



CLIMATE CHANGE AND HEALTH VULNERABILITY  
AND ADAPTATION ASSESSMENTS:  
**A KNOWLEDGE TO  
ACTION RESOURCE GUIDE**



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## 1. INTRODUCTION

Climate change is recognized as the greatest threat to human health of the 21<sup>st</sup> century and climate-related hazards already affect the health of many Canadians. Evidence suggests that risks to health from climate change are growing in many communities. The health effects of climate change in Canada include increased morbidity and mortality related to a greater frequency and severity of extreme weather events and natural hazards (e.g., extreme heat, floods, wildfires, hurricanes, ice storms, droughts); increased ambient and indoor air pollution; reduced recreational and drinking water quality; as well as increased food contamination and spread of vectors that cause disease and greater exposure to UV radiation. Climate change can also affect economic livelihoods and mental health. Food shortages and resulting food insecurity related to climate change are also a concern, although this connection is less clear in southern Canadian communities. Populations most vulnerable to the health impacts of climate change include seniors, children and infants, the socially and economically disadvantaged, those with chronic diseases and compromised immune systems, Indigenous populations, and residents of northern and remote communities.

Climate change and health vulnerability and adaptation assessments (V&As) help identify weakness in health systems, population groups, vulnerable to impacts and effect ways to respond. V&As aid health authorities in efforts to prepare for climate change by:

- ▶ Improving evidence and understanding of the current associations between weather/climate and health outcomes, including the health of populations most vulnerable to these risks;
  - ▶ Providing health and emergency management officials, stakeholders, and the public with information on the magnitude and pattern of current and future health risks associated with climate variability and change, and identifying vulnerabilities in the health system;
  - ▶ Identifying opportunities to incorporate climate change concerns into existing policies and programs designed to manage health risks associated with weather and climate, and to develop new programs where necessary to prevent and reduce the severity of future risks;
  - ▶ Serving as a baseline analysis against which future changes in risks and in associated policies and programs can be monitored;
  - ▶ Forging collaborations with sectors such as water and infrastructure to promote activities to improve population health in a changing climate; and
  - ▶ Strengthening the case for investment in health protection.
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## HOW TO USE THIS RESOURCE GUIDE

A wide variety of resources are available to support V&As being undertaken by Canadian health authorities. The purpose of this resource guide is to present tools and information that can help inform the development of rigorous and participatory V&As from local to national levels in Canada. In this report V&A guidance tools are presented along with examples of Canadian assessment studies that have been completed. In addition, more specific guidance for integrating Sex and Gender Based Analysis (SGBA+) considerations into V&As and tools for gauging the climate resilience of health facilities are highlighted. To inform deliberations about adaptation options through a V&A, climate change and health adaptation initiatives, case studies and learnings are presented in boxes throughout this report. Finally, the reader will find information to support capacity building for climate change and health action in the spirit of reconciliation through partnership building with Indigenous peoples.

In addition, in Canada, there are a number of federal programs focused on climate change and health adaptation. These programs provide information and resources on climate change impacts to human health and measures that health partners and Canadians can take to reduce risks. They also provide tools to support adaptation action. Information about the programs can be found at the links below.

[Canadian Institutes for Health Research](#)

[Health Canada – Climate Change and Health Program](#)

[Indigenous Services Canada Climate Change and Health Adaptation Program](#)

[Indigenous Services Canada Climate Change and Health Adaptation Program for First Nations North of 60 degrees N](#)

[Public Health Agency Infectious Diseases and Climate Change Fund](#)

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## 2. CLIMATE CHANGE AND HEALTH VULNERABILITY ASSESSMENT GUIDES

**Climate Change and Health Vulnerability and Adaptation Assessment: Workbook for the Canadian Health Sector (Health Canada, 2019)**—This workbook is tailored to, and intended for use by, health officials in Canada to conduct health vulnerability assessments and develop adaptation plans through participatory processes that engage partners from multiple sectors and organizations. It provides step-by-step information on how to conduct a climate change and health vulnerability and adaptation assessment in a manner that can be shared and followed by all those involved in the assessment process. In an attempt to increase the ease of use and streamline the organization and analysis of information, the material in each step is supplemented with a fillable template which can either be used directly as part of the assessment process or presented at meetings and workshops to help facilitate data gathering. Users of the document are referred to more detailed guidance for conducting assessments available in the World Health Organization (WHO) report [Protecting Health from Climate Change: Vulnerability and Adaptation Assessment](#) (WHO, 2013).

**Protecting Health From Climate Change: Adaptation and Vulnerability Assessment (WHO, 2013)**—This guidance document describes steps for undertaking a V&A, the critical first activity in the process of planning and preparing for climate change health impacts on individuals, communities and health systems. The assessment approach in the report is flexible, can be used for conducting V&As from local to national levels and can be tailored to suit the needs of specific health authorities. The V&A steps described in the document include:

1. Frame and scope the assessment;
2. Vulnerability assessment: Describe the human health risks of current climate variability and recent climate change, and the public health policies and programmes to address the risks;
3. Impact assessment: Project future health risks and impacts under climate change.
4. Adaptation assessment: Identify and prioritize policies and programmes to address current and projected health risks; and
5. Establish an iterative process for monitoring and managing the health risks of climate change.

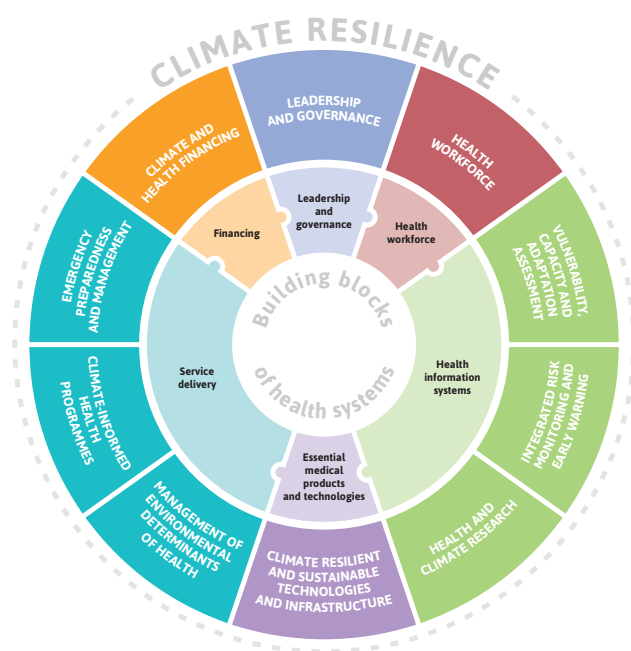
The report includes background information on climate change impacts on health and vulnerabilities, data sources for undertaking V&As, case studies of V&A assessment step application, and linkages to other tools and information.

The document can be found [here](#).

**Operational Framework for Building Climate Resilient Health Systems (WHO, 2015)**—This framework is intended for health sector decision makers, including public health professionals. It provides useful information relevant to officials in other health-relevant sectors like food, water, energy, transportation, urban planning, conservation, and emergency management. The framework includes ten components that are key for climate change adaptation planning based on the building blocks of health systems (Figure 1). The components include:

1. Leadership and governance;
2. Health workforce;
3. Vulnerability, capacity, and adaptation assessment;
4. Integrated risk monitoring and early warning;
5. Health and climate research;
6. Climate resilient and sustainable technologies and infrastructure;
7. Management of environmental determinants of health;
8. Climate-informed health programmes;
9. Emergency preparedness and management; and
10. Climate and health financing.

**FIGURE 1:** Ten components comprising the WHO operational framework for building climate resilient health systems, and the main connections to the building blocks of health systems (WHO, 2015).



The framework describes how the building blocks of health systems can be sensitive to, and are relevant for, adapting to the impacts of climate change. It provides examples of actions and indicators that health authorities can use to operationalize the framework in efforts to prepare for climate change. A key component of the framework presented in the report is undertaking vulnerability, capacity and adaptation assessments.

The framework can be found [here](#).

**Climate Change and Health: A Tool to Estimate Health and Adaptation Costs (Hutton, Sanchez & Menne, 2013) (Europe) (PDF format)**—This tool was developed by the WHO Regional Office for Europe and is intended to be used by Member States to calculate the economic damages of climate change on health, costs of adaptation, and the efficiency of adaptation measures.

The tool can be found [here](#).

## BOX 1 THE ONTARIO CLIMATE CHANGE AND HEALTH TOOLKIT (EBI ET AL, 2016)

This Ontario Climate Change and Health Toolkit is tailored to, and intended for use by, health officials in Ontario to conduct health vulnerability assessments and develop adaptation plans through participatory processes that engage partners from multiple sectors and organizations. It is based upon the steps in the WHO V&A guidance document (WHO, 2013). The Toolkit includes three reports:

1. Assessment technical guidance document;
2. Assessment workbook; and
3. Climate change and health modelling study.

The technical guidance document describes the steps in conducting a V&A and includes sources of data relevant to Ontario health authorities as well as case studies. The assessment workbook provides templates with examples of indicators for each step for use in acquiring and analysing data with partners. The modelling study assesses potential climate change impacts on health across Ontario and generates projection scenarios for the 36 public health units. It presents results for health outcomes related to heat, UV exposure, air pollution, vector-borne diseases, and extreme precipitation for the province.

The toolkit can be found [here](#).

**Climate Change and Health Vulnerability Atlas (Laval Department of Geography, & Department of Geomatics, 2018) (QC) (in French only)**—This interactive map provides information on the vulnerability of residents of southern Quebec to two types of key climate hazards on health – heat waves and floods. In addition, it describes the general capacity to cope with the hazards based on important indicators.

The atlas can be found [here](#).

**Building Resilience Against Climate Effects (BRACE) (U.S.)**—This framework was developed by the United States Centers for Disease Control and Prevention to help health authorities plan for climate change impacts on health. The BRACE framework is a five-step process that guides health officials develop strategies and programs that integrate

atmospheric data and climate projections into health adaptation plans. It includes steps for using weather and climate data with epidemiologic analysis to support efforts to better anticipate, prepare for, and respond to a range of health impacts associated with climate change.

The framework can be found [here](#).

**Assessing Health Vulnerability to Climate Change: A Guide for Health Departments (Managan et al, 2016) (U.S.) (PDF format)**—This document was designed to help local health departments assess climate change risks to health, vulnerabilities of specific populations and adaptive capacity needs to protect health. It uses a case study of Georgia to assess heat health vulnerability.

The document can be found [here](#).

### 3. HEALTH CARE FACILITY ASSESSMENT TOOLS

**Canadian Health Care Facility Climate Change Resiliency Toolkit (Canadian Coalition for Green Health Care, 2017)**—The Canadian Coalition for Green Health Care, Health Canada and the Government of Nova Scotia collaborated to develop the Canadian Health Care Facility Climate Change Resiliency Toolkit. The Toolkit is informed by the WHO guidance for conducting V&As (WHO, 2013) and includes the following tools to help officials in health care facilities prepare for climate change impacts:

1. Facilitator’s guide—provides guidance for engaging with partners to assess the climate resiliency of health facilities;
2. Assessment checklist—includes questions that can be used through an online application for conducting the assessment; and
3. Resource guide—provides information about adaptation options available to health facilities for building climate resilience.

The toolkit can be found [here](#).

**Smart Hospitals Toolkit (PAHO, 2017; Balbus et al., 2016) (PDF format)**—This toolkit, also aligned with the WHO guidance document (2013), helps health care facilities become climate smart which is achieved when its structural and operational safety during normal and emergency/disaster operations are linked with green interventions, at a reasonable cost-to-benefit ratio. The online toolkit includes a Hospital Safety Index, a Baseline Assessment Tool, a Green Checklist, a Cost Benefit Analysis Tool, and a Sustainability Construction Guide. It also includes case studies and training materials that health officials may use to prepare for climate change impacts on facilities.

The toolkit can be found [here](#).

**The Sustainable and Climate-Resilient Health Care Facilities Toolkit (Guenther & Balbus, 2016)**—This toolkit focuses on assisting health sector officials in the United States prepare for climate change based on 5 key elements relevant to health facility preparedness:

1. Climate risks and community vulnerability assessments;
2. Land use, building design, and regulatory context;
3. Infrastructure protection and resiliency planning;
4. Essential clinical care service delivery; and
5. Environmental protection and ecosystem adaptation;

It provides checklists for each of the 5 elements as well as other resources to accompany them. The toolkit largely focuses on health care infrastructure.

The toolkit can be found [here](#).

**Climate Action: A Playbook for Hospitals (Health Care Without Harm, 2017)**—This report focuses on climate change mitigation, sustainability, and the ‘greening’ of hospitals. It provides examples of actions taken by health facilities to address climate change, including economic savings realized by:

- ▶ Stewarding their resources, supply chain and operations to align with their environmental priorities;
- ▶ Strategically using their voice to raise awareness about the health and economic impacts of climate change and influence the development and implementation of meaningful domestic and international policy solutions; and
- ▶ Forging and strengthening collaborations with others to build resilience in both their own buildings and their respective communities.

The playbook can be found [here](#).

**Safe haven in the storm: Protecting lives and margins with climate-smart health care (Health Care Without Harm, 2018)**—This document, provided by Health Care Without Harm, focuses on the financial impacts of extreme weather within the health sector in the United States and the benefits to patients, hospital operations and hospital finances of building resilience against future impacts. The report provides an example of scenario analysis to demonstrate why investing in resiliency can protect hospitals from climate-related hazards (e.g., revenue, bad debt, staff and supplies, facilities, insurance).

The document can be found [here](#).

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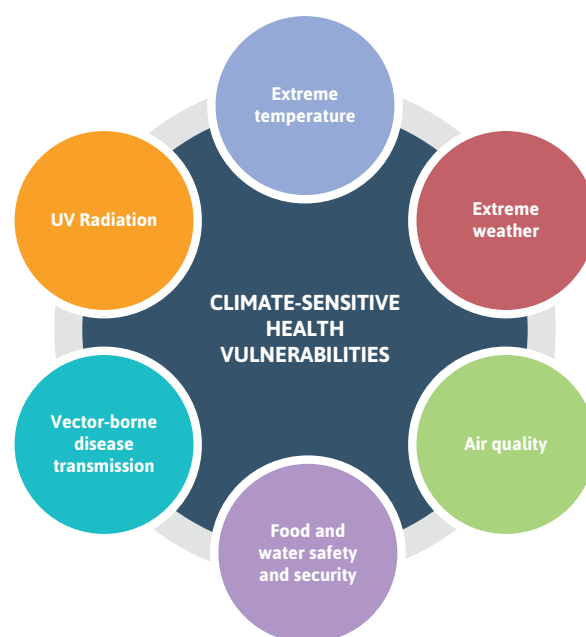
## 4. EXAMPLES OF CLIMATE CHANGE AND HEALTH ASSESSMENTS

**Health Chapter—Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation Berry et al, 2014) (PDF format)**—Part of the Government of Canada national assessment on climate change impacts and adaptation released in 2014, this chapter reports on health outcomes of current climate-related impacts related to temperature extremes, extreme weather events, air quality, contamination of food and water, infectious diseases transmitted by vectors, and ozone depletion. Projected health risks from climate change, available adaptation tools and strategies to address health risks, and population and regional vulnerabilities in Canada are presented in the chapter. Case studies of impacts and adaptation initiatives are provided as are knowledge gaps to direct future research in efforts to prepare Canadians for climate change.

The document can be found [here](#).

**A Changing Climate: Assessing Health Impacts & Vulnerabilities Due to Climate Change Within Simcoe Muskoka, Ontario (Levison et al., 2018) (PDF format)**—This local level V&A identified current and future climate-sensitive health outcomes populations vulnerable to impacts and policies and actions that can help protect health. The Simcoe Muskoka District Health Unit examined climate-related health risks to residents within Simcoe Muskoka. These health risks include: extreme temperature, extreme weather, air quality, food and water safety and security, vector-borne disease transmission, and UV radiation. The report also presents evidence of current and future adaptive capacity to address the health risks, and options to improve that capacity.

**FIGURE 2:** Identified Climate-sensitive Health Vulnerability Categories of Importance For Simcoe Muskoka. Source: (Levison et al., 2018)



The document can be found [here](#).

**Climate Change and Public Health in Grey Bruce Health Unit: Current Conditions and Future Projections (Grey Bruce Health Unit, 2017) (PDF format)**—This assessment report highlighted the potential health risks to residents living in Grey Bruce from climate change. It included information on risks to health associated with extreme temperatures, severe storms, vector-borne diseases, air pollution, and food and water contamination.

The report can be found [here](#).

**Climate Change and Health Vulnerability and Adaptation Assessment in Northwestern Health Unit, Ontario (Verret and Enright, 2017)**—On November 1, 2017 the Northwestern Health Unit (NWHU) launched its V&A with a stakeholder workshop to provide information to partners on the planned assessment process and obtain views on the project moving forward. The workshop included participation from a wide range of partners and a report of the event is posted on the health unit’s website. Since that time, NWHU has joined with the six other public health units in northern Ontario to collaborate on the Climate Change and Health Vulnerability and Adaptation Assessment for Northern Ontario Public Health Units, funded by Health Canada.

The report can be found [here](#).

**Public Health Vulnerability to Climate Change in the Region of Peel, Ontario (Peel Public Health, 2012) (PDF format)**—This assessment examines the public health risks from climate variability and change related to temperature extremes, air quality, extreme weather, food and water contamination, and vector-borne diseases for people in Peel Region. The most vulnerable people to health impacts include seniors, children, those in social isolation, individuals with chronic conditions, people with disabilities, and socially or economically marginalized individuals. Peel is currently using the results of the V&A to prepare for climate through actions such as updating their heat warnings systems, developing a GIS-based tool to identify priority planting areas to reduce the impacts of the urban heat island and by updating its urgent response plan to transition from business as usual to responding to emergency events. It is also completing and second V&A based upon recent census information for the region.

A summary, the assessment results, and next steps can be found [here](#).

**Climate Change and Health Impact Assessment Reports – (Alaska Native Tribal Health Consortium (ANTHC) (Center for Climate and Health)**—Alaska, while not a CRSCI grantee, has a number of climate change and health impact assessment reports for communities.

The reports can be found [here](#).

**The Arctic Monitoring and Assessment Programme (AMAP) Assessment 2015: Human Health in the Arctic (Arctic Monitoring and Assessment Program, 2015)**—

This assessment report presents the results of the 2015 Assessment of Human Health in the Arctic. The Arctic Monitoring and Assessment Programme (AMAP) is a group working under the Arctic Council and has the mandate to:

- ▶ Produce integrated assessment reports on the status and trends of the conditions of the Arctic ecosystems;
- ▶ Identify possible causes for the changing conditions;
- ▶ Detect emerging problems, their possible causes, and the potential risk to Arctic ecosystems including Indigenous Peoples and other Arctic residents; and
- ▶ Recommend actions required to reduce risks to Arctic.

This report includes a section on Canada and information on the impacts of climate change on health in the Arctic including, for example, impacts on food and water insecurity.

The report can be found [here](#).

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## 5. INFORMATION AND DATA TO SUPPORT HEALTH VULNERABILITY AND ADAPTATION ASSESSMENTS

**Canadian Centre for Climate Services (CCCS)**—Hosted by Environment and Climate Change Canada, this centre provides a wide range of climate change resources including a library of climate resources, a climate services support desk and a portal to download and display climate data. CCCS is a multi-disciplinary team with expertise across a broad range of climate-related disciplines that helps Canadians understand, and become more resilient to climate change by:

- ▶ Delivering climate services driven by user needs;
- ▶ Providing access to climate information;
- ▶ Building local capacity; and
- ▶ Offering training and support.

This website can be found [here](#).

**The Canadian Climate Data and Scenarios (CCDS)**—Also hosted by Environment and Climate Change Canada, this website supports climate change impact and adaptation research in Canada through the provision of climate model and observational data. It helps Canadians address the impacts of climate change by:

- ▶ Supporting climate change impact and adaptation research in Canada and other countries;
- ▶ Supporting stakeholders requiring scenario information for decision making and policy development; and
- ▶ Providing access to Canadian research on the development of scenarios and adaptation research.

The website can be found [here](#).

**The Climate Atlas of Canada (Prairie Climate Centre, 2018)**—This resource combines climate science, mapping and storytelling to help Canadians understand the issue of climate change and take local, regional, and national actions that will help build resilience to the impacts. The Atlas presents climate information on the basic science of climate change, summaries of projected climate changes for Canada's major cities, and examples of how planning professionals are taking action on climate change. It also provides a number of case studies of adaptation initiatives being undertaken throughout Canada.

The atlas can be found [here](#).

**Consortium on Regional Climatology and Adaptation to Climate Change (OURANOS)**—The mission of OURANOS is to bring together more than 450 scientists of various disciplines to provide an important source in regional climate simulation in North America. It specializes in:

- ▶ Co-financing for interdisciplinary and multi-institutional projects that bring together researchers, practitioners and policy-makers to promote and support adaptation to anticipated climate change;
- ▶ Climate scenarios and services to multiple partners in Quebec, across Canada and around the world; and
- ▶ Production of regional climate simulations using the Canadian Regional Climate Model 5 (CRCMC5).

The new CRCM5 chosen at Ouranos is developed by UQAM's [ESCER](#) centre, in collaboration with Environment and Climate Change Canada.

The website can be found [here](#).

**Pacific Climate Impacts Consortium (PCIC)**—The Pacific Climate Impacts Consortium is a regional climate service centre at the University of Victoria that provides practical information on the physical impacts of climate variability and change in the Pacific and Yukon Region of Canada. It collaborates with climate researchers and regional stakeholders to produce knowledge and tools in support of long-term planning.

The website can be found [here](#).

**SUPREME: An Integrated Heat Health Warning System for Quebec (Gosselin, Bustinza & Jeffers, 2010) (PDF format)**—

This tool is a province wide open source web application for the surveillance and prevention of the health impacts of extreme heat in Quebec. This decision support tool and information is available to public health officials to inform their actions to protect populations vulnerable to health impacts.

Information on the tool can be found [here](#).

**Lancet Countdown 2018 Report: Briefing for Canadian Policymakers (Howard, Rose, and Rivers, 2018) (PDF format)**—The Lancet Countdown 2018 Briefing for Canadian Policymakers focuses on the links between climate change and health, and their implications for Canadian policymakers. It was developed in conjunction with the Canadian Medical Association and the Canadian Public Health Association. It discusses the status of efforts in Canada to address climate change impacts on the health of Canadians. It examines key indicators of progress and includes recommendations for further actions to be undertaken.

The report can be found [here](#).

**The 2018 Report of the Lancet Countdown on Health and Climate Change: Shaping the Health of Nations for Centuries to Come (Watts et al, 2018)**—

This report describes the global monitoring of health dimensions and the response to climate change. The Lancet Countdown reports on progress in addressing climate change impacts on health and was established to provide an independent, global monitoring system dedicated to tracking the health dimensions of the impacts of, and the response to, climate change. It tracks 41 indicators across five global domains:

- ▶ Climate change impacts, exposures, and vulnerability;
- ▶ Adaptation, planning, and resilience for health;
- ▶ Mitigation actions and health co-benefits;
- ▶ Finance and economics; and
- ▶ Public and political engagement.

The report can be found [here](#).

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## **BOX 2 CANADA IN A CHANGING CLIMATE: SECTOR PERSPECTIVES ON IMPACTS AND ADAPTATION (WARREN & LEMMEN, 2014)**

Developed by Natural Resources Canada with a number of governmental and non-governmental partners, this assessment provides an overview of the various climate change impacts in Canada and options for adaptation. It includes analysis in a number of climate relevant sectors including:

- ▶ Natural resources;
- ▶ Food production;
- ▶ Industry;
- ▶ Biodiversity and protected areas;
- ▶ Human health; and
- ▶ Water and transportation infrastructure.

The national assessment process moving forward will include release of the report on Canada's Changing Climate in 2019 by Environment and Climate Change Canada and the following assessment reports in 2021:

- ▶ Canada in a Changing Climate: National Issues
- ▶ Canada in a Changing Climate: Regional Perspectives
- ▶ Health of Canadians in a Changing Climate: Advancing our Knowledge for Action
- ▶ Canada in a Changing Climate: Indigenous Issues

The assessment can be found [here](#).

## 6. ADDRESSING THE UNIQUE NEEDS OF DIVERSE POPULATIONS

### ***Climate Change, Health, and Equity: Opportunities for Action (Rudolph, Linda, & Gould, S. 2015) (PDF format)*** —

Developed by the Public Health Institute this report explores the connection between climate change, health and equity. A framework is presented to help conceptualize how these issues are linked and identify opportunities for action. Through the promotion of a collaborative “Climate, Health and Equity in All Policies” approach, the report illustrates how actions to address climate change also offers opportunities to simultaneously improve our society, human health, quality of life and the environment.

The report can be found [here](#).

### ***Climate Change and Gender in Canada: A Review (Sellers, 2018) (PDF format)***—

This research brief presents the findings of a literature review on gender and climate change in Canada. Reviewing articles from 2000, four key areas of research were targeted: food security in the north, human health, climate change attitudes and behaviours and climate change-related employment and governance. Concerning climate change and human health, current evidence provided in the report suggests that men may be more vulnerable to health risks such as heat stress and infectious disease. However, growing research on adverse pregnancy outcomes related to natural disasters indicate that women will also face unique health impacts.

The document can be found [here](#).

### ***Gender, Climate Change, and Health (WHO, 2014) (PDF format)***—

This document provides an overview of the connection between gender, climate change, and health, citing various examples from both developed and developing countries such as the impact of heat waves on women, increased risk of malaria to pregnant women, and how gender norms may impact vulnerability. It also discusses a number of potential adaptation actions that can be implemented to address these risks.

The document can be found [here](#).

### ***GBA+ Learning Module (Status of Women Canada)***—

This learning module provides information on the core concepts of GBA+, explains relevant terminology and discusses the process of applying GBA+ to programs, policies and research.

The module can be found [here](#).

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### **BOX 3** CLIMATE CHANGE, HEALTH AND EQUITY: A GUIDE FOR LOCAL HEALTH DEPARTMENTS (RUDOLPH, HARRISON, BUCKLEY, & NORTH, 2018)

This guide was developed by the Public Health Institute and the American Public Health Association with support from the California Department of Public Health. Some key messages from the guide include:

- ▶ Powerful institutions, social inequities, systems, health processes and climate processes interact in complex ways to impact health and the environment.
- ▶ The root causes of poor health outcomes and inequities (the social determinants of health), climate change and other adverse environmental impacts are largely the same.
- ▶ The impacts of climate change on health and health inequities are moderated by individual and community vulnerability and resilience.
- ▶ Interventions that improve the social determinants of health and population health and reduce health inequities can significantly reduce vulnerability and increase resilience to climate change, at the individual and community-levels.
- ▶ Many climate actions bring significant health co-benefits, but some may have adverse health consequences or increase health inequities. Thoughtful implementation of actions to reduce greenhouse gas emissions and adapt to climate impacts will help maximize co-benefits and minimize co-harms.

The guide can be found [here](#).

## 7. CLIMATE CHANGE AND HEALTH ADAPTATION: INITIATIVES, CASE STUDIES, AND LESSONS-LEARNED

### BOX 4 ADAPTING TO THE HEALTH IMPACTS OF EXTREME HEAT EVENTS IN CANADA

Extreme heat events have been increasing in severity and frequency in many communities and these events are expected to continue to worsen due to climate change. Health Canada has produced a number of climate change resources, bulletins, information and guidance documents to help Canadians prepare for the health impacts of extreme heat events.

The following reports, developed with input from a range of partners and experts, are available on the Health Canada website:

- ▶ Adapting to Extreme Heat Events: Guidelines for Assessing Health Vulnerability
- ▶ Heat Alert and Response Systems to Protect Health: Best Practices Guidebook
- ▶ Communicating the Health Risks of Extreme Heat Events: Toolkit for Public Health and Emergency Management Officials
- ▶ Extreme Heat Events Guidelines: Technical Guide for Health Care Workers
- ▶ Audience Specific Public Heat-Health Brochures
- ▶ Fact Sheets for Health Care Workers

The documents can be found [here](#).

**Accelerating Adaptation in Canadian Communities: Case Studies (Rogers, Behan, & the Clean Air Partnership, 2012) (PDF format)**—The Clean Air Partnership presents a series of case studies of climate change adaptation in Ontario in this report, including a syndromic surveillance system for heat-related illnesses employed by four public health units in Southeastern Ontario.

The case studies can be found [here](#).

**The Climate-Ready States and Cities Initiative (CRSCI) (APHA & US CDC, 2018) (Sheehan et al, 2017)**—The Climate-Ready States and City Initiative is led by the United States Centers for Disease Control and Prevention (CDC).

It provided funding to 16 states and 2 cities to assist them in developing and implementing actions to protect health from climate change, including the conduct of assessments to address gaps in critical public health functions and services. Many grantees have undertaken V&As and other research activities and implemented climate change and health adaptation activities.

Information on the initiative can be found [here](#).

## BOX 5 CRSCI: CALIFORNIA'S BRACE PROGRAM (CALIFORNIA DEPARTMENT OF PUBLIC HEALTH, 2018)

CalBRACE is a product of the CDC's Climate-Ready States and Cities Initiative. It provides resources and technical assistance for the state and local public health departments to build climate adaptation capacity and enhance resilience at the local and regional levels. It is focused on three climate impacts faced by the state: increasing temperatures, wildfires, and sea-level rise.

CalBRACE is developing an Adaptation Planning Toolkit for Public Health, a local health department community of practice, a checklist and template for assessing climate planning concerns, and a number of helpful resource links. There are currently a number of case studies available, in addition to 58 climate and health profile reports for the regions across California.

Information can be found [here](#).

**Cities Adapt to Extreme Rainfall: Celebrating Local Leadership (Kovacs, Guilbault, Sandink, D., & Institute for Catastrophic Loss Reduction, 2015) (PDF format)**—This document describes the actions of various cities in coping with flooding, overflow of wastewater, and similar issues caused by extreme rainfall.

The document can be found [here](#).

**TapMap app**—This app allows users to find drinking water fountains and bottle refilling stations throughout Metro Vancouver. This initiative supports adaptation to extreme heat by making water refilling stations accessible throughout the city.

The document can be found [here](#).

## BOX 6 CITIES ADAPT TO EXTREME HEAT: CELEBRATING LOCAL LEADERSHIP

Developed by the Institute for Catastrophic Loss Reduction and Health Canada, this report presents 20 case studies of how various cities across Canada are addressing health impacts of extreme heat. The first 10 case studies showcase heat alert and response systems. The remainder of the case studies share information on other actions that can be taken such as preventative measures. One case study describes efforts by Rosemont-La Petite-Patrie, to increase the number of cool and green roofs to reduce summer temperatures. The report summarizes 7 key lessons that should be considered when adapting to extreme heat.

The report can be found [here](#).

**TABLE 1:** Canadian Climate Change Strategies and Action Plans that Include Human Health (Adapted from Austin et al., 2015)

JURISDICTION	STRATEGY OR ACTION PLAN	HEALTH RISK ADDRESSED
Canada	<a href="#">Pan-Canadian Framework on Clean Growth and Climate Change: Canada's plan to address climate change and grow the economy (2016)</a> (PDF format)	extreme temperatures; vector-borne diseases (VBDs); food; vulnerable populations
Yukon; NWT; Nunavut	<a href="#">Pan-Territorial Adaptation Strategy: Moving Forward on Climate Change Adaptation in Canada's North (2011)</a> (PDF format)	food
Ontario	<a href="#">Ontario Climate Change Strategy (2015)</a> (PDF format)	heat; air quality; VBDs, water and food
Quebec	<a href="#">Quebec in Action: Greener by 2020 (2012)</a>	air quality; socio-economic conditions; heat; UV radiation; mental health; VBDs
British Columbia	<a href="#">Preparing for Climate Change (2012)</a> (PDF format)	drought; wildfires
Alberta	<a href="#">Climate Leadership Plan (2018)</a>	air quality
Manitoba	<a href="#">Made-in-Manitoba Climate and Green Plan (2017)</a> (PDF format)	flood; drought; water quality
Saskatchewan	<a href="#">Prairie Resilience: A Made in Saskatchewan Climate Change Strategy (2017)</a> (PDF format)	water quality; VBDs
New Brunswick	<a href="#">Climate Change Action Plan (2016)</a> (PDF format)	water quality; extreme weather events; VBDs
Nova Scotia	<a href="#">Toward a Greener Future - Climate Change Action Plan (2009)</a> (PDF format)	air quality; water quality
Newfoundland	<a href="#">Charting Our Course - Climate Change Action Plan (2011)</a> (PDF format)	temperature; extreme weather events; food quality
Yukon	<a href="#">Yukon Climate Change Action Plan (2009)</a> (PDF format)	health adaptation
Northwest Territories	<a href="#">2030 NWT Climate Change Strategic Framework (2018)</a> (PDF format)	food; air; diseases; mental health
Nunavut	<a href="#">Upagiatqavut: Setting the Course - Climate Change Impacts and Adaptation in Nunavut (2011)</a> (PDF format)	food; disease; extreme weather events
Edmonton	<a href="#">The Way We Green: The City of Edmonton's Environmental Strategic Plan (2011)</a> (PDF format)	air quality; food and water
Montreal	<a href="#">Montreal's Resilient City Strategy (2018)</a> (PDF format)	extreme weather events
Ottawa	<a href="#">Air Quality and Climate Change Management Plan (2014)</a>	air quality; heat; VBDs; extreme weather
Vancouver	<a href="#">City of Vancouver Climate Change Adaptation Strategy (2012)</a> (PDF format)	heat; respiratory illness; diseases
Saanich	<a href="#">Climate Change Adaptation Plan (2011)</a> (PDF format)	water; air pollution; extreme weather events



## 8. RESOURCES FOR BUILDING CAPACITY TO ADAPT IN A SPIRIT OF RECONCILIATION

**Climate Telling**—This website provides a repository of information collected as part of Indigenous Services Canada’s Climate Change and Health Adaptation Program, as well as links to research relevant to climate change and health adaptation in Indigenous communities. This information includes summaries of previously funded climate change and health adaptation projects proposed, selected and led by Indigenous peoples across Canada.

The website can be found [here](#).

**Centre for Indigenous Environmental Resources (Cave, Johnson, & McKay, 2017)**—a First Nations directed environmental non-profit organization that works to promote sustainability, as well as land and water protection. This includes work and projects on climate change, including its anticipated health impacts. The work of the CIER has led to partnerships with various organizations

which have resulted in a number of climate-relevant resources for First Nations communities, including guides to climate change informed infrastructure planning and to general water resource management.

CIER’s work with Health Canada led to the Manitoba First Nations Climate Change and Health Workshop, one of a series of workshops held in partnership with Indigenous communities and organizations across Canada. The Manitoba workshop gathered Manitoba First Nations communities and regional First Nations organizations to discuss the anticipated impacts of climate change on health of most concern, opportunities for collaboration, and access to information and data related to climate change impacts and vulnerability assessments.

The website can be found [here](#).

## BOX 7 ARVIAT NUNAVUT GOES GREEN

The Climate Change and Health Adaptation Program for Northern First Nations and Inuit Communities, now within Indigenous Services Canada, funds community-driven research projects that examine the impacts and risks of climate change on community wellbeing. The following is one such project in Arviat, Nunavut.

Hunting, sharing and consuming country foods are important for food security and fundamental to culture, identity, and wellbeing in Arviat. In recent years, climate change, including changes in sea ice and extreme weather events, has exacerbated existing stressors on traditional food harvesting activities, shifting patterns of food consumption away from traditional foods to a greater reliance on store foods. The availability of high quality, fresh foods like fruits and vegetables is limited by a variety of factors, such as high retail prices and decreased quality caused by transportation. Initial community research identified decreased food security linked climate change as a major issue facing the community.

Subsequent research explored options for local production of healthy foods, including introducing a community organic composting program to improve local soil quality and establishing a research greenhouse to assess the viability of commercial food production. Further research in the greenhouse focused on monitoring and data collection of optimal growing conditions and included partnerships with researchers to build capacity with community youth for ongoing operation.

Information about the program can be found [here](#).

**Indigenous Health Adaptation to Climate Change Program (Canadian Arctic, Peru, Uganda)**—This research portal provides access to a number of research outputs developed as part of a multi-year, trans-disciplinary research program with a focus on policy relevant community based adaptation research. This includes work done in partnership with Inuit communities in the Canadian Arctic, such as an examination of Iqaluit's food system.

The portal can be found [here](#).

**Community Health Indicators Tool (Jeffery et al, 2010)**— This toolkit provides an overview of one approach to developing community health indicators of local relevance. Though many of the indicators included may be applicable to other communities, where appropriate the approach described could serve as roadmap to the development of a community health evaluation framework that meets the unique needs of individual communities.

The tool can be found [here](#).

**Tribal Climate Health (Pala Band of Mission Indians—U.S.)**—This project develops and showcases tools for climate change adaptation in an American Indigenous context. It highlights resources developed to support general climate vulnerability assessments as well as adaptation planning guides and a clearinghouse for climate change and health research of particular relevance to Indigenous communities.

Information can be found [here](#).

**Tribal Climate Change Guide (U.S.)**—A list of American government and tribal resources and programs developed to support climate change adaptation within Indigenous communities. Though many of these resources are most relevant in an American context some may inform action within Canada by providing experience-based guidance or examples of climate change and health adaptive actions which, where appropriate, may inspire similar approaches in Canadian communities.

The document can be found [here](#).

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## 9. CLIMATE CHANGE ADAPTATION TOOLS

There are many additional climate change tools in various sectors in Canada and other countries with information on climate change risks to communities and adaptation approaches. The links below provide examples of useful resources.

[Adaptation Primers](#)

[American Academy of Pediatrics](#)

[City of Geelong's Climate Change Adaptation Toolkit](#)

[Climate and Adaptation Knowledge Exchange](#)

[Coastal Community Adaptation Toolkit](#)

[Community Tool Box](#)

[Global Heat Health Information Network](#)

[Local Governments for Sustainability \(ICLEI\) Building Adaptive and Resilient Communities Program](#)

[Plan2Adapt](#)

[Regional Analysis Tool](#)

[ReTooling for Climate Change](#)

[US Climate Resilience Toolkit](#)

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## 10. LIBRARIES

A wealth of information on climate change and health impacts and adaptation as well as other relevant environmental health topics is available in electronic libraries managed by governments and other organizations. Some libraries focus on environmental health challenges faced by Indigenous Peoples, including climate change, and measures to reduce risks in Indigenous communities. Examples of some of these libraries are found at the links below.

[Adaptation Clearinghouse](#)

[Adaptation Library](#)

[American Public Health Association](#)

[BC First Nations Health Authority](#)

[Climate Change and Human Health Literature Portal](#)

[Green Health Care: Preparing Health Care Facilities for Climate Change Resource Guides](#)

[National Collaborating Centre for Aboriginal Health Canada](#)

[National Collaborating Centre for Environmental Health](#)

[National Indian Health Board](#)

[National Institute of Environmental Health Sciences](#)

[PLOS](#)

[WHO/ UNEP - Health and Environment Linkages Initiative](#)

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