



Climate Vulnerability and Risk Assessment Workbook



*For Manitoba
Communities*

MANITOBA CLIMATE
RESILIENCE TRAINING

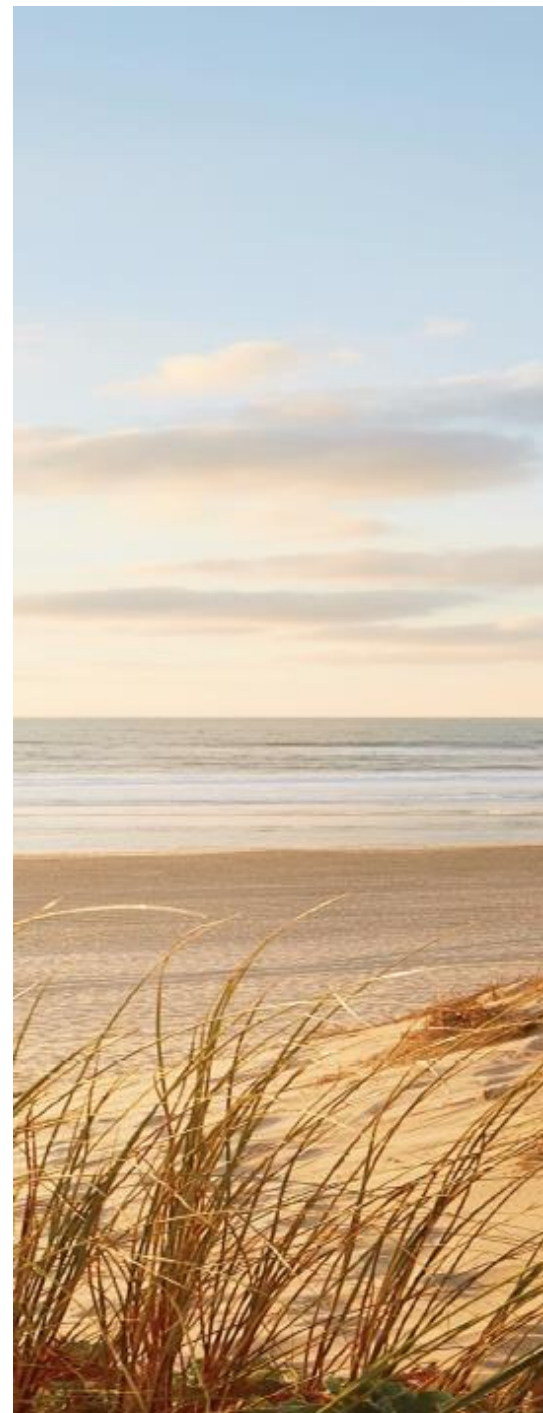


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Step 1: Climate Hazard Assessment

Task 1.1: Develop a list of climate-related hazards

The goal of Step 1 is to:

- Identify the climate hazards that already affect or will affect your community; and
- Understand how the climate hazards are predicted to change.

Begin by reflecting on the climate hazards that have historically or recently affected your community over the last 10 years or so. Consider the frequency (how often?), magnitude (how much?), and duration (how long?) of each event.

Instructions: What weather phenomena and extreme climate events have impacted your community in the past? Write them in **Box 1.1**.

Climate Hazard: Physical events or processes that can cause harm to human health, economies, infrastructure, and to natural resources and ecosystems.

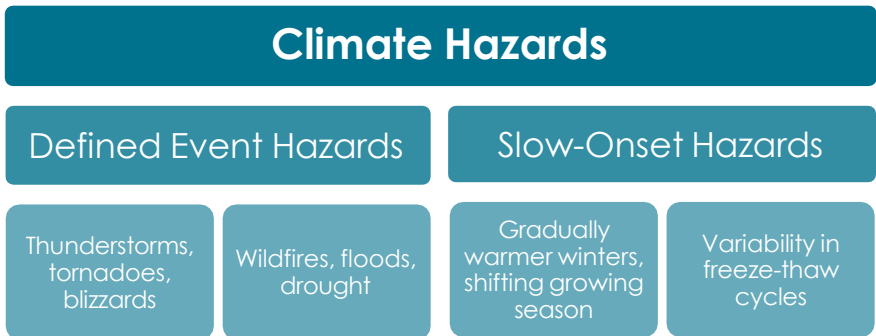


Figure 1.1: Climate hazards explained with examples.

Climate Hazard	Frequency	Magnitude	Duration
Heatwaves	Annually in July and August	Night temperatures of +20°C	3-4 days at a time

Box 1.1: Identify existing climate hazards in your community.

Step 1: Climate Hazard Assessment

Task 1.2: Identify how climate hazards are predicted to change

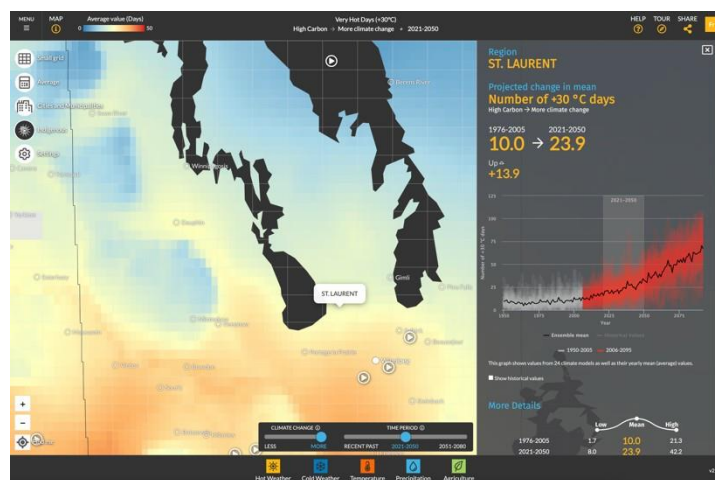


Figure 1.2: The Climate Atlas of Canada's interactive map.

Step 1: Visit The Climate Atlas of Canada at [ClimateAtlas.ca](https://climateatlas.ca)

Step 2: Click "Map" on the top of the homepage

Step 3: Locate your community on the map

Step 4: Explore the variables at the bottom of the page to see your projected climate future

Figure 1.3: How to find data on the Climate Atlas of Canada.

To identify how a changing climate will affect the hazards facing your community, or to anticipate new hazards, you must explore projected climate data. This can be found on the Climate Atlas of Canada, pictured in **Figure 1.2**. The Atlas provides users with an interactive map showing both historical and future climate data for a variety of scenarios and variables.

Instructions: Visit the Climate Atlas of Canada following the steps outlined in **Figure 1.3**. Be sure to set the "climate change" slider at the bottom of the page to "more." Explore the variables listed in **Box 1.2** and then fill in the data for your community.

Variable	Recent Past: 1976-2005	Near-term Forecast: 2021-2050	Change (+/-)
Very Hot Days (+30°C)	days	days	days
Very Cold Days (-30°C)	days	days	days
Annual Mean Temperature	°C	°C	°C
Mean Spring Precipitation	mm	mm	%
Frost-Free Season	days	days	days

Box 1.2: Fill in the boxes using data for your community from the Climate Atlas of Canada.



Now that you have recorded existing climate hazards and explored climate projections for your community, you can think about how they may change in the future.

Instructions: Using future climate data you recorded in **Box 1.2**, predict how climate change could change the hazards you identified in **Box 1.1**. Then write a one or two sentence statement to summarize the anticipated effects of climate change on each hazard. Each statement should identify the climate hazard, state the observed trends in frequency, magnitude, and duration, and predict how it may change in the future. Summarize the information into a specific example of your climate hazard to form your climate hazard statement. Record this information in **Box 1.3** below.

Did you consider how a changing climate may introduce new hazards to your community?

Climate hazard	How Might This Change the Hazard in the Future?
	Climate Hazard Statement
Example: Heatwaves	Average annual number of heatwaves increasing from 1.9 to 4.2 Average length of heatwaves increasing from 3.5 days to 5.3 days Average summer temperature increasing from 18.6°C to 20.7°C Average number of days above +30°C increasing from 14 to 31
	As summer temperatures and the number of days above +30°C increase, future heatwaves can be expected to be longer and hotter than those previously experienced.

Box 1.3: Fill in the boxes above to understand how the climate hazards impacting your community may change in the future.



Step 2: Climate Impact Assessment

Task 2.1: Develop an inventory of climate change hazards and impacts

The goal of Step 2 is to:

- Consider impacts of the identified climate hazards
- Explore how these impacts might be felt in the future
- Understand the consequences for your community

A **hazard** is a climate or weather event (e.g. tornado), whereas an **impact** is a hazard's effect (damaged buildings).

To fully assess climatic risk, you must first identify the presence of living things, natural systems, services, and so forth that may be impacted in the event of a climate hazard. Refer to the information you collected for your Climate Hazard Assessment. Use your list of climate hazards to begin thinking about potential impacts on your community. Consider what occurs during and immediately after the hazard event, as well as the effects on humans, critical services, infrastructure, the local economy, and the natural environment.

Instructions: View the example in **Figure 2.1**. For each climate hazard identified in Step 1, think of the direct impacts. Consider which aspects and assets of your community may be the most exposed to climate hazards and record them in **Box 2.1** on the following page.

Climate Hazard	What Are the Impacts of This Hazard?				
Example: Heatwave	-More hot days and night	-Reduced water supply	-Loss of soil moisture	-Increased risk of wildfires	-Amplification of drought conditions

Figure 2.1: An example of how heatwaves impact communities.



Climate Hazard	What Are the Impacts of This Hazard?				

Box 2.1: Consider and record the expected impacts of climate hazards on your community.

Step 2: Climate Impact Assessment

Task 2.2: Identify the climate consequences to your community



When identifying the consequences of climate impacts, try to consider specific factors of each impact. **Figure 2.2** outlines different categories to focus your thinking as you consider the various consequences to your community.

Instructions: Using the information you've gathered and the flow chart template in **Box 2.2**, develop your Climate Impact Assessment. For each identified hazard, list the impacts from **Box 2.1** and consider the associated consequences of those impacts. See the example in **Figure 2.3** before you get started.

Figure 2.2: Different categories to consider when recording the consequences of climate hazards.



Example: Climate Impact Assessment











Climate Hazard:	Heatwave: 7+ days of +30°C weather
[Box 1.3] Changes to Climate Hazards Climate Hazard Statement	
<p>Average annual number of heatwaves increasing from 1.9 to 4.2</p> <p>Average length of heatwaves increasing from 3.5 days to 5.3 days</p> <p>Average summer temperature increasing from 18.6°C to 20.7°C</p> <p>Average number of days above +30°C increasing from 14 to 31</p>	
<p>As summer temperatures and the number of days above +30°C increase, future heatwaves can be expected to be longer and hotter than those previously experienced.</p>	
[Box 2.1] What Are the Impacts of this Hazard?	
<ul style="list-style-type: none"> - More hot days and nights - Reduced water supply - Loss of soil moisture - Increased risk of wildfires - Amplification of drought conditions 	
What Consequences Might Occur in a Worst-Case Scenario?	
 Community & People	<ul style="list-style-type: none"> - Seniors/vulnerable community members suffer heat stroke - Cancellation of outdoor events, sports, and gatherings - Food security threatened by crop loss
 Critical Services	<ul style="list-style-type: none"> - Air conditioning failures in public buildings - Increased demand for emergency medical services - Electrical grid brownouts/blackouts
 Buildings & Infrastructure	<ul style="list-style-type: none"> - Foundational cracks in buildings - Heat damage to roads - Equipment failures from overheating
 Local Economy	<ul style="list-style-type: none"> - Financial pressure on farmers and agricultural businesses - Overwhelming demand for water-based attractions - Tourism industry brought to stand-still due to fire bans, water restrictions, etc.
 Natural Environment	<ul style="list-style-type: none"> - Loss of plant & animal life due to heat; water shortage - Decreased water quality and quantity lead to boil water advisories - Demand for irrigation exceeds water supply

Figure 2.3: An example of a completed Climate Impact Assessment. Adapted from All One Sky Foundation (2021). Climate Resilience Express: A Community Climate Adaptation Planning Guide.



Climate Impact Assessment Template

Climate Hazard:		
[Box 1.3] Changes to Climate Hazards Climate Hazard Statement		
[Box 2.1] What Are the Impacts of this Hazard?		
What Consequences Might Occur in a Worst Case Scenario?		
 Community & People		Consequence Rating
 Critical Services		Consequence Rating
 Buildings & Infrastructure		Consequence Rating
 Local Economy		Consequence Rating
 Natural Environment		Consequence Rating

Box 2.2: A template for completing a Climate Impact Assessment.



Step 3: Climate Risk Assessment

Task 3.1: Assess the severity of identified climate risks to your community

The goal of Step 3 is to:

- Understand how susceptible your community is to each of the impacts and consequences you have previously identified.
- Determine priorities for the adaptation planning phase and consider solutions.

Climate hazards and their consequences can be assessed using a severity rating scale from *insignificant* to *catastrophic*. This has been provided for your reference in

Figure 3.2. Consider your community's current vulnerabilities. Refer to your climate impact assessment and recall what key assets or groups are exposed to climate hazards.

Instructions: Return to your Climate Impact Assessment. For each consequence categories, assign a level of anticipated severity were those consequences to occur. Use the numbers 1 – 5 and see the **Figure 3.2** on the following page for a reference guide of severity levels.

How sensitive are community activities, assets, and services to changes in climate, as well as changes in climate hazards?

What risk management measures are currently in place?

What is your community's ability to adjust to or take advantage of changes in climates and their associated hazards


 Community & People	<ul style="list-style-type: none">- Increased risk of heat stroke and heat exhaustion, especially seniors- Wildfires and evacuations- Cancellation of outdoor events, sports, and gatherings	Consequence 4
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Figure 3.1: Return to your Climate Impact Assessment and assign a severity rating to each identified consequence.



<p>1 Insignificant</p>	<p>No practical impact on the community, its people, or assets.</p> <ul style="list-style-type: none"> • Impact may be observed but does not change day-to-day life • No deaths, injuries, or effects on health and safety • No impact to the economy, environment, property, or services.
<p>2 Minor</p>	<p>No significant impact on the community, its people, or assets, and can be handled through business-as-usual practices.</p> <ul style="list-style-type: none"> • No deaths or injuries, minor short-term effects on health and safety • Very minimal impact on local economy • Insignificant environmental disruption or damage • Slight damage to property and infrastructure, very short-term service interruptions, or negligible costs • No liabilities or significant extra costs
<p>3 Moderate</p>	<p>Moderate impacts at the local and regional scale of minor importance, to be addressed through low-cost or no-regret adaptation actions.</p> <ul style="list-style-type: none"> • Few injuries, or modest temporary impact on quality of life • Interruptions to business revenue and employment for less than one week • Isolated and reversible damage to wildlife, habitat, and/or ecosystem • Potential damage to property/infrastructure, short-term service interruptions, localized evacuations • Modest to higher cost events
<p>4 Major</p>	<p>Major impacts at the local and regional scale that are of high importance to municipal operations and agencies, requiring assistance from national agencies to quickly address through strategic adaptation actions.</p> <ul style="list-style-type: none"> • High possibility of injuries or chronic health issues or major temporary impact on quality of life • Interruptions to business revenue and employment for more than one week • Irreversible damage to wildlife, habitat, or ecosystems • Damage to property and infrastructure, longer-term service interruptions, major delays, and evacuations • Community complaints; dissatisfaction or anger with situation; legal liabilities and lawsuits possible
<p>5 Catastrophic</p>	<p>Extreme impacts at the local and regional scale of very high importance to municipal operations and agencies to urgently address through adaptation.</p> <ul style="list-style-type: none"> • Many serious injuries or illnesses, fatalities, and/or long-term impacts on quality of life • Interruptions to businesses and revenue for more than a month, extending to entire sectors at a major economic cost • Widespread and irreversible damage to wildlife, habitat, and ecosystems • Loss of and widespread damage to property and infrastructure, long-term interruption of services, widespread evacuations • Major costs to municipality, high possibility for legal liabilities and lawsuits

Figure 3.2: Different levels of severity for climate risks with examples.



Step 3: Climate Risk Assessment

Task 3.2: Prioritize climate risks to your community

Consider the outcomes of the consequence assessment in the previous task. Review your severity rankings and for each one, assign a level of anticipated risk. Likelihood represents the chance of each consequence occurring and have been organized from *very unlikely* to *very likely*. See **Figure 3.3** below for all four tiers of risk which may be assigned to a consequence.

This will help you decide which risks to take forward into adaptation planning response, and which ones may need further work or research.

Instructions: Follow the steps below to complete your risk assessment.

1. Use **Figure 3.3** to assign a level of likelihood to each consequence.
2. Plot each consequence on the Risk Assessment Matrix (**Figure 3.4**) on the following page.
 - o Place by *consequence severity* along the bottom and *likelihood* along the left side to find the suggested priority rating.
3. Record the results in the blank Risk Assessment Matrix in **Box 3.1** and brainstorm potential adaptation actions in **Box 3.2** to create your community's list of climate change adaptation planning priorities.

Very Likely – 5	Adaptation actions must be developed and applied immediately
Likely – 4	Develop and apply low-cost and “no regret” adaptation options with urgency
Possible – 3	Integrate low-cost and “no regret” adaptation options into routine planning practices
Unlikely – 2	Monitor and reassess the severity of consequences in the future
Very Unlikely – 1	Adaptation actions unnecessary or impractical

Figure 3.3: Levels of likelihood and the appropriate response needed.

Are there specific areas of the community, vulnerable populations, or existing inequities that may require immediate action?

What is the cost of the response and are there funding options?

Is there a level of uncertainty remaining, and is more researched needed before agreeing on any action?

ASSESSING CURRENT AND FUTURE CLIMATE RISKS



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Figure 3.4: Risk assessment matrix. Each box assigns a priority rating to assist in adaptation planning.
Adapted from City of Selkirk (2019) Climate Change Adaptation Strategy.

Likelihood	5 Very Likely	Medium Priority	Medium-High Priority	Medium-High Priority	High Priority	High Priority
	4 Likely	Medium-Low Priority	Medium Priority	Medium-High Priority	Medium-High Priority	High Priority
	3 Possible	Medium-Low Priority	Medium-Low Priority	Medium Priority	Medium-High Priority	Medium-High Priority
	2 Unlikely	Low Priority	Medium-Low Priority	Medium-Low Priority	Medium Priority	Medium-High Priority
	1 Very Unlikely	Low Priority	Low Priority	Medium-Low Priority	Medium-Low Priority	Medium Priority
Risk Assessment Matrix		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
Severity of Consequences						



Box 3.1: Fill in this blank Risk Assessment Matrix with your community's climate change adaptation planning priorities.

Likelihood	5 Very Likely					
	4 Likely					
	3 Possible					
	2 Unlikely					
	1 Very Unlikely					
Risk Assessment Matrix		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
Severity of Consequences						



Next Steps: Adaptation Planning Actions

Upon ranking consequences by priority, you have completed the steps of the Climate Vulnerability and Risk Assessment process. This exercise looks ahead to the next stage of Climate Adaptation Planning.

Instructions: For each consequence in a **red** or **orange** square, begin thinking about actions your municipality can take to address it through future adaptation planning measures.

"High Priority" Risk	Potential Actions to Explore Through Adaptation Planning
Example: Wildfires and evacuations	<ul style="list-style-type: none"> - Take inventory of vulnerable buildings, like healthcare centres, nursing homes, and schools - Plan evacuation routes and backup routes - Explore the creation of a firebreak around the community - Educate citizens on ways to reduce the risk of wildfires - Encourage citizens to make their own evacuation plan

Box 3.2: Brainstorm ideas your municipality can explore further to address the consequences you rated as high priority.

References

All One Sky Foundation. (2021). *Climate Resilience Express: A Community Climate Adaptation Planning Guide*. Retrieved from <https://www.allonesky.ca/climate-resilience-express>.

City of Selkirk. (2019). *Climate Change Adaptation Strategy 2019-2029*. Retrieved from <https://www.myselkirk.ca/wp-content/uploads/2019/07/Climate-Change-Adaptation-Strategy-Final-May2019.pdf>.

