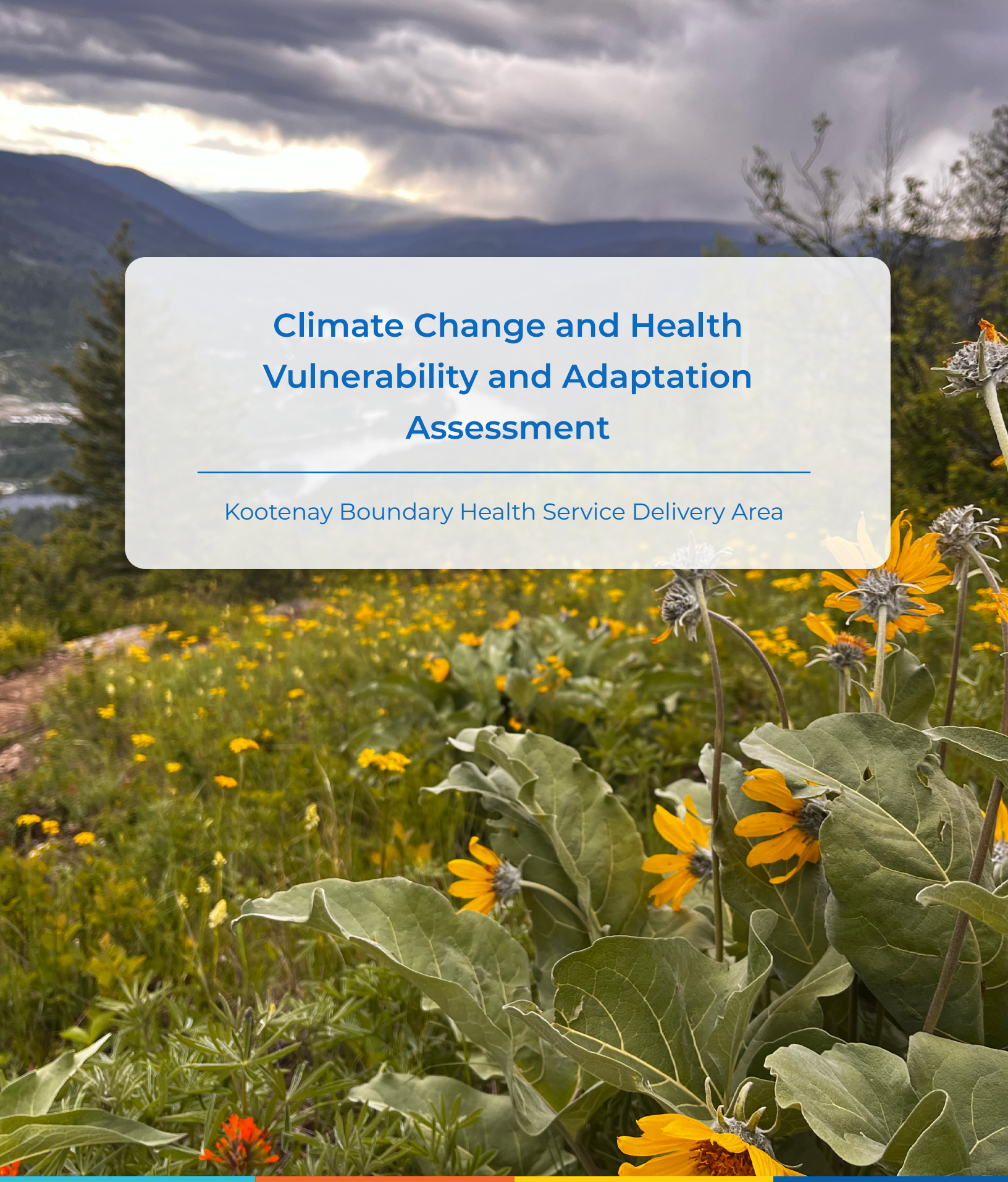

Climate Change and Health Vulnerability and Adaptation Assessment

Kootenay Boundary Health Service Delivery Area

Interior Health

May 2025

Acknowledgement

Interior Health (IH) provides health and wellness services across the ancestral, unceded and traditional territories of the Dãkelh Dené, St'át'imc, syilx, Tŝilhqot'in, Ktunaxa, Secwépemc and Nlaka'pamux Nations. We honour the First Nations as the traditional stewards of these lands and waters.

IH recognizes Métis Nation British Columbia (MNBC) and Métis Peoples in the Interior region who contribute to the diverse landscape of Indigenous ways of knowing and being.

We offer our sincere gratitude to our partners who have contributed to this project including representatives from MNBC and Ktunaxa Nation, Regional District of Central Kootenay (RDCK), Regional District of Kootenay Boundary (RDKB), the Cities of Nelson, Castlegar, Rossland and Trail, as well as the Town of Creston, Selkirk College, Columbia Basin Trust, Columbia Basin Environmental Education Network, Neighbours United and Youth Climate Corps. We would also like to thank our IH colleagues for taking time to share their perspectives and experiences with us.

Executive Summary

The IH region is already experiencing the impacts of extreme weather events, including heat, flooding, drought and wildfires, which are expected to intensify. In response, communities are working together to reduce climate risks, recognizing the social, economic and environmental benefits of coordinated action. To support these efforts, IH released the five-year climate change and sustainability roadmap (2023), which includes an action to conduct a climate change and health vulnerability and adaptation assessment (CCHVAA). This assessment evaluates vulnerability to climate-related health impacts, focusing on extreme heat, cold, flooding, wildfires and smoke, and drought, specifically in the Kootenay Boundary Health Service Delivery Area (KB HSDA). This assessment defines vulnerability to the health impacts of climate change as the interactions between climate exposure, sensitivity and adaptive capacity.

This CCHVAA was guided by a number of key tools, including Health Canada's Climate Change and Health Vulnerability and Adaptation Assessment: Workbook for the Canadian Health Sectors as well as CCHVAAs completed by other jurisdictions within BC and beyond. The assessment of vulnerability explored three dimensions; exposure, sensitivity and adaptive capacity.

- **Exposure** refers to the probability of a climate-related hazard, such as an extreme weather event, occurring to an individual or population.
- **Sensitivity** refers to the degree to which a populations or systems are affected, either adversely or beneficially, by climate variability or change.
- **Adaptive capacity** refers to the ability to adjust to those impacts and reduce any health risks.

This assessment employs two key methods: First, engagement with local government and Indigenous partners, postsecondary, funding and non-profit organizations, and health system partners across the KB HSDA. Second, synthesis of the variety of data on exposures, health impacts, and surveys exploring the broader realities of life for people who live in the KB HSDA.

The data presented in this report represents the best available data that we could collect within the scope of the project and capacity of our team. However, there are still limitations. The small populations and disparities in data collection create barriers to understanding the full extent of health vulnerabilities and our engagement was limited by time and resource constraints.

Exposure

This region experiences a unique combination of climatic conditions that can result in severe weather fluctuations, including intense heat waves, heavy snowfall, intense storms, wildfires, flooding and drought. While these phenomena are not new, their frequency and severity have been growing, driven by climate change. This growing exposure directly impacts the physical health of the population. Beyond the direct health impacts, climate change and the resulting extreme weather events drives significant disruptions to local ecosystems, economies, infrastructure, and social networks which all have impacts on physical and mental health through their effects on social, economic, and other determinants of health. This assessment focuses on key exposures, and their direct and indirect impacts on the health and wellness of communities across the KB HSDA.

Table 1: Overview of the current exposure to climate hazards and the resulting health impacts

Extreme Weather Event	Current Experience of Exposure	Overview of Health Impacts
Wildfire and wildfire smoke	• During the 2024 wildfire season, communities in the Slocan Valley faced evacuation orders due to encroaching wildfires.[1-3] • During the 2021 and 2023 wildfire seasons, there were news reports of air quality indices (AQI) in parts of the region reaching "hazardous" levels for weeks at a time.[4-6]	• Fine particulate matter (PM2.5) and other pollutants can penetrate the lungs triggering and worsening conditions like asthma, bronchitis and chronic obstructive pulmonary disease (COPD) .[7–10] PM2.5 can also contribute to systemic inflammation and oxidative stress.[11] • Chronic exposure to smoke, repeated evacuation orders and uncertainty about safety create widespread anxiety and emotional distress.[12] • Evacuation also drives negative health impacts as it imposes significant disruptions to social and economic ties and access to health care.[13,14]
Extreme Heat	• During the past summers, from 2022 – 2024, communities in the region have seen temperatures exceed 40°C, breaking historical records.[15-17] • These heatwaves are becoming a recurring summer phenomenon.[18-20]	• Heat-related illnesses, from mild conditions like heat cramps, to severe and life-threatening conditions like heatstroke.[21] • Extreme heat also places a significant strain on cardiovascular systems.[22-25] • High temperatures can also disrupt sleep patterns, increase irritability and exacerbate anxiety and depression.[26]
Extreme Cold and Winter Storms	• In 2024, winter storm warnings were issued on Highway 3 from Hope to Princeton and from Grand Forks to Creston.[27–29]	• Cold-related illnesses like hypothermia and frostbite which disproportionately impact individuals with precarious housing.[30] • Cold exposure exacerbates respiratory cardiovascular diseases.[31,32,33] • Falls, and other injuries that occur in icy conditions, can lead to fractures, musculoskeletal strain and head injuries.[34,35]

Extreme Weather Event	Current Experience of Exposure	Overview of Health Impacts
Floods 	• Communities in the region have experienced multiple high-water events resulting in heightened alert levels and evacuation orders being issued.[36–40] • These events impact critical infrastructure in the region, including roads, bridges and utilities.[41–44]	• Floodwaters often carry harmful pathogens, chemicals, debris, etc. impacting the quality of drinking water and creating public health risks.[45] • Standing water and high humidity following floods promote mold growth in homes and buildings, contributing to respiratory conditions such as asthma and allergies.[46,47]
Droughts 	• The KB HSDA has residents who rely on small drinking water systems and private wells, which are at risk of reduced quality and quantity during drought. • Drought conditions have put a strain on the agriculture industry forcing the province to step in to provide support.[48,49] • The KB HSDA has also seen heightened fire risk during drought years.[50]	• As water levels in rivers, lakes and reservoirs decline, the concentration of pollutants increases.[51] Exposure to contaminated water can cause gastrointestinal illnesses. • Drought conditions often result in dry, dusty environments, increasing airborne particulate matter which can result in irritation in the eyes, throat and airways.[52–55] • Persistent drought conditions create economic instability due to impacts to industries like agriculture. Financial stress and uncertainty contribute to increased rates of anxiety and depression.[55]
Compound Climate Hazards 	• The increasing frequency and intensity of climate-driven extreme weather events has resulted in rising co-occurrence and/or back-to-back occurrence of these events. Some communities may see extreme heat and wildfire occurring at the same time, while other communities may move from drought to fire to flood. These compounding hazards mean people struggle to cope and have little time to recover, resulting in longer-term physical and mental health impacts.	• The combination of exposure to extreme heat and wildfire smoke has been shown to increase hospitalizations for respiratory distress and cardiovascular complications.[56,57] • People exposed to multiple disasters, such as wildfires and floods, are more likely to report severe mental health outcomes, including post-traumatic stress disorder (PTSD).[58]

Sensitivity

The risk of being exposed to these events and suffering health impacts is not evenly distributed across the population. Certain populations in the KB HSDA face higher sensitivity to climate impacts due to social, economic and health-related factors. This assessment includes a description of a continuum of sensitivity in the KB HSDA, providing insight into the specific ways these physiological, socio-economic and geographic sensitivities expose people of the KB HSDA to heightened health risks from climate driven exposures.

Table 2: Overview of the disproportionate risk some sub-populations experience

Sub-Population	Mechanism of disproportionate risk and health impact
Individuals with pre-existing chronic conditions	Compared to provincial rates, the KB HSDA has higher rates of mental health disorders and chronic diseases such as COPD. Chronic health conditions that affect circulation, nerve function or metabolism, as well as medications that interfere with the body's natural processes like sweating or blood flow, can make individuals more vulnerable to extreme heat or cold. Conditions like chronic obstructive pulmonary disease (COPD) and asthma can worsen when exposed to both smoke particles during wildfires and mold spores in the aftermath of flooding events, leading to frequent hospital visits.
Children	Children's bodies are not fully developed to handle extreme heat or extreme cold, which makes them more vulnerable to dehydration, heat rash, and, in extreme cold, an increased risk of developing pediatric pneumonia.[59] In the event of smoke, their developing lungs are also less able to filter pollutants, and even short-term exposure to PM2.5 can have long-lasting effects on their respiratory health.[60,61]
Older adults	Across the KB HSDA, the proportion of the population aged 75+ is expected to grow by 36% between 2021 and 2026.[62] As people age, their bodies don't cool down as easily because they sweat less, and their hearts don't adjust as quickly to heat.[63,64] Older adults are also more sensitive to cold.[65] Additionally, they often have reduced respiratory capacity and pre-existing chronic conditions such as heart disease which can make exposure to wildfire smoke particularly dangerous.[66]
Individuals who are precariously housed	Individuals who are unhoused or underhoused are unable to find safe shelter from extreme weather events. Additionally, what little shelter they have may be lost during these events, drastically increasing their exposure to these events and the risk of negative health impacts.[67-69]
Outdoor workers	The nature of outdoor work in industries like agriculture, construction, etc., means that workers must spend extended periods outside, or in damp, structurally compromised buildings. Prolonged exposure to the elements can be especially harmful during wildfire season when there's lots of smoke or in the aftermath of a flood, when mold spores may be airborne.
Individuals with low socio-economic status	In 2021, the percentage of low-income persons exceeded the provincial rate in nine municipalities in the KB HSDA. Financial constraints significantly affect the ability to take health-protective actions like retrofitting a home to ensure it stays adequately cool in the summer or warm in the winter. These challenges make people more likely to experience negative health impacts of extreme weather events as they are less able to protect themselves.
Individuals who live in very rural and remote areas	For communities with limited access to health and social services due to their location, the risk of harmful impacts is heightened. For example, communities that rely on single access routes, such as bridges and mountain passes, may find these routes impassable during extreme weather events, isolating them and hindering emergency response efforts.

Adaptive Capacity

Adaptive capacity is a dynamic and multi-faceted concept that determines how effectively communities can respond to and recover from climate-related health risks. By engaging with a variety of people with local expertise including local governments, Indigenous partners, community, post-secondary and funding organizations and IH staff, the assessment identified the following strengths and barriers, as well as opportunities for strengthening adaptive capacity in the KB HSDA into the future.

Table 3: Building adaptive capacity in the KB HSDA

Strengths	Barriers
• A foundation to build upon existing climate adaptation and emergency preparedness and response efforts • Existing initiatives aimed at reducing the impacts of climate change on vulnerable populations • Data and information available to illustrate the connection between climate change and well-being. For example, Selkirk College State of the Basin, Columbia Basin Environmental Education Network - Wild Voices Programs, RDKB Boundary Watershed Webinars—Science & Learning • Committed grassroots organizations supporting climate change and environmental engagement and education	• Limited staff and volunteer capacity • Community polarization hindering adaptation efforts • Competing demands for many organizations • Inadequate and inconsistent funding alternatives • Aging infrastructure that is not resilient to climate impacts

Pathways to Strengthen Adaptive Capacity

- **Climate adaptation and resilience planning:** Planning can provide a framework for action and spread awareness about the interconnected impacts of climate change, health and well-being.
- **Climate emergency preparedness and response:** Preparedness plays a crucial role in building adaptive capacity by ensuring that communities are ready to face and recover from extreme weather events and other climate-related disasters.
- **Communication, knowledge translation and education:** Access to climate-informed education, data and knowledge translation can increase awareness of climate change impacts, empowering individuals and communities to take informed action. It can also support evidence-based adaptation strategies by bridging the gap between research and practice and improving coordination across sectors.
- **Supporting determinants of health:** Initiatives across the region that support the determinants of health can also reduce inequitable impacts of climate change by empowering communities and creating systems of support that address the determinants of health.
- **Supporting the built and natural environments:** Plans and policies shape the ways in which we live, work and move within our communities. Thus, policies and programs that adopt a climate informed approach to the decision making around land-use and ecosystem management can build resilient communities and systems the support health and well-being.

The assessment aimed to provide insight into the challenges that come with a changing climate as well as the opportunities to build on community strengths and bolster resilience. A key strength of this assessment was the way it brought together different kinds of expertise and data. We looked at both the obvious impacts—like more heatwaves and extreme weather—and the less visible ones, such as the increased strain on our local health services and the economic challenges. The work highlights where vulnerabilities exist and highlights the specific risks faced by different groups. Additionally, we mapped community assets, identified pre-existing initiatives and strengths, and developed strategies for Interior Health and organizations as a collaborative to strengthen adaptive capacity. It suggests that ongoing efforts to bolster infrastructure resilience, improve accessibility to health care and emergency services, and build on the region's existing social networks are critical to mitigating future climate impacts.

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Introduction

Purpose and Scope

Climate change is a significant global health threat that directly affects health and well-being as well as the determinants of health such as clean air, safe water, housing and economic security. The Interior Health (IH) region has already experienced the impacts of extreme heat, flooding, drought and wildfires, with these events expected to intensify as temperatures continue to rise. However, communities are taking collaborative action to reduce climate risks, recognizing the social, economic and environmental benefits of coordinated efforts. Addressing climate change requires shared responsibility across governments, organizations and communities to ensure responses are locally relevant and support public health.

In 2023, IH released the five-year Climate Change and Sustainability Roadmap (the Roadmap), which sets out collaborative action to support sustainability and address climate change both within IH and across communities. One of the actions in the roadmap is for IH to conduct a climate change and health vulnerability adaptation assessment (CCHVAA).

A CCHVAA is an evidence-based method of assessing the impacts that climate change has on a population in a defined geographic region[70] Given that climate change has become a lived reality in the IH region, especially when considering the events of recent years, we have chosen to focus this CCHVAA on the following climate hazards:

- Extreme heat
- Wildfires and smoke
- Flooding
- Extreme cold and winter storms
- Drought

The intention of a CCHVAA is to get a better sense of a region's vulnerability to the health impacts of climate change, which can be defined as the interactions between climate exposure, sensitivity and adaptive capacity. In the IH region, we are particularly interested in adaptive capacity and are looking to learn more about communities' current and future climate initiatives, gaps and opportunities for climate action, and where IH can help support communities with these efforts to strengthen resilience and ultimately promote community health and well-being.

This work can create many co-benefits to strengthen communities:

- Shed light on health inequities and inform ways in which we can bridge these gaps.
- Improve collaboration, open communication and reciprocity between health authorities, local governments, Indigenous partners, community organizations and academic and funding partners.
- Establish a baseline against which we can compare and monitor changes in local risk and resilience.
- Provide a strong basis of evidence for policy- and decision-makers to consider health and well-being and prioritize climate actions tailored for unique regional and geographic needs.
- Identify opportunities to strengthen or create policies and actions that enhance adaptive capacity and support healthy, thriving, and sustainable communities.

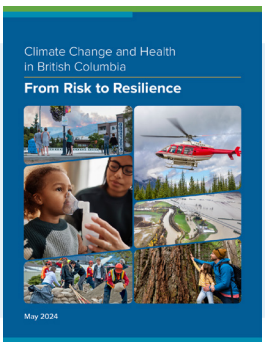
We have scoped our CCHVAA to be completed within each Health Service Delivery Area (HSDA) in the IH region. Conducting a single CCHVAA for the entire IH region would be very resource intensive and would likely not result in information that is specific or relevant enough to inform decision making at the community level.

By assessing at the HSDA level, we can reflect the sub-regional nuances and contexts across the IH region, while also enabling more thorough engagement with local partners. Our pilot assessment is focused on vulnerability and adaptation in the Kootenay Boundary (KB) HSDA (see map below). The Kootenay Boundary (KB) HSDA was selected as the pilot region based on a high-level assessment of vulnerability across HSDAs and the existing partnerships and ongoing climate initiatives in the area. These established relationships with external partners provided a strong foundation for testing the pilot assessment.

To further refine the scope of the assessment, we focused on climate-related health impacts on vulnerable populations in the region and adaptation actions that support broader climate resilience. A detailed assessment on the health system or health facilities was out of scope for this assessment.

This report is focused on the Kootenay Boundary Health Service Delivery Area. For more information about the health impacts of climate change across the IH region and across the province, refer to:

- 2023 MHO Report on Climate Change, Health and Well-Being
- Climate and Health in British Columbia from Risk to Resilience



Methodology

Team and Review

This CCHVAA was guided by Health Canada's Climate Change and Health Vulnerability and Adaptation Assessment: Workbook for the Canadian Health Sectors as well as CCHVAAs completed by other jurisdictions such as Vancouver Coastal Health and Fraser Health, Simcoe-Muskoka District Health Unit and Waterloo Region, Wellington County, Dufferin County and the City of Guelph. It was completed as part of broader work supported by the Ministry of Health and the Climate Preparedness and Adaptation Strategy.

The CCHVAA was completed by the CCHVAA Working Group, a cross-disciplinary group with representation from Population and Public Health programs and the Epidemiology and Surveillance Unit. This included:

- Dr. Sue Pollock, Medical Health Officer
- Julian Mallinson, Director, Strategic Initiatives
- Kady Hunter, Lead, Climate Change and Health
- Glory Apantaku, Climate and Health Scientist
- Carolina Arana, Coordinator, Climate Readiness and Resilience
- Jenny Green, Team Lead, Healthy Community Development Team
- Chanelle Giroux, Administrative Assistant
- Vi Nguyen, Public Health Epidemiologist
- Melissa Cline, Community Health Facilitator (during engagement period)

The working group was responsible for scoping the assessment, establishing an assessment framework, collecting and analyzing quantitative and qualitative data, and synthesizing the information into this report and future knowledge translation materials.

In addition, the CCHVAA was reviewed by IH staff external to the working group including the Chief Medical Health Officer, and staff from Population and Public Health, Emergency Response, Health Emergency Management BC, Communications and Engagement, and Indigenous Partnerships.

Process

The process for conducting the CCHVAA is summarized as follows:

Project Scoping

- Reveiwed existing climate change and health vulnerability and adaptation assessments
- Assessment was conducted at the Health Service Delivery Area (HSDA) level to reflect regional nuances and ensure locally relevant findings
- Established working group for the project
- Identified questions to be addressed and process of engagement and quantitative data collection

Community Engagement and Data Collection

A mixed-methods approach integrates quantitative climate and health data with qualitative insights from community partners, Indigenous groups, local governments, and organizations. Engagement activities include:

- **Environmental Scan & Pre-Engagement:** Conversations with key partners to understand priorities and refine engagement strategies.
- **Focus Groups & Interviews:** Sessions with local governments, Indigenous leaders, non-profits, and healthcare providers to capture lived experiences and adaptation measures (more detail below).
- **Virtual Participation & Interactive Tools:** Microsoft Teams, Zoom and Mural Boards were used to collect feedback and facilitate interactive discussions.

Quantitative data gathered includes: Historical climate data and projections, demography and socio-economic status, health status and healthcare utilization. The main sources of data for this assessment are the BC Centre for Disease Control (BCCDC), Statistics Canada and Interior Health.

Data Analysis and Assessment

- A thematic analysis was conducted on the engagement data, drawing out the key themes for each priority area that reflect participants' experiences and perspectives. Themes were summarized in an Engagement Summary report that was shared with partners and used to inform the assessment.

- The assessment process involved compiling climate data—such as temperature records, wildfire smoke levels, and flood occurrences and projections for the 2050s and 2080s—to describe environmental exposures across the region. In parallel, physiological and socio-economic data (including age distributions, prevalence of chronic conditions, income levels, education and housing quality, etc.) were gathered to illustrate the population's sensitivity to these exposures. Health data, such as emergency department visit counts during extreme weather events, were then presented to describe the physiological impacts of climate events. This data was integrated descriptively through summary statistics, graphs and tables to highlight key patterns. Finally, the descriptive findings were contextualized using the latest academic evidence on climate-related health impacts and recent local news articles, thereby grounding the analysis in both scientific research and regional realities. Multiple time periods were used for this assessment; where possible, the most current dataset was used.

Application to Policy and Decision-Making

- Results are communicated through a report that establishes a baseline for monitoring changes in climate-related health risks and identifies opportunities for policy interventions and community-led actions.
- Future tailored knowledge traslation materials will be developed to ensure information is accessible and usable for IH staff and external partners.

We designed our engagement strategy using established best practices to ensure a thoughtful, inclusive and context-specific approach to community engagement. This process involved conducting an environmental scan and holding pre-engagement conversations with Indigenous partners, IH Population and Public Health staff, and local government representatives. These initial steps helped us tailor our strategy to align with the local context, consider the desired level of engagement with partners, and the associated risks and opportunities.

We then identified a targeted list of relevant partners across the HSDA based on partner's current involvement in climate adaptation work and capacity to participate, including representatives from local governments, community non-profit organizations, Indigenous groups, post-secondary institutions and IH staff, and sent invitations to participate in the engagement sessions.

From there, we hosted a series of focus groups and interviews with the partners listed in table 4:

Table 4: Participants of engagement activities

Four focus groups with local government and Indigenous partners:	Interviews with post-secondary, funding and non-profit organizations[i]:	IH staff interviews:
• Central Kootenay: Participation from City of Nelson, Town of Creston, City of Castlegar, Regional District of Central Kootenay • KB: City of Rossland, City of Trail, Regional District of Kootenay Boundary • Ktunaxa First Nation[ii] • Métis Nation British Columbia: MNBC Ministry of Environment, Climate Change & Food Security, Ministry of Health and regional staff	• Selkirk College • Columbia Basin Trust • Columbia Basin Environmental Education Network • Neighbours United • Youth Climate Corps	• Staff that support community responses to extreme weather events, specifically supports for vulnerable populations • Clinical Operations directors that are involved in clinical responses to climate events and evacuations

i Community organizations that support vulnerable populations respond to climate change were sent invites; however, these organizations are stretched very thin, facing multiple pressures and demands. As a proxy, we engaged with the IH staff that work closely with these organizations.

ii It is important to recognize that the KB HSDA is a colonial boundary for health service distribution. The area we are assessing includes the traditional and unceded territory of the Ktunaxa, Sinixt, syilx, and Secwépemc people, who have been and continue to be the traditional stewards of these lands, air, waters, and their inhabitants. Based on conversations with the IH -Nation advocates, we spoke with representatives from the Ktunaxa Nation for this assessment as the Yaqan Nuʔkiy community is within the assessment area. We will have conversations with syilx and Secwépemc Nations in the future assessments.

Limitations

The data presented in this report represents the best available data at the HSDA level that we could collect within the scope of the project and capacity of our team. We have attempted to provide a comprehensive assessment based on this data; however, it should be recognized that there are still limitations.

First, climate data are often collected at a broader regional scale, making it difficult to directly correlate climate hazards with local health outcomes. Climate variables such as temperature extremes, air quality and precipitation patterns may vary significantly within a given geographic area, leading to discrepancies in exposure assessments. Without localized meteorological and environmental monitoring stations, the precision of climate models remains limited.

Second, the development of climate and health indicators is in its infancy in terms of research and validation, contributing to limitations in their use for public health planning and action. Few climate and health indicators exist that are routinely collected or monitored with enough data to report on historical trends to compare with the present. Robust indicators require that exposure and health outcome aspects can be linked with plausible associations. Since climate and health impacts are often regionally specific, the usefulness of such data also depends on its geographical granularity: the greater the granularity, the better the data can speak to local impacts while still being useful to local partners and governments that are working on climate change adaptation, planning and response.

Third, privacy regulations prevent the public release of health data in cases where individuals could be identified based on their medical records. This results in the suppression of data on climate-related health impacts, leading to gaps in vulnerability assessments. Without detailed local data, researchers must rely on broad regional trends that may not reflect the unique conditions faced by small rural communities, especially those with small populations. Data suppression also limits our ability to comprehensively assess how climate risks disproportionately impact specific subpopulations.

Fourth, rural residents typically live farther from hospitals and specialized care centres, increasing the risk of delayed medical intervention during climate-related health emergencies. The lack of nearby health-care resources complicates efforts to assess climate-related hospital admissions, as many cases may go undocumented if patients do not seek medical care. Additionally, many climate-related health impacts develop over time, such as the cumulative effects of heat exposure on cardiovascular health, or prolonged exposure to wildfire smoke on lung function. However, the connection of health data to environmental data is often done in short timeframes or only in response to major disasters, making it difficult to assess long-term trends.

Fifth, engagement was limited by time and resource constraints. It was targeted to include partners that were actively working in the climate adaptation space or with work that was being impacted by climate change. Therefore, the engagement data presented in this report does not include a broad representative sample of partners in the KB HSDA but rather shares perspectives of key organizations involved in strengthening adaptive capacity in the region.

Understanding Climate Vulnerability and Resiliency

Defining Dimensions of Vulnerability

As mentioned, for the purpose of this assessment, we are defining vulnerability to the health impacts of climate change as the interactions between climate exposure, sensitivity and adaptive capacity. In this report we cover:

Exposure: The extreme weather events that impact public health and the health system. As described, the extreme weather events discussed include:

- Extreme heat
- Wildfires and smoke
- Flooding
- Cold and winter storms
- Drought

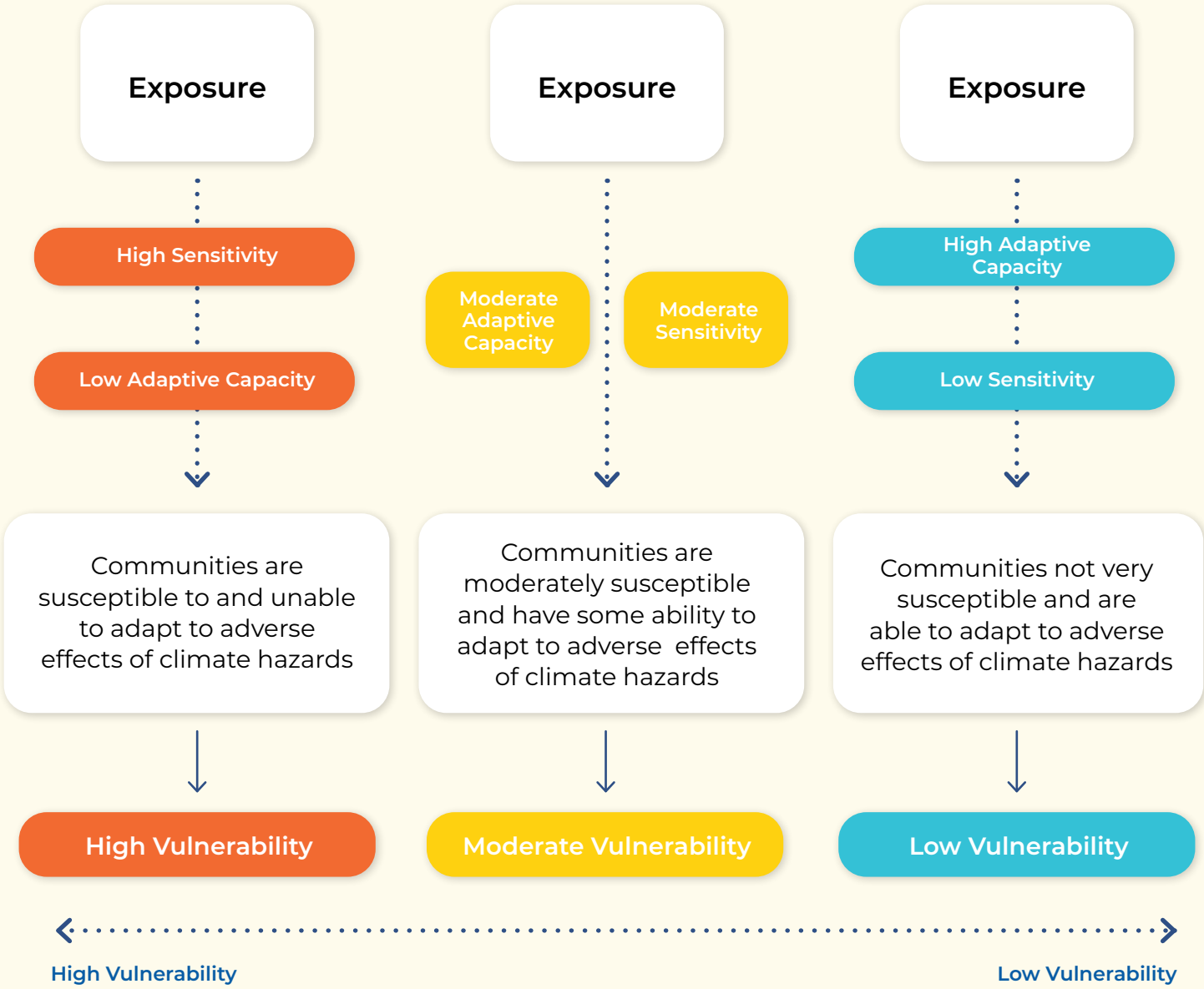
Sensitivity: How physiological, socioeconomic and geographic factors shape the experience of impacts of climate hazards. This section covers:

- **Physiological sensitivity**: The role of the health status of individuals in the experience of risks
- **Socioeconomic sensitivity**: The role of factors like income, occupation and access to health care in influencing climate vulnerability
- **Geographic sensitivity**: The role of location (i.e., living in wildfire-prone regions, flood plains, etc.) in determining exposure to climate hazards

Adaptive capacity: The ability of individuals, communities and institutions to adjust to climate-related health risks. This section explores the strengths and opportunities to build adaptive capacity across the KB HSDA. It also sheds light on existing community assets and ongoing adaptation actions.

Summarized simply, when exposed to climate hazards, communities where sensitivity is high and adaptive capacity is low will generally be more vulnerable to climate and health impacts whereas communities that have low sensitivity and high adaptive capacity will be less vulnerable to climate and health impacts. Figure 1 illustrates this concept of a continuum of vulnerability based on the relationship between exposure, sensitivity and adaptive capacity. As detailed in this assessment, many communities in the KB HDSA are highly to moderately vulnerable but there are opportunities to strengthen adaptive capacity to lower vulnerability.

Figure 1: Defining Vulnerability

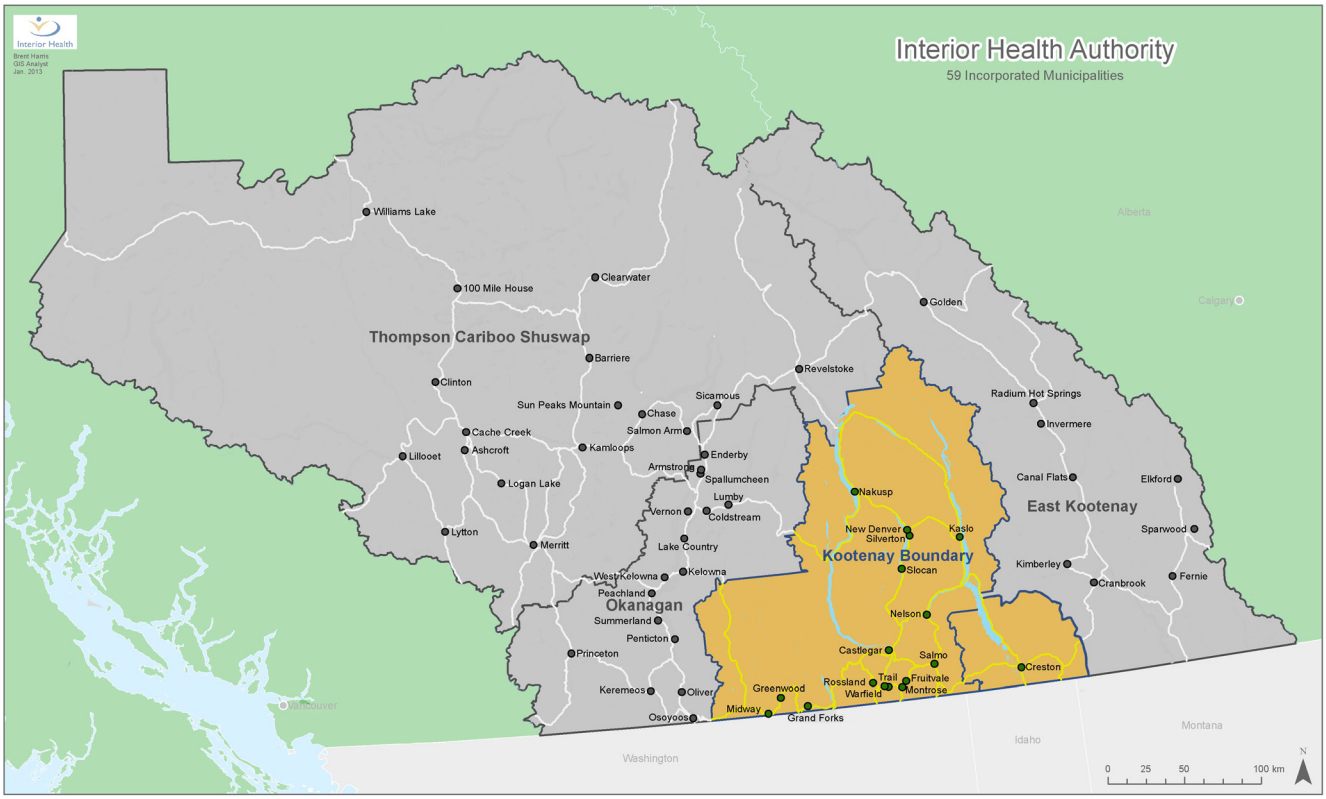


Introduction to Kootenay Boundary Health Service Delivery Area

It is important to recognize that the KB HSDA is a colonial boundary for health service distribution. The area we are assessing includes the traditional and unceded territory of the Ktunaxa, Sinixt, syilx, and Secwépemc people, who have been and continue to be the traditional stewards of these lands, air, waters, and their inhabitants. The area is also the chosen home to three Métis Chartered Communities: Nelson and Area Métis Society, Kootenay South Métis Association, and the Boundary Métis Community Association. For more information, refer to the map of First Nations & Métis Chartered Communities in Interior Health.

The KB HSDA covers two regional districts, 17[i] municipalities and 16 electoral areas:

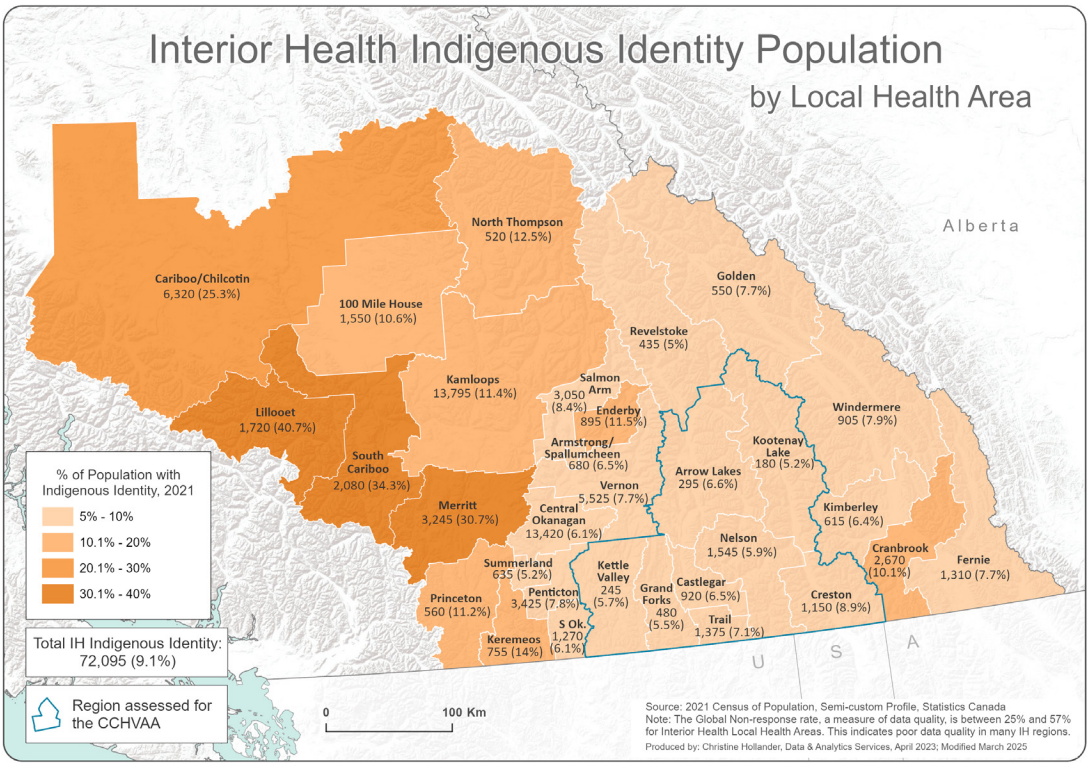
- **Regional District of Central Kootenay (RDCK)**:[11] Nine municipalities, 11 electoral areas
- **Regional District of Kootenay Boundary (RDKB)**:[12] Eight municipalities, five electoral areas



i The Creston Local Health Area is part of the East Kootenay HSDA, but for the purposes of this assessment, Creston will be included within the Kootenay Boundary assessment area because Creston is part of the RDCK and coordinates work with partners in the RDCK and RDKB areas.

Some notable population, health and economic trends within the KB HSDA[14]:

- **Greatest population growth by age group:** The proportion of the population aged 75+ is expected to grow by 36% between 2021 and 2026.
- **Health characteristics:** Compared to provincial rates, the KB HSDA has higher rates of mental health disorders and chronic diseases such as COPD, which are related to climate change and health impacts.
- **Indigenous identity:** A smaller proportion of the KB population identify as Indigenous than in the other IH HSDAs. However, upholding Indigenous Rights and incorporating Indigenous knowledge, perspectives and lived experience are integral to the proposed work, and critical to solving the climate crisis.
- **Employment and income distribution:** The Kootenay Development Region[i] has an employment rate of approximately 57% compared to a rate of 62% in B.C. The majority of people are employed in the service producing sector. In 2021, the percentage of low-income persons exceeded the provincial rate of 15.2% in nine municipalities in the KB HSDA: Slocan (33.8%), Greenwood (26.7%), Silverton (22.7%), New Denver (20.8%), Salmo (19.4%), Kaslo (18.7%), Midway (17.6%), Creston (16.9%) and Nelson (15.5%). More information about the Report from Selkirk College and income in the KB HSDA can be found in the State of the Basin Report from Selkirk College.



i Information about the economy in the KB HSDA comes from Statistics Canada's Labour Force Survey. In this survey, the KB HSDA is included as part of the Kootenay Development Region which also includes the Regional District of the East Kootenay

Population Density (2021)

Population	84,117
Area (Sq. Km)	28,862
Pop. Density per Sq. Km	3

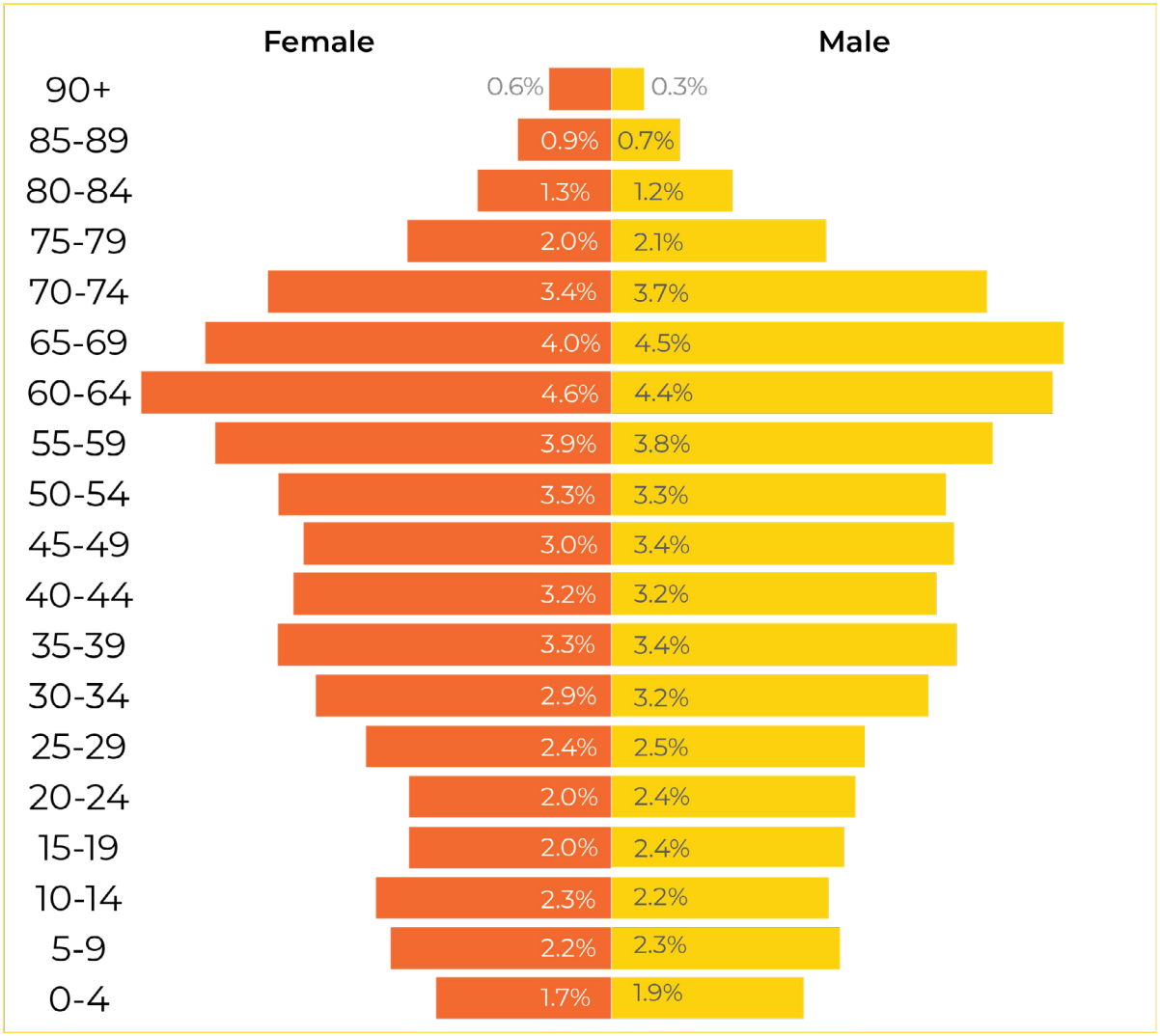
Population density represents the number of people living within one square km. Lower densities indicate more rural areas which typically have lesser access to health services, while those living in urbanized areas with higher population densities typically have greater access to health services.

Rejected Population Growth (2021-2026)

All Ages	2.8%
65+	17%
75+	36%
85+	19%

Population growth rates project the change in size of each age group over the next five years. These projections reflect a forecasting model that accounts for the trends in migration, employment, and past population change.

Population Pyramid, 2021



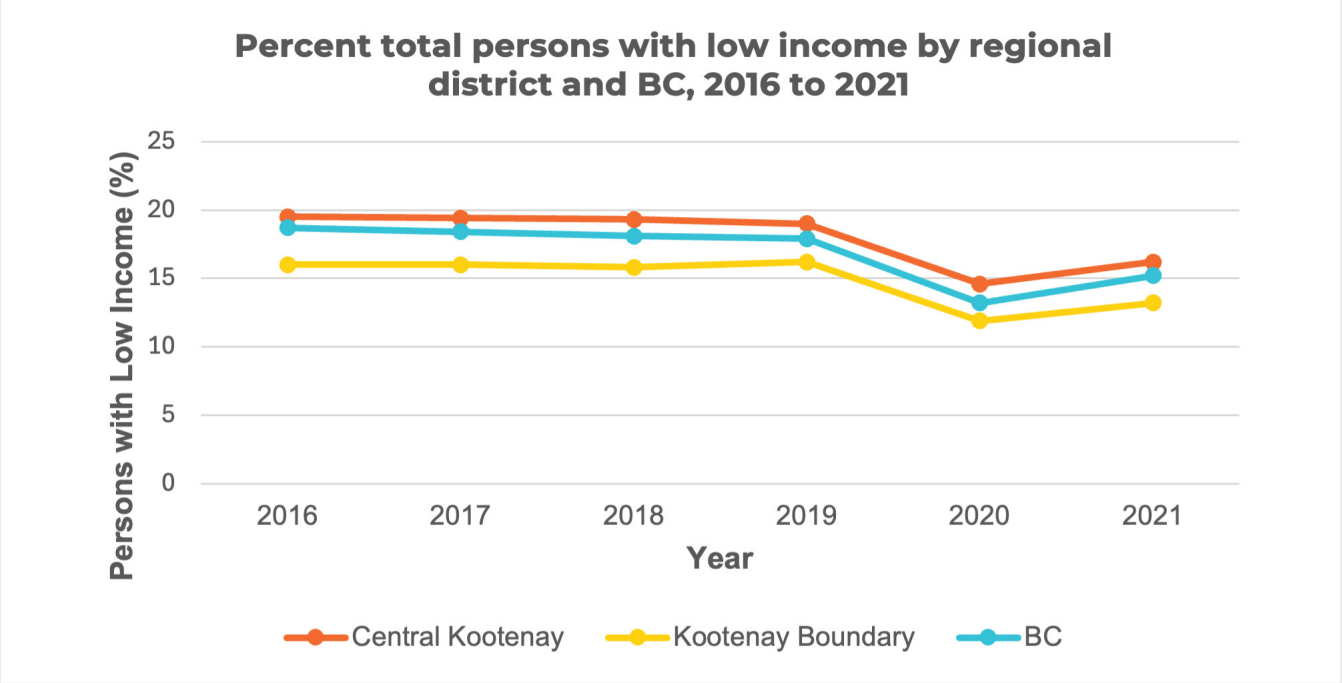
A population pyramid with a wide base indicates a younger population, while a top heavy pyramid indicates an aging population with a longer life expectancy.

Adapted from Interior Health website.

In 2024, the main sectors employing people in the region include:

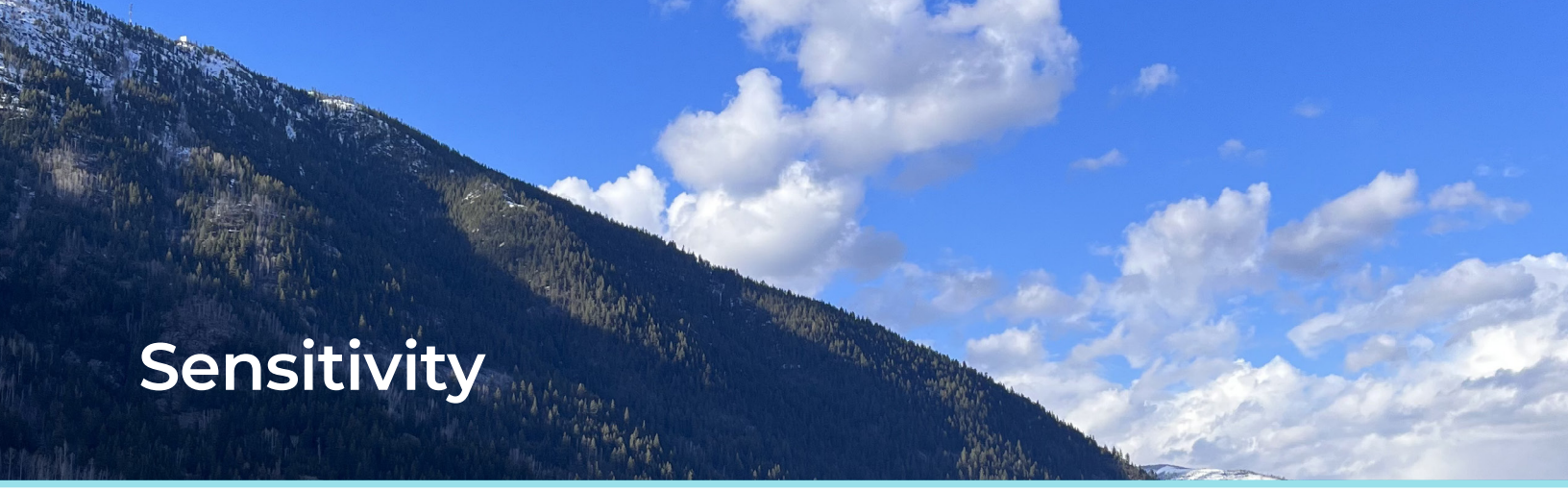
Industry	% of Population Employed
Service producing sector. Primarily associated with the production of services (e.g., sale of goods, provision of personal services); however, these sectors may also produce some goods (e.g., baked goods).	72.3%
Goods producing sector. Primarily associated with the production of goods (e.g., growing of crops, generation of electricity, the manufacturing of computers); however, these sectors may also produce some services (e.g., forest conservation, printing, wood treatment, machine shop services).	27.8%
Wholesale and retail trade	17.1%
Health care and social assistance	15.2%
Foresty, fishing, mining, quarrying and oil and gas	9.9%

Source: Statistics Canada. Table 14-10-0392-0. Employment by industry, annual, inactive (x 1,000).



Source: Statistics Canada. After-tax income status of tax filers and dependents based on Census Family Low-Income Measure. Community Data Program

The following sections provide a framework for understanding vulnerability by examining three interconnected components—sensitivity, exposure and adaptive capacity—and explaining how these factors shape climate-related health risks. The chapters that follow offer insights into the specific ways that climate hazards affect different population groups, the multi-layered threats posed by climate extremes, and approaches to enhance resilience.



Sensitivity

Key findings

Across the KB HSDA, every community experiences a significant degree of sensitivity to climate change resulting from their economic, social and geographic realities—though the specific reasons for and extent of these challenges can vary from one locale to the next.

Sensitivity

The degree to which a system is affected by climate change.

Physiological sensitivities. Describes the ways climate change places stress on people's bodies, affecting things like body temperature control, breathing, metabolism and mental health.

- As temperatures rise, environmental conditions will increasingly challenge the human body's ability to regulate temperature.[71,72]
- Extreme weather events like wildfires, heatwaves, flooding and droughts can make the air more polluted, which can strain people's respiratory systems.[73,74]
- Climate extremes can disrupt local ecosystems, agricultural production and supply chains, affecting dietary intake and metabolic health.[75,76]
- Chronic stress and anxiety triggered by uncertain weather patterns can lead to long-term elevations in cortisol and other stress hormones.[77]

Socio-economic sensitivities. Refers to how underlying social and economic conditions—such as income, housing stability and social networks—can influence how people experience and cope with the impacts of climate change.

- When extreme weather events happen, it can hurt the economy, making it harder for workers, businesses and local governments to cope, adjust and recover.
- People already living on tight budgets can see their living conditions deteriorate further without the financial means to improve them, compounding the cycle of stress and anxiety.

- Essential civic resources—libraries, community centres, after-school programs—must often compete with urgent demands like fixing bridges or reinforcing water treatment systems. This loss can erode the social connection that protects the health of communities.
- Health-care facilities in the KB HSDA are also highly sensitive to climate stressors, increasing the risk faced by residents.

Geographic sensitivities. Refers to how the physical characteristics and location of a place—such as its elevation, proximity to bodies of water, or natural hazard zones—can shape the impacts of climate change.

- The KB HSDA's mountainous terrain and varied elevations play a central role in its geographic sensitivity to climate impacts.
- The region also features larger populated communities, small towns and outlying settlements, each with distinct microclimates and often separated by challenging terrain that limits connectivity and access to services, especially during emergencies.
- The disruption in ecological balance driven by climate change reverberates throughout Indigenous communities, contributing to a sense of grief and loss that can erode mental and emotional well-being.

People living in the KB HSDA show different degrees of sensitivity depending on factors such as age, occupation, underlying health conditions, etc. This section will explore three dimensions of sensitivity: physiological, socioeconomic and geographic.

Physiological sensitivity explores the ways in which people living in the region with different health status experience the risk of changing climate conditions and resulting extreme weather events. As described, the region has a growing population of older adults and higher rates of mental health disorders and chronic diseases such as COPD: these factors often heighten the risk of negative health impacts from extreme weather events.

The socio-economic sensitivities in the KB HSDA reflect the intricate ties between the impacts of climate change and the economic stability and social life of communities across the region. The region's economy largely depends on resource-intensive sectors such as forestry, agriculture and tourism. As climate change impacts these sectors—whether through disrupted workflows, rising costs, or damage to infrastructure—the socio-economic fabric of the community is impacted, leading to physical and mental health strains for people who rely on these industries.

Geographically, the KB HSDA's varied terrain—rural mountain valleys, steep slopes and dense forests—adds an additional layer of sensitivity to climate change. The region is increasingly exposed to extreme weather events such as flooding, landslides and wildfires, which are becoming more frequent and destructive due to climate change.

These geographic factors not only increase the likelihood of infrastructure disasters but also hinder the accessibility of critical resources such as health-care and emergency services for remote communities.

The following section delves deeper into the specific ways these physiological, socio-economic and geographic sensitivities expose people of the KB HSDA to heightened health risks in an era of climate change.

Physiological Sensitivities to Climate Impacts

In the KB HSDA, extreme weather events driven by climate change are putting stress on people's bodies, affecting things like body temperature control, breathing, metabolism and mental health. Factors like age, job type, cultural background and income level also play a role in how people experience and cope with these challenges. In the following section, we explore how people's health can be impacted by extreme weather.

Regulating Body Temperature

As temperatures rise, environmental conditions will increasingly challenge the human body's ability to regulate heat.[71,72] In hot conditions, the body cools itself through sweating and increasing blood flow to the skin, while in cold conditions, it conserves heat by constricting blood vessels and initiating shivering. Heat waves and extreme cold place significant strain on the body's ability to regulate internal temperature. The body's cooling and heat conservation mechanisms can be limited by individual factors like chronic illness

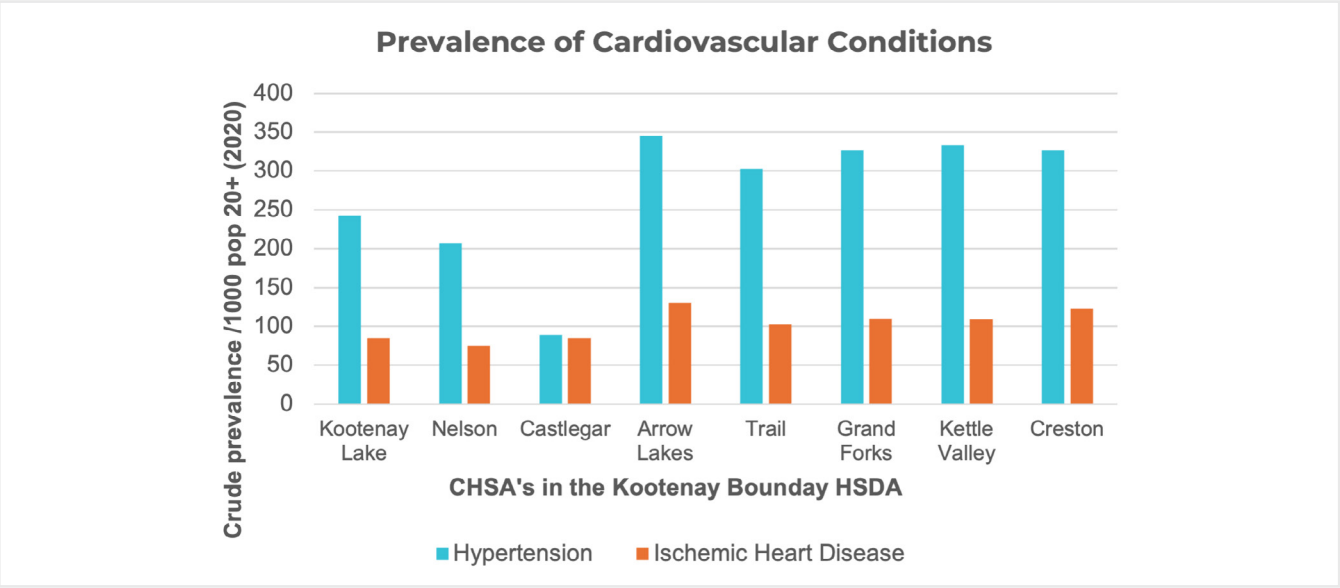
or the use of certain medications. Floods and storms may not directly raise temperatures, but they can create situations where power outages disrupt air conditioning, fans or heaters, leaving people without cooling and/or heating options.

Participants in our engagement sessions highlighted that those with substance use disorders are particularly susceptible to extreme heat since using substances may impact a person's ability to hydrate, seek shelter from heat, etc., leading to heat-related harms.

- **Children and Older Adults:** As people age, their bodies don't cool down as easily because they sweat less, and their hearts don't adjust as quickly to heat.[63,64] Older adults are also more sensitive to cold.[65] Additionally, older adults who live far from hospitals may have trouble getting medical help in time for heat or cold-related illnesses or heart problems. Young children's bodies aren't fully developed to handle extreme heat or extreme cold, making them more likely to get dehydrated or develop heat rash. or in the case of extreme cold increases the risk of pediatric pneumonia.[59] If a flood or storm causes power outages, they may also lose access to air conditioning or heaters, making the risks even higher.
- **Individuals with chronic conditions:** Chronic health conditions that affect circulation, nerve function or metabolism, as well as medications that interfere with the body's natural processes like sweating or blood flow, can make individuals more vulnerable to extreme heat or cold. For example, conditions like heart disease, hypertension or stroke can impair blood flow and circulation, making it harder for the body to adjust to temperature changes.[78] While certain medications (e.g., anticholinergics) can impair sweating.[79] During the 2021 heat dome, people with schizophrenia, kidney disease and heart disease were at higher risk of dying.[80]

Figure 2 shows the prevalence of cardiovascular conditions (hypertension and ischemic heart disease) in Community Health Service Areas (CHSA) across the region. The prevalence of hypertension in 2020/21 ranged from 89 per 1,000 population (age 20+) in Castlegar to exceeding 300 per 1,000 population (age 20+) in other communities such as Trail and Grand Forks, etc.). This variation points to uneven levels of physiological sensitivity to climate-related stressors like heat waves and cold snaps that disproportionately impact individuals living with cardiovascular conditions. In communities where a larger portion of the population is already managing cardiovascular issues, the impacts of extreme weather events could be more severe.

Figure 2: Prevalence of hypertension & ischemic heart disease in CHSAs across the KB HSDA



- **Outdoor workers:** Working hard in extreme heat makes it difficult for the body to stay cool. Storms can disrupt work schedules, forcing people to return to heavy labour in hot, damp conditions. This repeated strain can cause long-term exhaustion and make it harder for the body to handle future heat.
- **People who are pregnant.** The body changes associated with pregnancy, like increased hormonal sensitivity and changes in circulation and blood volume, can reduce a pregnant person's ability to regulate body temperature, increase their risk of dehydration and intensify stress on the cardiovascular system.[81]

Respiratory Strain

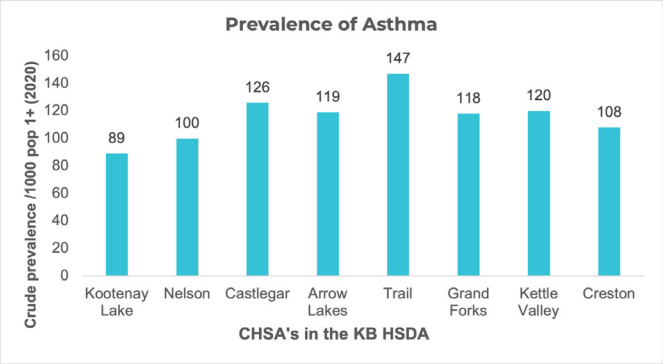
Extreme weather events like wildfires, heatwaves, flooding and droughts can make the air more polluted, which can strain people's respiratory systems.[73,74] Wildfire smoke, which contains tiny particles called PM2.5, can make asthma, COPD and other breathing problems worse.[82]

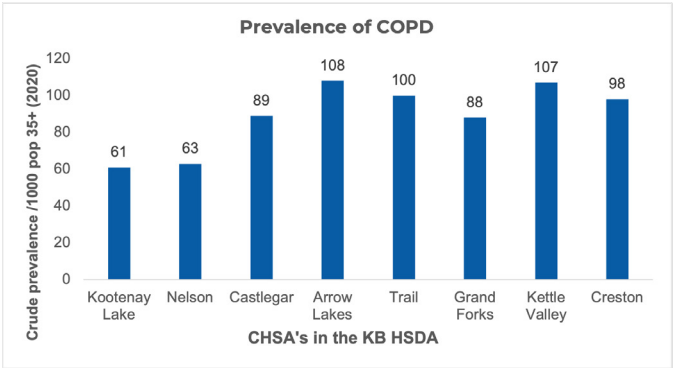
Flooding adds another danger, when homes get damp or flooded, mold can grow. Breathing in mold spores can irritate the lungs and make existing health problems even worse.[83] Residents of rural locations may experience compounded risks as they may also struggle with accessing health care.

Participants in our engagement sessions highlighted the worsening of respiratory issues caused by poor air quality from wildfire smoke, such as sore throats, exacerbation of asthma and COPD, as well as the mental and physical toll of extreme heat. Prolonged heat waves affect sleep quality and overall well-being, leading to fatigue and heat exhaustion. These health impacts are not only immediate but have long-term consequences on physical health and quality of life.

- **People with chronic conditions:** COPD and asthma can worsen when exposed to both smoke particles during wildfires and mold spores in the aftermath of flooding events, leading to frequent hospital visits. Figure 2 shows the prevalence of respiratory conditions (asthma and COPD) in CHSAs across the KB HSDA. The prevalence of asthma in 2020/21 ranged from 89 per 1,000 population (age 1+) in the Kootenay Lake to 147 per 1,000 population (age 1+) in Trail. For COPD, it ranged from 61 per 1,000 population (age 35+) in Kootenay Lake to 108 per 1,000 population (age 35+) in Arrow Lakes in the same period. These differences highlight the fact that the risks tied to extreme weather events are not uniform across the KB HSDA; certain CHSAs have a higher share of residents whose existing respiratory conditions could make them more sensitive to the effects of environmental stressors.

Figure 3: Prevalence of asthma and COPD in CHSAs across the KB HSDA





- **Children and adolescents:** Children breathe in more air relative to their body size, so they take in more polluted air and mold spores.[84] Babies are even more at risk because their airways are smaller, and their immune systems aren't fully developed.[84] Breathing in wildfire smoke or mold over and over, especially in homes with poor air circulation, can hurt lung growth, cause allergies, and make them more likely to get lung infections.[84]
- **Outdoor workers:** Wildfire smoke and post-flood mold can be especially harmful for individuals who spend extended periods outside or in damp, structurally compromised buildings. Consistent exposure to irritants can raise the risk of chronic issues like bronchitis.[85]

Metabolic and Nutritional Disruptions

Climate extremes can disrupt local ecosystems, agricultural production and supply chains, affecting dietary intake and metabolic health.[75,76] High temperatures, severe storms or flooding events can damage crops, limit the availability of fresh produce and compromise fisheries.[75,76] An unbalanced diet—with fewer nutrient-rich foods and more reliance on processed alternatives—raises the risk chronic diseases such as diabetes, and cardiovascular disease. Wildfires, extreme heat, droughts or floods can impact food production by leading to the loss of farmland or crops failure, which hurts local businesses and makes fresh produce harder to find. This affects people with health problems like diabetes or high blood pressure the most. When food becomes scarce or expensive, families who already experience food insecurity are disproportionally impacted and can lead to poor blood sugar control, and other health issues.

- **Indigenous Communities:** Traditional diets often rely on fish, wild game and foraged plants. Fish populations may be stressed by extreme water temperatures, while flooding can shift habitats or contaminate water sources. This disrupts cultural food practices and forces greater reliance on store-bought, potentially less nutritious foods.[86]

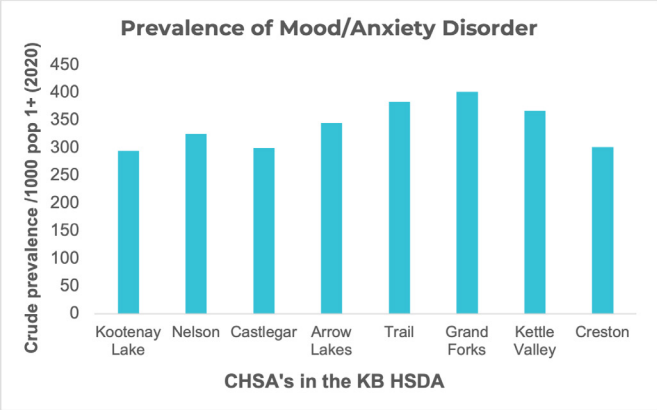
> *"Climate change is affecting our hunters. Not just hunters but our providers for our families as well. When we harvest our berries, I know that the berry count was very low this year and a lot of the animals are not coming around as much as they used to due to being pushed out by wildfires."* *Interview – Indigenous partner*

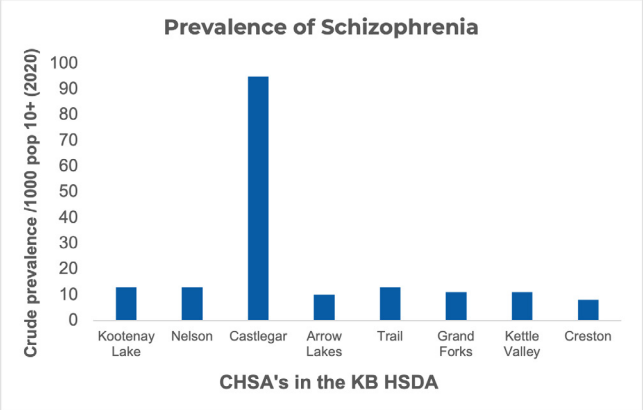
Mental Health and Physiological Stress

Chronic stress and anxiety triggered by uncertain weather patterns—extreme heat, wildfire risks or flood threats—can lead to long-term elevations in cortisol and other stress hormones.[77] Over time, elevated cortisol levels contribute to high blood pressure, weakened immune responses and poor sleep quality, creating a feedback loop between mental and physical health.

Preexisting mental health conditions—for example, dealing with chronic anxiety or depression— can impact how the body and mind respond to the additional stresses imposed by extreme weather events. Figure 4 shows how the prevalence of mood/anxiety disorders and schizophrenia varies across the CHSAs in the KB HSDA for adults aged 40 and older. The prevalence of mood/anxiety disorders in 2020/21, for instance, ranged from close to 300 per 1,000 population (age 1+) in a few CHSAs and up to 400 per 1,000 population (age 1+) in others. Schizophrenia (expressed as the per 1,000 population age 10+) is much less common overall, but there is still notable variation from community to community. In areas where more residents are affected by these diagnoses, there may be a larger share of individuals whose preexisting mental health circumstances could increase their sensitivity to the impacts of climate-related extreme weather events.

Figure 4: Prevalence of mood/anxiety disorders and schizophrenia in CHSAs across the KB HSDA





Concerns about managing extreme cold, heat waves or flood damage while living alone can also intensify feelings of isolation and anxiety. This mental strain often coincides with physical vulnerabilities especially for older adults, exacerbating chronic illnesses or weakening immune systems. Unpredictable work interruptions due to extreme weather advisories can breed financial uncertainty, compounding stress. Residents of rural locations may have limited access to mental health support and wellness services, compounding their risk of negative outcomes.

For Indigenous communities, spiritual and cultural connections to the land amplify the psychological and physiological impact of environmental degradation.[87] Disruptions to traditional practices—whether from wildfire destruction of sacred areas or flood damage to ceremonial sites—create layers of grief and stress that can manifest in both emotional and physical ailments.

For many Ktunaxa Nation communities, cultural practices like hunting, gathering, participating in ceremonies and revitalization of language provide a sense of purpose and grounding. When these practices are disrupted, it can lead to increased vulnerability, particularly for those already struggling with addiction and isolation. The inability to access cultural healing practices further exacerbates these issues, underscoring the critical link between culture, mental health and community resilience.

"Youth are facing growing uncertainty about the state of their environments and the state of the planet as they get older. Many youths have reported feeling 'the burden of solving the climate crisis.'" *Interview – Indigenous partner*

Socio-economic Sensitivities to Climate Impacts

The reality of climate change is increasingly placing a strain on underlying social and economic conditions—such as income, housing stability and social networks—in the KB HSDA. Socio- economic sensitivity refers to how these factors influence how people experience and cope with the impacts of climate change. Communities or groups that

already face disadvantages (e.g., low incomes, limited access to resources) tend to be more vulnerable to climate-related events, as they have fewer buffers against disruptions like heatwaves, floods or poor air quality. This section explores how these realities play out in the region.

Fluctuating Livelihoods and Income Instability

The economy in the KB HSDA is heavily affected by climate change because many jobs depend on land and resource-based industries like forestry, farming, mining and tourism. When extreme weather events such as wildfires happen, they can hurt these industries, making it harder for workers, businesses and local governments to cope, adjust and recover.

Shifts in precipitation patterns, increasing temperatures, and the frequency of extreme weather events disrupt agricultural operations.[88,89] Droughts reduce water availability for irrigation, while heat stress impacts crop yields and livestock productivity. These challenges are particularly pronounced for small-scale farmers with limited financial and technological resources to implement adaptive practices such as efficient irrigation systems or drought-resistant crop varieties.

These extreme weather events, along with pest outbreaks, pose significant risks to the forestry sector. Wildfires not only destroy timber but also disrupt supply chains and increase operational costs for companies. Prolonged periods of high temperatures further weaken forest health, making trees more susceptible to pests like the mountain pine beetle, which has historically caused extensive damage across the interior.[90,91]

Seasonal tourism, which contributes significantly to the region's economy, is sensitive to changing weather patterns. Unseasonable temperatures, wildfire smoke and flooding events deter visitors, leading to lost revenue for businesses that depend on outdoor recreational activities, such as hiking, skiing and fishing. For example, poor air quality during wildfire seasons can lead to reduced bookings in accommodations and cancellations of outdoor events.

> *"We have a resort and casino, we have hot springs, we have campsites, and all of these other places that are being disrupted by wildfires. People aren't coming down if they know there's a wildfire. This impedes us from bringing in tourism dollars which contributes to traditional knowledge and language revitalization efforts."* *Interview – Indigenous partner*

As these sectors become more volatile in response to environmental shifts, residents are exposed to recurrent bouts of employment insecurity. For example, a tourist-focused lodge could see mass cancellations during a smoky summer. These economic shifts mean that more people may have difficulty meeting their financial responsibilities. According to the 2023 BC SPEAK[i] survey, 55.9% from the KB HSDA said it has been somewhat or much more

[i] Data for the BC SPEAK survey were collected directly from participants via a self-administered online questionnaire. Given the SPEAK survey consists of individuals who self-selected and volunteered to participate, there may be sampling errors due to selection bias. In round three, the survey questions transitioned from focusing on the impact of the COVID-19 pandemic to capture more information about respondents' general health status and health-related behaviours.

difficult for them and their household to meet financial needs compared to one year ago.[92] The uncertainty of not knowing when the next pay cheque will arrive can induce prolonged anxiety, sleep disturbances and mood fluctuations. This ongoing tension can, over time, elevate blood pressure and weaken immune responses. Additionally, these abrupt closures or reduced hours can quickly ripple through households, forcing families to:

- **Delay or forgo preventive care.** People who live farther from medical services may have a harder time getting the care they need. Especially if it means taking time off work and paying for childcare or needing someone to go with you if you can't drive or travel alone. Because of these challenges, some people skip checkups or delay important tests, which can make chronic health conditions worse over time.[93-95]
- **Adjust spending on food and well-being.** When pay becomes inconsistent, alongside rising energy cost (i.e., spending more on cooling in the summer), households may switch to cheaper, calorie-dense foods, exacerbating diet-related health issues (e.g., vitamin deficiencies).[96] Additionally, extracurricular activities—like a child's sports league or an adult's gym membership—often get cut, diminishing opportunities for stress relief and social support.

Climate Impacts in the News

Clearing the Air: Climate and your pocketbook - Arrow Lakes News

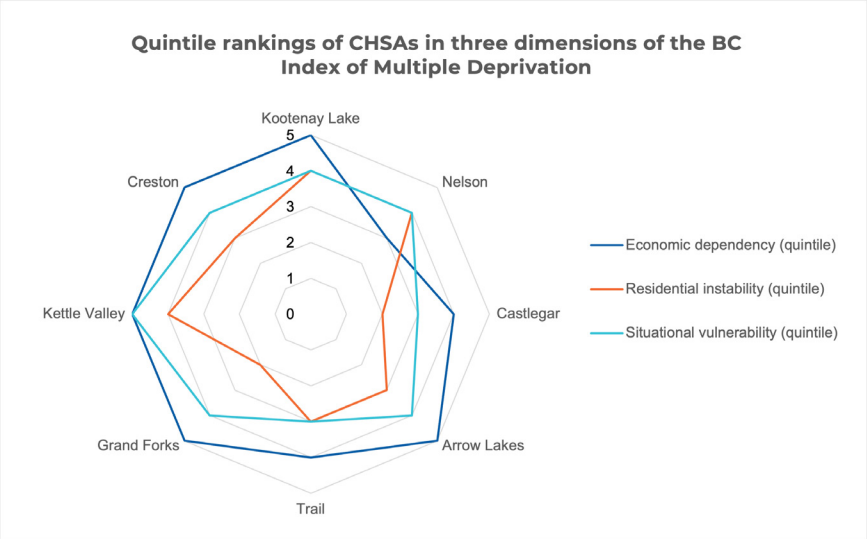
The cost of living here in the Kootenays is skyrocketing, as it is everywhere. The price of common goods has gone up and will keep doing so. While many factors contribute, extreme weather events brought on by climate change have made this much worse.

Photograph by Chris Kolmel

Many local enterprises are family-owned and rely on robust seasonal flows—farm stands selling fresh produce, outdoor guides taking tourists on guided trips, or art shops showcasing regional crafts. When droughts reduce agricultural yields, heat or poor air quality keep people inside, or floods and/or fires prompt road closures, foot traffic and sales plummet, leaving owners with accumulating debts and limited safety nets. Under this strain, they may:

- **Scale back employee benefits.** Health insurance subsidies, retirement contributions or paid sick leave could be curtailed to manage overhead costs, creating a domino effect for workers who then avoid visiting a doctor or taking mental health days.
- **Postpone essential upgrades.** The funds needed to improve ventilation systems or prevent mold infestation in business premises may be diverted to basic survival expenses, inadvertently exposing workers and customers to unhealthy conditions over time.

Figure 5: Quintile rankings of two dimensions of the BC Index of Multiple Deprivation for all CHSAs in KB. Higher scores indicate greater deprivation, and lower scores indicate lower deprivation[97]



Note: The indicators included in these descriptions are based on the 2016 census data and the dimensions are described as follows. **Economic dependency:** *Proportion of population participating in labor force (aged 15 and older), the proportion of population aged 65 and older, the ratio of employment to population, and the dependency ratio (population aged 0–14 and aged 65 and older divided by population aged 15–64).[97]* **Residential instability:** *Proportion of dwellings that are apartment buildings, the proportion of persons living alone, the proportion of dwellings that are owned, and the proportion of the population who moved within the past five years.[97]*

Situational vulnerability: *Proportion of population that identifies as Indigenous, the proportion of population aged 25–64 without a high school diploma, the proportion of dwellings needing major repairs, the proportion of population that is low-income, and the proportion of single-parent families.[97] **While the situational vulnerability dimension includes a proportion of Indigenous residents, it is important to note that Indigenous identity in itself does not translate into deprivation: rather, the historical, intergenerational and ongoing impacts of colonization and systemic racism play a pivotal role in driving deprivation in Indigenous communities.*

The radar chart in Figure 5 shows each CHSAs rankings (from lowest deprivation at quintile 1 to highest at quintile 5) in three dimensions: economic dependency (blue), residential instability (orange), and situational vulnerability (green). Each dimension's scale extends outward from the centre, so a point closer to the outer edge of the chart indicates a higher quintile (and thus higher deprivation) for that dimension. When you look at the chart, you will notice that no single CHSA has the exact same shape on the three coloured axes. Some areas stand out for being higher (4 or 5) on economic dependency but lower (1 or 2) on residential instability. In other cases, a CHSA shows consistently higher quintiles on two, or even all three, measures, suggesting a broader set of challenges. This variability highlights that deprivation in one dimension (for example, a local economy dependent on government transfers) does not necessarily coincide with deprivation in another (like frequent population turnover).

Because these three dimensions capture different aspects of community well-being, financial security, housing stability and demographic composition, each CHSA ends up with a unique vulnerability profile. In the context of climate change, these different profiles matter because each dimension can affect how populations respond to environmental stressors. A CHSA ranking high in economic dependency can indicate fewer financial buffers when disruptions occur. By observing how the rankings vary across the region, we can see that certain communities may have multiple layers of deprivation that could heighten their sensitivity to climate-related impacts, while others appear less affected in one dimension but moreso in another.

Transportation Networks and Public Utilities

Highways and rural roads in the KB HSDA often traverse steep terrain near rivers or through forests. Extreme weather events, such as flooding, wildfires and landslides, disrupt transportation routes, delaying the movement of goods and increasing costs for businesses reliant on supply chains. Rural areas with limited connectivity are particularly vulnerable, as disruptions can isolate communities and hinder economic recovery efforts.

> *Participants in our engagement sessions pointed out that some rural and remote communities with limited internet access often have a harder time staying informed about available government aid, shelter spaces and other community supports. This lack of access can leave rural residents unprepared for climate events, further increasing their vulnerability to these events.*

When this isolation persists, friends and neighbours may be unable to meet in person, amplifying feelings of loneliness—particularly for older adults or those living alone. Heightened isolation can exacerbate mental health challenges like depression or anxiety disorders.

> *"We're seeing a reduction of social connections due to reduced opportunities to connect outdoors in free spaces, reduced opportunity for intergenerational connections due to increased health risks for the young and the elderly."*
> *Workshop – Local government participant*

Additionally, the region's energy infrastructure, including hydroelectric facilities, is influenced by changing water flows due to altered precipitation patterns and glacial melt. Reduced water availability during drought periods impacts hydroelectric generation, increasing energy costs and reducing reliability for industries dependent on consistent power. Municipal water systems and irrigation networks can also be strained during prolonged droughts. Aging infrastructure, combined with insufficient investment in climate-resilient upgrades, exacerbate the economic impact of water scarcity on industries like agriculture and manufacturing.

Strains on Public Services Budgets

Local governments including those with relatively small tax bases, bear the brunt of repairing damaged infrastructure. The reliance on provincial or federal funding creates challenges in addressing infrastructure vulnerabilities and providing adequate support to residents. Essential civic resources—libraries, community centres, after-school programs—must often compete with urgent demands like fixing bridges or reinforcing water treatment systems. As a result:

- **Fewer community hubs.** Without inviting spaces where residents can gather, cultural events or health-promotion activities (like fitness classes, support groups or seniors' socials) may dwindle. Losing these focal points weakens social bonds that ordinarily buffer against stress.

- **Uneven recovery and growing inequalities.** Political will or lobbying efforts might direct road or utility repairs to economically influential areas first, leaving remote or lower-income neighbourhoods with substandard services. Such disparities can lead to feelings of neglect and diminish trust in local leadership, which in turn can exacerbate anxiety and frustration for residents.

> *"We're in a deficit-based position right now. The bigger city centres receive most of the help because they bring in the most revenue to the province (Lower Mainland and Okanagan). The Kootenays is always an afterthought, they act like we don't exist down here."* *Interview – Indigenous partner*

> *"We are being impacted by financial impacts across the board: heightened insurance costs, utility bills, design of homes through to operating them. It's just a massive additional financial pressure to exist in a particularly warmer world during the summer when you're on A/C all the time. And then kind of a double hit, at least in [municipality in the KB HSDA], if you're trying to use water. The cost of water is scaled towards pay to play where the more you use, the more you pay. Getting hit from every angle from how you build to how you operate it.*
>
> *And then on the City side, that's compounded by this lack of climate resilient infrastructure. [This] results in significant additional costs as we replace what we have, which translates to higher taxes. Kind of getting hit by all angles on the financial side."* *Workshop – Local government participant*

Access to Health Care

Health-care facilities in the KB HSDA are also highly sensitive to climate stressors, increasing the risk faced by residents. Facilities operating on limited schedules may be unavailable during sudden emergencies—especially after hours—forcing those in need to travel farther or wait for care. This delay can be critical when dealing with acute conditions like respiratory distress or injuries sustained during a flood or wildfire.

Moreover, the remoteness of some communities further restricts the window of opportunity for timely intervention: if an extreme weather event washes out rural roads or bridges, patients may have no safe or direct way to reach the next-closest facility. Even facilities in comparatively well-connected communities can become inaccessible when snowstorms, landslides or wildfire disrupt site access, preventing staff from arriving to provide care and hindering patients from accessing services.

Finally, because certain hospitals or multi-service clinics hold higher criticality[i]—often serving large catchment areas—their closure or evacuation during a severe event leaves entire populations without local backup. In this way, the sensitivity of health-care infrastructure directly translates into increased risk for community members, compounding the danger of climate-related disasters and creating scenarios where even treatable conditions can escalate.[98] Individuals may ignore minor ailments causing them to worsen, or delay filling routine prescriptions,[99,100] due to the logistical hurdles and extra costs of travelling greater distances for care.

Results from the 2023 BC SPEAK[ii] survey show that in KB HSDA, 45% of respondents said they have had trouble accessing health care from a doctor, nurse, traditional health-care provider or other health professional when they needed it in the past 12 months. Furthermore, among those who have had difficulty accessing health care, 61.4% said that difficulty accessing the care they needed has significantly or somewhat worsened their health in the past 12 months.[92]

Cultural and Spiritual Importance

The KB HSDA is home to First Nations communities who have deep-rooted ties to the local environment. These ties go beyond economic reliance; they reflect cultural practices, familial heritage and personal identity. As climate-related changes disrupt water levels, shift wildlife patterns or damage traditional food sources, these communities experience a deep sense of loss connected to:

- **Loss of ceremonial and communal routines.** Gathering medicines, fishing or holding seasonal gatherings in specific areas may become difficult or impossible. The resulting sense of disconnection can erode morale and sever the generational transfer of knowledge, contributing to stress, grief and existential worry about cultural survival.

[i] Criticality: The criticality classification of a building used as a measure of importance to the provision of services during a disaster.

[ii] Data for the BC SPEAK survey were collected directly from participants via a self-administered online questionnaire. Given the SPEAK survey consists of individuals who self-selected and volunteered to participate, there may be sampling errors due to selection bias. In round three, the survey questions transitioned from focusing on the impact of the COVID-19 pandemic to capture more information about respondents' general health status and health-related behaviours.

Our conversations during our engagement sessions underscored this experience. Climate change is severely affecting the ability of Ktunaxa Nation communities to practice their cultural and spiritual traditions. The increased frequency of wildfires, floods and extreme weather events is limiting access to land for activities like hunting, gathering of traditional medicines and other cultural ceremonies. This disruption not only impacts the physical ability to connect with the land but also impedes spiritual practices, such as sweat lodge ceremonies and sacred fires, which are essential to mental health and community well-being.

With drier summers, there are often restrictions like fire bans in place that prevent the use of fire in ceremonies and further limit the ability to carry out these practices. The result is a loss of connection to culture and identity, which undermines the sense of purpose and community cohesion that these practices provide. This is having a compounding effect during a time when many community members are suffering from addiction and could benefit from the cultural practices.

People often choose to live in this region because of access to outdoor recreation and opportunities to be more connected to their natural environment, viewing themselves as stewards of the land and engaging in conservation efforts like controlled burns or habitat restoration. When access to those opportunities dwindle, people can experience disempowerment and disconnection as individuals and community groups who have historically managed forest health or water quality may feel sidelined by top-down decisions. The resulting frustration can lead to a sense of hopelessness or alienation, eroding collective momentum for further ecological or social initiatives.

- **Emotional toll of changing landscapes.** Residents who rely on nature for emotional renewal can feel disoriented and listless if wildfire scars or flood debris significantly alter the landscape. Long-term distress stemming from these changes may manifest as persistent sadness, irritability or withdrawal from other social activities.

During our engagement sessions, participants noted facing tough choices between participating in outdoor activities or avoiding further exposure to smoke, particularly since outdoor recreation is often viewed as a valuable opportunity to exercise and connect within the community. The lack of safe indoor alternatives exacerbates the challenge, leaving communities struggling to protect their health while maintaining meaningful engagement with others.

"I think personally, this year specifically, we know smoke is coming. It's not a matter of if, it's when it's going to happen. So, I think there's been a mindset shift of, ok well you're expecting this many smoke days and you're going to be spending more time outside in the smoke knowing that it's going to be there. You're making that choice, and it's a physical choice of, 'I'm going to spend more days outside, I'm acknowledging the smoke is going to have an impact on my body, but perhaps my mental health will be better from being outside rather than being inside all those days.' And I'm sure other people are going through very similar thought processes."

Workshop - Local government participant

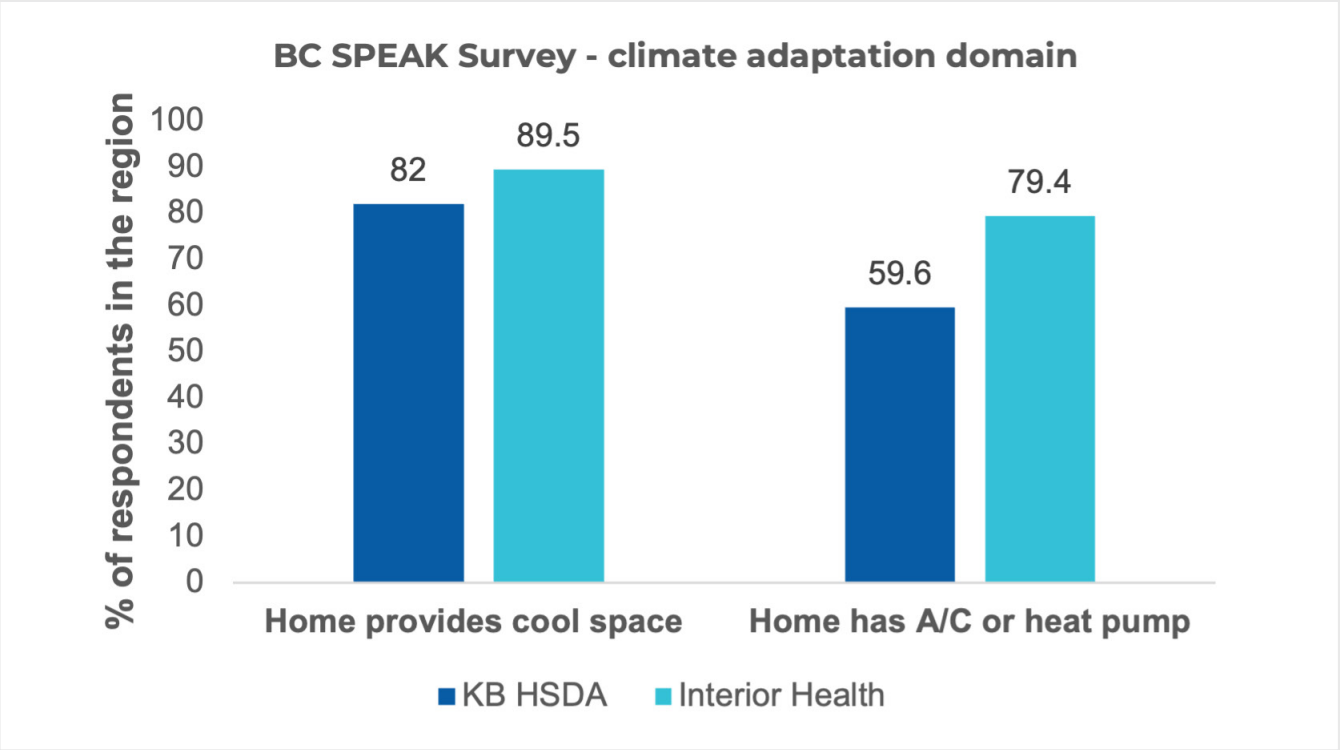
- **Increased tensions.** Conflicts can arise between competing interests—like industrial operations versus conservation groups—undermining mutual support networks. Heightened conflict leaves less emotional capacity for cooperation, which can exacerbate stress and strain within communities.

Isolation, Housing and Socioeconomic Insecurity

In a region where many live in remote areas or small towns, marginalized groups—low-income families, isolated older adults, individuals with disabilities and newcomers—are especially vulnerable when housing is limited or expensive. Housing insecurity—manifested through substandard living conditions or risk of displacement—heightens vulnerability.[67–69] Flood-prone areas, such as those near the Kettle River Watershed,[101] place residents at repeated risk of property damage and displacement, compounding economic and emotional stress. For marginalized groups, including Indigenous populations and recent immigrants, systemic inequities in housing access amplify these challenges. Rented homes may lack adequate insulation, cooling,[102] ventilation or safeguards against dampness and mold.

> *"The impacted populations we're seeing are renters who don't have the option to make their home environment more resilient (i.e., to temperature or to limit smoke)."*
> *Workshop – Local government participant*

Figure 6: Data from the BC SPEAK Round 3 Survey in 2023 on perception of homes providing a cooling space compared to homes with A/C or heat pump



The bar chart above illustrates responses to two climate-adaptation items included in the BC SPEAK survey, perception that their home can stay cool (Home provides cool space) and whether they have mechanical cooling equipment (Home has A/C or heat pump). The blue bars represent the KB HSDA, while the orange bars represent the IH region as a whole. In both areas, more people report having a "cool space" than report owning actual air conditioning or a heat pump—reflecting a difference between the feeling or perception of staying cool (e.g., shaded rooms, fans or good ventilation) versus the presence of mechanical systems specifically designed to cool indoor air.

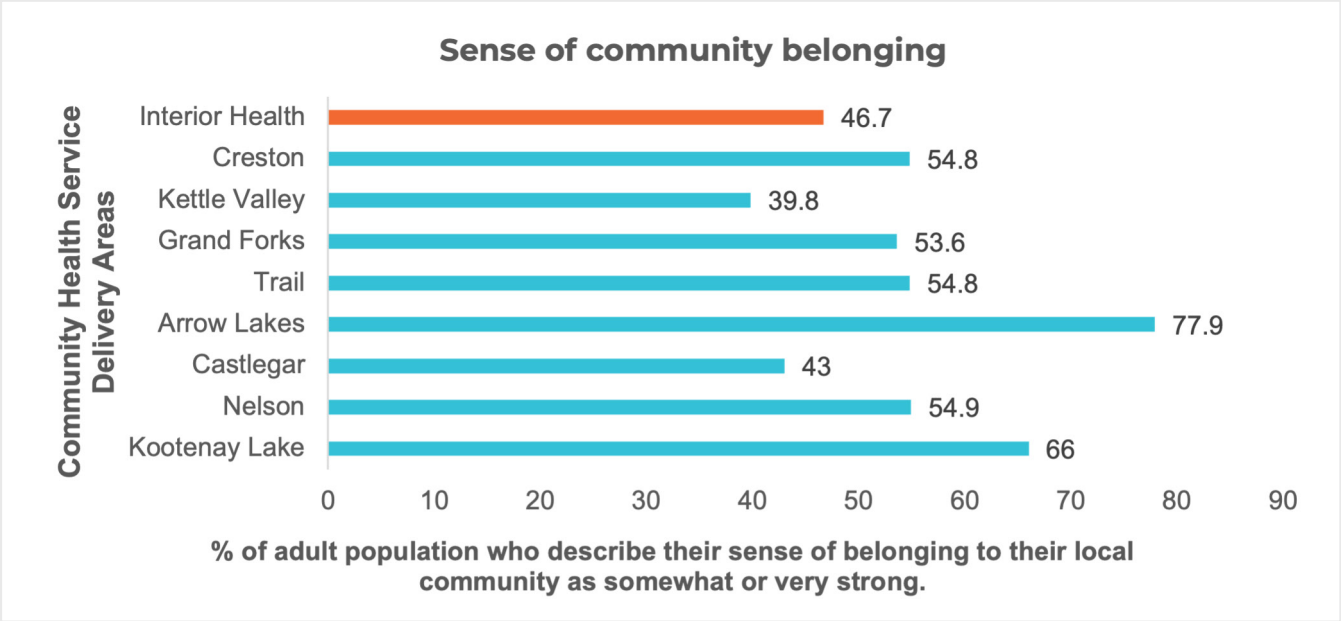
People already living on tight budgets can see their living conditions deteriorate further as they may lack the financial means or legal leverage to improve them. Chronic exposure to inadequate housing fosters a compounding cycle of anxiety and physical discomfort, which can sap an individual's ability to remain active or engaged in the community.

Participants in our engagement sessions highlighted that rural communities often lack sufficient community space to serve as shelters for populations most at risk during extreme weather events. The loss of a community space in a rural community often means much more than a loss of a space for social and other community events; it can impact the ability to respond and cope in the case of an emergency as there are limited alternatives for shelter which leaves people without a safe place to go.

Climate adaptation initiatives—like flood mitigation programs or new zoning regulations—often involve complex government processes. Individuals facing language barriers, mobility challenges or social stigma may be effectively shut out of these conversations, resulting in feelings of alienation from civic life. This experience can deepen a sense of powerlessness, fuelling chronic stress that can manifest physically through headaches, insomnia or heightened susceptibility to illness.

Additionally, without input from marginalized groups, support measures may fail to address specific vulnerabilities. For instance, older adults living alone might need reliable volunteer check-ins during emergencies. However, if they lack representation, resources might not be allocated for such programs. This gap in targeted services heightens distress when crises do occur.

Figure 7: Data from the BC SPEAK Round 3 Survey in 2023 on percentage of adult residents in communities across the KB HSDA that have a strong sense of community belonging.



The bar chart illustrates the percentage of adults in each CHSA (plus the broader Interior Health region) who describe their sense of community belonging as "somewhat" or "very strong." There is quite a variety across the CHSAs in the region: two are on the lower end and fall below the average across the health authority, while Arrow Lakes shows the highest sense of belonging at 77.9%. This variation suggests that feelings of connection and support differ widely across the region. In the context of climate sensitivity, a stronger sense of belonging often indicates more robust social networks and a greater likelihood of neighbours looking out for one another. Communities with lower reported belonging may experience fewer informal supports, which can factor into how people manage or cope with environmental stressors.

Geographic Sensitivities to Climate Impacts

The geographic sensitivities in the KB HSDA are shaped by its topographical features and settlement patterns. Geographic sensitivity refers to how the physical characteristics and location of a place—such as its elevation, proximity to bodies of water or natural hazard zones—can shape the impacts of climate change. These factors interact with climate variability to shape the region's vulnerability to hazards such as wildfires, flooding and extreme weather events.

Terrain and Landscape

The KB HSDA's mountainous terrain and varied elevations play a central role in its geographic sensitivity to climate impacts. Steep slopes and thin soils in the mountainous areas contribute to increased risks of erosion, landslides and debris flows, particularly following heavy rainfall, rapid snowmelt or wildfire.

This mountainous topography can also heighten vulnerability to wildfire. Dense forests that thrive in these elevated regions also become more prone to combustion during periods of drought, as moisture levels drop rapidly in thin mountain soils. Accessing and containing fires in such terrain is further complicated by limited road networks and steep, rocky inclines that restrict equipment movement.

Additionally, shifting wind patterns within mountain passes and valleys can stoke flames in unpredictable ways, catching nearby communities off-guard. The combined effect of steep gradients, dense forests, limited access routes and erratic winds makes wildfires both more likely to start and more difficult to control in the region.

Multiple rivers and tributaries in the region thread through steep canyons and broad floodplains, making certain corridors more susceptible to seasonal flooding. Even moderate increases in rainfall or rapid snowmelt can raise water levels significantly, affecting communities along these waterways. When floodwaters or landslides block roads or damage bridges, supply chains for essentials such as groceries, medications and fuel become unreliable. Households under financial stress may have to stretch existing supplies or delay refills, potentially exacerbating dietary deficiencies or chronic conditions. Repeated flood threats trigger an undercurrent of anxiety about damaged homes or forced evacuations. People living on floodplains sometimes experience a constant, low-level worry that can worsen mental health over the long term.

Participants in our engagement sessions highlighted that displacement anxiety is becoming more common, particularly because wildfires and smoke, heatwaves and flooding disrupt lives. People are questioning whether permanent relocation is a viable solution, especially when climate hazards are threatening their homes and livelihoods. The idea of leaving one's home to avoid these hazards is further complicated by the widespread nature of the climate events.

Additionally, access to outdoor spaces and trail networks can also be limited during climate events.

"We're dealing with reduced access to the outdoors, reduced activity levels in the summer due to heat and smoke, and reduced activity levels in the winter due to reduced snowpack." *Workshop – Local government participant*

There is also soil erosion and infrastructure strain. Fast-moving water in narrow valleys can erode riverbanks and destabilize roads and rail lines. Local governments faced with urgent repairs may divert funds from community initiatives (e.g., outreach programs for seniors), reducing preventative support structures. Families on eroding riverbanks might be forced to relocate or undertake costly mitigation measures, creating financial stress. When money is redirected to fortify or rebuild homes, it often results in cutbacks on health-related expenses or local community engagement opportunities.

Population Distribution

The KB HSDA features communities with larger populations, small towns and outlying settlements, each with distinct microclimates, and often separated by challenging terrain that limits connectivity and access to services. These settlement patterns are shaped by the area's topography, historical resource development, and diverse cultural heritage. Communities often cluster along river corridors or within mountain valleys, where transportation routes, farmable land, and access to water are most readily secured. However, many settlements remain isolated due to steep terrain, limited road networks and challenging winter conditions that can hinder travel between towns. As a result, population density remains low, with larger service centres—like Trail, Castlegar and Nelson—acting as hubs for surrounding rural areas.

> *"We tend to talk about our whole region as rural but then there's the actual rural populations. Rural communities are being hit the hardest. Proximity to the disasters for these communities constantly wear on people's mental health due to constant evacuations. For example, attention is often given to Nelson, but Slocan is currently struggling with fires. Our attention is typically on the bigger city centres. Although the region might be deemed as mostly rural, we have to consider the smaller rural communities."* *Interview – Post-secondary partner*

These settlement patterns mean that communities with fewer people have to travel long distances for routine and/or specialized care. There is also often an overreliance on single access routes such as bridges and mountain passes which further compounds risks, as extreme weather events can render these routes impassable, isolating communities and hindering emergency response efforts. The physical distance between towns can slow the flow of support during a crisis. There are also variations and inconsistencies in knowledge and preparedness levels across communities in the region. This can heighten collective stress, and fuel anxiety among neighbours unsure about the true severity or capacity to respond to a given threat.

> *"I think that there's also a lot of anxiety from rural communities where there might be only one access or egress along a highway or other secondary road. I have friends who live in areas like that, and they talk a lot about what does it mean when there is a potential flood, landslide or wildfire."* *Workshop – Local government participant*

Changes in Ecosystems

The changes in the ecosystems in the KB HSDA profoundly affect First Nation communities whose cultural identities, subsistence patterns and spiritual practices are intimately tied to the land. As warming temperatures alter habitats, once-abundant species may shift their ranges or diminish in numbers, affecting traditional hunting, fishing and foraging.

For example, higher water temperatures and changing stream flows can disrupt critical fish runs, undermining a historically reliable source of protein and an integral aspect of

communal gatherings. Likewise, medicinal plants and berries—once collected at specific times of the year—might emerge earlier or later or fail to thrive in altered soil and moisture regimes, complicating important ceremonies and the passing of harvest knowledge between generations. New or invasive species, introduced by a warmer, drier climate, further crowd out the plants and animals that have long been the cornerstone of local diets, crafts and spiritual observances.

Participants in our engagement sessions highlighted as climate change alters the landscape, including changes to ecosystems, wildlife and weather patterns, traditional knowledge passed down through generations is increasingly at risk. The Ktunaxa Nation's deep connection to the land is key to their cultural identity, and the ability to harvest, gather and hunt relies on maintaining that relationship.

This disruption in ecological balance reverberates throughout First Nation communities, contributing to a sense of grief and loss that can erode mental and emotional well-being. The inability to reliably engage in harvesting or ceremonial practices can foster a profound disconnection from ancestral lands, weakening the intergenerational bonds that carry cultural teachings and traditions forward. Over time, the cumulative strain of such ecological upheaval can diminish community cohesion and make it harder to sustain the health, identity and social resilience that have long defined Indigenous life in the region.

In Conclusion

Across the KB HSDA, every community experiences a significant degree of sensitivity resulting from physiological, socio-economic and geographic factors, though the specific reasons for and extent of these challenges vary from one locale to the next. For example, in the socio-economic dimension, sensitivity can show up as older residents living on fixed incomes or small municipalities with limited tax revenue struggling to pay for needed infrastructure upgrades. It can also mean more low-income residents who have fewer resources to rely on. These challenges make day-to-day life more fragile and climate change, with its more frequent and intense extreme weather, only adds to the pressure. While the severity varies across the region, these issues are common and create a shared backdrop of sensitivity.

Within this overarching context, communities also display distinct strengths—including committed leadership, and grassroots volunteerism. Some are on firmer footing than others, with stronger social networks, or more robust health services. Consequently, where one community might struggle to keep pace with infrastructure repairs, another may mobilize an active group of volunteers to offset limited public funding. In this sense, although they may share the same broad challenges, communities can respond in various ways.

This region-wide assessment has shed light on the challenges communities face and their strengths. By reviewing factors like economic stability, infrastructure quality, local health

trends and the depth of social connections, we identified that communities exist along a continuum. Some communities face high sensitivity because they're under-resourced and dealing with multiple challenges. Others have a more moderate sensitivity, with strong community ties that help offset some barriers and in some cases, fewer economic pressures and better overall health.

It is important to emphasize that these categories are not rigid or prescriptive. They simply offer one framework for understanding the interplay of social, economic and health factors that can shape a locality's sensitivity. A community may shift along the continuum over time as it gains (or loses) resources, experiences demographic changes, or strengthens its social networks. These categories can serve as starting points for discussions about where interventions might generate the greatest positive impact.

High Sensitivity

These communities face a combination of economic fragility, infrastructural deficits, a weakened social fabric and challenging health status, all of which significantly heighten their sensitivity to everyday stresses and acute shocks.

1. **Economic fragility.** A community with people heavily reliant on government transfers or low-wage work is likely to struggle to afford climate-adaptation measures such as home repairs. This limited financial resilience also makes it more difficult to rebuild or recover after extreme weather events. Furthermore, if the local economy is resource-based (e.g., agriculture, forestry, etc.), shifts in climate can directly threaten livelihoods, compounding economic insecurity. At the municipal level, the small size of the tax base limits the community's ability to invest in upgrades or social programs.

2. **Infrastructural deficits.** Public infrastructure like roads and community centres require maintenance or retrofitting to handle floods, storms or extreme temperatures. Large portions of the housing stock may require extensive maintenance or repairs that residents can't afford. Leaky roofs, mold or outdated wiring can worsen health conditions (e.g., asthma, respiratory infections) and pose safety hazards. Transportation options (public or private) may also be precarious, when roads, power or communications go down. Older adults and those with fewer supports can be disproportionately isolated. Additionally, multiple essential health facilities in some of these communities have poor site access, which suggests that during extreme weather, it can become difficult to transport critically ill or injured individuals to care in time. Moreover, ongoing management of chronic illnesses becomes more difficult when specialized care is hours away and travel is uncertain.

3. **Low sense of community belonging.** Strong social networks are critical in crisis situations, especially where official emergency resources might be limited. A low sense of belonging erodes this informal support system, impeding neighbour-to-neighbor aid and reducing the effectiveness of community-level emergency planning. This can leave people, especially older residents, at higher risk if they must shelter in place or manage an evacuation. With limited communal gathering spaces

or underfunded recreation programs, residents have fewer opportunities to bond.

4. **Health challenges.** In communities where more residents live with one or more chronic conditions like hypertension, COPD, asthma, and mood/anxiety disorders, the impact of climate change can be more damaging. As described in this report, climate-related stresses—such as prolonged heatwaves, wildfire smoke or flooding—can exacerbate all these chronic conditions.

Under-resourced and strained communities battle a complicated array of challenges: uncertain finances, deteriorating infrastructure, a shortage of social ties and multiple health burdens. This often leaves them vulnerable to cycles of persistent hardship, where each setback—be it an economic downturn or an extreme weather event—can have lasting effects on residents' well-being.

Moderate Sensitivity

Other communities experience a moderate sense of sensitivity. Some are similar to the higher sensitivity communities, relying on a narrow economic base and struggling with similar infrastructure and housing issues but with a stronger sense of community belonging. Others have less economic constraints and better health status, and various other combination of these factors that drive sensitivity.

However, what is generally most different about some of these communities is their:

1. **Higher sense of community belonging.** Residents in these communities feel connected to each other and the place they live. Residents may be engaged in community life including volunteering. This sense of belonging can mean that residents are more likely to come together in support of adaptive measures—like supporting a neighbourhood fire-prevention team and checking on elderly neighbors during an extreme heat event—even if they have limited finances.

2. **Fewer health challenges.** The lower prevalence of respiratory or cardiovascular conditions means that for these communities there is less concern about disease exacerbation during heat waves, wildfire smoke or other environmental shocks. The health system in these areas is less likely to be overwhelmed by emergencies compared to a population with widespread chronic conditions.

Fewer underlying health issues and stronger social connections place some communities in a better position to handle climate-related challenges. Even when facing economic pressures, lower rates of chronic illness and a strong sense of community belonging act as buffers, helping residents manage stress and protect well-being during climate disruptions.

Exposure

Key findings

- This region experiences severe weather fluctuations, including intense heat waves, heavy snowfall, intense storms, wildfires, flooding, and drought. While these phenomena are not new, their frequency and severity have been growing, driven by climate change. These increasing levels of exposure increases the risk and experience of health impacts. particularly for vulnerable populations such as the elderly, those with pre-existing health conditions and those with lower incomes, are particularly at risk.
- **Extreme heat.** Across the region, heatwaves are becoming a recurring summer phenomenon, with prolonged week-long heat events.[18–20]
    - Exposure to extreme heat increases the risk of heat-related illness and places a strain on cardiovascular systems, particularly for individuals with pre-existing cardiovascular conditions and other chronic diseases.[22–25]
- **Wildfire and smoke.** Over the past decade, the wildfire season has grown longer and more intense, with fires now burning from early spring to late fall.[103]
    - Exposure to wildfire smoke poses severe risks to respiratory health.[82, 104, 105]
- **Flooding.** The region has experienced multiple high-water events over recent years, resulting in heightened alert levels and evacuation orders being issued.[36-40] Residents in communities like Grand forks have experienced repeat displacement due to floods.[106]
    - Floodwaters often carry harmful pathogens, chemicals and debris, creating significant public health risks.[45, 107]
- **Drought.** Warmer temperatures are accelerating snowmelt earlier in the season, reducing the water supply available during the hotter summer months.[108] In recent years, the region has recorded extended periods of below-average rainfall, leading to declining river flows, soil moisture deficits and increased stress on groundwater resources.[109,110]

    - Lower water flow reduces the dilution of contaminants, leading to higher levels of bacteria, heavy metals and harmful algal blooms.[111,112]

- **Cold and winter storms.** Snow accumulation and icy surfaces make travel treacherous, contributing to accidents and vehicle breakdowns. In some cases, roads are closed.

    - Exposure to cold increases the risk of hypothermia and frostbite. This exposure can also exacerbate cardiovascular and respiratory conditions.

- The health system is also exposed to all the extreme weather events described. These events disrupt health-care operations, strain workforce capacity and damage critical infrastructure, making it difficult for medical facilities to provide timely and effective care.

As outlined in the previous chapter, the KB HSDA has unique geographical features. Coupled with its socio-economic characteristics, the region is particularly sensitive to shifts in climate patterns. From rising temperatures to changes in precipitation, the sensitivity of the region amplifies the potential risks posed by extreme weather events. Now, we turn our focus to the extreme weather events the region is exposed to and their health implications.

This region experiences a unique combination of climatic conditions that can result in severe weather fluctuations, including intense heat waves, heavy snowfall, intense storms, wildfires, flooding and drought. While these phenomena are not new, their frequency and severity have been growing, driven by climate change. As these weather extremes intensify, so do their potential health impacts on individuals, particularly those who are already vulnerable, such as the elderly, those with pre-existing health conditions, and those with lower incomes. Extreme weather events can have direct and indirect consequences for human health. Extreme heat, for example, can lead to heatstroke and other heat-related illnesses. Cold snaps and winter storms can increase the risk of hypothermia, frostbite and other cold-related injuries.

IH routinely monitors acute impacts of extreme temperatures such as heat by focusing on emergency department (ED) visits due to heat-related illness during warm months. The heat deaths during the 2021 heat dome in B.C. overwhelmed the health system's ability to respond. The event highlighted the need for monitoring and action. Preventing severe outcomes, however, relies on early warning signs, hence the focus on ED visits through surveillance.[113–116] Cold, and by extension, cold-related ED visits, are increasingly being considered, as health and housing are recognized to be important determinants of health. In recent years, these intersecting issues have been further compounded by the concurrent toxic drug crisis and housing crisis in B.C.[117]

Wildfires increase air pollution, and, in some cases, people must evacuate. On the other hand, droughts can increase the risk of water-borne diseases. Floods can lead to displacement and contamination of water supplies. Each of these events (or a combination

of multiple events occurring at the same time) can increase stress and anxiety for people exposed to them. The implications for health systems are far-reaching, stretching resources and creating additional strain on emergency services and public health infrastructure.

While each of these events individually poses significant health risks, their cumulative and compounded impacts lead to far greater public health challenges. Repeated exposure to multiple extreme events within a short time frame results in prolonged physiological and psychological stress, greater strain on health systems, and a deepening of social and economic vulnerabilities. This section explores the impact of each extreme weather event. It is important to note, however, that in this region, communities may be exposed to multiple extreme weather events at the same time or must deal with these events regularly: the impacts are therefore compounded.

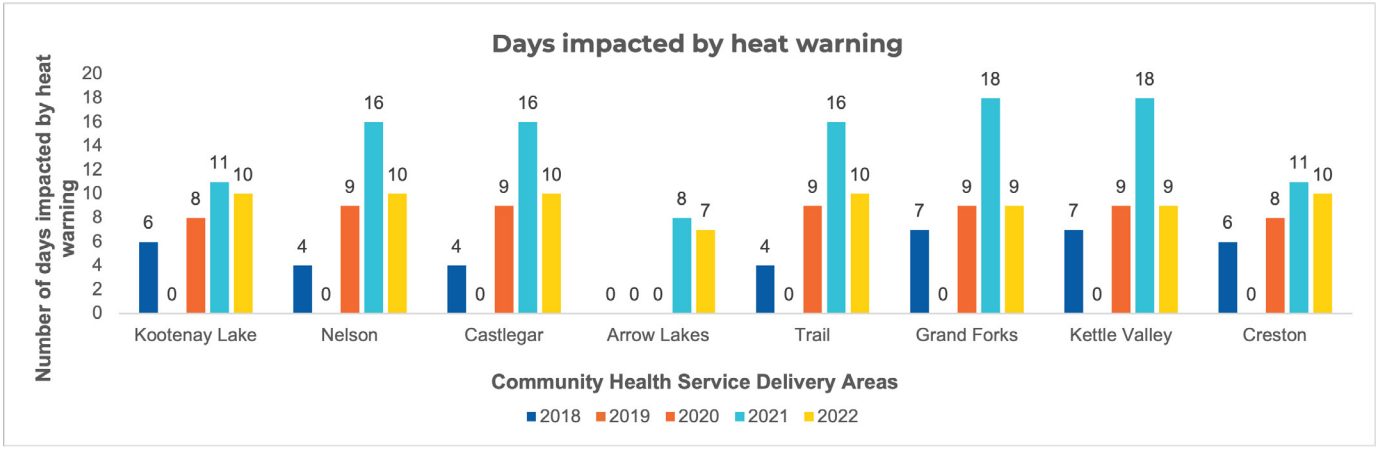
The rest of this chapter provides an overview of the impacts of these extreme weather events in the region and health implications associated with each type of extreme weather event. We explore the physical health risks, such as cardiovascular and respiratory problems, injuries and infectious diseases, as well as the mental health consequences, which can include stress, anxiety and trauma.

Additionally, we highlight the different ways in which various groups within the community are disproportionately affected.

Exposure to Extreme Heat

The KB HSDA is now experiencing more frequent and severe heatwaves. During the past summers, from 2022 to 2024, many communities in the region have seen temperatures exceed 40°C, breaking historical records.[15–17] These heatwaves are becoming a recurring summer phenomenon.[18–20] Prolonged heat events now last upwards of a week, creating sustained stress on individuals and systems.[118]

Figure 8: The number of days impacted by a heat warning in the past few years. A heat warning is issued by Environment and Climate Change Canada (ECCC) when the maximum daytime temperature of two or more consecutive days, and the nighttime minimum temperature of the night in between, meet or exceed a set of regional-specific thresholds.



Farmers in the region are significantly impacted as the heat stress drives crop failure in areas like the Creston Valley.[119] In 2021, there were reports of crops experiencing stunted growth and sun damage, resulting in economic strain and undermining the livelihoods of farmers.[119]

Climate Impacts in the News

Creston Valley cherry orchards suffer from heatwave
Acres upon acres of fruit have been left unpicked on the trees due to damage from the hot and dry conditions.

Reduced nighttime cooling has become a particularly insidious issue.[120] While daytime temperatures often peak at dangerous levels, the inability to cool down at night exacerbates health risks.[121] For example, during the 2021 heat dome, nighttime temperatures in communities across B.C. remained above 25°C for several consecutive nights.[122] Nighttime recovery is especially critical for older adults and those with chronic

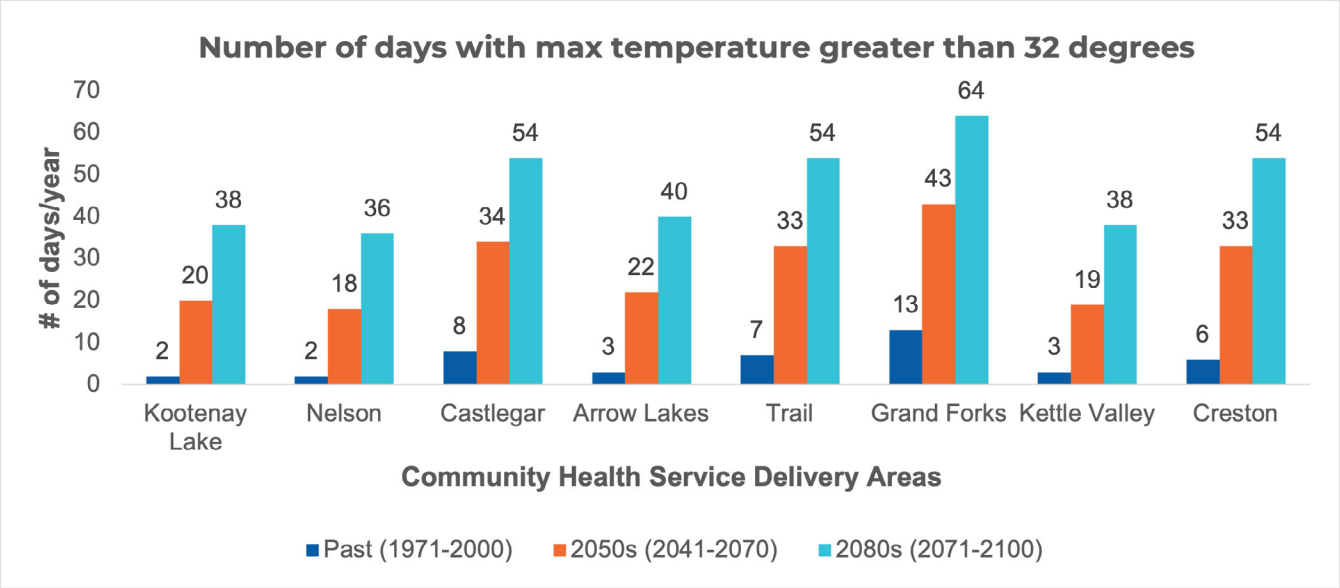
conditions, as extended periods of heat exposure without relief significantly increase the likelihood of hospitalization or fatal outcomes.[122]

Across the province, infrastructure has shown increasing vulnerability under extreme heat conditions. During peak heat events, electricity demand spikes as residents turn to fans and air conditioning units. This activity increased the demand on transformers and substations not designed to handle such high temperatures, and often resulting in localized outages.[123–126] Transportation infrastructure also suffers: highways like the Coquihalla, and sidewalks in communities across the North Okanagan, from Salmon Arm to Vernon, have shown signs of thermal cracking and buckling under extreme heat.[127–130]

> *"Our community is especially hot in the extreme heat events because of the pavement and cement holding the heat which leaves very few places to get relieve from the heat."* *Workshop – Local government participant*

Climate models project that the KB HSDA will experience a significant increase in average temperatures, with annual averages rising by 2.5–4.5°C by 2050 under a high-emission scenario. Heatwaves, characterized by prolonged periods of extreme heat, are expected to become more frequent, intense and longer-lasting, placing immense strain on residents, infrastructure and natural systems.

Figure 9[i]: The historical and projected number of days with maximum temperature over 32°C in CHSAs across the KB HSDA. This indicates a change in the length of hot weather events expected for the region. A longer hot weather period can mean more heat-related morbidity and mortality, especially if they happen consecutively.



[i] Climate projection data are from the Power Analytics and Visualization for Climate Science (PAVICS) data catalog. Specifically, the data was generated from the Coupled Model Intercomparison Project Phase 6 (CMIP6) version. They are presented under three Shared Socio-economic Pathway (SSP) scenarios. The SSP scenarios are used to characterize possible future development pathways for human societies. The scenario used here is high emission, corresponds to the climate scenario SSP5-8.5.

Health Impacts from Extreme Heat

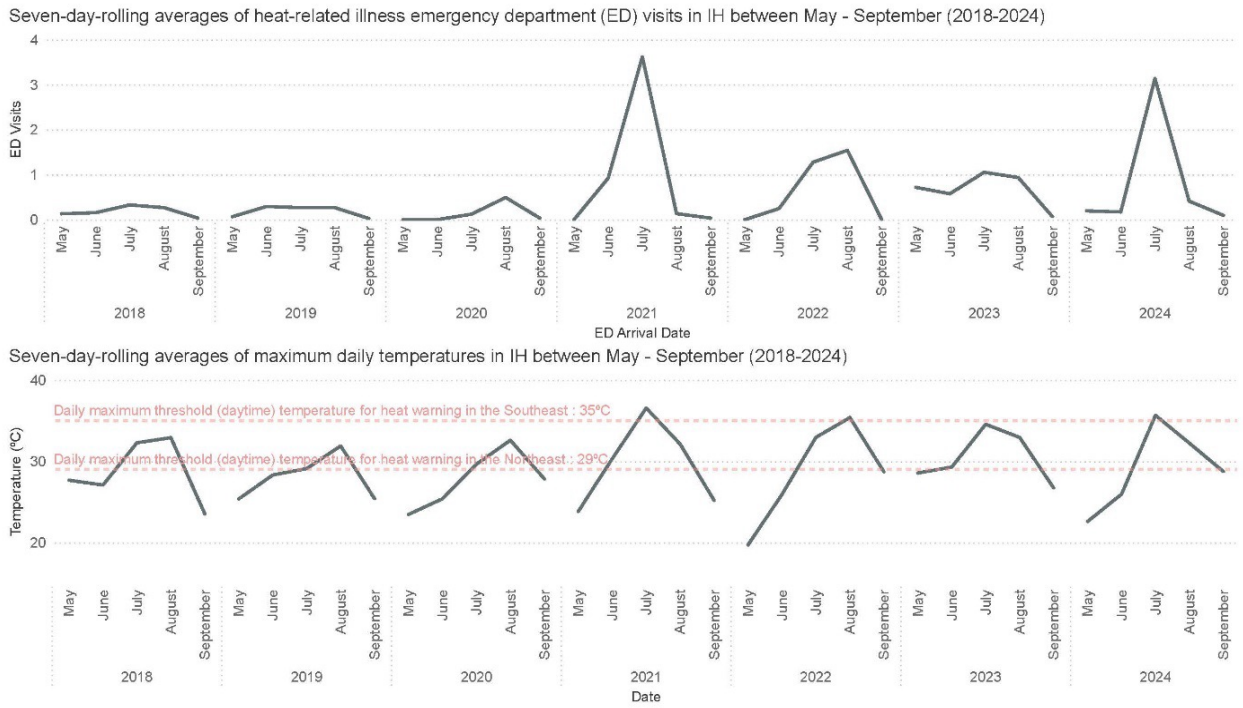
Climate Impacts in the News

Heat-related emergency calls spike in B.C. as temperatures soar
Nearly 40 communities in BC set daily temperature records on July 9, 2024 with many communities in the Interior with temperatures over 38C. Across the province B.C. Emergency Health Services recorded an uptick in calls for medical emergencies related to heat.

Heat-related illnesses

Heat-related illnesses represent some of the most direct and immediate impacts of extreme heat. These illnesses occur on a spectrum, starting with mild conditions such as heat cramps, and progressing to severe and life-threatening conditions like heatstroke.[21] Heat cramps are painful muscle spasms caused by the depletion of salt and electrolytes during excessive sweating. If left untreated, heat cramps can progress to heat exhaustion, characterized by heavy sweating, rapid pulse, dizziness, nausea, and a drop in blood pressure. Heat exhaustion is a critical warning sign, and without intervention, it can escalate to heatstroke.[21] Heatstroke, the most severe form of heat-related illness, occurs when the body's core temperature exceeds 40°C.[21] This condition disrupts the central nervous system, leading to confusion, seizures, loss of consciousness, and, in severe cases, multi-organ failure.[21]

Figure 10: Heat-related illness emergency department (ED) visits presented with daily maximum temperature data in IH



From 2018 to 2024, the trend in heat-related illness (HRI) ED visits in IH followed the same trajectory of daily maximum temperature for the corresponding time period (Figure 9). Note that HRI is a newer Canadian Emergency Department Information System) code that was introduced in late 2016.[131,132] While there were no recorded instances of HRI ED visits in 2017, it was a newly introduced code that takes time to work into practice.[114]

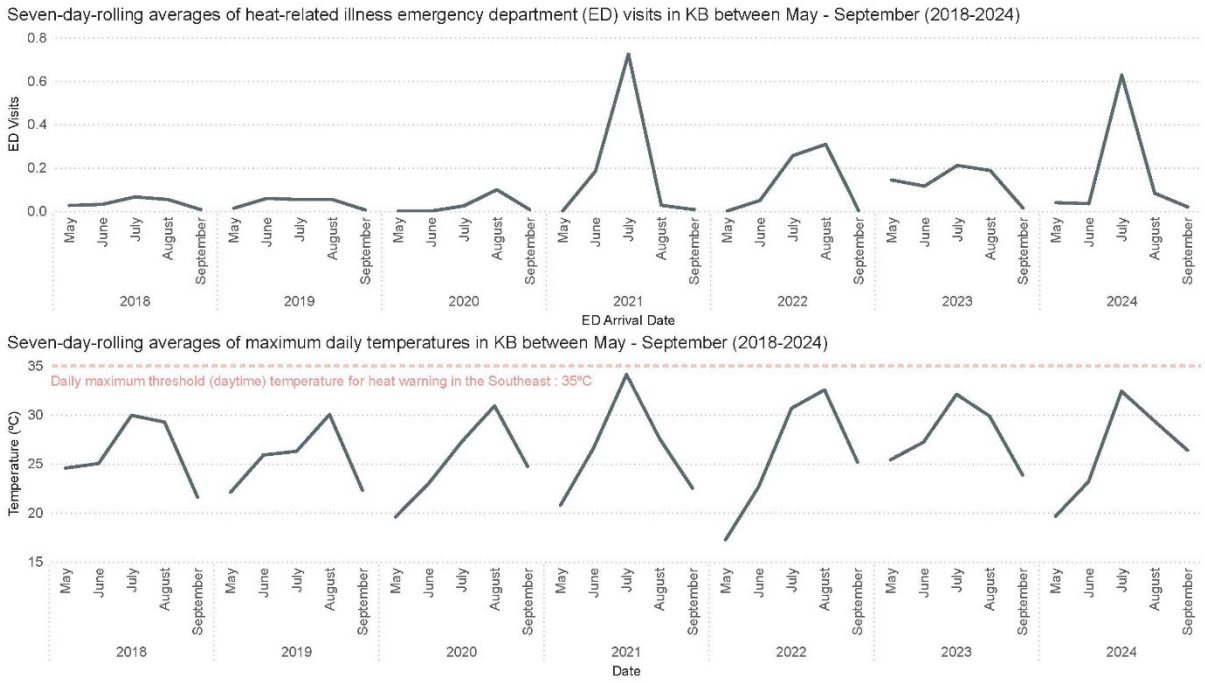
Environment and Climate Change Canada's heat warning system covers the northeast and southeast regions of the Interior. Heat warnings are triggered when the daytime maximum temperatures are 29°C and 35° C, respectively (see Table 1 in BC HARS 2024[107]).

As seen in Figure 9, as daily maximum temperatures spiked above 29°C and 35°C, HRI ED visits also spiked proportionally for the same time period. The same trends were seen for the KB, although the magnitude of the impact was smaller as seen with smaller numbers of ED visits displayed on the y-axis (Figure 10).

Notable HRI ED Demographic Trends from 2018-2024

In IH, for nearly all of the years examined, patients who identified as men were most impacted. Most patients were not admitted as inpatients, and did they not arrive by ambulance. When looking across age groups, for nearly all of the years, most patients were in their 20s and 30s. When stratified by HSDAs, the KB had small numbers and could not be stratified further to report on demographics to protect the privacy of patients (data not shown).

Figure 11: Heat-related illness ED visits presented with daily maximum temperature data in KB HSDA



Data Notes: ED visits related to heat-related illnesses were based on a presenting complaint with a Canadian Emergency Department Information System (CEDIS) code of 207-heat-related issue, extracted from the IH Admissions universe.

Cardiovascular and respiratory stress

Extreme heat places a significant strain on cardiovascular systems, with potentially fatal outcomes, particularly for individuals with pre-existing cardiovascular conditions and other chronic diseases.[22–25] Respiratory systems are similarly affected, with extreme heat often coinciding with elevated levels of air pollution, such as ground-level ozone and fine particulate matter (PM2.5). These pollutants exacerbate asthma and COPD, resulting in heightened morbidity during heatwaves.[56,133]

Pregnancy and neonatal health

Extreme heat can have profound effects on pregnancy and neonatal health, with potentially life-altering consequences. Pregnant individuals exposed to high temperatures face an increased risk of preterm labor, stillbirths and low birth weight.[81,134,135] These risks are amplified during prolonged or extreme heat events, particularly in the later stages of pregnancy when the fetus is most vulnerable to environmental stressors.

Mental Health Challenges

There is growing evidence of the mental health impacts of extreme heat. High temperatures can disrupt sleep patterns, increase irritability, and exacerbate anxiety and depression.[26] Prolonged heatwaves are linked to higher rates of psychological distress, particularly in communities already experiencing socio-economic or environmental stress.[26] Wildfires that coincide with heat events amplify these effects, as the physical threat of fire, smoke exposure, and the need for evacuation add layers of stress. PTSD, eco-anxiety, and feelings of helplessness are common in communities repeatedly exposed to extreme heat and wildfires.[58]

Populations that are Disproportionately Impacted

Children and older adults

The impacts of extreme heat are not evenly distributed, with certain populations disproportionately affected due to systemic and situational vulnerabilities. Older adults are particularly susceptible to heat-related illnesses due to reduced thermoregulation capacity and a higher prevalence of chronic conditions that amplify heat stress.[63,64] Similarly, children, with their smaller body size and underdeveloped thermoregulatory systems, are at heightened risk of dehydration and heat-related illnesses.[136]

Low-income households

Socioeconomic factors further exacerbate vulnerabilities. Individuals living in poorly insulated housing without air conditioning face prolonged exposure to high indoor temperatures, even when advised to stay indoors.[80] Children and older adults who are socially marginalized also face greater exposure.[137] Rural and remote communities encounter additional challenges, including limited healthcare infrastructure, longer emergency response times, and fewer resources for heat mitigation. Indigenous communities also experience compounded vulnerabilities due to systemic inequities in housing, health care access, and higher rates of pre-existing health conditions.

Outdoor workers

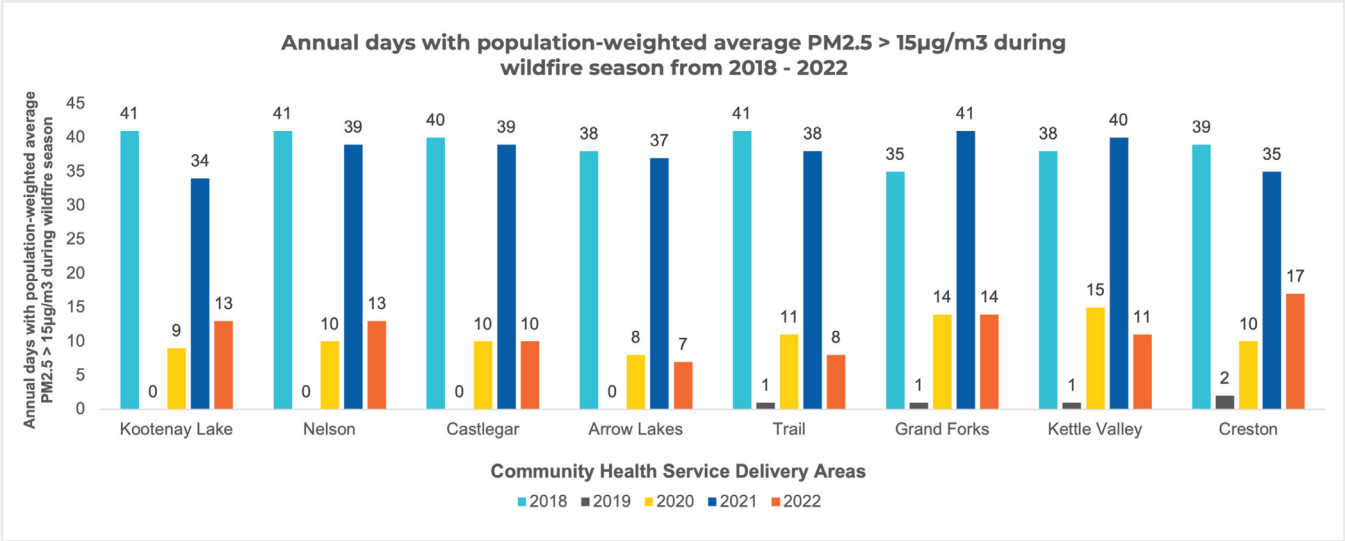
Heatwaves have disproportionately impacted outdoor workers in agriculture, forestry and construction due to prolonged exposure to high temperatures without adequate access to hydration, cooling or shaded rest areas.[138–140] This exposure can lead to heat-related illnesses such as heat stroke, dehydration and cardiovascular complications.[141,142] Studies have highlighted that rural workers are less likely to have access to workplace protections like cooling systems, shade or regulated rest breaks, exacerbating their vulnerability.[141,143]

Exposure to Wildfires and Smoke

In the 2024 wildfire season, 73,048 hectares (ha) burned in the Southeast Fire Centre of which 27,349 ha burned in the KB HSDA region.[144] Over the past decade, the wildfire season has grown longer and more intense, with fires now burning from early spring to late fall.[103] Communities in and around the KB HSDA region faced evacuation orders and air quality alerts as wildfires encroached on populated areas.6

During the 2024 wildfire season, communities in the Slocan Valley, including Silverton and adjacent rural areas, Slocan, New Denver, north of Wilson Creek and on the east side of Kootenay Lake, such as Argenta and Johnsons Landing, faced evacuation orders due to encroaching wildfires.[1–3] On July 20, 2024, the RDCK recorded a total of 98 wildfires in the area.[3] Wildfire smoke is a pervasive and dangerous exposure for the region's residents. During the 2021 and 2023 wildfire seasons, air quality indices (AQI) in parts of the region reached "hazardous" levels for weeks at a time.[4–6] Fine particulate matter (PM2.5) concentrations often exceeded safe limits by a factor of five or more. These poor air quality periods also affect the industries and businesses within the region, causing them to shut down operations.[1,145] Figure 11 shows how many days during wildfire season each community health service delivery area in the Kootenay Boundary region experienced fine particulate matter (PM2.5) levels above 15 µg/m³ between 2018 and 2022. Overall, the graph highlights how wildfire-related smoke events vary by year and by local geography within the region, with certain areas or seasons experiencing considerably worse air quality than others.

Figure 12[i]: Days with PM2.5 >15ug/m3 during wildfire seasons from 2018-2022



[i] Estimates of PM2.5 related to wildfire smoke are from the Canadian Optimized Statistical Smoke Exposure Model (CanOSSEM), a large-scale machine-learning model that estimates PM2.5 at a 5 km × 5 km spatial resolution with multiple data input, including satellite images, meteorological modeling and measurements from air quality monitors. Daily population-weighted averaged PM2.5 exposure were calculated for each wildfire season (May and September) from 2016 to 2022.

During the 2024 wildfire season, more than 2,100 properties in the region were impacted by evacuation orders or alerts. The process of evacuation can be very traumatic, resulting in immediate safety concerns and creating long-term stress and economic instability for displaced families.[13,146,147] People often struggle to find temporary housing, especially in rural areas with limited accommodation options.[148] Wildfires also destroy essential infrastructure and disrupt economic activities, from agriculture to tourism that residents depend on. Farmers across the Interior have had to deal with crop losses or diminished crop outputs, along with the negative impacts of fire on the quality of the soil.[149,150] Critical roadways, such as Highways 3 and 6, have been repeatedly closed, cutting off supply chains and isolating communities.[151,152] The health of forest ecosystems is also a significant concern in the aftermath of a fire as they provide flood protection, clean air and water filtration which are often being degraded, increasing vulnerability to secondary hazards such as landslides and water contamination.[153–155] For example, post-fire erosion following the wildfire season often results in sedimentation of local rivers, impacting fish populations and water quality for communities reliant on these resources.[156]

Wildfires can result in the closure of parks, hiking trails, campgrounds and recreational sites, reducing tourism traffic during peak seasons. Additionally, tourism relies on scenic landscapes, forests and outdoor activities such as hiking, fishing and wildlife viewing. When wildfires alter these environments, their aesthetic appeal and ecological integrity are compromised, leading to long-term declines in visitor interest. Some areas take years or decades to recover, making it difficult for tourism operators to maintain business viability. Even in areas not directly affected by wildfires, the smoke from wildfires can impact air quality and generally make these spaces seem less appealing. The perception of risk discourages visitors, leading to declining tourism numbers.

Climate Impacts in the News

The wildfires in the Slocan Valley in 2024 had a large impact on the summer tourism revenue that many local businesses rely on. The fires prompted evacuations in Silverton and Slocan, and the closures of Highway 6, Valhalla Provincial Park and recreation areas. Many businesses had to shut down or saw dramatic drops in revenue due to cancellations. Community Future Central Kootenay with Columbia Basin Trust offered support programs, including low-interest loans and business counselling, to assist affected businesses in recovery.

1 / 2 Jordan Knott at Slocan Village Market. | (Bill Metcalfe)

For First Nation communities who have deep cultural, spiritual and economic ties to the land, wildfires result in major disruption by destroying forests, water sources and wildlife habitats essential for traditional ceremonies, hunting, fishing and plant harvesting. The loss of medicinal plants and sacred sites further erodes cultural heritage and Indigenous ways of life. Remote First Nation communities in forested areas with limited evacuation routes face even higher levels of risk. When forced to evacuate, this displacement results in temporary or permanent loss of housing, disrupting community cohesion and increasing reliance on emergency shelters or urban relocation.

Climate models consistently predict a substantial increase in wildfire frequency and intensity across B.C.[157] This trend is fuelled by earlier snowmelt, prolonged drought conditions and higher average temperatures, which together create ideal conditions for ignition and fire spread.[157] Extreme weather events, such as lightning storms, droughts and heatwaves, may also to contribute to more frequent fire starts.[158] Projections indicate that wildfires could extend further into the spring and fall, effectively creating a nearly year-round fire season.[159] These projected exposures will threaten critical infrastructure, including power lines, highways and water reservoirs. High-intensity fires are more likely to destroy the forest canopy, reducing the region's capacity for water retention and increasing runoff, erosion and sedimentation in waterways.[160] This will compromise water quality and create downstream impacts for communities reliant on clean water supplies. The destruction of forests will also reduce biodiversity, increase the spread of invasive species, and degrade habitats critical to both wildlife and human livelihoods.

Wildfire smoke exposure is anticipated to worsen, with air quality indices (AQI) expected to reach hazardous levels more frequently.[161] The intensity and duration of future smoke events will likely exceed recent experiences in the 2021, 2023 and 2024 wildfire seasons. Fine particulate matter (PM2.5) concentrations will rise during peak fire periods, exacerbating public health concerns. Larger population centres like Trail and Nelson, as well as rural communities, may experience prolonged periods of smoke exposure, making outdoor activities unsafe and impacting vulnerable populations.

Figure 13: Seven-day-rolling average of daily maximum PM2.5 in the KB between May to September (2018-2024)

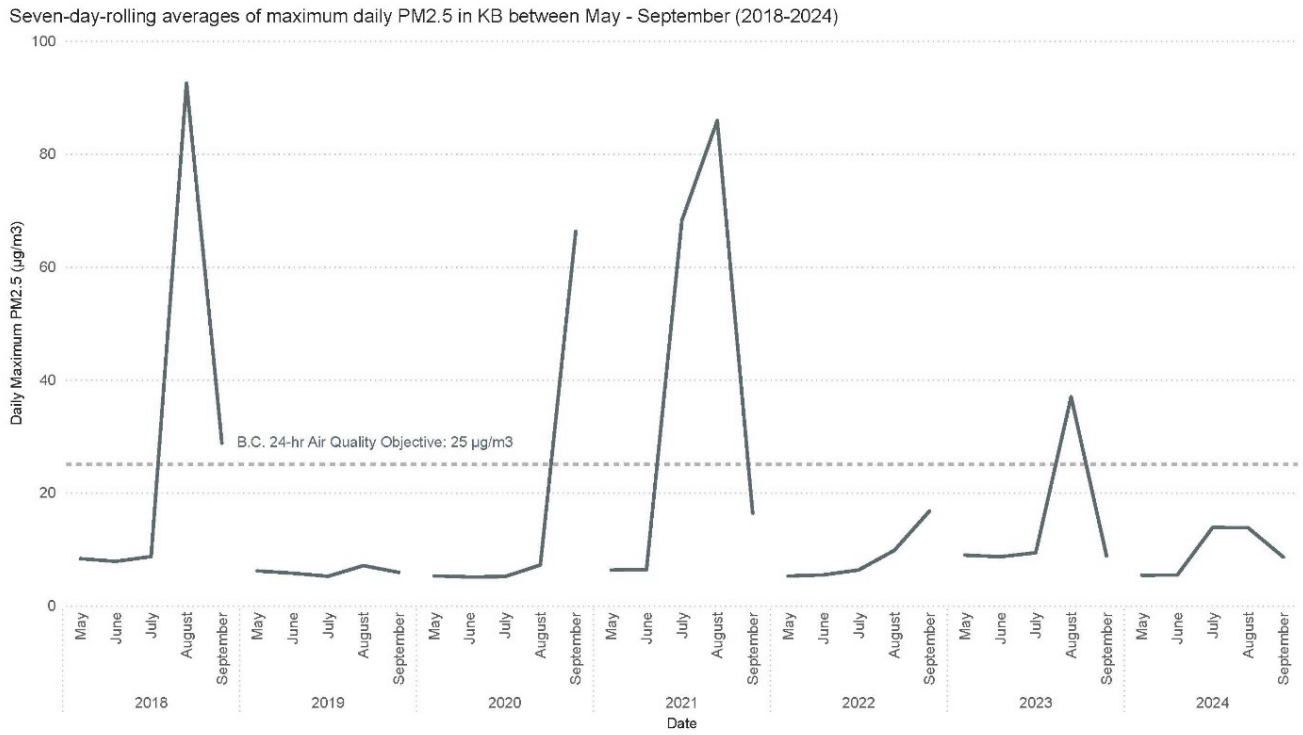


Figure 13 shows that the KB experienced large spikes in poor air quality due to PM2.5 that far exceeded the B.C. 24-hour air quality objective of 25 µg/m 3 during the wildfire seasons of 2018, 2020, 2021 and 2023.[144] These particular years did correspond with impactful wildfire seasons in B.C. The Province declared a state of provincial emergency arising directly from wildfires during the 2018, 2021 and 2023 seasons, lasting 23, 56 and 28 days, respectively. At the time of writing, the B.C. Wildfire Service has underscored the 2023 wildfire season as the worst in recorded history.

It is worth noting that occurrence and impacts of wildfires can be hard to constrain to a specific geographical area, given that wildfire smoke (and components such as PM2.5) may not originate from a local source. While the 2020 wildfire season in B.C. was not as active as anticipated, Figure 12 shows that the KB experienced one of the highest PM2.5 spikes in recent years that year, starting in August and continuing late into September. For context, the B.C. Wildfire Service deployed firefighting resources to support the western United States' extreme wildfire season in California and Oregon in the fall of 2020. The proximity of the U.S. wildfires may help explain this spike in the KB, despite B.C. not having as impactful of a wildfire season.

Data Notes:

- *BCCDC provided the air quality monitoring station data from B.C. Air Quality.*
- *Air quality data is only representative of the communities where monitoring stations are located.*

Health Impacts from Wildfire and Wildfire Smoke

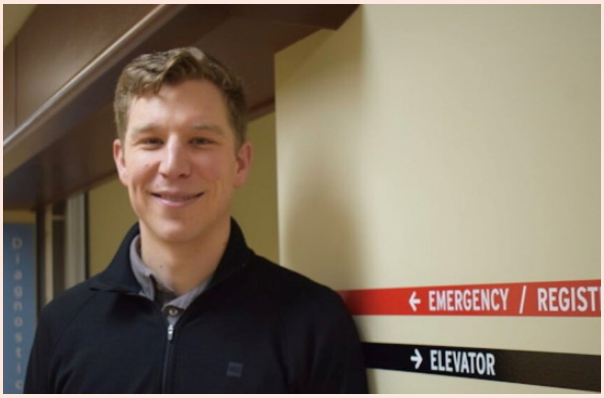
Respiratory Conditions

Exposure to wildfire smoke poses severe risks to respiratory health.[82,104,105] Fine particulate matter (PM2.5) and other pollutants can penetrate deep into the lungs, triggering and worsening conditions such as asthma, bronchitis and COPD. Figure 12 shows the tends in asthma inhaler dispensation in the KB HSDA in the past few years.

Acute exposure can lead to increased incidences of pneumonia and lung infections, especially in children, older adults and individuals with pre-existing respiratory conditions.[7–10] In the long-term, exposure to wildfire smoke has been linked to reduced lung function and a heightened risk of developing chronic respiratory illnesses.162 During intense wildfire seasons, emergency room visits and hospitalizations for respiratory complications spike significantly, placing substantial strain on the health system.[7]

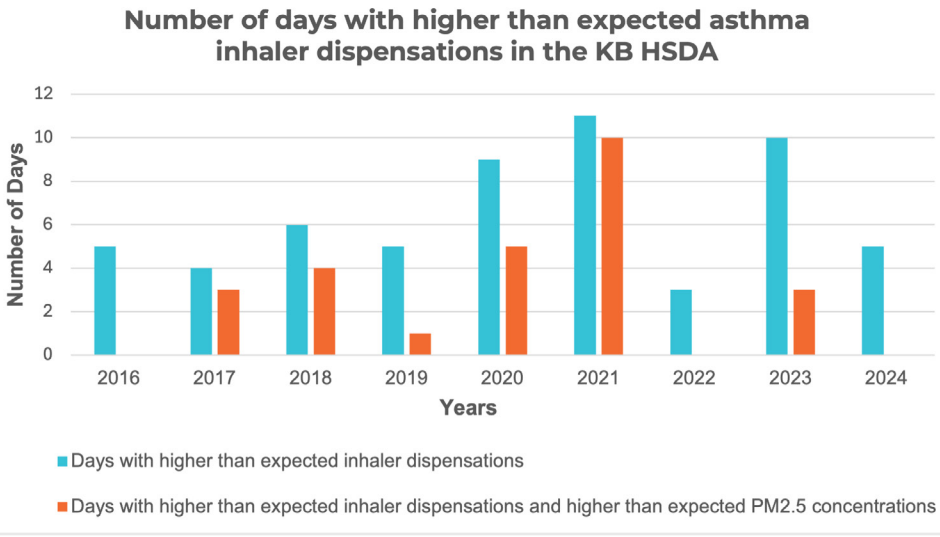
Climate Impacts in the News

During a period of poor air quality due to wildfire smoke in 2021, Dr. Kyle Merritt, an emergency department doctor at Kootenay Lake Hospital in Nelson, diagnosed a patient with a case of worsening asthma as "suffering from climate change." Dr. Merritt recognized climate change as the underlying cause of the respiratory symptoms and thought it was important to clearly connect patient health with climate change.



Photograph by Kyle Merritt

Figure 14: Number of days with higher-than-expected asthma inhaler dispensation in the KB HSDA (2016-2024)



Cardiovascular conditions

The cardiovascular impacts of wildfire smoke are equally concerning. Fine particulate matter enters the bloodstream through the lungs, contributing to systemic inflammation and oxidative stress, which are precursors to cardiovascular events.[11] Studies have demonstrated that wildfire smoke exposure increases the risk of heart attacks, arrhythmias and strokes.[10,163] Individuals with pre-existing cardiovascular conditions, such as hypertension and coronary artery disease, face heightened vulnerability.[10] Public health records show a notable rise in emergency department visits and admissions for cardiac emergencies during and after periods of intense wildfire smoke,[7,10] which highlights the possible strain on health-care resources.

Pregnancy and neonatal health

There is a growing body of evidence that suggests a link between exposure to wildfire smoke and gestational diabetes, preterm birth and low birth weight.[164–168] While the mechanism for this impact is not fully understood, it is thought that when pregnant people inhale these tiny smoke particles, they can enter the lungs and then travel through the bloodstream to the placenta. There, they may trigger inflammation, damage DNA, and disrupt hormone production essential for fetal growth.[167] Additionally, the toxins may cause the blood vessels in the placenta to narrow, reducing the flow of oxygen and nutrients to the fetus.[167]

Mental health challenges

Wildfires leave a profound psychological toll on affected communities. Chronic exposure to smoke, repeated evacuation orders and uncertainty about safety and livelihood (e.g., access to outdoor recreation) create widespread anxiety, sadness, and emotional distress.[12] Survivors of major wildfires, such as those who lost homes in the Fort McMurray fire in Alberta, report higher incidences of PTSD and depression. This impact has been observed to linger years after the event.[58] Children, in particular, are at risk of developing long-term mental health issues, including behavioural disorders and anxiety, from experiencing wildfire-related trauma.[169,170]

> *"I think personally, we know smoke is coming. It's not a matter of if, it's when it's going to happen. And so I think there's been a mindset shift of, ok well you're expecting these many smoke days and you're going to be spending more time outside in the smoke knowing that it's going to be there. You're making that choice, and it's a physical choice of, 'I'm going to spend more day outside, I'm acknowledging the smoke is going to have an impact on my body, but perhaps my mental health will be better from being outside rather than being outside all those days.' And I'm sure other people are going through very similar thought processes."*
>
> *Workshop – Local government participant*

Many communities face recurring wildfire seasons, leading to cumulative trauma. People exposed to multiple disasters, such as wildfires and floods, are more likely to report severe

mental health outcomes, including compounded PTSD and reduced resilience.[58] For example, Fort McMurray residents who experienced the 2016 wildfires and subsequent flooding in 2020 reported significantly higher mental health burdens compared to those who faced a single disaster.[58]

Populations that are Disproportionately Impacted

Children and youths

Young children are particularly sensitive to wildfire smoke, as their respiratory and cardiovascular systems are less capable of handling the stress caused by high levels of PM2.5. Children's developing lungs are less able to filter pollutants, and even short-term exposure to PM2.5 can have long-lasting effects on lung function and overall respiratory health.[60,61] Studies show pediatric admissions for asthma-related complications spiked during the 2021 wildfire season.[171] Youths were also more likely to experience anxiety and depression in the aftermath of wildfires.[148,172]

Older adults and people with preexisting conditions

In older adult populations, reduced respiratory capacity and pre-existing chronic conditions such as heart disease make wildfire smoke particularly lethal.[66] Individuals with pre-existing respiratory, cardiovascular and related conditions are also at risk of heightened impacts. A study in Canada showed that Métis peoples had the highest prevalence of self-reported COPD,[173] which puts them disproportionately at risk.

Indigenous communities

There are Indigenous communities across the interior that reside in areas that are susceptible to wildfires. Across Canada, Indigenous Peoples are disproportionately impacted in wildfire evacuations.[13,146] Their history of displacement makes these evacuations especially traumatic for these communities.[174] Their reliance on the land for traditional practices and sustenance makes them especially vulnerable to the loss of place caused by fires.[148]

Low-income households

Families with fewer resources often lack the means to install air filtration systems or relocate during prolonged smoke events. These households are more likely to suffer long-term health consequences due to continued exposure. Additionally, individuals who are unhoused and underhoused are more exposed to these conditions and more likely to experience health impacts.[148]

Co-occurrence of Extreme Heat and Wildfire

The KB HSDA is increasingly exposed to the simultaneous occurrence of extreme heat and wildfire due to a combination of geographic, climatic and ecological factors.[175] Climate change has intensified this exposure by increasing the frequency, duration and severity of both extreme heat and fire conditions, creating an environment where these two hazards increasingly overlap.[175] When high temperatures persist alongside active wildfires, human exposure to both extreme heat and hazardous smoke is prolonged, increasing the burden on vulnerable populations and essential services.

This compounded exposure creates a feedback loop where each hazard intensifies the impacts of the other.[176] Wildfires release massive amounts of particulate matter, reducing air quality and aggravating respiratory conditions, while extreme heat reduces the body's ability to cope with these pollutants. The combination has been shown to increase hospitalizations for respiratory distress and cardiovascular complications.[56,57] These combined exposures also impact mental health, as prolonged exposure to extreme heat and wildfire smoke contributes to stress, anxiety and long-term trauma. Displacement, property loss and uncertainty about future events exacerbate psychological distress, particularly for communities with limited economic resources or previous experience with evacuation and rebuilding.

Figure 15: Co-occurrence of wildfire and extreme heat in the KB HSDA

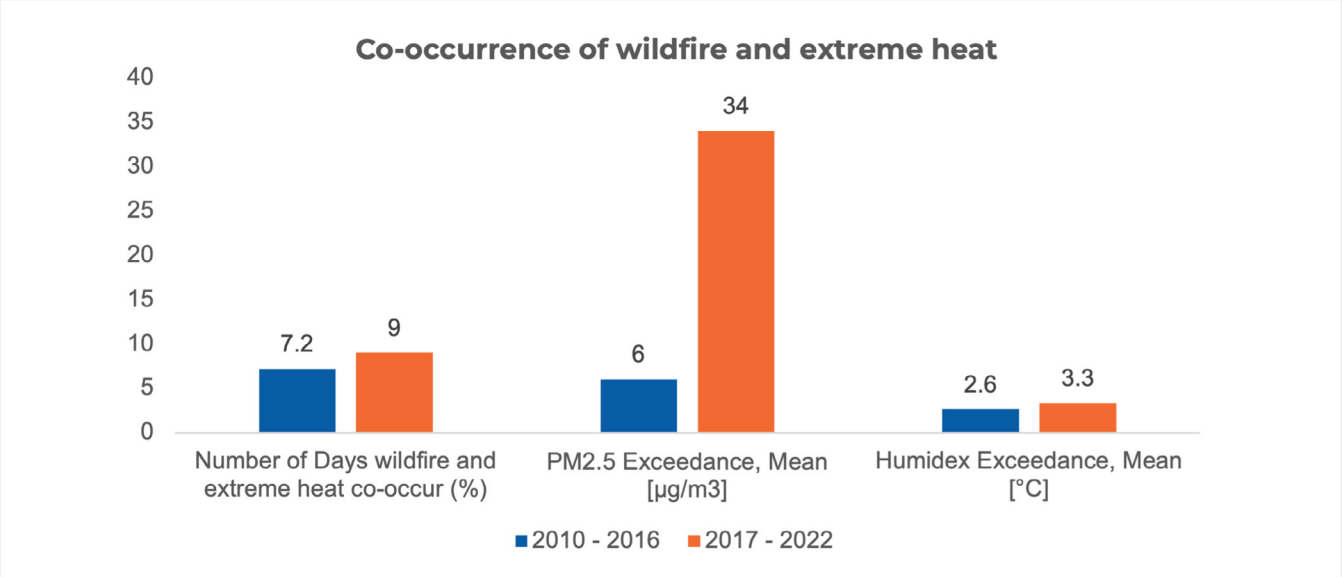


Figure 15 illustrates the increasing co-occurrence of wildfire and extreme heat events in the KB HSDA over two time periods: 2010– 2016 and 2017 –2022.[175] It presents three indicators which have all increased over this time period: percentage of days where wildfires and extreme heat co-occur, humidex exceedance, a measure that combines temperature and humidity to reflect human-perceived temperature, and PM2.5 exceedance, which represents particulate matter pollution levels associated with wildfire smoke. The latter has increased most dramatically, from 7.2 µg/m³ in 2010 –2016 to 45.7 µg/m³ in 2017 –2022.

Exposure to Flooding

Flooding is a recurring environmental hazard in the KB HSDA, driven by the area's geography, hydrological patterns and the increasing effects of climate change. This region is characterized by mountain ranges, extensive river networks such as the Kootenay, Columbia and Kettle Rivers, and rural communities, making it particularly vulnerable to the health, economic and environmental impacts of flooding. Seasonal snowmelt, combined with heavy spring rains, frequently leads to rising water levels, often overwhelming riverbanks. Low-lying areas, particularly those near major waterways, are at heightened risk of flooding during these periods.

Climate change is exacerbating these risks by increasing the frequency and intensity of extreme weather events. Warmer temperatures lead to faster snowmelt and more severe rainstorms, both of which contribute to unpredictable and severe flooding. The region has experienced multiple high-water events over recent years, resulting in heightened alert levels and evacuation orders being issued.[36–40] Residents in communities like Grand Forks have experienced repeat displacement due to floods.[106]

A lot of the housing stock in the region is older and in need of major repair, there are also homes in flood-prone areas.[177] Older houses often lack the necessary flood defenses, such as elevated foundations or waterproofing, leaving residents vulnerable to property damage and displacement. In rural areas, residents frequently rely on wells and septic systems, both of which can become contaminated during floods, compounding public health risks.

Flooding in the region and across the province frequently impacts critical infrastructure, including roads, bridges and utilities.[41–44] Washed-out roadways and damaged bridges disrupt transportation, isolating communities and delaying emergency responses.[43,44] Power outages are common during flooding events, particularly in rural and remote areas, further complicating efforts to maintain public safety and access essential services.[178] These damages to homes, businesses and infrastructure result in costly repairs and insurance claims.

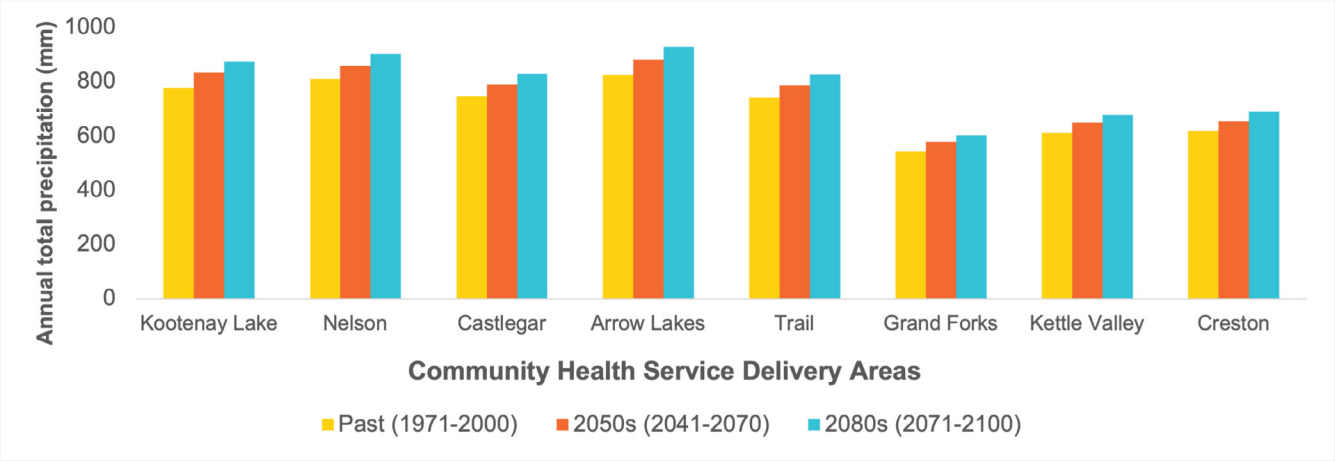
Flooding also has profound effects on soil structure, texture and other chemical properties of soil.[179] The region's fertile valleys are often used for agriculture, and flooding can render agricultural land unusable for extended periods. Floods have devastating effects on soil quality, crops and farm infrastructure, which affects the livelihoods of local farmers and straining the broader food supply chain.[180,181] Environmentally, floods disrupt ecosystems, they erode riverbanks, deposit debris, contaminate waterways, among other adverse effects.[182] These changes impact fish habitats, biodiversity and the overall health of the region's natural systems. The long-term ecological effects of repeated flooding events can destabilize local ecosystems, reducing their resilience to future climate challenges.

Climate models project that the KB HSDA will experience increases in annual total precipitation and maximum one-day precipitation which is sometimes called the "wettest day of the year" (Figures 15 and 16). These projected changes can significantly impact

multiple water bodies in the region such as rivers, lakes and reservoirs. Higher volumes of water can alter flow patterns, creating faster currents and higher water levels. In rural and mountainous areas, these elevated flows may exacerbate soil saturation, potentially leading to more frequent localized flooding.

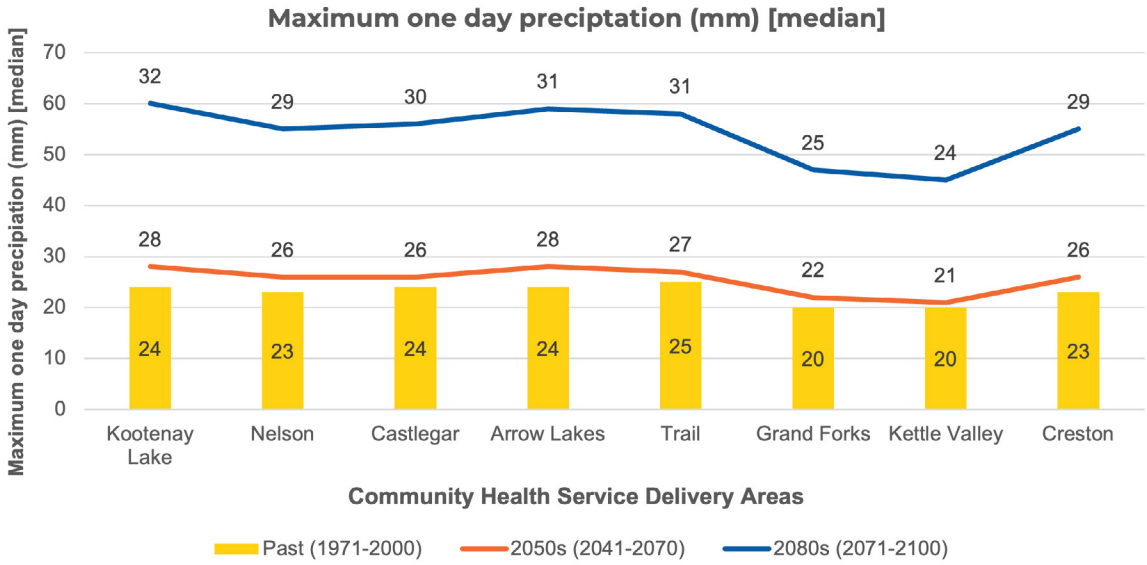
The possibility of heavier downpours. which concentrate large amounts of water in short timeframes, can significantly strain stormwater management systems, leading to flash floods that erode land, damage infrastructure and disrupt transportation. The interplay between greater year-round precipitation and increasingly heavy single-day storms can compound negative effects. Saturated soil from prolonged wet weather makes landscapes more vulnerable when a sudden torrent arrives. Floodwaters may pick up sediment, rock and vegetation, intensifying the destructive force of debris flows. Tourism and recreation may also be interrupted, as trails, campsites and ski hills contend with unstable ground conditions and altered snow accumulation patterns.

Figure 16[i]: Historical and projected maximum one-day total precipitation for all CHSAs in the KB HSDA, described as the largest amount of precipitation (rain and snow combined) that falls within a single 24-hour day in a year



[i] Climate projection data are from the Power Analytics and Visualization for Climate Science (PAVICS) data catalog. Specifically, the data was generated from the Coupled Model Intercomparison Project Phase 6 (CMIP6) version. They are presented under three Shared Socio-economic Pathway (SSP) scenarios. The SSP scenarios are used to characterize possible future development pathways for human societies. The scenario used here is high emission, corresponds to the climate scenario SSP5-8.5.

Figure 17: Historical and projected maximum one-day total precipitation for all CHSAs in the KB HSDA, described as the largest amount of precipitation (rain and snow combined) that falls within a single 24-hour day in a year



Health Impacts of Exposure to Flooding

Waterborne illnesses

Floodwaters often carry harmful pathogens, chemicals and debris, creating significant public health risks.[45,107] Contaminated drinking water sources can lead to outbreaks of gastrointestinal illnesses such as E. coli or cholera.[61] Residents relying on private wells are particularly vulnerable to water contamination during floods.[61]

Respiratory issues

Standing water and high humidity following floods promote mold growth in homes and buildings, contributing to respiratory conditions such as asthma and allergies.[46,47] Prolonged exposure to damp environments exacerbates these issues, particularly for individuals with pre-existing respiratory conditions and compromised immune systems.[47]

Injuries

Floods pose immediate physical risks, including drowning, falls and injuries caused by fast-moving water or floating debris.[45] During cleanup efforts, residents are also at risk of cuts, infections and musculoskeletal injuries from handling heavy debris and contaminated materials.[45]

Mental health conditions

The psychological effects of flooding are significant, with many residents experiencing anxiety, depression and PTSD as a result of property loss, displacement and the uncertainty

of recurring flood events.[183,184] These challenges are often more severe in rural areas where access to mental health services is limited.[184]

Populations that are Disproportionately Impacted

Indigenous communities

Indigenous populations in the region face heightened vulnerabilities due to systemic inequities, remote locations and reliance on natural water systems for drinking, fishing and cultural practices.[185] Flooding disrupts these essential activities, compounding the challenges faced by these communities.

Low-income households

Families with limited financial resources are less able to prepare for or recover from flooding events.[186] They may lack the means to purchase flood insurance, repair damaged properties or replace lost belongings.[181] These challenges prolong the recovery process and increase the risk of long-term displacement. For example, during the 2018 floods in Grand Forks, the neighbourhoods that were most impacted were neighbourhoods that had a larger proportion of rental housing and older houses.[187]

Older adults

Older adults are particularly vulnerable during floods due to mobility challenges and a higher likelihood of pre-existing health conditions.[188] Evacuation efforts are often more complex for seniors, who may require specialized transportation and assistance.[188]

Remote and rural areas

Flooding disproportionately impacts rural communities,[186] further isolating residents and cutting off access to emergency services, health care and supplies. Limited infrastructure in these areas further exacerbates vulnerabilities, making recovery efforts slower and more resource intensive.

Exposure to Cold and Winter Storms

The region's microclimates create significant variability in temperature and weather patterns, with colder conditions often observed in higher altitudes and northern-facing slopes. Climatic variability, driven by global climate change, has further increased the unpredictability of cold events. Sudden, intense cold snaps disrupt typical weather patterns, compounding the challenges faced by the population.

A substantial portion of the region's housing stock comprises older buildings that lack modern weatherproofing and are highly susceptible to heat loss.[177] Energy poverty exacerbates these issues, as low-income households may struggle to afford adequate heating, leading to prolonged exposure to harmful indoor cold.[177] Winter storms also increase the risk carbon monoxide poisoning as people resort to using portable generators, improperly ventilated wood stoves, and other means to heat their homes.[189,190]

The region's outdoor recreational culture also increases exposure to extreme cold. Activities like skiing, snowmobiling and ice fishing are popular but require preparation to mitigate risks. Those unprepared or underprepared for sudden weather changes or accidents during outdoor activities may face severe consequences, including life-threatening cold exposure. Inadequate protective clothing or prolonged shifts in sub-freezing temperatures often result in frostbite and hypothermia. Many residents are exposed to hazards such as icy terrain, which increases the risk of injury.

Winter road conditions are a significant hazard in the KB HSDA. In 2024, winter storm warnings were issued on Highway 3 from Hope to Princeton and from Grand Forks to Creston.[27–29] Snow accumulation and icy surfaces make travel treacherous, contributing to accidents and vehicle breakdowns and in some cases forcing roads to be shut down, as was the case with Montrose Hill in 2024.[191] For those travelling in remote areas, delays in assistance can leave individuals stranded in freezing temperatures for extended periods, risking hypothermia and frostbite. Limited public transportation services during these events can compound the challenges for residents without personal vehicles, isolating them further and hindering access to critical resources.

Health Impacts of Cold Weather

Extreme cold profoundly impacts human physiology, disrupting the body's ability to maintain thermal homeostasis and triggering a cascade of adverse health outcomes. The body responds to cold by constricting peripheral blood vessels (vasoconstriction) to preserve core temperature, which increases blood pressure and cardiac workload.192 This physiological response can lead to various health conditions, especially among vulnerable populations.

Hypothermia

Hypothermia occurs when the body loses heat faster than it can produce it, causing core temperatures to drop below 35°C.[193,194] Early symptoms include shivering, confusion and fatigue. As hypothermia progresses, it leads to slowed heart rate, respiratory failure, and, eventually, unconsciousness or death if untreated.[193,195] Older adults and individuals with chronic illnesses are at heightened risk due to their reduced ability to generate and retain heat.

Climate Impacts in Research

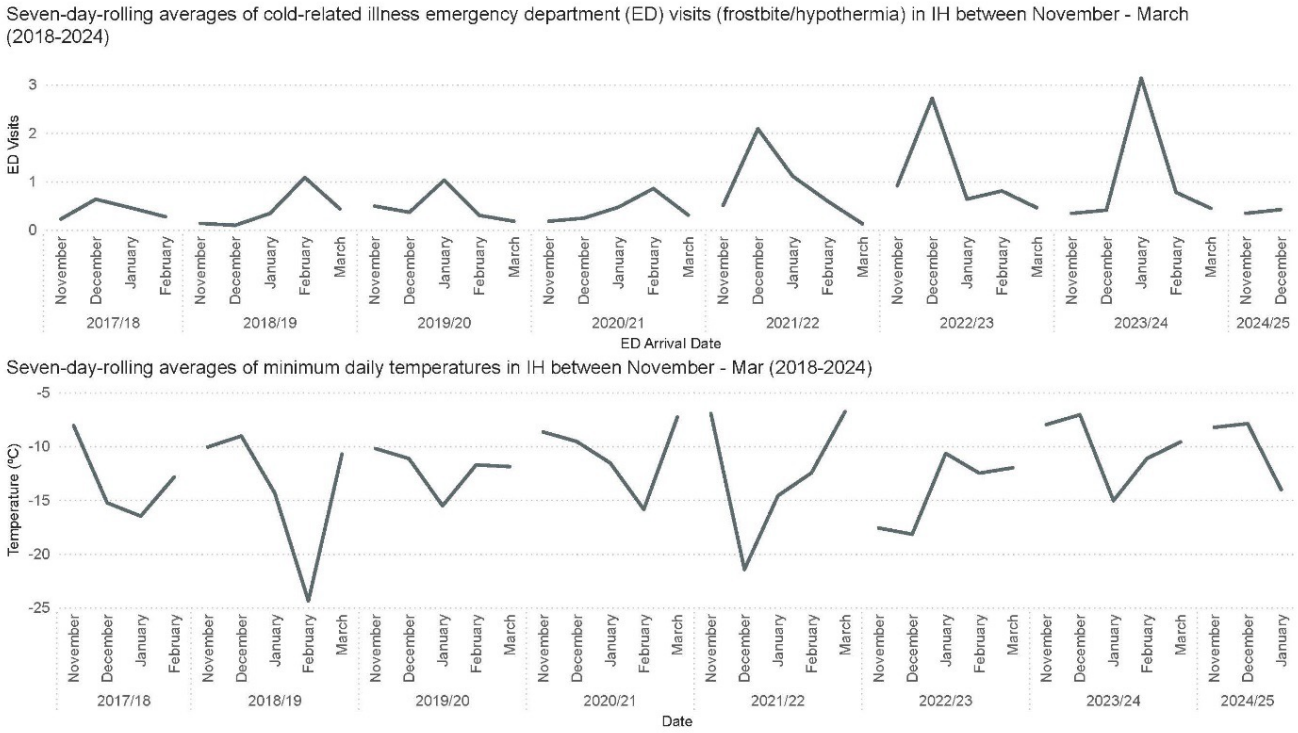
Frostbite and hypothermia among individuals experiencing homelessness in the South interior region of BC: a chart review of emergency department presentations

Experiencing homelessness is a risk factor for prolonged exposure to cold weather potentially resulting in cold-related conditions (frostbite and hypothermia). A chart review of patients with cold-related conditions that presented to IH EDs, December 1–31, 2022 showed that individuals experiencing homelessness accounted for 39% of the total presentations.

Frostbite

Frostbite, a localized injury caused by freezing of skin and underlying tissues, is another significant risk. It typically affects extremities such as fingers, toes, nose and ears. Frostbite can cause irreversible tissue damage, leading to necrosis and potential amputation. Early signs include numbness, tingling and pallor in the affected areas.[196] Extreme adventurers and those who are unhoused or underhoused are more likely to experience this impact.[30,196]

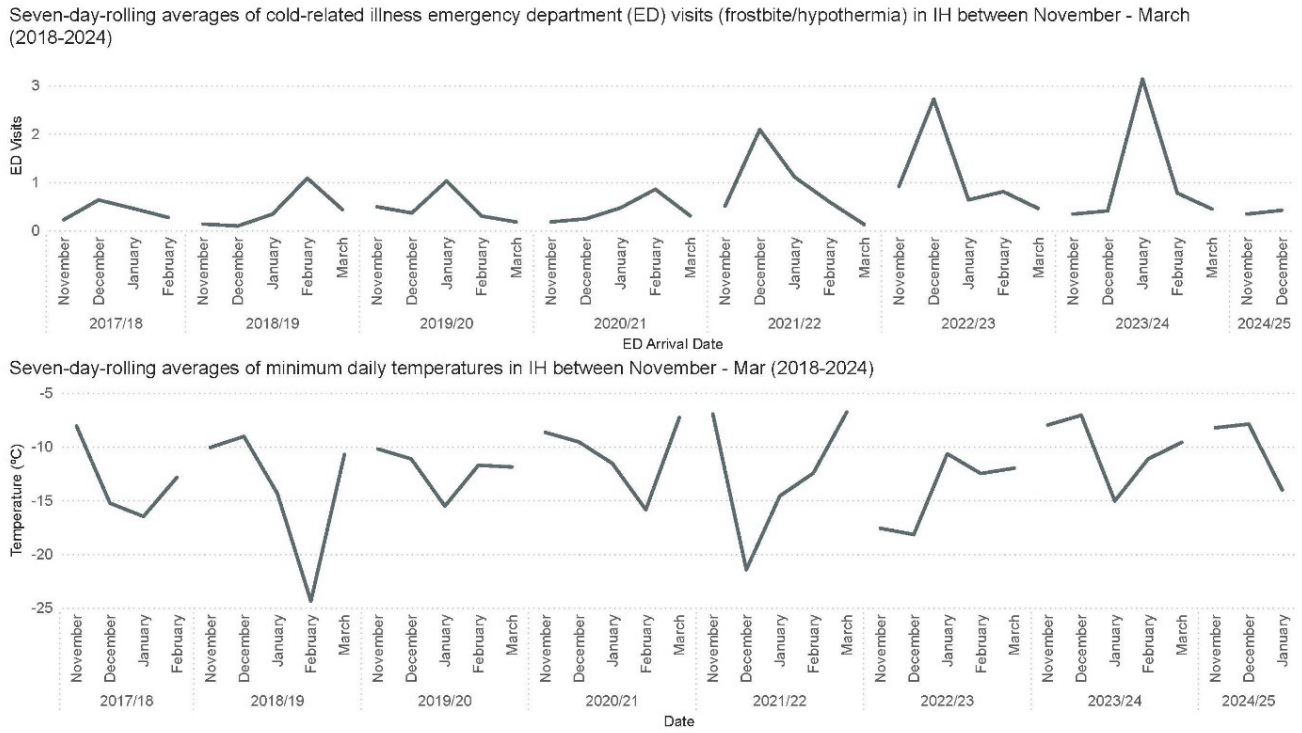
Figure 18: Seven day-rolling averages of cold-related illness emergency department visits presented with daily minimum temperature data in IH



From 2017/18 to 2024/25, the trend in cold-related illness (CRI) emergency department (ED) visits (from frostbite/ hypothermia) in IH followed the inverse relationship with daily minimum temperatures for the corresponding time period (Figure 18). While official heat warning criteria exist, an analogous system for cold warnings is not currently or formally established yet. In their public health guidance, the B.C. Health Effects of Anomalous Temperatures (HEAT) Coordinating Committee has highlighted the increasing trend of these types of cold-related injuries in the unhoused population during the last decade, across all regional health authorities 5. While citing ED data from IH and Northern Health that demonstrated that most hypothermia cases happened at 0°C or below, BC HEAT recommended that cold weather response plans should be initiated at 0°C or at warmer temperatures if wet, snowy or windy conditions are forecast.

For CRI in the KB HSDA, the trends were very similar to the that found in IH (Figure 19). The main differences in the KB were that the magnitude of impact was smaller, and the temperature minimums were higher, compared with IH overall.

Figure 19: Seven day-rolling averages of cold -related illness emergency department visits presented with daily minimum temperature data in KB HSDA



Notable cold-related illness (frostbite/hypothermia) emergency department (ED) demographic trends from 2018-2024: In IH, men were the most impacted patient gender. Most patients were not admitted as an inpatient nor did they arrive by ambulance (data not shown). For nearly all of the years, the age groups that were most impacted were those in their 20s, 30s and 40s. The only exception was 2019/20 with those in their 50s. The small number in the KB could not be stratified further to report on demographics (similar to heat-related data, again to protect privacy).

Data Notes:

- *Cold-related visits were based on CEDIS codes 201 – frostbite/cold injury and 205 – hypothermia, extracted from the IH admissions universe.*
- *Cold-related ED data and the associated daily minimum temperature data are displayed by fiscal year to group together the data from one winter season from November to March, for continuity in viewing trends.*
- *The 2024/25 fiscal year was not included when looking at breakdown of demographic data since the ED data was current as of December 31, 2024, and did not represent a complete winter season.*

Cardiovascular conditions

Cold exposure exacerbates cardiovascular diseases.[31,32] Cold-induced vasoconstriction places significant strain on the heart, particularly in individuals with pre-existing conditions like coronary artery disease or congestive heart failure.[192] Studies have shown spikes in cardiovascular mortality during extreme cold events.[31]

Respiratory conditions

Cold air irritates the respiratory tract, causing inflammation and increased mucus production. Individuals with asthma or COPD are particularly vulnerable, as cold exposure can worsen symptoms.[33] Prolonged exposure also increases susceptibility to respiratory infections such as pneumonia and influenza, as the immune system is compromised in cold conditions.[197]

Musculoskeletal and neurological conditions

Falls and injuries are common during icy conditions, leading to fractures and musculoskeletal strain.[34,35] Prolonged cold exposure can also cause numbness, reduced motor coordination and nerve damage, further increasing the risk of injury. Neurological symptoms, including confusion and impaired judgment, often occur in severe hypothermia, compounding the danger of cold exposure.[193]

Immune system suppression

The body's immune response is weakened by prolonged exposure to cold, increasing vulnerability to infections.[198] Reduced blood flow to extremities compromises the delivery of immune cells, while stress hormones released during cold exposure further suppress immune function.

Populations that are Disproportionately Impacted

Extreme cold and winter storms disproportionately affect low-income households, older individuals, Indigenous communities, the unhoused and underhoused, and rural populations. Low-income families struggle with rising heating costs and may lack proper home insulation, increasing their risk of hypothermia and respiratory illnesses.[199,200]

Older adults who face mobility challenges and are more susceptible to cold-related conditions such as frostbite and cardiovascular strain, especially if they are isolated during storms.

Indigenous communities, particularly those in remote areas, often experience delays in emergency services and supply shortages during severe winter weather, exacerbating existing health and economic disparities.

Those who are unhoused or underhoused, by virtue of their precarious housing situation are more exposed to extreme cold and suffer adverse health impacts.[30,196] Rural populations, with fewer resources and emergency response services, are more vulnerable to road closures, power outages, and limited access to medical care, prolonging the impacts of extreme cold events.

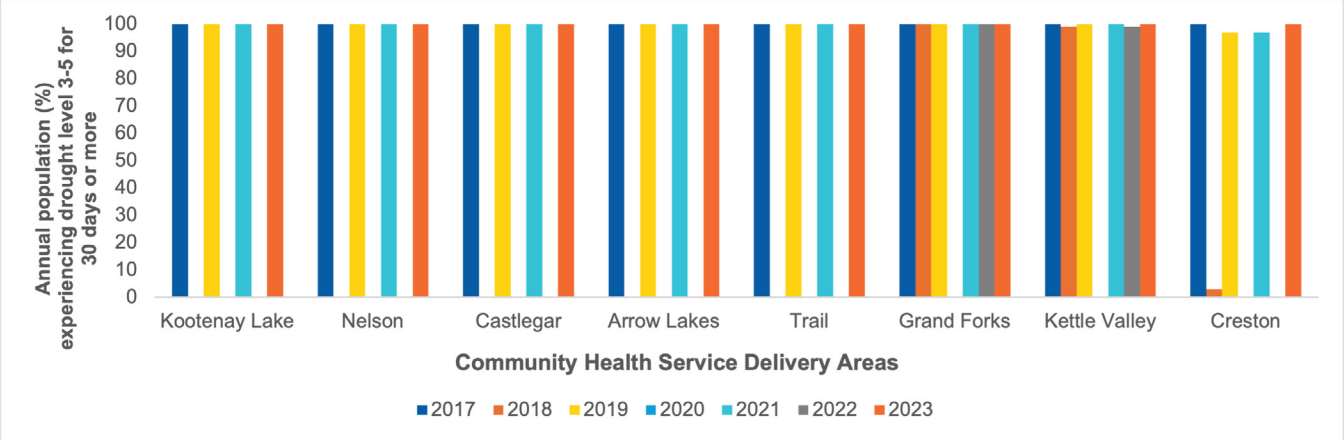
Exposure to Drought

The KB HSDA experiences a mix of climatic conditions, with semi-arid valleys and temperate mountain zones. Water availability is largely dependent on seasonal precipitation, snowpack levels and glacial melt. However, climate change is disrupting these patterns, leading to prolonged dry spells and reduced snow accumulation in the winter.[108,201,202]

Warmer temperatures are accelerating snowmelt earlier in the season, reducing the water supply available during the hotter summer months.[108] In recent years, the region has recorded extended periods of below-average rainfall, leading to declining river flows, soil moisture deficits, and increased stress on groundwater resources.[109,110] This variability in precipitation affects not only surface water availability but also the recharge rates of aquifers that serve as critical sources of drinking water.

Figure 20 shows the estimated annual percentage of population residing in regions with drought level 3 or higher for 30 days or more in the KB HSDA. It highlights the fact that two of the community health service delivery areas in the region have experienced this level of drought in 6 of the last 7 years, and all had this experience in 2023.

Figure 20[i]: The estimated annual percentage of population residing in regions with drought level 3 or higher for 30 days or more



Note that since 2021, drought levels in B.C. are measured using a 0 to 5 scale, with 5 the w severe, based on water supply from snow, rain and rivers. The core indicators used to set drought levels are 30-day precipitation and 7-day average stream flow.

[i] Drought level data were provided by GeoBC. See BC Drought Information Portal.

Climate Impacts in the News

In the winter of 2023/2024, ski hills in the KB HSDA region faced significant challenges due to unreliable and reduced snowfall. The Salmo Ski Hill, for instance, was operational for only 14 days, a stark contrast to its typical 35-day season. This decline in snowfall not only affected recreational activities but also had economic repercussions for local businesses dependent on winter tourism.

Many communities in the KB HSDA rely on surface water sources such as rivers, reservoirs and wells for drinking water. During drought conditions, these sources experience significant reductions in volume, affecting both municipal and rural water systems. People dependent on private wells face heightened risks of depletion, leading to increased costs for drilling new wells or securing alternative water sources.

Lower water levels can also lead to higher concentrations of contaminants in drinking water sources. Reduced flow in rivers and reservoirs decreases the dilution of pollutants, leading to increased risks of waterborne illnesses. Harmful algal blooms, which thrive in stagnant, warm water, pose additional risks to human and animal health. Reduced water availability also affects aquatic ecosystems, fish populations and biodiversity.[203,204] Lower river levels increase water temperatures, which can be detrimental to fish species such as salmon and trout.

Agriculture is a major industry in the region, with farmers heavily reliant on irrigation to sustain crops and livestock. The Province has had to step in to provide support.[48,49] Drought conditions lead to water restrictions and reduced irrigation capacity, which can result in crop failures that impacting farmers' income, and food supply chains.[49,205] Livestock producers also face challenges as grazing lands dry out and water shortages impact herd management.[49] The economic ripple effects extend beyond farmers, affecting local food markets and consumers.

Climate Impacts in the News

Life in the Kettle Basin, the heart of B.C.'s summer drought

For over a month in 2021, the Kettle River watershed, located in central southern B.C., has been under level five drought, the provincial government's highest rating putting a significant strain on cattle ranchers in the region. "A scarcity of feed due to strained, dry pastures has led to increased feed costs forcing many farmers to cull large portions of their stock, which could flood the beef market, lower the price and compound the hardship"

Across the province, drought conditions strain electricity production, prompting utilities to bring in power from out of province which raises the cost of electricity.[206] Lower-income families, who have limited resources, may struggle to afford higher bills or invest in water-saving infrastructure, making it more difficult for these households to adapt to prolonged drought conditions. Indigenous populations in the region often rely on traditional water sources to support their food systems and cultural practices. Drought conditions disrupt these activities, creating additional challenges for communities already facing systemic inequities in water access and infrastructure support.

Prolonged drought conditions heighten the risk of wildfires by reducing moisture levels in vegetation and soil.[203] Dry conditions create highly combustible landscapes, increasing the frequency and intensity of wildfires. The KB HSDA has already seen heightened fire risk during drought years.[50]

> *"We need to focus on drought and all the ways that drought is impacting us. I think it's one of the biggest ones that we are encountering, and it's not front of mind, at least not in the Kootenays. It is in Creston valley... Drought, food security, habitat loss, impacting fish populations, habitat. And the anxiety, when people don't have water and the risk of that. Also, how drought compounds wildfire, landslides and everything else."* *Workshop – Local government participant*

As climate change continues to influence precipitation patterns and temperature extremes, the frequency and severity of drought events are expected to increase.

Health Impacts of Drought

Drought conditions in the KB HSDA have far-reaching health implications, affecting individuals and communities in multiple ways. The prolonged lack of water availability not only threatens agriculture and ecosystems but also has significant consequences for public health, increasing the risks of illnesses, food insecurity and mental health challenges.

Water and food-related health risks

As water levels in rivers, lakes and reservoirs decline, the concentration of pollutants increases.[51] Lower water flow reduces the dilution of contaminants, leading to higher levels of bacteria, heavy metals and harmful algal blooms.[111,112] Additionally, the hot, dry and dusty conditions during droughts are also favourable to some food-borne pathogens.[52,53] Exposure to contaminated water and/or food can cause gastrointestinal illnesses, and in severe cases, toxic poisoning. Rural communities reliant on wells or surface water sources are particularly at risk.

Respiratory and air quality concerns

Drought conditions often result in dry, dusty environments, increasing airborne particulate

matter, which can result in irritation in the eyes, throat and airways.[52–55] Children, older adults and individuals with preexisting respiratory conditions are at heightened risk of hospitalization due to poor air quality. Reduced moisture in vegetation also increases the likelihood and severity of wildfires.[207] Smoke from wildfires contains fine particulate matter (PM2.5) and hazardous gases that contribute to cardiovascular and respiratory diseases.[53]

Stress and anxiety

Persistent drought conditions create economic instability, especially for farmers and rural residents whose livelihoods depend on water availability.[55] Financial stress and uncertainty contribute to increased rates of anxiety, depression, and even suicide among affected populations.[55] Rural and Indigenous communities, which are deeply connected to their land, face particularly severe emotional and cultural impacts.

Vector-borne and infectious diseases

Drought conditions alter local ecosystems, sometimes creating stagnant water pools that serve as breeding grounds for mosquitoes.[55] This can lead to an increased risk of vector-borne diseases such as West Nile virus.[53] Additionally, rodents may migrate in search of water, increasing the spread of hantavirus and other zoonotic diseases.[52] Water conservation measures can lead to reduced hygiene practices, increasing the risk of

Populations that are Disproportionately Impacted

Drought disproportionately affects agricultural workers, Indigenous communities, low-income families and rural residents. Farmers and ranchers face crop failures, livestock losses and financial instability due to water shortages, with long-term economic consequences for their livelihoods.

Indigenous communities, which rely on traditional land-based practices, experience disruptions in food security, access to clean water and economic stability. Low-income families are affected by rising food prices due to reduced crop yields, as well as limited access to clean drinking water in areas where supply diminishes.

Rural populations, particularly those relying on well water, face severe challenges as groundwater levels drop, increasing the cost and difficulty of securing a stable water source. These combined factors deepen socio-economic inequalities and increase the long-term vulnerability of these populations.

Health System Impacts of Climate-Driven Extreme Weather Events

The health system in the KB HSDA is also exposed to all the extreme weather events described. These events disrupt health-care operations, strain workforce capacity, and damage critical infrastructure, making it difficult for medical facilities to provide timely and effective care.

Workforce challenges

Health-care workers experience immense pressure during extreme weather events as they are also experiencing the various exposures while trying to support communities, leading to increased fatigue, burnout and staff shortages.[208,209]

Severe cold and storms disrupt transportation networks, preventing staff from reaching medical facilities and requiring available personnel to work extended shifts.

During heatwaves and wildfires, prolonged exposure to high temperatures and poor air quality leads to respiratory distress and physical exhaustion among workers, compounding staffing challenges. Mental health impacts are also significant, as repeated exposure to emergency situations, resource scarcity and high patient loads contribute to anxiety, depression and post-traumatic stress.[208] High turnover rates, exacerbated by extreme weather crises, further reduce the workforce's resilience and disrupt long-term continuity of care.

Participants in our engagement sessions highlighted the physical and mental stress faced by individuals working in climate response roles.

Individuals working in climate response roles, including emergency responders, mental health professionals, and those working in climate-related fields, are particularly affected by the stressors associated with climate change. Many of these individuals are dealing with the mental health consequences of responding to reoccurring crises while also experiencing the anxiety and stress that these events create in their own lives.

Conversations with IH staff highlighted the logistical challenges of delivering care – such as transport disruptions caused by flooding or extreme heat-related technical issues and the inability to operate medical equipment in extreme heat – that underscore the vulnerability of the health system during climate events. Staff themselves are impacted, dealing with health impacts, home evacuations, and at times, patient evacuations, and balancing other personal and professional

responsibilities during emergencies.

"We live rural remote, if someone's workplace is on order [evacuation order], the staff has to follow their clients. So, who is taking care of staff's homes, animals, as some of these individuals have farms." – Health System Partner

Furthermore, the impact on health-care workers is compounded by their exposure to the physical and emotional toll of frequent and severe climate-related events and the mental health distress they face from constantly having to deal with crises. Frequent events like wildfires and flooding disrupt both their personal and professional lives, leading to heightened stress and burnout. IH clinical staff members are often on call, with the expectation to continue regular operations during crises, which further exacerbates anxiety and fatigue. The looming threat of evacuations, both their own and the evacuation of their patients, combined with trauma-related stress from the constant state of readiness, further contributes to mental strain.

Additionally, the growing mental toll that reoccurring hazards are having on clinical staff is being compounded by the way climate-related information is communicated. Participants mentioned that while messaging around climate hazards is necessary, it is also intensifying stress, leading to a sense of helplessness and fatigue. This sentiment underscores the importance of clear, timely and targeted communication that ensures staff are informed and not overwhelmed, helping to reduce unnecessary fear and support their mental well-being during ongoing climate challenges.

Clinical ops and sustainability teams

Health-care facilities face structural damage and operational disruptions due to extreme weather events.[210] Power outages from winter storms, wildfires, floods, and heatwaves compromise essential medical equipment, including ventilators, dialysis machines, and refrigeration units for medications and blood storage.[210]

While backup generators provide temporary relief, they may not fully support operational needs. Extended outages can force hospitals and clinics to ration power, potentially leading to postponed treatments and worsened patient outcomes. Flooding can also weaken building integrity, and contaminate ventilation systems, necessitating costly repairs and temporary facility closures. Fire hazards from electrical overloads or heating system malfunctions increase risks for both staff and patients. Without robust infrastructure reinforcements, these challenges severely hamper the ability of medical institutions to provide uninterrupted care.

"The biggest thing that we see is the age of our infrastructure. We can't keep it cool or hot enough. We end up closing rooms because we can't admit people. We move them to other areas of the facility that aren't meant for people." – Health System Partner

Emergency response and logistics disruptions

Severe weather events create significant logistical challenges for health-care delivery. Snow and ice accumulation, flooding and wildfire-related road closures prevent ambulances from reaching patients in time, leading to critical delays in emergency response. Evacuation alerts and/or orders may mean that health-care facilities are evacuated, and patients transferred to sites outside the evacuation zone, which is a challenging undertaking.

> *"Wildfires are top of mind. Slocan had fire and we had to deal with evacuations for staff too. Other implications include where the patients need to be evacuated to. The coordination that goes into this is deeper rooted than regular operations. It's a big undertaking in operations and on top of that we have to deal with scheduling, and an incident command on call. All of this mixed together is a lot."*
> *– Health System Partner*

Rural and remote communities, already facing limited health-care access, become further isolated, increasing mortality risks for those requiring urgent medical attention. Supply chain disruptions further impede the delivery of pharmaceuticals, oxygen tanks and essential medical gear, reducing the system's ability to manage heightened demands. The reliance on just-in-time supply chains makes health-care facilities particularly vulnerable to these disruptions, emphasizing the need for emergency stockpiling and alternative supply routes.

System overload and capacity limitations

Extreme weather events often push health-care facilities to their operational limits. Rural clinics and hospitals often lack sufficient resources to handle surges in patient volume from various exposures resulting in rapidly depleted bed availability and strained emergency departments.

> *"Every year we're seeing severe wildfires. We have a responsibility to Home Health clients, so we need to make sure these individuals are evacuated safely. This is a huge strain on the system and on communities as well."* *– Health System Partner*
>
> *"Looming thought of 'Is something going to happen.'" Always being ready for evacuation is stressful, it's daunting, it's heavy."* *– Health System Partner*

Mental health cases also rise, necessitating more support, which is often underfunded and understaffed in rural regions. Drought conditions create systemic challenges, as hospitals and clinics rely on a consistent water supply for handwashing, surgical sanitation and infection control, and any disruption increases risks of hospital-acquired infections. Flooding can also introduce contaminated water into health-care environments, increasing the risk of waterborne diseases and mold-related respiratory conditions among both patients and staff.

Adaptive Capacity

Key findings

- Adaptive capacity refers to the ability of individuals, communities, and institutions to adjust to climate change impacts and reduce any associated health risks. Many of the factors that strengthen adaptive capacity are the same factors that contribute to community health and well-being.
- Mapping community assets helps identify strengths, gaps, and opportunities for collaboration. The KB HSDA has many organizations and assets that can and already are implementing climate adaptation actions that are contributing to adaptive capacity. This includes local governments, libraries, Indigenous partners, funding agencies, health-care partners, educational institutions, environmental stewardship organizations, economic development organizations, climate advocacy organizations, food system organizations, the private sector and organizations that serve vulnerable populations.
- Through the engagement sessions, we determined that there are opportunities to implement climate adaption actions that strengthen social connectedness, local food system resilience, nature-based solutions and community education, and improve climate data accessibility.
- Future action will need to consider existing barriers to adaption action including limited staff/volunteer capacity, community polarization, competing organizational priorities and inconsistent funding, especially in rural and Indigenous communities.
- Moving forward, increasing adaptive capacity in the KB HSDA will require sustained collaboration between IH and cross-sectoral partners.

Adaptive capacity refers to the ability of individuals, communities and institutions to adjust to climate change impacts and reduce any associated health risks. Through our CCHVAA process, we used the term adaptive capacity synonymously with the term climate change resilience.

The factors that influence how well a community can adapt are aligned with the factors that determine health and well-being, including access to resources (financial, human and social resources), access to technology and information, along with existing infrastructure, organizations and programs. Therefore, from a population and public health perspective, actions that improve health system resilience to climate change and also reduce the health risks of climate change are the same actions that build adaptive capacity at the community-level.

For example, by promoting more tree coverage in our communities or by supporting building retrofits, we can promote and protect health during extreme weather events while also mitigating greenhouse gas emissions. We often describe the multi-faceted benefits of climate adaptation actions as the co-benefits of climate action recognizing one action may produce positive benefits across sectors of society.1 These co-benefits are enhanced when decision-makers across sectors collaborate to implement adaptation actions.

Mapping of Community Assets and Partners

Mapping community assets is an important step in assessing adaptive capacity as it provides a baseline understanding of the human and organizational resources and strengths in the region. We mapped organizations throughout the KB region that were identified during engagement sessions. Though these do not represent all the organizations involved in climate adaptation work in the region, they do represent organizations that participants identified as currently supporting climate adaptation or organizations that could be collaborators in the future.

Figure 21. Partners in the KB HSDA who can support strengthening adaptive capacity

Local Government and Libraries

- Municipal and Regional Governments (17 municipalities and 2 regional districts
- Libraries (13 libraries)

Food System Organizations

- Central Kootenay Food Policy Council
- Boundary Food Hub
- Emergency food providers`

Agencies that Support Local Governments

- BC Housing
- Community Energy Association
- Asset Management BC
- Government Finance Officers Association of British Columbia

Climate Change Advocacy Organizations

- West Kootenay Climate Hub
- Climate Caucus

Indigenous Partners

- First Nation partners (Ktunaxa Nation, syilx Nation, Colville Confederacy)
- MNBC

Education Institutions

- Selkirk College
- Selkirk Innovates
- School Districts

Environment Stewardship Organizations

- Living Lakes
- Elk Root Conservation
- Youth Climate Corps
- Friends of Kootenay Lake
- Columbia Basin Environmental Education Network

Private Sector

- Local businesses
- Industry (e.g. Teck, Kalesnikoff)
- Chamber of Commerce

Funding Agencies

- Columbia Basin Trust
- United Ways
- Community foundations

Healthcare Partners

- IH programs and staff
- Health Emergency Management BC
- Doctors and Nurses for Planetary Health

Organizations Serving Vulnerable Populations

- Community Action Teams
- Nelson Cares
- Castlegar Integrated Services
- Trail United Church
- Seniors Centres
- Trail Skills Centre
- Columbia Basin Alliance for Literacy
- ANKORS

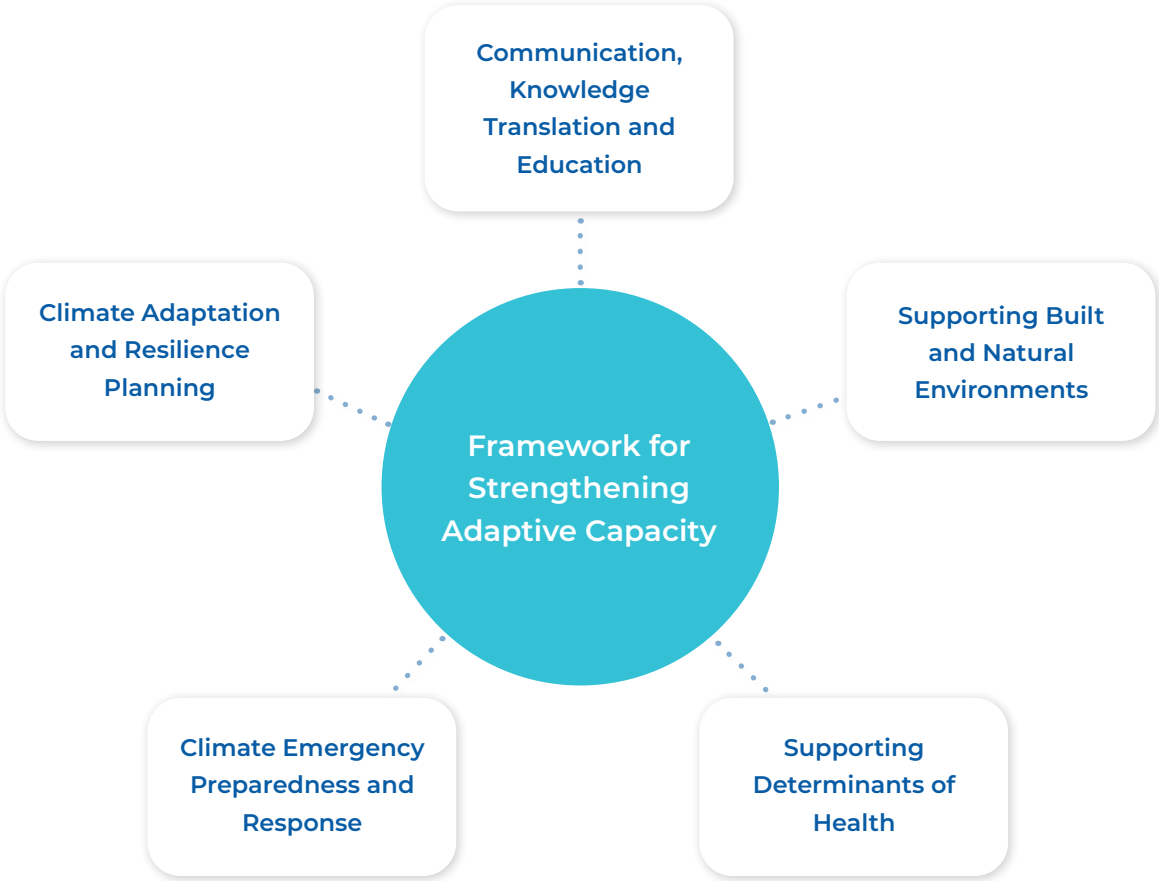
Economic Development Organizations

- Community Futures
- Greater Nelson Economic Development
- Lower Columbia Initiatives Corporation

Strengths and Opportunities to Build Adaptive Capacity

The following discussion explores the strengths and opportunities that underpin adaptive capacity in the KB HSDA. This section highlights the assets, resilient community networks, and proactive policy and planning frameworks already present in the region. These elements form a foundation and framework upon which further adaptive strategies can be built, enabling local systems to better respond to the evolving challenges posed by climate change. This section provides examples of current actions, but a more fulsome list of actions can be found in Appendix A.

Figure 22. Framework for Strengthening Adaptive Capacity



Climate adaptation and resiliency planning

Planning can provide a framework for action and spread awareness about the interconnected impacts of climate change, health and well-being. These strategic efforts often involve identifying local vulnerabilities—from increased wildfire activity to more frequent heatwaves—and then designing interventions that protect critical infrastructure and public health services.

For example, retrofitting buildings and constructing flood defenses can reduce the immediate risk of climate hazards, while longer-term plans such as revising land-use design and upgrading health-care facilities can create a robust framework for sustaining essential services even during extreme weather events.

This planning often goes beyond physical infrastructure: it can also strengthen community adaptive capacity by integrating climate information into decision-making, promoting awareness and fostering local leadership. By engaging a range of stakeholders—from government agencies to community organizations—resilience planning can ensure that adaptation strategies are shaped to local conditions and vulnerable populations have a voice in the process.

Examples of Current Initiatives	
Community-level initiatives: • Creston Climate Action Plan • Nelson Next Climate Action Plan • RDKB Climate Action Plan • RDCK Ideas for Climate Action	**Health authority initiatives:** • IH Climate Change and Sustainability Roadmap

Climate emergency preparedness and response

Preparedness plays a crucial role in building adaptive capacity by ensuring that communities are ready to face and recover from extreme weather events and other climate-related disasters. And by developing robust emergency response plans, communities can significantly reduce the immediate impacts of climate shocks, such as floods, heatwaves and wildfires.

This proactive approach minimizes disruptions to critical services—particularly health care—and limits economic losses, thereby reinforcing the overall resilience of communities. The process of developing emergency preparedness and response plans often integrates community engagement. This kind of collaboration within and across local communities, along with leveraging data and traditional knowledge, can ensure planning is tailored to address specific local vulnerabilities and needs. When individuals and communities are equipped with the tools and knowledge to manage emergencies, such as having clear evacuation plans, accessible information channels and community support networks, they can reduce the level of uncertainty associated with exposure to these events.

"The cooling centre in Trail was planned in advance, starting in late May to early June, in anticipation of extreme summer heat. The centre could only open when Environment Canada confirmed temperatures met the trigger point. Initially, it stayed open for eight days before closing for three days, then reopening due to another heatwave.

During the closure, volunteers distributed cold water and freezies, and provided education to vulnerable populations, such as seniors and people experiencing homelessness, about where to find cooling resources. When the centre reopened, people had less anxiety because they knew alternative cooling locations, showing the success of the educational outreach.

The experience highlighted the importance of early, on-the-ground education, especially for those with mental health and addiction challenges who need repeated messaging to understand how to stay safe. The key takeaway was that education and communication help reduce anxiety and improve preparedness for extreme weather events". *Workshop – Local government participant*

Examples of Current Initiatives

Community-level initiatives:

- RDCK Neighbourhood Emergency Preparedness Program
- Grand Forks Flood Mitigation Program
- City of Castlegar Wildfire Protection Plan
- City of Trail and Nelson Extreme Temperature responses
- Emergency Preparedness Webinars for Métis Chartered Communities

Health authority initiatives:

- Climate Resilience Leadership Program (in development)
- Seasonal Readiness Working Group
- IH Climate Exposure Screen
- IH Site-Level Climate Assessment
- Site-level Emergency Response Plans
- IH Heat, Cold and Air Quality Plans
- IH micro-grants for organizations supporting vulnerable population in cold weather

Communication, knowledge translation and education

Access to climate-informed education, data and knowledge translation can increase awareness of climate change impacts, empowering individuals and communities to take informed action. It can also support evidence-based adaptation strategies by bridging the gap between research and practice and improving coordination across sectors.

Collaborating across sectors to create and share messaging that is relevant for community is essential to ensure that messages are heard and learning opportunities are tailored to address the unique needs of each region. This also presents an opportunity to provide education in a

way that reduces community polarization on topics related to climate adaptation.

Education is also key to protecting those most at risk, such as people experiencing homelessness, by providing accessible information on shelters and resources ahead of extreme weather events. It is vital to consider these populations in both the planning and response to climate hazards, ensuring that they have the necessary resources and support to navigate these climate-related challenges.

Specifically related to IH's role, Medical Health Officers and IH staff were seen to be a credible and trusted source for communicating information to local government audiences. Participants in our engagement sessions highlighted the importance of engaging with local governments, school districts, community organizations such as the Columbia Basin Environmental Education Network (CBEEN), Youth Climate Corps and local libraries to mobilize communities to prepare for climate hazards and to further incentivize participation in local adaptation efforts.

However, participants in our engagement sessions also felt there was an opportunity to improve access to consistent and reliable local climate data that reflect local environmental conditions. Community partners could benefit from support to appropriately apply and integrate climate data into their work. This opportunity extends to broader knowledge translation of existing tools like the State of the Basin Initiative and, the Columbia Basin Climate Source developed by Selkirk College and Columbia Basin Trust. Improving access and understanding of data tools like this can empower communities with the information they need to make informed decisions and take proactive steps towards adapting to climate change and building resilience.

Examples of Current Initiatives

Community-level initiatives:

- Selkirk College State of the Basin
- Columbia Basin Climate Source
- Columbia Basin Environmental Education Network - Wild Voices Programs
- Neighbours United – Deep Canvasing
- RDKB Boundary Watershed Webinars – Science & Learning
- Youth Climate Corps – Community Ambassador
- Ktunaxa Nation – Cultural Burning

Health authority initiatives:

- 2023 MHO Report on Climate Change Health and Well-Being
- CCHVAA to be used to develop tailored knowledge translation with partners
- Health and climate education shared through seasonal communication plans

Supporting determinants of health

Initiatives across the region that support the determinants of health can also reduce inequitable impacts of climate change by empowering communities and creating systems of support that address the determinants of health. Through our engagement session, participants identified strengths and opportunities to build adaptive capacity in ways that support the determinants of health in the region.

An area that was highlighted is social connectedness which plays a key role in building resilience to climate impacts, especially as the COVID-19 pandemic has increased isolation. This is particularly important in rural areas, where strong community networks can provide crucial support during extreme weather events. Engaging community members in climate adaptation efforts ensures that solutions reflect local needs. Participatory approaches, including input from those with lived experiences, can lead to more effective, inclusive and long-lasting climate resilience initiatives. However, limited resources and short-term funding create challenges for sustaining initiatives that foster social bonds and enhance resilience.

Additionally, participants identified the need for local food system resilience and food security. While strengthening local food systems to increase self-sufficiency and reduce reliance on external food sources has been a priority for population health for many years, local food systems are also impacted by climate change.

As noted in this report, drought and other weather events negatively impact agriculture in the KB HSDA. Extreme weather events can destroy crops and disrupt food supplies in both the local and global food systems. There is an opportunity to identify both strengths and threats to the local food system to increase resiliency.

While increasing food infrastructure such as greenhouses in food insecure communities can help increase local production, planning for threats from drought and other extreme weather events is necessary. There are many organizations in the KB HSDA working on projects to improve resilience to various aspects of the food system including growing/producing, transportation and distribution, as well as emergency access to food. However, participants felt that there were still opportunities to leverage these projects and further collaborate. For example, there are opportunities to broaden the reach of some projects across multiple communities or include climate adaptation actions into projects that support complimentary factors, such as community dinners, that are strengthening social connectedness.

For the Ktunaxa Nation and Métis communities, harvesting traditional foods and medicines is essential to cultural identity, but climate change is disrupting access. Greenhouse farming offers a potential solution, but it must respect cultural customs. Elders and Indigenous leadership play a key role in ensuring food production aligns with traditional practices, which inherently prioritizes planetary health, reduces impacts on the climate and incorporate emergency planning. Maintaining cultural connections through food and medicine, along with community knowledge-sharing, is vital for future generations. Climate-resilient food systems should integrate new approaches while honoring and

preserving cultural traditions.

Examples of Current Initiatives	
Community-level initiatives: • Boundary Food Hub • Grow and Connect: Kootenay-Boundary Distribution Pilot • Resilience and Alternative Food Network • Bridging Rural Homelessness Project • RDCK Housing Needs Assessment and Report • Well-Being in the Boundary Region: Strategy to Eliminate Poverty	**Health authority initiatives:** • Support for community-level poverty reduction policy and initiatives • Support for community-level action to support vulnerable populations

Healthy built environment team

Plans and policies shape the ways in which we live, work and move within our communities. Thus, policies and programs that adopt a climate informed approach to the decision making around land-use and ecosystem management can build resilient communities and systems the support health and well-being.

Participants in our engagement sessions who had experience in municipal governance emphasized the opportunity to integrate nature-based approaches like tree canopy expansion, riparian restoration, making communities FireSmart, and ecosystem protection, to help community infrastructure withstand climate impacts.

There is also an opportunity to use proactive community planning as a tool to build resilience. For example, sustainable transportation plans that include actions related to active transportation and incentives for carpooling or using public transport, can reduce carbon footprints and support the process of adapting to the impacts of climate change. IH Clinical Operations staff highlighted the opportunity to retrofit aging IH infrastructure and design new facilities to endure extreme weather. For example, upgrading HVAC systems, improving energy efficiency, and ensuring public buildings remain operational during climate events are key priorities for resilience planning.

Examples of Current Initiatives	
Community-level initiatives: • Official community plans (OCPs) that integrate climate change resilience • RDKB Floodplain Mapping and Management Bylaw • South Kootenay Green Link Active Transportation Plan • RDCK Regional Energy Efficiency Program • yaqan Nu?kiy Wetland Restoration	**Health authority initiatives:** • Support integrating health evidence and an equity lens into land use planning and policies such as OCPs

When considering the implementation of these opportunities, it is also important to consider how the barriers to building adaptive capacity may be addressed.

Limited staff and volunteer capacity

Many of the organizations we engaged mentioned the significant barrier that limited staff and volunteer capacity can have on the implementation of climate adaptation action. Additionally, many climate adaptation efforts rely on volunteers which is challenging as volunteerism is declining and climate response work becomes even more complex. For example, many Métis Chartered Communities are volunteer-led, and there is a growing difficulty in finding people with the time or capacity to work on multiple projects simultaneously. Community organizations are also facing challenges in succession planning for volunteers, which can leave critical programs understaffed.

Community polarization significantly hinders climate adaptation efforts

Through our engagement, our participants cited that there has been a growing distrust of government action since the COVID-19 pandemic. Misinformation and disinformation further fuel skepticism, with some residents questioning the relevance of local climate action in addressing a global issue. This polarization weakens communication and collaboration, making collective climate adaptation efforts more challenging.

Competing demands for many organizations

Many people working in climate adaptation are already stretched thin, balancing immediate emergency response needs with the long-term planning and implementation of climate adaptation actions. Staff are often doing climate-related tasks “off the side of their desks” while balancing the work with competing organizational priorities, meaning they cannot dedicate sufficient time or resources to prioritize sustainability and adaptation projects. This limited capacity is compounded by staff burnout and the failure to properly address climate readiness alongside daily operational tasks.

Inadequate and inconsistent funding disproportionately impacting rural and Indigenous communities

Participants spoke about the inequities in funding distribution between urban centres and some rural and remote areas. Many communities are struggling to secure consistent funding for essential programs such as heating and cooling centers, shelters, and mitigation initiatives. For example, the current provincial funding pathways for extreme weather response do not compensate for the planning and preparatory actions that are needed to activate a response. Without stable and adequate financial support, these programs cannot operate efficiently or sustainably, leaving communities vulnerable during extreme weather events or climate-related emergencies.

Moving forward, increasing adaptive capacity in the KB HSDA will require sustained collaboration between IH, local governments, Indigenous partners, funding agencies, and community organizations and institutions. The following pathways and strategies offer opportunities to strengthen adaptive capacity and build resilience in the face of increasing

Pathways to Build Adaptive Capacity

The pathways and the strategies presented here emerged from our assessment process. They are not intended to be prescriptive but rather identify ways in which adaptive capacity can be strengthened in the KB HSDA. Some of these pathways include strategies that could contribute to adaptive capacity in the near term, whereas some pathways include strategies that build longer-term adaptive capacity and resilience. Some of the strategies are more specific to roles that IH can play, and other strategies will require collaboration with external partners.

Pathways	Strategies	Resources
Improving Near-term Adaptive Capacity • These pathways and strategies represent opportunities to work through some of the issues and barriers identified to be impacting how communities can plan and respond to climate events currently.		
Climate Adaptation and Resiliency Planning	• Baseline work to ensure there is framework for action and spread awareness about the interconnected impacts of climate change, health and well-being • Strategies for this pathway can include many of the strategies below	• Preparing for Climate Change

Climate Emergency Preparedness and Response	**IH Strategies**
	• Strengthen IH's role in preparedness and response efforts by actively participating in emergency preparedness planning with local governments:
	  • Medical health officers and IH staff enhance credibility of work by presenting to local government councils
	• Clarify internal roles and responsibilities for preparedness and response by mapping out IH's planning and response actions across all hazards
	• Advocate to BC HEAT and Environment and Climate Change Canada (ECCC) for greater transparency on weather monitoring station locations to improve local interpretation of forecasts
	• Explore opportunities for IH Employed Student Nurses to conduct outreach to vulnerable populations during summer months, providing support related to extreme heat and wildfire smoke exposure
	• Implement climate resilience program for IH leadership to support staff health and well-being
	
	Collaborative Strategies
	• Support mental health resilience by considering mental health as part of climate preparedness efforts:
	  • Establishing mental health training for individuals responding to climate emergencies
		• BC Heat Alert Response Plan
		• Public Health Recommendations to Reduce the Impacts of Exposure to Winter Weather on People Experiencing Homelessness
		• IH Employed Student Nurse program
		• Mental Health and Climate Change Alliance
		• PHSA – Psychosocial First Aid resources
		• Climate Wellbeing Resource Kit

Communication, Knowledge Translation and Education	**IH Strategies**
	• Refine IH's hazard-specific communication plans annually, incorporating community feedback to ensure messaging is relevant and addresses multiple risks (e.g., multiple hazards, mental health impacts)
	  • Collaborate with regional partners (local governments, community organizations) before each season to tailor key hazard communications to local contexts (e.g., provmoting awareness of cool public spaces)
	• Share findings from the Climate Change and Health Vulnerability and Adaptation Assessment (CCHVAA) to strengthen the connection between climate projections and health impact data, supporting evidence-based decision-making
	• Build capacity and confidence internally for population health programs to integrate a climate change and health lens into knowledge translation work with external partners
	
	Collaborative Strategies
	• Engage new partners to raise awareness of the links between climate change and health year-round and during climate events.
	  • Partnering with libraries, recreation centers, and employment services to disseminate climate and health information.
	  • Partnering the academic institutions that are delivering community-based research projects that enhance adaptive capacity such as SFU BREATHE
		• CCHVAA Knowledge Translation items to be developed early summer 2025

Building long-term adaptive capacity • These pathways and strategies represent opportunities to collaborate with Indigenous partners, local governments and community organizations with climate adaptation and action planning. These strategies can serve as a next step following this assessment to provide in-community support by helping to integrate findings from this assessment into community planning processes and programs.		
Supporting Determinants of Health	**Strengthening Social Connection and Cohesion** **IH Strategies** • Integrate a climate and health lens into frontline public health practice (e.g., public health nurses who provide breastfeeding education or postnatal check-ins can also offer tailored guidance and information about community services during wildfire season) • Encourage frontline staff to connect clients with local social programs (e.g., library events, community programs) to strengthen community ties	• Public Health Guidelines for Social Connection: Building Healthier Lives and Communities | Social Connection Guidelines • Social Prescribing Resources

	Collaborative Strategies
	• Embed social connectedness principles into policies and environments that foster community interaction
	• Support investment in social events and programs that enhance well-being and resilience:
	  • Columbia Basin Trust Funding Programs, community programs, integrated service hubs (e.g. The Hub in Nelson); connect climate resilience to this ongoing work
	  • IH can support investments by writing letters of support for grants, etc.	

	Supporting Resilient Local Food Systems
	IH Strategies
	• Identify role in supporting Indigenous food security and sovereignty as it relates to climate resilience and well-being
	
	Collaborative Strategies
	• Use health evidence to advocate for:
	  • Technological, social, and economic innovations that support a resilient, low carbon local food system in the KB HSDA
	  • Local food programs and projects that enhance regional food access that include an emergency planning lens (e.g., community food hubs regional food distribution projects, emergency food access initiatives)
		• Regional Adaptation Strategy for the Kootenay and Boundary Region
		• Environment and Climate Regional Guidebook
		• Climate Change Mitigation in the Food System

Supporting the Built Environment and Natural Environment	**Collaborative Strategies**
	• Strengthen local government climate action by promoting the health and climate co-benefits through community planning and implementation. This can include:
	  • Implementing the BC Step Code to improve building energy efficiency
	  • Expanding retrofit programs that prioritize renters and low-income community members
	  • Housing strategies that consider current and future climate impacts
	  • Using natural asset management for climate resilience
	  • Planning for and implementing public indoor and outdoor spaces that consider current and future climate impacts
		• Advancing Adaptation Case Studies
		• Climate Change, Health Equity and the Built Environment

Summary and Path Forward

Key learnings

- **A range of increasing climate hazards impact health and access to healthcare:** Over the past few decades, the region has experienced longer, hotter summers and increasingly variable precipitation patterns, setting the stage for fire-prone conditions and fluctuating river levels that threaten infrastructure, homes and livelihood. While some larger centres in the region offer relatively robust health-care services, many rural communities rely on small clinics or distant hospitals that can be difficult to access during emergencies.
- **A variety of physiological, socioeconomic and geographic factors heighten the risk:** Factors such as high prevalence of chronic conditions, older housing stock, and remote communities—add further layers of challenge. For example, limited incomes often restrict the capacity to invest in home retrofits (e.g., better insulation to regulate indoor temperature) or relocate when needed.
- **There are notable strengths and assets to build on:** Despite these barriers, many communities have cultivated strong social cohesion—neighbours regularly check on vulnerable community members, share equipment and pool resources during crises. Formal and informal collaborations between local governments, Indigenous communities, health authorities and volunteer-led initiatives, also contribute to improved communication and more effective implementation of adaptation actions.

Building on the insights from this assessment, the next steps are focused on transforming the information into practical actions that benefit both our communities and the local health system. The key is to use this knowledge to build resilience and improve preparedness, ensuring that everyone is better protected against the evolving challenges posed by climate change.

This assessment was created to take a deep and thoughtful look at how climate change affects public health in the KB HSDA. It wasn't just about providing weather facts or predicting the next storm—it was about understanding how changes in our environments can affect the everyday lives and health of people in our communities. We know that climate change is much more than just rising temperatures or shifting weather patterns; it also touches on our social lives, our jobs, and our overall well-being. With this in mind, the assessment aimed to connect these dots and provide a full picture of the challenges that come with a changing climate as well as the opportunities to build on community strengths and bolster resilience.

This meant looking carefully at how extreme weather events like heatwaves or heavy rains can lead to issues such as heat stress, breathing difficulties, and even waterborne diseases. By studying these effects, we were able to identify the most vulnerable areas and groups within the region. For instance, we looked at the kinds of communities that might be more sensitive to the impacts of wildfire smoke or heatwave due to the health status of the community, or which communities might not have easy access to healthcare facilities during an emergency. However, we didn't want to simply record what is happening now; we also wanted to explore how these challenges might evolve. Using historical data along with data from predictive models, the assessment highlighted potential future scenarios. This forward-looking approach is very important because it helps us plan ahead. If we know that certain weather patterns are likely to become more frequent or intense, we can begin to prepare strategies that will keep our communities safe and healthy in the long run.

A key strength of this assessment was the way it brought together different kinds of expertise, and data. We consulted people such with local expertise such as health professionals, community planners, community leaders. and gathered a wide range of environmental, socio-economic and health data to ensure that our analysis was both broad and deep and considered the unique qualities of the KB HSDA. This approach meant that we didn't just focus on one aspect of the problem. Instead, we looked at both the more direct impacts of climate hazards such as heat related illness and the less visible ones, such as the increased strain on our local health services and the economic challenges that come from environmental changes. This comprehensive approach helps us see the whole picture and not just isolated parts of the problem.

What have we gained?

- **Insights into how exposure and sensitivity intersect:** The assessment provides a clearer picture of where vulnerabilities exist and highlights the specific risks faced by different groups. Local leaders, community organizations and IH can use this detailed information to identify which populations need the most support. The information from this assessment can be a tool for driving local initiatives and fostering a culture of preparedness
- **An understanding of opportunities for collaboration:** The assessment highlights the need for a variety of local organizations to come together, share experiences, and collaborate on solutions that directly address their unique challenges. There could be opportunities to collaborate with organizations that aren't already involved directly in the work such as economic development and new immigrant groups. Establishing regular communication channels and partnerships can help align efforts, ensuring that community-driven initiatives and health policies reinforce each other. Joint workshops, planning sessions, and communication plans can facilitate this collaboration, making it easier to track progress and adapt strategies over time.
- **Leverage points for the health system to enhance resilience:** The health system can leverage these findings to enhance its readiness and response to climate-related health issues. Health authorities and local medical providers can use the assessment to pinpoint areas where health services are most likely to be strained during extreme weather events. This information can complement other assessments within the health system can guide decisions on resource allocation, such as where to bolster healthcare infrastructure, increase staffing, or improve access to care during climate events. By integrating climate vulnerability data into health system planning, the system can adopt more proactive measures.

Taken together, the assessment suggests to strengthen adaptive capacity include climate adaptation and resiliency planning; climate emergency preparedness and response; communication, knowledge translation and education; and supporting the determinants of health, built and natural environments. By continuing to align these strategies with community-driven priorities—while leveraging both local knowledge and external expertise—the KB HSDA can maintain and enhance its overall climate and health resilience.

Appendices

Inventory of Local Actions that Strengthen Adaptive Capacity

Year	Community	Hazard	Initiative	Lead Organization	Target Audience
Climate Adaptation and Resilience Planning					
In development	Creston	All Hazards	Creston Climate Action Plan (DRAFT)	Town of Creston	Community-wide
2024	RDCK	All Hazards	RDCK Ideas for Climate Action	RDCK	Community-wide
2024	Métis Communities	All Hazards	The Métis Nation Climate Change Strategy	Métis Nation Council	Métis Communities (across Canada)
2022	RDKB	All Hazards	RDKB Climate Action Plan	RDKB	Community-wide
2020	Métis Communities	All Hazards	Métis Nation Council Climate Change and Health Vulnerability Report	Métis Nation Council	Métis Communities (across Canada)
2020	Nelson	Not hazard specific	Nelson Next Climate Action Plan	City of Nelson	Community-wide
2023	West Kootenay Region	Not hazard specific	Selkirk College Sustainability Plan 2023-2027	Selkirk College	Students & Staff at Selkirk College
2019	Kootenay & Boundary	Not hazard specific	B.C. Agriculture and Climate Change Regional Adaptation Strategies Plan for Kootenay and Boundary Region	Investment Agriculture Foundation	Farmers

Year	Community	Hazard	Initiative	Lead Organization	Target Audience
Climate Emergency Preparedness and Response					
Ongoing	RDKB, RDCK	Cold	Extreme Weather Communication: Trail, Grand Forks, Creston	RDKB, RDCK	Community-wide
Ongoing	RDKB, RDCK	Heat	Extreme Weather Communication: Nelson (Facebook communication), Greenwood (Facebook communication), Montrose (Facebook communication), Castlegar, Creston	RDKB, RDCK	Community-wide
Ongoing	RDCK	All Hazards	Hazard and Risk Assessments	RDCK	Community-wide
Ongoing	RDKB, RDCK	All Hazards	Emergency Operations Training for Local Government Staff	RDKB, RDCK	Local Government Staff
Ongoing	RDCK	All Hazards	Neighbourhood Emergency Preparedness Program	RDCK	Community-wide
2016	RDCK	All Hazards	Emergency Response and Recovery Plan	RDCK	Community-wide
Ongoing	RDKB, RDCK, Nelson	All Hazards	Emergency Notification Systems	RDKB, RDCK, Nelson	Community-wide
2023-2024	Métis Communities	All Hazards	Emergency Preparedness Webinars for Chartered Metis Communities	MNBC	Métis Communities (across BC)w
Ongoing	Métis Communities	All Hazards	Emergency Small Grants and Emergency Kits	MNBC	Métis Communities (across BC)
Ongoing	RDKB, RDCK	All Hazards	Emergency Preparedness for Rural Entrepreneurs [Community Futures Business Continuity Plan Tool]	Community Futures British Columbia	Business owners

2021	Boundary region	Drought	RDKB Boundary Region Drought Response Plan	RDKB	Community-wide
2022	RDKB	Drought	Nine Mile Creek Watershed: Drought Management Plan	RDKB	Community-wide
Ongoing	Grand Forks	Flooding	Grand Forks Flood Mitigation Program	City of Grand Forks	Community-wide
2020	Castlegar	Wildfire	Community Wildfire Protection Plan	City of Castlegar	Community-wide
2015-2020	RDCK	Wildfire	Community Wildfire Protection Plan	RDCK	Community-wide
Ongoing	RDCK, RDKB, Nelson, Rossland, Creston, Castlegar	Wildfire	FireSmart Rebate and Community Programs	RDCK, RDKB, Nelson, Rossland, Creston, Castlegar	Community-wide
2023	Ktunaxa territory	Wildfire	Cultural Burning	Ktunaxa Nation	First Nation communities
	Salmo	Wildfire	Salmo Wildfire Risk Reduction Project	Youth Climate Corps	Community-wide

Year	Community	Hazard	Initiative	Lead Organization	Target Audience
Communication, Knowledge Translation and Education					
Ongoing	Columbia Basin	Not hazard specific	State of the Basin Initiative	RDKB, RDCK	Community-wide
2023	Columbia Basin & Boundary	Not hazard specific	Columbia Basin Climate Source	RDKB, RDCK	Community-wide
Ongoing	Columbia Basin	Not hazard specific	Columbia Basin Environmental Education Network - Wild Voices Programs	RDCK	Community-wide
Ongoing	West Kootenay region	Not hazard specific	Deep Canvasing	Neighbours United	Community-wide
Ongoing	West Kootenay region	Not hazard specific	West Kootenay Climate Hub	Volunteer led	Community-wide
Ongoing	RDKB	Not hazard specific	RDKB First Responders Mental Health and Wellness Program [Resilient Minds Training]	Canadian Association of Fire Chiefs	First responders
2017	yaqan nuʔkiy	Not hazard specific	yaqan nuʔkiy The Wetlands a Short Film	yaqan nuʔkiy	Community-wide
2020-2021	RDKB	Water Supply	Boundary Watershed Webinars—Science & Learning	RDKB	Community-wide
Ongoing	Métis Youth	Not hazard specific	Eco Collective A Michif Collective for Environmental Action	Métis Nation Council	Métis Youth (across Canada)

Year	Community	Hazard	Initiative	Lead Organization	Target Audience
Supporting Determinants of Health					
Ongoing	RDCK	All Hazards	Community Engagement/ Community Ambassador	Youth Climate Corps	Community-wide
Starting in 2024	West Kootenay region	Not hazard specific	Building Economic Resilience	Selkirk College	Local Businesses
2020 & 2024	RDCK	Not hazard specific	Housing Needs Assessment and Report	RDCK	Community-wide
Ongoing	First Nation communities in the Basin	Not hazard specific	First Nations Housing Sustainability Initiative	Columbia Basin Trust	First Nation communities
Ongoing	RDKB	Not hazard specific	Boundary Food Hub	Boundary Community Ventures Association	Local food producers and processors
Ongoing		Not hazard specific	Grow and Connect: Kootenay-Boundary Distribution Pilot		Local food producers and processors
Ongoing	West Kootenay region	Not hazard specific	Resilience and Alternative Food Networks	Selkirk College	Food-related sectors
2021	RDKB	Not hazard specific	Well-Being in the Boundary Region: Strategy to Eliminate Poverty	RDKB	Community-wide
2022-2025	West Kootenay region	Not hazard specific	Bridging Rural Homelessness Well-Being Project	Selkirk College	Service Providers and Vulnerable Populations

Ongoing	Columbia Basin	Not hazard specific	Columbia Basin Trust Funding Programs	Columbia Basin Trust	Community-wide
Ongoing	KB HSDA	Not hazard specific	KB Doctors and Nurses for Planetary Health	KB HSDA	Community-wide
Year	**Community**	**Hazard**	**Initiative**	**Lead Organization**	**Target Audience**
Supporting Built and Natural Environments					
Ongoing	Rossland, Trail, Fruitvale	Not hazard specific	South Kootenay Green Link Active Transportation Plan	RDKB	Community-wide
Ongoing	RDKB	Not hazard specific	RDKB Climate Reserve Fund Bylaw	RDKB	Community-wide
Ongoing	RDKB	Not hazard specific	RDKB Green Building Policy	RDKB	Regional district
Ongoing	RDCK, RDKB	All Hazards	Official Community Plans (Climate change resilience explicitly mentioned in these plans)	City of Rossland, City of Nelson, Village of Salmo, Village of Fruitvale, Village of Slocan, Village of Kaslo, Village of New Denver, City of Grand Forks, City of Castlegar	Community-wide
2023	RDKB	Flooding	Floodplain Mapping and Flood Plain Management Bylaw	RDKB	Community-wide
2024	Lardeau Valley	Not hazard specific	Lardeau Valley Grid Sustainability Pilot Program	RDCK	Lardeau Valley Residents
2020	West Kootenay region	Not hazard specific	West Kootenay 100% Renewable Energy Plan	West Kootenay EcoSociety	Community-wide

Ongoing	Rossland, Nelson	Not hazard specific	E-Bike Incentive Programs		Homeowners
Ongoing	RDKB	Not hazard specific	RDKB HomeSmart Program	RDKB	Homeowners
Ongoing	RDCK	Not hazard specific	RDCK Regional Energy Efficiency Program	RDCK	Homeowners
2023	RDKB	Not hazard specific	RDKB Curbside Collection Program	RDKB	Community-wide
Ongoing	yaqan nuʔkiy	Not hazard specific	yaqan nuʔkiy Hunting Grounds Ecosystem Restoration Project	yaqan nuʔkiy	yaqan nuʔkiy community members
Ongoing	yaqan nuʔkiy	Not hazard specific	yaqan nuʔkiy Wetland Restoration	yaqan nuʔkiy	yaqan nuʔkiy community members

Inventory of IH Actions that Strengthen Adaptive Capacity

Year	Hazard	Initiative	Lead Portfolio	Target Region within IH	Notes
Climate Adaptation and Resilience Planning					
2023-2028	Not hazard specific	IH Climate Change and Sustainability Roadmap	Organization-wide	Regional	The IH Climate Change and Sustainability Roadmap is a strategic document that provides a cohesive strategy to help guide IH towards a more sustainable future as an organization, health-care provider and key community member.
Ongoing	Not hazard specific	Environmental Sustainability Committees throughout region	Organization-wide	Regional	Members of Environmental Sustainability Committees across IH act as role models to inspire sustainability action, encourage behaviour change among peers, engage and lead groups of people, and help create a culture of sustainability throughout the organization.
2024	All Hazards	IH Climate Exposure Screen	Organization-wide	Regional	This project provides a portfolio-level climate hazard exposure screen, including individual assessments and climate projections for health facilities across the IH region, along with a high-level vulnerability assessment to prioritize sites for future planning. The report summarizes the methodology, outcomes, and offers recommendations for leveraging the results to guide climate adaptation and resilience efforts.
2024	All Hazards	Site-Level Exposure Screen	Organization-wide	Regional	The portfolio-level exposure screen assessed climate hazard exposure for 58 health facility sites across 56 IH areas, focusing on four key climate hazards in B.C.: extreme heat, wildfire smoke, interface wildfire, and flooding. The screen provides climate data and future projections for each site, with an emphasis on these hazards.

Year	Hazard	Initiative	Lead Portfolio	Target Region within IH	Notes
Climate Emergency Preparedness and Response					
In development	Not hazard specific	Climate Resilience Leadership Program (in development)	Organization-wide	Regional	In partnership with Intelligent Futures, IH is working to enhance leadership capacity across the organization to respond to climate-related events through training and exercises. The program aims to equip directors to navigate climate impacts on services, care delivery, and facilities.
Ongoing	All Hazards	Seasonal Readiness Committee	Organization-wide	Regional	The purpose of IH's Seasonal Readiness Committee is to provide health authority-wide leadership and coordination for seasonal readiness activities related climate hazards.
Ongoing	All Hazards	Site Emergency Response Plans	HEMBC	Regional	The IH HEMBC team has developed various site emergency response plans to create more resilient health care facilities that can effectively mitigate, prepare for, respond to, and recover from the impacts of emergency events.
Ongoing	Heat	IH Heat Response Plan	Organization-wide	Regional	The IH Heat Response Plan was developed by the IH Seasonal Readiness Committee, with contributions from a broad range of internal teams. The purpose of this plan is to support a coordinated approach to heat warnings and/or extreme heat emergencies in alignment with the BC Heat Alert Response System (BC HARS).
Ongoing	Heat & Cold	Mental Health & Substance Use (MHSU) and Home Health Extreme Weather Toolkit	MHSU & Home Health	Regional	The Extreme Weather Toolkit offers practical resources, guidelines, and protocols to help clinical teams manage weather-related challenges, adapt services, and maintain continuity of care while minimizing health and safety risks.

Ongoing	Heat & Cold	Extreme Heat and Cold Event Wellness Check Standard Work	MHSU & Home Health	Regional	The MHSU & Home Health Extreme Health and Cold Event Wellness Check Standard Work documents provide community teams with a process to identify individuals vulnerable to extreme heat and cold and conduct wellness checks during such events.
Ongoing	Cold	IH Cold Weather Preparedness & Response Plan	Organization wide	Regional	The IH Cold Weather Preparedness and Response Plan was developed by the IH Seasonal Readiness Committee, with contributions from a broad range of internal teams. The purpose of this plan is to support a coordinated approach to planning, preparedness, and response to cold weather including, but not limited to, extreme cold in alignment with the BC HEAT Committee.
Ongoing	Wildfire & Smoke	IH Air Quality Response Plan	Organization wide	Regional	The IH Air Quality Plan was developed by the IH Seasonal Readiness Committee, with contributions from a broad range of internal teams. The plan was developed to support a coordinated approach to air quality events in alignment with the work of the BC HASE Coordination Committee.

Year	Hazard	Initiative	Lead Portfolio	Target Region within IH	Notes
Communication, Knowledge Translation and Education					
2023	All Hazards	2023 Medical Health Officer Report on Climate Change Health and Wellbeing	Population Health	Regional	The Medical Health Officer Report 2023 provides an overview of the health status of communities across the IH region, as it relates to climate change. The report includes reflections on recent climate-related events and experiences and explores the climate hazards that are most likely to impact the region: extreme heat, cold, flooding, wildfire and smoke, and drought. The report includes stories of innovation and resilience to climate change that are intended to inspire action and creative solutions at the community level.
Ongoing	All Hazards	Annual Climate Change Accountability Reports	Organization-wide	Regional	IH produces an annual climate change accountability report that provides a comprehensive overview of the organization's greenhouse gas (GHG) emissions profile, total offsets achieved toward net-zero emissions, actions taken to reduce GHG emissions, and plans for continued reductions for the year and beyond. The 2025 report is currently in development.

Glossary

Climate – The average of weather patterns in a specific area over a longer period, usually 30 or more years, that represents the overall state of the climate system. Human activity in the industrial age, and particularly during the last century, is significantly altering our planet's climate through the release of harmful greenhouse gases.[211]

Climate change – The long-term changes in the Earth's climate that are warming the atmosphere, ocean and land. Climate change is affecting the balance of ecosystems that support life and biodiversity and is impacting our health. It also causes more extreme weather events, such as more intense and/or frequent hurricanes, floods, heat waves and droughts, and leads to sea level rise and coastal erosion as a result of ocean warming, melting of glaciers and loss of ice sheets.[211]

"A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere, and which is in addition to natural climate variability observed over comparable time periods." (UNFCC)

Climate adaptation – Actions that help reduce vulnerability to the current or expected impacts of climate change like weather extremes and natural disasters, sea-level rise, biodiversity loss, or food and water insecurity. Many adaptation measures need to happen at the local level, so rural communities and cities have a big role to play. Such measures include planting crop varieties that are more resistant to drought, practicing regenerative agriculture, improving water storage and use, managing land to reduce wildfire risks, and building stronger defenses against extreme weather like floods and heat waves.[211]

"In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities." [212]

Climate resilience – The capacity of a community or environment to anticipate and manage climate impacts, minimize their damage, and recover and transform as needed after the initial shock. Ultimately, a truly climate-resilient society is a low-carbon one, because drastically reducing greenhouse gas emissions is the best way to limit how severe climate impacts will be in the future. It is also a society based in equity and climate justice that prioritizes support for people and communities most exposed to climate impacts or least able to cope with them.

"The capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure." [212]

Climate vulnerability: The predisposition for health to be adversely affected by climate change. Note: climate vulnerability is not a label for communities or populations.[213]

Exposure: The presence of people, livelihoods, species or ecosystems, environmental functions, services, resources, infrastructure, or economic, social, or cultural assets, in places and settings that could be adversely affected.[212]

Extreme weather events: An extreme weather event is unusual or unseasonal extremes compared to historical data.[214]

PM 2.5: Fine particulate matter are particles in the air that measure less than 2.5 micrometers (μm) in diameter and typically consists of a mix of things like smoke, soot, liquid or solid particles in aerosol, or biological matter like mold, bacteria, pollen and animal dander. PM2.5 poses a risk to health because, when inhaled, it can travel deeply into your lungs.[215]

Health systems: Include an ensemble of all public and private organizations, institutions and resources mandated to improve, maintain or restore health, as well as incorporate disease prevention, health promotion and efforts to influence other sectors to address health concerns in their policies. (World Health Organization, 2019)

Health-care facilities: Provide direct health treatment procedures for patients and include hospitals and health-care clinics. In the context of emergencies, health-care facilities are hospitals, primary health care centres, isolation camps, burn patient units, feeding centres and others. (World Health Organization, 2019)

Sensitivity: The degree to which a system is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).[212]

Weather – Atmospheric conditions at a particular time in a particular location, including temperature, humidity, precipitation, cloudiness, wind and visibility. Weather conditions do not happen in isolation: they have a ripple effect. The weather in one region will eventually affect the weather hundreds or thousands of kilometers away.[211]

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