EVERGREEN

PROGRESSING TO RESILIENCE:

A Climate Risk and Resilience Self-Assessment Tool for Communities

How to assess climate risks in your community
and adopt measurable actions to build resilience.

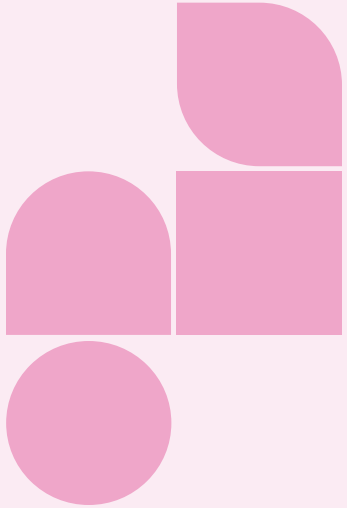
A toolkit created by the Community Solutions Network

Acknowledgement of Indigenous Lands and Treaties Across Canada

The sacred lands and waterways upon which Evergreen operates, and the built communities and cities across the country, are the traditional territories, homelands and nunangat of the respective First Nations, Métis Nations and Inuit who are the long-time stewards of these land. These lands are occupied lands and subject to inherent rights, covenants, treaties, and self-government agreements to peaceably share and care for the lands and resources across Turtle Island. These regions are still home to diverse Indigenous peoples, who are still fighting for their sovereign rights and tirelessly protecting their traditional territories. As uninvited guests who live and work on these lands, we have a responsibility to know the treaties that tie us together, advocate for Indigenous rights and commit to learning our responsibilities to each other.

Acknowledgements

This resource was created for the Community Solutions Network. This toolkit was created by Joshua Welch and Ismail Alimovski with support from Juan Rueda, Zoya Sodhi, Angela Parillo, Dipika Giritharan, Marielle Nicole, and Cheryl Gudz. We would also like to offer a special thanks to Laura McPhie for her valuable feedback in reviewing this document. It is supported by secondary research of relevant initiatives across Canada. We are grateful for the knowledge and experience of many experts in these fields who have inspired and informed this toolkit and all community members who have participated in our events through the Community Solutions Network program. The Community Solutions Network is supported through funding provided by Infrastructure Canada. The views expressed in this publication do not necessarily reflect those of the Government of Canada.



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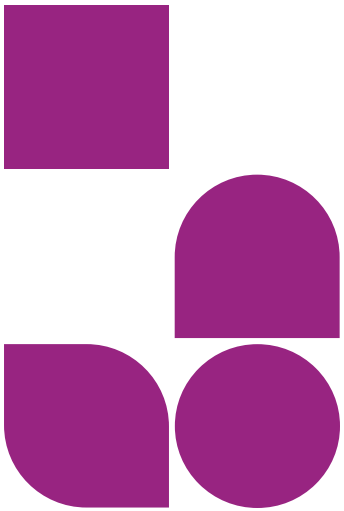


Preface

Communities across Canada are facing the very real impacts of *climate change* on a near-daily basis. Building and strengthening *climate resilience* in Canadian communities of all sizes will work to improve communities' health and wellbeing, strengthen the local economy and its workforce, and enhance nature and biodiversity ensuring the most vulnerable in our community are protected from the most direct impacts of climate change – climate-based disasters. Small communities, however, are at a disadvantage with limited fiscal resources, *human capacity*, integration of technology and data, community and political willingness and localized geography and climate which can limit the level of resilience and interventions that have or could take place.

This toolkit aims to provide communities with baseline information, assessments, and resources (online tools, guides, and funding opportunities) to help build resilience in their communities, today, tomorrow and in the future. This goal is focused on assessing the technology and data capacities of communities in their climate resilience journey. We recognize that the first step for many communities may be identifying climate vulnerabilities and increase *community resilience* which requires focus on all considerations and adaptation measures to climate change. These can include basic concepts and measures to new technologies and data approaches; this toolkit aims to provide both as considerations.

The Community Solutions Network is a program led by Evergreen in partnership with Open North. Our team works with communities to build capacity and improve the lives of residents using data and connected technology approaches. We deliver advisory services, workshops and online resources that focus on key areas such as climate resilience, data governance, inclusive public space, technology procurement and public engagement.
The Community Solutions Network is supported by funding from the Government of Canada.

Why this Toolkit

Communities across Canada are actively acting and working towards increasing resilience and adapting to the expected (and unexpected) future impacts of climate change. However, the steps, capacity, funding, and resources to act across the country are not equitably distributed across Canada. Many smaller Canadian communities lack the capacity, resources, subject matter experts, governance, or administrative ability to tackle complicated funding requirements, undertake resilience actions, implement community climate plans, have technical knowledge of new technology and/or understand the climate threats that could pose a risk to their community in the future.[1-2-3]

The need for capacity building, resources and climate data has never been higher. A recent study conducted by the Climate Risk Institute (2022), noted that among 53 municipalities in Ontario, over 50% did not have any capacity to work on *climate adaptation* or the responsibility was shared across several departments. On the other hand, communities with less than 25,000 residents had a total lack of capacity for adaptation or action implementation at any level.[4] These same respondents noted that *extreme weather events* and *climate disasters* were the primary drivers to improve adaptation and that the COVID-19 pandemic slowed down adaptation work in communities across the board.[5]

1 'Social Dimensions of Climate Change'. The World Bank. *https://www.worldbank.org/en/topic/social-dimensions-of-climate-change*.
2 'Climate change and 'left behind' neighbourhoods'2021. Oxford Consultants for Social Inclusion. *https://ocsi.uk/2021/12/06/climate-change-and-left-behind-neighbourhoods/*.
3 'Building climate-resilient rural communities' Rural Health Services Research Network of British Columbia. *https://storymaps.arcgis.com/stories/89e97ce2e9f3485cbb325a8c760e5c05*.
4 'Benchmarking Climate Change Adaptation Action in Ontario' 2022. Climate Risk Institute. *https://climateriskinstitute.ca/wp-content/uploads/2022/08/Summary-Benchmarking-Adaptation_CRI-August-2022.pdf*.

These hurdles and roadblocks are exacerbated for rural, remote and Indigenous communities, due not only to the previously mentioned factors but typically a stronger community dependence on the natural environment (economy, tourism, food production, etc.), which may be disrupted by climate change and its impacts.[6] Existing community vulnerabilities such as, food insecurity, access to safe water, remoteness, cost of living and access to infrastructure support may also contribute to existing factors. It is through a combination of measures from *grey and green infrastructure*, nature-based solutions, the use of new technologies and data approaches, and the creation and implementation of actionable plans that we can ensure all communities can benefit from increased climate change planning and resilience.

Climate adaptation is "the process of adjustment to actual or expected climate and its effects […] to moderate or avoid harm"[7] and describes the changes that can be made to thrive in a changing climate. An example of climate adaptation efforts includes investing in nature-based solutions to better manage and prepare for risks from natural hazards.

Climate resilience is "the capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, and learning and transformation."[8] An example of climate resilience is integrating climate risk assessments or vulnerability assessments to identify the likelihood of climate hazards and assess their impact on cities and communities.

5 'Benchmarking Climate Change Adaptation Action in Ontario' 2022. Climate Risk Institute. *https://climateriskinstitute.ca/wp-content/uploads/2022/08/Summary-Benchmarking-Adaptation_CRI-August-2022.pdf*.
6 'Building climate-resilient rural communities' Rural Health Services Research Network of British Columbia. *https://storymaps.arcgis.com/stories/89e97ce2e9f3485cbb325a8c760e5c05*.
7 Ibid.
8 Ibid.

Climate resilience, a warming world and not leaving communities behind.

2023 will go down as the hottest summer on record by a large margin across the world.[9] Natural disasters have crowded news headlines worldwide as the effects of climate change continue to increase with climate disasters impacting every corner of the planet. Canada faced record-breaking wildfires, as well as droughts, severe storms, and flooding throughout the country. Canada had its worst-ever wildfire season with over 15 million hectares burned (equalling 28 million football fields or 98.9 million National Hockey League-sized ice rinks) – 6 times the area burned of the 10-year average.[10-11] In a country like Canada that is expected to continue to warm at double the rate of the rest of the world[12] and climate impacts to worsen, it is imperative that all communities, regardless of size, location or resources, can work towards becoming more resilient.

Not all communities face the same impacts and threats.

Climate change does not look the same for every person, environment, and community across Canada (or the world), and certain geographic regions may see disproportionately more negative impacts than others. However, there are instances where some communities may see partial positive effects (when adaptation and preparation are done properly) like increased food production growing seasons due to reduced frost days in spring and extended warmer summer and fall.[13]

Taking climate resilience and adaptation steps, incorporating measures, approaches to increasing community resilience, municipal policies and utilizing technology to stay connected will help to alleviate future impacts on your community.

Community leaders need to understand that investment in climate resilience, adaptation and *resilient infrastructure* today has been found to yield significant economic, social, and environmental benefits.[14] Decisions like investing in future-proof resilient infrastructure in communities are modelled to save and benefit communities in the long run. Roughly, **every 1$ invested today in climate adaptation and resilient infrastructure will yield 4$ in increased community resilience, disaster mitigation and community benefits.** The Canadian Climate Institute highlights one Canadian example modelling the use of climate-resilient materials when maintaining and replacing roads which can reduce future heat and rainfall-related damage costs by up to 98 percent.[15]

9 'Summer 2023: he hottest on record' 2023. Copernicus Climate Change Service. *https://climate.copernicus.eu/summer-2023-hottest-record*.

10 'World on Fire: 2023 is Canada's worst wildfire season on record — and it's not over yet'(Carty, M.). 2023. CBC. *https://www.cbc.ca/radio/ideas/world-on-fire-canada-s-worst-wildfire-season-on-record-1.6946472*.

11 'Canada reports worst wildfire season on record — and there's more to come this fall' (Tasker. P.). 2023. CBC. *https://www.cbc.ca/news/politics/canada-wildfire-season-worst-ever-more-to-come-1.6934284*.

12 'Canada's climate is warming twice as fast as global average' 2019. Government of Canada – Environment and Climate Change Canada. *https://www.canada.ca/en/environment-climate-change/news/2019/04/canadas-climate-is-warming-twice-as-fast-as-global-average.html*.

13 'Growing Season' 2022. Government of Canada – Natural Resources Canada. *https://natural-resources.canada.ca/climate-change/climate-change-impacts-forests/forest-change-indicators/growing-season/18470*.

14 'Investing in resilience and making investments resilient' (Hallegatte, S. Li J.). 2022. World Bank Climate Change Group. *https://journals.plos.org/climate/article?id=10.1371/journal.pclm.0000077*.

15 'Climate damages are inflating the costs of living for every Canadian' (Ness, R.). 2023. Canadian Climate Institute. *https://climateinstitute.ca/climate-damages-inflating-costs-of-living-for-every-canadian/*.

Not all communities are equally equipped to fight climate change.

This toolkit was developed to support and guide small to mid-sized communities in undergoing or reviewing a base-level climate resilience self-assessment and provide an aggregation of resources and tools to communities who may lack the capacity, subject matter expertise or resources to understand where to begin regarding climate resilience.[16]

1. **Fiscal Resources** – communities commonly have competing interests for a limited budget and planning for the future doesn't necessarily meet the requirements of the present day. This toolkit will help to provide information on external funding opportunities for climate resilience and adaptation.

2. **Human Capital** – in a competing space for top climate talent, it is most commonly underserved communities that find it harder to hire subject matter experts on climate resilience and adaptation due to fiscal, governance and location barriers. It is typically only after a climate disaster is experienced that resources can be allocated to these human capital requirements reactively.

3. **Climate and Geography** – depending on where you find yourself from the far north to Indigenous lands, rural Canada, deep in the mountains or located right on the coast, where your community is located will be pivotal in how to prepare and the impacts that may be faced in the future.

4. **Technology and Data** – good decisions are only made based on good data, however, depending on your communities' resources, location and technical knowledge, access to quality data, and emerging climate-based tools and technologies may be a barrier in decision making. While there is a technical hurdle for subject-matter-experts, the use of local, regional, and national databases and tools can help to strengthen a community's resilience and understand how climate change impacts will affect them.

16 'Benchmarking Climate Change Adaptation Action in Ontario' 2022. Climate Risk Institute. *https://climateriskinstitute.ca/wp-content/uploads/2022/08/Summary-Benchmarking-Adaptation_CRI-August-2022.pdf*.

How to use this toolkit

This toolkit is best used as a resource to complement the development of your climate resilience and adaptation projects and plans, relating to all aspects of communities, from climate disasters to health and well-being, biodiversity, infrastructure, and local economies. It can help establish a shared understanding, spark ideas, and create a holistic and impactful approach as you work towards a resilient, sustainable community.

This resource is intended for leaders in communities across Canada of all sizes, with a primary focus on small to medium-sized communities that may not have the same resources, human capital, or capacity. These include municipal staff of multiple sectors (i.e. sustainability, economic development, transportation, greenspace, etc.), elected officials, Indigenous community members and leaders at other organizations who are tackling climate-related challenges such as public health, emergency response and management, local utility operators, development planners, natural disaster response, environmental and climate change leaders.

This toolkit encourages you to better understand how climate disasters are expected to change in your community. From Tool 1 you will be primed on how broadly climate disasters are expected to change in the coming years because of climate change and by filling out a self-assessment on the likelihood of events taking place in your community or region. With this understanding, from there can begin to investigate the adaptation measures and considerations as a jumping-off point to think about how to improve physical and community resilience.

1. **Tool 1** ends with some key online tools, guides, and resources to address climate disasters and better inform and help communities prepare and adapt.

2. **Tool 2** aims to better understand your community's resilience on a human-community level, speaking to the community members themselves, local economy, health and wellbeing, infrastructure and a better understanding of the community's technology and data capabilities.

3. **Tool 3** looks to build on the momentum and provide some funding direction and avenues at the provincial and local level to better aggregate funding sources and ideas on how to invest in your community, which is particularly important to communities where fiscal resources and human capacity are limited.

You are encouraged to work through this self-assessment collaboratively, where possible, with your team and key community members, ensuring a range of perspectives across key departments and sectors.

We know that each community is unique, with its strengths, assets, and challenges. Communities and their leaders are invited to use the tools as you wish (as they complement each other), to explore a range of options and craft their pathway to climate resilience. Use what works for your community, and feel free to adapt or expand along the way. This is meant to be an introduction and resource for your resiliency journey rather than a comprehensive or technical guide.

Evergreen encourages you to explore the range of options and get creative in your unique approach to move your community forward, so that no community, regardless of where you are across Canada, is left behind.

Let's begin to learn how we can prepare to become climate resilient.

TOOL 1

TOOL 1: Climate Disaster Resilience Primer, Self-Assessment and Resilience Resources.

Better understanding the impact and threats of climate change in the context of your community. How will your community be affected today, tomorrow and in the future?

Climate disasters are a real threat to communities, regardless of location, size, or resources. The choice is simple: to act now and be resilient, stronger, and sustainable communities in the future or face the growing threats of climate disasters, health and negative impacts on your community's local economy, infrastructure, and people.

About the Tool

The **Climate Disaster Primer** talks about how the impacts and threats of climate disasters are expected to change across Canada in the coming years and includes broad adaptation measures and considerations that communities can adopt to increase climate resilience – to one or many of the potential impacts.

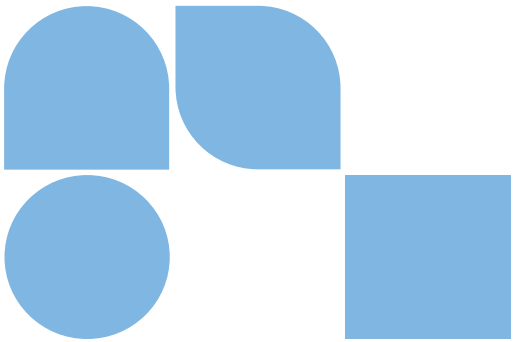
The **Climate Disaster Resilience Self-Assessment** is designed to better understand the climate and geography-based risks, threats and impacts that climate change poses to your community. The climate disasters in this primer focus on immediate climate events that have large-scale impacts on communities. While the authors understand there are many impacts of climate change, like reduced air quality, permafrost melt, freeze-thaw cycles and more, this tool looks to better understand your communities' risks to large(r) scale impacts and how climate change is expected to affect them. This tool is the first step in this toolkit to what the future may look like and will then transition into community-focused tools, including a funding resource guide for communities.

Tips

- ✓ **Everyone is impacted differently** – Correlation does not equal causation, while many of these disasters are expected to increase in the coming years and decades, they may not have a direct impact on your community. It is better to prepare and adapt now than be forced to be reactive later. Many of the measures and considerations to build resilience in your community are proven to support a host of immediate and long-term co-benefits to your community.

- ✓ **Start with the biggest and work your way down** – In communities where resources, human capital and capacity are limited, and are facing multiple climate impacts and threats, identifying impacts that will have the largest net-negative impact on the community may be the best way to move forward when identifying a plan for community resilience. Many of the climate disasters and impacts that communities face can be adapted for, be resilient to and promote additional co-benefits to the community. One adaptive measure may have co-benefits of protecting against other climate impacts while also improving the lives of your community members, increasing biodiversity, and reducing pollution.

- ✓ **Work with others** – When working towards building a stronger, resilient community, action does not have to be taken in a silo, ask neighbouring communities, connect with local community groups, provincial associations, businesses, and utility providers, and engage with regional authorities and/or the provincial/territorial government bodies to work towards a common goal of resilient adaptative communities across Canada.



TOOL 1: Climate Disaster Primer

This table provides key information to better understand the expected changes of climate disasters. In addition, it provides some base adaptation measures and considerations for communities to further to build resilience. What measures and considerations work for one community may not be ideal for another, in the same vein communities that have already implemented a measure can work to reinforce and increase a measure's resilience if expected changes to impacts are likely to increase in frequency or severity.

With the information in this primer, and an existing (historical) understanding of your community, the local government climate action team will be able to make a more informed decision on the likelihood of a climate disaster occurring in a community in the following self-assessment.

Climate Disaster (Type)	Expected Change due to Climate Change	Adaptation Measures and Considerations
Earthquake / Tsunamis	• While the effects of climate change can be exacerbated by earthquakes (melting, degraded permafrost are more susceptible to strong shaking and failure[17]), the frequency and intensity of earthquakes are not expected to change. • Earthquakes and, where applicable, tsunamis still pose a serious threat to communities in areas of seismic activity and should be planned for accordingly.	• Implement a tsunami early warning system. • Engage in high-ground tsunami community education, awareness, and directions/ signage. • Remediation, protection and restoration of coastal wetlands, dunes, and forests. • Implement or enhance coastal protection, dykes, levies, seawalls, and water breaks. • Investigate elevated and vertical evacuation options in low-lying areas. • Update improved/ strengthened building codes for new buildings and retrofits with seismic zone mapping and tsunami floodplains in mind. • Implement seismic monitoring stations and sensors. • Complete tsunami risk assessments for coastal communities

17 The First Public Report of the National Risk Profile' 2023. Government of Canada – Public Safety Canada. *https://www.publicsafety.gc.ca/cnt/rsrcs/pblctns/2023-nrp-pnr/index-en.aspx*.

Climate Disaster (Type)	Expected Change due to Climate Change	Adaptation Measures and Considerations
Flooding (Seasonal, Coastal, Precipitation or Storm Surge)	• Sea level rise and increased high-water events are expected to increase flooding of coastal communities. • As the country warms, the expected frequency and intensity of extreme precipitation events also increases, with large regions of Canada at risk or in the hazard zone of riverline or rainfall flooding in winter or spring. (As the average air temperature rises, its capacity to hold moisture grows.)[18] • Extreme precipitation events that were once expected to occur every 20 years on average are now projected to happen every 10 years by 2050 and every 5 years by the end of the century.[19]	• Remediation, protection and restoration of wetlands, natural river ecosystems, river adjacent ecosystems and forests. • Revised building development, zoning, floodplain management and/or standards in coastal and riverline flood-prone areas. • Installation or enhancement of coastal protection, through grey infrastructure dykes, levies, seawalls, and water breaks. • Implementation of flood management plans and early warning systems. • Flood forecasting and warning centre • Community-wide text message alert system for flood conditions • Managed retreat and buyout programs for community members in danger/high-risk flooding and storm zones.
Hurricanes/ Tropical Storms	• Coastal Canadian communities can expect an increase in the risk of and impact of hurricanes and tropical storms due to climate change.[20] • The increase in sea surface temperatures specifically in the Atlantic Ocean on the eastern seaboard (mid-latitudes) of the United States will provide more energy to hurricanes and tropical storms to travel northward and impact eastern Canada,[21] much like Hurricane (Tropical Storm) Fiona did in 2022.[22]	• Remediation, protection and restoration of coastal wetlands, dunes, and forests. • Revised building development and standards in coastal flood-prone areas. • Implement or enhance coastal protection, dykes, levies, seawalls, and water breaks. • Codify building standards to be resilient to high winds and debris. • Engage in community awareness, resources, and education on preparedness and risks.

18 'Tides of Change: Climate Change and Flooding in Canada' (Fan, G.) 2023. Marsh Advisory. *https://www.marsh.com/ca/en/services/risk-consulting/insights/climate-change-and-flooding-in-canada.html*.

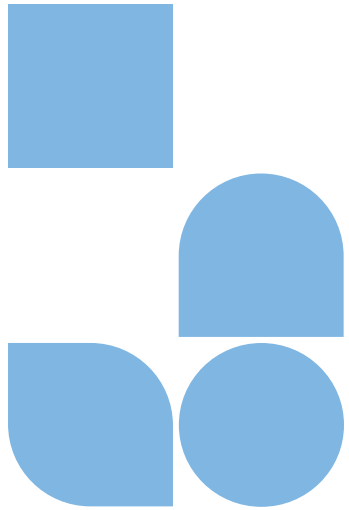
19 'Tides of Change: Climate Change and Flooding in Canada' (Fan, G.) 2023. Marsh Advisory. *https://www.marsh.com/ca/en/services/risk-consulting/insights/climate-change-and-flooding-in-canada.html*.

20 'Hurricanes and Climate Change'. Centre for Climate and Energy Solutions. *https://www.c2es.org/content/hurricanes-and-climate-change/*.

21 'Hurricane risk: What the future holds for Canada' (Contant, J.). 2022. Canadian Underwriter. *https://www.canadianunderwriter.ca/insurance/hurricane-risk-what-does-the-future-hold-for-canada-1004226083/*.

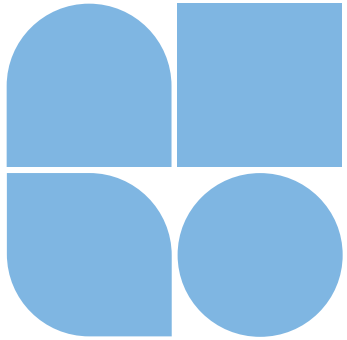
22 'Post-tropical storm Fiona most costly weather event to ever hit Atlantic Canada, new estimate says' 2022. The Canadian Press. CBC. *https://www.cbc.ca/news/canada/nova-scotia/fiona-atlantic-canada-insured-damages-660-million-1.6621583*.

Climate Disaster (Type)	Expected Change due to Climate Change	Adaptation Measures and Considerations
Coastal Erosion	• With rising sea levels, high-wave events, wind, tidal action, reduction in sea ice and storm surges, it is expected that coastal erosion will have an ongoing and increasing impact of a changing climate in on all coasts in Canada,[23] although the rate of erosion is not expected to be uniform across the country's coasts.	• Update land use zoning and *coastal setbacks* to provide a buffer to building areas and communities. • Install hard/ reinforced grey infrastructure to reduce erosion in critical areas and alleviate coastal flooding risks. • Undertake a coastal erosion adaptation and risk study by geographic and local area/ region. • Re-vegetation and stabilization of coastal dunes. • Maintenance of coastal sediment supply. • Building relocation, for at-risk building areas due to erosion and coastal flooding. • Hard infrastructure shoreline protection in areas of storm surge flooding, erosion, and sea level rise. • Complete sea level rise risk studies –and collaborate with the coastal geographic region to combine resources. • Update, expand and implement dyke systems, channels, levies, and seawalls.



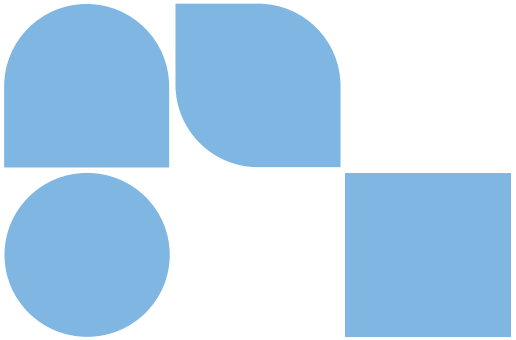
23 'Coastal erosion and climate change' (Davidson-Arnott, R. Ollerhead, J.) 2017. Prince Edward Island Department of Environment, Labour, and Justice. *https://www.csrpa.ca/wp-content/uploads/2017/11/coastal_erosion_and_climate_change_0.pdf*.

Climate Disaster (Type)	Expected Change due to Climate Change	Adaptation Measures and Considerations
Winter / Ice Storms	• While winters are expected to become warmer and shorter-lasting because of climate change in Canada, the winter storms communities experience are likely going to be stronger with increased amounts of precipitation (snow). These winter storms are expected to cause precipitation to fall much quicker and 'heavier'.[24-25] • Communities around (large) lakes must compete with the added changes that the *lake effect snow* has in winter which can lead to increased snowfall, winds, and whiteout conditions.[26] As the climate warms and winters become milder, these extreme events are expected to continue to increase.	• Update to stronger load-bearing building standards where increased snow is expected. • Implement and expand all-season public spaces with all-weather infrastructure to protect the most vulnerable. • Invest in and expand emergency shelters for the most vulnerable populations. • Purchase appropriate winter vehicle management, snowplows, salters etc. • Open and invest in warming centres. • Invest in and create redundancy in backup power generation for critical infrastructure.



24 'Winter weather and the climate crisis: explained'. 2022. The Climate Reality Project. *https://www.climaterealityproject.org/blog/winter-weather-and-climate-crisis-explained*.
25 '4 reasons climate change is here, even though it's cold'. 2023. Environmental Defense Fund. *https://www.edf.org/card/4-reasons-climate-change-still-happening-despite-cold-weather*.
26 'Why winter storms are becoming bigger and badder around the Great Lakes — and what it means for those at risk' (Mahdavi, D.), 2023. CBC News. *https://www.cbc.ca/news/canada/hamilton/lake-effect-climate-change-ontario-1.6712232*.

Climate Disaster (Type)	Expected Change due to Climate Change	Adaptation Measures and Considerations
Freeze Events	• While a warming world has models indicating that winters will become milder in Canada (on average), extreme freezing and freezing rain events still require additional studies. Over the skies of eastern Canada, specifically the Saint-Lawrence River Valley freezing rain events, which pose a major disruption to ground and air transportation, health and well-being and power networks, are being studied to understand the expected increase of these events and how natural location, specific topography, wind channelling and melting and sub-freezing layers of the environment affects this climate-related impact.[27-28]	• Undertake localized studies with academic institutions. • Open and invest in warming centres. • Undertake a salt (de-icing) management plan. • Update emergency management plans for extreme freezing and freezing rain events. • Source appropriate backup emergency power (non-connected to the grid).



27 "Changes in freezing rain occurrence over eastern Canada using convection-permitting climate simulations." (Mariner, S., Thériault, J., & Ikeda, K.). 2022. Climate Dynamics. *https://archipel.uqam.ca/15854/1/Marinier_Changes_in_freezing_ClimDyn_2022_s00382-022-06370-6.pdf*.

28 "Changes in freezing rain occurrence over eastern Canada using convection-permitting climate simulations." (Mariner, S., Thériault, J., & Ikeda, K.). 2022. Climate Dynamics. *https://archipel.uqam.ca/15854/1/Marinier_Changes_in_freezing_ClimDyn_2022_s00382-022-06370-6.pdf*.

Climate Disaster (Type)	Expected Change due to Climate Change	Adaptation Measures and Considerations
Avalanches	• Avalanche hazards are only expected to impact specific geographic regions of Canada, specifically British Columbia, (western) Alberta, and the western flank of the island of Newfoundland.[29] Climate change and changing winter precipitation make it more difficult to predict how precipitation and snow pact will impact alpine avalanche conditions in the future. • Lower elevations are expected to experience a decline in the size and number of avalanches due to decreased snow pact.[30]	• Undertake and update avalanche risk assessments and mitigation plans. • Utilize seasonal or emergency road closures for at-risk hazard areas. • Implement active avalanche control. • Install snow sheds and deflection walls over critical transportation corridors or infrastructure. • Apply snow netting in known risk areas. • Utilize online tools and early warning systems for at-risk slopes to community members and transportation corridors.
Landslides	• Landslide hazards are only expected to impact a limited number of geographic regions across Canada based on local topography. • Due to increased extreme precipitation events in the coming years, the likelihood of landslides is expected to increase. Further, human-influenced interventions in the natural environment, like logging and forest management which reduces soil's ability to hold water, will contribute to the threat in at-risk areas.[31]	• Stabilize the slope mechanically or with vegetation in at-risk slopes/areas. • Improve drainage of sloped areas. • Elevate roadways to allow potential landslides to flow beneath (in problem areas) in critical transportation corridors. • Avoid designing corridors and roads around over-steep cuts and fills. • Utilize seasonal or emergency road closures for at-risk hazard areas.

29 "Avalanche Risk Map." 2023. Avalanche Canada. *https://www.avalanche.ca/en/map*.
30 "Layers of Complexity: Climate Change and the Future of Avalanches." (Horton, S.). 2023. Protect Our Winters – Canada. *https://www.protectourwinters.ca/layers_of_complexity*.
31 "Increase resilience to landslides by protecting roads and structures from higher landslide frequency, and reduce management activities that increase landslide potential." 2023. United States Department of Agriculture. *https://www.fs.usda.gov/ccrc/approach/increase-resilience-landslides-protecting-roads-and-structures-higher-landslide-frequency*.

Climate Disaster (Type)	Expected Change due to Climate Change	Adaptation Measures and Considerations
Wildfires	• Wildfires as a result of a warming climate, earlier snow melt, dryer conditions and increased frequency of extreme weather (lighting associated with thunderstorms) are some of the key factors which will lead to an increased frequency, intensity, and total size of fires in Canada.[32] • With an expected 50% to 300% increase in the number of dry windy days deemed 'fire weather', the speed at which fires will grow and spread will considerably worsen.[33]	• Creation/expansion of community fire breaks and buffer zones. • Create/implement a forest and fuel management. • Create/implement/ update an Emergency/ Wildfire Management Plan. • Engage in community disaster awareness and education. • Revise landscape regulations to increase community fire resilience. • Update (Re-)Zoning and building policy in high-risk fire areas. • Complete pre-scribed and cultural fires. • Provide masks and appropriate personal protective equipment (PPE) provided to community members to mitigate wildfire air quality degradation. • Implement an Early Warning System - SMS notification and wildfire tracking.
Extreme Heat Waves (30C for 3+ days)	• Extreme heat is defined as when the average temperature is higher than 31 ºC in the daytime and between 16 ºC and 20 ºC at night for three consecutive days or more.[34] In Canada, extreme heat is expected to occur more frequently on average in all geographic regions. • To the small benefit of rural, remote, and small communities, the effects of extreme heat and heat waves are expected to be less pronounced as they will not have the compounding effects of *urban heat islands* that can be found in large urban centres.	• Implement a community heat warning system. • Sensors • Weather Stations • SMS Notifications • Open and invest in cooling centres. • Undertake health checks on vulnerable populations. • Update/ Create extreme heat emergency plans. • Increase tree canopy cover. • Expand vegetated areas and water bodies for a cooling effect and create a blue-green infrastructure network. • Implement shading devices in high-traffic, direct heat areas (*green or grey infrastructure*).

32 "Forest Fires and Climate Change." 2023. Climate Atlas Canada. *https://climateatlas.ca/forest-fires-and-climate-change*.
33 "Forest Fires and Climate Change." 2023. Climate Atlas Canada. *https://climateatlas.ca/forest-fires-and-climate-change*.
34 "Extreme Heat in Canada."2023. Canadian Climate Institute. *https://climateinstitute.ca/reports/extreme-heat-in-canada/*; "Tsunami Mitigation Measures." (Al-Faesly, T., Palermo, D., & Nistor, I.). n.d. Canadian Association of Earthquake Engineering. *https://www.caee.ca/pdf/Paper_94210.pdf*.

Climate Disaster (Type)	Expected Change due to Climate Change	Adaptation Measures and Considerations
Drought(s)	• Droughts are expected to increase in length and frequency in large regional areas of Canada. Regions/ communities that already receive low rainfall and snow precipitation, primarily the prairie regions of Canada, are expected to see more prevalent drought conditions. Drought conditions are expected to expand northward in the prairies and laterally in southern British Columbia.[35-36-37] • Droughts have a direct negative impact on community food production and human health across the country, with drought effects being extrapolated further by Pacific *El Niño* and *La Niña* events.	• Management and increase of water reserves and reservoirs for food production and human use. • Implement and update drought contingency plans. • Develop models to understand potential water quality changes and model groundwater conditions with studies, sensors, and technology. • Model and reduce agricultural and irrigation water demand. • Build infrastructure needed for aquifer storage, increased capacity, and recovery. • Modify community-wide land use to include watershed management and water demand management.
Tornadoes	• While tornadoes in Canada are considered a rare occurrence, changing and increased weather systems and climate models associated with tornadoes seem to be indicating that Ontario, Quebec, and the eastern prairies may see a gradual increase in tornado and twister likelihood. While the research is not conclusive on strong trends of increasing tornadoes in these regions, the number of tornadoes/ twisters has increased dramatically over the last decade.[38]	• Update building bodes for affected regions/communities. • Implement early warning systems in high-risk communities. • SMS Notifications • Sirens • Sensors • Access and distribute 'hurricane straps' in areas identified as higher risk.[39]

35 "Droughts." 2021. Ministry of Natural Resources – Government of Canada. *https://natural-resources.canada.ca/climate-change/impacts-adaptations/climate-change-impacts-forests/forest-change-indicators/drought/17772#adaptation*.

36 "Drought and Human Health in Canada." (Yusa, A.). 2023. ClimateData Canada. *https://climatedata.ca/case-study/drought-and-human-health-in-canada/*.

37 "Adaptation Strategies for Drought." 2023. Indiana University. *https://eri.iu.edu/erit/strategies/drought.html*.

38 "Canada's Tornado Alley may be moving from Prairies to Ontario-Quebec, warn researchers." (Daigle, T. & Mcleister, M.). 2023. CBC News. *https://www.cbc.ca/news/canada/tornado-alley-moving-to-ontario-quebec-experts-warn-1.6907140*.

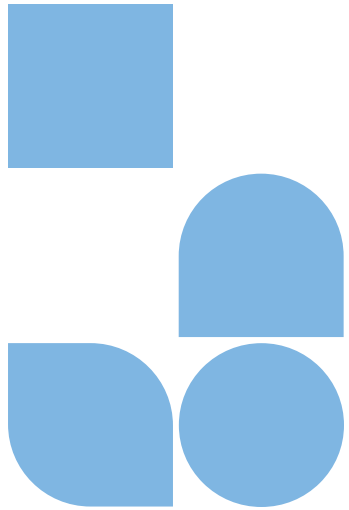
39 Hurricane clips or straps are used for deck or roof framing to secure rafters, trusses, or joists to the wood framework. This is done to resist uplift and lateral forces, like those that come from a hurricane or severe storm.

Tool 1: Climate Disaster Resilience Self-Assessment

For each of the below climate disasters and events, check the box that matches the likelihood of a disaster occurring in your community from 1 to 5 (based on your understanding). Base your selection on your community's history, experience, expected future of environmental/climate-related change and potential impacts that similar regions and adjacent communities have faced. If you have an understanding of the expected severity rate, fill in the severity level column to understand your risk better.

Climate Disasters	**Expected likelihood in your community.** (If events have already occurred in your community, it is likely to re-occur. If events have not occurred but are considered a disaster, take into account whether affected neighbouring communities or the region have experienced the disaster)					Expected Severity Level 1=insignificant 2=minor 3=moderate 4=major 5=extreme
	1 – Extremely Unlikely	2 – Unlikely	3 – Not Applicable / Unknown	4 – Likely	5 – Very Likely	
Earthquakes / Tsunamis						
Flooding (Seasonal, Coastal, Precipitation or Storm Surge)						
Hurricanes / Tropical Storms						
Coastal Erosion						
Winter / Ice Storms						
Freeze Events						
Avalanches / Landslides						
Wildfires						
Extreme Heat Waves (30C for 3+ days)						

Climate Disasters	**Expected likelihood in your community.** (If events have already occurred in your community, it is likely to re-occur. If events have not occurred but are considered a disaster, take into account whether affected neighbouring communities or the region have experienced the disaster)					Expected Severity Level 1=insignificant 2=minor 3=moderate 4=major 5=extreme
	1 – Extremely Unlikely	2 – Unlikely	3 – Not Applicable / Unknown	4 – Likely	5 – Very Likely	
Drought						
Tornados						



TOOL 1: Additional Resources (Data, Technology, Information Tools and Solutions)

This section provides some data and tech tools and resources for leaders of communities, and community members to better understand some of the resources available to prepare for and increase resilience based on some of the previously mentioned climate disasters.

Climate Disaster(s)/ Event(s)	Summary
• Flooding • Coastal Erosion • Hurricane/ Tropical Storms	**Canadian Extreme Water Level Adaptation Tool:** A science-based planning tool for climate change adaptation of coastal infrastructure related to future water-level extremes and changes in wave climate.
• Extreme Heat Waves • Freeze Events • Extreme Precipitation Events • Drought / Agriculture	**Climate Atlas:** An interactive climate change modelling tool from the Canadian government that combines climate science, mapping and storytelling with Indigenous Knowledge and community-based research and videos to inspire awareness and action.
• Extreme Heat Waves • Drought	**National Collaboration Centre for Environmental Health's Health Check:** An easy-to-use infographic and guide for community leaders, staff, businesses, and community groups to use when completing health checks in-person or remotely. This can be used as a guiding template to build your own guide based on your community and its needs.
• Extreme Heat Waves	**Extreme Heat Preparedness Guide:** A British Columbian government guide for extreme heat preparedness for community members.
• Flooding • Coastal Erosion • Hurricane/ Tropical Storms • Tsunami's	**Canada's Marine Coasts in a Changing Climate:** A key tool for community leaders and staff to better understand the implication of climate change on coastal communities – broken down by regions. This tool provides a deeper insight into the effects of climate change and how to adapt different regions and industries to a changing world.
• Flooding • Coastal Erosion • Hurricane/ Tropical Storms	**CLIMAtlantic Coastal Adaptation Toolkit:** A tool to help communities prepare for coastal climate impacts and highlights climate adaptation networks to connect with like-minded communities on the east coast of Canada.

Climate Disaster(s)/ Event(s)	Summary
• Flooding	**Flood Smart Canada:** A resource with links to floodplain mapping, emergency preparedness and climate adaptation resources for flooding in Canada.
• Extreme Heat Waves • Drought	**Canada Drought Monitor:** A nationwide drought monitoring tool to understand the current drought conditions throughout Canada. The tool also provides additional drought resources and tools for analysis, monitoring, and open data portals.
• Extreme Heat Waves • Drought • Wildfires • Flooding	**Natural Resources Canada's Forest Change Adaptation Tool:** A resource that provides users with a wide array of functional tools to model forest change due to several variables including disease, climate change, pests, and wildfires. In addition, it provides a wide variety of adaptation tools and resources.
• Flooding	**CRNO Hub:** An online geoportal hub for GIS mapping of Quebec and New Brunswick-based communities to better understand climate events and better visualize its impacts on communities (how, as one example flooding, and 100-year flood events are visualized to impact communities.
• Coastal Erosion • Winter / Ice Storms • Freeze Events	**Smart Ice:** A community enterprise business that uses technology and data to provide real-time sea-ice levels in northern Canada, to map the effects of climate change and protect communities. SIKU: An Indigenous Knowledge Social Network that uses data and insights from SmartIce to provide real-time insights into sea-ice thickness in northern Canada as well as providing social connections, valuable resources and more.
• Wildfires	**FireSmart:** A national program/tool that helps Canadians increase neighbourhood resilience to wildfire and minimize its negative impacts through guidelines, resources and liaisons for the community, neighbourhoods, and individual community members.
• Wildfires	**Fire smoke:** An online real-time forecasting tool to understand how fires and associated smoke and air quality are modelled to move through communities, regions and provinces based on current climatic data.

Climate Disaster(s)/ Event(s)	Summary
• Wildfires	**Wildfire dashboards:** Consists of provincial monitoring and reporting systems for wildfires within a given province or territory. *Yukon* *Northwest Territories and Nunavut* *British Columbia* *Alberta* *Saskatchewan* *Manitoba* *Ontario* *Quebec* *New Brunswick* *Nova Scotia* *Prince Edward Island* *Newfoundland and Labrador* *While this resource is widely available and utilized by communities, individuals in communities may not be aware of this tool.
• Flooding • Hurricane/Tropical Storms • Extreme Heat Waves • Winter/Ice Storms • Freeze Events • Extreme Precipitation Events • Wildfires	**Government of Canada resource:** A webpage providing valuable data and technology tools, guides, and information as it pertains to climate disasters, climate impacts (like sea level rise) and broad climate change adaptation in Canada.
• Flooding • Hurricane/ Tropical Storms • Tsunamis • Extreme Heat Waves • Winter/Ice Storms • Freeze Events • Extreme Precipitation Events • Wildfires	**The Justice Institute (British Columbia):** Highlights several resources to strengthen community climate resiliency and hazard preparedness. While this resource is in the context of British Columbia much of the resource content can be used by communities across Canada.

TOOL 2

TOOL 2: Understand the Community's Willingness and Resilience to Address Climate Change.

Overview

Climate resiliency in the context of community planning refers to the proactive and adaptive measures implemented by municipalities to prepare their respective communities for the challenges posed by climate change. It encompasses strategies aimed at minimizing vulnerabilities, safeguarding critical infrastructure, and enhancing the ability of a community to withstand and recover from the adverse impacts of climate-related events. These events can include extreme weather conditions, rising sea levels, prolonged droughts, changing biodiversity patterns, shifts in overall community health and wellbeing and more. By integrating resiliency into planning, municipalities can reduce the potential for damage, loss of life and economic disruption associated with alternating climate patterns. Moreover, it fosters community cohesion, promotes public health, and supports economic stability by preserving local resources and enhancing adaptability. In essence, climate resiliency is an essential framework that safeguards a community's present and secures its future in the face of a changing climate.

About the Tool

This tool is an evaluative checklist designed as a baseline to examine a community's current allocation of climate-resilient infrastructure, data and technology integrations, and programs on community health and wellbeing to assess a community's ability to withstand and adapt to challenges posed by climate change. This tool aims to support communities in assessing their vulnerabilities, developing robust adaptation plans, and implementing sustainable practices to safeguard their infrastructure, livelihoods, and natural resources. As climate-related risks intensify, developing a structured framework for preparedness, risk reduction and resilience-building is important. By assessing current capabilities and understanding priority challenges, this checklist aims to prompt municipalities to evaluate their respective options and provide localized solutions that can play a critical role in implementing climate resiliency initiatives.

Tips

- ✓ **Be present** – Assess your community's capacity and resource allocation to climate resilience based on what is currently available. This tool is a guide to help highlight key areas of focus that may serve as a priority as well as introduce other ideas that may not have been considered.
- ✓ **Customize it to your local context** – This tool is not prescriptive; it is a guide to support a local governance body in the creation of its assessment tools. Feel free to add, modify or remove content that may ideally paint a picture of climate-resilient resources that fit better to your region or community.
- ✓ **Support climate resilience in public spaces** – Utilize this tool to gain further understanding of how your public spaces and assets are/could be utilized to make your community more climate-resilient.
- ✓ **Be open to collaborating with your community** – While making an assessment, consider the different perspectives that exist in your community and evaluate the potential for partnerships to support your community's team.
- ✓ **Consider impacts** – Consider long-term economic, environmental, and social benefits for your investments in climate resiliency within the public realm.

CASE STUDY
Alberta Municipalities Community Climate Resilience Assessment Tool

The climate preparedness checklist[40] is a free online assessment tool launched by Alberta Municipalities as a part of their Municipal Climate Change Action Centre program. This tool serves as a framework for local governance staff to evaluate their overall understanding, practices, and community awareness of climate resiliency within their respective jurisdiction. Some themes they evaluate include:

- **Literacy and Practice** – The climate resilient practices currently being done.
- **Leadership** – Accountability and governance leadership over climate resilient programs/projects.
- **Working Together (Understanding the Challenge)** - Engagement and community collaboration strategies.
- **Planning and Implementation** – Taking ideas and putting them into community action.

Though under a provincially oriented agency, this checklist can serve as a working template for variables that municipalities can consider when forming and digitizing their self-guided climate resiliency checklists.

40 "Community Climate Resilience Self-Assessment Tool." 2023. Municipal Climate Action Change Centre, Alberta. *https://mccac.ca/community-climate-resilience-self-assessment/tool/*.

CASE STUDY
Diamond Valley, Alberta – Climate Resiliency Action Plan, 2016

In 2016, the municipality of Diamond Valley, AB (estimated Population of 3,427)[41] published a *climate resiliency action plan*[42] that highlights the various figures they evaluated in their overall assessment of climate risk and opportunity. This action plan is thorough and conclusive given a municipality of this size and offers a unique insight into how other small-scale local governments can conduct their climate resiliency actions. Some of their findings examined the following:

- Climate Data Analyses for what natural disasters are prominent in the area and will see a significant increase over time.
  - In their findings using the Alberta Municipalities Community Climate Resilience Assessment Tool, the highest risks were associated with wildfires, tornadoes, and flooding.
  - The first phase of analyses was conducted in community sessions that highlighted methods that were used to gather current and historical climate information.
  - Moreover, these analyses utilized past trend data obtained by federal and provincial environmental ministries to forecast statistical projections of various factors that will be affected by climate change and then cross-compared variables to assess high, medium, and low-priority risks. Some variables included:
    - Mean temperature by month
    - Mean precipitation by month
    - Risk of extreme weather events such as wildfires, tornadoes, flooding, drought etc.
    - Movement of biodiversity trends such as species loss and invasive species migration
- An assessment of the infrastructure available to ensure disaster preparedness and reduce ecological impacts.
  - This included disaster response items, green infrastructure, an analysis of biodiversity and localized health risks.
- The municipality also proposed several opportunities that may come from the implementation of their plan. A prominent one is an increase in eco-tourism/economic development from the work associated with implementing green infrastructure.

41 "Population Growth and Land Requirements." 2023. Town of Diamond Valley, Alberta. *https://www.diamondvalley.town/439/Population-Growth-and-Land-Requirements*.

42 "Town of Diamond Valley, Alberta's Climate Resilience Action Plan." 2016. Town of Diamond Valley, Alberta. *https://www.diamondvalley.town/DocumentCenter/View/3019/Climate-Resilience-Action-Plan-#:*.

TOOL 2: Community Climate Resiliency Action Planning – Guided Checklist

Based on some of the resources evaluated from across Canada, this tool serves as a guiding document for local governance systems to begin to develop assessment of current preparedness.

Drawing inspiration from the Climate Resiliency Checklist from Alberta Municipalities and the Climate Risk Institute, rank your community's capabilities to the following question based on whether your community has... 1- "…no experience with this aspect." 2- "…a very basic understanding of this aspect." 3- "…planning or ready to plan with this aspect." 4- "…ready to implement this aspect." 5- "…ready to build upon existing experience with this aspect."	**1**	**2**	**3**	**4**	**5**
Community Demographics/Information					
Does your community have a Climate Resiliency Action Plan, or another document related to climate resiliency published by a governance body?					
Has your community conducted an assessment of community members that will be most impacted by climate change? (I.e., children and youth, older adults, racialized groups/peoples, other marginalized peoples, etc.)					
Is there a focused and specialized engagement, consultation, and inclusion process for vulnerable folk to contribute to in planning for climate resiliency in your community?					
Does your climate resiliency action planning take into account those with visible and non-visible disabilities as well as others who may require extra accommodation to participate in the planning process as well as provide services for participation?					
Are there analyses and plans available that contain climate hazard mapping and estimations for your region?					

Add your numerical rankings for each of the 70 questions above to see your total score out of 350.* In sum, a total score of:	**70-139** Suggests **little to no** community preparedness to resilience to climate change. **135-209** Suggests **mild** community preparedness and resilience to climate change. **210-279** Suggests **moderate** community preparedness and resilience to climate change. **220 -350** Suggests **strong** community preparedness and resilience to clima.

**This score serves as a rough guideline to assess community resources and preparedness. Evaluate each question based on what is relevant given the geographical, political, and cultural context of the community being evaluated. Should certain questions be deemed irrelevant (ex. questions on costal flooding when the community is in an inland region), feel free to deduct the total score by 5 points per question to provide a more contextually accurate representation.*

Infrastructure					
Does your community take into account different factors that are expected to shift with climate change in any policy documents? (I.e., watersheds, biodiversity, sustainable communities, emergency action, etc.)					
Do flood management plans, both policy and infrastructure, exist for your community?					
Does critical infrastructure (i.e., storm sewers, culverts) exist in your community to reduce the impacts of extreme storm events?					
Is there significant shoreline infrastructure (residences, water and wastewater treatment, tourism, transportation, industry) within the Special Flood Hazard Areas in your region?					
Is there *land subsidence* in the shoreline areas of your community that threatens the built environment?					
Will it take more than 3 days to clear roads and bridges blocked by storm debris after a 10–100-year storm event or greater in your community?					
Are there heating and cooling centers available in your community?					
Are there stocked emergency storm/disaster shelters in your community?					
Do emergency management plans exist for suspected impacts now and in the future for your community?					
Are there climate-informed emergency management mechanisms and emergency response plans in place for your community?					
Are there fire breaks in the area of your region?					
Have adaptive measures through natural or built infrastructure been implemented in your community?					
Do all-season/weather public spaces exist in your community?					
Is there a tree canopy cover in your community, when applicable?					
Are there initiatives in place to ensure access to clean and safe drinking water during droughts or other extreme weather events?					

Infrastructure					
Has your region faced a drought in the past during which have failed to meet local water demands or required water use restrictions?					
Is shoreline erosion above and beyond natural occurrences currently being observed in your region?					
Does local water quality have the potential to be contaminated by extreme storm events, drought or increasing temperatures?					
Are there exposed estuaries, wetlands or beaches that are susceptible to more frequent coastal storms and/or water level fluctuations in your region?					
Are there recognized threats due to the introduction and/or spread of invasive species (aquatic or terrestrial) to local ecosystems?					
Do you have water resources that could be threatened or impacted by the result of a wildfire (i.e., increased erosion and sedimentation)?					
Are steps being taken to ensure the resilience of transportation infrastructure during extreme weather events?					
Does your community have a local/regional transportation plan that includes climate adaptation?					
How reliant is your local economy and well-being on natural resource extraction or the natural environment?					
With respect to the previous question, are these industries heavily reliant on fossil fuel extraction and consumption?					
Does your community have an extreme weather emergency fund to fund sudden climate-related risks and disasters?					
Are there fees and regulations in place for developers and heavy carbon-emitting industries that help mitigate and fund infrastructure to minimize climate change effects?					
Is climate change an explicit factor in your community's budget and economic development analyses?					
Are natural assets (i.e., forests, ravines, water bodies, etc.) incorporated into local asset management planning and valued by the services/benefits they may provide?					

Infrastructure					
Does your community's Procurement Policy include climate change considerations and aspects that are likely to affect respective decisions?					
Are there community by-laws in place that encourage, enforce, and allow equitable practices to occur for climate resilient strategies (i.e., climate resilient building standards, tree-cutting by-laws, green infrastructure additions, considerations between the relationship of nature and culture etc.)					
Data and Technology					
Are there technological sensors installed or monitored to project live data to local officials for disaster prevention and response? (I.e., fire detection, water-level sensors, weather, or radar tracking, etc.)					
Does your community have adequate broadband and mobile network range/coverage to be able to distribute alerts to the community in the wake of an emergency? (I.e., *AlertReady*, warning systems, etc.)					
Does the community utilize tools such as remote sensing, GIS applications, and forecasting trends to adequately monitor climate trends to prepare for?					
Does an accessible portal of data and resources exist for people in your community to form their household response plans to drastic climate events?					
Has the community implemented energy and data storage infrastructure (i.e., batteries, backup power generation, backup drives, disaster recovery cloud services) to ensure a stable energy and broadband network supply in the event of a shutdown or disaster?					
Does the community host or utilize web and/or mobile applications to inform and allow residents to engage in the climate action process?					
Does the community have access to a supply of technological supports that can assess climate disaster damage and aid response? (i.e. drones, rescue machines, etc.)					
Are there safe and reliable telehealth networks set up to service the most vulnerable populations in your community? Are they still functional in an energy emergency?					
Are financial incentives or support programs available to residents to install climate-resilient technologies and monitoring mechanisms for homes and businesses? (I.e., micro-infrastructure)					

Health and Wellbeing					
Does your community assess specific health risks associated with climate change in our community?					
Are there partnerships and collaborations with local healthcare providers and organizations in place to address climate-related health challenges?					
Does your region plan to ensure the resilience of healthcare facilities during climate-related disasters?					
Are vulnerable populations, such as older adults and those with chronic illnesses, being prioritized in climate adaptation strategies?					
Are there mental health support services available for community members dealing with climate-induced stress or trauma?					
Are there green spaces and recreational areas planned or protected to promote mental and physical well-being in a changing climate?					
Is the local governance body addressing air quality concerns related to climate change, particularly in areas with increased pollution risks?					
Are measures being taken to protect community members from vector-borne diseases (like Lyme disease and West Nile virus) due to changing climate patterns?					
Are there thermal comfort measures (i.e., infrastructure, policies to open warming/cooling centers etc.) in place to ensure the health of the most vulnerable members of the public during extreme temperature waves?					
Are there food security measures in place that will mitigate the effects of food supply changes that may occur because of climate disasters or long-term climate patterns?					
Community, Awareness, and Education					
Has there been community consultation and education on understanding local/regional climate-related risks?					
Has there been increased land stewardship and planting for nature-based solutions (wetlands and natural storm management ponds), regenerative farming and reforestation?					
Does your region engage with local communities to gather input and involve them in climate resilience planning?					

Community, Awareness, and Education					
Are there programmatic partnerships in place with representatives of local communities (especially Indigenous partners), organizations that are climate-resilient experts, academic institutions, and grassroots organizations to build, steward and maintain climate-resilient infrastructure within your region? Is this widespread or localized?					
Are there local assistance programs and/or resource funds available for community members to access in the prevention or recovery of climate-related disasters?					
Has your region embedded the perspectives of local Indigenous peoples on climate change and environmental stewardship (such as values and respected teachings) in climate change planning?					
How reliant is your local economy on local tourism, hospitality, and eco-programming? (ex. parks and recreation, natural landmarks, coastal industries, etc.)					
Does the locality have an established method or protocol for mitigating the effects of mass-spread misinformation?					
Are there educational programs in place to raise awareness about the mental health impacts of climate change and coping strategies?					
Are there any substantial governance partnerships in place with your community to enact and service climate resiliency action plans within your region? (I.e., partnerships between different municipalities, multiple levels of government, local Indigenous governance bodies, community associations, etc.)					
How are the working relationships between your respective locality and other subject matter experts in climate change and adaptation? (I.e., Environmentally focused organizations, academic institutions, Indigenous knowledge experts, etc.)					
Has leadership from politicians been relatively supportive or passive in combatting climate change impacts within the community?					
Are there competent levels of staffing and expertise located in-house within your jurisdiction's climate resilience action team?					
Is accurate and accessible information on climate change patterns and local resilience actions displayed and updated regularly on your community's web page and social media accounts?					
Are there specialized engagement practices within community consultations that focus on climate resiliency as a topic of discussion and consideration?					

Feel free to utilize your score result as a suggested preparedness level overall community preparedness to climate change. Moreover, a low score in specific categories of the checklist can serve as a critical indicator, signaling a pressing need for your community to direct its attention toward evaluating solutions and respective actions to address those areas. These lower scores may highlight vulnerabilities and deficiencies in infrastructure resilience, public health, or environmental safeguards regarding climate resiliency.

Addressing these components is paramount to ensure the well-being and sustainability of the community. Listed below are some resources from the Community Solutions Portal to help formulate a local climate resiliency action plan:

Green Energy Solutions: A Practitioner's Toolkit

The Green Energy Solutions toolkit was designed to help practitioners use public spaces, like parks, beaches, and civic spaces, to support green energy technology. For communities developing climate resilience, decarbonization and public space projects and plans, this resource can help create a shared understanding, spark ideas, and create a holistic approach to creating a low-carbon energy future.

The Future Fix: Mapping Arctic Sea Ice

This episode of Evergreen's Future Fix podcast series explores SmartICE in Canada's North. Not all technology has to be disruptive. It may be most useful as an extension of our ways of life, instead of as a replacement. In the Arctic, the Inuit rely on extensive traditional knowledge to safely traverse sea ice for hunting, gathering supplies, and travelling between communities. SmartICE is a social enterprise which uses technology to build on this traditional knowledge and map the increasingly unpredictable sea ice conditions caused by climate change, so people can make informed decisions about how and where to travel.

Technology-Based Solutions for Resilience: A Practitioner's Toolkit

The Technology-Based Solutions for Resilience toolkit is designed to support you and your team in charting a pathway towards greater resilience through your public spaces, leveraging technology to help you understand your local risks and respond to them. It can help you to better plan and invest where you need it, use innovative tools to keep your community safer and healthier into the future, and become more able to "weather the storms."

Advancing the Solutions for Climate Action – One City at a Time

Climate change is a global threat that's expected to have an increasingly large impact, both in magnitude and frequency, as we look years and decades into the future. Decisionmakers and policymakers must have the tools, technology, and data today to make informed decisions that will impact tomorrow. The AI for The Resilient City: A Communications Toolkit, explores what this Evergreen program does, aims to do and, in its earliest stages, the impact it has had on decision and policy making with the City of Calgary with respect to action on climate change.

Latest Breakthroughs in Housing Construction Technology and Climate Resilience

This video is a recording of a session moderated by Larry Brydon and looks at how innovative technology and inclusive policies can help us meet our national housing challenges and climate targets. Panelists discuss several ideas for building sustainable homes faster and to increase climate resilience for low-income housing. Panelists also examine the challenges of implementing innovation and technology in their fields, while sharing their successes and outlooks on the future of housing construction.

Approaches to Climate Resilience in Rural, Remote, Northern and Indigenous Communities

This presentation from an Evergreen event discussing the impacts of climate change and different methods for building climate resilience in rural communities.

TOOL 3

TOOL 3: Capital Resources and Funding Avenues for Climate Resilience

About the tool

This third tool serves as a broad funding resource guide and is designed to assist communities across Canada in searching for relevant funding opportunities for their proposed climate resiliency and climate adaptation projects. Climate resiliency projects encompass a wide array of initiatives, from infrastructure improvements to public health measures, climate disaster preparedness, use of emerging technologies and environmental conservation efforts. Securing adequate funding for these projects is crucial for several reasons.

Firstly, it allows communities to safeguard the well-being of their members, ensuring their safety during climate-related disasters.

Secondly, it promotes long-term sustainability by mitigating risks and enhancing adaptive capacity and additional co-benefits.

Lastly, climate resiliency funding aids in achieving national and international climate goals, contributing to the broader effort to combat climate change.

This tool is not exhaustive and can be used as a reference point to identify funding streams and opportunities for your community's climate resilience needs.

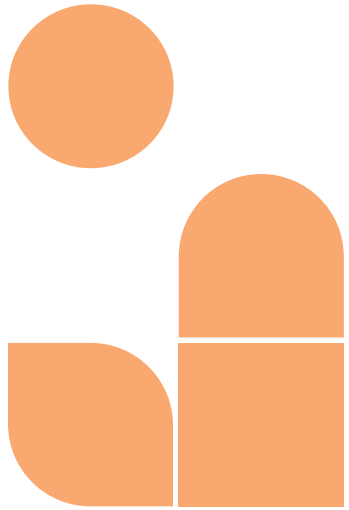
Tips

- **Work together** – Funding streams and grants can be resource-intensive to apply for or have minimum funding requirements that do not make sense for your community. In these instances, when you cannot go it alone, reach out to neighbouring or regional communities who are likely facing similar impacts to climate disasters, health and well-being, local economies and infrastructure and combine forces and resources to make the most of available funding and expertise.

- **Utilize subject matter experts** – Reach out to local or provincial universities and colleges to learn more about any climate, resilience or disaster resilience work that may be currently underway (or planned to be undertaken) and see if a partnership through funding or human resources could be reached to implement studies and ideas within your community.

- **Stay connected to the grid and community** – Get in touch with local utility providers; many of these businesses offer climate adaptation and resilience grants, services, and funding to ensure resilience during climate disasters and extreme weather.

- **Investment in education and awareness** – While climate change adaptation interventions and infrastructure can carry a , the ability to communicate with community members on available *online tools, education* and awareness resources, is largely priceless and could very well save lives.



TOOL 3: Funding Resources for Communities Implementing Climate Change Adaptation, Resilience, and Disaster Interventions

Many of the funding sources found below are excellent opportunities to integrate data and technology solutions to adapt to climate change. From sensors to monitoring stations, web-based applications, or early warning systems, all are readily available technologies that communities can implement to build better resilience today.

Scale of Program/ Source of Funding	Body or Organization Providing funding or resources	Description
National	Government of Canada: Natural Resources Canada (NRCan)	**Natural Resources Canada (NRCan) Funding Resource Page:** A national resource for NRCan funding calls for green, climate and energy-based funding and grants.
National	Government of Canada: Natural Resources Canada (NRCan)	**Climate Resilient Coastal Communities Program:** This program will provide funding to enable communities and sectors to work together at a regional scale to co-develop coordinated actions that increase climate resilience in coastal regions.
National	Government of Canada: Infrastructure Canada	**Disaster Mitigation and Adaptation Fund:** Funding for the current round is currently closed but based on the federal budget, funding may be re-opened.
National	Government of Canada	**2 Billion Trees Program:** A new funding proposal to plant 2 billion trees by 2031. This funding can be used to restore, reforest, and adapt to climate change across Canada.
National	Government of Canada	**Low Carbon Economy Fund:** The Low Carbon Economy Fund supports projects to reduce Canada's greenhouse gas (GHG) emissions, generate clean growth, build resilient communities, and create good jobs for Canadians.
National	Government of Canada: Environment and Climate Change	**Government of Canada:** Environment and Climate Change A national resource funding page for Indigenous climate and environmental funding opportunities.

Scale of Program/ Source of Funding	Body or Organization Providing funding or resources	Description
Provincial	Province of British Columbia	**Community Climate Funding Guide and Funding:** A funding aggregator tool for local governments and Indigenous Peoples of British Columbia.
Provincial	Province of Alberta	**Alberta Watershed Resiliency and Restoration Program:** Funding for projects that enhance watershed resiliency to floods and droughts in the province of Alberta.
Provincial	Province of Saskatchewan	**Public Safety Agency – Provincial Disaster Assistance Program:** This provincial program helps residents, small businesses, agricultural operations, First Nations, non-profit organizations, and communities recover from natural disasters, including flooding, tornadoes, plow winds and other disasters caused by severe weather.
Provincial and Local	Indigenous Climate Hub	**Indigenous Climate Hub:** A resource for Indigenous peoples, groups, and nations to act on climate change across the country, aggregating funding sources and working with like-minded Indigenous leaders from across Canada.
Provincial	Province of Manitoba	**Conservation and Climate Fund:** (Currently closed for 2023) This fund provides support to projects occurring in Manitoba that incorporate actions to address and adapt to a changing climate and protect the environment in alignment with the priorities and implementation of the province's *Climate and Green Plan*.
Provincial	Province of Manitoba	**Resilient Agricultural Landscape Program (RALP) - Carbon Sequestration and Grassland Resilience:** The objective of RALP is to increase the environmental resilience of agricultural landscapes by accelerating the adoption of beneficial on-farm land use and management practices that increase carbon sequestration. Two funding streams for agroforestry and grasslands/grazing management are available.
Provincial	Province of Ontario	**Ontario Green Investment Fund:** A provincial investment fund to support projects that will fight climate change, grow the economy, and create jobs.

Scale of Program/ Source of Funding	Body or Organization Providing funding or resources	Description
	Province of Québec	**FR:** **Fonds d'électrification et de changements climatiques (FECC)** Le FECC est un fonds spécial entièrement consacré à la lutte contre les changements climatiques. À ce titre, il vise des mesures concrètes et efficientes de réduction des émissions de GES, d'adaptation aux impacts des changements climatiques et d'électrification de l'économie. **EN:** **Electrification and Climate Change Fund** The FECC is a special fund entirely dedicated to the fight against climate change. As such, it targets concrete and efficient measures to reduce GHG emissions, adapt to the impacts of climate change and electrify the economy.
	Province of Québec	**FR:** **Programme OASIS** OASIS vise à offrir un soutien financier aux organisations municipales et aux communautés autochtones pour qu'elles planifient et réalisent des projets de verdissement leur permettant de mieux adapter leur milieu aux impacts des changements climatiques. **EN:** **Oasis Program** OASIS aims to provide financial support to municipal organizations and Indigenous communities so that they can plan and carry out greening projects allowing them to better adapt their environment to the impacts of climate change.
	Province of Québec	**EN:** **Flood Resilience and Adaptation Program (PRAFI)** The Flood Resilience and Adaptation Program (PRAFI) aims to increase the safety of people and the protection of property from flooding in built environments and increase the resilience of communities due to climate change. Municipal organizations can request financial assistance to support the creation of resilient developments or building relocation projects.
Provincial	Province of Nova Scotia	**Sustainable Communities Challenge Fund:** The Sustainable Communities Challenge Fund is a provincial grant program for local action on climate change in Nova Scotia. It supports community efforts to reduce or remove greenhouse gas emissions or to prepare for and respond to the impacts of a changing climate.

Scale of Program/ Source of Funding	Body or Organization Providing funding or resources	Description
Provincial	Province of Nova Scotia	**Accelerating to Zero Grant Program:** HCi3's Accelerating to Zero (A2Z) grant program supports innovative projects that help Halifax/Kjipuktuk reach its goal of becoming net zero by 2050 through a just and equitable low-carbon transition.
Private	New Brunswick Investment Fund (Venture and Startup Capital) - NBIF	**Climate Impact Research Fund:** The fund will support research into technologies with the potential to mitigate greenhouse gas emissions or improve community capacity to respond to climate change.
Provincial	Province of Prince Edward Island	**PEI Climate Challenge Fund:** The Government of Prince Edward Island established a $1-million annual Climate Challenge Fund (CC Fund). The CC Fund is intended to support the development of innovative solutions to the threat of climate change.
Territorial	Territory of Yukon	**Yukon Green Infrastructure Program:** Through this new program initiative, the Government of Yukon intends to fund renewable energy projects. These projects will be collaborations between the Yukon government and external partners.
All Levels	Retooling for Climate Change	**Funding Aggregator – Retooling for Climate Change:** An up-to-date climate-change funding aggregator for British Columbia (however non-specific BC funding is also linked here from the federal government).
Provincial and Local	Union of BC Municipalities	**Union of BC Municipalities Updated Funding Resources:** A source for BC municipalities to locate funding for climate change, climate resilience and other community opportunities.
Provincial and Local	Community Energy Association	**Community Energy Association Funding Opportunities:** A resource for funding all government levels primarily based in BC, to take climate action through plans and low-carbon projects to protect communities and the environment.
Local across Canada	Federation of Canadian Municipalities (FCM)	**FCM Funding Opportunities:** FCM offers funding in a wide variety of types to municipalities across Canada for infrastructure, climate change, energy, and resilience in the forms of studies, plans, pilot, and capital projects as well as grants.
Territorial across Nunavut	Qaujigiartiit Health Research Centre (QHRC)	**The Qaujigiartiit Health Research Centre (QHRC):** QHRC helps Nunavummiut with applying for climate change adaptation or climate monitoring funding.

GLOSSARY

Climate Adaptation: are measures taken with the intent of reducing the negative effects of climate change and is "the process of adjustment to actual or expected climate and its effects […] to moderate or avoid harm"[43]

Climate Change: is measurable changes in weather patterns over a long period of time (decades) and may be due to natural or human causes. Changes occur in the composition of the atmosphere when greenhouse gases build up and get trapped.

Climate Resilience: describes the capacity to respond to and adapt to or cope with climate change impacts and is "the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, and learning and transformation."[44]

Climate Resiliency Action Plan: An "action Plan identifies several anticipatory measures to manage priority risks and opportunities anticipated to result from climate change in the area over the next several decades."[45]

Coastal Setback: "a prescribed distance to a coastal feature such as the line of permanent vegetation, within which all or certain types of development are prohibited."[46] A setback may dictate a minimum distance from the shoreline for new buildings or infrastructure facilities or may state a minimum elevation above sea level for development. Elevation setbacks are used to adapt to coastal flooding, while lateral setbacks deal with coastal erosion.

Co-Benefits: Co-beneficial approaches to climate change are those that also promote positive outcomes in other areas, such as air quality and health, economic prosperity, and resource efficiency or more general in terms of sustainable development benefits.[47]

Climate Disaster: A natural disaster that is exacerbated, strengthened, or seeing an increase in frequency and intensity due to the effects of climate change.

43 "Annex II - Glossary - Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change." 2022. Intergovernmental Panel on Climate Change. *https://archive.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-AnnexII_FINAL.pdf*.

44 "Annex II - Glossary - Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change."2022. Intergovernmental Panel on Climate Change. *https://archive.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-AnnexII_FINAL.pdf*.

45 "Climate Resilience Action Plan". 2016. Town of Diamond Valley, Alberta. *https://www.diamondvalley.town/DocumentCenter/View/3019/Climate-Resilience-Action-Plan*.

46 "Coastal Setbacks." (Linham, M. & Nicholls, R.). 2010. UN Climate Technology Centre & Network. *https://www.ctc-n.org/technologies/coastal-setbacks*.

47 "Co-Benefits of Climate Change Mitigation." (Helgenberger, S., Jänicke, M., & Gürtler, K.). 2019. Climate Action – Encyclopedia of UN Sustainable Development Goals. *https://link.springer.com/referenceworkentry/10.1007/978-3-319-71063-1_93-1*.

Community Resilience: The connections created between groups of people, which enable them to mitigate the negative effects of and/or adapt to crisis and disruption. This often requires an ability to rapidly mobilize resources and support.

El Niño: El Niño can affect our weather significantly. The warmer waters cause the Pacific jet stream to move south of its neutral position. With this shift, areas in the northern U.S. and Canada are dryer and warmer than usual.[48]

Extreme Weather Events: is a rare (by location or season) meteorological event, that is outside the normal range for a geographic location. Examples include flooding, heat waves and intense storms.

La Niña: During La Niña events, trade winds are even stronger than usual, pushing more warm water toward Asia. Off the west coast of the Americas, upwelling increases, bringing cold, nutrient-rich water to the surface. These cold waters in the Pacific push the jet stream northward. This tends to lead to heavy rains and flooding in the Pacific Northwest and Canada. During a La Niña year, winter temperatures are cooler than normal in the North. La Niña can also lead to a more severe hurricane season.[49]

Green Infrastructure: Environmental components and natural assets (such as a forest, river, green roofs, or rain gardens) that are integrated into an urban landscape (buildings and public spaces) to create and promote more sustainable ecosystems.

Grey Infrastructure: Infrastructure that manages and controls elements of the environment that are engineered by humans (e.g., water treatment plants, pipes, dams, and tunnels) using concrete, metals, and synthetic materials to support services such as transportation, communication, water, and waste management.[50]

Human Capital: Consists of the knowledge, skills, and health that people invest in and accumulate throughout their lives, enabling them to realize their potential as productive members of a community and the expertise they can provide to their community and country.

Human Capacity: The development or improvement of individual knowledge, skills, technical expertise, and ability to adapt and be resilient to policy and leadership changes.[51]

Impacts: In the climate change context, is the effects of existing or forecasted changes in climate (hazards) on built, natural, and human systems. Impact can occur on social (e.g., health, displacement, work and emergency needs), economic (e.g., loss, insurance, restricted movement and demand for goods), physical (e.g., on public spaces and infrastructure), and ecological systems (e.g., changes in species distribution, habitat change and survival rates), which are inter-connected.[52]

48 "What are El Niño and La Niña?" 2023. United States National Oceanic and Atmospheric Administration (NOAA). *https://oceanservice.noaa.gov/facts/ninonina.html*.

49 "What are El Niño and La Niña?" 2023. United States National Oceanic and Atmospheric Administration (NOAA). *https://oceanservice.noaa.gov/facts/ninonina.html*.

50 "Benefits of Adopting National Infrastructure." 2019. Horizon Advisers. *https://awc-wpac.ca/wp-content/uploads/2019/08/Adopting-Natural_Infrastructure.pdf*.

51 "Human Capacity Definition." N.d. Law Insider. *https://www.lawinsider.com/dictionary/human-capacity*.

52 "Good Practices in Climate Risk Management – A Summary." 2021. Canadian Council of Ministers of the Environment. *https://ccme.ca/en/res/riskassessmentsummarysecured.pdf*.

Lake Effect Snow: This is produced during cooler atmospheric conditions when a cold air mass moves across long expanses of warmer lake water (pronounced effects when air masses cross larger lakes like Canada's Great Lakes). As the cold air passes over the unfrozen, and relatively warm waters of the (Great) lake(s), warmth and moisture are transferred into the lowest portion of the atmosphere. The rising air ultimately leads to cloudiness and snow on the leeward sides of the (Great) lake(s).

Land Subsidence: is the lowering of the land-surface elevation due to changes that take place underground, via the movement of earth materials, groundwater changes, or ground thawing.

Resilient Infrastructure: Infrastructure that "reduces, but may not fully eliminate, the risk of climate-related disruptions."[53]

Urban Heat Islands: These are urbanized areas that experience higher temperatures than outlying areas. Structures such as buildings, roads, and other infrastructure absorb and re-emit the sun's heat more than natural landscapes such as forests and water bodies. Urban areas, where these structures are highly concentrated and greenery is limited, become "islands" of higher temperatures relative to outlying areas.[54]

53 "Climate-Resilient Infrastructure – Policy Perspectives." 2018. OECD. *https://www.oecd.org/environment/cc/policy-perspectives-climate-resilient-infrastructure.pdf*.

54 "Heat Island Effect." 2023. United States Environmental Protection Agency. *https://www.epa.gov/heatislands*.

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With funding provided by:

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