrost thaw, bring new risks that need to be considered when building, maintaining and operating infrastructure.	Building and maintaining public and private infrastructure (e.g., homes, buildings, roads, energy and telecommunications systems, airports, etc.) in a changing climate is likely to result in an increase in cost. Without proper planning and asset management, this is likely to put strain on budgets and limit the availability of funding for other areas/sectors. Some older infrastructure assets may be more vulnerable to climate change impacts which need to be reflected in capital planning.


OBSERVED AND PROJECTED CHANGES TO
INFRASTRUCTURE &
ACCESS TO ESSENTIAL SERVICES
INCREASED COST FOR BUILDING AND MAINTENANCE
PERMAFROST THAW
NECESSITY TO MAINTAIN / BUILD / OPERATE DIFFERENTLY
INCREASED SNOWLOADS
INCREASE IN EXTREME WEATHER EVENTS
CHANGES IN RAIN
RIVER & COASTAL EROSION
RISING SEA-LEVELS
LONGER AND MORE INTENSE WILDFIRE SEASONS
LOW WATER LEVELS
DISRUPTION TO SUPPLY CHAINS
INCREASED PRICES
SUPPLY SHORTAGES
SHORTER WINTER ROAD SEASON
RISKS TO SHORELINE INFRASTRUCTURE & BUILDINGS

CURRENT ACTIONS

Here are some actions currently happening in the NWT to address climate change risks that threaten the value of infrastructure and access to essential services:

- The GNWT is keeping roads safe by monitoring roadbeds more closely with thermistors as well as monitoring ice thickness for roads crossing rivers and lakes. In Tuktoyaktuk, some roads have been elevated to tackle erosion due to flooding.

- For buildings, gauges are installed on the roofs of old buildings to monitor the depth of snow and indicate when to remove snow. Innovative foundation systems are also used by NWT Housing for new modular housing. This foundation system makes it easier to relevel buildings that may be subject to movement due to changing ground conditions resulting from permafrost thaw for instance.

- The GNWT is supporting the federal government (CIRNAC) in piloting the Risk-Based Approach to Community Planning in Northern Regions standard developed by the Northern Infrastructure Standard Initiative (NISI) in at least two NWT communities with the aim to advance the development of suitability maps that inform land-use planning.

- GNWT started a study design to conduct an infrastructure portfolio vulnerability assessment. This will assess existing buildings, highways, structures, and airport assets in the GNWT's inventory against predicted climate impacts. This will help assign risk rankings to these assets to create the basis for adaptation planning for existing assets against the effects of climate change.

- Using ground-penetrating radar systems pulled by snowmobiles, along with drones and satellite observations, researchers from Wilfrid Laurier University measure the thickness of the ice on Great Slave and Great Bear Lakes. They can also detect where ice has cracked or buckled, which is instrumental in determining the best path for the ice road. These researchers are learning from the Dél̨ı̨ę community, gratefully absorbing their expansive knowledge of the lake and its ecosystem, and their deep respect for the land.

ONGOING ACTIONS TO ADDRESS RISKS TO INFRASTRUCTURE & ACCESS TO ESSENTIAL SERVICES

NEW TECHNOLOGIES AND MAINTENANCE METHODS, SUCH AS IMPROVED DRAINAGE, ROAD ELEVATION, ICE THICKNESS MONITORING ON WINTER ROADS, SNOW LOAD MONITORING ON THE ROOFS OF OLD BUILDINGS, THERMOSYPHONS, AND SPACEFRAMES ARE BEING USED TO MAKE ESSENTIAL INFRASTRUCTURE SAFE AND TO ADDRESS RISKS ASSOCIATED WITH PERMAFROST THAW.

4.5 Risks to business and economy

“The weather was much warmer this fall. It was good for gardens but does not feel right.”

“We have experienced damage and interruptions to our business due to flooding.”

“Milder winters affect the trappers getting back on the trap line in time for the trapping season so making the season very short.”

“Looking at the broad impacts, the capacity to manage the response and recovery isn’t always there.”

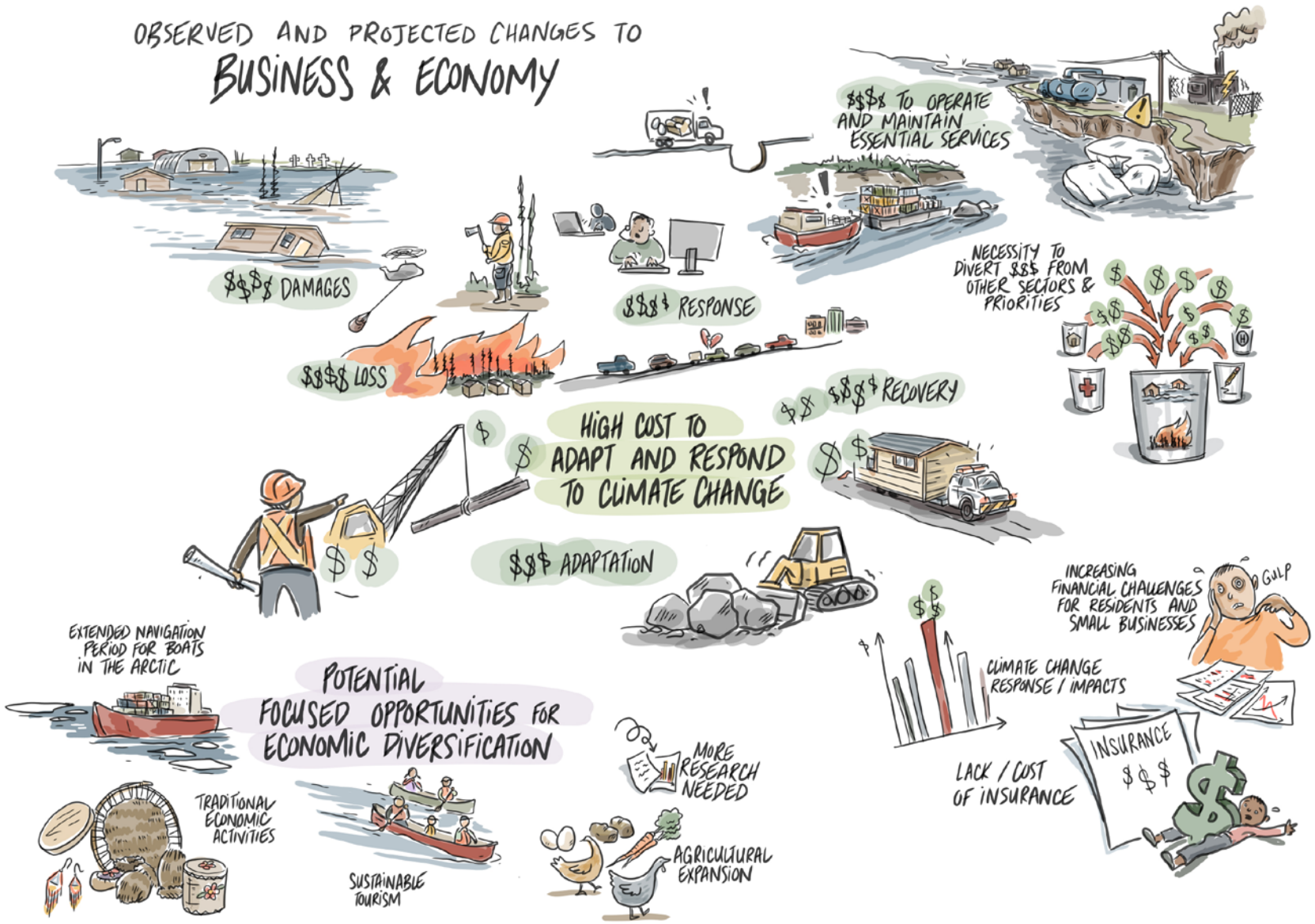
“We could rely on sustainable living and partner with other tourism operators. Ecotourism could work but there is hesitation due to over-tourism.”

Participants’ quotes

The value of business and economy means that economic self-sufficiency promotes a positive economic environment in the NWT for both profit-based and traditional economic activities. **Table 8** presents the most concerning climate change risks that compromise the value of business and economy value.

Table 8. Business and economy: Most concerning climate change risks.

The high cost to adapt and respond to climate change and climate-related disasters can cause financial losses or constraints for governments, businesses, and residents, affecting the economic resilience in the NWT.	The cost of recovering from the damages and losses of extreme weather events, wildfire and flooding is rapidly increasing as climate change intensifies. The potential lack of appropriate and affordable insurance for natural disaster in the NWT exacerbates financial challenges for some people and businesses. As the climate changes, the capital, operation and maintenance cost of many assets and provision of essential services are increasing. Budget for emergency management preparedness and disaster recovery can also be expected to rise. This will likely require diverting financial resources from other sectors and priorities.

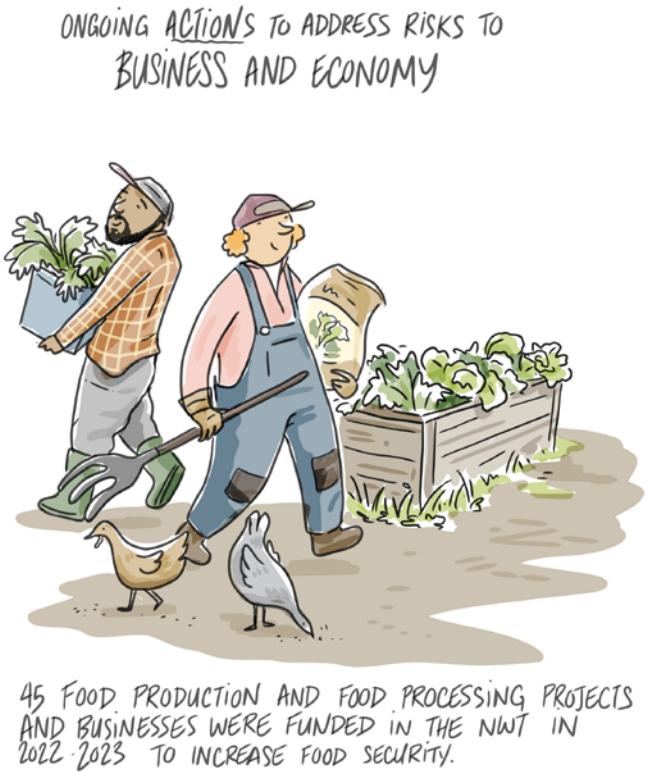

OBSERVED AND PROJECTED CHANGES TO
BUSINESS & ECONOMY
$$$ TO OPERATE AND MAINTAIN ESSENTIAL SERVICES
$$$ DAMAGES
$$$ RESPONSE
$$$ LOSS
NECESSITY TO DIVERT $$$ FROM OTHER SECTORS & PRIORITIES
$$$ RECOVERY
HIGH COST TO ADAPT AND RESPOND TO CLIMATE CHANGE
$$$ ADAPTATION
INCREASING FINANCIAL CHALLENGES FOR RESIDENTS AND SMALL BUSINESSES
GULP
CLIMATE CHANGE RESPONSE / IMPACTS
LACK / COST OF INSURANCE
INSURANCE
$$$
EXTENDED NAVIGATION PERIOD FOR BOATS IN THE ARCTIC
POTENTIAL FOCUSED OPPORTUNITIES FOR ECONOMIC DIVERSIFICATION
MORE RESEARCH NEEDED
TRADITIONAL ECONOMIC ACTIVITIES
SUSTAINABLE TOURISM
AGRICULTURAL EXPANSION

CURRENT ACTIONS

Here are some actions currently happening in the NWT to address climate change risks to the value of business and economy:

- The GNWT in partnership with the Canadian Northern Economic Development Agency provided an additional $1,000,000 each as additional contribution funding under the Support for Entrepreneurs and Economic Development (SEED) Policy as a one-time funding initiative to support small NWT businesses dealing with the impacts of wildfire evacuations. In total, $2,273,120 was provided to 319 businesses in 2023-2024 for wildfire relief.

- 74 food production and food processing projects and businesses were funded in the NWT in 2023-2024 with $2,215,000. Food security and local food production support the NWT economy and its diversification, as well as environmental stewardship and climate change resiliency.



4.6. Cross-cutting climate vulnerabilities

"Lower paid staff are becoming very stressed as the cost of items has gone up. There is inequality in how climate change affects Northerners."

"Too much erosion. … I had to move my cabin back as it would have fall into the river. It was very expensive to do this kind of stuff, with no help at all."

"We lost everything we had in Paradise Valley due to spring flooding of the Hay River in 2022."

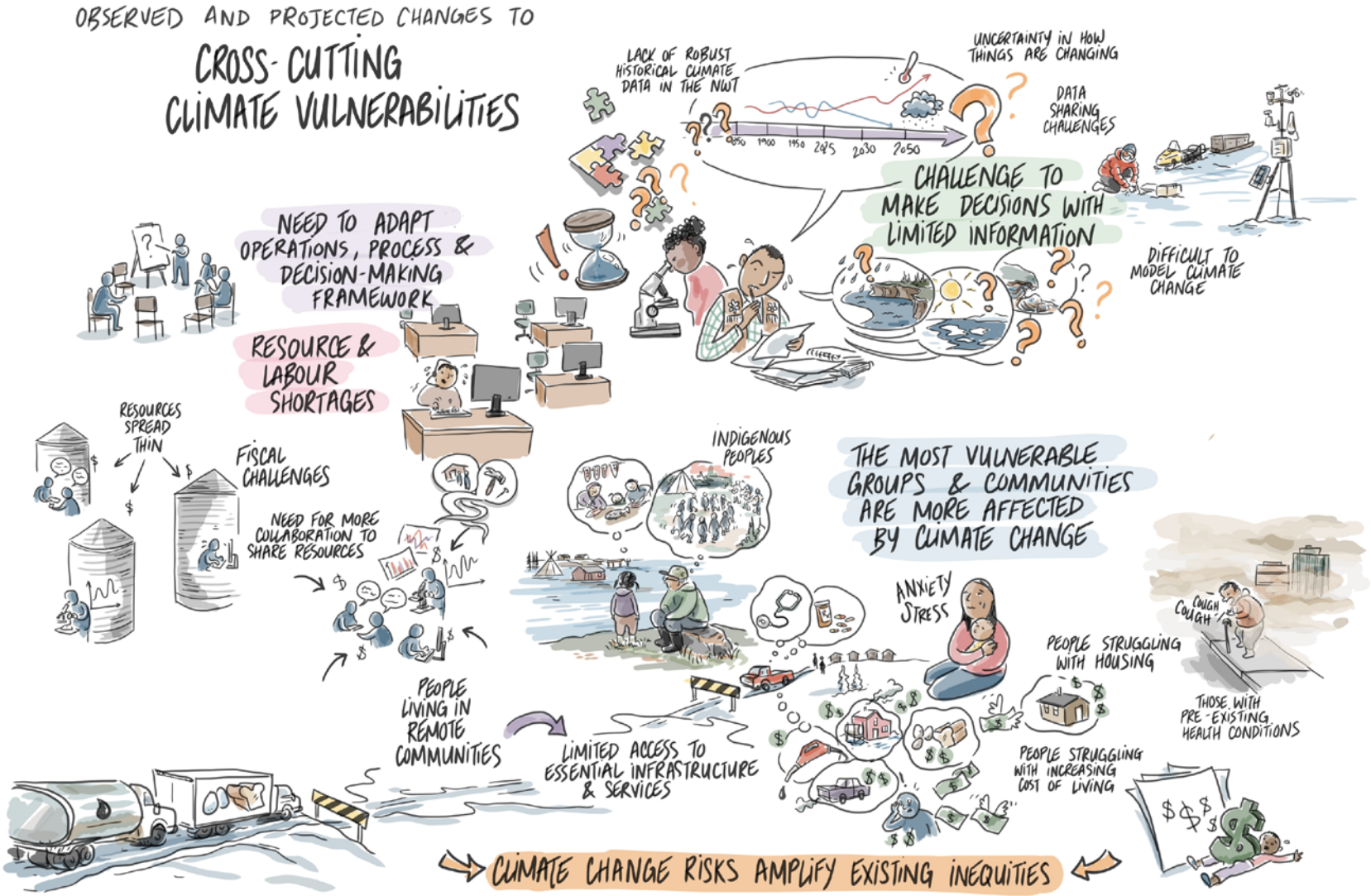
"Providing the Indigenous governments and Indigenous organizations' workforce with training is a great opportunity for them to be the ones doing the on the land research, monitoring, ecotourism (but need to avoid over-tourism), and food security (which is heavily impacted by climate change). All this supports Indigenous sovereignty."

Participants' quotes

The consequences of climate changes span beyond their impacts on the five NWT values. They lead to cascading effects by adding stressors to other issues the NWT is facing. **Table 9** presents existing vulnerabilities in the NWT that are worsened by climate change.

Table 9. Main climate vulnerabilities.

Efforts to reduce and adapt to the impacts of climate change may be slowed by limited resources and capacity shortages and a lack of adequate processes and/or governance mechanisms to respond efficiently.	The NWT faces broad capacity and resource challenges, including a labour shortage and fiscal constraints. Responding to and recovering from climate related disasters is expected to exacerbate these challenges. Responses to new and emerging climate change risks challenge existing processes and governance structures and call for enhanced collaboration and alignment among NWT partners so resources are not spread thin and adverse impacts on vulnerable groups are reduced.
Climate change risks can amplify existing inequities and disproportionately affect certain communities and groups	Indigenous Peoples, who are deeply connected to the land and facing ongoing legacies of colonialism, are disproportionately experiencing the impacts of climate change (see Risks related to Connection to the Land value). Residents living in remote communities with limited access to essential infrastructure and services as well as those struggling with housing and increasing costs of living are also more likely to be disproportionately impacted by climate change. An equitable climate change adaptation approach recognizes the needs and perspectives of most vulnerable groups and builds on existing actions and strategies that are already in place to address these challenges. This integrated approach ensures leadership and inclusion in decision-making processes.
Lack of robust historical climate data in the NWT, and limited climate monitoring and ways to share data can challenge informed decision-making in the NWT.	Climate modeling for the NWT is limited by the lack of robust baseline data for some key climate variables (e.g., air temperature, precipitation) and the lack of a sound monitoring network (e.g., weather stations, riverbank and coastal erosion). This comes in addition to the complexity and uncertainty of climate modeling. As a result, determination of climate trends and projections is limited in the NWT. Increased climate monitoring, shared data management, and traditional and Indigenous knowledge can reduce some level of uncertainty. But, in some cases, decision-makers still need to make decisions with incomplete information and deal with the uncertainty inherent to climate sciences.


OBSERVED AND PROJECTED CHANGES TO
CROSS-CUTTING CLIMATE VULNERABILITIES
LACK OF ROBUST HISTORICAL CLIMATE DATA IN THE NWT
1850
1900
1950
2015
2030
2050
UNCERTAINTY IN HOW THINGS ARE CHANGING
DATA SHARING CHALLENGES
CHALLENGE TO MAKE DECISIONS WITH LIMITED INFORMATION
DIFFICULT TO MODEL CLIMATE CHANGE
NEED TO ADAPT OPERATIONS, PROCESS & DECISION-MAKING FRAMEWORK
RESOURCE & LABOUR SHORTAGES
RESOURCES SPREAD THIN
FISCAL CHALLENGES
NEED FOR MORE COLLABORATION TO SHARE RESOURCES
INDIGENOUS PEOPLES
THE MOST VULNERABLE GROUPS & COMMUNITIES ARE MORE AFFECTED BY CLIMATE CHANGE
ANXIETY STRESS
COUGH COUGH
PEOPLE STRUGGLING WITH HOUSING
THOSE WITH PRE-EXISTING HEALTH CONDITIONS
PEOPLE LIVING IN REMOTE COMMUNITIES
LIMITED ACCESS TO ESSENTIAL INFRASTRUCTURE & SERVICES
PEOPLE STRUGGLING WITH INCREASING COST OF LIVING
CLIMATE CHANGE RISKS AMPLIFY EXISTING INEQUITIES

CURRENT ACTIONS

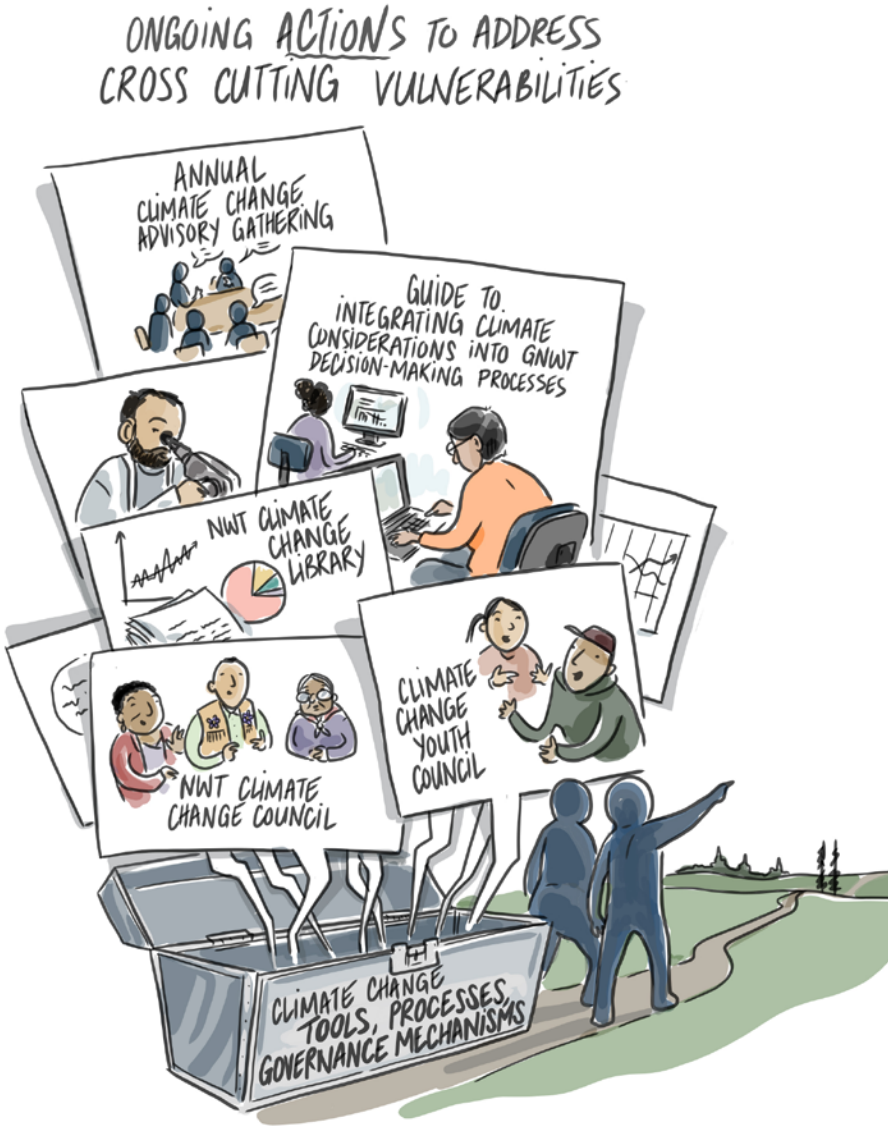
Here are some actions currently happening in the NWT to address the cross-cutting climate vulnerabilities:

- The GNWT has launched an online NWT Climate Change Library (the Library) (***climatelibrary.ecc.gov.nt.ca***) to make credible technical climate change information relevant to the NWT more accessible. The Library provides a single, central online platform for accessing technical resources related to climate change in the NWT and help inform action and decisions.

- In 2022-23, the GNWT approved $833,000 in community government funding to support the reduction in the municipal funding gap to meet municipal core needs. Though this is not a requirement, it is anticipated that some of this funding will be put toward infrastructure impacted by climate change. The federal Investing in Canada Infrastructure Fund for community governments continues to target community roads and solid waste sites.

- The GNWT, NWT communities, and the federal government are collaborating on several initiatives to provide NWT communities with tools and maps that help them identify and visualize what part of their community is exposed to climate change risks.
  - The GNWT is working with NRCan and NWT communities, to develop updated flood maps for the NWT's flood-prone communities. This project will help communities identify flood vulnerabilities and inform emergency, and land use planning and development.
  - Hazard mapping and geo-surficial mapping are being advanced in NWT communities by the GNWT, NWT communities, and the Government of Canada. The mapping of features such as permafrost sensitivity will help communities plan for adaptation to permafrost thaw and other climatic changes.

- GNWT Environment and Climate Change (ECC) developed the policy instrument ***Guide to Integrating Climate Change Considerations into GNWT Decision-Making Instruments*** in winter 2020. As of 2021, all GNWT Decision Papers, Financial Management Board submissions, and Legislative Proposals need to consider climate change factors. These climate change factors include GHG mitigation, climate change impacts, knowledge, and adaptation.


ONGOING ACTIONS TO ADDRESS CROSS CUTTING VULNERABILITIES
ANNUAL CLIMATE CHANGE ADVISORY GATHERING
GUIDE TO INTEGRATING CLIMATE CONSIDERATIONS INTO GNWT DECISION-MAKING PROCESSES
NWT CLIMATE CHANGE LIBRARY
CLIMATE CHANGE YOUTH COUNCIL
NWT CLIMATE CHANGE COUNCIL
CLIMATE CHANGE TOOLS, PROCESSES, GOVERNANCE MECHANISMS

5. Building Made-in-the-NWT Adaptation Pathways

Throughout the engagement on the Assessment, we heard that NWT residents and communities are resilient and have the ability to adapt and adjust to the risks caused by climate change.

This Assessment identifies our climate change risks, but it is important to highlight the ways that we can, and already are, adapting to our changing climate.

There are many ways to adapt to climate change. Numerous adaptation options are on the table, each leading to different possible outcomes for the NWT. This range of possible outcomes are called ' adaptation pathways'. An adaptation pathway is the result of step-by-step choices and decisions made by residents and communities, reassessed over time as the climate and social values change. These choices balance short-term and long-term goals, as well as climate change uncertainty (see Box 4).

What could a made-in-the-NWT adaptation pathway look like? No one idea will be a blanket solution for all the NWT's diverse regions, groups, and communities. Building on what was heard during the past two years of engagement activities, this section outlines possible elements of what a made-in-the-NWT Adaptation Pathway could look like that strengthens the five NWT values. We highlight adaptation actions that are already underway in the NWT, as well as future pathways.

Whatever pathway the NWT will take, the level of adaptation effort will depend on the level of global carbon emissions from human activities. This is why the NWT is doing its share to reduce its carbon emissions through the implementation of the 2030 Climate Change Strategic Framework and the 2030 Energy Strategy.

5.1 A pathway braiding reconciliation and self-determination

In the NWT, there is a unique opportunity to adopt a climate change adaptation pathway that embraces Indigenous reconciliation and self-determination.

Multiple Indigenous governments and Indigenous organizations across the North are proactive in identifying climate change action priorities. For instance, the Inuvialuit Regional Corporation has developed and is implementing the ***Inuvialuit Settlement Region Climate Change Strategy***. The North Slave Métis Alliance and the Tłı̨chǫ Government are working with their respective members to identify their climate change adaptation priorities, to inform the co-development process of the federal ***Indigenous Climate Leadership Initiative***. Many other Indigenous governments and Indigenous organizations are in the process of developing their own similar Strategies and pathways shaped by their unique needs and priorities. In addition, work is on-going to identify shared priorities across all segments of NWT society, for a whole-of-the-NWT climate change adaptation pathway.

Identifying these shared priorities for a made-in-the-NWT adaptation pathway relies on collaboration and trust. This collaboration has been fostered through the ***NWT Climate Change Council***. The Council is a key forum for Indigenous governments', Indigenous organizations', and NWT community governments' perspectives on climate change impacts and solutions. The Council met in February 2024 to inform and develop shared climate change action priorities for the NWT. Their input guided the drafting of the 2025-2029 NWT Climate Change Action Plan, and they have expressed the desire to enable and guide coordination and collaboration for climate change action in the NWT. This coordination role provides an opportunity to build on and strengthen relationships, shared understandings, and trust, which in turn supports the GNWT's implementation of the United Nations Declaration on the Rights of Indigenous Peoples (see Box 4).

The work of Indigenous governments and Indigenous organizations to define and implement their own climate change adaptation priorities emphasizes their right to maintain and protect their unique cultures, traditions, and ways of life. It also highlights the importance of Indigenous Knowledge in supporting climate change adaptation decision-making that affect their lands and resources.

BOX 4: WHAT IS THE UNITED NATIONS DECLARATION OF THE RIGHTS OF INDIGENOUS PEOPLES?

- The United Nations Declaration on the Rights of Indigenous Peoples describes the fundamental human rights of Indigenous peoples around the world. It describes how governments should respect the human rights of Indigenous peoples. The Declaration recognizes Indigenous peoples' right to self-determination, culture, language, and traditional lands. In addition, the Declaration describes the minimum standards required to protect Indigenous peoples' rights and contribute to their survival, dignity, and well-being.

- Made up of 46 articles that describe specific rights and actions that governments must take to protect the rights of Indigenous peoples, this Declaration is a valuable tool for developing strategies and taking action. Both the Truth and Reconciliation Commission and the National Inquiry on Missing and Murdered Indigenous Women and Girls included calls for all levels of government to adopt the UN Declaration as the framework for reconciliation across Canada.

- On March 2023, the GNWT introduced *Bill 85: The United Nations Declaration on the Rights of Indigenous Peoples Implementation Act*. Here in the Northwest Territories, this declaration is especially relevant because it acknowledges the rights of the First Nations, Métis and Inuit peoples who have lived here for generations.

5.2 A pathway balancing opportunities arising from climate change

A made-in-the-NWT adaptation pathway could also explore the potential economic opportunities residents identified from climate change. These might include sustainable tourism, an extended open water navigation period in the Arctic Ocean, agricultural expansion, and leveraging future carbon offset programs[4].

However, these potential opportunities are to be approached cautiously. For example, decreased sea ice may increase access to the Northwest Passage which may increase pollution and Arctic security concerns. However, new defense infrastructure may have positive synergies for northerners if such infrastructure can increase northern resilience to climate change. More work is needed to assess their overall benefits, their barriers, as well as their unintended consequences.

For instance, some aspects of climate change that can be perceived positively from an economic lens will likely result in negative impacts to ecosystems and connections to the land and culture. This trade-off was highlighted by a participant from the Inuvialuit region: "Increased marine traffic (cruise ships) and 'over-tourism' brings money, but also brings negative impacts to our traditional ways of life. We are seeing this already in our communities." These negative impacts could include increased risks of accidents when conducting traditional activities on seas with nearby cruise ships, impacts on the quantity and quality of fish, and disturbance of marine animals due to underwater noise and pollution of cruise ships.

5.3 A pathway that incorporates both social and economic equity

Climate change can increase existing socio-economic inequities in the NWT as it disproportionately affects vulnerable communities and groups, as presented in Section 4.6. The Indigenous-led *For our future: Indigenous resilience report* (***changingclimate.ca/indigenous-resilience***) highlights how climate change increases existing inequity for Indigenous people in Canada. Made-in-the-NWT adaptation pathways need to identify climate change adaptation solutions that address these socio-economic inequities, like housing and food insecurity.

Housing NWT is already undertaking work to upgrade and build climate-resilient homes that are more resistant to wildfire and ground instability from permafrost thaw. Others are advancing local energy systems that rely on woodstoves and solar and wind energy to reduce the cost of energy for households while increasing their energy security and independence.

Adopting actions that enable local food production, such as community gardens, greenhouses, and small-scale agriculture farms and fisheries also tackles the inequity of food insecurity. Many communities and Indigenous organizations have already initiated these types of projects. For instance, the Inuvialuit Regional Corporation operates a greenhouse and local food processing plants, while the North Slave Métis Alliance built a community garden and greenhouse to provide locally grown food for their members. The *Northern Food Systems Research Group*[5] within Wilfried Laurier University, supported by the GNWT, is working with

[4] Carbon offset encompasses action intended to compensate for the emission of carbon dioxide into the atmosphere as a result of industrial or other human activity. International offset mechanisms are currently being developed. Offset mechanisms for the NWT could advance nature-based solutions.

[5] The research group website is available at: ***researchcentres.wlu.ca/centre-for-sustainable-food-systems/research/northern-food-systems-research-group.html.***

Ka'a'gee Tu First Nation, Délı̨nę Got'ine Government, Tsá Tué Biosphere Reserve, Sambaa K'e First Nation, and the City of Yellowknife to access traditional foods, fish, game, and gardens to increase food security and food sovereignty. Some communities and Indigenous organizations have also established community freezers so that locally harvested food can be frozen to last longer, providing communities with more predictable access to country foods amidst unpredictable changing conditions on the land. The Sustainable Livelihoods Action Plan supports country food research and programs across the territory.

Northern adaptation solutions for the NWT could also include continuing and enhancing on the land activities and safety courses that connect Youth and Elders so that intergenerational knowledge, including knowledge of climate change and climate solutions, are passed between generations.

These adaptation solutions likely involve the creation of new jobs, whose training and certification could be done in the NWT through Aurora College trade and apprenticeship programs. Increasing local food and energy production would also increase the NWT's capacity to be more resilient to supply chain and infrastructure disruptions.

5.4 A pathway further advances the NWT as a climate change research centre, integrating multiple ways of knowing

> *"The time to act is now. Lessons learned from climate action in the North will be valuable elsewhere across the global north and south in the years to come and will be of great benefit to future generations."*
>
> *Pan-Northern Leaders' Statement on Climate Change*

As the North warms up to four times faster than the rest of the world, the NWT is at the forefront of climate change impacts. Understanding these impacts will help improve climate change modelling, which in turns helps us prepare for, and adapt to, future climate hazards. This modelling is crucial not only for us in the North, but for all of Canada and the world at large.

A made-in-the-NWT adaptation pathway can go hand-in-hand with positioning the NWT as a climate change research centre of expertise. This involves climate change knowledge and adaptation that integrates both Western and Indigenous ways of learning and knowing. Section 6 presents some research opportunities that could serve as potential examples to channel investment into research in the NWT. Research that helps prepare and adapt to the changing climate could include developing, testing, and commercializing new technologies and approaches such as carbon offsets, innovative wildlife or conservation management, adapting buildings for permafrost thaw and weather changes, and advancing local food production in northern regions. Research like this can, and does, create further spin-off economic activity and diversification.

The NWT is already well positioned to become an advanced climate change research hub. Many initiatives that integrate Western and Indigenous ways of learning and knowing are already in place, as presented in Box 5 below: NWT initiatives to position the NWT as a centre for climate change

research integrating Western and Indigenous ways of knowing. The GNWT will continue to advocate for this pathway at the national and international level, as indicated in the GNWT Innovation Action Plan[6].

BOX 5: NWT INITIATIVES TO POSITION THE NWT AS A CENTRE FOR CLIMATE CHANGE RESEARCH INTEGRATING WESTERN AND INDIGENOUS WAYS OF KNOWING

- **Indigenous Knowledge.** The NWT values multiple ways of learning and knowing. For instance, the Northwest Territories Cumulative Impact Monitoring Program (NWT CIMP) is a source of environmental monitoring and research in the NWT with a focus on three priorities: caribou, water, and fish. The program coordinates, conducts, and funds the collection, analysis and reporting of information related to environmental conditions, while prioritizing the use of Indigenous Knowledge. NWT CIMP considers all sources of knowledge, including science and Indigenous knowledge equally valuable. Community capacity building and community-based monitoring are key principles that are supported and linked to monitoring that produces information relevant to cumulative impacts. Similarly, the Tłı̨chǫ Government's Research and Training Institute, Hotìì ts'eeda, which has attracted academic partners and research funding for its *Ekwo ̀ Nàxoède K'è: Boots on the Ground caribou* monitoring program, caribou monitoring program based on the traditional knowledge of Indigenous Elders and harvesters that began in 2016. It is a multi-year traditional knowledge monitoring program that uses a methodology of "do as hunters do." The researchers identify and wait at specific na'oke (water crossings) and follow caribou herds by boat and on foot to identify traditional knowledge indicators.

- **Research capacity and facilities.** The NWT hosts several research institutes whose activities intersect with climate research. This includes Aurora College's Aurora Research Institute (Inuvik, Fort Smith, Yellowknife) and independent research organizations like the Institute for Circumpolar Health Research. The GNWT operates the Tundra Ecosystem Research Station at Daring Lake that facilitates climate change research. The GNWT's Knowledge Agenda identifies climate change priorities that direct GNWT research partnerships. For instance, the Wilfrid Laurier University (WLU) - GNWT partnership led to 40 research programs focused on climate change, impacts of climate change on resources or communities in the NWT, and developing research capacity. Through the WLU-GNWT partnership, WLU has had an office located in Yellowknife since 2017, and the partnership has brought $ 42.8M of funding for local research and infrastructure in the NWT since 2010.

- **Cross-cutting research on permafrost.** The NWT Permafrost Team, nested within the Northwest Territories Geological Survey, has staff in Yellowknife and Inuvik. The team undertakes baseline monitoring and terrain characterization across the NWT to better understand permafrost thaw and its impacts on community infrastructure, roads, and ecosystems. The Permafrost Team also promotes its research results nationally and internationally, with the goal of increased research collaboration and funding flowing to the NWT. This group also disseminates research results to NWT residents and supports partners in writing successful grant applications that meet their research needs. The team also participates in several initiatives to train Indigenous partners to participate in research fieldwork programs, such as the *NWT Thermokarst Mapping Collective* (***nwtgeoscience.ca/services/northwest-territories-thermokarst-mapping-collective***).

[6] Released in 2023, one of the goals of the GNWT Innovation Plan is to expand research activities in the NWT by strengthening and promoting the NWT as a location for targeted research; by promoting Indigenous, traditional, and local knowledge in research programs. And by supporting further development of domestic research capabilities. ***https://www.iti.gov.nt.ca/sites/iti/files/Innovation_Action_Plan_2023.pdf***

6. Observed and future climate related hazards in the NWT

This section provides a summary of seven themes of climate hazards. Each hazard includes a summary of trends and observations as well as a future outlook. Data limitations are included as well as opportunities for monitoring and research priorities.

These opportunities can provide a research roadmap around which to position the NWT as a research centre on climate change, as discussed in Section 5.

6.1 Climate and weather changes

"There are quick changes in the weather. It goes from one extreme to another rapidly."

"I am concerned with the extremes – extreme heat waves, cold snaps, drought or precipitations."

"When I was a kid, it was hot and dry in the summer, very cold and dry in the winter. I see now that summers are longer and wetter. Winters are warmer and snowier. It is also a lot windier."

"We are experiencing more, and stronger storms, high winds and winds that are coming from different directions rather than the usual west winds."

Participants' quotes

What are weather and climate, and what hazards do they refer to?

The NWT is warming at a rate disproportionate to other regions in Canada and around the world. The impacts of climate change, including extreme variations in the amount of precipitation (e.g. rainfall/snowfall), are widespread and can have direct consequences in the NWT that impact health and well-being, culture and connection to the land, infrastructure, ecosystems, and the economy.

Current trends and observations

On average across Canada's three territories (the North), air temperatures have been increasing at about three times the global rate of warming. The rate is even greater in northern NWT, with some stations having more than four times the global rate of temperature warming. Warming in winter has also been considerably greater than warming at other times of the year in northern Canada. In contrast, the magnitude of summer warming in the North has been relatively consistent with that of southern Canada.

These warming temperatures have resulted in an extended frost-free season of about 20 days from 1948 to 2016. The frost-free season is now starting approximately 10 days earlier and ending approximately 10 days later. As a result, the length of the growing season has also increased across Canada by approximately 15 days between 1948 and 2016.

As the atmosphere warms it can hold more water vapour, meaning that rainfall/snowfall is generally increasing throughout the North. However, there is considerable regional variation and data quality issues make determination of trends difficult.

Future outlook with climate change

Future warming in the NWT is projected to continue the historical pattern seen in the observed record, with warming occurring more quickly further north and in winter. For example, in the Inuvik Beaufort Delta administrative region , under a high emissions scenario, it is estimated that in the 2050s, the average winter air temperatures may be 5.5°C to 9.2°C warmer than current conditions, and average annual air temperatures may be 7.7 to 6.1°C warmer (Representative Concentration Pathway 8.5)

Rainfall and snowfall are expected to continue to increase with increasing temperatures in the North. However, there is a great deal of uncertainty around this projected trend. Rainfall is also expected to become a greater component of total precipitation as opposed to snowfall, due to the extended length of the summer season.

Additionally, as temperatures warm, drought and extreme precipitation events may become more common.

What is done to monitor climate and weather?

Climate monitoring stations are operated by Environment and Climate Change Canada (ECCC) as well as the GNWT. To increase the number of year-round stations, the GNWT is now operating many fire weather stations year-round, which previously only operated in the summer.

Data limitations

A barrier to detecting changes in climate in the NWT is the limited monitoring network. There are few stations with long (e.g. >50 years) records, and many regions of the NWT are not well monitored (e.g. high-elevation locations). Over time, there have been changes in the methodology and instruments used to monitor climate that has adversely impacted the quality of snowfall measurements. It is also difficult to model extreme weather events with confidence for future climate conditions.

Examples of potential priorities for future research and monitoring

- Maintain and enhance a comprehensive network of weather stations.
- Assess the quality, reliability, and applicability of past climate records.
- Research how climate change and extreme events may impact humans such as: insurance, energy grids, building codes, heating, and cooling requirements for buildings.
- Research how climate change and extreme events may impact human health and well-being, including culture and personal identity.
- Develop climate projections, models, and indices for the NWT for future time periods including comparisons between models.

More information

For more information on climate and weather changes, see:

- NWT State of Environment Report: ***Driving Force Climate Change.***
- ***Sixth Assessment Report, Climate Change 2021: The Physical Science Basis, the Working Group I contribution to the Sixth Assessment Report Summary for Policy Makers***

6.2 Vegetation and wildlife changes

"Not only the animal population is changing but also variety of fauna and flora."

Participant's quote

What is an ecosystem?

Ecosystems are communities of living organisms, primarily plants and animals, which live in the same environment and interact with each other and their physical environment. When outside forces change the population or behavior of one species, their interactions with other species may also be affected, potentially disrupting the entire ecosystem. There are many types of outside forces that can cause this disruption, such as temperature, weather, and changes to permafrost and wildfire regimes.

Current trends and observations

Warming temperatures are causing a shift in species ranges, resulting in altered ecosystems with different interacting species. Thawing permafrost has also been found to alter vegetation species, since different species thrive in thawed soils. Often, these alterations can be negative, as the new ecosystem needs time to adjust and balance to the new changes. For example, with warming temperatures, invasive species such as mountain pine beetle and ticks have the potential to appear in the NWT. Mountain pine beetles can kill trees and damage forests, and ticks are a pest to people, pets and wildlife.

Species are not just migrating northward from southern Canada directly, but in the case of pacific salmon, are also increasingly moving northward from the Bering Sea around Alaska to the Beaufort Sea and into rivers along the Canadian Arctic coast.

Future outlook with climate change

Ecosystem modelling research indicates that by the end of the century, there will be

large changes to boreal and arctic ecosystems across the North, driven by increasing temperatures and changing rainfall and snowfall patterns (**Figure 1**). Generally, the range of these ecosystems is expected to shift northward. The southern NWT may become grasslands, unable to support forest, and the treeline may move north into what is now tundra. Species that are now in the southern NWT may need to shift north or up in elevation to maintain required habitats. However, species that already occur in the northern NWT or alpine environments (e.g. cold-water fish) may be unable to move further north in response to climate change. Current ecosystems developed so that many species depend on each other. As some species respond to changes at different rates, it may result in mismatches in the life cycles of species that currently depend on each other. For example, the life cycles of pollinating insects could become misaligned with the time that plants bloom. Hence, with climate change we do not expect ecosystems to move north as units, but each species will migrate at different rates, potentially resulting in altered ecosystems.

Species in the NWT may experience new parasites and pathogens, to which they are not currently adapted.

With warmer and drier conditions, the frequency of wildfires may increase in the NWT. This may result in forests that are younger with different species than current forests, changing the habitat available for wildlife.

These changes may greatly affect Indigenous populations, whose traditional knowledge and practices rely on specific environments and species while living on the land. Adaptation of traditional lifestyles will be required to live on the land as ecosystems continue to change.

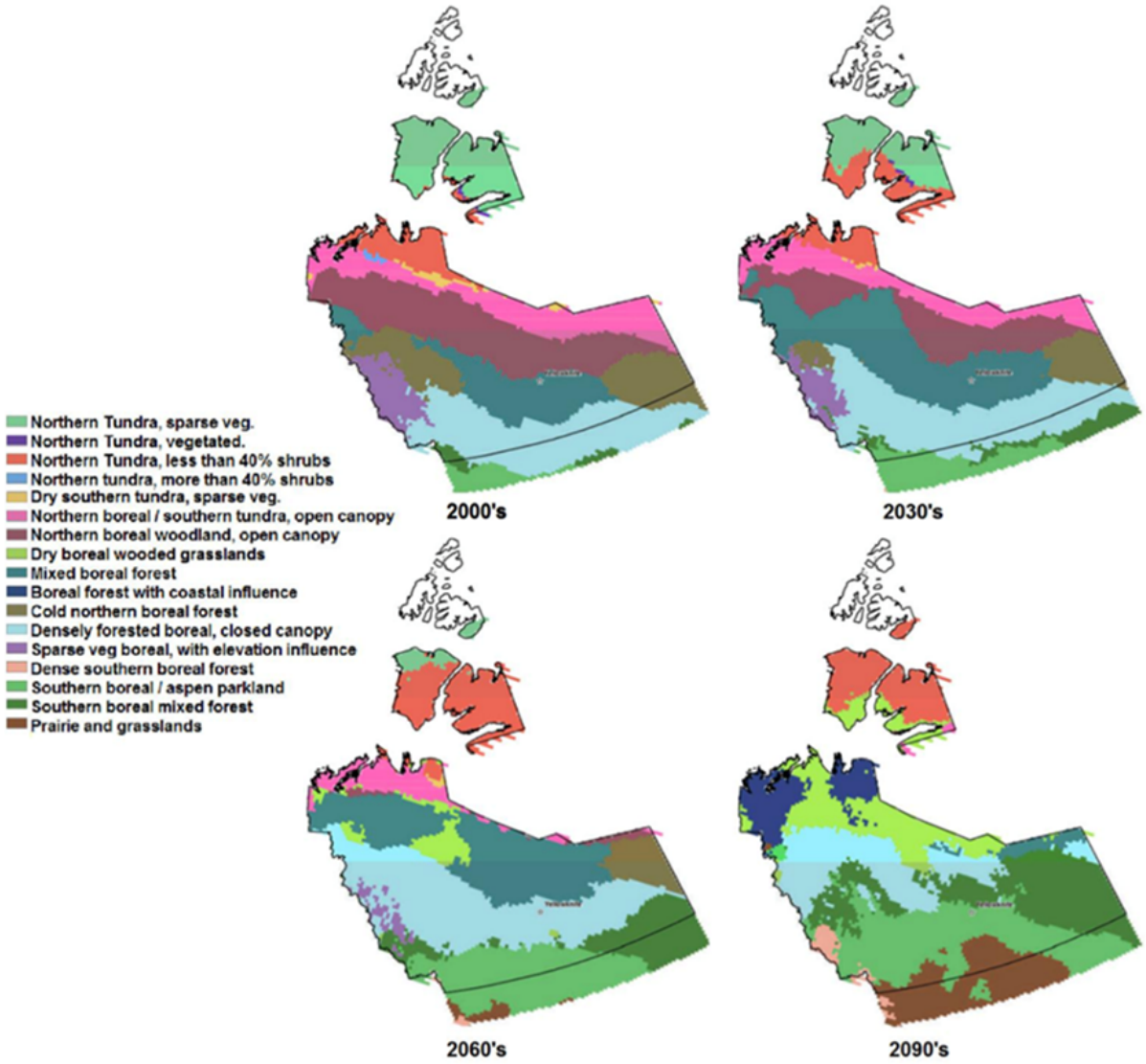


Figure 1: Ecoregion modelling showing the projected change in ecoregions in the NWT up to the 2090s.[7]

The treeline is located at the pink/purple boundary. Note that the treeline is projected to move north until it reaches the Arctic coast by the 2090s. Also note the brown areas, which represent prairie and grassland ecosystems. These habitats are not present in the NWT currently but are projected to appear in the southern NWT by the 2090s, as the area may be too dry to support forests.

Data limitations

Modelling future ecosystems under climate change requires good historical climate data and high-resolution projections of the future. Given the sparse coverage of climate data in the NWT, these data requirements are a barrier for many projects.

[7] Scenarios Network for Arctic Planning and the EWHALE lab, University of Alaska Fairbanks 2012 Predicting Future Potential Climate-Biomes for the Yukon, Northwest Territories, and Alaska. A climate-linked cluster analysis approach to analyzing possible ecological refugia and areas of greatest change 105 pp. Available at ***Cliomes-FINAL.pdf (uaf-snap.org)***

Examples of potential priorities for future research and monitoring

- Conduct analysis to determine how changing climate affects wildlife behaviors, including migration, breeding, and feeding patterns.
- Advance long-term wildlife population monitoring programs across the NWT to track changes in abundance, distribution, and health.
- Develop a better understanding of how climate change is affecting and will affect the composition and distribution of vegetation in northern ecosystems.
- Vegetation monitoring is advanced to track changes in plant communities and their distribution.
- Research is conducted on the use of country food sources, including their health, abundance and distribution, to determine availability and quality of food sources for generations to come.
- Research on how ecosystem change / biodiversity loss may impact mental health and well being.

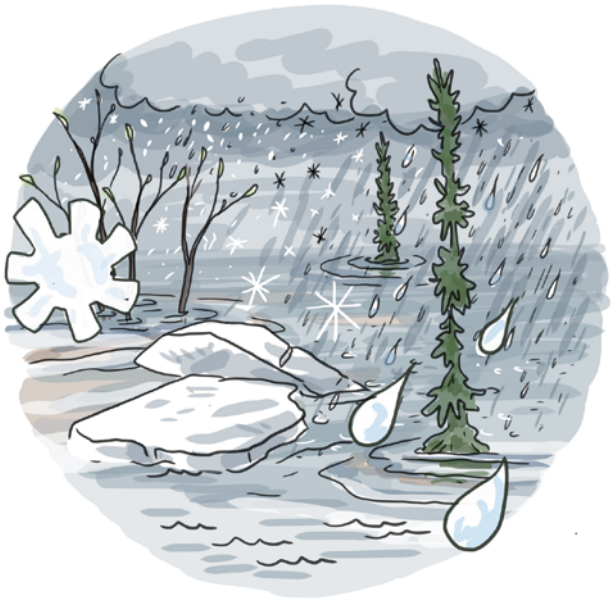
More information

Enhanced inventories of existing ecosystems may aid in modelling future environments. The GNWT has a network of permanent sampling plots which are monitored to detect ecosystem change.

The GNWT has undertaken a climate change vulnerability assessment of NWT species at risk. Vulnerabilities identified from this work can provide guidance for future conservation, management, and adaptation planning decisions and inform where future research and monitoring should occur.

For more information on invasive species, vegetation and wildlife in the NWT, see:

- ***NWT Council on Invasive Species, Pests, and Pathogens (nwtcispp.ca).***
- ***State of Vegetation | Environment and Climate Change (gov.nt.ca)***
- ***State of Wildlife | Environment and Climate Change (gov.nt.ca)***
- ***Community Based Monitoring of Salmon in the Arctic.***



6.3 Fresh Water changes

"I live in Old Town Hay River and have been evacuated a few times but that comes with living on a flood plain, however. The spring flow rate on the Hay River were above record levels the last two years."

"In our community there is either too much water or too little water."

"Very unpredictable water levels. Often very low water, very dry conditions."

"The longer, dryer summers are concerning. The stronger storms too."

Participants' quotes

What is hydrology, and what hazards do they refer to?

Hydrology is the science of the movement of fresh water across land, rivers, and lakes. Hydrology hazards are generally defined to include extreme events associated with the movement of water, such as flooding and drought.

Flooding occurs when a riverbank is no longer able to hold the volume of water moving through the river. Most flooding in the NWT occurs as a result of ice-jam floods. Ice jams typically occur on northern flowing rivers, where ice first breaks up on the southern part of the river. River ice then flows north, where it encounters solid ice and the ice chunks pile up behind the solid ice, forming an ice jam. This ice jam prevents the flow of water down the river and raises water levels upstream. Ice-jam floods have been reported on the Hay River (Town of Hay River, K'atlodeeche First Nation), Liard River (Fort Liard), Island River (Sambaa K'e), Mackenzie River (Jean Marie River, Fort Simpson, Fort Good Hope, Aklavik), Great Bear River (Tulita), and Peel River (Fort McPherson).

In many other locations in Canada, flooding is caused by extreme rainfall or rapid snowmelt. This type of flooding

is relatively rare in the NWT; however, it has occurred in Nahanni Butte when rainfall and/or snowmelt rapidly raised the water level on the South Nahanni River at the same time that water levels on the Liard River were high.

Drought occurs when there is more evaporation than precipitation (either rain or snow) over a given time period. Drought conditions result in lower water levels in rivers and lakes and create conditions that are favourable for forest fires. These conditions may impact navigation on waterways and can prevent boats and barges from reaching communities that are dependent on them.

Water quality can also be affected by climate change in a variety of ways including by flooding and drought, changing groundwater flow regimes, and landscape disturbances such as forest fires, landslides and permafrost thaw slumps.

Current trends and observations

There are limited long-term observational records of precipitation (combined total of rain and snow) in the NWT, which makes it difficult to assess if total annual precipitation is changing. There are no trends in the amount of water flowing through large rivers (Slave, Mackenzie, Liard) in the NWT, however many smaller rivers and creeks have shown small increases over the last 40 years.

There is great year-to-year variability in precipitation, and this variability has been even more extreme in recent years. This has resulted in both record high and record low water levels on Great Slave Lake over the past five years, as well as on rivers within the Great Slave Lake basin and downstream of Great Slave Lake. The high-water levels were a contributing factor to flooding events in 2021 and 2022 and the low water levels resulted in navigation challenges on the Mackenzie River in 2023 and 2024. Climate change projections have been predicting an increase in extreme events, which is consistent with what has been observed over the past five years.

Although there have been many flooding events in the NWT over the past few years, there is no long-term trend of increasing flood events. Ice-jam floods are dependent on a number of factors, including existing water levels, snowpack volume, winter temperatures and ice thickness, and the timing of snowmelt and ice break up. Climate change is projected to impact each of these factors differently and there is no consensus on how the frequency of ice-jam floods will change in the future.

Water quality has also been affected. Turbidity, which is a measure of suspended sediment or 'muddiness' of the water, is increasing in the Slave, Liard, Peel, and part of the Mackenzie River. Conversely, turbidity is decreasing on the Hay, Great Bear Lockhart, and southern Mackenzie River.

Amounts of dissolved carbon in the water has also been observed to be changing over time. Dissolved carbon has been found to be increasing at all measuring sites across the territory. These increases are likely due to an increase in algae in the water or expansion of wetlands as permafrost thaws.

Hydrology outlook with climate change

Climate models predict a general increase in total precipitation (rain and snow) in the NWT, and a higher percentage of precipitation falling as rain due to warming temperatures and a shorter winter period. It is predicted that the total amount of water flowing through rivers in the NWT will increase in the future, however the seasonality of these flows will also change. For example, there will be more water available in the spring and early summer, but possibly less in the mid-to-late summer. These studies use hydrological and climate models to predict how the environment will change. This work shows how

general trends will change (i.e. averages) over the next 50 years, but there is uncertainty about how individual extreme events (such as flooding and droughts) may unfold. More research is needed to identify how climate change will affect the hydrology of northern rivers and lakes, and how feedback between changing permafrost and vegetation will impact the water cycle.

Examples of potential priorities for future research and monitoring

- Research the impacts of changing hydrological conditions, including seasonal variations and long-term trends.
- Monitor the quality and chemistry of fresh water, including contamination, turbidity, and other metrics, as well as the impacts on aquatic ecosystems.
- Study how changing hydrological regimes will impact the timing and seasonality of streamflow in the NWT.

Data limitations

It should be noted that in northern regions such as the NWT, data from climate and hydrometric (i.e. water level and flow) monitoring stations are sparse. Climate models depend on simulating atmospheric functions, but the atmosphere is a very complex system – especially in the North. Climate models tend to work the best in areas where there are a lot of data that can be used to 'tune' (or 'calibrate') the model. With limited long-term observational datasets, there is a lot more uncertainty about how well models will predict a system.

The GNWT partners with the Water Survey of Canada to monitor streamflow and water levels in the NWT

More information

For more information on hydrology changes, see:

- ***NWT State of the Environment Report — Section 11: Water. (2021)***

6.4 Marine and coastal changes

What are marine and coastal hazards?

Along the Beaufort Sea shoreline of the northern NWT there are many coastal hazards. For example, both sea level rise and coastal erosion are prominent processes along the northern coastline, which act to cause coastline retreat. These processes can damage infrastructure and cultural sites along the coast. Decreasing sea ice can impede the ability to travel across the ice, but also provide the opportunity for increased shipping. Storm surge occurs when winds and changes in atmospheric pressure push seawater onshore. Storm surges can be magnified by sea level rise and decreasing sea ice, as well as by changes in storm frequency. As carbon dioxide increases in the atmosphere, it is absorbed by sea water, resulting in the seawater becoming more acidic and harmful to marine life. Many of these coastal hazards occur slowly, such as sea level rise and ocean acidification, while others occur rapidly over a short period of time, such as coastal erosion and storm surges.

Past trends and observations

Arctic sea ice has been decreasing since it has started being tracked extensively by satellites in the 1970s. Less sea ice means that there is a longer annual period where waves and storms can erode the coast. As sea ice declines in response to warming Arctic temperatures, the ocean becomes darker since water is darker than ice, absorbing more heat (dark material absorbs more heat than light material), causing further warming in a positive feedback loop. Additionally, cold Arctic waters absorb carbon dioxide at a greater rate than warm water, and longer ice-free seasons allow for a longer period of absorption of carbon dioxide by Arctic Ocean waters. Thus, from 2003-2007, ocean acidification increased in the Beaufort Sea at 10 times the rate of other oceans.[3]

Sea level has been increasing at Tuktoyaktuk by about three mm per year. Much of the coast is made up of ice-rich permafrost, leaving it vulnerable to rapid coastal erosion if exposed to waves of warm seawater. Much of the coastline has already been rapidly eroding, including in Tuktoyaktuk where coastal erosion has forced the relocation of numerous buildings.

Future outlook with climate change

With climate change we expect warmer temperatures and less sea ice in the Beaufort Sea. Sea level in the Beaufort Sea may o rise by up to 40 cm by 2050[8] (**Figure 2**). Presently during the winter coastal areas are protected from storm surge by sea ice which acts as a lid sealing in the sea water. With less sea ice, increasing storm surge will damage ecosystems and infrastructure over a larger portion of the year. Additionally, permafrost currently acts as the glue holding the shoreline together, and as permafrost thaws, we expect coastal erosion to increase. The amount of coastal erosion may be amplified by sea level rise, larger waves, and storm surge.

Zooplankton such as sea snails have shells which may be damaged by increasing ocean acidification. This is important as such species are near the base of the food chain, thus potentially having a significant impact on higher levels of the food chain such as fish, marine mammals and land mammals. This may adversely impact the traditional foods important for Indigenous peoples.

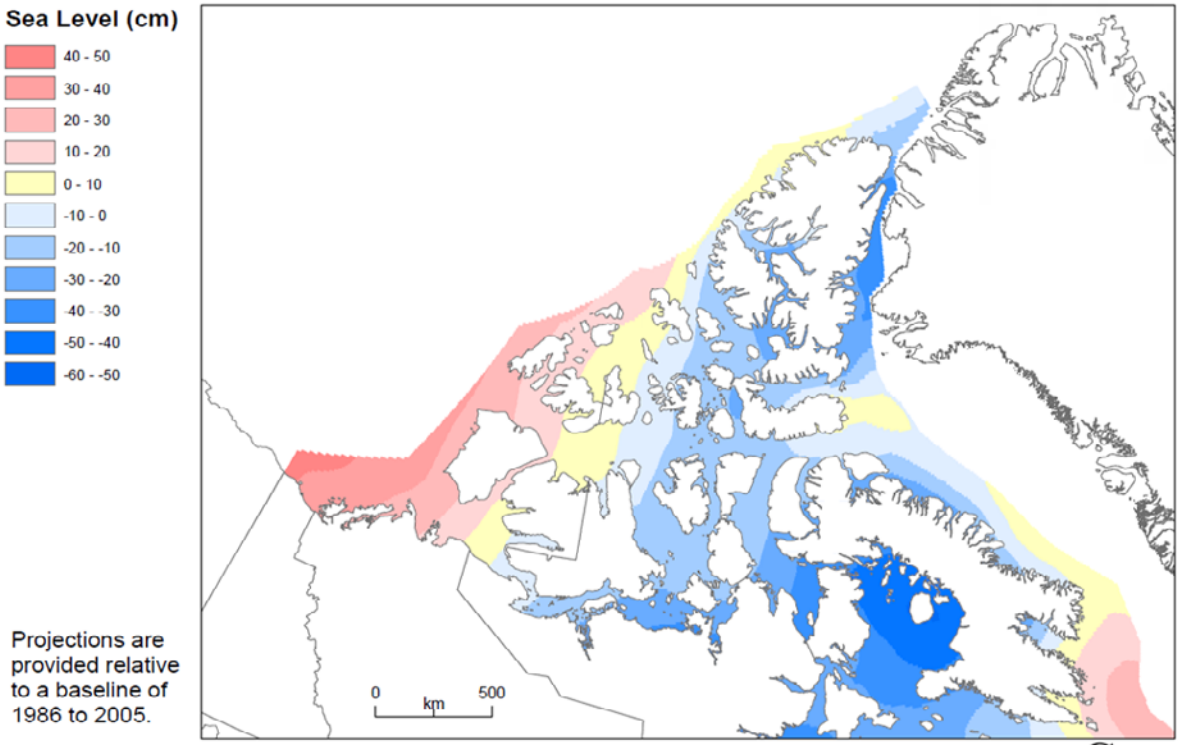


Figure 2: Sea level change projection for the north coast of Canada, at 0.1° latitude and longitude resolution, for the high emissions scenario (RCP 8.5) for the year 2050 for the median of sea level projection data.[9]

[8] The rate of sea level rise is increasing over time. The sea level rise at a given location is due to the combined effect of several factors including the increase in melt of glaciers, thermal expansion of sea water, the movement of the surface of the earth and the distance from glaciers. Tuktoyaktuk is sinking at about 1 mm a year and the thermal expansion of sea water is increasing with temperature.

[9] James, T.S., Robin, C., Henton, J.A., and Craymer, M., 2021. Relative sea-level projections for Canada based on the IPCC Fifth Assessment Report and the NAD83v70VG national crustal velocity model; Geological Survey of Canada, Open File 8764, 1 .zip file, ***https://doi.org/10.4095/327878***

Monitoring and data limitations

While sea ice extent can be measured using satellites, there is only limited monitoring of sea level rise, coastal erosion, and ocean acidification in the Beaufort Sea. Increased monitoring would support adaptation by providing site-specific information on rates of change.

Examples of potential priorities for future research and monitoring

- Enhanced monitoring and modelling of coastal erosion.
- Enhanced monitoring and modelling of tides to support sea level rise projections, determine the vulnerability of coastal infrastructure to sea level rise, and support safe marine transportation.
- Enhanced bathymetric measurements (which map the sea floor) in the ocean to support marine transportation in a changing arctic with decreasing ice and enhanced sediment movement due to coastal erosion.

More information

For more information, see:

- ***NWT State of Environment Report – Land and Ocean***

6.5 Wildfire

"It seems to be more wildfires and longer wildfire seasons."

Participants' quotes

Wildfire hazard

Wildfires are part of a natural cycle of burn and regrowth that drives forest ecosystem renewal and regeneration. This cycle has maintained forest health and diversity for many thousands of years across the entire North American Boreal Forest, which extends across Canada and covers a large portion of the NWT. Factors that affect the likelihood of forest fire occurrence and its intensity include weather conditions (e.g. air temperature, humidity, rainfall, wind), types, abundance, and flammability of trees and other vegetation, and characteristics of terrain. Hot, dry, and windy conditions are most favourable to wildfires, and these conditions can also create a high likelihood of high-intensity fires. In the NWT, around 89.5% of wildfires are ignited by lightning and 10.5% are human-caused.

Current trends and observations

Since 1969, the NWT experienced an average of 248 wildfires every year, usually during the summer months. The average area burned is 0.6 million hectares, although the number and extent of wildfires can vary greatly depending on precipitation. The number of fires and area burned can be much higher in dry years, and very low in wet years. NWT experienced extremely severe wildfire seasons in 2014 and 2023, including preceding and following seasons, due to severe drought conditions and extreme dryness of surface fuels, tree crowns, and the entire forest canopy.

In 2023, there were 307 fires, which is close to the 1969-2023 average. However, fires in 2023 were substantially larger in size, burning a total of 3.5 million hectares, or 4% of NWT forest lands. This resulted in the evacuation of 12 communities,

including the capital of Yellowknife, with over two-thirds of the population of NWT being evacuated in the summer of 2023. The 2023 wildfires were largely driven by wind event conditions combined with extreme flammability of crown/live fuel caused by severe second-year drought. The wildfires resulted in extreme amounts of smoke (**Figure 3** and **Figure 4**) impacting air quality and health across the territory.

Additionally, a considerable amount of stored carbon was released into the atmosphere. In contrast, the 2018- 2021 fire seasons were calm due to high amounts of precipitation, resulting in the annual number of fires and area burned being substantially below average. During wet and low fire years, some carbon is sequestered back from the atmosphere by forest ecosystems. However, it may take many years before all carbon released during an extreme fire year is fully recovered.

Figure 3: Extreme smoke in Yellowknife on the morning of Sept 23, 2023. Photo courtesy ECC – B. Sieben.

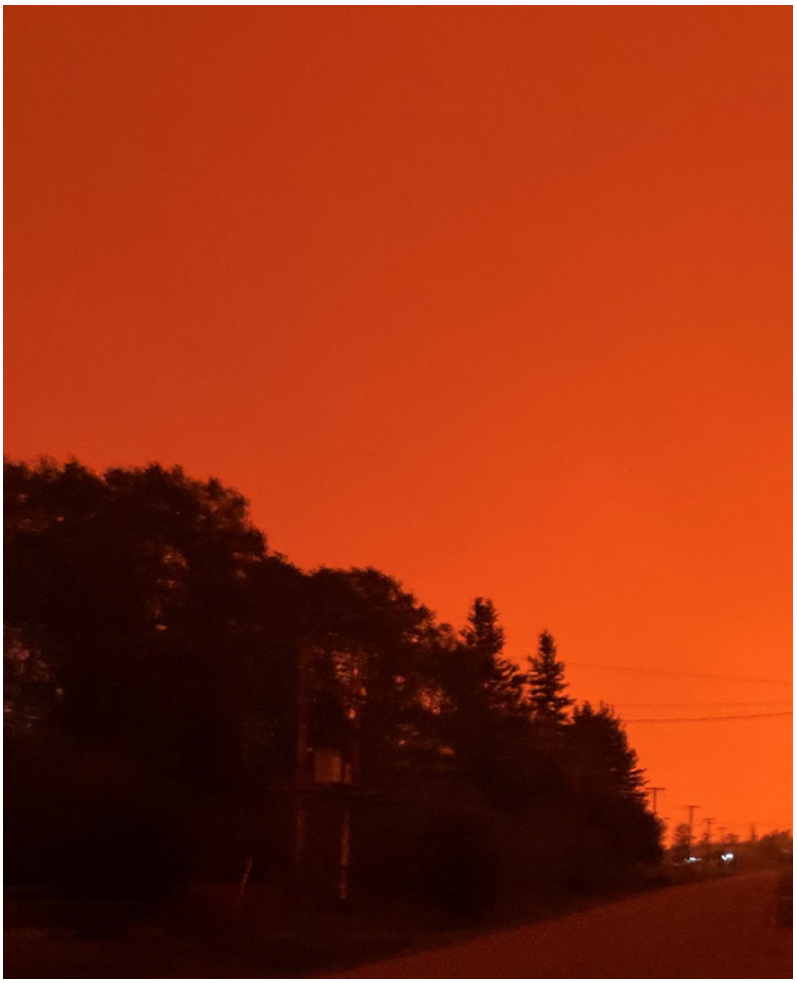


Figure 4: Gusting winds carrying particles of ash and flames-illuminated in red full-sky smoke cover creating a midnight-like darkness at afternoon approximately 3:30 PM. These conditions persisted from 2:30 PM until end of the day of 13 August 2023 in Fort Smith, NWT; fire-darkness was gradually replaced by night-time darkness with no more sunlight that day. At the time the picture was taken, the firestorm is passing the Salt Mountain area and approaching Fort Smith from the West with a speed of up to 15 km per hour, or quarter of a kilometer per minute (250 m/min) resulting in a 60 km advance in only four hours. Image by Oleg Melnik, Fire Operations FMD ECC GNWT

Future outlook with climate change

Wildfire modelling research suggests that wildfires may increase in the boreal forest due to climate change. Additionally, some models suggest that it may become too dry for coniferous forests in the southern NWT, where some part of these ecosystems may become grasslands and mixed wood forests. Forests in these areas may be drought stressed and become vulnerable to insects, diseases, and wildfire. If the summers of 2014 and 2023 can be used as an indicator of the future, it can be expected that air quality will decrease due to an increase in forest fires. However, until more extreme wildfire events occur over a few more decades to get a reliable temporal comparison, we cannot be certain of these trends. From 1969 to 2023, wildfire activity did not show a substantial change: there was a slight increase in total area burned and decrease in number of fires. Additionally, changes in wildfire and smoke release are just predictions suggested by climate models for now, and, if these changes occur in the future, they may be compensated by the potential

transition of coniferous forests to less flammable and less smoke producing grasslands and mixed wood forests.

Examples of potential priorities for future research and monitoring

- Research trends and patterns of wildfires in the NWT, including their causes and impacts on ecosystems and communities.
- Understanding the changing wildfire regime and potential implications for NWT residents and communities, including economic, cultural, and mental health aspects of wildfire impacts.
- Monitor wildfire activity, including fire frequency, size, severity, and intensity.

Data limitations

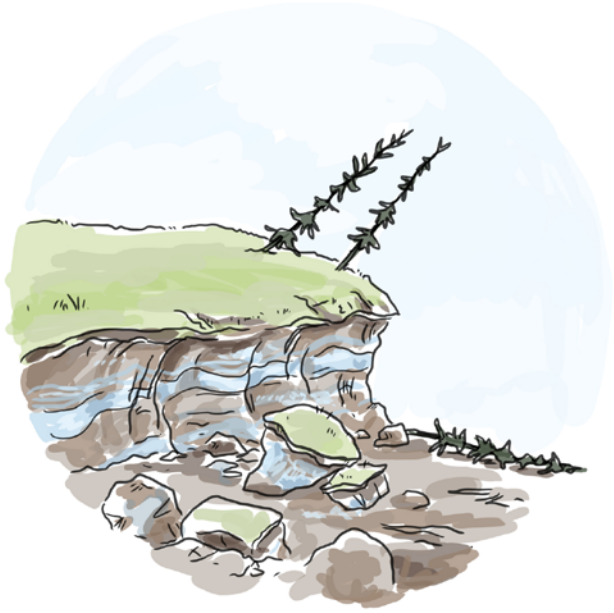
More studies are needed to investigate the main factors contributing to the 2014 and 2023 extreme wildfire seasons in the NWT. These factors may include the extreme record drought conditions experienced in those years (likely linked to climate change and variability including climate patterns such as El Niño). Some of these factors may also be related to growing human disturbance such as an increase in human-caused ignitions and a landscape-scale excess accumulation of forest biomass and therefore fuel accumulation. This accumulation of forest fuels resulted from many decades of fire suppression and corresponding decline in wildfire activity and natural rates of forest renewal by fire.

Fire suppression has caused an artificial decrease in annual area burned that resulted in a shift to older forests and a corresponding landscape-scale increase in the amounts of fuel available on the land; younger, less-flammable natural forests were replaced by older, fuel-richer, less stable, and more flammable forests. Abnormally high amounts of forest fuel in areas traditionally affected by fire suppression, combined with extreme fire-weather conditions and second-year drought likely exacerbated by climate change, likely resulted in the 2023 NWT catastrophic wildfire events.

More information

For more information on wildfires, see:

- NWT ***State of the Environment Report - Annual Area Burned by Wildfire***



6.6 Permafrost thaw

"With rising temperatures, living in the Sahtú, the colder weather comes a bit later, then it is really cold, this impacts permafrost that is melting causing the riverbanks to erode."

Participant's quote

What is permafrost and what hazards does it cause?

Permafrost is defined as ground that is at or below 0°C for two or more consecutive years. Permafrost is prevalent throughout the NWT. While it is continuous in the northern NWT, it is discontinuous (partial coverage of permafrost) or sporadic (only pockets of permafrost) in the southern NWT (**Figure 5**). Permafrost distribution is dictated by ground temperature, which is affected by localized conditions such as air temperature, the presence or absence of vegetation, the type of soil, water bodies, and the amount of snow in winter. This means that permafrost in different areas is reacting differently to changing conditions; while some areas are thawing, others may be static or even growing. In general, however, due to increasing overall air temperatures in the North, permafrost is warming and thawing.

Due to the pervasiveness of permafrost in the NWT, and the fact that most of it is warming and thawing, impacts are widespread. Where permafrost thaws, the landscape is altered topographically (some areas sink and cause irregular terrain) and hydrologically (changes in surface water and groundwater flows affect water quantity and quality). The thaw of ice-rich permafrost on hills can result in landslides, including thaw slumps. Permafrost thaw can result in shifting ground conditions impacting travel on the land, such as roads, runways and snowmobile trails (Appendix Figure B).

Thawing of permafrost that contains high amounts of ground ice will cause the ground to sink more than thawing of ice-poor permafrost. Permafrost that has a high ice content is therefore more susceptible to causing impacts due to climate warming.

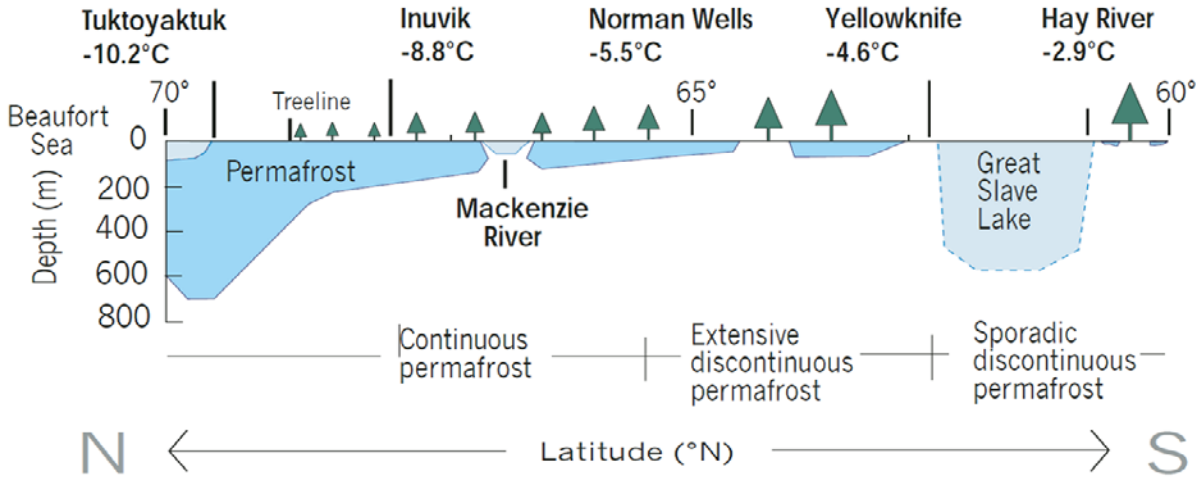
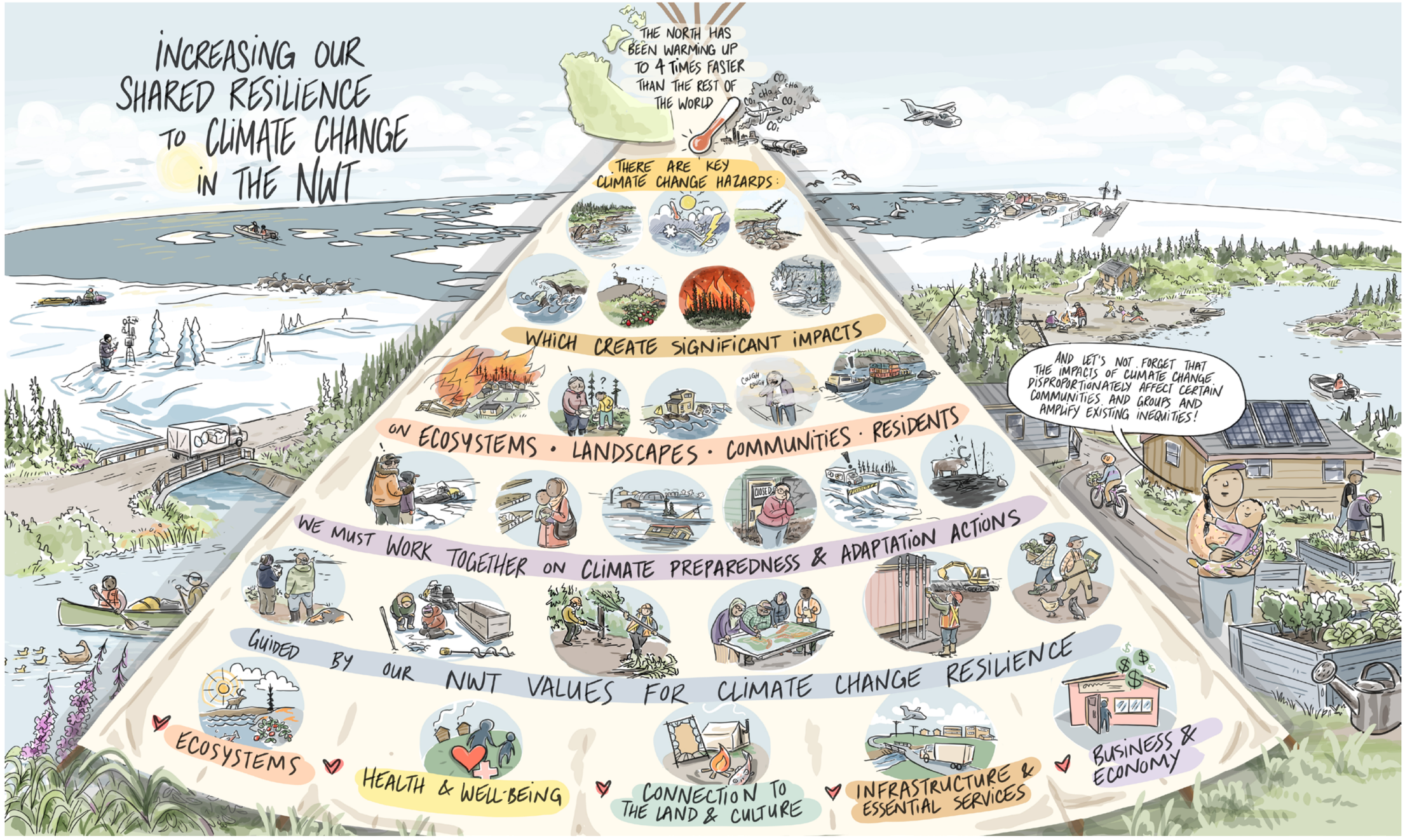


Figure 5. Air temperatures and permafrost distribution by latitude in the NWT.[10]

Figure 6. Dip in the Inuvik Airport runway caused by permafrost thaw. Source GNWT.

[10] Modified from Wolfe (1998). Wolfe, S. 1998 Living with Frozen Ground. A field guide to permafrost in Yellowknife, Northwest Territories. Geological Survey of Canada Miscellaneous Report 64. Natural Resources Canada. Ottawa. 71 p.


INCREASING OUR SHARED RESILIENCE TO CLIMATE CHANGE IN THE NWT
THE NORTH HAS BEEN WARMING UP TO 4 TIMES FASTER THAN THE REST OF THE WORLD
THERE ARE KEY CLIMATE CHANGE HAZARDS:
WHICH CREATE SIGNIFICANT IMPACTS
ON ECOSYSTEMS · LANDSCAPES · COMMUNITIES · RESIDENTS
WE MUST WORK TOGETHER ON CLIMATE PREPAREDNESS & ADAPTATION ACTIONS
GUIDED BY OUR NWT VALUES FOR CLIMATE CHANGE RESILIENCE
ECOSYSTEMS
HEALTH & WELL-BEING
CONNECTION TO THE LAND & CULTURE
INFRASTRUCTURE & ESSENTIAL SERVICES
BUSINESS & ECONOMY
AND LET'S NOT FORGET THAT THE IMPACTS OF CLIMATE CHANGE DISPROPORTIONATELY AFFECT CERTAIN COMMUNITIES AND GROUPS AND AMPLIFY EXISTING INEQUITIES!
COUGH COUGH
CLOSED

Current trends and observations

Current observations show that ground temperatures are rising, resulting in permafrost thaw and an increase in the thickness of the active layer (the top layer of soil that seasonally thaws above the permafrost). This thaw is already having impacts on communities. Locals talk about difficulties travelling on the land due to undulating terrain, while roads, airport runways, and buildings are currently being affected in numerous communities (**Appendix Figure E**).

Future outlook with climate change

As temperatures continue to rise due to climate change, permafrost warming and thaw is expected to continue throughout the NWT. Eventually permafrost may disappear entirely in southern NWT, and while permafrost likely won't disappear in northern NWT, the active layer will become thicker. Ice-rich permafrost will be susceptible to thawing, leading to sinking of the land and hillslope failures. These changes will likely have a profound impact on the landscape. There may be changes in ecosystems as groundwater flow is affected by the disappearance of permafrost, potentially altering lakes, rivers, wetlands, and vegetation. Damage to infrastructure will be an ongoing issue as permafrost continues to thaw.

Data limitations

Detailed permafrost mapping is not currently available in much of the NWT. The NWT Geological Survey (NTGS) is working to fill this gap by mapping permafrost landforms and thaw sensitivity across the entire territory, as well as implementing permafrost mapping and monitoring in more detail in and around communities. Information provided by this project will improve our understanding of the prevalence, distribution, and change to permafrost landforms in the NWT. More information on the permafrost mapping project can be seen in this ***GNWT video***.

The Geological Survey of Canada (GSC) has been measuring ground temperatures in the Mackenzie Valley since the 1970s. The NTGS, GSC and additional partners support a ground temperature monitoring network with a focus on key terrain types in multiple regions. Ground temperature data will be housed in the new Northwest Territories Permafrost Database.

Examples of priorities for future research and monitoring

- Improve climate and ground temperature monitoring, including a network of representative locations in and around communities, including active layer depth, temperature changes, and ground settlement.
- Identify thaw-sensitive terrain and anticipate permafrost thaw and impacts across natural and non-natural environments.
- Hazard maps including permafrost mapping for communities, and better data to develop those maps

More information

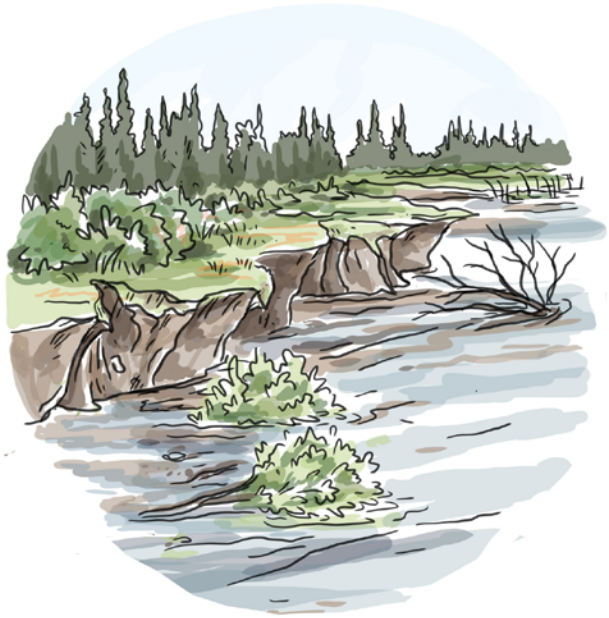
For more information on permafrost research and the impacts on northern communities see the permafrost story maps:

- ***The Frozen Ground of the Far North is Thawing: Studying permafrost thaw, and what it means for Arctic communities and global climate change*** (Woodwell Climate Research Center)
- ***Rivers of Change***: Thawing permafrost is changing the land and water of northwestern Canada (NTGS, Carleton University and additional collaborators)

For more information on the PermafrostNet research collaborative see:

- ***NSERC PermafrostNet***

NWT ***State of Environment Report -13-Permafrost***



6.7 River erosion

What is river erosion?

Riverbank erosion is the process of removal of riverbank material over time, through either widening of a river or the changing course of a river over time (meandering). As shown in **Figure 7**, the rates of riverbank erosion in northern rivers are controlled by a variety of processes which are either terrestrial (land based), atmospheric, or fluvial (within the river). River erosion is a concern as erosion can impact communities, infrastructure, places of cultural significance, aquatic ecosystems and water quality.

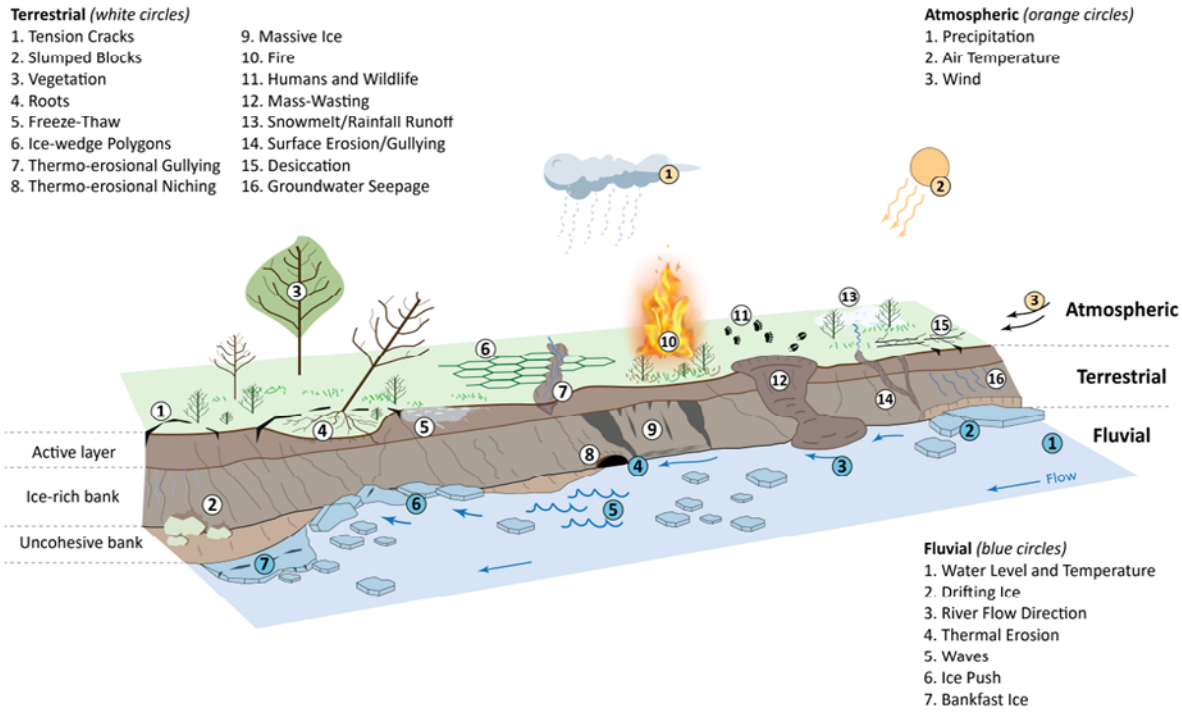


Figure 7: Summary of processes that control riverbank erosion in northern Rivers. Source: Beel (2024).

Current trends and observations

While rivers always change over time, there is genuine concern that climate change will increase the impacts of river erosion in communities. However, there is currently no concrete evidence that the rate of river erosion in the NWT is increasing. This is likely due to a lack of research and monitoring documenting this trend. There are some processes that can be expected to increase river erosion in northern regions. Primarily, warming temperatures cause permafrost to thaw, potentially leading to more unstable riverbanks. Additionally, as the length of the ice-free season increases, so too does the period of time in each year that river erosion can occur.

The importance of terrestrial, fluvial and atmospheric processes shown in **Figure 7** are likely different in various regions of the NWT as different regions are experiencing different rates of climate change and have different physical and biological environments (different vegetation).

River erosion is a concern to NWT communities such as Fort Simpson (**Figure 8**). Communities have raised concerns about infrastructure and cultural sites such as cemeteries being impacted by river erosion.

Figure 8: Riverbank erosion in Fort Simpson. Photo courtesy of Brandon Buggins.

Future outlook with climate change

All the processes shown in **Figure 5** will be impacted by climate change. Hence, the impact of climate change on riverbank erosion will be site specific and hard to predict. The combined effect of many processes in each location will need to be considered to properly assess riverbank erosion. With climate change, temperatures are expected to continue increasing, resulting in increased permafrost thaw that may decrease the stability of the riverbanks. The magnitude and duration of stream flow will likely increase with climate change in northern regions of the NWT, leading to more bank erosion. Bank erosion could decrease in some areas as trees and shrubs move north with climate change, providing greater riverbank stability as

vegetation holds sediments together. The impact of climate change on woody debris and ice jams is complex and may change in upstream and downstream environments.

Data limitations

A barrier to understanding river erosion in the NWT is that there is no formal monitoring program and limited research specific to NWT river erosion. Once processes are better understood in different regions of the NWT, models could be developed to estimate river erosion under future climate conditions.

Examples of potential priorities for future research and monitoring

- Monitor river erosion rates primarily in communities adjacent to waterways to understand changing risks to infrastructure and cultural sites (e.g., cemeteries), but also elsewhere to understand water quality changes and other impacts.

More information

For more information on river erosion, see:

- River Erosion Literature Review completed by Beel (2024).

7. Next steps: Preparing and adapting to climate change together

"We need GNWT and federal governments at the table listening. … Communications is what's important and needed … to see who is doing what, who is engaging with who, who's talking to who. Without it, we're all second guessing ourselves – did we talk to the right people, did we get the right information out? It would help make sure the information is out there, and that we are we all on the same page. … Let's start sharing information."

"We have to work collaboratively to access funding."

Participants' quotes

The Assessment provides a shared picture of the most pressing climate change risks that NWT residents and communities are facing in the next five years. It is a roadmap that outlines shared climate change adaptation priorities, where better collaboration, coordination and pooling resources could lead to meaningful and impactful adaptation to and preparedness for a changing climate. Aligning adaptation priorities across the NWT will also be essential in securing the resources and capacity needed to implement these actions.

This will also be essential to work on paving the way to made-in-the-NWT adaptation pathways that address these shared priorities and shared values.

The GNWT will use this Assessment and will work closely with NWT partners and the public to identify and prioritize adaptation actions and measures it can lead and support by securing federal funding, coordinating work undertaken by different parties in different places, or by building capacity. For instance, the NWT's new Climate Change Action Plan will be informed by this Assessment. Similarly, the GNWT will also address data gaps identified in this Assessment to inform its monitoring plan.

Risks identified in the Assessment can also help better inform future sector-based risks assessments as well as an assessment and action plans at the NWT, regional, and community level.

Finally, to ensure the most concerning risks remain relevant and accurate, the GNWT will review the Assessment in five years from now to identify new priorities or confirm existing ones and update the assessment in 10 years time.

BOX 6. TO LEARN MORE ABOUT CLIMATE CHANGE AND CLIMATE CHANGE ADAPTATION IN THE NWT.

- The **NWT Climate Change Strategic Framework** and any associated Action Plan set the context for climate change action in the NWT and prioritizes the most needed action. (***www.gov.nt.ca***)

- **The Climate Atlas of Canada** (***climateatlas.ca***) combines climate science, mapping, and storytelling together with Indigenous Knowledges and community-based research and video to inspire awareness and action. There are many resources relevant to the NWT context.

- **Canada In a Changing Climate** is a series of reports by the Government of Canada provides a national assessment of how and why Canada's climate is changing; the impacts of these changes on our communities, environment, and economy; and how we are adapting. Reports cover different sectors and regions, including a regional perspective on Northern Canada. Reports can be accessed at: ***changingclimate.ca***.

- **For Our Future: Indigenous Resilience Report** (***changingclimate.ca/indigenous-resilience***): This report draws on Indigenous knowledge, perspectives and experiences to explore the multidimensional and intersecting aspects of climate change impacts and adaptation. This Indigenous-led report was released in 2024.

- **Learning more about Climate Change Action in the NWT:**

- **GNWT's climate change website** provides an overview of GNWT's key climate policies and programs: ***www.gov.nt.ca/ecc/en/services/climate-change***. You can find on the website:
- The *2030 NWT Climate Change Strategic Framework* provides the GNWT with a long-term comprehensive and coordinated response to climate change around three goals including
- The *2019-2023 Climate Change Action Plan* is the first of two five-year action plans to support the implementation of the 2030 NWT Climate Change Strategic Framework.
- The *Responding to Climate Change in the NWT Annual report 2022-2023* provides progress updates on specific actions the GNWT and its partners are working on to realize the vision outlined in the *2030 NWT Climate Change Strategic Framework*. This report highlights climate change action achievements during the 2022-23 fiscal year.

- **The NWT Climate Change Library** provides technical climate change information and can be accessed at: ***climatelibrary.ecc.gov.nt.ca***

- NWT Association of Communities' Climate Change Toolkit and Climate Change and Asset Management Toolkit provides a series of tools and resources often codeveloped with, or funded by the GNWT. They can be accessed at: ***nwtac.com/toolkits***.

Appendix A:
List of organizations engaged

Indigenous Governments and Organizations
Acho Dene Koe First Nation
Deh Gáh Got'ı̨ę First Nation
Dehcho First Nations
Délı̨nę Got'ı̨nę Government Denínu Kų́ę́
Dehcho First Nations
First Nation Fort Good Hope Guardians
Fort Providence Métis Council
Fort Resolution Métis Government
Fort Smith Métis Council
Fort Resolution Métis Council
Gwich'in Tribal Council
Hay River Métis Government Council
Hotìı ts'eeda
Kátł'odeeche First Nation
Łíídlı̨ų Kų́ę́ First Nation
Łutselk'e Dene First Nation
Inuvialuit Regional Corporation
North Slave Métis Alliance
Northwest Territory Métis Nation
Sahtú Renewable Resource Board
Sahtú Secretariat Inc.
Tłı̨chǫ Government
West Point First Nation
Yamoga Lands Corporation
K'asho Got'ine Lands Corporation
Yellowknives Dene First Nation

Regulatory, Non-Governmental
Inuvialuit Water Board
Mackenzie Valley Environmental Impact Review Board
Sahtú Land Use Planning Board
Sahtu Renewable Resources Board

Non-governmental organizations
Alternatives North
Ducks Unlimited
Ecology North
NWT Native Women's Association
Ocean Wise
Northwest Territories Association of Communities
NWT Agrifood Association
Native Women's Association of the NWT

Industry
BGC Engineering
Climaction Services Inc.
Ed Hoeve Consulting
Gonezu Energy
NWT Agri-Food Association
NWT Chamber of Mines
True North Weather Consulting Inc.
Ecofish
Climate Risk Institute

Academia
Wilfrid Laurier University
Aurora Research Institute
University of Waterloo
University of British Columbia
University of Alberta
Colorado State University
University of Massachusetts
University of Calgary
Carleton University
Memorial University
University of Ottawa
University of Montreal
University of Colorado

Federal government
Parks Canada
Canadian Forest Service, Natural Resources Canada
National Research Council
Fisheries and Oceans Canada
Geological Survey of Canada, Natural Resources Canada
Crown-Indigenous Relations and Northern Affairs Canada
Environment and Climate Change Canada

Community Governments Hamlet of Tulita Community Government of Whatì NWT Association of Communities and members Local Government Administrators of Northwest Territories	**Government of the Northwest Territories** Department of Education, Culture, and Employment Department of Environment and Climate Change Department of Finance (NWT Centre for Geomatics) Department of Health and Social Services Department of Infrastructure Department Industry, Tourism, and Investment Department of Municipal and Community Affairs NWT Housing Corporation
Other Groups/Agencies Climate Change Youth Advisory Group Government of Yukon NASA NWT Chamber of Mines	

Appendix B: List of scenarios

- A list of 37 climate change risks scenarios was developed, building on the seven climate hazard categories identified, engagement activities and literature review. A scenario describes a possible event in the future. These events are complex to anticipate they may or may not happen.
- The scenarios are meant to be high-level and may not impact in the same way every community in the territories.
- An asterisk (*) indicates scenarios with lower confidence levels. A lower level of confidence could be driven by the availability of historical climate data, uncertainty associated with the scenario, regional differences, likelihood scores, or weak consensus among subject-matter experts.
- During the scoring process, some scenarios were assigned a low confidence level due to lack of availability of environmental data, uncertainty associated with the scenario, regional differences, and/or weak consensus among participants. Climate modeling and local context lead to complex and unique interactions which make it difficult to assign a score at the territory-wide level.

ID	Scenario (An asterisk (*) indicates scenarios with lower confidence levels.)
1	Extreme heat waves pose health risks to people, particularly for vulnerable groups.
2	Increasing temperatures result in a northward shift and increased prevalence of invasive species, pests and pathogens and associated disease and illness.
3	Permafrost thaw impacts industrial sites (e.g., mining structures) that contain waste storage (e.g., tailings ponds). *
4	Warming winter temperatures shorten the operating season length of public and private winter roads and increase the costs of their operation and maintenance to ensure safe travel.
5	Increasing riverbank erosion impacts communities, infrastructure, ecosystems, and areas of cultural significance *
6	Longer growing season and warming temperatures (e.g., available heat units) increase agricultural opportunities (including crop and livestock production).
7	Extreme precipitation events result in widespread community flooding. *
8	Increased snow loads with heavier, wetter snow causes building failures and damages. *
9	High winds cause damages to energy infrastructure (generation, transmission, and distribution). *
10	Stronger and more variable high-winds pose risks to transportation infrastructure and buildings. *

ID	Scenario (An asterisk (*) indicates scenarios with lower confidence levels.)
11	Increased frequency of freezing rain events affects operation and maintenance of public and private transportation infrastructure and leads to more accidents. *
12	Prolonged drought conditions significantly reduce water levels and runoff rates in lakes, streams, rivers, and creeks (e.g., Great Bear and Great Slave Lake and Mackenzie River) which has impacts on ecosystems and access to critical services (hydroelectricity, barging supply, water intakes.
13	High winds and extreme weather increase health and safety risks, especially when traveling on the Land. *
14	Increasing frequency and intensity of wildfire disrupts wildlife and shifts habitat occurrence and spatial distribution. *
15	Large wildfires lead to poor air quality (prolonged period of PM2.5) resulting in health issues. *
16	Large wildfires damage or destroy critical and community infrastructure. *
17	Permafrost thaw and degradation impact on-the-land travel safety.
18	Permafrost thaws causes large-scale landscape changes, including thaw slumps, plateau shrinkage, landslides, soil and vegetation changes.
19	Permafrost thaw and ground subsidence increases the costs of maintaining public and private buildings (e.g., housing).
20	Permafrost thaw and ground subsidence damage transportation infrastructure (e.g., roads, runaways, barging/ferry launching platforms) and results in closures.
21	Permafrost thaw and degradation impact navigability of water ways through changes to shoreline stability, erosion, and sedimentation. *
22	Erosion damages coastal regions, including ecosystems, infrastructure, heritage sites and other places of cultural significance.
23	Permafrost thaw and degradation impact water quality (e.g. turbidity and heavy metals). *
24	Warming temperatures cause later freeze-up and early break up, changing sea and lake ice thickness, extent, coverage, duration, and location.
25	Sudden increase in winter temperatures results in rapid snowmelt and runoff or sudden ice break up, causing potential flood (freshet or ice-jam), with impacts on ecosystems, infrastructure and communities. *
26	Increasing air temperature impacts the health, availability, and distribution of plant species. *

ID	Scenario (An asterisk (*) indicates scenarios with lower confidence levels.)
27	Increasing air temperatures impact the movement, distribution, connectivity, and availability of wildlife species.
28	Increasing water temperatures in rivers and lakes adversely impact aquatic ecosystems and species (e.g., thermal tolerances of certain fish species is exceeded). *
29	Warming temperatures impact the accessibility, quality and availability of country foods and the timing of harvests. *
30	Unpredictable shifts in seasons impacts Indigenous culture and traditional way of life.
31	Drought conditions and low soil moisture impact tree growth and mortality.
32	Rapid ocean acidification alters marine ecosystems.
33	Warming climate conditions lead to a longer summer season, providing opportunities for economic development (e.g., tourism).
34	Increased sea level rise causes shoreline to move inland.
35	Increased rain on snow events causes ice lenses, reducing the ability of hooved animals (e.g., caribou) to obtain winter food.
36	Decreasing sea ice and sea level rise results in increased coastal erosion and flooding (e.g., potential for increased storm surges). *
37	Longer sea ice free seasons could increase ship traffic in NWT.

Appendix C:
Heat map for each value

The numbers shown on each risk map correspond with the scenario ID numbers presented in Appendix A.

Legend

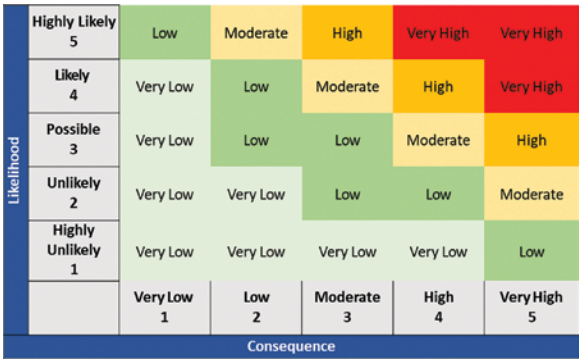
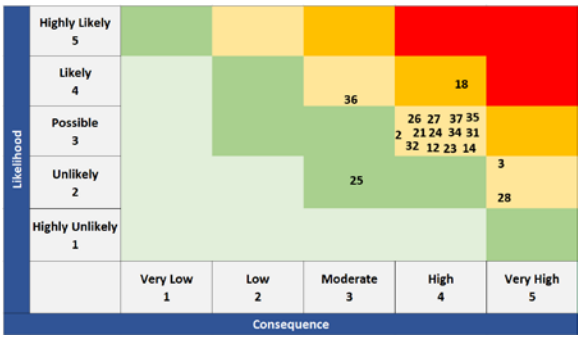


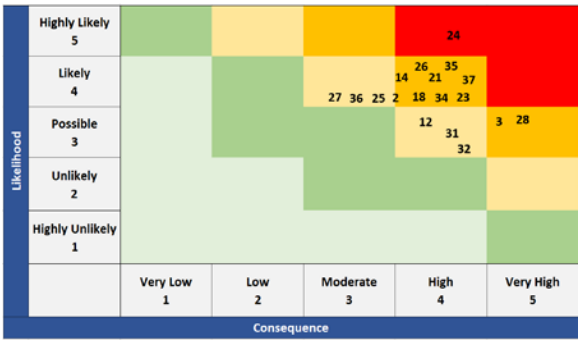
Figure 9: Risks and Opportunity Matrix Legend

Risk to ecosystems

Present time

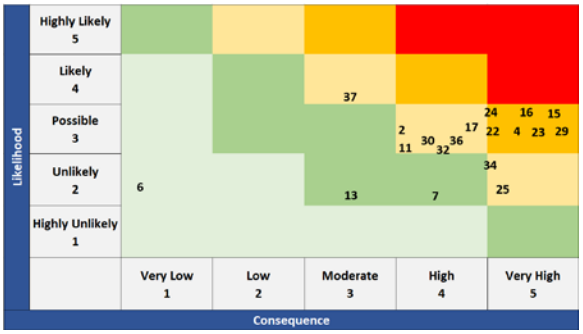


In 2040-2070

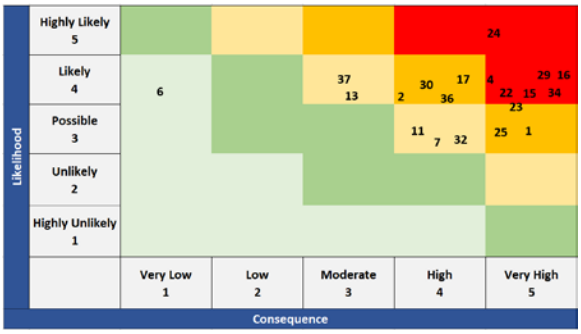


Risks to health and well-being

Present time

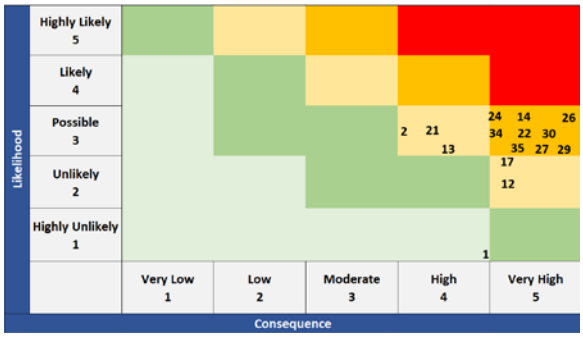


In 2040-2070

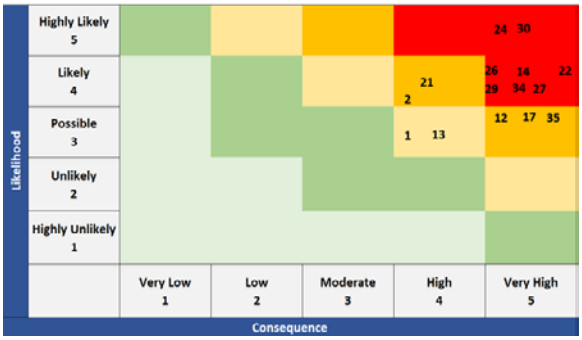


Risks to connection to the land and culture

Present time

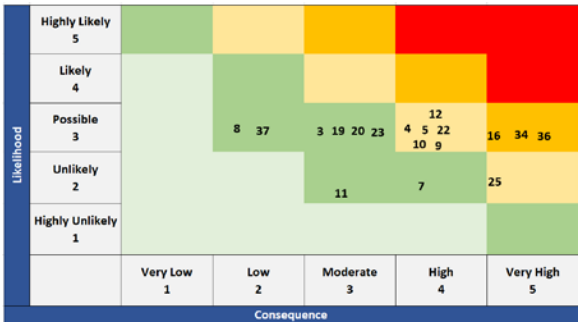


In 2040-2070

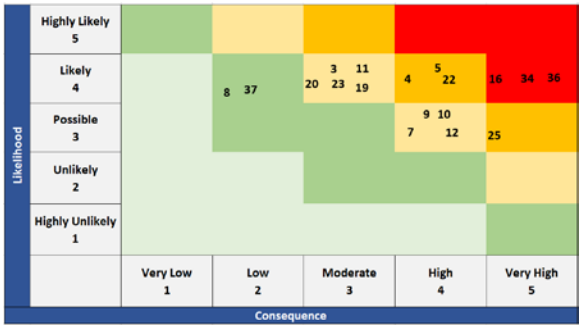


Risks to infrastructure and essential services

Present time

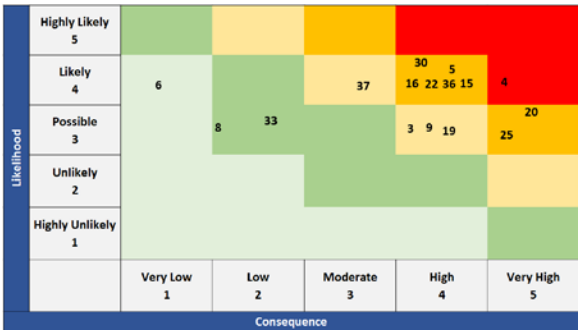


In 2040-2070

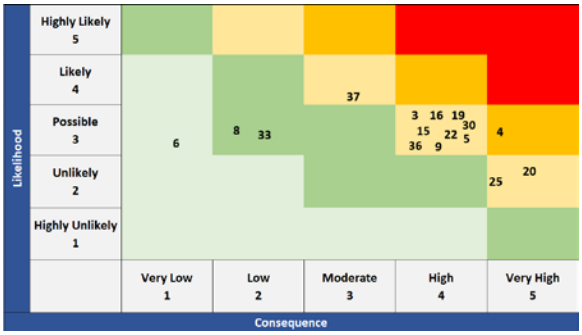


Risks to business and economy

Present time



In 2040-2070



Appendix D: Scoring criteria

A. Likelihood scoring criteria

Score	Rating	Criteria
N/A	**Not Applicable**	This scenario will not occur.
1	**Improbable**	This scenario is not likely to occur in timeframe under consideration.
2	**Remote**	This scenario may occur once per decade.
3	**Occasional**	This scenario is more likely than not to occur once per decade, may occur multiple times per decade.
4	**Probable**	This scenario is more likely than not to occur multiple times per decade, may occur annually.
5	**Very Likely**	This scenario is very likely to occur annually or have ongoing occurrences.

B. Consequence scoring criteria

Ecosystem (Land, Water, Wildlife)

Very Low	Low	Moderate	High	Very High
Ecosystems are not affected	Ecosystems remain strong, though ecosystem health is temporarily degraded / disrupted.	Ecosystems are strained for some regions and species; changes are likely reversible.	Ecosystem health is reduced for most regions and species. Recovery from impact is slow or largely irreversible.	Ecosystem(s) is degraded irreversibly. Important species decline significantly or are lost completely.

Health, Well-being, and Healthy Communities

Very Low	Low	Moderate	High	Very High
Mental and physical health and well-being of NWT residents is not affected. The distribution and availability of food supplies is unaffected. Food costs are unaffected. Access to country foods is unaffected.	Disruption to mental and physical health and well-being is localized. Impacts (e.g. feelings of fear and anxiety, injuries, illness, disease) are temporary and residents recover in a short period of time. Potential for a small number of accidents or injuries leading to hospitalizations. Limited, short-term disruption to the distribution and availability of food supplies. Food costs are marginally affected. Country foods are still relatively accessible however with some residents experiencing short-term challenges.	Disruption to mental and physical health and well-being is significant. Impacts (e.g. fear, anxiety, displacement, loss of identity, inter-generational trauma, PTSD, illness, injuries, diseases) for some, can be long-lasting. For others, the disruption is moderate. Moderate risk of injuries and accidents leading to hospitalization. Disruption to the distribution and availability of food supplies in a few communities is affected for extended periods of time. Food costs for basic items moderately increases. Access to country foods is challenging. For some residents, country food consumptions may change.	Disruptions to mental and physical health and well-being are widespread (i.e., whole community or multiple communities). Impacts (e.g. fear, anxiety, displacement, loss of identity, inter-generational trauma, PTSD, illness, injuries, diseases) for many are long-lasting. Significant risk of injuries and accidents leading to hospitalization. Significant and widespread disruptions to the distribution and availability of food supplies affects multiple communities and is prolonged. Basic items remain available but at a high cost. Residents experience significant increase in overall food costs. Access to country foods is significantly challenging. For some residents, consumption of country foods cannot by maintained.	Disruptions to mental and physical health and well-being are severe and widespread (i.e. whole communities). Impacts (e.g. fear, anxiety, displacement, loss of identity, inter-generational trauma, PTSD, illness, injuries, diseases) for a significant portion of residents are long-lasting. Significant risk of injuries and accidents leading to hospitalization and fatalities. Severe and widespread disruptions to the distribution and availability of food supplies, including for basic items. Resident experience significant increase in food costs. NWT experiences significant increases in food insecure households. Access to and consumption of country foods no longer possible for many residents.

Connection to the Land and Culture

Very Low	Low	Moderate	High	Very High
Ability to maintain culture, knowledge transfer and learning is not affected. Residents' ability to access the land safely for harvesting, cultural and recreational purposes is not affected.	Ability to maintain culture, knowledge transfer, and learning is increasingly challenging but NWT residents can carry on many important aspects of on-the-land practices and cultural activities and knowledge transfer. Residents' ability to access the land safely for harvesting, cultural, and recreational purposes is increasingly challenging and a concern. Ability to access important places or activities may be delayed for a short period of time.	Ability to maintain culture, knowledge transfer, and learning is challenging. For some residents, many aspects of on-the land practices and cultural activities and knowledge transfer change. Residents' ability to access the land safely for harvesting, cultural, and recreational purposes is challenging and a significant concern. Ability to access important places or activities is often delayed for a longer period of time.	Ability to maintain culture, knowledge transfer, and learning is significantly challenging. For many residents, important aspects of on-the land practices and cultural activities and knowledge transfer are limited or cannot be maintained. Residents' ability to access the land safely for harvesting, cultural, and recreational purposes is significantly challenging and concerning. Ability to access important places or activities is often delayed for an unknown, longer period of time.	Ability to maintain culture, knowledge transfer, and learning is changed significantly. Many important aspects are completely lost. Residents' ability to access the land safely for harvesting, cultural, and recreational purposes is severely challenging and concerning. Ability to access important places or activities is significantly limited or no longer possible. Many residents no longer unable to access important traditional place(s).

Infrastructure and Access to Essential Services

Very Low	Low	Moderate	High	Very High
No or limited damage; no change in maintenance or repair costs, or lifespan of critical (water, energy, healthcare, schools, homes, buildings) infrastructure. No noticeable disruptions to the access of essential services or transportation. No or limited damage; no change in maintenance or repair costs, or lifespan of transportation infrastructure (roads, airports, ferries) and network.	Limited damage occurs or accumulates to critical infrastructure (water, energy, healthcare, schools, homes, buildings). Costs associated with repairs or replacements are manageable. Disruptions to the access of essential services are localized, very short in duration, and few residents and businesses are minimally affected. Limited damage occurs or accumulates to transportation infrastructure and network. Costs associated with repairs or replacements are manageable. Transportation disruptions are very short in duration and manageable.	Damage occurs or accumulates to critical infrastructure (water, energy, healthcare, schools, homes, buildings). Additional funding is required for repairs or replacements, affecting other budgets. Disruptions to the access of essential services moderately affect a small number of residents and businesses for a relatively short period of time. Some damage occurs or accumulates to transportation infrastructure and network. Additional funding is required for repairs or replacements, affecting other budgets. Transportation disruptions moderately affect a small number of residents and businesses for a relatively short period of time.	Significant damage occurs or accumulates to critical infrastructure (water, energy, healthcare, schools, homes, buildings). Repair, replacements costs are significant, requiring reallocation of funding, or new external funding. Short- to mid-term asset planning modified. Widespread, significant disruptions to access of essential services affects many residents and businesses in more than one community over a prolonged period of time. Community capacity to recover from the impact created by loss services is high but remains manageable. Significant damage occurs or accumulates to transportation infrastructure and network. Repair, replacements costs are significant, requiring reallocation of funding, or new external funding. Short- to mid-term planning modified. Transportation disruptions may be prolonged, affecting more residents and businesses (i.e., entire community). Costly alternative available.	Critical infrastructure severely damaged or destroyed (water, energy, healthcare, schools, homes, buildings). Repair, replacement costs are significant, requiring significant reallocation of, or new external funding. Funding for repair not always accessible. Changes to longer-term plans required to cope with damage/loss. Widespread, severe, and prolonged disruptions to essential services affect residents and business in many communities. In some cases, some communities experience a complete long-term prolonged loss of access to services. Community capacity to recover from the impact created by loss services is high but remains manageable. Transportation infrastructure destroyed. Significant reallocation of or new funding required. Funding for repair not always available. Changes to longer-term plans required to cope with loss. Transportation disruptions widespread (multiple communities) and prolonged with no alternative available.

Business and Economy

Very Low	Low	Moderate	High	Very High
Potential direct or indirect economic losses are marginal. Economy not affected. Economic losses not expected. Ability to generate livelihoods from traditional economies not affected. No apparent impacts or disruptions to territory's imports or supply chain.	Some sectors of the economy temporarily disrupted and impacts and losses short-term and can be easy to recover from. Ability to generate livelihood from traditional economies are temporarily disrupted but is short-term and manageable. Short-term impacts to territory's imports or supply chain are low.	Large sector of the economy is disrupted and strained. Some businesses and residents are challenged by economic losses (i.e., rising costs, employment). It is difficult but still doable for these sectors to fully recover. Ability to generate livelihoods from traditional economies is strained for some residents. Short-term impacts to territory's imports or supply chain with more costly alternate/ substitute inputs available.	Entire economy is significantly disrupted and strained. Businesses and residents are increasingly challenges by economic losses (i.e., rising costs, employment). Long-term viability, of some businesses or sectors, comes into question. Ability to generate livelihoods from traditional economies is strained for many residents. Moderate impacts to territory's imports or supply chain with limited alternate / substitute inputs available.	Entire economy is severely disrupted and strained. Most residents and businesses are affected by economic losses (i.e., rising costs, employment). Financial security of residents and viability businesses is compromised. Sustainability of some business or sectors is compromised. Long-term viability of generating livelihoods from traditional economies is compromised for most residents living from it. Longer-term impacts to territory's imports or supply chain, resulting in long lasting economic disruption.