# Climate Vulnerability and Risk Assessment Guidebook for Manitoba Communities

Revised Final Draft: July 2023

Prepared by: IISD under the Manitoba-IISD 2022-23 Work Plan

Submitted to: Climate and Green Plan Implementation Office Manitoba Environment and Climate

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## **Glossary of Terms**

This glossary is derived from Guidance on Good Practices in Climate Change Risk Assessment (CCME, 2021), unless otherwise noted.

Adaptation	Any effort or action to respond to actual or anticipated climate change impacts that minimizes the effects of climate change on built infrastructure, natural ecosystems, and social systems.
Adaptation planning	"The process and mechanism of incorporating climate risks and anticipated outcomes in the development of planning documents so as to make communities more resilient to the potential impacts of climate change" (from Manitoba Climate Resilience Training [MCRT], 2021, p. 1).
Adaptive capacity	The ability of built infrastructure, natural ecosystems, and social systems to adjust to changing environmental conditions (like climate variability or extreme weather events), minimize possible damage, take advantage of opportunities, or handle the consequences.
Climate change	A slow change in long-term weather patterns due to natural phenomena and human activities (e.g., use of fossil fuels and release of carbon dioxide) that change the chemical composition of the atmosphere through the accumulation of greenhouse gases. Climate change is contributing to a rising global temperature, changing rain and snowfall patterns, warming oceans, and many other impacts.
Climate hazard	A biophysical event that can cause impacts to built infrastructure, natural ecosystems, and social systems. Examples of hazards include droughts, rain, high winds, tornadoes, wildfires, and hail.
Climate impact	The effects of climate (either existing or forecasted) on built infrastructure, natural ecosystems, and social systems. For example, the impact of drought (a climate hazard) may be reduced crop yields, insufficient potable water, and an increased risk of wildlife.
Climate risk	The potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain. Risk results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence.

Consequence	Something that occurs in response to a particular climate impact. Drought (hazard) causes reduced crop production (impact) which can lead to an increase in insurance claims (consequence).
Exposure	The presence of people, livelihoods, species, ecosystems, resources, infrastructure, or cultural assets in locations and settings that could be affected by climate change.
Mitigation	Reducing the sources of greenhouse gas emissions or enhance the sinks of greenhouse gases to further prevent climate change (IPCC, 2014).
Resilience	The ability of built infrastructure, natural ecosystems, and social systems to maintain their function when exposed to hazard. Resilience can be increased by making changes in preparation for a hazard, such as relocating a house built outside of the floodplain in preparation for the increased frequency and severity of floods.
Sensitivity	The degree to which built infrastructure, natural ecosystems, and social systems are affected when exposed to climate change impact, and their ability to function normally when the impact occurs. For example, a house built in the flood plain is highly sensitive to flooding, as the residents will likely have to evacuate, and the house will be damaged.
Vulnerability	The degree to which built infrastructure, natural ecosystems, and social systems is susceptible to harm or damage from climate change impacts. It is a function of both the community's sensitivity to climate change and its capacity to adapt to the impacts.

## Abbreviations

BRACE	Building Regional Adaptation Capacity and Expertise
CVRA	climate vulnerability and risk assessment
GHG	greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
MEL	monitoring, evaluation, and learning
MCRT	Manitoba Climate Resilience Training
RCP	Representative Concentration Pathway

## Foreword

Since 2018, the Manitoba Government has worked to enhance the climate resiliency of communities and businesses by supporting adaptation planning and action across the four pillars of its Climate and Green Plan – Climate, Jobs, Nature, and Water. As part of these efforts, Manitoba initiated the Manitoba Climate Resilience Training (MCRT) Project in partnership with Natural Resources Canada, with initial co-funding provided under the Building Regional Adaptation Capacity and Expertise (BRACE) program. The MCRT Project aimed to create tailored approaches to integrating climate risk and opportunities into decision-making and planning within the northern business, Indigenous, planning, and infrastructure sectors of Manitoba.

The overall MCRT framework consists of four distinct but interrelated phases (Figure 1):

- The scoping phase (MCRT-1; initiated in 2018) aimed to increase the capacity of organizations, professionals, communities, and small-to-medium sized businesses to undertake climate change adaptation actions within Manitoba. This phase included design and delivery of a series of engagement sessions to evaluate capacity building needs, gaps, and opportunities for knowledge planning to mainstream adaptation into existing processes.
- 2. The training and capacity building phase (MCRT-2; initiated in 2020) involved tailored, virtual training courses for targeted sectors (northern business, Indigenous, planning, and infrastructure). Within this phase, a comprehensive suite of training and capacity building modules were prepared to enhance the expertise of professionals, including engineers and planners, to address risks associated with a changing climate in areas such as land use, water management, and infrastructure.
- 3. The climate vulnerability and risk assessment (CVRA) phase (MCRT-3; initiated in 2022) involves the development of CVRAs for communities through guidance documents and training.
- 4. The adaptation planning (mainstreaming) phase (TBD) will translate the CVRAs into actionable information, supporting communities in developing robust and evidence-based local climate adaptation plans.



Figure 1: MCRT Framework

The training modules and related resources from phases 1 and 2 are available on the <u>ClimateWest</u> <u>website</u>. Phases 3 and 4 are designed to build upon the suite of foundational courses that were delivered for targeted sectors in MCRT-2.

The *Climate Vulnerability and Risk Assessment Guidebook for Manitoba Communities* was prepared by the International Institute for Sustainable Development (IISD) to support the activities of MCRT-3.

### Introduction

Manitoba's climate has changed, and will continue to change. The Canadian Prairies, Manitoba included, have warmed significantly in recent decades, particularly in the winter (Sauchyn et al., 2020). Our climate has become more variable and uncertain, as recently experienced with the province moving from one of the driest summers in 2021 to the wettest springs in 2022. As Manitoba's climate continues to change, communities will increasingly need to deal with the resulting impacts, such as flood damages to infrastructure, drought stress on crops and local economies, heat waves that threaten the health of vulnerable populations, and fewer cold days that reduce the reliability of winter road systems.

While we still need to reduce greenhouse gas (GHG) emissions to reduce the extent of climate change, communities also need to prepare for a more extreme and less predictable climate in the years ahead. To prepare, communities need to understand how the climate in their location has changed and is likely to change in the future, and based on this knowledge, take steps to reduce the potential negative impacts associated with these changes. At the same time, they can also identify and plan for potential new economic and social opportunities that could emerge as Manitoba's climate changes.

This guidebook is designed to assist Manitoban communities in the completion of a climate vulnerability and risk assessment (CVRA). A CVRA is the foundation of adaptation planning and action, helping communities to understand existing sensitivities to change climate risks, as well as the future potential consequences of these risks. Once the climate risks are identified, assessed, and prioritized, the results can be used in the next step of the adaptation planning process, which is the selection of adaptation actions to address and reduce risk. A CVRA provides insight into current and potential future climate risks for a particular point in time. It is intended to be an iterative process; as our climate continues to change and our society and communities grow and advance, the CVRA needs to be revisited, revised, or updated on a periodic basis to reflect these changes.

#### About this Guidebook

The *Climate Vulnerability and Risk Assessment Guidebook for Manitoba Communities* has been developed to help local government representatives across Manitoba lead a CVRA and assess how the anticipated impacts of climate change will affect their communities and residents.

It is designed for use by small population centres<sup>1</sup> and rural areas in Manitoba to complete a community-wide assessment. As such the assessment can include municipal infrastructure and services, private homes and buildings, natural ecosystems, and the well-being of residents. Municipalities will require resources and capacity to successfully complete the CVRA, including financial resources, time allocation, and trained staff. To leverage resources, smaller communities may consider partnering with others within a larger area.

The intended user of this guidebook should have a basic knowledge and understanding of climate change and risk management, including concepts like climate mitigation versus climate adaptation, climate risks, impacts, and adaptive management. Some resources to strengthen your knowledge of these topics are provided in the resources section at the end of this guidebook.

<sup>&</sup>lt;sup>1</sup> Statistics Canada (2017) defines small population centres as those with between 1,000 and 29,999 residents.

#### How to use this Guidebook

The *Climate Vulnerability and Risk Assessment Guidebook for Manitoba Communities* begins by outlining the guiding principles for undertaking a CVRA, describing key concepts that are frequently used throughout the CVRA process, and providing a brief overview of how a CVRA fits into a larger adaptation planning process. With this knowledge, you will be better prepared to undertake your CVRA.

The remainder of the guidebook covers the following, as described in Figure 2:

1. Getting Started with the CVRA,

which describes the steps needed to prepare for a climate risk assessment. These steps include raising awareness of climate change and the need for a CVRA with stakeholders and community leaders, confirming the scope and the specific objectives of the risk assessment, building a team, finalizing a work plan, and creating a community profile.

2. Climate Vulnerability and Risk Assessment: Assessing Current and Future Climate, which is the focus of this guidebook. It provides guidance on the process to gain an understanding of the degree to which climate change will impact your community. It provides guidance on how to identify, evaluate, and prioritize climate change risks, which can drive targeted action and investment in climate risk management or adaptation.



Figure 2: CVRA Guidebook Process

**3.** Next Steps: Planning, Implementation, and Monitoring, Evaluation, and Learning, which provides a brief overview of what can be done after climate risks have been identified and prioritized by your community.

The guidebook includes some tips and actions that can be taken during the CVRA process. These actions are marked by this symbol:  $\mathfrak{B}$ .

The guidebook is also supported by the *Climate Vulnerability and Risk Assessment Workbook for Manitoba Communities*, which provides fillable worksheets to support each step in the CVRA process.

## **Guiding Principles**

The following guiding principles have informed development of the *Climate Vulnerability and Risk Assessment Guidebook for Manitoba Communities*:

- **Transparent** the process used should be accessible, well documented, and its process and outcomes shared.
- Inclusive a diversity of community members and stakeholders should be included in the CVRA process to ensure their support for its outcomes and increase the likelihood of successfully developing and implementing an adaptation plan in the future. This principle includes recognition of the need to embrace meaningful engagement with Indigenous Peoples, working together on a shared path to climate resilience.
- **Equitable** the process should seek to address the climate risks facing all Manitobans, while ensuring that prioritized risks and potential adaptation actions do not result in unintended negative consequences or increase inequality between people, groups, or other communities.
- **Iterative** the CVRA should be repeated on regular basis to incorporate new knowledge, lessons learned, and changes within communities.
- **Well-informed** the CVRA should draw on the best available sources of information, including scientific expertise and local knowledge, as well as Indigenous knowledge systems.

As the most successful CVRAs adhere to these guiding principles, you are encouraged to follow them at all stages, as well as throughout other efforts to prepare for climate change.

### **Key Concepts**

The CVRA process is rooted in several concepts and terms. Having a strong understanding of these concepts and terms strengthens capacity to complete the processes described in this guidebook and communicate the purpose of its different steps to others.

To deepen understanding of these key concepts, this section is organized around a series of questions that are likely to be raised as the CVRA is initiated.

#### What is climate risk?

In the context of climate adaptation, risk is the "the potential for adverse consequences" due to climate change. These consequences include negative impacts on livelihoods, health and wellbeing, economies, social and cultural assets, infrastructure, services, and ecosystems. Climate risks can arise from the changes in our climate but also from human responses to climate change (such as the effectiveness or lack of climate policy and climate-related investments) (IPCC, 2022).

As discussed in more detail in the "Climate Vulnerability and Risk Assessment: Assessing current and future climate" section of this document, climate risks result from the interactions between climate hazards, exposure of the things we value, and vulnerability of people, assets, and services to the effects of a hazard. Hazards, exposure, and vulnerability are subject to uncertainty in terms of magnitude and likelihood of their occurrence, and each may change over time and space due to socioeconomic changes and human decision-making. Uncertainty, or more broadly, incomplete knowledge, is a key element of the concept of risk (IPCC, 2022).

#### Why is it important to understand climate risk?

Despite ongoing efforts to reduce GHG emissions, climate change is already underway and further future change is unavoidable. CVRAs are critical in identifying, assessing, and prioritizing changing climate risks and their potential impacts on our communities. CVRAs are a credible approach to prioritize complex issues that can be used at a later date to choose adaptation actions that will most benefit the community and reduce its exposure to climate risks. As climate change impacts will affect community members differently, an inclusive process should be undertaken to ensure that their different understandings, skills, and experiences are brought into the CVRA process.

## Why do we need to undertake climate vulnerability and risk assessments?

Manitoba's climate has already changed, with Manitobans experiencing hotter temperatures, increasing wildfires, changing precipitation patterns, and more frequent flooding and droughts. Our location, at the centre of the continent and at a northern latitude, means that we will warm faster than the global average, making us susceptible to earlier and more extreme changes in climate.<sup>2</sup> This means that the climate of the future will not be the climate of the past. Therefore, underlying assumptions upon which decisions have traditionally been made, such as when spring break-up will occur, what crops will grow, how much snow will fall, or the stability of the permafrost on which we build, may no longer hold true. Neglecting to identify the risks associated with climate change can lead to:



Figure 3: Example of output from the Climate Atlas of Canada (2019), showing the projected change of Manitoba's annual temperature from 1976-2005 to 2021-2050, an increase of 2.4°C.

• Social risks, including the loss of lives and the disruption of lives.

<sup>&</sup>lt;sup>2</sup> Manitoba's mean annual temperature is projected to increase by 2.4°C from the recent past (1976-2005) into the near future (2021-2050), under a high carbon scenario. Even with significant reductions in global GHG emissions, further climate change is inevitable (Figure 3; Climate Atlas of Canada, 2019).

- Economic risks, such as cost related to the damage or destruction of built infrastructure and distribution of supply chains.
- Environmental risks, such as changes in plant and animal species that can thrive in different parts of the province.
- Legal liability issues, if a community or business fails to act in the face of a known risk.

Undertaking a CVRA is an important part of preparing for the anticipated impacts of a changing climate and taking actions to reduce these risks and increase resilience to current and future climatic changes.

#### What are the different approaches to climate vulnerability and risk assessments?

There are a variety of approaches to CVRAs, each with its own focus and purpose. CVRAs can be applied at different scales and at different levels of detail. The approach can be influenced by the purpose of the assessment, the availability of data and resources, and timelines. It can be completed as a standalone process, or as an initial exercise to accompany an expert-led assessment down the road. Alternatively, the CVRA can be completed as a part of the development of an adaptation action plan for reducing current and future climate-related risks.

Depending on those factors, CVRAs can focus on identifying risks either by using a qualitative process, such as stakeholder input, traditional knowledge, and expert opinion, or be more quantitative in nature, such as using systematic hazard mapping, data, and scenario analysis (Box 1). In most cases, a combination of both qualitative and quantitative processes is used.

This guidebook supports a hybrid approach, where the climate risk assessment is developed based on preliminary climate data along with experiences, observations, and perceptions of stakeholders and community members.

#### Box 1. The difference between qualitative and quantitative CVRAs

**Qualitative CVRA** is gathered through learning about the experiences or perspectives of community members. *How has the weather and seasons have changed since you were a child? If you are a farmer, how will your crop production or livestock be impacted by more frequent drought?* 

**Quantitative CVRA** is gathered through research and data analysis, using historical climate and weather data, modelled climate projections, and numerical scoring systems for vulnerability and risk.

#### Climate vulnerability and risk assessment and the adaptation planning process

Adaptation planning is a process through which communities can prepare for current and future climatic changes. The adaptation planning process typically follows five stages (Figure 4), with CVRA as the focus of Stage 2 (adapted from IPCC, 2014):

1. **Getting started:** Leaders raise awareness around climate change and engage with community members and relevant stakeholders. The scope and objectives of the CVRA and/or adaptation plan are determined, as well as necessary resources.

- 2. **Assessing and prioritizing vulnerability and risk:** Those working on the adaptation planning process identify, assess, and prioritize current and future climate risks.
- 3. **Identifying and evaluating adaptation options:** Climate adaptation measures that can reduce the highest climate risks are determined.
- 4. **Implementing the adaptation strategy:** An adaptation plan that includes the selected adaptation measures is finalized and implemented over a set timeframe.
- 5. **Monitoring, evaluation, and learning:** Progress on the implementation of the plan is measured and evaluated. Based on this assessment and new information regarding projected climate risks, the CVRA and/or plan is updated to reflect the lessons learned.

This guidebook focuses on the steps required to complete a CVRA. It also includes a description of important considerations as communities get started with the CVRA and the steps that can be taken in the adaptation planning process, once the CVRA is completed.



Figure 4: The adaptation planning process, in which CVRA is the second stage (adapted from IPCC, 2014).

## **Getting Started with a Climate Vulnerability and Risk Assessment**

CVRAs will be more successful with some preparation prior to getting started, which can include identifying its goals, setting the scope, forming the implementation team, confirming internal support and resources, and beginning to engage internal and external stakeholders. Below are a number of

actions that can be taken to prepare for your community to undertake a CVRA. These preparatory activities, adapted from guidance prepared by the Canadian Council of Ministers of the Environment (2021), will be important discussion points for your community to consider you as you get started. Once complete, you will have a work plan and support for implementation of your CVRA.

#### Learn more about climate change

Having a good understanding why climate change is happening and how it might impact your location is important to the CVRA process. This knowledge can help to gain interest and support from community leaders, potential team members, and other stakeholders to engage in the CVRA process. Expert knowledge is not required, but it is good to have a basic understanding of:

- How the climate of your location is expected to change over time.
- The potential negative and positive impacts of these changes in your community.
- The types of adaptation actions that can be implemented and how other communities have taken steps to prepare for climate change.

Take some time to refresh or enhance your knowledge on climate change at this step.

#### Resource to learn more about climate change:

- The Prairie Climate Centre has prepared a report, <u>Manitoba and Climate Change</u>, that summarizes the expected impact of climate change for Manitoba.
- MCRT has videos of its previously delivered <u>courses</u> available online, including topics like <u>Climate 101</u> and <u>Climate Change Risk Assessment Core Principles</u>.

#### Identify the goals and objectives of the Climate Vulnerability and Risk Assessment

There are a variety of reasons to complete a CVRA. It can be a standalone process, an initial exercise to accompany a future expert-led assessment, or completed as a part an adaptation planning process. The CVRA process may aim to provide a basic assessment of climate risks, or it may seek to do a more comprehensive, detailed assessment. Confirming the motivation(s) behind your CVRA and the objectives you want it to achieve will help inform the process and ensure the assessment meets your intended outcomes.

**#** Document the reasons you or your community may have for completing the CVRA.

#### Consider your organizational capacity and constraints

Most communities will have some constraints regarding their capacity to complete a CVRA, such as budget, staff time, expertise, and data (Box 2). However, it is also important to acknowledge the capacity and local knowledge that your community can contribute to the assessment. Considering both capacity and constraints are important to planning the scope, timeline, and execution of the CVRA. For example, already having access to climate change projections for your community can reduce the staff time or the cost needed to acquire this information, saving time and money. **#** Create a list of the resources (human, financial, or other) that you and your community have access to for the completion of the CVRA.

#### Box 2. The benefits of regional collaboration (Boyd and Zukiwsky, 2019)

Communities can also consider engaging others to undertake a collaborative regional approach. For example, communities in the <u>Edmonton Metropolitan Region</u> have found success and benefit from working together. Smaller communities with limited funding, staff capacity, or technical expertise may especially benefit from collaborating with others. Regional collaboration initiatives vary in scope and scale, but often are loose membership groups that include a mix of local governments, government agencies, regional authorities, utility corporations, non-profits, and private business, among many others.

## Determine the scope and detail level of the climate vulnerability and risk assessment

A CVRA can be undertaken at several different scopes (Figure 5) and levels of detail, depending on goals, objectives, and organizational capacity. It is possible that your planning process could start broadly at the community level, followed by more detailed analysis of a particular asset that as been identified as being especially at risk due to climate change.<sup>3</sup> **Tip:** All One Sky's *Climate Resilience Express: A Community Climate Adaptation Planning Guide* (2021) provides a useful table for determining the scope of your CVRA or adaptation planning process.

The scope and depth of the CVRA and adaptation planning process your community undertakes will likely depend on its objective, resources available, and timelines. This guidebook is focused on CVRA undertaken at the community-wide level. However, the approach presented is flexible, and can be applied to processes of different scale and detail.

**#** Document the scope and detail level of your CVRA, ensuring that the scope decided on matches with the human and financial resources available to you.

<sup>&</sup>lt;sup>3</sup> A more detailed assessment is more likely to be appropriate when the scope of the adaptation planning process is a single asset, such as bridge, and should be completed by a qualified professional (using a process such as that outlined in the <u>PIEVC Engineering Protocol</u>).



Figure 5: Potential scales of adaptation planning processes (All One Sky, 2021).

## Types of data and information that will be used to inform the climate vulnerability and risk assessment

A variety of data and information can be used in a CVRA. They can focus on identifying risks either by using a qualitative process, such as stakeholder input, traditional knowledge, and expert opinion, or be more quantitative, such as using systematic hazard mapping, data, and scenario analysis (see Box 1). In most cases, a combination of both qualitative and quantitative processes is used.

This guidebook supports a hybrid approach, where the CVRA is developed based on climate data, along with the experiences, observations, and perceptions of stakeholders and community members.

Create a list of the data and information already available in your community. This might be data that has been previously collected/ complied for past projects like an engineering assessment or more local sources of knowledge provided by community experts and Elders.

#### Engage with stakeholders and partners

Participatory CVRA are more likely to lead to robust plans and successful implementation, so it is useful to engage key stakeholders and partners in the process as early as possible. These stakeholders may be within your organization, such as other departments, or external to your organization, such as members of the business community, social sector, or environmental organizations. The breadth of planned engagement with stakeholders will depend on the scope of your CVRA, as well as other factors such as available financial resources and timelines.

During the initial engagement process, you may want to raise awareness within these groups about climate change, the need to adapt, and the expected scope of the process to be undertaken. Several different approaches can be used to communicate this information, such as:

- Internal meetings with others within the local government.
- Community workshops and open houses.
- One-on-one dialogue with key individuals or groups.
- Distribution of written materials, such as fact sheets or posters.
- Social media campaigns and web presence.

The approach taken should be tailored to the stakeholders and partners that you are planning to reach, keeping in mind the needs of different groups. For example, you may need to offer childcare to ensure the participation of single parent households, share information in different languages, or hold events in spaces where particular groups feel most comfortable.

**36** Document how you or your community would like to engage with your stakeholders during the CVRA process. This could include identifying where in the process you may want to engage with others to verify the information collected.

#### Secure support from senior decision makers

Engaging senior decision makers early in the CVRA process is critical to ensure that its objectives are

achieved. Without their support, the completion of the assessment is unlikely, as well as development and implementation of a future adaptation plan. You can gain internal support for the planned the scope and scale of the process by sharing knowledge about climate change and its anticipated local impacts, as well as existing understanding of current levels of climate change preparedness and potential actions to avoid or lessen its impacts.

**Tip:** <u>Talking it Through: A Discussion</u> <u>Guide for Local Government Staff on</u> <u>Climate Adaptation</u> is a useful resource to support conversations around climate change and adaptation with senior decision makers and elected officials.

**#** Consult with senior decision makers in your community on the intended outcomes and plan for the completion of your CVRA.

#### Form your team

Once the need for a CVRA has been confirmed, a leader and team need to be formed. Depending on the scope of the planned process, this team could be composed of individuals within the community (e.g., just local government staff), knowledge holders (e.g., community members), or external experts (e.g., civil engineering firm knowledgeable about municipal assets).

At this stage, and throughout the rest of the CVRA process, it is important to ensure that the guiding principles of equity and inclusion are reflected in the team formed. Significant research and experience show that successful adaptation planning is enabled when those who will be impacted by climate change, and those who will be responsible for taking action to reduce these risks, are involved at every step (New et al., 2022). Box 3 dives more deeply into how to apply an equity and inclusion lens throughout the CVRA process.

**#** Form your team for your community's CVRA. Ensure that all those on the CVRA are clear on their individual roles and responsibilities.

#### Box 3. The importance of equity and inclusion in the CVRA process

Throughout the CVRA process, it is important to recognize that people experience the impacts of climate change differently and possess different types of knowledge that can enrich the process. To ensure that the full range of climate impacts and knowledge are considered in the CVRA process, an inclusive and equitable approach should be taken. For clarity:

- Inclusivity means intentionally making space for all community members and relevant stakeholders to be included in the process, to ensure fairness and equitable outcomes from the identification of risk and subsequent adaptation actions (adapted from C40 Cities Climate Leadership Group et al., 2019).
- **Equity** means ensuring that the process is fair and that the identification of risk and subsequent adaptation actions provide equal possible outcomes for everyone (adapted from Tozer et al., 2022).

In practice, ensuring an inclusive and equitable process will involve creating opportunities for participation by a diversity of community members and stakeholders. Outreach can be performed specifically to those who are typically excluded from decision-making processes, such as Indigenous Peoples, women, youth, people living with disabilities, LGBTQIA2S+ individuals, and those who are not fluent in English, amongst others. This not only means inviting them to sit at the table, but also making space for their knowledge and lived experiences to play a role in informing decisions.

#### Create a community profile

Determining and documenting the important characteristics of your community, its people, economy, assets, natural environment, and critical services will provide a shared understanding of your community for your project team and stakeholders. The community profile will be used in the CVRA process to inform how climate impacts may influence your community.

The community profile should align with the scope of your CVRA. This may include a specific group of people (i.e. municipal staff, or those that use a specific asset), the whole community, or even those from the surrounding region who rely on your community and its services. Important factors to document may include:

- Important characteristics of your community, such as its projected rate of growth and societal groups within your community. While documenting the characteristics of residents within your community, keep in mind that some may be better able to respond to and recover from shocks and stressors (whether these are extreme weather events or economic changes) due to access to financial resources, their livelihoods, education levels, and other factors. Others may face greater hardships if they live with limited mobility, have precarious employment, or face discrimination.
- Your community's existing and planned physical and social elements, such as services and assets. Table 1 provides an example of the community element categories that you could consider. It is not exhaustive but aims to aid your team to think through different elements to consider in your assessment.
- **#** Create a short community profile that provides a shared understanding of your community.

 Table 1: Community element categories to consider in your assessment (adapted from California Governor's Office of Emergency Services, 2020).

Critical	Hospitals, clinics, and other medical facilities
Services	Police and fire stations, emergency operations centers, and evacuation shelters
	Schools, childcare, and early years services
	Water, wastewater, and solid waste infrastructure
	Transportation fuels, natural gas, electric power, and renewable energy systems
	Telecommunication systems
	Social services – shelters, children's aid, welfare, and income support
Infrastructure	Airports and landing strips
	Highways, bridges, tunnels, roadbeds, overpasses, winter roads, and snow dumps
	Railway tracks, tunnels, bridges, rail yards, and depots
	Waterways (locks, harbors, piers)
	Cultural infrastructure (recreation complexes, arts centre, and museums)
Local	Major employers, businesses, and operations that are important to the local or
Economy	regional economy
Natural	Natural infrastructure, forests, lakes, rivers, parks, conservation areas, and green
Environment	spaces that provide important ecosystem services, resources, and/or have
	recreational or social value for the community
Cultural assets	Places that have cultural significance to your community or locations and space
	where community members gather for example, community centers, the local sport
	complex/ curling rink, religious or spiritual sites, historical sites or other locations
	that are important to your community members.

#### Finalize the climate vulnerability and risk assessment work plan

Lastly, pull together the information documented in the actions outlined above and in consultations with senior decision makers, other team members, and internal and external stakeholders into a work plan. This work plan should communicate:

- The CVRA processes' planned scope, scale, and depth.
- Team members and their roles and responsibilities.
- Level of planned stakeholder engagement and with whom.
- Timeline.
- Required financial and other resources to complete the CVRA process.

The planned budget should include sufficient funding to enable robust outreach and participation throughout the planning process. As appropriate, this plan should be approved by senior decision makers and elected officials, such as through a council decision, prior to creating a community profile and initiating the CVRA.

# Climate Vulnerability and Risk Assessment: Assessing current and future climate risks

Completing a CVRA will help you understand the degree to which climate change will impact important aspects of your community and help your team to prioritize the climate risks to prepare for.

The approach used in this guidebook is based on an understanding of climate risk as a function of three interconnected elements (Figure 6). These elements are:

- **Hazards**, or the biophysical events that can cause impacts to built infrastructure, natural ecosystems, and social systems. Examples of climate hazards are intense thunderstorms, high winds, blizzards, tornadoes, wildfires, droughts, and hail.
- **Exposure**, or the presence of people, livelihoods, species, ecosystems, resources, infrastructure, or cultural assets in locations and settings that could be affected by (climate) hazards.
- **Vulnerability**, or the degree to which built infrastructure, natural ecosystems, and social systems is susceptible to harm or damage from climate change impacts. It is a function of both the community's sensitivity to climate change and its capacity to adapt to the impacts.

Together, these elements determine the climate risks that can impact a community's assets, economy, and people. For example, the extent to which a community is at risk to climate change will depend on the type of climate hazards that it experiences (such as a riverine flood), the extent to which people, assets, or services are exposed to this hazard (such as people and businesses along the river will be more exposed to a flood than those located inland), and their vulnerability to this hazard (such as people and businesses without insurance or savings will be more affected by the flood event).

Within the CVRA, you will complete the following steps:



Figure 6: Climate-related risk is the interaction of hazards, exposure, and vulnerability (IPCC, 2014).

**Step 1: Climate Hazard Assessment:** Step 1 will help you answer the following questions:

- What climate hazards has your community seen to date?
- How are these hazards projected to change in the future because of climate change?

You will identify climate hazards that are affecting your community and determine the main climate hazards to consider in your CVRA.

**Step 2: Climate Impact Assessment:** In this step, you will assess the impacts of climate hazards experienced to date and how these impacts may change in the future. You will also assess the risks of the identified impacts to your community. The climate impact assessment step will help you better

understand the cause-and-effect relationships between climate hazards, their impacts, and their consequences to your community.

**Step 3: Climate Risk Assessment**: In Step 3, you will assess how susceptible your community is to each of the impacts and consequences identified in the climate impact assessment (Step 2) and prioritize the risks to include in a future adaptation planning process.

The accompanying *Climate Vulnerability and Risk Assessment Workbook for Manitoba Communities* is designed to support each of these steps in the CVRA process.

In completing each of these three steps, you should draw upon the best available sources of information, data, and knowledge. However, no matter the strength of these sources, you will need to deal with uncertainty. As the process of climate change is ongoing and influenced by the degree to which global emissions of GHGs are reduced, there is inherent uncertainty about the magnitude and frequency of future climate hazards. As well, there is uncertainty about future exposure to these hazards (e.g., if new community assets are built) and vulnerability to a hazard (e.g., if steps to reduce climate risks are successful). This uncertainty about how our climate is changing should not be seen as an impediment to taking action. Communities constantly have to act and make decisions in the face of uncertainty and preparing for climate change is no different.

#### **Step 1: Climate Hazard Assessment**

**Purpose of this step:** The goal of the climate hazard assessment is to identify the climate hazards that are already affecting or will affect your community. The climate hazard assessment will help you understand and document the climate hazards facing your community now and in the past, and how their frequency, magnitude, and duration are projected to change. Consulting with multiple sources of data and local knowledge, such as newspapers, municipal records, community members, and Elders, can help you in preparing a list of climate hazards that have impacted your community and what changes community members have observed in the occurrence of these hazards.

**Tasks involved:** List climate hazards that have been observed in your community and determine how these events are predicted to change with our changing climate.

- List climate hazards of concern and observed trends in their occurrence (e.g., drought, heatwave, flood).
- Understand projected future changes to climate hazards based on climate data, climate models, and other sources of information.

#### Develop a list of climate hazards

Climate hazards are biophysical events or processes that can cause harm to human health, economies, infrastructure, and to natural resources and ecosystems. These may include:

• Single events, such as thunderstorms, freezing rain events, heatwaves, and wildfires that have a defined beginning and end.

• Slow-onset hazards, such as gradual changes in average temperatures or changes in the length of seasons.

Examples of climate hazards are listed in Table 2.

Table 2. Examples of climate hazards (Adapted from The Resilience Institute & All One SkyFoundation, 2019).

Single event type climate hazards			
Winds (strong)	Freezing rain	Wildfire/ grassfire	Hail
Heavy snowfall	Extended snowpack	Tornado	Fog
Extremely hot days	Heat wave	Blizzards	Heavy rainfall
Lightning	Thunderstorms	Floods	Multi-year drought
Icy roads	Cold spell	Dry spell	
Slow-onset hazards			
Length of frost-free	Length of growing	Changes to stream flows	Freeze-thaw cycles
period	season		
Warming winter, Loss of extreme cold			

Once you have completed your list of historical climate hazards, consider the current trends in the frequency (number of occurrences) and magnitude (size and scale) of these events. Are events occurring more or less often? Are they more intense, last longer, or are of lesser concern than in the past?

You may choose to consult with community members, external stakeholders, and written accounts of historical climate events or sources of historical climate and weather data to inform your trend assessment. Historical climate and weather data can help you understand recent trends through the exploration of climate variables and indices related to your identified climate hazards. As an example, a community that has identified extreme heat as a hazard may want to explore climate variables related to temperature changes to help understand this observed trend.

 Refer to Task 1.1 in the Climate Vulnerability and Risk Assessment Workbook for Manitoba Communities. In Box 1.1, develop a list of climate-related hazards and document the climate hazards, weather phenomena, and extreme climate events that have occurred in your community, as well as their frequency, magnitude, and duration.

#### Questions to consider:

- What weather phenomena and extreme climate events have impacted your location in the past?
- Has your community observed any recent trends (e.g., in the last decade) in the frequency or magnitude of climate hazards impacting your community?

#### Identify how the climate hazards identified are predicted to change

Future climate projections can help you understand how the climate of your community is predicted to change. The Climate Atlas of Canada (climateatlas.ca) is a useful resource for community-led CVRAs. It provides an interactive map that can be used to explore how the climate is projected to change in the near- and longer-terms for a particular location, region, watershed, or Indigenous community. You can

look at projected changes for different climate parameters, such as temperature, precipitation, and length of the frost-free season.

When starting to identify future climate hazards, you must first decide on the time period(s) and emission scenario(s) for your assessment. When considering how climate hazards will change in the future, most communities choose a near-term time-period (up to 2050) and worst-case emissions scenario (RCP8.5) where GHG emissions are high, resulting in more severe climate change (Figure 7). You may consider these same parameters, as the near-term time period may be most relevant to your community's planning horizon and the worst-case scenario can assist your community to be prepared for the worst, while hoping for the best.



Figure 7: Example of mapping features and climate projections from the Climate Atlas of Canada, with selection options for the amount of climate change (less or more) and the time period (recent past, 2021-2050, and 2051-2080) (Climate Atlas of Canada, 2019).

**Tip:** <u>ClimateWest</u> is regional hub for climate services serving the provinces of Manitoba, Saskatchewan, and Alberta. It provides access to regionally relevant climate information and the support to use it effectively in planning and decision making.

Information on climate models, emission scenarios, and choosing the right climate model data can be found in ClimateWest's <u>Guide to Finding Climate Information & Data</u>, which also points to two free sources of climate data available to Canadians:

- <u>The Climate Atlas of Canada</u>, which is user friendly and the suggested source for community-led initiatives.
- <u>ClimateData.ca</u>, which provides data that is appropriate for highly detailed assessments led by trained experts.

ClimateWest offers a <u>help desk</u> to assist communities, businesses, and others with locating the most relevant climate data and how to integrate this data into decision-making.

Refer to Task 1.2 in the Climate Vulnerability and Risk Assessment Workbook for Manitoba Communities. In Box 1.2, explore how the climate of your location is projected to change. Box 1.2 provides a summary of some of the variable you may want to explore using the Climate Atlas of Canada.

Also consider the potential for new climate hazards that have not been previously experienced in your community. In reviewing your list of climate hazards (Table 2; Box 1.1) and your climate projections (Box 1.2), are there any new projected changes that could impact your community? For example, if your community is projected to see higher average summer temperature and more extreme heat days (temperatures >30°C) then in the recent past, this may indicate that heatwaves/ extreme heat events may impact your community more in the future than they have in the past.

Another thing to consider is if the projected changes to your climate will result in changes to the physical or natural environment surrounding your community. For example, the loss of extreme cold days (temperatures < -30 °C) could result in the emergence of new invasive plants or insects.

**X** These new climate hazards and the projected changes that contribute to the occurrence of these hazards should be included with your previously identified climate hazards in Box 1.1 of the workbook.

#### Questions to consider:

- How do climate models project that your community's climate will change?
- How will changes to your community's climate impact the frequency, magnitude, and duration of climate hazards?
- Will the predicted changes to your community's climate result in new climate hazards?

#### Create climate hazard statements

Following the identification of climate hazards and their projected trends, your team should prepare concise hazard statements that answer the following questions:

- What is the climate hazard?
- How is the hazard projected to change?

It should contain the following information:

- The hazard itself or biophysical event (e.g., heatwave, drought, rain or wind).
- The observed trend of the hazard's magnitude (size and scale) (e.g., hotter days; longer frost-free period).
- The frequency (occurrence of the event) of the climate hazard (e.g., increased number of days above 30°C, more frequent thunderstorms).

Some examples of a climate hazard statement are:

• More heatwaves per year (on average 5-6 days in duration) with more of these days being above 32°C due to increasing temperatures during summer months.

- Ice-free season on lakes and rivers increase by X weeks due to increasing average winter temperatures.
- Refer to Task 1.2 in the Climate Vulnerability and Risk Assessment Workbook for Manitoba Communities. In Box 1.3, document your climate hazard statements by describing how your climate hazards (listed in Box 1.1) are predicted to change (based on the projections in Box 1.2).

#### **Outputs of this step:**

- A list of observed climate hazards that have historically impacted your community along with trends in the frequency, magnitude, and duration of the identified climate hazards (Box 1.1). Also consider adding future hazards that may impact your community, based on projected climate variables.
- Projected changes in climate variables that can influence climate hazards at your location (Box 1.2).
- Hazard statements that describe anticipated climate hazards due to climate change (Box 1.3).

#### Step 2: Climate Impact Assessment

**Purpose of this step:** The goal of this step is to understand the impacts of the climate hazards identified in Step 1, how these impacts might change in the future, and the consequences of these changes for your community. The climate impact assessment can help you better understand the cause-and-effect relationships between hazards, impacts, and consequences to your community.

**Tasks involved:** Using your list of climate hazards, you will assess the climate change impacts and subsequent consequences to your community. You will identify:

 Climate change impacts (effects of a hazard) (e.g., drought [the hazard] causes reduced crop yields [the impact]). **Tip:** Remember the differences between hazard, impact, and consequence with the following example.

Drought (hazard) may cause reduced crop yields (impact) which can lead to an increase in insurance claims (consequence).

Additionally, cause-and-effect relationships are important to consider. Burning fossil fuels (a cause of climate change) increases GHG concentrations, increasing global surface temperature (an effect of climate change). Hotter temperatures (primary hazard) can increase the likelihood of drought (secondary hazard). This can lead to greater crop stress (primary impact) and, consequently, reduced crop yields (secondary impact).

• Climate change consequences (based on exposure to the climate hazard) (e.g., reduced crop yields [the impact] can lead to an increase in insurance claims [the consequence].

This step can best be done by conducting a participatory workshop with experts and key stakeholders. You may want to use pin boards and cards, along with the workbook, to collect and arrange impacts identified by participants.

#### Develop an inventory of climate change hazards and impacts

Using the information developed in Step 1, identify the potential climate impacts for each climate hazard of concern.

In completing this activity, it is important to understand the relationship between "hazard" and "impact." A **hazard** is a climate event (e.g., drought, rain, or wind), whereas an **impact** is what occurs as a direct result of a specific hazard (e.g., insufficient irrigation water or damage to buildings).

For each of the <u>climate hazard statements</u>, develop a list of potential impacts by asking the question: *If* [climate hazard 1] were to happen, what would happen to our communities' [infrastructure, businesses, natural environment, human health, etc.]?

Identify the presence of people, livelihoods, ecosystems, resources, infrastructure, or economic, social, or cultural assets in places and settings that could be impacted, if they are located within an area affected by a climate hazard and impacts. Use the community profile your team developed and identify

#### Tip: Climate hazard mapping: A useful tool

You may want to consider mapping climate hazards to help you identify potential impacts. A mapping exercise can reveal overlapping hazards that could result in interconnected or cascading impacts, such as flooding events making emergency access roads impassable in the event of an unrelated disaster such as a wildfire.

the elements that will most likely be exposed to climate hazards. The elements exposed may include specific assets, sectors, areas of service, and/or groups from the following categories:

- Critical Services
- Infrastructure
- Community and People

- Local Economy
- Natural environment
- Cultural Assets

**X** Refer to Task 2.1 in the *Climate Vulnerability and Risk Assessment Workbook for Manitoba Communities*. In Box 2.1 of the workbook, document the impacts of the climate hazards you identified in Step 1.

#### Question to consider:

- What could occur should the events described in the climate hazard statements take place (impact)?
- What assets are most likely exposed to the climate hazards being examined?
- How exposed is the community and surrounding service area to the impacts of climate change?

#### Identify the potential consequences of climate hazard impacts

Taking into account the potential impacts of each climate hazard statement, the next task is to examine the potential consequences (or ramifications) of these impacts. As shown in Box 2.2 of the workbook, first list the climate hazard, the projected changes in the hazard, the climate hazard statement, and the associated climate impact(s). Then identify the relevant consequences of these expected impacts. Prepare this information for each climate hazard statement to assess the consequences for your community.

The goal of this task is to link the climate hazard, climate impacts, and associated consequences for your community. In doing so, take into consideration aspects of vulnerability and adaptive capacity. Consider relevant factors which will affect your community's ability to cope and adapt to the impacts of climate change. These factors may be social, economic, and cultural attributes that could increase or decrease your community's capacity to manage the impacts of the climate hazard examined.

When identifying the consequences of the climate impacts you have listed, it is helpful to consider specific factors that could be affected. Figure 8 outlines some different categories to consider as you list the various consequences to your community.

#### Tip: Remember these definitions:

**Vulnerability** is the degree to which built infrastructure, natural ecosystems, and social systems is susceptible to harm or damage from climate change impacts. It is a function of both the community's sensitivity to climate change and its capacity to adapt to the impacts.

Adaptive capacity is the ability of built infrastructure, natural ecosystems, and social systems to adjust to changing environmental conditions (like climate variability or extreme weather events), minimize possible damage, take advantage of opportunities, or handle the consequences.

## Fatali

#### Community & people

Fatalities, injuries, medical treatment, hospitalization, temporary or permanent displacement, mental health and emotional well-being



#### Critical services

Loss of services such as transportation, water, electricity, etc.



#### Buildings and infrastructure

Damage to buildings, equipment, vehicles, pfrastructure



#### Local economy

Disruption or loss of ability to produce, consume, and trade goods and services, and to generate income supporting livelihoods



#### Natural environment

Impacts to land, water, air, plants, and animals, and the provision of ecosystem services

Figure 8: Different categories to consider when recording the consequences of climate hazards.

 Refer to Task 2.2 in the Climate Vulnerability and Risk Assessment Workbook for Manitoba Communities. In Box 2.2, consider the associated consequences of the identified climate hazards. Box 2.2 will consolidate the information documented in previous boxes to allow for easier incorporation and identification of consequences for each climate hazard statement.

#### Questions to consider:

- Did historic climate hazards create economic losses? How might economic losses change given projected changes in climate?
- Is the community, service area, or a particular community group subject to existing stresses?
- Are there specific groups that are particularly sensitive to certain consequences?
- Will current or future consequences cause the demand for a resource or service to exceed its supply or current abilities?
- Are there barriers to the community / service area/ sector's ability to accommodate changes in climate? Are they related to institutional, resources, expertise, technology, leadership?
- Are there existing programs and policies that help the community manage impacts and consequences?

#### **Output of this step:**

An overview of climate change impacts that outline the relationship between the climate hazard statements (Box 1.3), impacts (Box 2.1), and consequences (Box 2.2) to specific element(s), such as assets and services in your community.

#### Step 3: Climate Risk Assessment

**Purpose of this step:** The goal of this step is to understand how susceptible your community is to each of the impacts and consequences identified above and determine which climate-related risks to prioritize for the adaptation planning stage.

#### Tasks involved:

- Revisit your climate impact assessment, specifically the consequences identified.
- Discuss the potential consequences for your community and assign a severity score.
- Determine the likelihood of your community's specific climate hazard statements occurring.

#### Assess the severity of identified consequences to your community

Climate hazards and related consequences can be assessed using a rating scale that goes from "insignificant" to "catastrophic." Specific definitions for what is considered to be an "insignificant" or "catastrophic" consequence should be agreed upon by your team (see Table 3 for an example). The assessment, including the determination of consequence and likelihood levels, should be conducted using a participatory approach that draws upon the expertise of municipal staff and local stakeholders in your community.

The consequence assessment should consider your community's current sources of vulnerabilities and the capacity of different community members to absorb, cope with, or adapt to a specific climate hazard (as expressed in the climate hazard statement) and its impacts. Refer to your climate impact assessment (Box 2.2) and the categories of consequences exposed to each climate hazard you identified in Step 2.

#### Questions to consider:

- How sensitive are community activities, assets, and services to changes in climate and changes in climate hazards?
- What risk management measures are currently in place?
- What is your community's ability to adjust, or take advantage of changes in climate and changes in climate hazards?

For each of the categories of consequences—community and people, critical services, buildings and infrastructure, local economy, and natural environment—assess the severity of the potential consequences. Note that these values are qualitative, intended to prioritize consequences relative to each other. Communities can modify the severity scale according to their local context.

Refer to Task 3.1 in the Climate Vulnerability and Risk Assessment Workbook for Manitoba Communities. Revisiting the Climate Impact Assessment in Box 2.2, fill in the consequence level box (from 1 to 5, based on the levels provided in Table 3) to document your assessed severity of the consequences for each category, should they occur.

Consequence level	Definition	
1 Insignificant	<ul> <li>No practical impact on the community, its people, or assets.</li> <li>Impact may be observed but does not change day-to-day life</li> <li>No deaths, injuries, or effects on health and safety</li> <li>No impact to the economy, environment, property, or services.</li> </ul>	
2 Minor	<ul> <li>No significant impact on the community, its people, or assets, and can be handled through business-as-usual practices.</li> <li>No deaths or injuries, minor short-term effects on health and safety</li> <li>Very minimal impact on local economy</li> <li>Insignificant environmental disruption or damage</li> <li>Slight damage to property and infrastructure, very short-term service interruptions, or negligible costs</li> <li>No liabilities or significant extra costs</li> </ul>	
3 Moderate	<ul> <li>Moderate impacts at the local and regional scale of minor importance, to be addressed through low-cost or no-regret adaptation actions.</li> <li>Few injuries, or modest temporary impact on quality of life</li> <li>Interruptions to business revenue and employment for less than one week</li> <li>Isolated and reversible damage to wildlife, habitat, and/or ecosystem</li> <li>Potential damage to property/infrastructure, short-term service interruptions, localized evacuations</li> <li>Modest to higher cost events</li> </ul>	
4 Major	<ul> <li>Extreme impacts at the local and regional scale (non-acceptable) of very high importance to municipal operations and agencies to urgently address through adaptation.</li> <li>Many serious injuries or illnesses, some fatalities, or long-term impact on quality of life for most residents</li> <li>Long-term impact on businesses and economic sectors, major economic costs or disruption for months</li> <li>Widespread and irreversible damage to wildlife, habitat and ecosystems, or long-term damage, disruption to environmental amenities</li> <li>Loss of and widespread damage to property &amp; infrastructure (including critical facilities and lifelines), extensive and long-term interruption of services, widespread evacuations</li> <li>Major cost to municipality, high possibility for liabilities, including lawsuits</li> </ul>	
5 Catastrophic	<ul> <li>Extreme impacts at the local and regional scale of very high importance to municipal operations and agencies to urgently address through adaptation.</li> <li>Many serious injuries or illnesses, fatalities, and/or long-term impacts on quality of life</li> <li>Interruptions to businesses and revenue for more than a month, extending to entire sectors at a major economic cost</li> <li>Widespread and irreversible damage to wildlife, habitat, and ecosystems</li> <li>Loss of and widespread damage to property and infrastructure, long-term interruption of services, widespread evacuations</li> <li>Major costs to municipality, high possibility for legal liabilities and lawsuits</li> </ul>	

#### Table 3. Consequence severity levels and definitions (Adapted from All One Sky, 2021).

#### Assess the likelihood of your climate hazards

The likelihood of a climate hazard occurring can be assessed on a scale from "very unlikely" to "very likely". Specific definitions for each of the likelihood categories should be agreed upon by your team. Table 4 provides an example of definitions for each of the five likelihood categories. Similar to the

consequence and severity assessments, the likelihood assessment should be conducted using a participatory approach that utilizes the experiences of municipal staff and local stakeholders in your community.

Using the climate hazards statements developed in Box 1.3, conduct a likelihood assessment. First consider the historical occurrence of climate hazard similar to what was recording in your climate hazard statements by choosing a period of the recent past and determining how often the climate hazard has occurred, drawing on information from Step 1. For example, thinking back on the last 20 years, consider how often your identified climate hazard has occurred. Considering the impacts of climate change on your community, determine if the occurrence of the identified climate hazards will change. Will climate change increase, decrease, or not effect the likelihood of a specific climate hazard? Adjust your likelihood scores accordingly.

Likelihood level	Definition
1 Very unlikely	The climate hazard has not occurred in the past 20 years.
2 Unlikely	There is some indication that the climate hazard may have occurred in the past 20 years ago.
3 Possible	The climate hazard has occurred in the past 20 years.
4 Likely	The climate hazard has occurred several times in the past 20 years.
5 Very Likely	The climate hazard has occurred frequently, every year or every other year, during the past 20 years

Table 4. Likelihood levels and definitions (Adapted from All One Sky, 2021).

**#** Document the likelihood scores for each of your identified climate hazards providing justification for your team's choices.

#### Prioritize climate risks to your community

Taking into consideration the outcomes of the consequence assessment and likelihood assessment, review your ratings as a team and assign risk levels to help decide which climate hazards to take forward into the adaptation planning phase, and which ones may need further research or can be managed. A risk assessment matrix as illustrated in Figure 3.4 of the *Climate Vulnerability and Risk Assessment Workbook for Manitoba Communities* can assist in the prioritization process.

Table 5 provides examples of risk ratings that can be used to assign risk and determine which climate hazards are prioritized for the adaptation planning stage.

It is not realistic for most communities to develop and implement adaptation actions to all prioritized high risks. This list should rather act as a checklist of high priorities as communities implement risk management strategies or pursue adaptation planning.

#### Table 5: Risk levels for prioritization

High Priority	Immediate actions must be developed
Medium-High Priority	Short to medium term adaptation options to be developed
Medium Priority	Consider "low cost" and "no regret" adaptation options
Medium-Low Risk	Future action (to be monitored), either because of change in climate or
	change in community
Low Priority	Action not currently required or needs additional information

 Refer to Task 3.2 in the Climate Vulnerability and Risk Assessment Workbook for Manitoba Communities. In Box 3.1, use the risk assessment matrix to plot the results of your consequence (Box 2.2) and likelihood assessments to determine your community's list of prioritized climate risks.

#### Questions to consider:

- 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 do we need to do more research before agreeing on any action?
- Is early action needed before the risk manifests and objectives for safety, wellbeing, or system performance can no longer be met?

#### **Outputs of this step:**

• A list of priority climate risks, based on the risk assessment matrix (Box 3.1) for the future development of risk management strategies or adaptation plans.

**Tip:** Remember that CVRA is an iterative process, and should be reviewed on a regular basis, such as every five years, to ensure that its content remains up to date. When reviewing your CVRA, consider:

- Is there new research and understanding of climate change hazards that could change the assessment of climate impacts, risks, and opportunities?
- Has there been a change in the socio-economic and broader environmental context that could alter the potential for climate risks and opportunities?

# Next Steps: Planning, Implementation, and Monitoring, Evaluation, and Learning

Once the CVRA has been completed, your community is well positioned for the next steps in the adaptation planning process—planning, implementation, and monitoring, evaluation, and learning (MEL). The following provides a brief overview of what to expect as your community works to increase its resilience to climate change.

#### Planning

The adaptation planning process involves three main steps, all typically done through a participatory process that brings together team members and, potentially, those outside the implementation team who have relevant expertise:

 Identifying potential adaptation actions for each of the prioritized climate risks identified during the CVRA. These actions may seek to avoid or reduce the anticipated harm associated with the prioritized consequences or take advantage of benefits resulting from climate change. For example, actions to reduce risks associated with flooding may include moving development out of the floodplain, upgrading stormwater systems, conserving, or restoring wetlands, making flood risk maps easily accessible, and outreach to homeowners about actions that can be taken to reduce risk to their property.

Although not a necessary part of the CVRA process, the "Next Steps" section of the Climate Vulnerability and Risk Assessment Workbook for Manitoba Communities provides a chance to start thinking about potential future adaptation actions for medium and high priority climate risks (Box 3.2).

- Evaluating these potential actions against specific criteria (e.g., financial resources, organizational capacity, and community support) to assess which can most realistically be undertaken and then prioritize the adaptation actions previously identified, generally using a 4 or 5-point scale (i.e., very low to very high).
- **Preparing an adaptation plan** which identifies the actions to be completed, as well as information like lead departments or staff, timeline, anticipated costs, and financial resources. Once completed, as appropriate, the adaptation action plan may need to be approved prior to its implementation.

#### Implementation

Once the adaptation plan is complete, the next step is its implementation. As climate adaptation is an ongoing process, integrating adaptation actions into regular planning processes and policies means that they are more likely to have greater impact and longevity. Opportunities for mainstreaming adaptation measures into routine processes include annual budget planning cycles, asset management planning, and maintenance schedules, among many others. Implementation also includes securing the financial resources required for the prioritized adaptation actions, which can be allocated from internal budgets or secured through external grants and funding opportunities.

#### Monitoring, Evaluation, and Learning

Once implementation of adaptation actions begins, a MEL system is needed to report on the plan's progress, assess which actions are successful or not, and update decision makers on a regular basis. The information gathered through this process can also support the future efforts to update the CVRA and adaptation plan. Questions to be addressed include:

- **Monitoring:** Is the plan being implemented as expected? Are its goals and objectives being achieved?
- **Evaluation:** Are the actions being implemented leading to a reduction in climate risk? Would the implementation of other actions lead to better outcomes?
- Learning: What has worked well? Where can we improve?

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### Resources

These resources can provide additional information to support steps and actions within this guidebook.

#### Learn more about climate change

- The Climate Atlas of Canada has a variety of <u>articles</u> and <u>short videos</u>, with the option to filter by "climate science" (or read and watch them all to learn about health, Indigenous knowledge, cities, and more!)
- <u>Climate Change Connection</u> explains the science behind climate change, focused on Manitoba
- <u>Up North on Climate's Adaptation Framework</u>: pages 9-19 explain climate change, the greenhouse effect, and projections in an easy-to-understand format, accompanied by fun illustrations
- The World Wildlife Fund's article explains <u>the difference between climate change mitigation and</u> <u>adaptation</u> and how both can be used to address climate change.
- The <u>Climate Change Adaptation Quick Guide</u> uses illustrations to show how climate change impacts the land and communities. It also includes examples of actions that can be used to adapt to drought, flooding and wildfires, amongst others.
- Natural Resources Canada's <u>Adapting to Climate Change: An Introduction for Canadian</u> <u>Municipalities: Chapter 1</u> covers what climate adaptation is and why it is important in Canada.

#### Information for local governments

- Part 1 and 2 of the Federation of Canadian Municipalities' (FCM) <u>Climate in focus Jump start</u> your municipality's climate action journey introduces municipal climate action and how to get started
- Not specific to adaptation, but a useful guide for <u>Municipal Climate Change Staff</u>, explaining municipal governance, the type of information to gather, and who to work with
- The <u>Cost of Climate Adaptation</u> demonstrates the urgent need for investment in climate adaptation action, especially for municipalities who own and maintain the majority of public infrastructure
- The Centre for Indigenous Environmental Resources has developed a <u>Climate Change</u> <u>Adaptation Planning (ICCAP) Toolkit</u>; <u>Guidebook 1: Starting the Planning Process</u> helps communities learn about climate change and assemble a leader and team, while sharing community examples

#### Connect with municipal leaders, stakeholders, and community members

• The Centre for Indigenous Environmental Resources has developed a <u>Climate Change</u> <u>Adaptation Planning (ICCAP) Toolkit</u>; <u>Guidebook 2: Climate Change Impacts in the Community</u> includes activities to start to engage community members about local climate change impacts, while sharing stories of communities that have already suffered from climate change

#### Community profile data

 Statistics Canada has a database containing several socioeconomic indicators from the 2021 census. Data is available for a range of <u>municipalities</u>, <u>communities</u>, <u>urban districts</u>, <u>and census</u> <u>agglomerations and divisions</u> in Manitoba.

- <u>The Canadian Index of Multiple Deprivation (CIMD)</u> uses census data to illustrate socioeconomic and cultural deprivation and marginalization at the dissemination area level.
- <u>The Manitoba Bureau of Statistics</u> provide province-wide trends and resources for a number of socioeconomic factors, including population, housing and employment.

#### **Climate data**

- ClimateWest's <u>A Guide to Finding Climate Information & Data</u> provides a user-friendly overview of the free sources of climate data and information available to Canadian municipalities and others.
- <u>The Climate Atlas of Canada</u> hosts climate model data through an interactive map. Users can explore their current modelled climate and projected future climates using a number of temperature and precipitation variables and indices. The Climate Atlas allows you to view and download data specific to their location through tables, graphs, and reports.
- <u>ClimateData.ca</u> provides high-resolution climate data for a number of climate variables and indices that can be explore for locations throughout Canada. It provides access to modelled data, observed climate normal, and observed station data.
- <u>The Canadian Disaster Database</u> contains information on the costs, losses, and locations of over 1,000 disaster events that have affected Canadians at home or abroad.
- The Government of Manitoba host a webpage detailing the province's <u>flood events and damage</u> since 1950. They also host a page where you can access <u>fire mapping data</u> from 2010-2019.
- <u>The Manitoba Drought Monitor</u> includes information on precipitation, river and lake levels, groundwater levels, and reservoir supply levels across the province.

#### **Climate risk assessment processes**

- The Centre for Indigenous Environmental Resources has developed a <u>Climate Change</u> <u>Adaptation Planning (ICCAP) Toolkit</u>; <u>Guidebook 3: Identifying Community Sustainability and</u> <u>Climate Change Vulnerabilities</u> works with community members to explore the concept of community sustainability versus community vulnerability to climate change.
- The Canadian Council of Ministers of the Environment (CCME) provides <u>Guidance on Good</u> <u>Practices in Climate Change Risk Assessment</u>. The guidance document explains the fundamental elements of climate risk assessment and includes six case studies highlighting good practice in Canada.