



### II.VII.I. Fleas:

Fleas are included in this Section because they are a vector for disease and because of the projected increase in rats and mice (which carry fleas and ticks) in BC due to climate change. While there are limited studies on the increase in climate change related flea populations in Canada, and no studies for BC, there is evidence that there has been an increase in rodent populations. With an increase in rodent populations, there will be an increase in flea populations. As per Mayla (2020), a microbiologist and a science officer for the Global Lyme Alliance, there are a variety of factors that have helped spread fleas and ticks along with rising temperatures, including urban sprawl and the rise of the deer population and invasive plants (which have given ticks more hosts, means of travel and habitat).<sup>188</sup> The increase in flea populations is a world wide issue as per the Express:<sup>189</sup>

“Reports of the insects are up by 198 percent during the first quarter of the year, compared to the same period in 2018, the Daily Mail reports.”

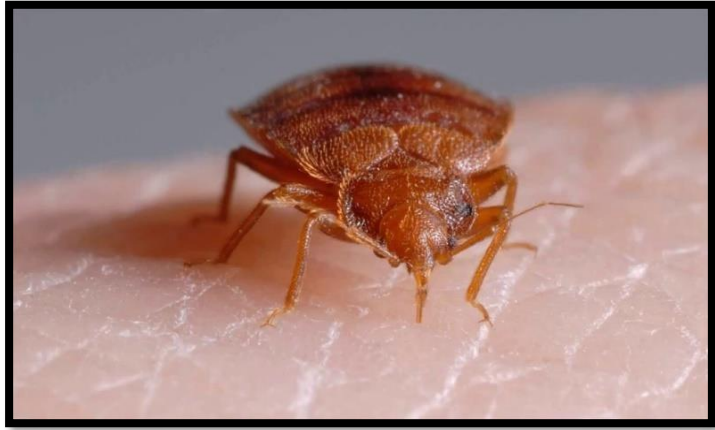


Employers and Locals should monitor this issue and conduct hazard and risk assessments as necessary.

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<sup>188</sup> PETMD. Does Climate Change Impact Flea and Tick Populations? No date. Retrieved February 20, 2020 from <https://www.globallymealliance.org/news/climate-change-impact-flea-tick-populations>

<sup>189</sup> Read, C. (April 25, 2019). UK FLEA INFESTATION: Cases SURGE by 198 percent as pest-controllers blame climate change. *Express*. Retrieved February 20, 2020 from <https://www.express.co.uk/news/uk/1118940/fleas-climate-change-UK-weather-rentokil-davidcross-extinction-rebellion>



## II.VII.II. Beg Bugs:

There are very few studies linking bed bug population increases from 2000 to present to climate change. While beg bugs thrive in warm and humid conditions, there is insufficient scientific evidence at this time to confirm that their population numbers are increasing and that there is an impact on workers due to climate change. CUPE members from at least two sectors in BC e.g. Education and Social Services, have reported a significant increase in the bed bug population over the last eight years. This is anecdotal evidence only. Bed bugs are not known to spread disease as per the US and Canadian Centers for Disease Control and Prevention, however, they carry as many as 45 disease causing pathogens.<sup>190,191</sup>

Examples include:

- Aspergillus Flavus
- Hepatitis B, C, E
- Influenza
- Rabies
- Parasites
- Yellow fever

Employers and Locals should monitor this issue and conduct hazard and risk assessments as necessary.

<sup>190</sup> US Centers for Disease Control and Prevention. Retrieved February 20, 2020 from <https://www.cdc.gov/parasites/bedbugs/faqs.html>

<sup>191</sup> Delaunay, P., Blanc, V., Del Giudice, P., Levy-Bencheton, A., Chosidow, O., Marty, P., & Brouqui, P. (2011). Bedbugs and Infectious Diseases. *Clinical Infectious Diseases*. 2011, January 15; 52(2). Retrieved February 20, 2020 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3060893/>



### II.VII.III. Spiders:

There are several types of poisonous spiders in BC. These include the western black widow spider,<sup>192</sup> the brown recluse spider and the hobo spider. There are only a few studies showing an increase in geographic range of certain types of spiders due to climate change, however, there are very few reports from CUPE members or from WorkSafeBC regarding worker health and safety issues. The limited data shows that the geographic range is expanding for all three species (recognizing that there are a number of types of black widow spiders in Canada).<sup>193</sup> As per the CBC:

“Venomous northern black widow spiders are being spotted farther north than they've ever been found before, scientists have found with the help of photos snapped by the public.”

"They're occupying new habitats that we didn't previously think they could," said Yifu Wang, lead author of a new Canadian study tracking the shifting range of the northern black widow, most likely due to climate change.”

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<sup>192</sup> HealthLink BC. Retrieved February 19, 2020 from <https://www.healthlinkbc.ca/health-topics/tm6498spec>

<sup>193</sup> Chung, E. (August 09, 2018). Black widow spiders creep northward. *CBC News*. Retrieved February 19, 2020 from <https://www.cbc.ca/news/technology/black-widow-climate-change-1.4778025>

The hobo (also called the funnel web spider) is now widespread across southern BC and is now found in South-Western and South-Central BC.



There are conflicting studies and reports about the presence of the brown recluse spider<sup>194</sup> in BC (or the rest of Canada).<sup>195,196,197</sup> Only five brown recluse spiders have been recorded in the last century.

Given the potential for serious injury<sup>198</sup> from the various types of spiders Employers and Locals should monitor this issue and conduct hazard and risk assessments as necessary. Remember that many insects are vectors for disease.

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<sup>194</sup> HealthLink BC. Retrieved February 19, 2020 from <https://www.healthlinkbc.ca/health-topics/brown-recluse-spider-bite>

<sup>195</sup> E-Fauna BC. Retrieved February 19, 2020 from <https://ibis.geog.ubc.ca/biodiversity/efauna/spiders.html>

<sup>196</sup> Shepert, E. (October 04, 2019). Here is how much of a threat the 'brown recluse' spider poses in Vancouver. *Vancouver Is Awesome*. Retrieved February 19, 2020 <https://www.vancouverisawesome.com/animals/brown-recluse-spiders-vancouver-1946057>

<sup>197</sup> Retrieved February 19, 2020 <https://myhealth.alberta.ca/>

<sup>198</sup> Venomous organisms spread their toxins using a specific body part in order for the toxins to penetrate while poisonous organisms do not need a specific body part in order to spread the toxins





#### II.VII.IV. Wasps and Hornets:

BC has a number of types of wasps, including social and non-social wasps. There are very few studies showing an increase in geographic range due to climate change or reports from CUPE members or from WorkSafeBC regarding worker health and safety issues. There are numerous non-scientific reports indicating a significant increase in the number of wasps (hornets) such as yellow jackets. As per The Times Columnist (Victoria)<sup>199</sup> and CTV News “Wasp populations ‘off the charts’ in Greater Victoria”.<sup>200</sup> There are a number of studies showing an increase in both the population and aggression of endemic wasps such as yellow jackets (which is called a hornet – a type of wasp, which is often larger and more aggressive) during periods of higher temperatures and drier weather.<sup>201</sup> This has also been reported by Oregon State University.<sup>202</sup> With current and projected increases in temperatures (and drier temperatures during the summer) in BC, there may be an increase in the impact (stings) on workers.

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<sup>199</sup> Watts, R. (August 08, 2019). Wasp population boom likely weather-related: expert. *The Times Columnist*. Retrieved February 20, 2020 from <https://www.timescolonist.com/news/local/wasp-population-boom-likely-weather-related-expert-1.23918746>

<sup>200</sup> CTV News. Wasp populations ‘off the charts’ in Greater Victoria. (2019). Retrieved February 20, 2020 from <https://vancouverisland.ctvnews.ca/wasp-populations-off-the-charts-in-greater-victoria-1.4558406>

<sup>201</sup> Government of Canada. Wasps. Retrieved February 20, 2020 from <https://www.canada.ca/en/health-canada/services/pest-control-tips/wasps.html>

<sup>202</sup> Hendricks, J. (August 06, 2018). OSU experts: warm weather, drought boost wasp and yellow jacket populations. *FOX 12 Oregon News*. Retrieved February 19, 2020 from <https://today.oregonstate.edu/news/drought-driving-more-yellowjackets-backyards-year>

There have been increasing reports of a large, aggressive invasive hornet in BC, with larger colonies. The Asian giant hornet has been found in multiple locations in BC in 2019, 2020 and 2021.<sup>203,204</sup> As per the CBC:

“People who are stung more than 10 times are at risk of developing a toxic or allergic reaction.”

As per the CTV News:<sup>205</sup>

“The Asian hornets are thought to have likely travelled to the island in a shipping container. The four-centimetre-long hornets may pose a public health risk, said Van Westendorp.

‘The amount of venom a person will get may well threaten their health, may well threaten their well-being,’ he said.

In 2013, 41 people in China were killed and 1,600 were injured when the predatory pests plagued the province of Shaanxi.”

Despite the lack of reports of worker injuries and the lack of studies on the presence of expanded range due to climate change (only a small number of Asian giant hornets have been found), Employers and Locals should monitor this issue and conduct hazard and risk assessments as necessary given the potential for serious injury from this aggressive and venomous insect.

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<sup>203</sup> (No author). (September 19, 2019). Nest of Asian giant hornets destroyed in Nanaimo. *CBC News*. Retrieved February 19, 2020 from <https://www.cbc.ca/news/canada/british-columbia/asian-giant-hornet-next-destroyed-nanaimo-1.5290691>

<sup>204</sup> Azpiri, J. ‘Murder hornet’ found in B.C. trap, say Washington state officials. (November 02, 2021). *Global News Canada*. Retrieved June 06, 2022 from <https://globalnews.ca/news/8345272/bc-murder-hornet-2021/>

<sup>205</sup> (No author). (September 12, 2019). ‘There must be a nest’. B.C. expert says invasive giant hornets have a home on Vancouver Island. *CTV News*. Retrieved February 20, 2020 from <https://vancouverisland.ctvnews.ca/there-must-be-a-nest-b-c-expert-says-invasive-giant-hornets-have-a-home-on-vancouver-island-1.4591090>



#### II.VII.V. Fire Ants:

Fire ants are relatively new to BC. There are several studies showing an increase in geographic range due to climate change, however, there are very few reports from CUPE members or from WorkSafeBC regarding worker health and safety issues (such as stings). As per the Invasive Species Council of BC:<sup>206</sup>

“One of the world’s 100 worst invasive species—European fire ants (*Myrmica rubra*)—is emerging in areas of BC in alarming numbers, packing a punch with its surprising swarm and sting.

Provincial biologists first confirmed the presence of the European fire ant in BC in 2010. Known populations have nearly doubled since last year, showing up in Burnaby, Vancouver, Richmond, North Vancouver, Maple Ridge, Chilliwack, as well as Victoria and Courtenay.”

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<sup>206</sup> Invasive Species Council of BC. European Fire Ants. Retrieved February 18, 2020 from <https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/invasive-species/alerts/european-fire-ant-alert.pdf> and [https://www.bcinvasives.ca/documents/European\\_Fire\\_Ants\\_in\\_BC\\_Public\\_Factsheet\\_V1-Nov\\_2012.pdf](https://www.bcinvasives.ca/documents/European_Fire_Ants_in_BC_Public_Factsheet_V1-Nov_2012.pdf)



As per US data:<sup>207</sup>

“An estimated 14 million people are stung every year, with some of those incidents leading to hospitalizations. About half of people are at least somewhat allergic to fire ant stings, and roughly one percent of people are at risk of having a dangerous full body reaction.”

Given the potential impact on worker health Employers and Locals should monitor this issue and conduct hazard and risk assessments as necessary.

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<sup>207</sup> Airhart, E. (February 01, 2019). One Species Loves our Climate-Wrecking Ways: Fire Ants! *WIRED*. Retrieved February 18, 2020 from <https://www.wired.com/story/one-species-loves-our-climate-wrecking-ways-fire-ants/>



### II.VII.VI. Mosquitoes:

There are currently over 80 species of endemic mosquitoes in Canada. Only a few carry pathogens that are harmful to humans. The most common mosquito borne virus in Canada is the West Nile virus. Climate change is increasing mosquito populations the potential for pathogens to be spread to workers. Mosquitoes that the primary vectors for West Nile virus in Canada include:

- *Culex pipiens*
- *Cx. restuans*
- *Cx. Tarsalis*

Examples of potential new mosquito borne diseases include:

- Saint Louis encephalitis virus
- La Crosse encephalitis
- Chikungunya
- Rift Valley fever
- Japanese encephalitis



As per the Globe & Mail:<sup>208</sup>



“A team of public-health experts writing in the Canada Communicable Disease Report recently acknowledged that ‘climate change is anticipated to have significant effects on Canada’s endemic mosquito populations and thus on MBDs [mosquito-borne diseases]. ... The expected climate-induced changes in mosquitoes and MBDs underline the need for continued surveillance and research to ensure timely and accurate evaluation of the public health risks to Canadians. Public health professionals and clinicians need to promote awareness among Canadians of this important public health risk.’ Climate change means that the diseases carried by mosquitoes (and itinerant vectoring mosquito species) are expanding their reach, penetrating more northerly ecosystems.”

And:

“Researchers at the National Collaborating Centre for Infectious Diseases warn that local pockets, including Southern Ontario, home to more than 12 million people, may develop ecosystems ‘that are conducive to the survival of exotic mosquitoes and the transmission of exotic MBDs’ and the emergence and establishment of invasive, and comparatively lethal, “new strains of mosquitoes and new mosquito-borne diseases.” The rest of Canada is not immune, as ‘climate change will increase the risk of endemic mosquito-borne diseases’ across the country.”

Climate change will expand the range, concentration and types of mosquitoes in Canada. As per CityLab, if current rates of emissions continue, by 2050 nearly half of the world’s population will live in places where the *Aedes aegypti* mosquito occurs,<sup>209</sup> including Ontario and most of Eastern Canada. *Aedes* mosquitoes transmit over 20 pathogens including several arboviruses, including dengue, chikungunya, Zika, West Nile and yellow fever viruses.

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<sup>208</sup> Winegard, T. (August 28, 2019). Mosquitoes are a Canadian icon – and a growing public health risk. *Globe & Mail*. Retrieved February 19, 2020 from <https://www.theglobeandmail.com/opinion/article-mosquitoes-are-a-canadian-icon-and-a-growing-public-health-risk/>

<sup>209</sup> CityLab. Oh, the Places Mosquitoes Will Go! (2019). Retrieved February 18, 2020 from <https://www.citylab.com/environment/2019/03/mapping-global-spread-mosquitoes-climate-change-research/584197/>



There is a small area of Canada where exotic *Aedes* mosquitoes have become established, however, there is no evidence that these carry any exotic mosquito borne diseases. Most of the expansion of mosquito ranges have occurred in Central Canada. There is no evidence of endemic mosquito borne diseases in BC at this time. Levels of another species of mosquito from the genus *Culex*, which transmit the West Nile virus to humans, have been linked to warm winters and warm, wet springs. Although incidence of West Nile virus has been low in BC, more frequent weather extremes on the back of a warmer climate may contribute to future outbreaks. As per Ogden et al. (2019):<sup>210</sup>

“For example, ambient temperature affects the rate of development of mosquito eggs, larvae and pupae, with warmer temperatures accelerating the mosquito lifecycle. Warmer temperatures also accelerate the extrinsic incubation period, or how fast mosquito-borne pathogens ingested by adult mosquitoes multiply and are disseminated from the gut to the salivary glands from whence they can be transmitted to humans (14). Higher temperatures can also affect the activity level of the adult mosquitoes. In addition to changes in temperature, changes in precipitation can also affect mosquito abundance. Excess precipitation often leads to standing water, and this can enhance mosquito replication, because standing water is required for the larval and pupal stages of the mosquito. As a further complication to weather based forecasting, droughts turn drainage channels in urban and sub-urban areas into standing water, which then becomes mosquito breeding habitat. Therefore, some outbreaks in these areas are associated with dry as well as hot weather.”

An indirect effect of climate change on workers is a 99% reduction in predators of mosquitoes such as dragon flies. This will affect mosquito populations, but the degree is unknown.<sup>211</sup>

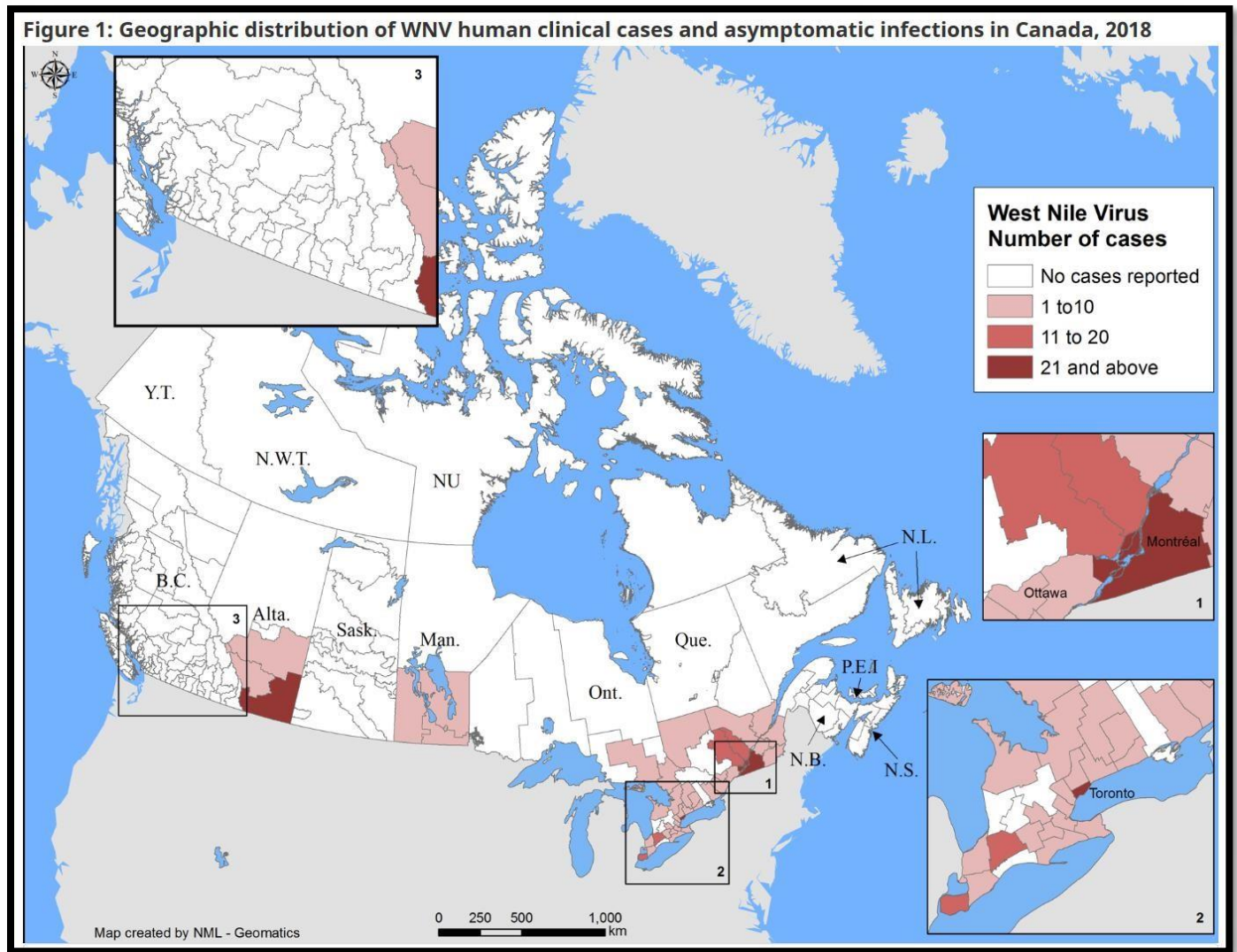
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<sup>210</sup> Ogden, N.H., Lindsay, L.R., Ludwig, A., Morse, A.P., Zheng, H., & Zhu, H. (2019). Weather-based forecasting of mosquito borne disease outbreaks in Canada. Retrieved February 18, 2020 from <https://pubmed.ncbi.nlm.nih.gov/31285703/>

<sup>211</sup> (No author). 4<sup>th</sup> National Climate Assessment. Retrieved February 26, 2020 from <https://nca2018.globalchange.gov/>

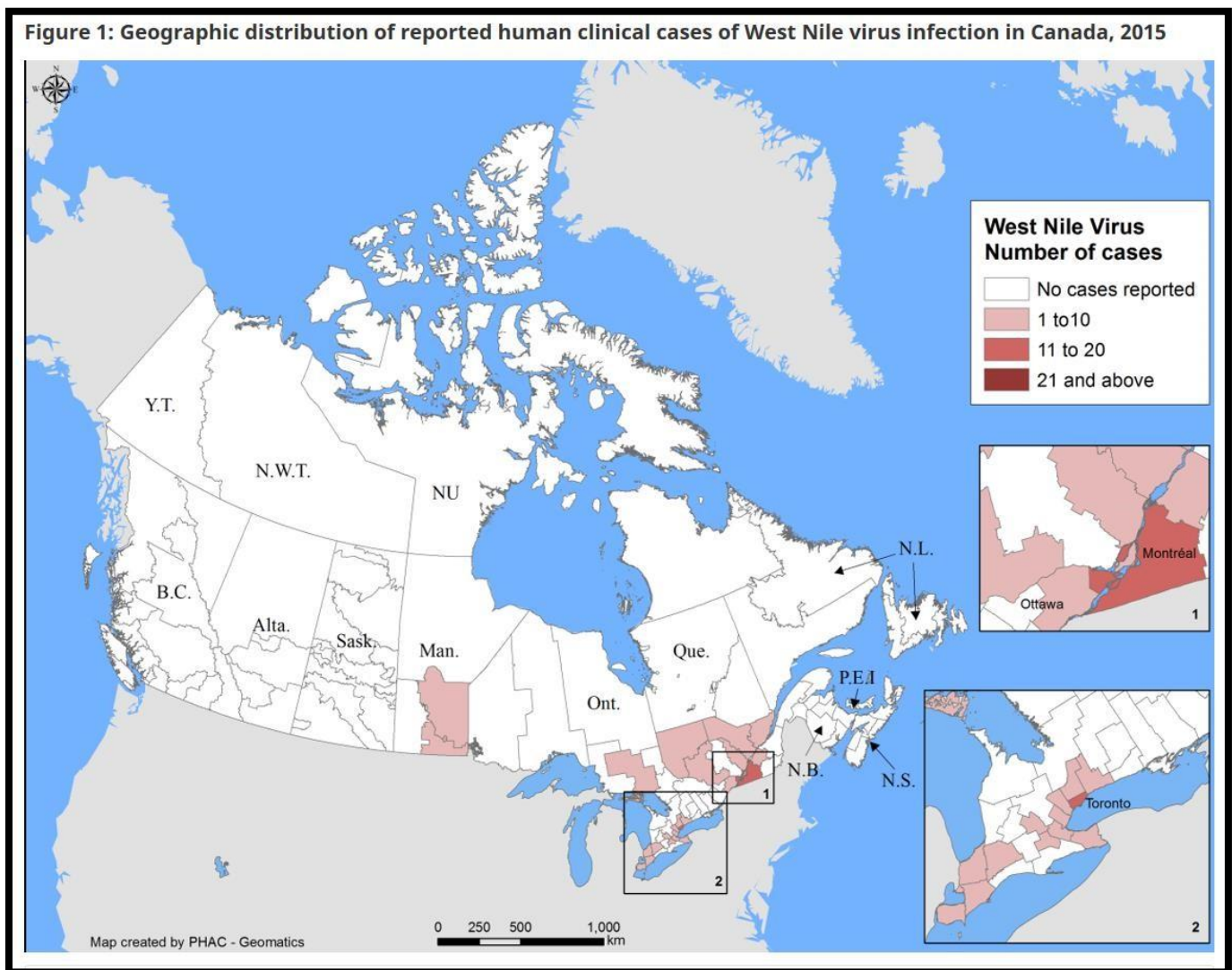


Reporting from the Government of Canada shows an increase in diseases like West Nile virus as per the West Nile virus surveillance report for Canada 2018 map below.<sup>212</sup>



<sup>212</sup> Government of Canada. West Nile Virus national surveillance report. (2018). Retrieved February 19, 2020 from <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/west-nile-virus-surveillance/2018/november-11-december-15-week-46-50.html>

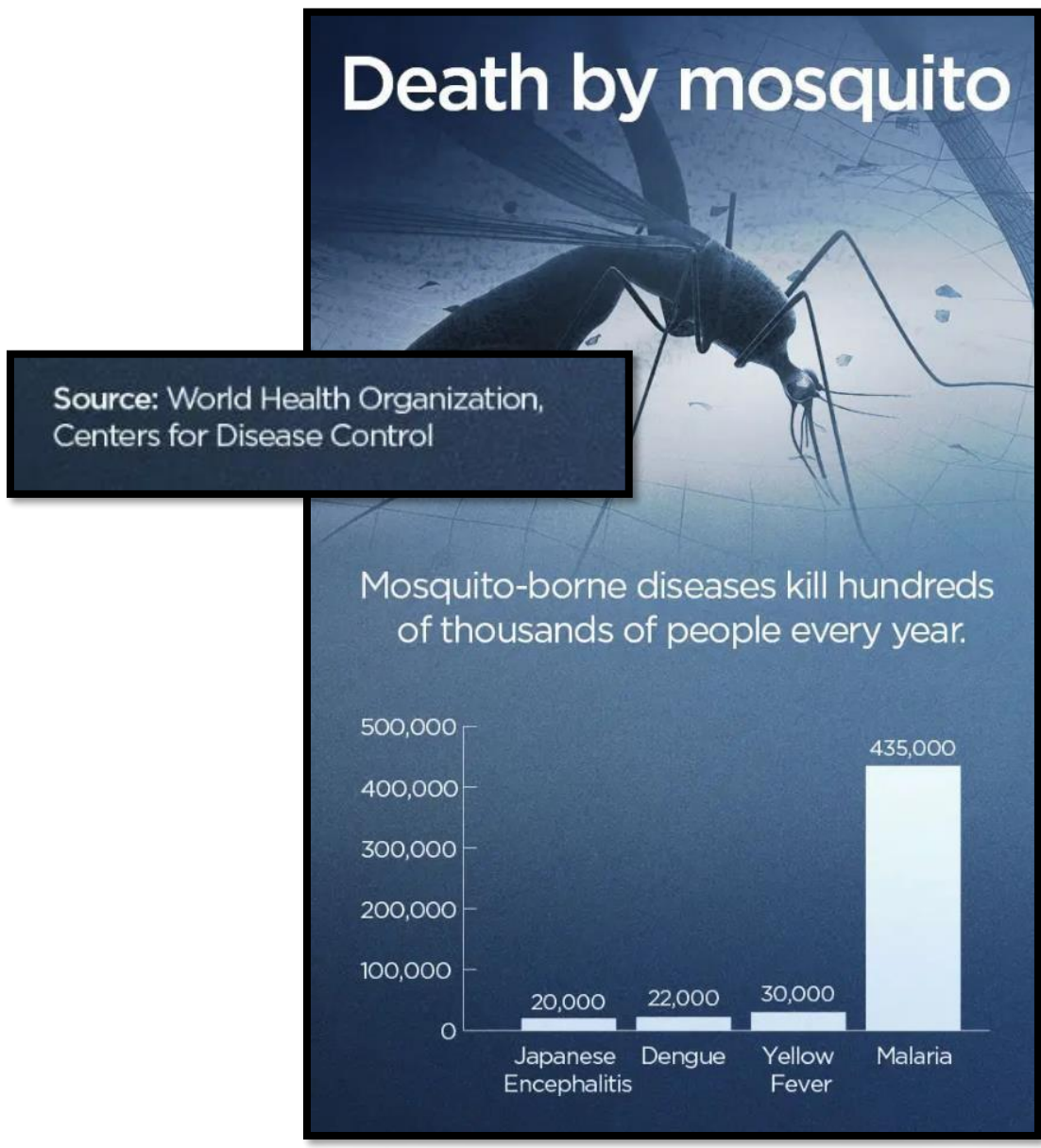
This is compared to the West Nile virus surveillance report map for Canada 2015:



Over the last 20 years, there has been a 10% increase in endemic mosquito borne viruses. This has been attributed to climate change.<sup>213</sup>

<sup>213</sup> Ludwig, A., Vrbova, L., Zheng, H., & Drebot, M.A. (2019). Increased risk of mosquito-borne diseases in Canada due to climate change. *Canada Communicable Disease Report*. 45(4):91-97. Retrieved February 18, 2020 from [https://www.researchgate.net/publication/332237903\\_Increased\\_risk\\_of\\_endemic\\_mosquito-borne\\_diseases\\_in\\_Canada\\_due\\_to\\_climate\\_change](https://www.researchgate.net/publication/332237903_Increased_risk_of_endemic_mosquito-borne_diseases_in_Canada_due_to_climate_change)

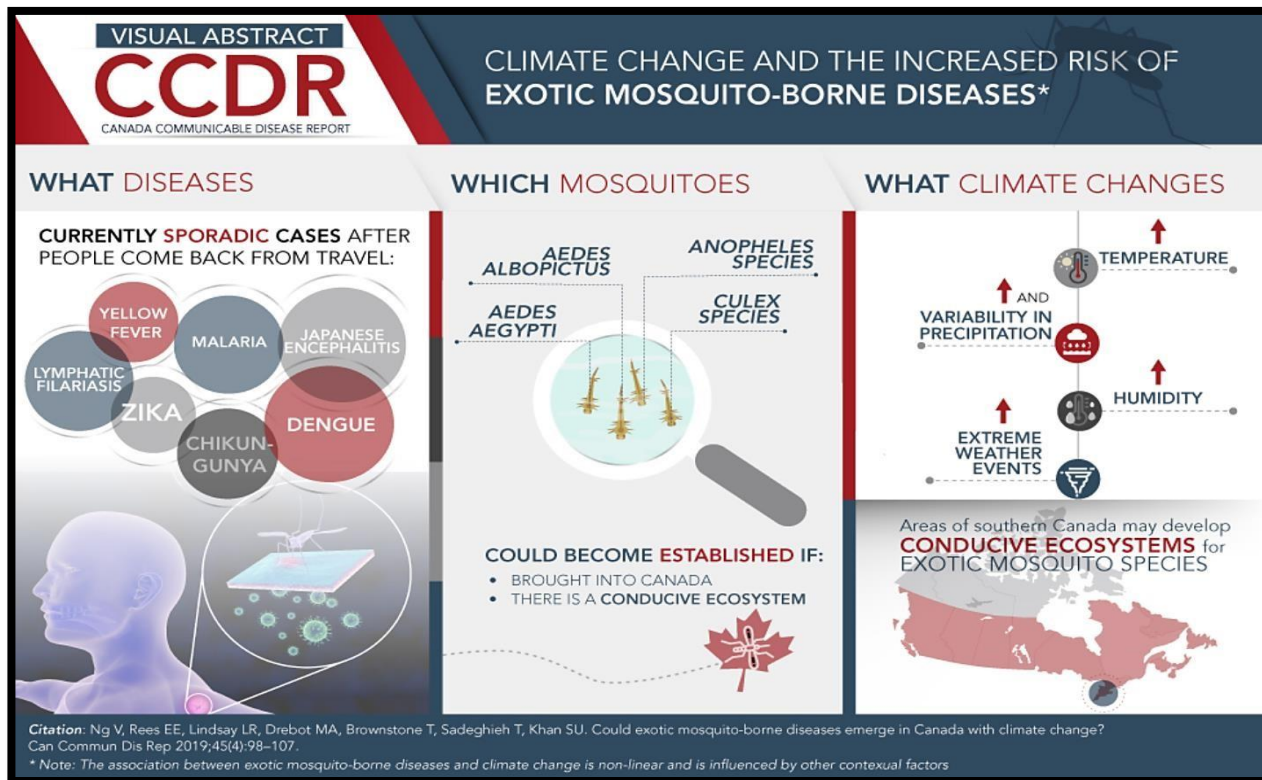
Worldwide, mosquitoes are a significant health threat as per Global News:<sup>214</sup>



<sup>214</sup> Young, L. (August 25, 2019). Mosquitoes are on the move due to climate change, and they could bring diseases. *Global News*. Retrieved February 20, 2020 from <https://globalnews.ca/news/5798882/mosquitoes-disease-climate-change/>



The *Aedes aegypti* mosquitoes that carry diseases such as Zika virus, yellow fever, dengue fever, etc. were only first reported in Canada in 2017. Now they are fairly common. As per the Government of Canada CCDR Visual Abstract figure below, there is significant evidence of climate change related expansion of mosquito borne diseases:<sup>215</sup>



Approximately 20% of individuals who are exposed to mosquito borne viruses will develop acute clinical illness, including fever, headache, skin rash, nausea and muscle aches. Most affected people recover fully, but approximately 1% develop severe illness (e.g. meningitis, encephalitis, acute flaccid paralysis and poliomyelitis), in which case neurologic and cognitive deficits may be prolonged or permanent.<sup>216</sup>

<sup>215</sup> Government of Canada. CCDR. Increased risk of exotic mosquito-borne diseases with climate change. Retrieved February 18, 2020 from <https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2019-45/issue-4-april-4-2019/article-4-exotic-mosquito-borne-diseases-climate-change.html>

<sup>216</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

There could be a significant increase in the number of mosquito borne diseases as per the following table from the Government of Canada with expanding ranges:<sup>217</sup>

Mosquito genus	Mosquito species or species complex	Global distribution	Main disease/s carried	References
<i>Aedes</i>	<i>Ae. aegypti</i>	North and South America, Middle East, Africa, India/Western Asia and Southeast Asia and the Pacific	CHIKV, dengue, YF and ZIKV	[2] [3] [14]
	<i>Ae. albopictus</i> [8]	North and South America, Europe and Middle East, Africa, India/Western Asia and Southeast Asia and the Pacific	CHIKV, dengue and ZIKV (to a lesser degree than <i>Ae. aegypti</i> )	[2] [3] [14] [20]
	<i>Ae. polynesiensis</i>	South Pacific Islands	LF ( <i>W. bancrofti</i> ) and dengue	[12]
	<i>Ae. scapularis</i>	North and South America	LF ( <i>W. bancrofti</i> )	[12]
	<i>Ae. pseudoscutellaris</i>	South Pacific Islands	LF ( <i>W. bancrofti</i> ) and dengue	[12] [21] [22]
<i>Anopheles</i>	<i>An. albimanus</i> , <i>An. albimanus</i> , <i>An. aquasalis</i> , <i>An. darlingi</i> , <i>An. freeborni</i> [8], <i>An. marajoara</i> , <i>An. nuneztovari</i> , <i>An. pseudopunctipennis</i> , <i>An. quadrimaculatus</i> [8]	North and South America	Malaria	[4] [19]
	<i>An. atroparvus</i> , <i>An. labranchiae</i> , <i>An. messeae</i> , <i>An. sacharovi</i> , <i>An. sergentii</i> , <i>An. superpictus</i>	Europe and Middle East	Malaria	[4]
	<i>An. arabiensis</i> , <i>An. funestus</i> [5], <i>An. gambiae</i> [5], <i>An. melas</i> , <i>An. merus</i> , <i>An. moucheti</i> , <i>An. nili</i>	Africa	Malaria  Malaria and LF ( <i>W. bancrofti</i> ) [5]	[4] [12] [23]
	<i>An. culicifacies</i> , <i>An. stephensi</i> , <i>An. fluviatilis</i>	India/Western Asia	Malaria	[4]
	<i>An. aconitus</i> , <i>An. annularis</i> , <i>An. balabacensis</i> , <i>An. barbirostris</i> [8], <i>An. culicifacies</i> , <i>An. dirus</i> , <i>An. farauti</i> , <i>An. flavirostris</i> , <i>An. fluviatilis</i> , <i>An. koliensis</i> , <i>An. lesteri</i> , <i>An. leucosphyrus/latens</i> , <i>An. maculatus</i> , <i>An. minimus</i> , <i>An. punctulatus</i> , <i>An. sinensis</i> , <i>An. stephensi</i> , <i>An. subpictus</i> , <i>An. sudaicus</i>	Southeast Asia and the Pacific	Malaria  Malaria and LF ( <i>B. timori</i> ) [4]	[4] [12]
<i>Culex</i>	<i>Cx. tritaeniorhynchus</i>	Southeast Asia and the Pacific, Africa, Middle East	JE, Rift Valley fever, Murray Valley encephalitis virus	[24] [25]
	<i>Cx. quinquefasciatus</i>	North, Central and South America, Southeast Asia	LF ( <i>W. bancrofti</i> )	[12] [23]
<i>Mansonia</i>	Various species	Asia and the Pacific	LF ( <i>B. malayi</i> )	[12] [23]

<sup>217</sup> Government of Canada. CCDDR. Increased risk of exotic mosquito-borne diseases with climate change. Retrieved February 18, 2020 from <https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2019-45/issue-4-april-4-2019/article-4-exotic-mosquito-borne-diseases-climate-change.html> and Ng, V., Lindsay, R.L., Brownstone, T., Sadeghieh, T., & Khan, S.U. (2019). Could exotic mosquito-borne diseases emerge in Canada with climate change? Government of Canada. CCDDR. Volume 45(4), April 4, 2019: Climate change and infectious diseases: the challenges. Retrieved February 18, 2020 from <https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr/monthly-issue/2019-45/issue-4-april-4-2019/article-4-exotic-mosquito-borne-diseases-climate-change.html>

As per Ng et al. (2019):

“As temperatures in Canada become milder and humidity and precipitation increase, larger parts of Canada will become climatically suitable for the establishment of some exotic mosquitoes that are currently limited to the tropics and subtropics. Furthermore, as the winters become shorter and summers become longer, the duration of climatic suitability for disease transmission will increase, allowing autochthonous transmission of exotic MBDs for a limited period in some regions of Canada.”

“Extreme weather events, such as droughts and heat events, can bring host reservoirs searching for water sources and mosquito breeding grounds together.”



### II.VII.VII. Ticks:

Ticks are vectors for disease and the risk is increasing.<sup>218, 219</sup>

There are more than twenty species of ticks in BC, however, only three species bite humans.<sup>220</sup> This includes Lyme disease which has been uncommon in BC compared to the rest of Canada.

The risk of Lyme disease in BC is lower than it is in Eastern and Central Canada. Lyme disease was virtually unknown in Canada decades ago with only 144 cases in 2009 but increasing to over 2000 (Canada wide) in 2017 as per the Public Health Agency of Canada and “Canada’s Top Climate Change Risks, The Expert Panel on Climate Change Risks and Adaptation Potential”.

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<sup>218</sup> Rocky Mountain spotted fever, Tularemia, tick paralysis and Colorado tick fever are not discussed in this Guide as these are very rare in BC

<sup>219</sup> Armstrong, L. Experts expect a bad year for ticks as disease-carrying bugs expand range in Canada. The Globe and Mail. (June 01, 2022). Retrieved 07, 2022 from <https://www.theglobeandmail.com/canada/article-experts-expect-bad-year-for-ticks-as-disease-carrying-bugs-expand/>

<sup>220</sup> Government of BC. Ticks in British Columbia. Retrieved February 18, 2020 from <https://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/animals-and-crops/plant-health/insects-and-plant-diseases/home-garden/ticks>



Outdoor workers have up to a five times higher risk for Lyme disease than indoor workers.<sup>221</sup>

As per the US Centers for Disease Control and Prevention, there are numerous diseases that may be carried by ticks.<sup>222</sup> These include:

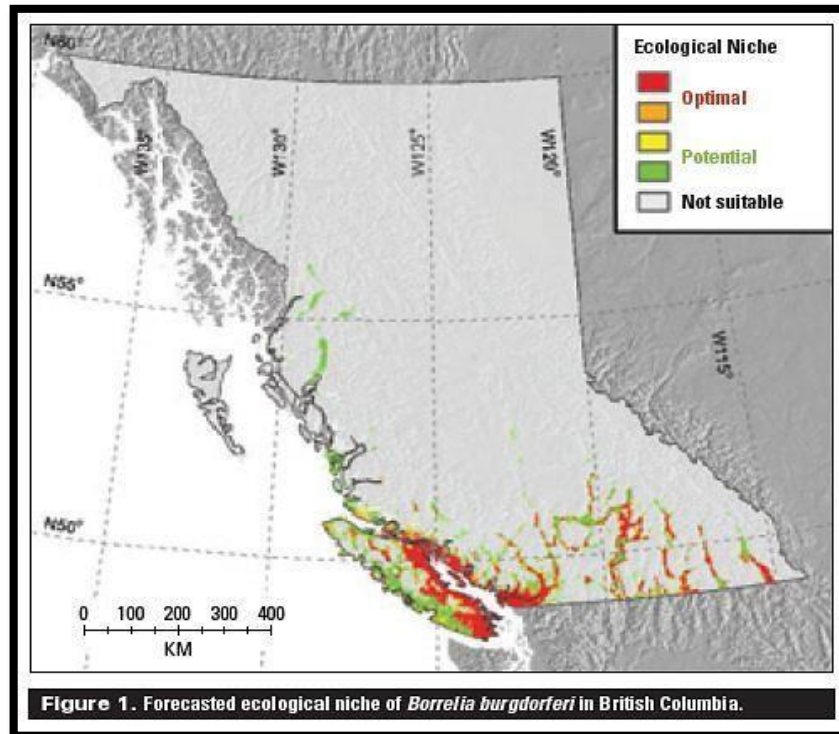
- *Anaplasmosis*
- *Babesiosis*
- *Borrelia mayonii*
- *Borrelia miyamotoi*
- Bourbon virus
- Colorado tick fever
- Heartland virus
- Lyme disease
- Powassan disease
- *Rickettsia parkeri*
- Rocky Mountain spotted fever
- Tickborne relapsing fever
- Tularemia
- *364D Rickettsiosis*

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<sup>221</sup> Schulte, P.A., Bhattacharya, A., Butler, C.R., Chun, H.K., Jacklitsch, B., & Jacobs, T. (2016). Advancing the framework for considering the effects of climate change on worker safety and health. *Journal of Occupational and Environmental Hygiene*. Volume 12, 2016, Issue 11. Retrieved February 12, 2020 from <https://oeh.tandfonline.com/doi/full/10.1080/15459624.2016.1179388#.XkSk8GhKjFg>

<sup>222</sup> US Centers for Disease Control. Retrieved February 20, 2020 from <https://www.cdc.gov/ticks/diseases/index.html>

As per the BC Medical Journal and figure 1: Forecasted ecological niche of *Borrelia burgdorferi* in British Columbia, there is a potential doubling of areas suitable for ticks in BC:<sup>223</sup>

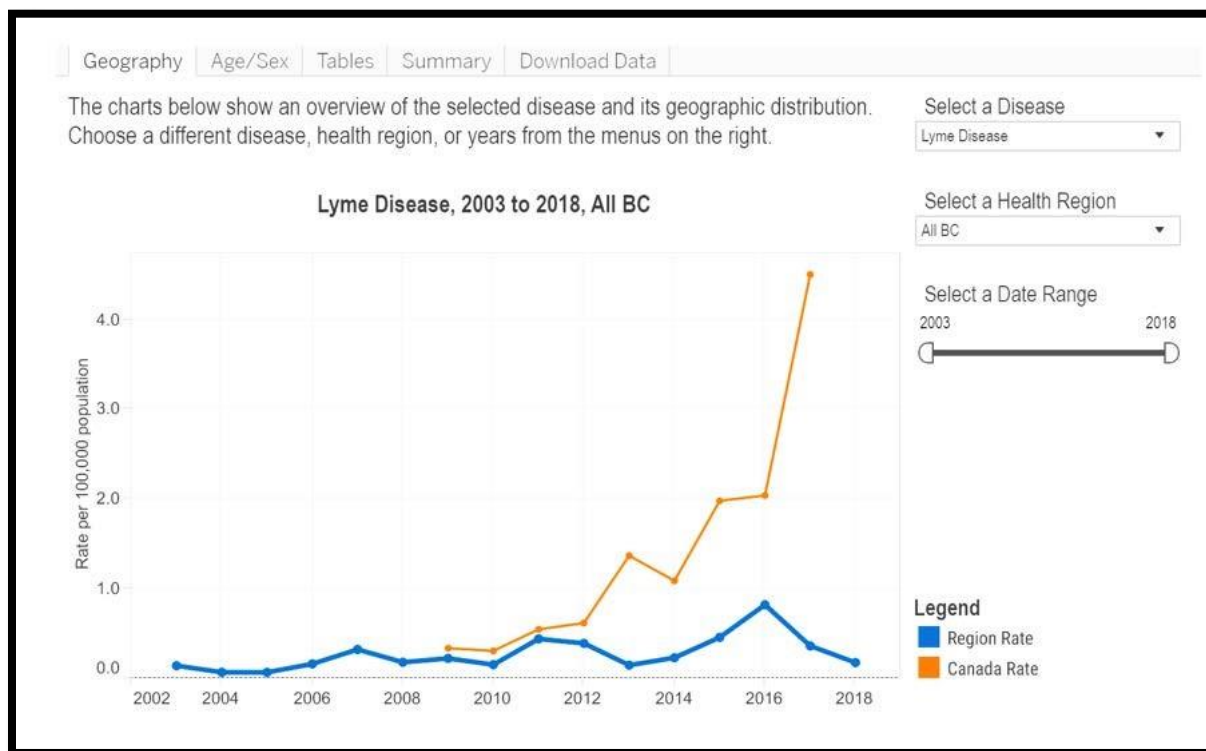


Climate change is driving zoonotic diseases northwards into Canada from the U.S. As warming drives blacklegged ticks northwards into Canada, Canada is now experiencing more incident cases of viral borne encephalitis and human granulocytic anaplasmosis. Babesiosis is not yet endemic in Canada but because it is found in the northeastern U.S., researchers expect it will spread here in the future. Lone Star ticks are making their way into Canada, and while we haven't identified diseases associated with these ticks yet, this is possible over the coming years.<sup>224</sup>

<sup>223</sup> Henry, B. (June 2011). Lyme Disease in British Columbia: Are We Really Missing An Epidemic? *BC Medical Journal*. Retrieved February 19, 2020 from <https://www.bcmj.org/articles/lyme-disease-british-columbia-are-we-really-missing-epidemic>

<sup>224</sup> Infectious Disease and Climate Change in Canada: Key informant interviews. (September 2019). Canadian Public Health Association. Retrieved June 07, 2022 from [https://www.cpha.ca/sites/default/files/uploads/resources/idcc/CPHA\\_IDCC\\_Key\\_informant\\_interviews.pdf](https://www.cpha.ca/sites/default/files/uploads/resources/idcc/CPHA_IDCC_Key_informant_interviews.pdf)

Lyme disease is increasing as per the BC Centre for Disease Control and Lyme disease distribution chart 2003 to 2018 in BC below:



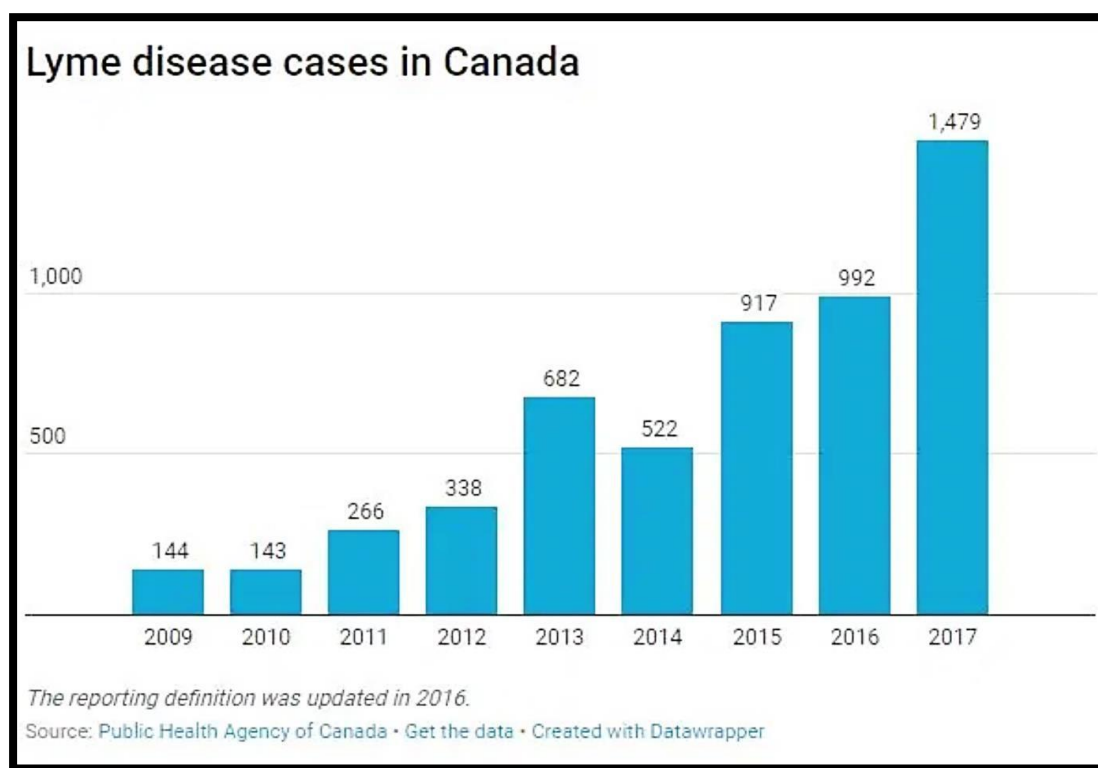
The range of Lyme disease appears to be spreading in Canada at a rate of 35 to 55 km per year.<sup>225</sup> In Ontario and Eastern Canada Lyme disease rates have increased with climate change.<sup>226</sup> This is due to the presence of different host mammals (rodents versus deer) and different types of vegetation (coniferous versus deciduous forests) in BC, for example. Less than 1% of ticks tested carried the bacterium responsible for Lyme disease in BC. Up to 20% of blacklegged ticks carry the bacteria that causes Lyme disease in other parts of Canada.

<sup>225</sup> Canada's Top Climate Change Risks. The Expert Panel on Climate Change Risks and Adaptation Potential. (2019). CCA CAC. Retrieved February 18, 2020 from <https://cca-reports.ca/wp-content/uploads/2019/07/Report-Canada-top-climate-change-risks.pdf>

<sup>226</sup> BC Centre for Disease Control. Retrieved February 18, 2020 from <http://www.bccdc.ca/health-info/diseases-conditions/lyme-disease-borrelia-burgdorferi-infection>

Lyme disease is caused by a bacterium called *Borrelia burgdorferi* which is spread by ticks. *B. burgdorferi* has been found in two species of ticks in BC: *Ixodes pacificus* and *Ixodes angustus*, also known as the western blacklegged ticks.<sup>227</sup>

The BC Centre for Disease Control states that “ticks that carry Lyme disease are found in southwestern BC, including Vancouver Island, the Gulf Islands, the Sunshine Coast, Greater Vancouver, and the Fraser Valley. The geographic distribution of Lyme disease in people and in ticks in BC has remained constant over time.” As per the following figure from Global News on Lyme disease cases in Canada 2016:<sup>228</sup>



<sup>227</sup> BC Centre for Disease Control. Retrieved February 18, 2020 from <http://www.bccdc.ca/health-info/diseases-conditions/lyme-disease-borrelia-burgdorferi-infection>

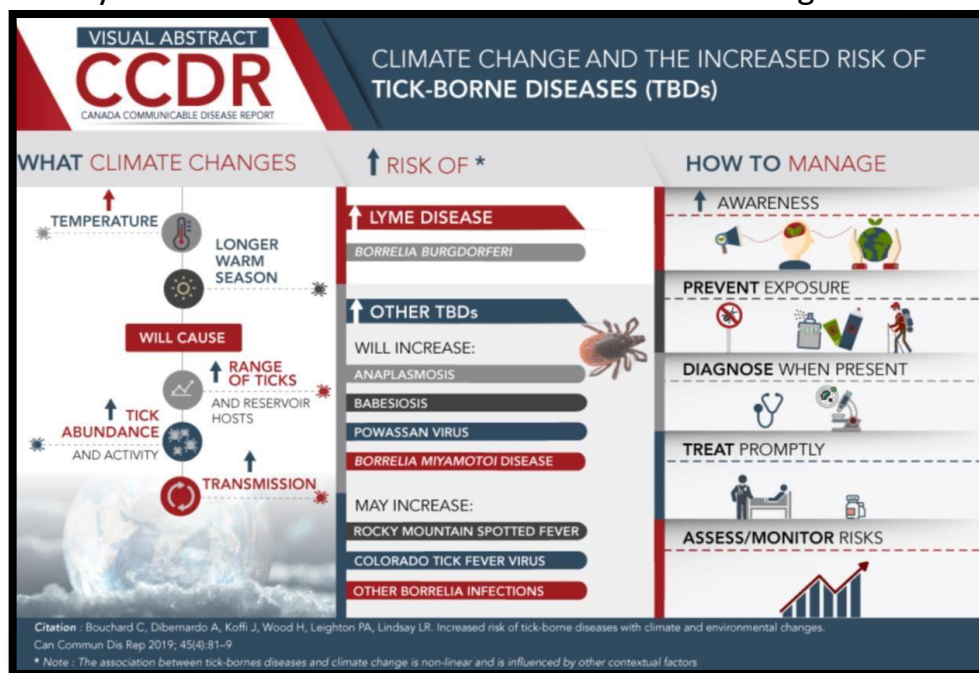
<sup>228</sup> Young, L. (May 18, 2018). Tick forecast 2018: Experts predict more Lyme disease in Canada. *Global News*. Retrieved February 18, 2020 from <https://globalnews.ca/news/4197168/tick-forecast-lyme-disease-canada-2018/>

Ticks may have increased ranges, increased prevalence at higher latitudes, increased populations, changed behaviours, increased questing behaviour and increased contact with both animal and human hosts over a longer season due to climate change.

High risk tick areas have spread across British Columbia, Manitoba, Ontario, Quebec, New Brunswick and Nova Scotia, usually in forested and overgrown areas. As per Canada Communicable Disease Report:<sup>229</sup>

“In addition to Lyme disease, four other tick-borne diseases (TBDs) have started to emerge and are likely to increase: Anaplasmosis; Babesiosis; Powassan virus; and *Borrelia miyamotoi* disease. Increased temperature increases the survival and activity period of ticks, increases the range of both reservoir and tick hosts (e.g. mice and deer) and increases the duration of the season when people may be exposed to ticks. Other ticks and TBDs may spread into Canada as the climate changes.”

The Canada Communicable Disease Report states in the following figure that ticks and Lyme disease may increase in certain areas due to climate change:



<sup>229</sup> Canada Communicable Disease Report. (2019). Retrieved February 17, 2020 from <https://www.canada.ca/en/public-health/services/reports-publications/canada-communicable-disease-report-ccdr.html>



## II.VIII. Rodents including Rats and Mice:

Climate change affects rodent<sup>230</sup> populations as well as increasing contact with workers via increasing optimal breeding conditions, increasing the availability of food e.g. vegetation, increasing the survival rate of rodents and decreasing predation by creating more protective environments.<sup>231</sup> In areas of BC where there are droughts, the inverse will occur.<sup>232</sup> This includes both rats and mice. There are two main types of rats in BC and two types of indoor mice. There is limited evidence of deer mouse population increases in BC. Increasing rodent populations will bring workers into more frequent contact with rodents, rodent feces, rodent urine, ticks and fleas.<sup>233</sup>

<sup>230</sup> Norway rats (*Rattus norvegicus*), Black rats (*Rattus rattus*), house mice (*Mus musculus*)

<sup>231</sup> Zeidler, M. (May 11, 2018). Rats on the Rise in B.C. Cities. *Globe & Mail*. Retrieved February 20, 2020 from <https://www.theglobeandmail.com/news/british-columbia/rats-on-the-rise-in-bc-cities/article15777196/>

<sup>232</sup> Dhang, P. (2016). Climate Change Impacts on Urban Pests. Retrieved February 20, 2020 from [https://books.google.ca/books?hl=en&lr=&id=rG3lDQAAQBAJ&oi=fnd&pg=PA31&dq=rats+and+mice+increasing+climate+change&ots=ger2rSHHCO&sig=6BZjyGN\\_7P97uzVKmnhnu14wrGg#v=onepage&q=rats%20and%20mice%20increasing%20climate%20change&f=false](https://books.google.ca/books?hl=en&lr=&id=rG3lDQAAQBAJ&oi=fnd&pg=PA31&dq=rats+and+mice+increasing+climate+change&ots=ger2rSHHCO&sig=6BZjyGN_7P97uzVKmnhnu14wrGg#v=onepage&q=rats%20and%20mice%20increasing%20climate%20change&f=false)

<sup>233</sup> City of Vancouver. Retrieved February 20, 2020 from <https://vancouver.ca/home-property-development/rats-and-mice.aspx>



Climate change increases the likelihood of contact with rodent related pathogens. As per Guterres & Regina Sampaio de Lemos (2016):<sup>234</sup>

“Climate change and landscape alteration affect hantavirus transmission...”<sup>235</sup>

As per Michael Parsons, a researcher at Fordham University:<sup>236</sup>

“Warmer temperatures for longer stretches of time also mean rats may reproduce more, which poses public health problems. Rats serve as hosts for ticks and fleas and carry diseases such as Salmonella and bubonic plague (the disease that brought us the Black Death). Add to this the fact that warmer temperatures allow ticks and fleas to breed longer and spread to new parts of the country, and the problem begins to compound.”

As per Wu et al. (2016):<sup>237</sup>

“diseases transmitted by rodents sometimes increase during heavy rainfall and flooding events because of altered patterns of human–pathogen–rodent contact. For example, during hazard periods deer mice may enter human dwellings searching for food and thereby transmit *hantavirus* to humans, leading to hantavirus pulmonary syndrome (HPS) cases.”<sup>238</sup>



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<sup>234</sup> Guterres, A. & Regina Sampaio de Lemos, E. (2018). Hantaviruses and a neglected environmental determinant. *One Health*. Volume 5, June 2018. Retrieved February 19, 2020 from <https://www.sciencedirect.com/science/article/pii/S2352771417300526>

<sup>235</sup> HealthLink BC. Hantavirus Pulmonary Syndrome. Retrieved February 20, 2020 from <https://www.healthlinkbc.ca/healthlinkbc-files/hantavirus-pulmonary-syndrome>

<sup>236</sup> Sadasivam, N. (May 05, 2019). Is Climate Change Really Driving the Ratpocalypse? *HuffPost*. Retrieved February 20, 2020 from [https://www.huffpost.com/entry/climate-change-rats-health-research\\_n\\_5cf8196be4b0e63eda94be0f](https://www.huffpost.com/entry/climate-change-rats-health-research_n_5cf8196be4b0e63eda94be0f)

<sup>237</sup> Wu, X., Lu, Y., Zhou, S., Chen, L., & Xu, B. (2016). Impact of climate change on human infectious diseases: Empirical evidence and human adaptation. *Environment International*. Volume 86. Retrieved February 17, 2020 from <https://www.sciencedirect.com/science/article/pii/S0160412015300489>

<sup>238</sup> WorkSafeBC. Hantavirus. Retrieved February 20, 2020 from <https://www.worksafebc.com/en/health-safety/injuries-diseases/infectious-diseases/types/hantavirus>



As per Guterres & Regina Sampaio de Lemos (2016):<sup>239</sup>


“The factor “precipitation” is the most studied climatic predictor of HCPS outbreaks, with several authors indicating a positive correlation with rodent densities and prevalence of hantavirus. High rainfall increases vegetation growth, raising rodent densities and increasing the probability of human-rodent encounters and consequent hantavirus transmission.”

The changes caused by climate change were predicted by Klempa in 2009:<sup>240</sup>

“We can anticipate changes in the size and frequency of hantavirus outbreaks, the spectrum of hantavirus species and geographical distribution (mediated by changes in population densities), and species composition and geographical distribution of their reservoir hosts. The early effects of global warming have already been observed in different geographical areas of Europe.”




As per the WorkSafeBC Resources on A Hantavirus Exposure Control Program for Employers and Workers, the issue of Hantavirus is a common concern for workers:

## Resources



### A Hantavirus Exposure Control Program for Employers and Workers

This booklet is intended for employers and workers who may come into contact with rodents, or rodent droppings, while on the job. It contains guidelines for employers on preventing hantavirus infections...

Publication Date: Nov 2006 |  PDF |  Book |  Download | [Preview](#)

<sup>239</sup> Guterres, A. & Regina Sampaio de Lemos, E. (2018). Hantaviruses and a neglected environmental determinant. *One Health*. Volume 5, June 2018. Retrieved February 19, 2020 from <https://www.sciencedirect.com/science/article/pii/S2352771417300526>

<sup>240</sup> Klempa, B. (2009). Hantaviruses and climate change. *Clinical Microbiology and Infection*. 2009, June:15(6). Retrieved February 19, 2020 from <https://onlinelibrary.wiley.com/doi/10.1111/j.1469-0691.2009.02848.x>

Rats can carry a wide variety of diseases that can be transmitted from animals to humans, including viruses, bacteria and parasites. Specific diseases include, non exhaustively:

- *Leptospira interrogans*
- *Streptobacillus moniliformis*
- *Rickettsia typhi*
- Hantaviruses
- *Yersinia pestis*

The diseases that rats carry differ according to their geographical area and they can vary not only by city, but by city block.<sup>241</sup>

Climate change will continue to increase rodent populations, thereby leading to increased contact with pathogens via fleas; ticks; rodent feces, urine, hair and bites. Given the potential impact on worker health, Employers and Locals should monitor this issue and conduct hazard and risk assessments as necessary. Orkin Canada has identified BC top cities for rat infestations (which may not be based on scientific or climate change evidence).



<sup>241</sup> Leung, W. (November 12, 2017). Nature on the move. *The Globe & Mail*. Retrieved February 18, 2020 from <https://www.theglobeandmail.com/life/health-and-fitness/health/four-pest-and-plant-species-that-pose-health-risks-and-how-to-protect-yourself/article35577281/>



## II.IX. Plants:

This section addresses the hazards and risks posed by skin contact and physical injuries such as punctures and cuts.<sup>242</sup> Ingestion and inhalation are not addressed in this section such as by

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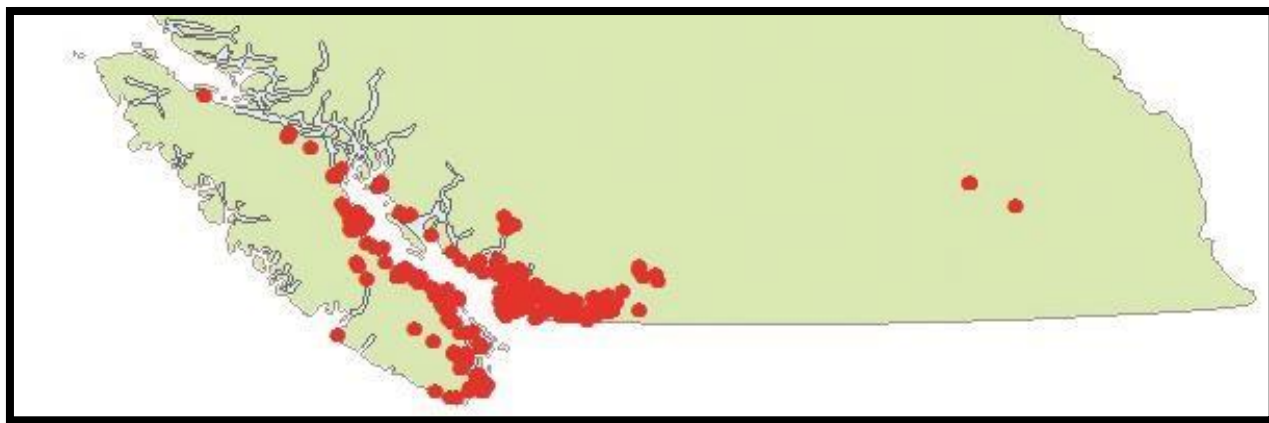
<sup>242</sup> Invasive Species Council of BC. See <https://bcinvasives.ca/news-events/media/articles/weed-of-the-week-daphne-spurge-laurel>



foxglove, American pokeweed, winterberry, water hemlock, black nightshade, death camas, Canada moonseed, etc.

With the changing climate, there have been changes in the range<sup>243</sup> and number of poisonous or noxious plants such as:<sup>244</sup>

- Devil's club (BC, Alberta, Ontario)
- Giant hogweed (BC, Ontario, Quebec and Atlantic Canada) – Which has frequently been labelled Canada's most dangerous plant.<sup>245</sup> Extreme caution should be exercised near this highly invasive plant<sup>246</sup>
- Poison sumac (Ontario, Quebec, Atlantic Canada)
- Poison oak (most provinces)
- Poison ivy (most provinces)
- Bloodroot (Nova Scotia to Manitoba)
- Spurge laurel (primarily BC)



Invasive Species Council of BC. Giant Hogweed Map.<sup>247</sup>

<sup>243</sup> (No author). (August 11, 2017). Climate change may encourage invasive species, scientist warns. *CBC News*. Retrieved February 18, 2020 from <https://www.cbc.ca/news/canada/kitchener-waterloo/invasive-species-spreading-top-10-canada-dan-kraus-nature-conservancy-1.4244103>

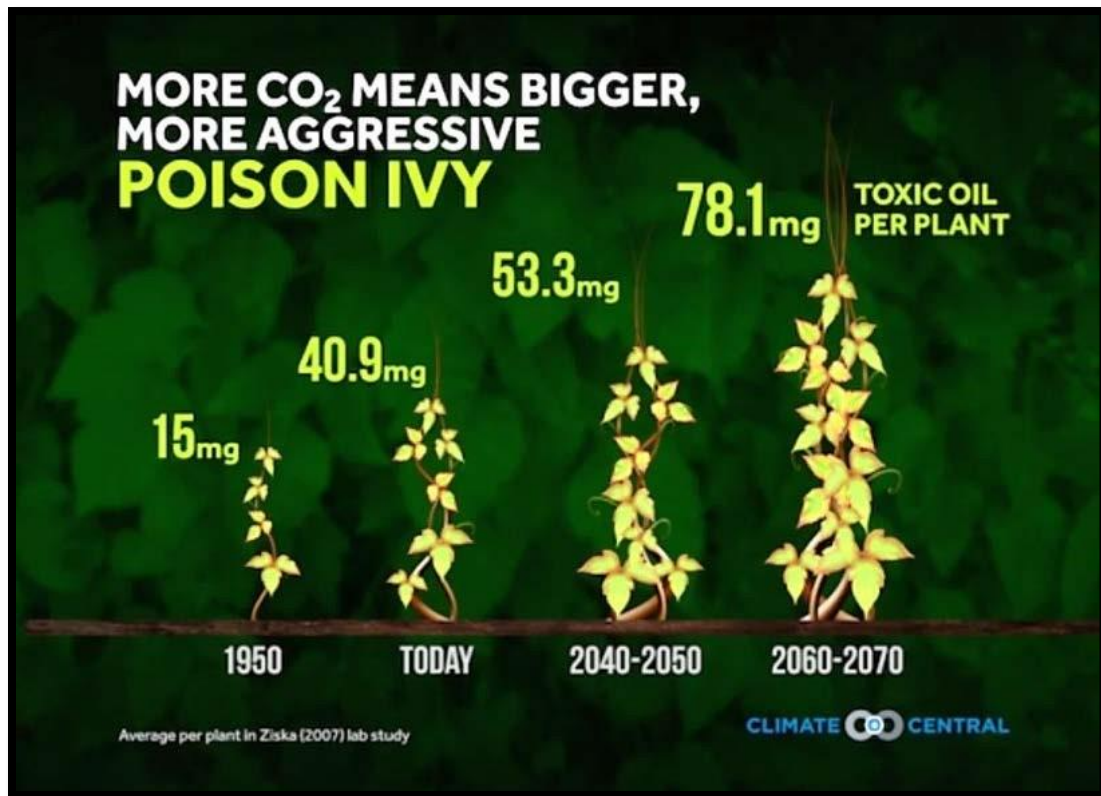
<sup>244</sup> WorkSafeBC. See <https://www.worksafebc.com/en/health-safety/hazards-exposures/toxic-plants>

<sup>245</sup> (No author). (June 22, 2018). Canadians urged to watch out for invasive hogweed plant that blinds, burns. *Global News*. Retrieved February 18, 2020 from <https://globalnews.ca/news/4291662/hogweed-plant-warning-canada/>

<sup>246</sup> (No author). (June 22, 2018). Canadians urged to watch out for invasive hogweed plant that blinds, burns. *Global News*. Retrieved February 18, 2020 from <https://globalnews.ca/news/4291662/hogweed-plant-warning-canada/>

<sup>247</sup> Invasive Species Council of BC. Retrieved February 20, 2020 from <https://bcinvasives.ca/invasive-species/identify/invasive-plants/giant-hogweed>

While not dangerous, poison ivy and poison oak can cause significant skin and eye irritation. As per Climate Central figure for poison ivy (from 2007 data):<sup>248</sup>



There is very limited data on the presence of other noxious and poisonous plants. While other plants such as poison ivy may not pose a serious health hazard to most workers, Employers and Locals should monitor this issue and conduct hazard and risk assessments as necessary.

<sup>248</sup> Climate Central. More CO2 Means Bigger, More Aggressive Poison Ivy. Retrieved February 18, 2020 from <https://www.climatecentral.org/>



## II.X. Extreme Weather Events and Conditions:<sup>249</sup>

### II.X.I. Overview:

BC has been experiencing weather extremes. In 2017, an ice storm struck the Fraser Valley.<sup>250</sup> In 2017 the largest forest fire season on record occurred. Multiple windstorms have occurred for several years in a row with wind speeds reaching nearly 150 kms per hour in some areas. The Lower Mainland and Vancouver Island suffered extensive damage and there were 700,000 customers without power.

<sup>249</sup> Including fire weather: changing precipitation and temperature (along with changing wind) that alter the risk of extreme wildfires and arise from hot, dry, and windy conditions

<sup>250</sup> (No author). (December 30, 2017). Fraser Valley ice storms leave 100,000 people without power overnight. *Daily Hive*. Retrieved February 15, 2020 from <https://dailyhive.com/vancouver/fraser-valley-ice-storms-thousands-without-power-december-2017>

Extreme weather events will expose emergency responders, municipal workers, energy workers, transportation workers, healthcare workers and others in situations involving exposure to hazardous agents as well as physical and psychological risks. A study in Quebec found that people aged 40 to 74 are more likely to be injured due to weather conditions.<sup>251</sup> Many Indigenous populations are also at greater risk of waterborne diseases, especially since most water management infrastructure in these communities are considered at moderate or high-risk to the impacts of heavy precipitation.<sup>252</sup> In the Greater Vancouver area, an estimated 17% to 28% increase in collisions is expected by 2055 due to increased maximum and total precipitation.<sup>253</sup>

Extreme weather events include:<sup>254</sup>

- High winds and turbulence
- Tornadoes
- Hurricanes
- Heavy rain
- Flooding

Extreme weather events e.g. flooding, can cause significant bacterial loads in surface water and stormwater can cause an increase in injuries that include lacerations, punctures, electrocutions and falls. Extreme weather can contaminate groundwater which increases the risk of waterborne diseases such as gastrointestinal diseases e.g. viruses such as enterovirus, bacteria such as *Campylobacter* and Legionellosis, and enteric protozoa such as *Giardia*.<sup>255</sup>

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<sup>251</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>252</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>253</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>254</sup> McKenzie-Sutter, H. (January 31, 2019). Canada's extreme weather could be the new norm, governments should start preparing: experts. *Global News*. Retrieved February 20, 2020 from <https://globalnews.ca/news/4909707/canadas-extreme-weather-government-prepare/>

<sup>255</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>



Almost half of pathogens that significantly affect human or animal health are sensitive to precipitation or moisture.<sup>256</sup> Campylobacter, Cryptosporidium, Giardia and Legionella in particular were affected. In Vancouver, days that had high precipitation increased the number of Cryptosporidium and Giardia cases up to six weeks after the event<sup>257</sup> (Chhetri et al., 2017). Heavy rainfall and storms can also increase the risk of foodborne pathogens, such as norovirus, Campylobacter, Toxoplasma gondii and Listeria monocytogenes

For post-traumatic stress, people with high levels of anxiety are more likely to experience high levels after extreme weather events.

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<sup>256</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>257</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>



## **II.X.II. Thunderstorms, including Flooding and High Velocity Winds:**

Climate change has resulted in an increase in the number, severity and location of high velocity wind events and thunderstorms. As per the Vancouver Courier:<sup>258</sup>

“The number of customer outages during major storm events has increased by about 265 per cent.” (from 2013 to 2017)

“BC Hydro reports that the number of storm events it has responded to has tripled over the past five years.”

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<sup>258</sup> Shepert, E. (November 16, 2018). Wild weather: BC Hydro says storms becoming more 'frequent, severe'. *Vancouver Courier*. Retrieved February 19, 2020 from <https://www.vancourier.com/news/wild-weather-bc-hydro-says-storms-becoming-more-frequent-severe-1.23500841>

Thunderstorms usually involve:

- Lightning strikes
- Strong winds including debris being moved at high velocity. Winds may reach 150 kilometres or more
- Tornadoes between F0 and F5 on the Fujita Scale with about 80 tornadoes hitting Canada each year (and 25% of these in Ontario at F0 or F1)
- Heavy rain and flooding
- Landslides (people living on clay soil or near steep slopes are at increased risk of landslides)
- Sleet
- Snow
- Hail
- High humidity
- Atmospheric pressure changes

Storms, including thunderstorms, may occur individually or as part of a cluster of storms.

There are numerous hazards when associated with storms:

- Wind caused injuries e.g. projectiles
- Eye injuries
- Sprains and strains
- Falls
- Crush injuries (collapsing buildings, trees falling)
- Asphyxiation
- Drowning
- Lacerations
- Burns (chemical, fire and electrical)
- Electrocutation (broken power lines)
- Poor air quality
- Diseases

After a flood, women appear to have an increased risk of experiencing psychological impacts, while men seem to be more likely to experience physical impacts, such as cardiac events.<sup>259</sup> People with pre-existing health problems are more susceptible to the effects of flooding.<sup>260</sup> First Nations and Métis peoples are particularly vulnerable to extreme events such as flooding.<sup>261</sup> The literature on how climate change will impact Indigenous populations living in Canada is not complete. Most research is on Inuit populations and the Canadian Arctic. There are few studies of people living in Southern Canadian or urban areas, and of Métis peoples across Canada. Significant research gaps exist about climate change impacts on the health of Indigenous communities in the Prairies and the Atlantic provinces.<sup>262</sup>

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<sup>259</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>260</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>261</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>262</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

Storms can have both indirect and direct impacts as per the table from Protecting your Community from Climate Change, A Training Program for Ontario Municipalities:<sup>263</sup>

Extreme Weather Event	Examples of Health Impact Pathway(s)	Examples of Potential Health Effects	Populations at Higher Risk
<b>Extreme rain or snow fall</b>	<ul style="list-style-type: none"> <li>Flooding and its after-effects (e.g. poor indoor air quality from growth of moulds)</li> <li>Increase in populations of mosquitoes and other disease carriers</li> <li>Contamination of drinking water by chemicals or waste in surface runoff</li> <li>Failure of essential infrastructure (e.g. sewers, water treatment facilities)</li> <li>Algal blooms and other changes in aquatic ecology</li> </ul>	<ul style="list-style-type: none"> <li>Physical injury, shock and trauma</li> <li>Death by drowning</li> <li>Respiratory illness</li> <li>Outbreaks of vector-borne infectious disease</li> <li>Outbreaks of cryptosporidiosis, giardiasis, amoebiasis, typhoid and other water borne infections</li> </ul>	<ul style="list-style-type: none"> <li>Children</li> <li>Seniors</li> <li>People living along coasts or waterways</li> <li>People with chronic illnesses</li> <li>People with compromised health status</li> <li>People with impaired immune systems</li> <li>People with inadequate or no housing</li> </ul>

Here is one sample of what hazards and risks a storm can expose workers to (in terms of the variety of infrastructure damage and potential hazards):<sup>264</sup>

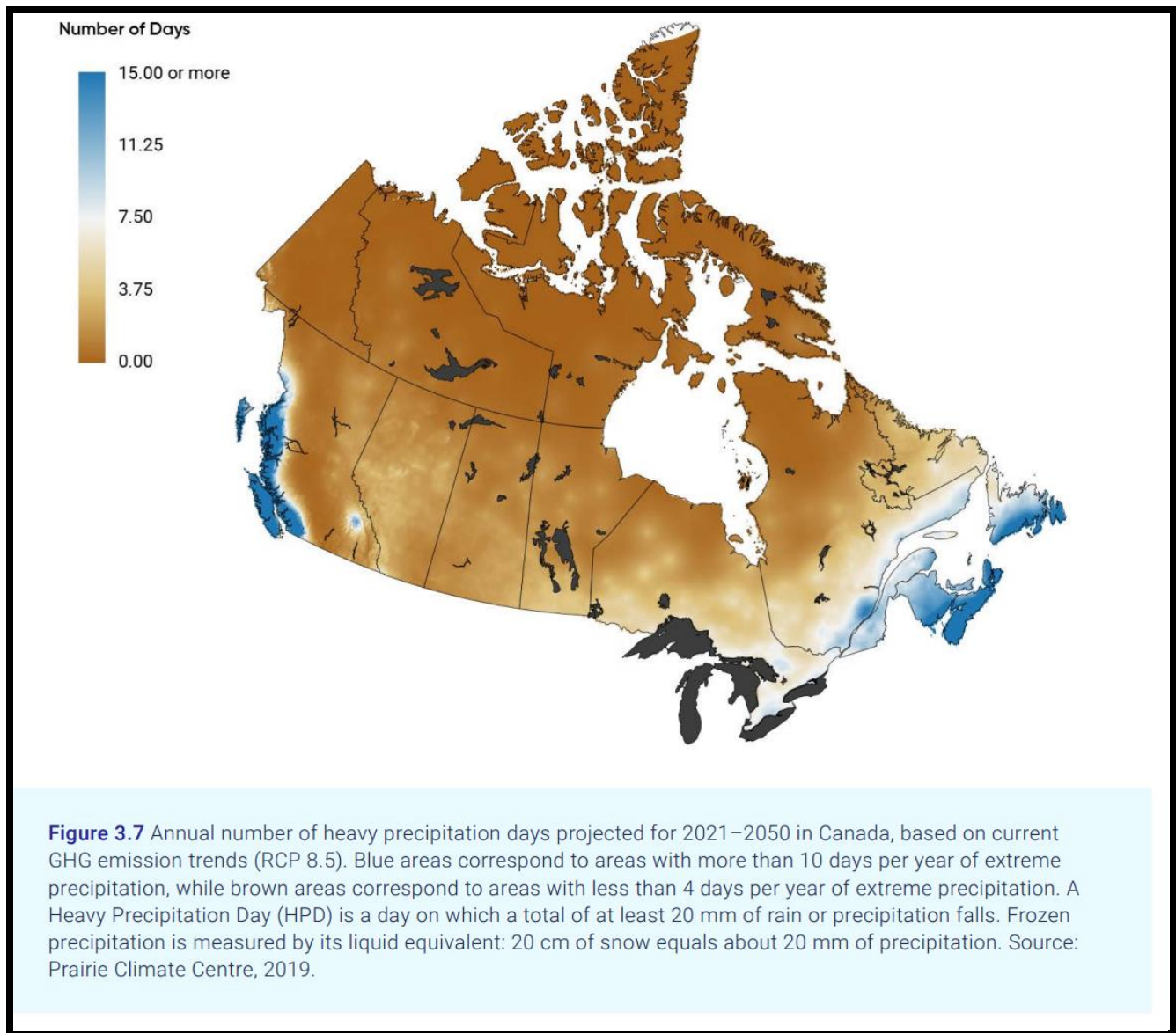


<sup>263</sup> Protecting your Community from Climate Change. A Training Program for Ontario Municipalities. Retrieved February 17, 2020 from [https://climateontario.ca/ORAC\\_Products.php](https://climateontario.ca/ORAC_Products.php)

<sup>264</sup> Protecting your Community from Climate Change. A Training Program for Ontario Municipalities. Retrieved February 17, 2020 from [https://climateontario.ca/ORAC\\_Products.php](https://climateontario.ca/ORAC_Products.php)



As per the map from Health of Canadians in a Changing Climate, there is going to be a significant increase in heavy rainfall events:<sup>265</sup>



<sup>265</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>





### II.X.III. Other Types of Storms:

Climate change has resulted in an increase in other types of severe weather events such as snowstorms, blizzards, hurricanes, ice storms, windchill, etc. There is very limited evidence for an increase in snow (overall) or snow events in BC; long term overall snowfall is reduced. Precipitation is increasing in the form of rain as opposed to snow. In some cases, it is in the form of ice.

There are dangers from ice such as slips, trips, falls and that the weight of ice covering a tree limb can be more than 30 times the weight of the tree branch.<sup>266</sup> This may result in severe injuries and fatalities to arborists, utility workers, operations workers, sanitation workers, etc.

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<sup>266</sup> Protecting your Community from Climate Change. A Training Program for Ontario Municipalities. Retrieved February 17, 2020 from [https://climateontario.ca/ORAC\\_Products.php](https://climateontario.ca/ORAC_Products.php)

Cold temperatures coincide with the influenza and respiratory infections such as pneumonia and bronchitis.<sup>267</sup> In Quebec, the coldest temperatures were associated with a maximum 12% increase in excess hospital visits for ischemic diseases in winter from 1989 to 2006.<sup>268</sup> Cold does not appear to have any particular effect on mental health disorders.<sup>269</sup>

Temperatures near freezing and rainfall followed by a significant drop in temperature have been associated with a higher risk of falling.<sup>270</sup> Vehicular accidents due to snow have not been included in this report. Injuries and fatalities due to changing snowfall needs to be assessed. The risk of hospitalization was found to increase on average by 2.8% for each degree the temperature decreased below optimal conditions.<sup>271</sup> Projections under an average global warming scenario for 15 Canadian cities indicated that the annual rate of deaths due to cold could decrease from 3 to 19 deaths per 100,000 inhabitants by 2079, compared to current rates, depending on the city.<sup>272</sup>

Mortality rates for older persons will be affected by snowfall and colder temperatures, however, there was little data on older workers. In Ontario, during summer, every 5°C increase was associated with four excess daily deaths; during the winter, every 5°C decrease was associated with seven additional daily deaths. Cardiovascular and respiratory mortality in people aged 65 and older increases by 1.7% and 2.9%, respectively, with a reduction of 1°C below optimal temperature.<sup>273</sup>

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<sup>267</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>268</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>269</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>270</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>271</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>272</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>273</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

There are studies that show that men under age 65 have higher rates of mortality in colder temperatures due to physical exertion related to activities such as shovelling snow. In Ontario, each 1°C reduction below 0°C between 2004 and 2010 led to a median 15% increase in the median number of visits to the emergency department related to outdoor work (frostbite or hypothermia).<sup>274</sup> The impact of pre-existing morbidity on susceptibility to cold is also age dependent.<sup>275</sup> Other factors include:

- Smoking
- Weight
- General health
- Pre-existing conditions
- Use of alcohol
- Use of drugs

Heat related mortality is expected to outpace the reduction in cold related mortality in most regions of Canada.<sup>276</sup>

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<sup>274</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>275</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>276</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

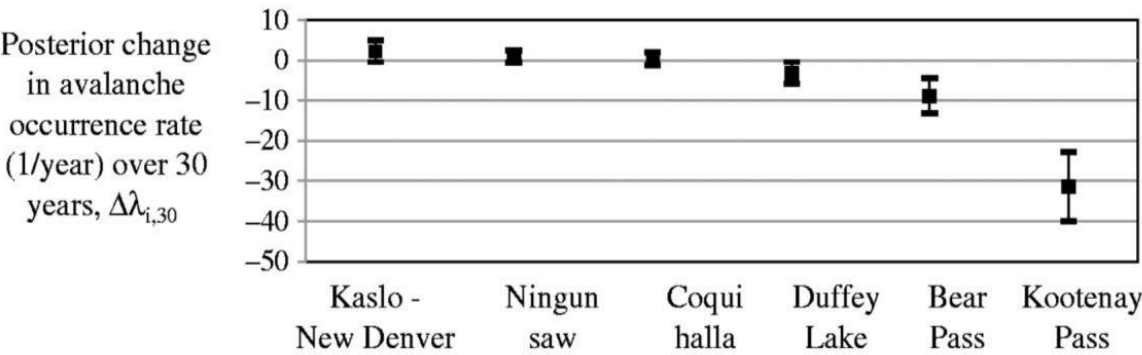
Snowfall pattern changes and types of snow may change the risk of avalanches. The snow avalanche hazard has affected people and facilities in BC, Alberta, Yukon, NWT, Nunavut, Ontario, Quebec and Newfoundland.

Avalanches, which are often in the BC news reports, can be triggered by wind, rain, earthquakes, warming temperatures, snow, type of snow, people. With climate change there is an increased risk of avalanches being bigger, travelling further and occurring earlier in the year. This is opposed to an actual increase in the number of avalanches.<sup>277</sup> This is supported by Stethem et al. (2003). Studies indicate a decreasing snowpack, decreasing snow fall, increasing rain and increased temperatures.

There is almost no long term statistically significant evidence of province wide increases in avalanches (in BC, for example) due to climate change.<sup>278</sup> The opposite appears to be true as per Sinickas et al. (2014):

“a strong decrease in occurrence rates for Kootenay Pass and Bear Pass, negligible changes for Duffey Lake, Coquihalla and Ningunsaw and probably a negligible increase in Kaslo-New Denver.”

As per the table from the same study:



<sup>277</sup> (No author). (March 14, 2018). Global warming increases the chance of avalanches. *ScienceDaily*. Retrieved February 20, 2020 from <https://www.sciencedaily.com/releases/2018/03/180314092612.htm>

<sup>278</sup> Sinickas, A., Jamieson, B., & Maes, M.A. (2014). Snow avalanches in western Canada: investigating change in occurrence rates and implications for risk assessment and mitigation. *Journal of Structure and Infrastructure Engineering*. Volume 12; 2016, Issue 4. Retrieved February 20, 2020 from <https://www.tandfonline.com/doi/full/10.1080/15732479.2015.1020495>

Jamieson (no date) found weak associations between climate change and avalanches and no increase in avalanches in the geographic locations identified.<sup>279</sup> Jamieson states that “Neither the historical trends nor the projections suggest a substantial increase in avalanches reaching transportation corridors within the current planning timeframe.”



CCOHS. Working in the Cold.

<sup>279</sup> Jamieson, B. (No date). Climate change and planning for snow avalanches in transportation corridors in western Canada. Retrieved February 20, 2020 from [https://schulich.ucalgary.ca/asarc/files/asarc/snowavalanchetrendstransporationcorridors\\_geoottawa2017\\_jamiesonetal\\_1july2017.pdf](https://schulich.ucalgary.ca/asarc/files/asarc/snowavalanchetrendstransporationcorridors_geoottawa2017_jamiesonetal_1july2017.pdf)





#### **II.X.IV. Tornadoes and Air Turbulence (Other than storms and high velocity wind events):**

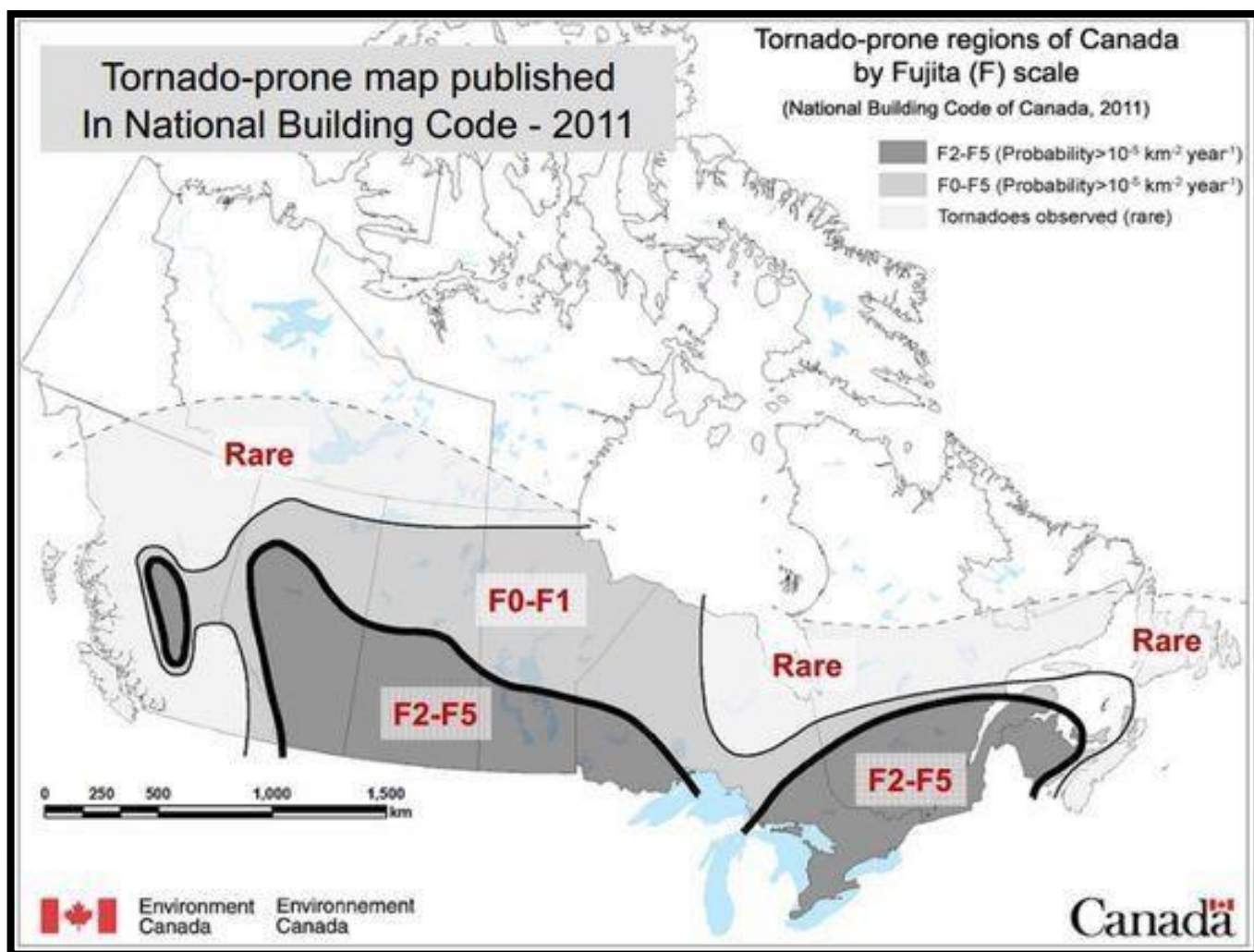
There are different types of high velocity wind events. These include tornadoes, waterspouts, windstorms and high altitude turbulence. Other types of high velocity wind events are discussed in Section II.X.II. above.

As per the map from Environment Canada, there are 62 tornadoes per year in Canada on average.<sup>280</sup> The likelihood of tornadoes (as contrasted to increasingly high velocity winds) in BC is very low as per the following figure from Environment Canada (while the figure is from 2011, the current statistics indicate no change in tornado distribution, frequency or severity).

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<sup>280</sup> Environment Canada. Retrieved February 17, 2020 from [https://weather.gc.ca/canada\\_e.html](https://weather.gc.ca/canada_e.html)

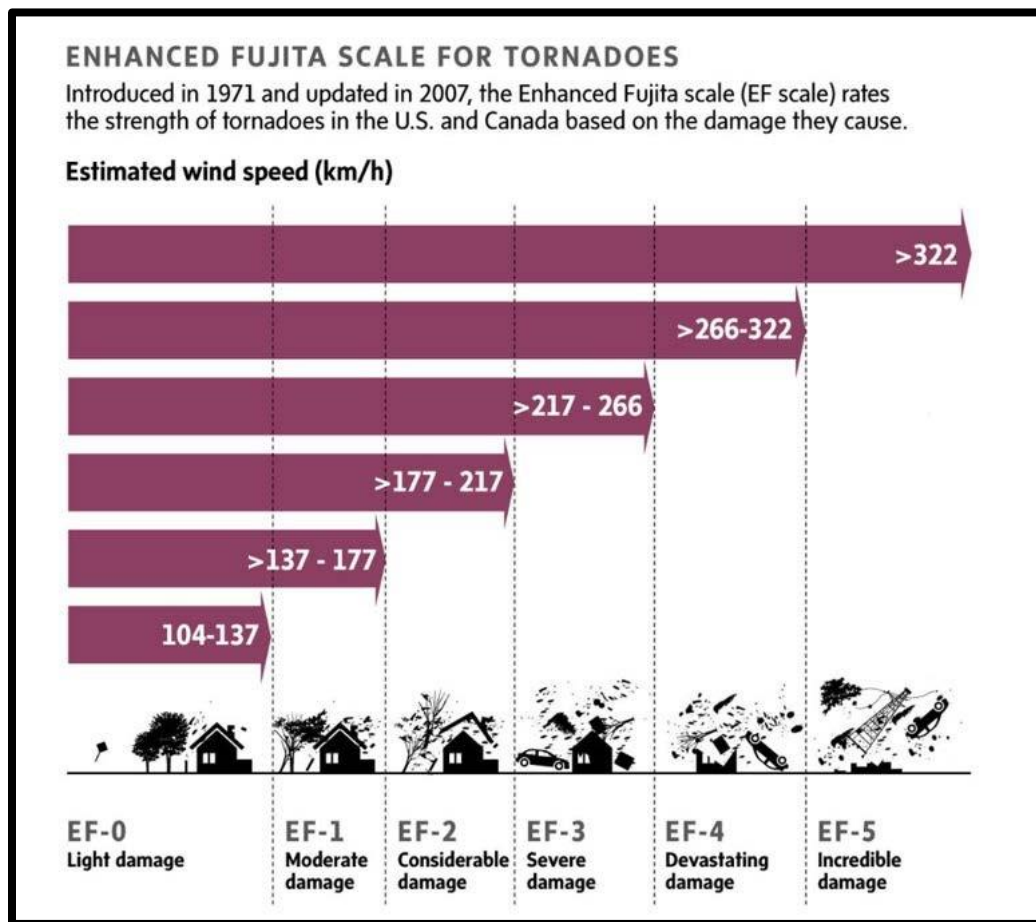




Where tornadoes occur, the damage can vary greatly as per the following figure from the National Oceanic and Atmospheric Administration:<sup>281</sup>

(See next page)

<sup>281</sup> Blackley, S. (September 27, 2018). Are tornadoes in Canada on the rise? A look at the dangerous storms. *The Globe & Mail*. Retrieved February 17, 2020 from <https://www.theglobeandmail.com/canada/article-are-tornadoes-in-canada-on-the-rise-a-look-at-the-dangerous-storms/>



While the incidence of tornadoes in BC is very low, there are numerous, increasing, high velocity wind events such as windstorms. There are small number of studies that correlate the increase to climate change.

Turbulence is another form of wind related hazard. It is caused when a mass of air moving at a particular speed meets another mass of air that is moving at a different speed. It is often created by jet streams, thunderstorms, weather fronts and air moving around mountains according to the Federal Aviation Administration (“FAA”).<sup>282</sup>

<sup>282</sup> Lallanilla, M. (February 18, 2014). Air Turbulence: How Dangerous Is It? *Live Science*. Retrieved February 20, 2020 from <https://www.livescience.com/43448-air-turbulence-dangerous-injuries.html>

As per the FAA, generally, two thirds of turbulence related accidents occur at or above 30,000 feet. An aircraft can drop 1000 feet in a few seconds when this occurs. This hazard occurs in BC as well as the rest of Canada. This hazard affects air travel, including flight crew and passenger safety. Turbulence has increased significantly in North America.<sup>283</sup>

As per The Telegraph:<sup>284,285</sup>

“A previous study by Reading University predicted that climate change will make severe turbulence up to three times<sup>189</sup> more common by 2050-80.”

“Researchers predict that the problem would get worse as the climate continued to deteriorate through global warming.”

As per the same study, the worst hit flight corridor will be the North Atlantic. With increased turbulence there is a much greater likelihood of injury. As per Live Science, Turbulence:<sup>286</sup>

“Some experts are concerned that turbulence might become more common due to a warming planet: A 2013 report found that turbulence strength over the North Atlantic flight corridor could increase by 10 percent to 40 percent, and turbulence frequency could jump by 40 percent to 170 percent.

‘We conclude that climate change will lead to bumpier trans-Atlantic flights by the middle of this century, assuming the same flight tracks are used,’ the researchers wrote in the journal *Nature Climate Change*.’

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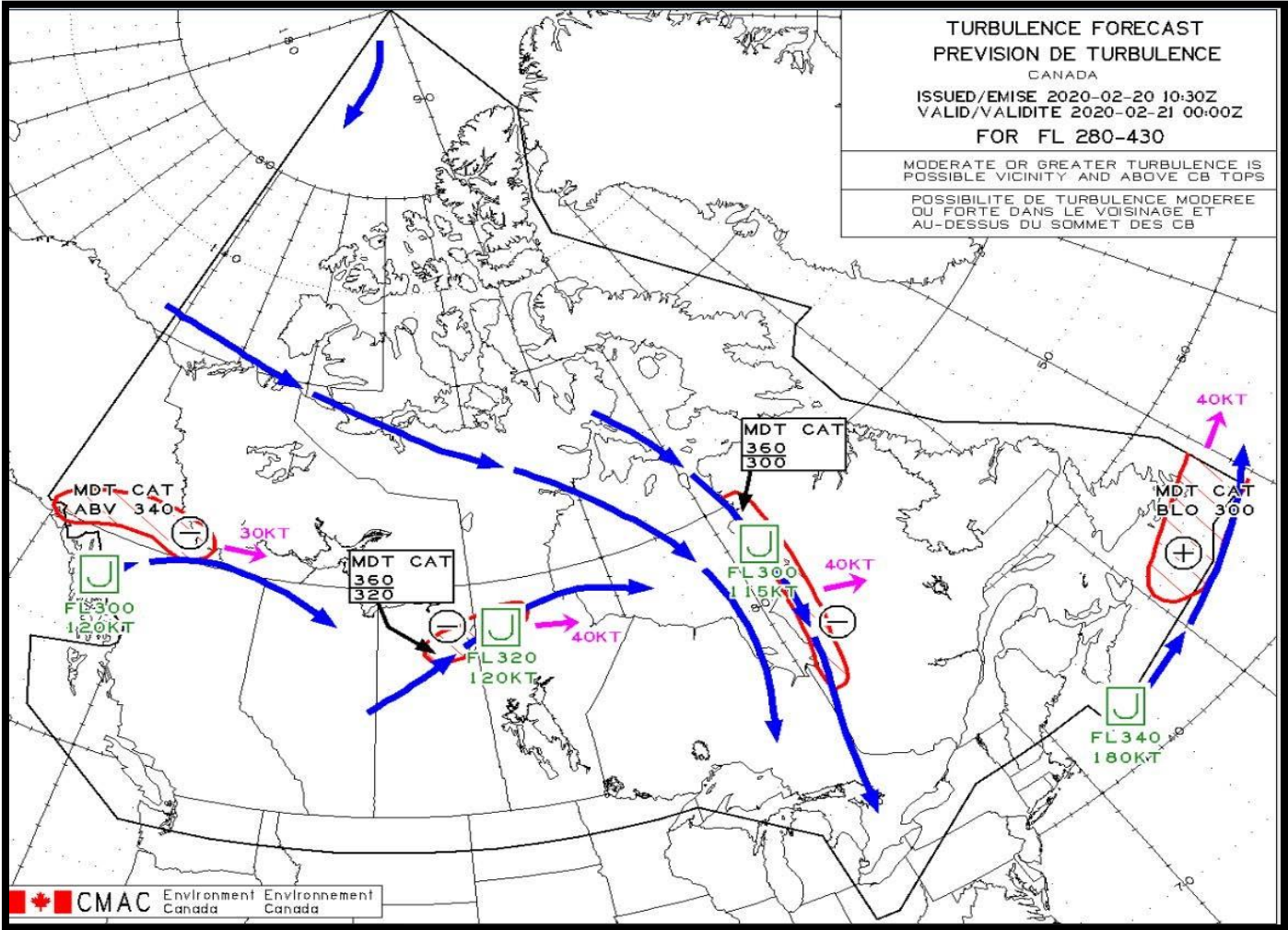
<sup>283</sup> Hayward, J. Will Rising Temperatures Impact Flight Takeoffs? (June 06, 2022). Simple Flying. Retrieved June 07, 2022 from <https://simpleflying.com/will-rising-temperatures-impact-aircraft-takeoffs/>

<sup>284</sup> Knapton, S. (August 07, 2019). Turbulence is getting worse because of climate change, study proves as it finds serious injuries have doubled since the 1980s. *The Telegraph*. Retrieved February 19, 2020 from <https://www.telegraph.co.uk/science/2019/08/07/turbulence-flights-getting-worse-global-warming-makes-jet-stream/>

<sup>285</sup> % increase at 39,000 feet by 2050 – 2080. Simple Flying. Is Turbulence Getting Worse? Air Canada Injuries 35. (2019). Retrieved February 19, 2020 from <https://simpleflying.com/air-canada-turbulence/>

<sup>286</sup> Lallanilla, M. (February 18, 2014). Air Turbulence: How Dangerous Is It? *Live Science*. Retrieved February 20, 2020 from <https://www.livescience.com/43448-air-turbulence-dangerous-injuries.html>

As per the Turbulence Forecast<sup>287</sup> and the Government of Canada, Turbulence and Icing map, there are several areas of concern:<sup>288</sup>



As per the FAA, there are numerous passenger and crew injuries. The following table showing the number of turbulence events and resulting injuries (US) illustrate the severity of the problem.

<sup>287</sup> Turbulence Forecast. Retrieved February 20, 2020 from <https://www.turbulenceforecast.com/canada.php>

<sup>288</sup> Government of Canada. Turbulence and Icing. Retrieved February 20, 2020 from [https://weather.gc.ca/model\\_forecast/turb\\_e.html](https://weather.gc.ca/model_forecast/turb_e.html)

While the following table does not show an increase in passenger or crew injury rates, despite an increase in turbulence, this is due to new rules and regulations to improve safety.<sup>289</sup>

Year	Passenger	Crew	Total
2009	74	27	101
2010	35	23	58
2011	4	25	29
2012	4	19	23
2013	2	4	6
2014	19	9	28
2015	11	16	27
2016	29	13	42
2017	9	8	17
2018	4	5	9

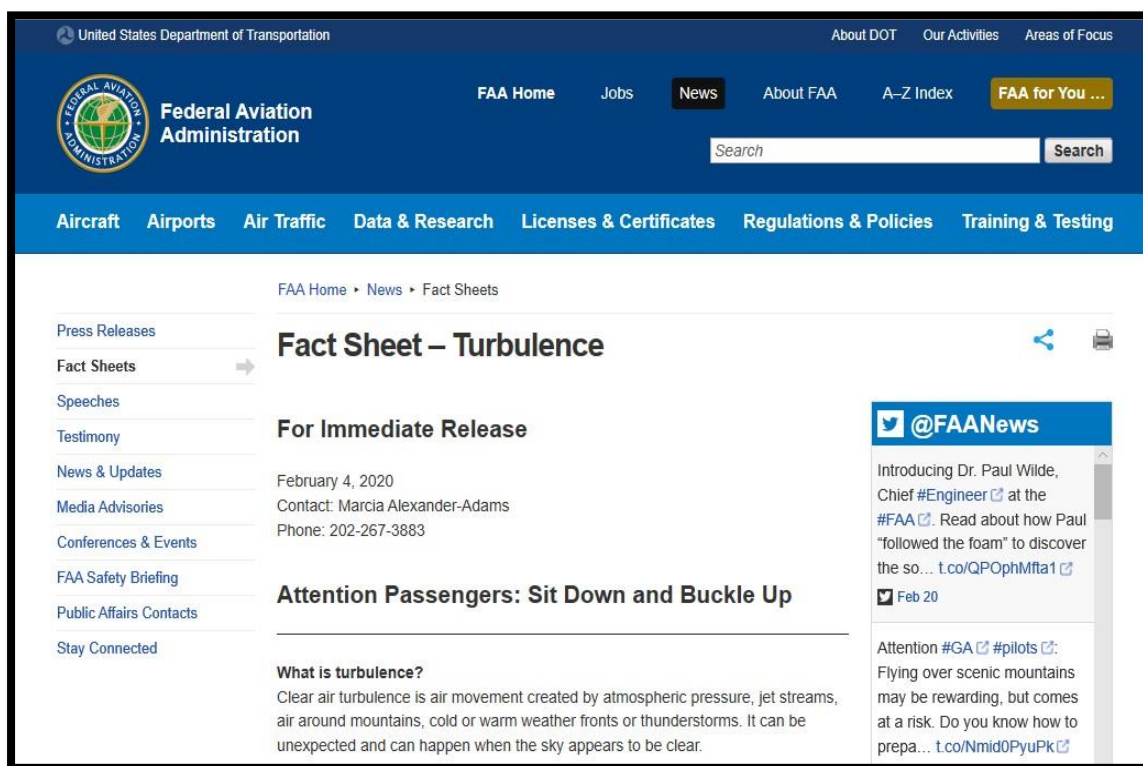
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<sup>289</sup> Federal Aviation Administration. Fact Sheet – Turbulence. Retrieved February 20, 2020 and June 07, 2022 from [https://www.faa.gov/news/fact\\_sheets/news\\_story.cfm?newsId=20074](https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=20074)



In Canada, Transport Canada reported that there were 81 incidences of turbulence between 2005 and 2015 where passengers and crew were injured.<sup>290</sup>

Due to the number of injuries, the FAA issued a fact sheet (figure below) dated February 04, 2020:<sup>291</sup>



<sup>290</sup> Southwick, R. (January 01, 2016). In-flight turbulence 'surprisingly common,' says aviation investigator. *Calgary Herald*. Retrieved February 20, 2020 from <https://calgaryherald.com/news/local-news/in-flight-injuries-from-turbulence-surprisingly-common-says-aviation-investigator>

<sup>291</sup> Federal Aviation Administration. Fact Sheet – Turbulence. Retrieved February 20, 2020 from [https://www.faa.gov/news/fact\\_sheets/news\\_story.cfm?newsId=20074](https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=20074)





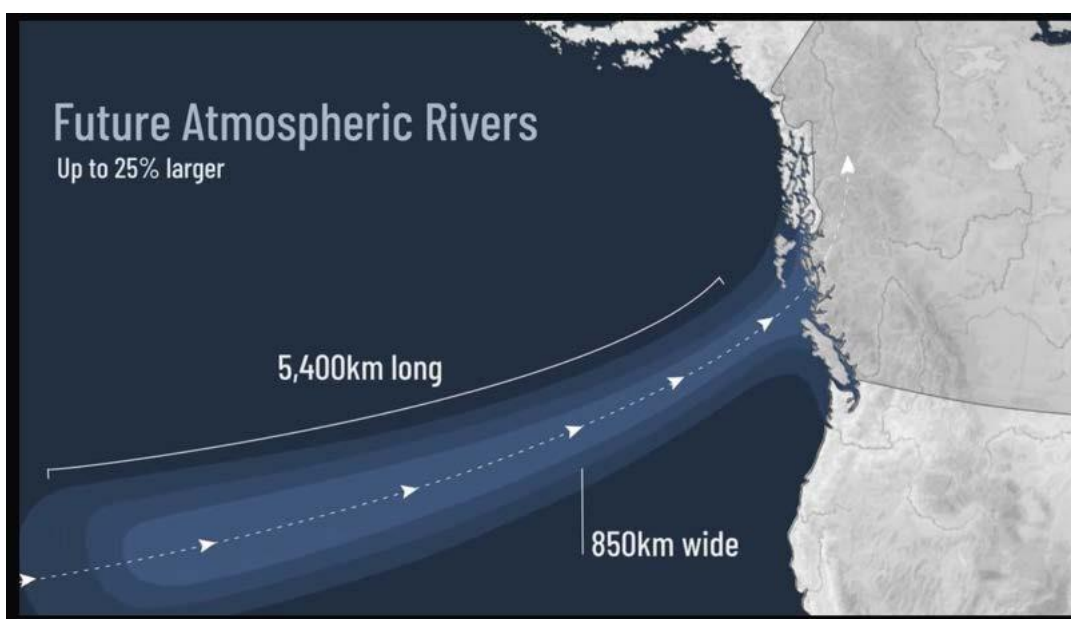
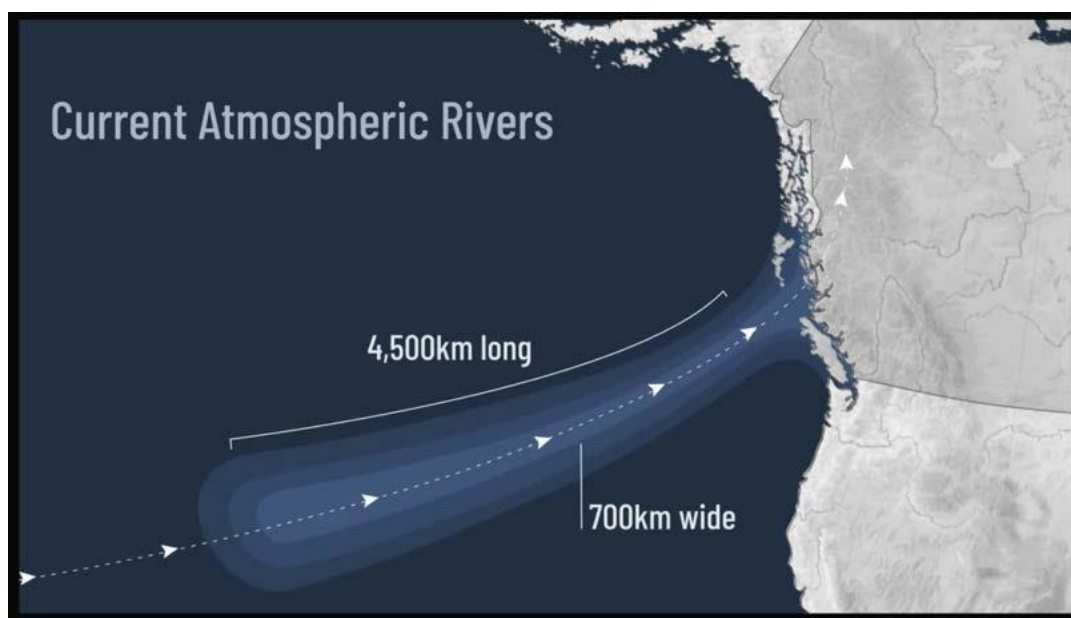
## **II.X.V. Precipitation and Flooding:**

Precipitation patterns across Canada are expected to change dramatically over the next 50 years. As per The Star “A River in the Sky”, the atmospheric rivers that bring precipitation are expected to be up to 25% larger. These phenomena increase precipitation, storms and flooding. Extremes in El Niña and La Niña could double by the end of this century as well.<sup>292</sup> This would further exacerbate weather extremes. Flooding can result in injuries, drowning, hypothermia, and electrocution, sewage overflow, gastrointestinal and skin disease, as well as infect wounds.

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<sup>292</sup> (No author). 4<sup>th</sup> National Climate Assessment. Retrieved February 26, 2020 from <https://nca2018.globalchange.gov/> and (No author). (November 29, 2018). We broke down what climate change will do region by region

The following two figures contrast the current atmospheric river and a future atmospheric river:<sup>293</sup>

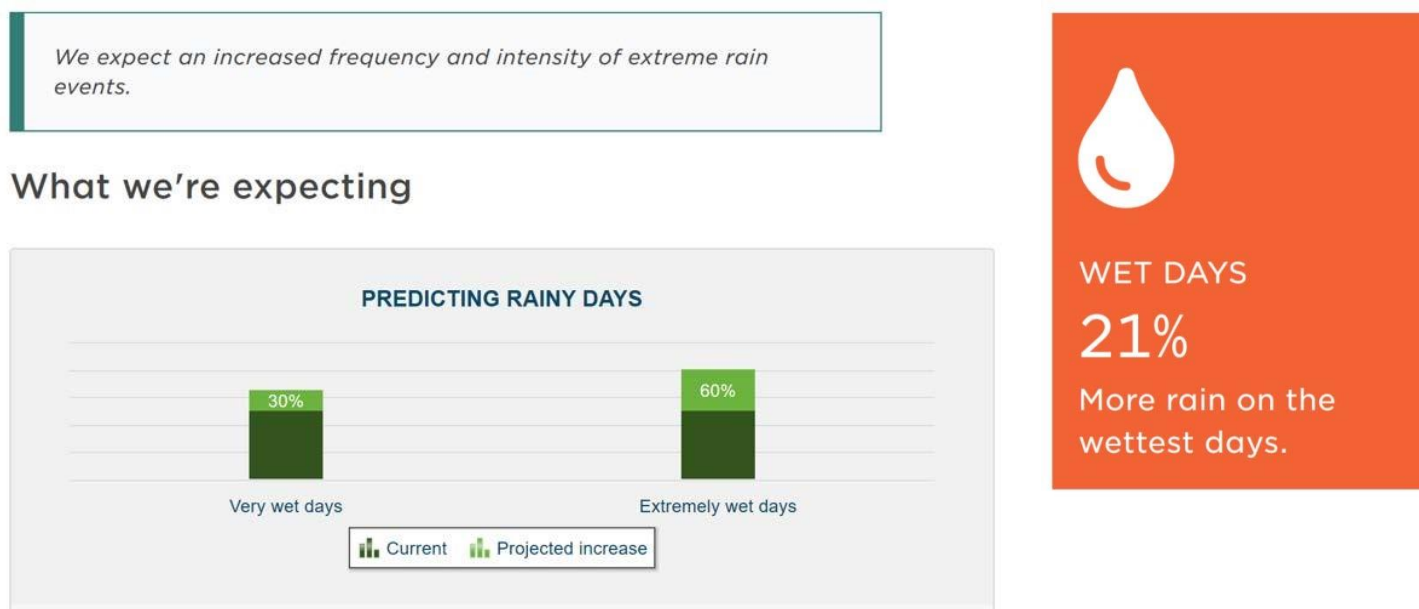


<sup>293</sup> Cruickshank, A. (May 30, 2019). A River in the Sky. *The Star*. Retrieved February 19, 2020 from <https://projects.thestar.com/climate-change-canada/british-columbia/>

The Star also states that:

“Models indicate the typical AR in the 21st century will be about 25 per cent wider — 855 km versus 700 km — and 25 per cent longer — 5,400 km versus 4,300 km — than the ARs of the 20th century.”

The City of Vancouver Climate Change Adaptation Strategy shows a large increase in rain:<sup>294</sup>



The results for Victoria, BC and other coastal municipalities are similar:<sup>295</sup>

“Victoria, BC, is expected to experience a general increase in precipitation across all seasons, with the average amount in winter increasing by 60 mm.”

<sup>294</sup> City of Vancouver. Climate Change Adaptation Strategy. Retrieved February 13, 2020 from <https://vancouver.ca/green-vancouver/temperature-climate.aspx>

<sup>295</sup> Charron, D.F., Edge, T., Fleury, M.D., Galatianos, W., Gillis, D., Kent, R., Maroouf, A.R., Neudoerffer, C., Schuster, C.J., Thomas, M.K., Valcour, J., & Waltner-Toews, D. Link between Climate, Water and Waterborne Illness, And Projected Impacts of Climate Change. Retrieved February 16, 2020 from <https://collections.unu.edu/eserv/UNU:2653/pdf252333.pdf>

For BC, the Government of Canada stated that there was an 18.2% increase in spring precipitation between 1948 and 2012 with regional variations e.g. Metro Vancouver.<sup>296</sup> In summer, southwestern BC is expected to see “a median reduction of more than 30%”.<sup>297</sup>

Across Canada there could be a 25% to 40% reduction in snow in mountainous regions by the end of this century. The risk of spring flooding (with earlier starting dates) will increase.<sup>298</sup> The Government of Canada report echoes the City of Vancouver’s report:

“Projected increases in extreme precipitation are expected to increase the potential for future urban flooding (high confidence). Projected higher temperatures will result in a shift toward earlier floods associated with spring snowmelt, ice jams, and rain-on-snow events (medium confidence).”

Coastal and interior watersheds in BC are projected to experience increased flooding potential due to more rainfall, winter rain-on-snow events in the coastal watershed, more spring rain and more rapid snowmelt events in the interior watershed. Changes such as deforestation caused by fires are expected to exacerbate this.

A flood mitigation plan has already been created in Vancouver as per page 130. E. Coli is just one of a number of indirect hazards and risks associated with extreme weather events and increased precipitation.<sup>299</sup>

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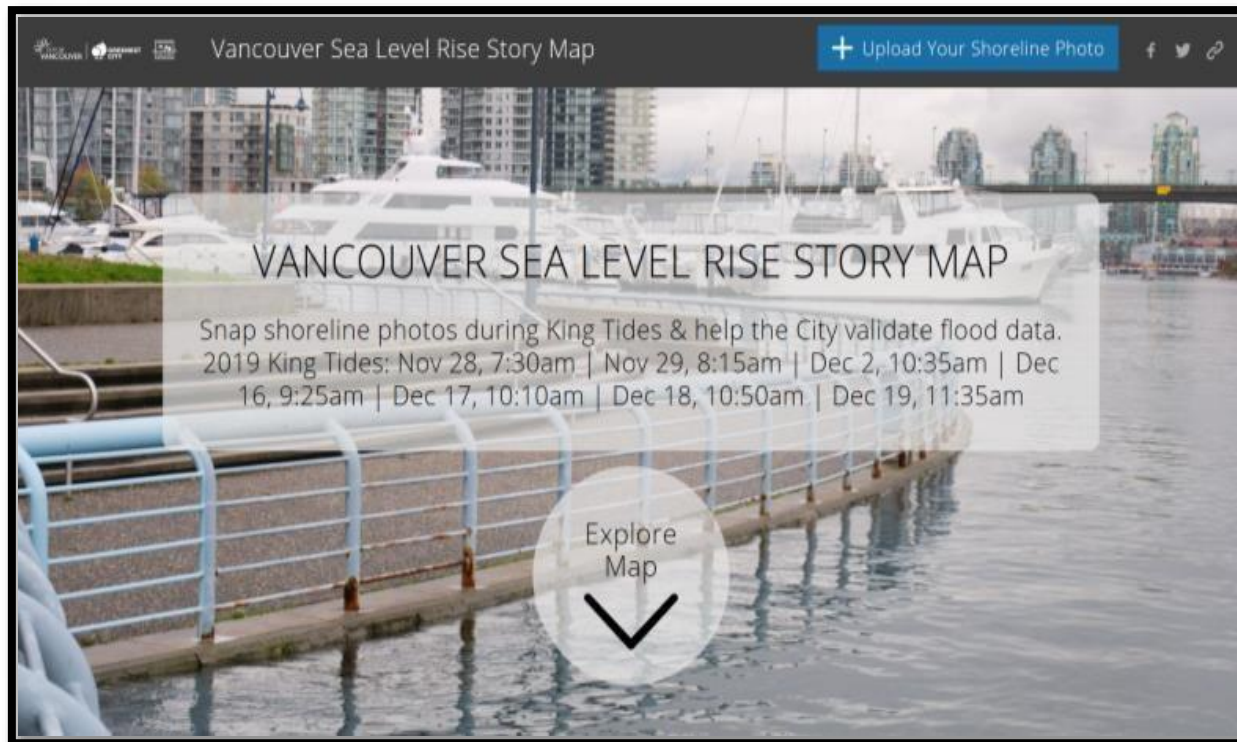
<sup>296</sup> Government of Canada. Canada’s Changing Climate Report. (CCCR 2019). Retrieved from [https://changingclimate.ca/site/assets/uploads/sites/2/2019/04/CCCR\\_FULLREPORT-EN-FINAL.pdf](https://changingclimate.ca/site/assets/uploads/sites/2/2019/04/CCCR_FULLREPORT-EN-FINAL.pdf)

<sup>297</sup> Government of Canada. Canada’s Changing Climate Report. (CCCR 2019). Retrieved from [https://changingclimate.ca/site/assets/uploads/sites/2/2019/04/CCCR\\_FULLREPORT-EN-FINAL.pdf](https://changingclimate.ca/site/assets/uploads/sites/2/2019/04/CCCR_FULLREPORT-EN-FINAL.pdf)

<sup>298</sup> Government of Canada. Canada’s Changing Climate Report. (CCCR 2019). Retrieved from [https://changingclimate.ca/site/assets/uploads/sites/2/2019/04/CCCR\\_FULLREPORT-EN-FINAL.pdf](https://changingclimate.ca/site/assets/uploads/sites/2/2019/04/CCCR_FULLREPORT-EN-FINAL.pdf)

<sup>299</sup> Government of Canada. E. coli (Escherichia coli) infection. Retrieved February 14, 2020 from <https://www.canada.ca/en/public-health/services/diseases/e-coli.html>

Impacts on workers will include exposure to biohazards e.g. E. Coli, allergens, electrocution, drowning (two feet of moving water is enough to move a vehicle), carbon monoxide exposure, exposure to chemicals e.g. petroleum products and pesticides, lacerations, structural instability, musculoskeletal injuries from lifting, mould, rodents, insects, hypothermia, injury due to damaged or non-functional fire suppression systems, etc.<sup>300</sup> Additional related hazards include landslides, sink holes and structural collapse as per the City of Vancouver figure below:



As per the City of Vancouver, snowpack is projected to decrease by the 2050s with the April 1st snowpack is projected to decline by 58% which could impact our region's water supply watersheds.<sup>301</sup> The City of Vancouver figures below show a 22% increase in summer dry days.

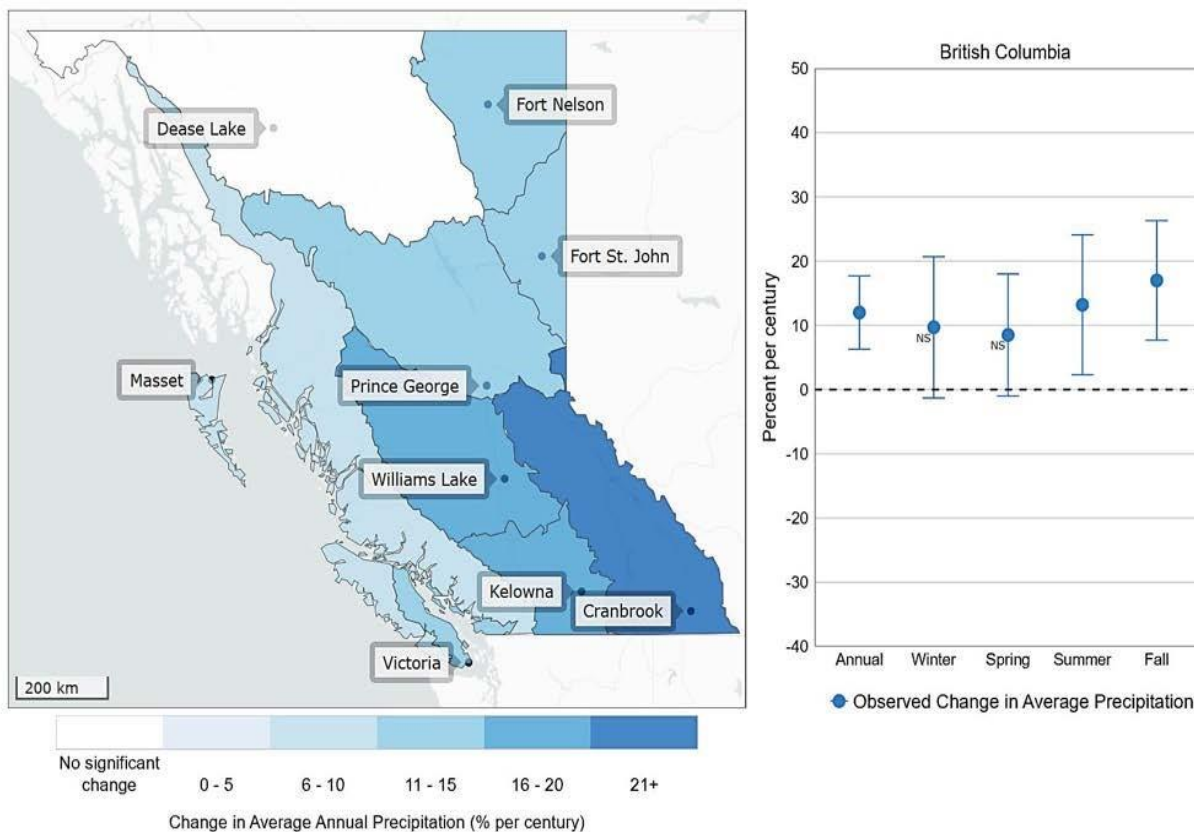
<sup>300</sup> EHS Today. Retrieved February 13, 2020 from <https://www.ehstoday.com/environment/article/21917207/seasonal-safety-protecting-employees-from-the-hazards-of-flooding>; NIOSH; Centers for Disease Control and Prevention. Retrieved February 14, 2020 from <https://www.cdc.gov/niosh/topics/emres/flood.html>

<sup>301</sup> City of Vancouver. Climate Change Adaptation Strategy. Retrieved February 13, 2020 from <https://vancouver.ca/green-vancouver/temperature-climate.aspx>





The Government of British Columbia, Environmental Reporting BC Long-term Change in Precipitation in B.C. (1900 – 2013) figure shows areas of increased precipitation:<sup>302</sup>



<sup>302</sup> Government of British Columbia. Environmental Reporting BC. Long-term Change in Precipitation in B.C. (1900 – 2013). Retrieved February 10, 2020 from <http://www.env.gov.bc.ca/soe/indicators/climate-change/precip.html>

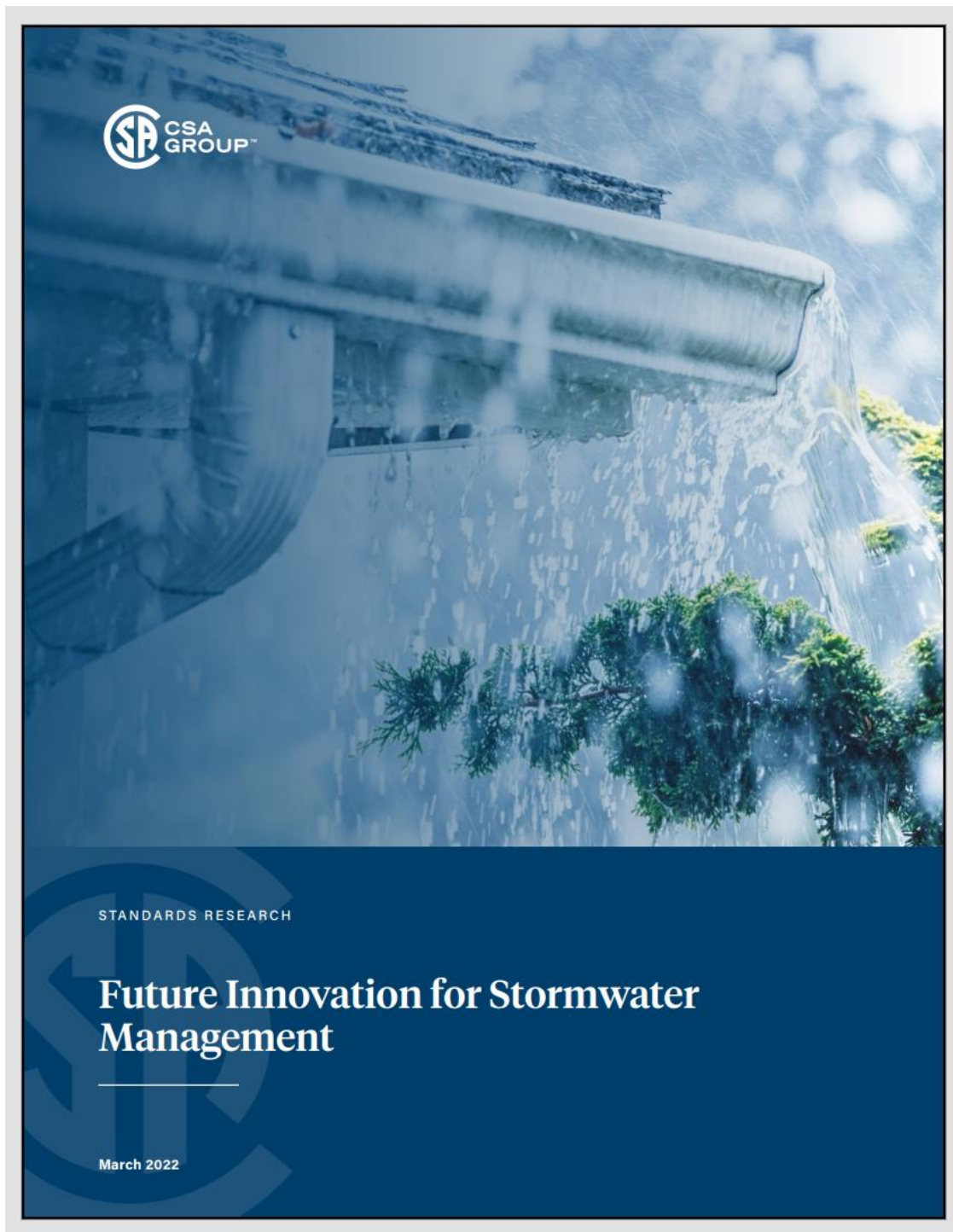
Coastal communities and the Lower Mainland of BC are already experiencing increased flooding. Vancouver has created a flood mitigation plan to address the wide ranging impacts on infrastructure, the public, the environment and workers. As stated on page 128, the impacts on workers include:

- Biohazards e.g. diseases, bacteria, allergens, mould
- Rodents
- Electrocution
- Insects
- Drowning (two feet of moving water is enough to move a vehicle)
- Hypothermia
- Carbon monoxide exposure
- Injury due to damaged or non-functional fire suppression systems, etc.<sup>303</sup>
- Exposure to chemicals e.g. petroleum products and pesticides
- Landslides
- Lacerations
- Sink holes
- Structural instability
- Structural collapse
- Musculoskeletal injuries from lifting



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<sup>303</sup> Smith, S. (November 06, 2015). Seasonal Safety: Protecting Employees from the Hazards of Flooding. *EHS Today*. Retrieved February 13, 2020 from <https://www.ehstoday.com/environment/article/21917207/seasonal-safety-protecting-employees-from-the-hazards-of-flooding> and NIOSH. Centers for Disease Control and Prevention. Retrieved February 14, 2020 from <https://www.cdc.gov/niosh/topics/emres/flood.html>



CSA Group. Sample Standards Research document on stormwater management.



## II.XI. Forest Fires:

The number and severity of forest fires across Canada is increasing.<sup>304</sup> Two-fifths of Canada's forests are already close to housing, industry buildings and other infrastructure.<sup>305</sup> This affects both indoor and outdoor workers over multiple health domains.

A recent study by McGill University found that over the last 20 years there were higher rates of lung and brain cancer in people exposed to forest fires across Canada. People living within 50 kms of forest fires had a 10% higher incidence of brain tumours and 4.9% higher incidence of lung tumours.<sup>306</sup>

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<sup>304</sup> Wang, X., Parisien, M.A., Taylor, S.W., Candau, J.N., Stralberg, D., Marshall, G. A., Little, J.M., & Flannigan, M.D. (2017). Projected changes in daily fire spread across Canada over the next century. *Environmental Research Letters*, 12(2), 025005. Retrieved February 18, 2020 from <https://doi.org/10.1088/1748-9326/aa5835>

<sup>305</sup> Rodriguez, J. CTV News. Wildfires disproportionately threatening First Nations and worst could be yet to come, study finds. (August 26, 2021). Retrieved June 03, 2022 from <https://www.ctvnews.ca/climate-and-environment/wildfires-disproportionately-threatening-first-nations-and-worst-could-be-yet-to-come-study-finds-1.5544760>

<sup>306</sup> Korsiak, J., Pinault, L., Christidis, T., Burnett, R., Abrahamowicz, M., & Weichenthal, S. (2022). Long-term exposure to wildfires and cancer incidence of in Canada: a population-based observational cohort study. *The Lancet*, Volume 6, Issue 5. Retrieved June 03, 2022 from [https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196\(22\)00067-5/fulltext](https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(22)00067-5/fulltext)



**“Less than 10 per cent of the needed work has been completed on more than 11,000 square kilometers of forested land identified by the province as needing wildfire risk reduction.”**

**“81 per cent of the 985 of the Indigenous land reserves in Canada face flood risk, with the highest number of ‘hot spots’ located in B.C.”**

**“there are more than 350 communities, First Nation and regional districts in B.C. that are trying to figure out if they have a wildfire problem”**

**(Vancouver Sun, May 10, 2022)**

Professor Weichenthal stated that:

“Wildfires also pollute aquatic, soil, and indoor environments. While some pollutants return to normal concentrations shortly after the fire has stopped burning, other chemicals might persist in the environment for long periods of time, including heavy metals and hydrocarbons.”

First Nations communities are disproportionately threatened by wildfires, with people who live on reserves making up nearly one-third of all evacuees in Canada since the 1950s, as per a study published in Canadian Science Publishing in April 2021.<sup>307</sup> The lead authors stated that “Our results suggest that the extent of losses and the number of evacuations that First Nations populations experience could drastically increase in the coming decades”.<sup>308</sup>

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<sup>307</sup> Rodriguez, J. CTV News. (August 26, 2021). Wildfires disproportionately threatening First Nations and worst could be yet to come, study finds. Retrieved June 03, 2022 from <https://www.ctvnews.ca/climate-and-environment/wildfires-disproportionately-threatening-first-nations-and-worst-could-be-yet-to-come-study-finds-1.5544760>

<sup>308</sup> Rodriguez, J. CTV News. (August 26, 2021). Wildfires disproportionately threatening First Nations and worst could be yet to come, study finds. Retrieved June 03, 2022 from <https://www.ctvnews.ca/climate-and-environment/wildfires-disproportionately-threatening-first-nations-and-worst-could-be-yet-to-come-study-finds-1.5544760>



The article stated that:

“Knowledge keepers and fire experts have previously said governments’ disregard of Indigenous prescribed and cultural burns -- purposefully burning away entire patches of trees and dry vegetation -- has greatly contributed to the wildfire crisis in British Columbia today.

A University of Waterloo study also found that Indigenous fire stewardship could help protect the world from the type of severe wildfires that have been occurring more frequently in recent years.”

As per the Climate Atlas of Canada:<sup>309</sup>

“the Canadian Forest Service analyzed the findings of almost 50 international studies on climate change and fire risk. They found that our future looks ‘smoky’ because climate change will worsen the three major factors that influence wildfire: having dry fuel to burn, frequent lightning strikes that start fires, and dry, windy weather that fans the flames.

Another recent study by Flannigan and several other scientists predicts that western Canada will see a 50% increase in the number of dry, windy days that let fires start and spread, whereas eastern Canada will see an even more dramatic 200% to 300% increase in this kind of “fire weather”.

Other studies predict that fires could burn twice as much average area per year in Canada by the end of the century as has burned in the recent past.”

And as per Climate Atlas of Canada (continued):

“Climate change can also promote forest fires in less direct ways.

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<sup>309</sup> The Climate Atlas of Canada. Retrieved February 18, 2020 from <https://climateatlas.ca/forest-fires-and-climate-change>

In BC and Alberta, warming temperatures are enabling the dramatic spread of the mountain pine beetle, which has affected more than 180,000 square kilometres of forest (an area larger than all of Greece). These beetles kill their host trees, and have created vast swaths of standing deadwood which are now huge reservoirs of wildfire fuel.

The pine beetle is only one of many damaging forest pests that are likely to spread thanks to warmer winters caused by climate change.”<sup>310</sup>

There is ample evidence showing a significant increase in forest fires in BC as per Wang et al. (2017):<sup>311</sup>

“Our results suggest that climate change over the next century may have significant impacts on fire spread days in almost all parts of Canada's forested landmass; the number of fire spread days could experience a 2-to-3-fold increase under a high CO<sub>2</sub> forcing scenario in eastern Canada, and a more than 50% increase in western Canada, where the fire potential is already high.

Our results also indicate an increase in the frequency of seasons with a large number of spread days (more extreme extremes); further exploration of the influence of extreme events constitutes a future research question of great interest.”

This is due to a change in weather patterns driven by climate change bringing warmer, drier weather and more lightning to BC.<sup>312</sup> This is exacerbated by insect damage from the mountain pine beetle.

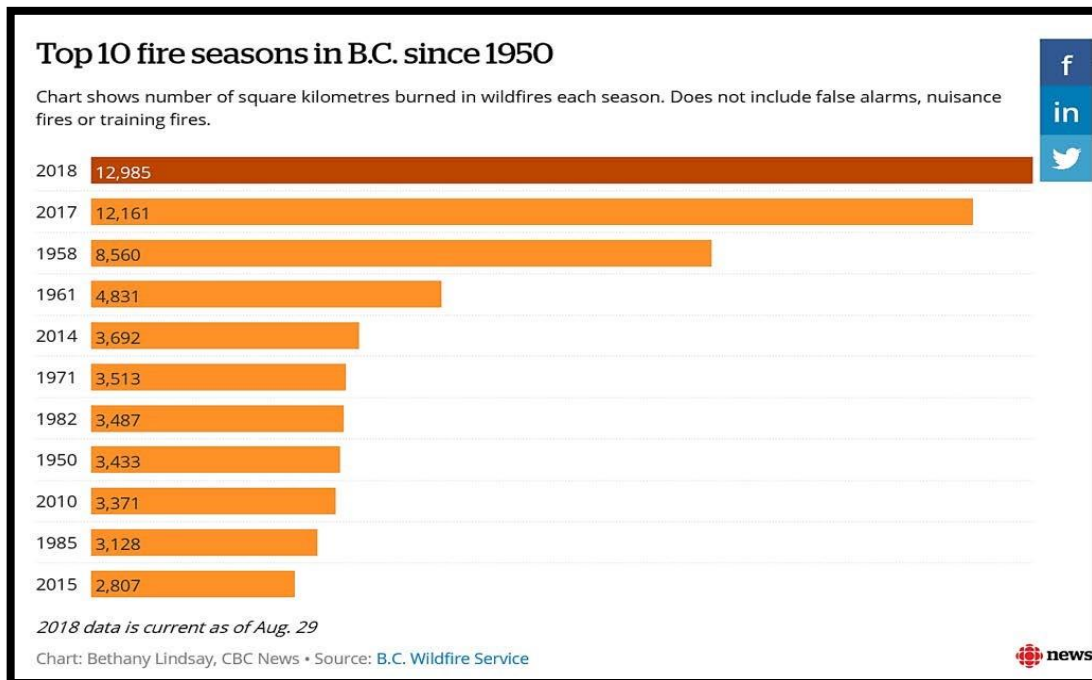
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<sup>310</sup> The Climate Atlas of Canada. Retrieved February 18, 2020 from <https://climateatlas.ca/forest-fires-and-climate-change>

<sup>311</sup> Wang, X., Parisien, M.A., Taylor, S.W., Candau, J.N., Stralberg, D., Marshall, G. A., Little, J.M., & Flannigan, M.D. (2017). Projected changes in daily fire spread across Canada over the next century. *Environmental Research Letters*, 12(2), 025005. Retrieved February 18, 2020 from <https://doi.org/10.1088/1748-9326/aa5835>

<sup>312</sup> Lindsay, B. (August 29, 2018). 2018 now the worst fire season on record as B.C. extends state of emergency. *CBC News*. Retrieved February 18, 2020 from <https://www.cbc.ca/news/canada/british-columbia/state-emergency-bc-wildfires-1.4803546>

As per the top 10 fire seasons in B.C. since 1950 to 2018 figure from CBC News (2018) the number of square kilometers burned has increased significantly:<sup>313</sup>



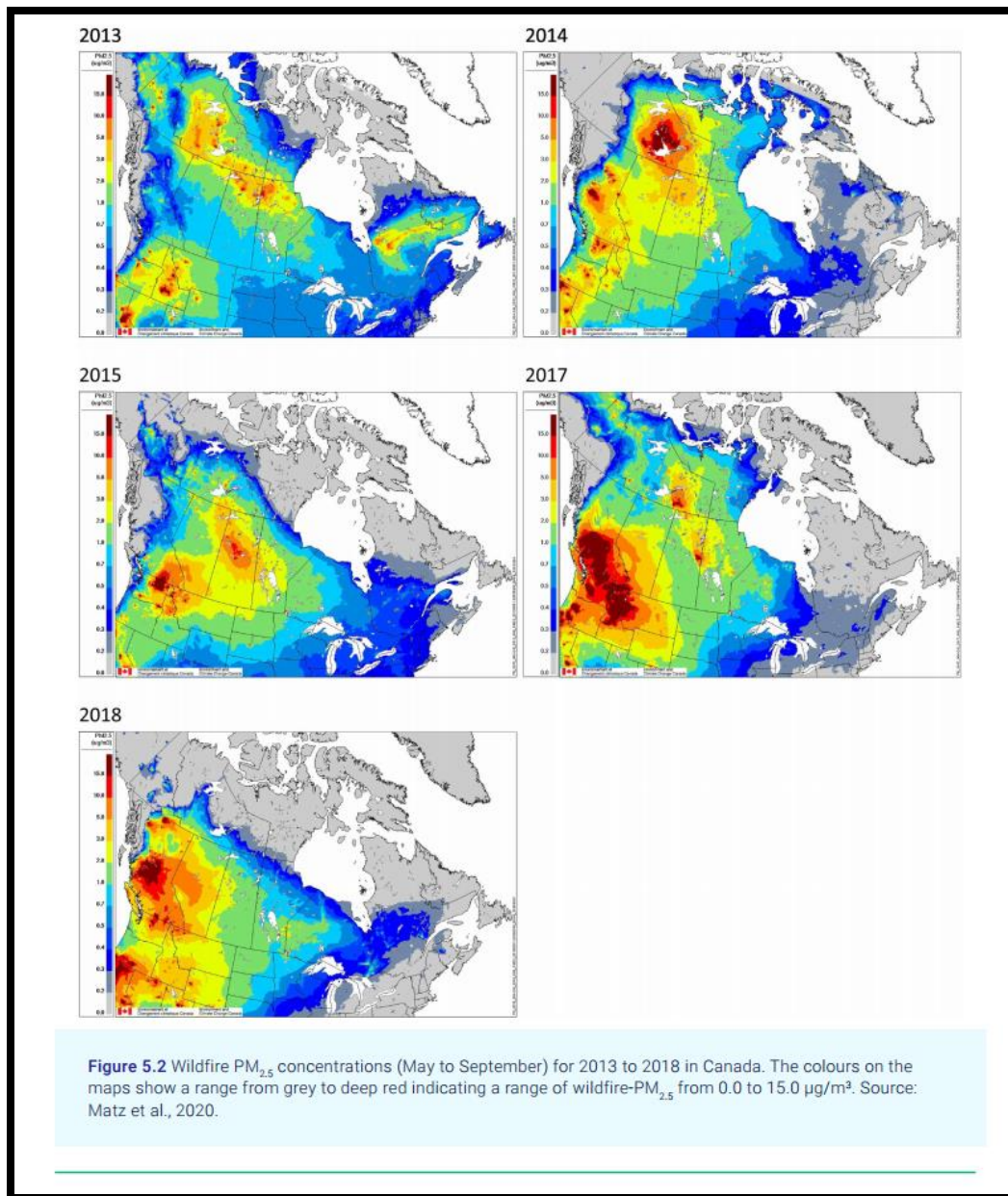
When looking at the statistics, it is important to look at the number of forest fires per year, the frequency within certain time frames (months) and the areas burned per fire as well the total number of fires. The data shows that forest fires are becoming more prevalent in BC. The health impacts – physical and mental – over the short term and long term – are also increasing. The statistics from Canada and the US are similar. As per the US Centers for Disease Control and Prevention, forest fires have multiple effects on health:<sup>314</sup>

“Smoke exposure increases respiratory and cardiovascular hospitalizations; emergency department visits; medication dispensations for asthma, bronchitis, chest pain, chronic obstructive pulmonary disease (commonly known by its acronym, COPD), and respiratory infections; and medical visits for lung illnesses.”

<sup>313</sup> Lindsay, B. (August 29, 2018). 2018 now the worst fire season on record as B.C. extends state of emergency. *CBC News*. Retrieved February 18, 2020 from <https://www.cbc.ca/news/canada/british-columbia/state-emergency-bc-wildfires-1.4803546>

<sup>314</sup> Centers for Disease Control and Prevention. Wildfires. Retrieved February 18, 2020 from <https://www.cdc.gov/climateandhealth/effects/wildfires.htm>

The report Health of Canadians in a Changing Climate map shows the changes in the forest fire activity.<sup>315</sup>



<sup>315</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

Forest fires have multiple hazards in risks including, non-exhaustively:

- Heat
- Air quality issues
- Temperature
- Mental health impacts
- Potential for explosions
- Structural collapse
- Vehicular accidents

There are short term, long term, direct and indirect hazards and risks. As per Yao (2019), even short term e.g. hourly exposures are hazardous.<sup>316</sup>

“model estimates were then linked to ambulance dispatches, paramedic assessments, and subsequent hospital admissions.”

“Increased PM<sub>2.5</sub> was associated with increased dispatches for respiratory and cardiovascular reasons within one hour following exposure.”

Mental health effects can last more than 18 months after wildfires.<sup>317</sup> Exposure to wildfire smoke has increased the exacerbation of respiratory diseases, particularly asthma, chronic obstructive pulmonary disease, bronchitis and pneumonia.<sup>318</sup> Some studies report that the relationship between wildfire smoke exposure and cardiovascular disease remains inconclusive.<sup>319</sup>

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<sup>316</sup> Yao, J. (2019). Assessing Sub-Daily Exposure to Wildfire Smoke and its Public Health Effects in British Columbia. University of British Columbia. Faculty of Medicine. School of Population and Public Health. Retrieved February 19, 2020 from <https://www.spph.ubc.ca/oeh-seminars/>

<sup>317</sup> Weber, B. (October 28, 2018). Mental-health problems hit hard at survivors of Fort McMurray fire. *The Globe & Mail*. Retrieved February 20, 2020 from <https://www.theglobeandmail.com/canada/article-mental-health-problems-hit-hard-at-survivors-of-fort-mcmurray-fire/>

<sup>318</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>319</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>



And, as per Yao (2019)(continued):

“The findings show that ambulance calls for heart and lung conditions increased within one hour of exposure to smoke, while calls for diabetic conditions increased after 254 hours.”

Wildfires can also raise levels in water of organic matter, sediment and heavy metals, such as nitrogen, phosphorus, arsenic, mercury and manganese.<sup>320</sup>

Where workers are chronically exposed to forest fire smoke, even for short durations, there may be significant health impacts.

There are several groups of workers that may be more adversely impacted by wildfire smoke: persons over age 65;<sup>321</sup> people with asthma, chronic obstructive respiratory diseases or lung infections; racialized groups (women in particular); Indigenous persons and firefighters.<sup>322</sup>

Indigenous persons experience a disproportionate burden of chronic respiratory diseases, such as asthma and chronic obstructive pulmonary disease, compared to non-Indigenous people, and these diseases can become exacerbated by poor air quality.<sup>323</sup> There are higher rates of respiratory infections, such as bronchitis, bronchiolitis, pneumonia and tuberculosis, also reported for Indigenous peoples.<sup>324</sup> The risks of exposure to poor air quality are greater for Indigenous persons because of underlying health determinants.

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<sup>320</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>321</sup> In the Northeastern United States, hospitalization rates for respiratory and cardiovascular problems in people aged 65 years and older during smoke events increased by 49.6% and 64.9%

<sup>322</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>323</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>324</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

This is in addition to mental health impacts as per CBC News, the University of Alberta and the Kamloops Canadian Mental Health Association (“CMHA”).<sup>325</sup> The traditional view was that workers would only be exposed to hazardous levels of smoke after extended durations e.g. days or weeks. This is incorrect. Hazardous exposures can occur after a few hours.

Six months after the 2016 Fort McMurray fires, 20% of residents surveyed met the criteria for generalized anxiety disorder. People with certain risk factors (pre-existing anxiety disorder, having witnessed the destruction of one’s own home, living in other accommodations after the fires, limited family or government support and seeking psychological counselling) were two to seven times more likely to meet the criteria for the disorder.<sup>326</sup>

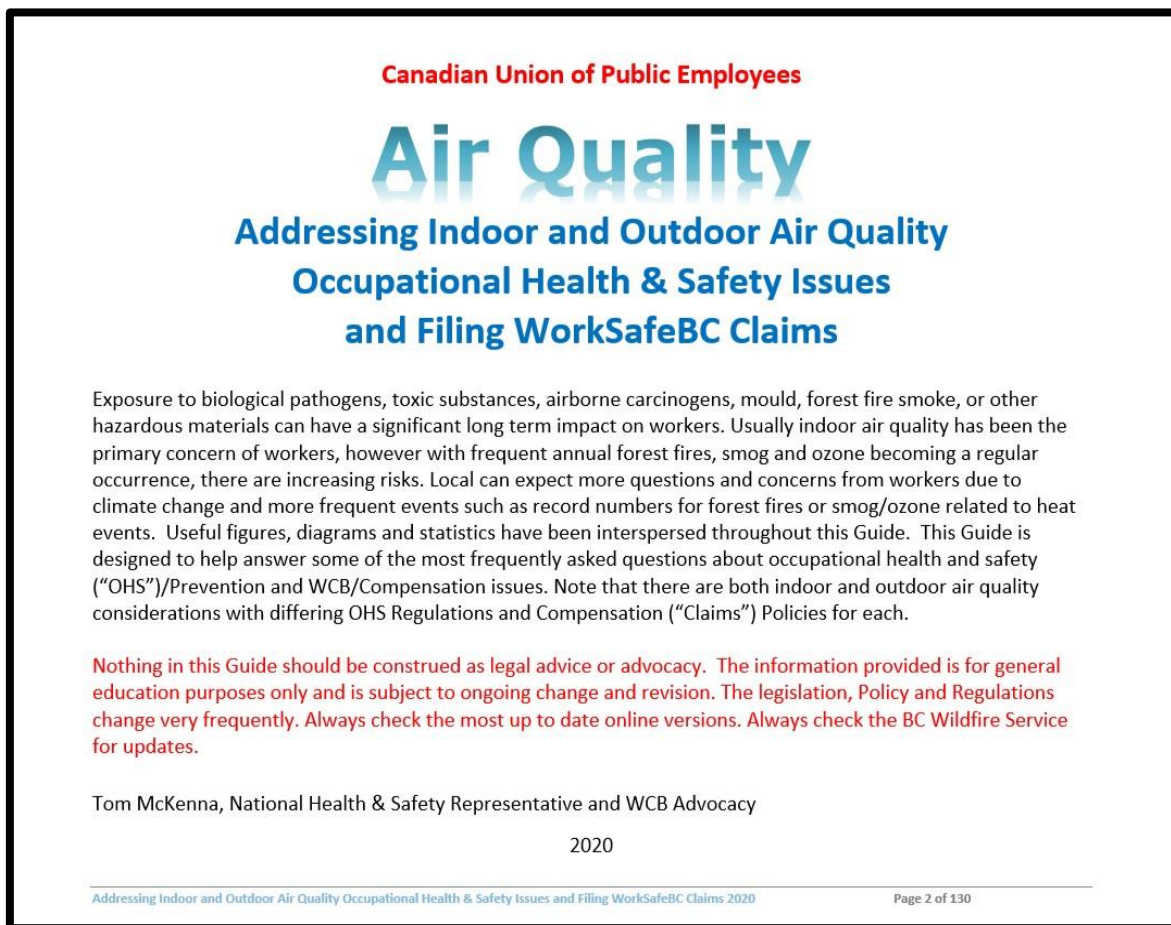
As per Health of Canadians in a Changing Climate (2022):

“During the summer of 2014, the Yellowknife area experienced an extreme wildfire season referred to as the “Summer of Smoke.” These fires resulted in a massive spike in air pollution to dangerous levels, confining many residents indoors for extended periods of time (Howard et al., 2017; Dodd et al., 2018a; Dodd et al., 2018b). The poor air quality associated with this wildfire season negatively affected First Nations communities, particularly children and the elderly. For example, the fire season corresponded to significant increases in emergency room visits for respiratory problems (42% over previous years), especially among children up to 4 years old (114% over previous years), as well as more cases of cough, pneumonia, and asthma (Dodd et al., 2018a). Confinement indoors during fires, disruptions in land-based activities, and physical inactivity also contributed to mental health impacts such as stress, anxiety, and depression.”

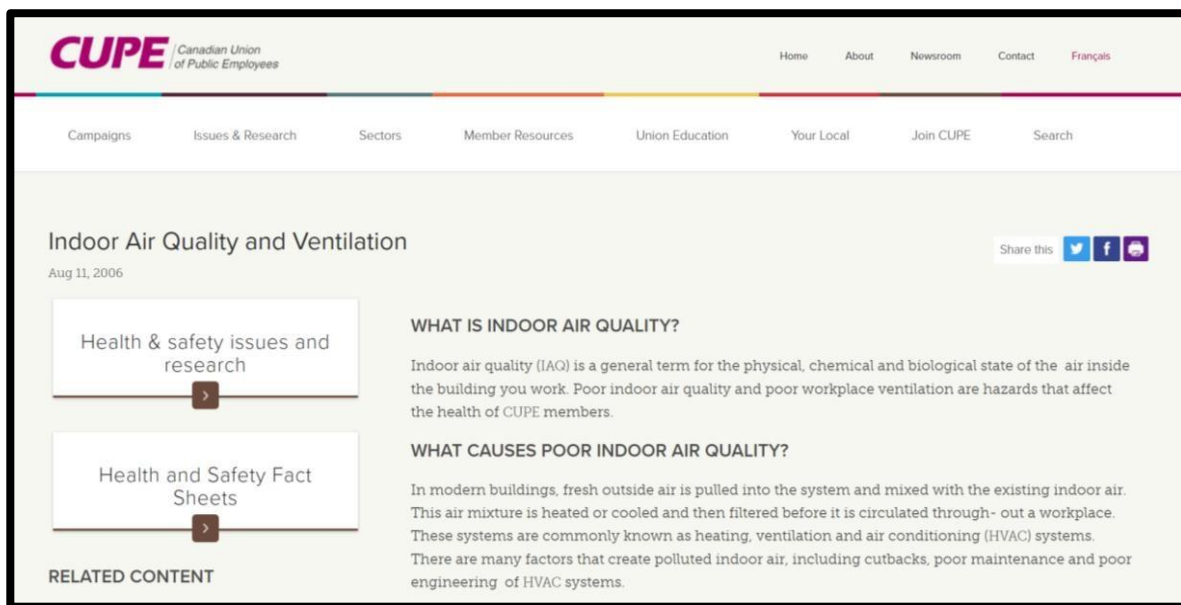
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<sup>325</sup> Henning, C. (August 21, 2018). How smokey skies from wildfires are affecting British Columbians’ mental health. *CBC News*. Retrieved February 21, 2020 from <https://www.cbc.ca/news/canada/british-columbia/forest-fires-smoke-mental-health-1.4792195>

<sup>326</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

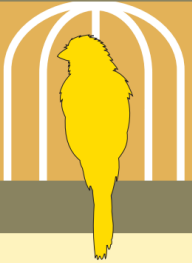


CUPE BC Region and CUPE Health and Safety Branch have a number of resources as well.



# Indoor Air Quality and Ventilation

**HEALTH AND SAFETY FACT SHEET** **CUPE** Canadian Union of Public Employees



**What is Indoor Air Quality?**  
Indoor air quality (IAQ) is a general term for the physical, chemical and biological state of the air inside the building you work. Poor indoor air quality and poor workplace ventilation are hazards that affect the health of CUPE members.

**What causes poor indoor air quality?**  
In modern buildings, fresh outside air is pulled into the system and mixed with the existing indoor air. This air mixture is heated or cooled and then filtered before it is circulated throughout a workplace. These systems are commonly known as heating, ventilation and air conditioning (HVAC) systems.

partitions), or by adding more staff than originally intended. More workers in the same space may lead to them not getting adequate amounts of fresh air.

**What are the hazards of poor air quality?**  
Poor ventilation and IAQ allows for the accumulation and mixture of hazardous contaminants. The resulting physical effects on workers are harmful.

Major outcomes and hazards of poor ventilation:

- Chemical and biological contaminants may build up, leading to multiple conditions.

CUPE Health and Safety. Indoor Air Quality and Ventilation.

# Work-Related Asthma

**Two types:**

**Occupational asthma**  
Asthma caused by something in the workplace

**Work-exacerbated asthma**  
Something in the workplace aggravates existing asthma

**15%** Internationally, up to 15% of adult onset asthma may be related to the workplace.

**What employers can do...**

- Read and be aware of safety data sheet information about respiratory health effects.
- Replace substances with less harmful ones.
- Minimize exposure (ventilation, enclosures).
- Develop administrative controls (such as changing the job or tasks).
- Educate workers on proper handling, avoiding spills and good housekeeping practices.
- Provide personal protective equipment. This should be the last option.

If there is one worker with asthma symptoms, it may warrant a closer look at the air quality of the workplace and its ventilation controls.

**Asthma is a respiratory disease**  
It creates a narrowing of the air passages that makes it difficult to breathe.

**Symptoms**

Tightness of the chest   Difficulty breathing   Wheezing   Coughing

Symptoms are usually worse on work days and improve when away from the workplace.

**Industries affected**

- Cleaning and janitorial services • Bakeries • Healthcare • Manufacturing • Construction
- Agriculture • Automobile spray painting • Insulation and polyurethane work
- Fisheries and fish processing • Forestry

Created in partnership with THE LUNG ASSOCIATION™

**CCOHS.ca**  
Canadian Centre for Occupational Health and Safety

CCOHS Infographic. Work-Related Asthma.





## II.XII. Violence:

Violence is a significant issue for all workplaces. The effects of climate change on workers can be both direct and indirect.

There are a number of studies showing the likelihood of aggression, reduced inhibition, prevalence and magnitude of violence increases with temperature. Violence affects workers in multiple sectors.<sup>327</sup>

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<sup>327</sup> Yong, E. (August 01, 2013). Climate Change and Violence. *The Scientist*. Retrieved February 19, 2020 from <https://www.the-scientist.com/daily-news/climate-change-and-violence-38914> and Hsiang, S.M. Hsiang, Migeul, E., & Burke, M.B. (2013). Quantifying the influence of climate on human conflict. See [https://gspp.berkeley.edu/assets/uploads/research/pdf/Hsiang\\_Burke\\_Miguel\\_2013.pdf](https://gspp.berkeley.edu/assets/uploads/research/pdf/Hsiang_Burke_Miguel_2013.pdf)



As per The Scientist:

“warmer temperatures and extremes in rainfall can substantially increase the risk of many types of conflict. For every standard deviation of change, levels of interpersonal violence, such as domestic violence or rape, rise by some 4 percent, while the frequency of intergroup conflict, from riots to civil wars, rise by 14 percent.”

This has been corroborated in other studies. As per Plante & Anderson (2017):<sup>328</sup>

“a 1°C increase in average temperature — a fairly conservative estimate of climate change in the following decades — will likely yield a 6% increase in violent crime rates”

Llorente (2015)<sup>329</sup> states that in respect to increases in temperature having an indirect effect:

“The research indicates an increase in high temperatures and little precipitation bring an increase of crime rates”

This is supported by a very recent study by Otrachshenko et al. (2019):<sup>330</sup>

“hot weather favours the occurrence of violence so that days with temperatures above 25°C are associated with an increase of 0.60 homicide victims per million inhabitants.”

“males are more often the victims; young and mature males are more likely to become victims of homicide than women.” (during the week)

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<sup>328</sup> Plante, C. & Anderson, C.A. (2017). Global Warming and Violent Behavior. Association for Psychological Science. Retrieved February 19, 2020 from <https://www.psychologicalscience.org/observer/global-warming-and-violent-behavior>

<sup>329</sup> Llorente, A. (2015). How Does Weather Affect Crime Rates? Retrieved February 25, 2020 from <http://www.city-data.com/blog/28-weather-affect-crime-rates/>

<sup>330</sup> Otrachshenko, V., Popova, O., & Tavares, J. (2019). Extreme weather and violence in Russia: Evidence across age and gender. *VOX CEPR Policy Central*. Retrieved February 28, 2020 from <https://voxeu.org/article/extreme-weather-and-violence-russia>

“both males and females are more likely to become homicide victims during weekends with unusually high temperatures, where overall victimhood rates roughly double for both males and females.”

Hot temperatures affect psychological and social health, including violence, as per the Health of Canadians in a Changing Climate (2022) report.<sup>331</sup>

High temperatures increase stress and people’s propensity for aggressive behaviour, as reflected in increased crime and violent crime rates observed in certain U.S. cities. In Toronto, the highest temperatures between 2002 and 2010 corresponded with a 29% increase in emergency department visits for schizophrenia, mood disorders and neurotic disorders over a seven-day period compared to visits during average temperatures.

In about 15 studies, high temperatures were correlated with an increase in the suicide rate, with relative risk increasing by 1% to 37% on average for every 1°Celsius increase in annual average temperature.<sup>332</sup> A meta-analysis covering 341 cities in 12 countries estimated that the highest risk of suicide was observed at an average temperature of 27°Celsius.<sup>333</sup> A 2019 study analyzed the association between the daily mean temperature and incidence of suicide for 341 locations in 12 countries and found that the pooled excess relative risk for suicide for 26 Canadian locations (1986 to 1999) was highest at a daily mean temperature of 24.2°Celsius.<sup>334</sup>

See the Violence Prevention Kit on the CUPE Health and Safety website.

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<sup>331</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>332</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>333</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>334</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>



### II.XIII. Mental Health and Psychosocial Impacts:

The relationship between extreme weather disasters such as floods, forest fires, heat waves and mental health issues such as post-traumatic stress disorder is well established.

“Mental health impacts of climate change may include exacerbation of existing mental illness such as psychosis; new-onset mental illness such as post-traumatic stress disorder; mental health stressors such as grief, worry, anxiety, and vicarious trauma; and a lost sense of place, which refers to the perceived or actual detachment from community, environment, or homeland. Impacts can also include disruptions to psychosocial well-being and resilience, disruptions to a sense of meaning in a person’s life, and lack of community cohesion, all of which can result in distress, higher rates of hospital admissions, increased suicide ideation or suicide, and increased negative behaviours such as substance misuse, violence, and aggression.”<sup>335</sup>

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<sup>335</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

“Climate change disproportionately affects the mental health of specific populations, including Indigenous Peoples; women; children; youth; older adults; people living in low socio-economic conditions (including the homeless); people living with pre-existing physical and mental health conditions; and certain occupational groups, such as land-based workers and first responders. For example, Indigenous Peoples are at greater risk of being displaced by climate-related hazards and this can result in a loss of community connections and loss of livelihoods that affect individual and collective well-being.”<sup>336</sup>

There are numerous studies that show that extreme weather events cause psychological injuries.<sup>337</sup> Climate change may present acute and chronic stressors that may have severe mental health effects. As per the US Centers for Disease Control and Prevention:

“Suicide rates vary with weather, rising with high temperatures, suggesting potential impacts from climate change on depression and other mental illnesses.”

Climate change increases the risks of mental health impacts:<sup>338</sup>

- Worsening of existing mental illness such as psychosis
- New-onset mental illness such as post traumatic stress disorder
- Mental health stressors such as grief, worry, anxiety and vicarious trauma

There are two different types of impacts: acute hazard impacts (floods, extreme heat events, wildfires and hurricanes) and slow hazard impacts (drought, sea-level rise and melting permafrost). The range of responses to each varies. There are secondary impacts as well.

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<sup>336</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>337</sup> Schulte, P.A., Bhattacharya, A., Butler, C.R., Chun, H.K., Jacklitsch, B., & Jacobs, T. (2016). Advancing the framework for considering the effects of climate change on worker safety and health. *Journal of Occupational and Environmental Hygiene*. Volume 12, 2016, Issue 11. Retrieved February 12, 2020 from <https://oeh.tandfonline.com/doi/full/10.1080/15459624.2016.1179388#.XkSk8GhKjFg>

<sup>338</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

Acute hazards may result in mood and behavioural disorders and may also result in secondary impacts on mental health from physical harm and displacement. The secondary impacts result from loss of livelihood, trauma, fear of impending impacts and ongoing mood and behavioural disorders such as post traumatic stress disorder, depression and anxiety.<sup>339</sup> Slow-onset hazards can affect sense of place, ecosystem health, culture and identity and can lead to emotional responses of anxiety, grief, anger, helplessness and depression.<sup>340</sup>

As per the Health of Canadians in a Changing Climate (2022) report:<sup>341</sup>

“all of these can result in distress, higher rates of hospital admissions, increased suicide ideation or suicide, and increased substance misuse, violence, and aggression. Studies are also showing that people can become distressed about climate change itself, resulting in increased anxiety (often termed eco- or climate anxiety), grief (often termed eco-grief or climate grief), worry, anger, hopelessness, and fear.”

And,

“Exposure to flooding appears to increase excessive use of drugs, alcohol, or medication.”

And,

“flooding, the most frequent form of disaster globally, can lead to increased levels of PTSD, general distress, depression, and anxiety among flood survivors. Even people who are indirectly exposed to climate-related hazards can experience poor mental health outcomes, including vicarious trauma, secondary stress, and/or compassion fatigue for those whose lives have been disrupted by extreme events.”

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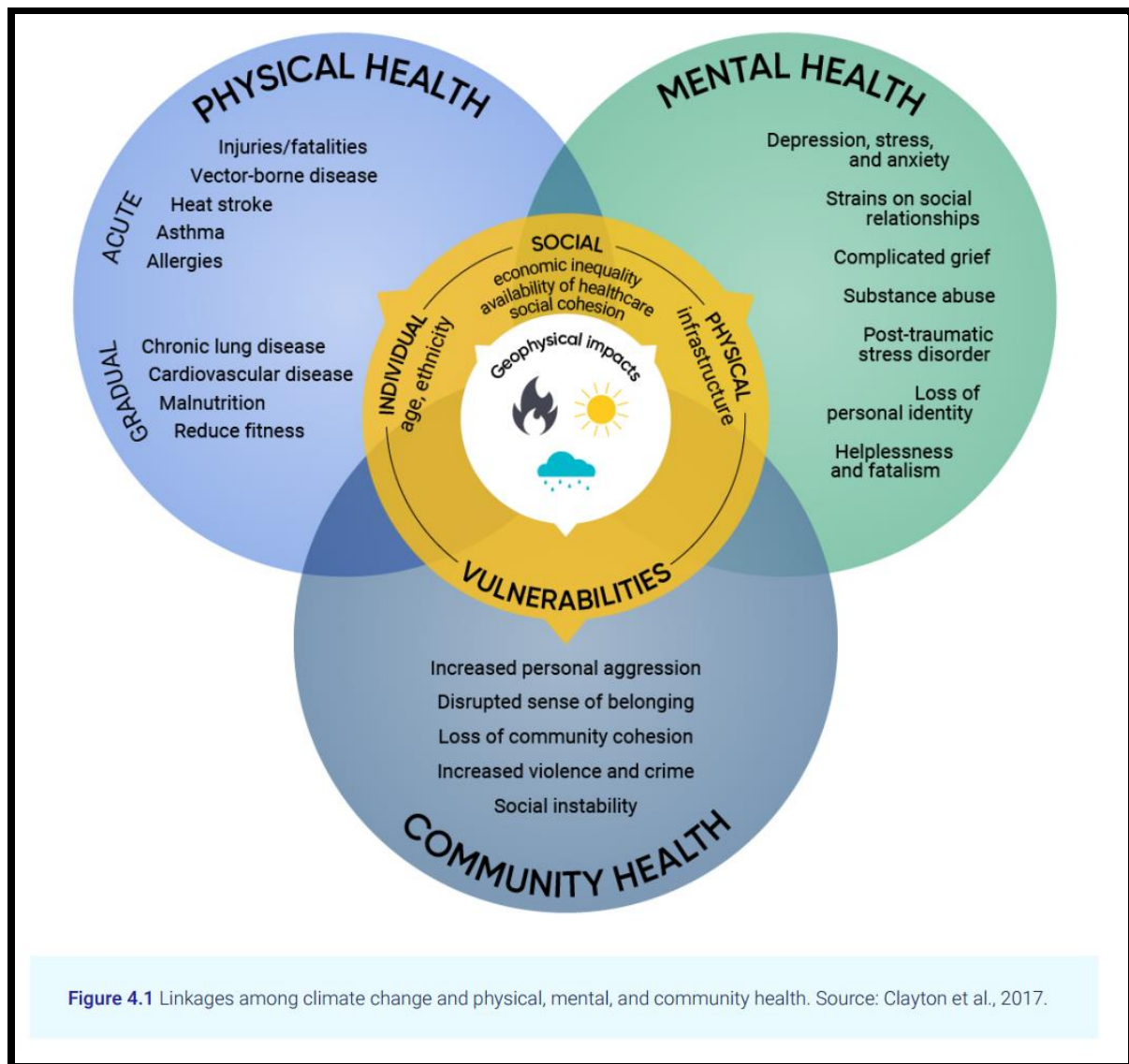
<sup>339</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>340</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

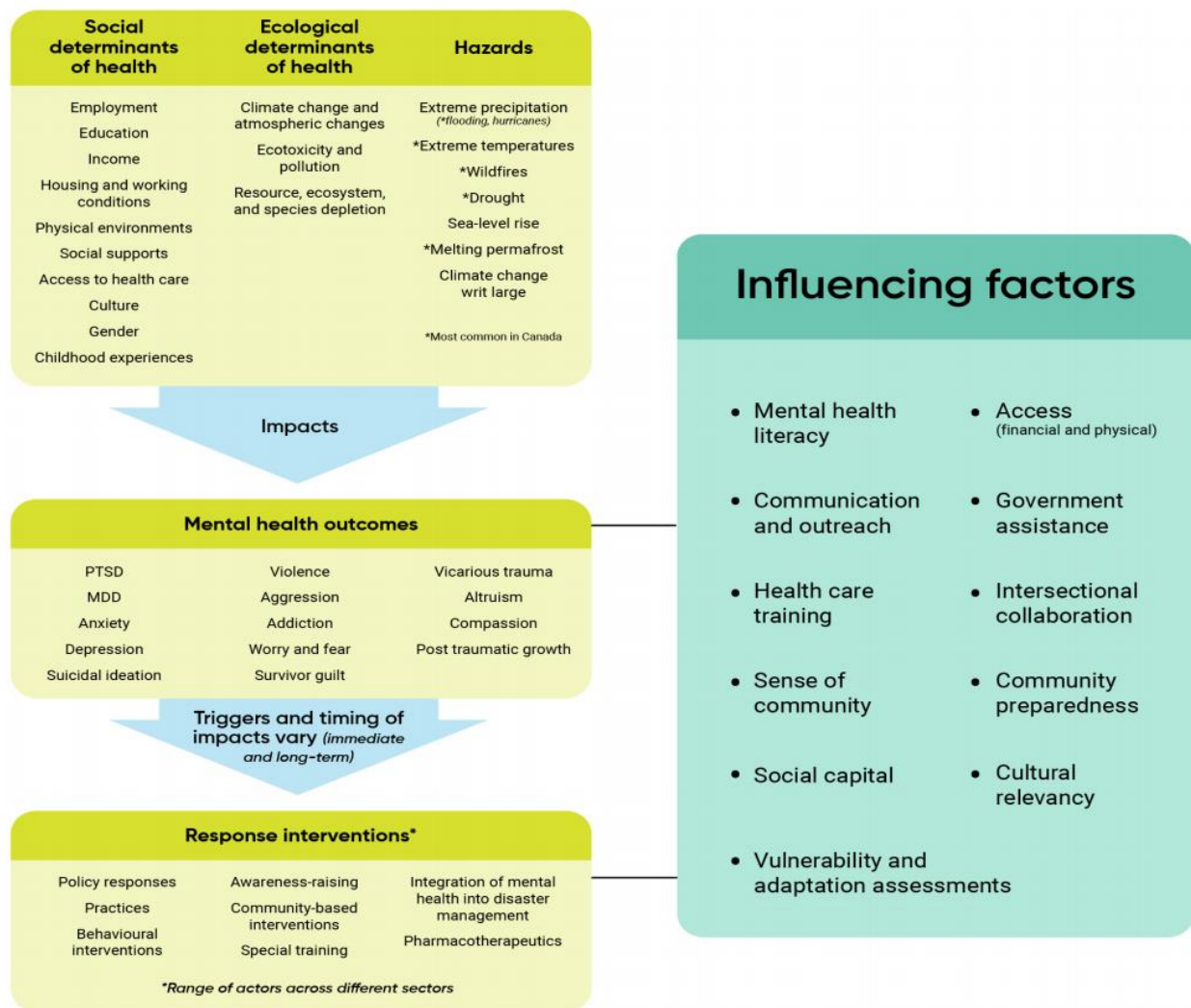
<sup>341</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>



The figures from the report Health of Canadians in a Changing Climate (2022) reviews the links between climate change and psychological injury (three figures):<sup>342</sup>



<sup>342</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

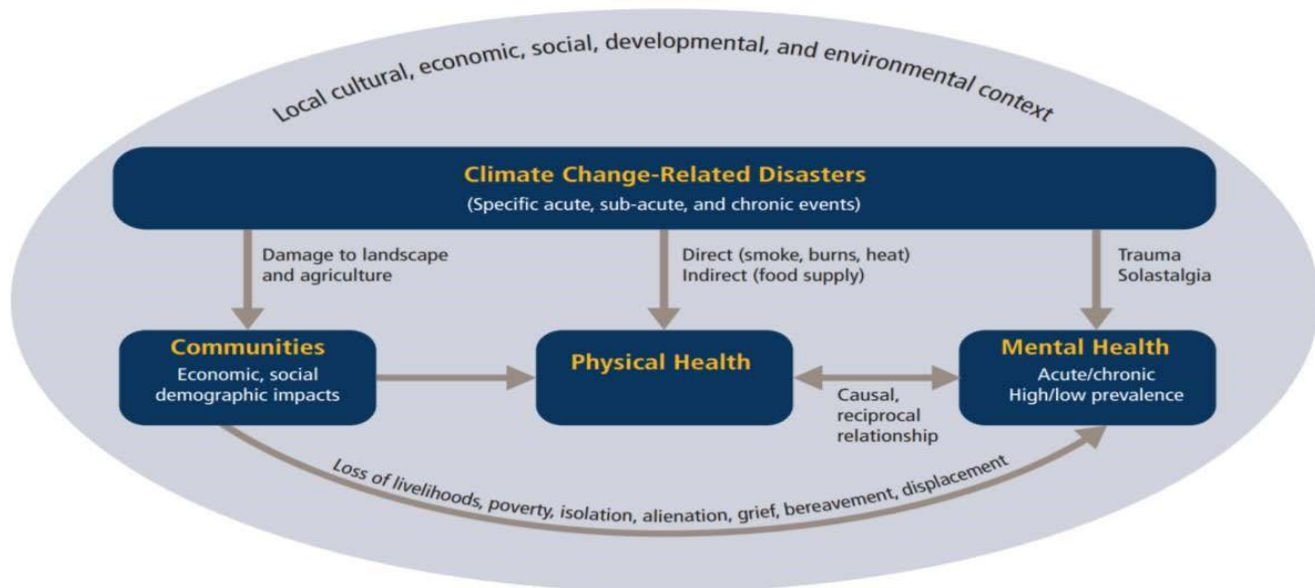


**Figure 4.2** Factors that influence the psychosocial health impacts of climate change. Source: Hayes et al., 2019.

## Overview of Climate Change Impacts on Mental Health

HEALTH IMPACT OR HAZARD CATEGORY	CLIMATE-RELATED CAUSES	POSSIBLE HEALTH EFFECTS
Mental health	<ul style="list-style-type: none"> <li>• Increased frequency and severity of precipitation (such as hurricanes, flooding, ice storms)</li> <li>• Droughts</li> <li>• Wildfires</li> <li>• Extreme temperatures</li> <li>• Decreased food and water security</li> <li>• Melting permafrost</li> <li>• Sea-level rise</li> <li>• Gradual warming</li> </ul>	<ul style="list-style-type: none"> <li>• Post-traumatic stress disorder (PTSD)</li> <li>• Anxiety</li> <li>• Worry and fear</li> <li>• Depression</li> <li>• Stress</li> <li>• Vicarious trauma</li> <li>• Recovery fatigue</li> <li>• Suicide ideation</li> <li>• Weakened social ties</li> <li>• Addictions (such as drug and alcohol usage)</li> <li>• Aggression including domestic violence</li> <li>• Ecoanxiety/climate anxiety</li> <li>• Ecogrief/climate grief</li> <li>• Solastalgia</li> <li>• Post-traumatic growth</li> <li>• Impacts on health and social services</li> </ul>

Similar to acute hazard and slow-onset hazard impacts, there is a relationship between the direct and indirect effects of climate change, extreme weather events and the short term and long term psychosocial impacts on workers.<sup>343</sup>



This is important because by the time they reach the age of 40, approximately 50% of people living in Canada will have, or have had, some form of mental illness (MHCC, 2017).<sup>344</sup>

Types of workers (all groups) most severely affected by mental health and psychological injuries related to climate change include:<sup>345</sup> Emergency Medical Services, healthcare workers, protection services e.g. police.

<sup>343</sup> Canada's Top Climate Change Risks. The Expert Panel on Climate Change Risks and Adaptation Potential. (2019). CCA CAC. Retrieved February 18, 2020 from <https://cca-reports.ca/wp-content/uploads/2019/07/Report-Canada-top-climate-change-risks.pdf>

<sup>344</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>345</sup> The American Psychiatric Association. Retrieved February 20, 2020 from <https://www.psychiatry.org/patients-families/climate-change-and-mental-health-connections/affects-on-mental-health>

The most common types of mental health conditions that workers may face related to climate change include: <sup>346, 347, 348, 349</sup>

- Post Traumatic Stress Disorder
- Anxiety Disorders
- Phobias
- Depressive Disorders
- Substance Use Disorders
- Somatic Symptoms

People who tend to be at greater risk of poor mental health outcomes from exposure to extreme heat include older persons, people with chronic physiological conditions and people with pre-existing mental health conditions.<sup>350</sup> Flooding effects can include increased levels of post traumatic stress disorder, general distress, depression and anxiety. For those who directly experienced flooding, post traumatic stress disorder was the most commonly reported impact (36.2%), followed by anxiety (28.3%) and depression (20.1%).<sup>351</sup> For wildfires, 60% of respondents self-reported symptoms of post traumatic stress disorder.<sup>352</sup>

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<sup>346</sup> Lancet Commission on Health and Climate. Health and climate change: policy responses to protect public health. The Lancet. Published online June 2015 and Clayton, S. (2017). Mental Health and Our Changing Climate: Impacts, Implications, and Guidance. American Psychological Association and ecoAmerica. Retrieved February 21, 2020 from <https://www.psychiatry.org/patients-families/climate-change-and-mental-health-connections/affects-on-mental-health>

<sup>347</sup> Health An Impact of Wildfires on the Mental Health of Fort McMurray Residents: Neurotic Disorders, Daily Physician Visits within an Emergency Department 2015 vs. 2016. Alberta Health, Health Standards, Quality and Performance Division, Analytics and Performance Reporting Branch, 2016. Retrieved February 18, 2020 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5621945/>

<sup>348</sup> Canadian Medical Association. Climate Change and Health. Retrieved February 18, 2020 from <https://www.cma.ca/climate-change-and-health>

<sup>349</sup> Cunsolo, A. & Ellis N. (2018). Ecological grief as a mental health response to climate change-related loss. *National Climate Change*. 2018;8(4):275–81. Retrieved February 18, 2020 from <https://www.nature.com/articles/s41558-018-0092-2>

<sup>350</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>351</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>352</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>



Droughts have high correlations to suicide and despair.<sup>353</sup> People with severe mental illness are extremely vulnerable during climate hazards. Individuals with pre-existing mental health issues are at increased risk for other morbidities and mortality.

Indigenous persons are at higher risk for the psychological impacts of climate change. Compounding the impacts of a rapidly changing climate are the ongoing legacies and traumas stemming from colonization, land dispossession, residential schools, forced relocation, racism, social exclusion and the continued marginalization. Indigenous peoples have a greater burden of chronic physical illness as a result of experiencing systemic health inequities that can exacerbate climate related mental ill health outcomes<sup>354,355</sup> Climate change can also disrupt the transmission of intergenerational knowledge and land skills, stress, “ecological grief” from past and future climate change related losses of land, ecosystems and species, environmental knowledge and cultural identity.<sup>356</sup>

People whose occupations are primarily outdoors, as well as emergency responders, firefighters and police are at greater risk for psychosocial impacts of climate change. As per Global News:<sup>357</sup>

“Researchers have found that people experienced elevated levels of depression and even post-traumatic stress disorder following the wildfires in Fort McMurray in 2016. Another study on residents of the Northwest Territories, which had a massive wildfire season in 2014, found that the fires had a detrimental event on their mental well-being...”

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<sup>353</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>354</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>355</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>356</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>357</sup> Young, L. (December 07, 2018). Climate change means more disease, deaths for Canadians, Lancet report finds. *Global News*. Retrieved February 18, 2020 from <https://globalnews.ca/news/4708944/climate-change-health-impacts-canada/>

As per Goldmann and Galea (2014):<sup>358</sup>

“one review of the literature estimates the prevalence of PTSD at 30–40% among direct victims, 10–20% among rescue workers, and 5–10% in the general population”

As per Global News: <sup>359</sup>

“Researchers have found that people experienced elevated levels of depression and even post-traumatic stress disorder following the wildfires in Fort McMurray in 2016. Another study on residents of the Northwest Territories, which had a massive wildfire season in 2014, found that the fires had a detrimental event on their mental well-being...”

As per Goldmann and Galea (2014):<sup>360</sup>

“one review of the literature estimates the prevalence of PTSD at 30–40% among direct victims, 10–20% among rescue workers, and 5–10% in the general population”

As per Banyan Mental Health: <sup>361</sup>

“One survey found that 44.5% of first responders in the study had clinically significant symptoms for one or more mental health disorders compared to the general population that was at 10.5%.”

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<sup>358</sup> Goldmann, E & Galea, S. (2014). Mental Health Consequences of Disasters. *Annual Review of Public Health. Volume 35*. Retrieved February 20, 2020 from <https://www.annualreviews.org/doi/full/10.1146/annurev-publhealth-032013-182435>

<sup>359</sup> Young, L. (December 07, 2018). Climate change means more disease, deaths for Canadians, Lancet report finds. *Global News*. Retrieved February 18, 2020 from <https://globalnews.ca/news/4708944/climate-change-health-impacts-canada/>

<sup>360</sup> Goldmann, E & Galea, S. (2014). Mental Health Consequences of Disasters. *Annual Review of Public Health. Volume 35*. Retrieved February 20, 2020 from <https://www.annualreviews.org/doi/full/10.1146/annurev-publhealth-032013-182435>

<sup>361</sup> Banyan Mental Health. (No date). Retrieved February 20, 2020 from <https://www.banyanmentalhealth.com/2019/09/24/mental-health-issues-after-natural-disasters/> and Mellow, R. (2017). Groundbreaking Data Collected on Mental Health of First Responders. *Journal of Emergency Medical Services. Issue 11, Volume 12*. Retrieved February 20, 2020 from <https://www.jems.com/2017/11/01/groundbreaking-data-collected-on-mental-health-of-first-responders/>

Post traumatic stress disorder is often diagnosed three months after a natural disaster (Harwood, 2017).<sup>362</sup> Symptoms of operational stress injuries increase over time as well. The percentage of persons with symptoms of a mental health injury in the general population is 10% while for emergency medical services (Paramedics, dispatchers, RCMP, police, firefighters) is 44% BEFORE natural disasters even occur; emergency services workers are already at much higher risk for developing co-morbid conditions.<sup>363</sup> Post traumatic stress disorder rates among first responders range from 13% to 18% four years after responding to an extreme weather event.<sup>364</sup> As per the CBC News:

“‘It's higher, and, surprisingly higher,’ said University of Regina psychology professor Nick Carleton, who led the team of researchers.”

Early evidence also shows that climate change may also be contributing to the opioid crisis and other drug use due to new and aggravated mental disorders.<sup>365</sup> Drug related deaths increased dramatically in New Orleans after Hurricane Katrina and Hurricane Sandy.<sup>366</sup> This was corroborated by Stephan Goetz, professor, Pennsylvania State University and Meri Davlasheridze, Assistant professor, Texas A&M University, as per the following three figures (see next page).<sup>367</sup>

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<sup>362</sup> Harwood, A. The Trauma after the Storm. Scientific American. (November 07, 2017). Retrieved February 20, 2020 from <https://www.scientificamerican.com/article/the-trauma-after-the-storm/>

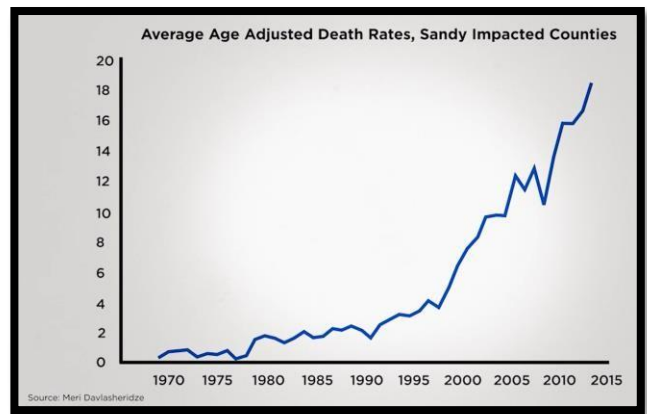
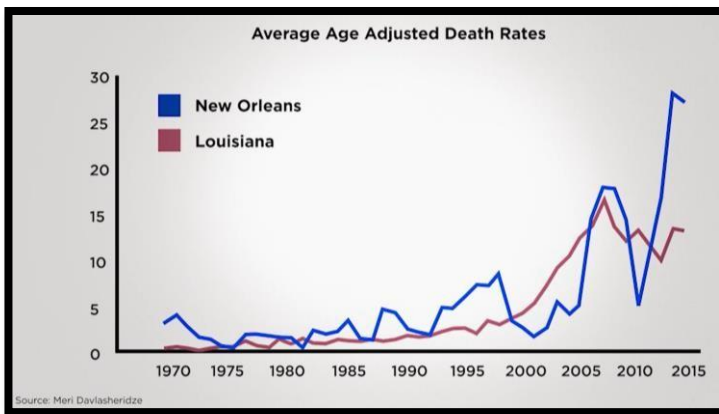
<sup>363</sup> Crawford, A. (August 30, 2017). Researchers find significantly higher rate of mental disorders among first responders. CBC News. Retrieved February 22, 2020 from <https://www.cbc.ca/news/politics/police-fire-fighters-ptsd-paramedis-1.4266720>

<sup>364</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

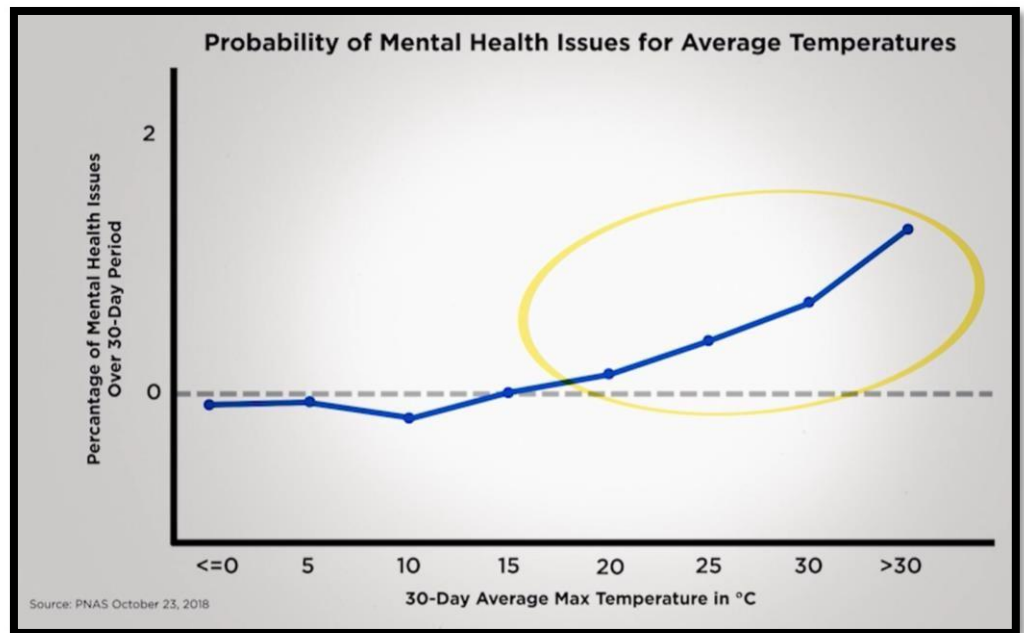
<sup>365</sup> (No author). (May 22, 2019). How climate change is making the opioid crisis worse. Global News. Retrieved February 25, 2020 from <https://globalnews.ca/video/5303296/how-climate-change-is-making-the-opioid-crisis-worse>

<sup>366</sup> Goetz, S. & Davlasheridze, M. Retrieved February 25, 2020 from <https://cleantechnica.com/2018/03/24/climate-change-make-opioid-crisis-worse/>

<sup>367</sup> Simons, M. (March 24, 2018). Climate Change Could Make The Opioid Crisis Worse. Nexus Media. Retrieved February 25, 2020 from <https://cleantechnica.com/2018/03/24/climate-change-make-opioid-crisis-worse/>



The incidence of drug related deaths in New Orleans was 3.45 deaths per 100,000 people between 1999 and 2004. It rose to 16.1 after Hurricane Katrina.



The figures from the report Health of Canadians in a Changing Climate provides a detailed summary of populations that are at risk and potential health outcomes:<sup>368</sup>

Table 4.3 Monitoring and measuring climate change impacts on mental health			
CLIMATE HAZARD	POPULATIONS AT INCREASED RISK	POTENTIAL MENTAL HEALTH OUTCOMES	INDICATORS AND MEASUREMENT TOOLS
Extreme Heat	<ul style="list-style-type: none"> <li>• People with pre-existing mental health conditions</li> <li>• People taking psychotropic medications that affect thermoregulation</li> <li>• Older adults (who have poor thermoregulation)</li> <li>• People with substance use disorders</li> <li>• People living in urban heat islands</li> <li>• Urban poor without access to air conditioning</li> <li>• People who are homeless</li> <li>• Workers exposed to heat and people active outdoors</li> </ul>	<ul style="list-style-type: none"> <li>• Exacerbated mood or behavioural disorders</li> <li>• Violence</li> <li>• Aggression</li> <li>• Suicide</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor emergency department visits after extreme heat events for an increase in patients reporting mood or behavioural disorders</li> <li>• Monitor mortality statistics following extreme heat events — look for co-morbidities related to mental health and incidents of suicide</li> <li>• Interviews or questionnaires with people who experienced extreme heat events to ask about their mental health in relation to heat events</li> <li>• Review police records following extreme heat events to monitor elevated incidents of violence or aggression</li> </ul>

<sup>368</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>



CLIMATE HAZARD	POPULATIONS AT INCREASED RISK	POTENTIAL MENTAL HEALTH OUTCOMES	INDICATORS AND MEASUREMENT TOOLS
<p><b>Extreme Weather Event</b> (flood, hurricane, drought, mudslides, etc.)</p>	<ul style="list-style-type: none"> <li>• Gender (women)</li> <li>• Sex (female, particularly pregnant women)</li> <li>• Age (children, infants, older adults)</li> <li>• Race and ethnicity (non-White)</li> <li>• Immigrants</li> <li>• People with pre-existing health conditions</li> <li>• People with low socio-economic status</li> <li>• People who are under- and non-insured (health care and home insurance)</li> <li>• People who are homeless</li> <li>• Outdoor labourers</li> <li>• First responders</li> <li>• First Nations, Inuit, Métis</li> </ul>	<ul style="list-style-type: none"> <li>• Post-traumatic stress disorder (PTSD)</li> <li>• Depression (including major depressive disorders)</li> <li>• Anxiety</li> <li>• Suicidal ideation</li> <li>• Aggression</li> <li>• Substance abuse and addiction</li> <li>• Violence</li> <li>• Survivor guilt</li> <li>• Vicarious trauma</li> <li>• Altruism</li> <li>• Compassion</li> <li>• Post-traumatic growth</li> </ul>	<p>Surveys</p> <ul style="list-style-type: none"> <li>• Self-report surveys of general health. Consider using: <ul style="list-style-type: none"> <li>» General Health Questionnaire (GHQ)</li> </ul> </li> <li>• Self-report surveys of mental illness and mental problems. Consider using any, or a combination of: <ul style="list-style-type: none"> <li>» Disaster-PAST</li> <li>» Generalized Anxiety Disorder Scale (GAD-7)</li> <li>» Post-Traumatic Stress Disorder Checklist (PCL)</li> <li>» Center for Epidemiologic Studies Depression Scale (CES-D)</li> <li>» Kessler Psychological Distress Scale (K6; K10)</li> <li>» Brief Trauma Questionnaire</li> </ul> </li> <li>• Self-report surveys of affirmative mental health. Consider using: <ul style="list-style-type: none"> <li>» Stress-Related Growth Scale (SRGS)</li> <li>» Post-Traumatic Growth Index (PTGI)</li> <li>» Benefit Finding Scale (BFS)</li> </ul> </li> </ul>

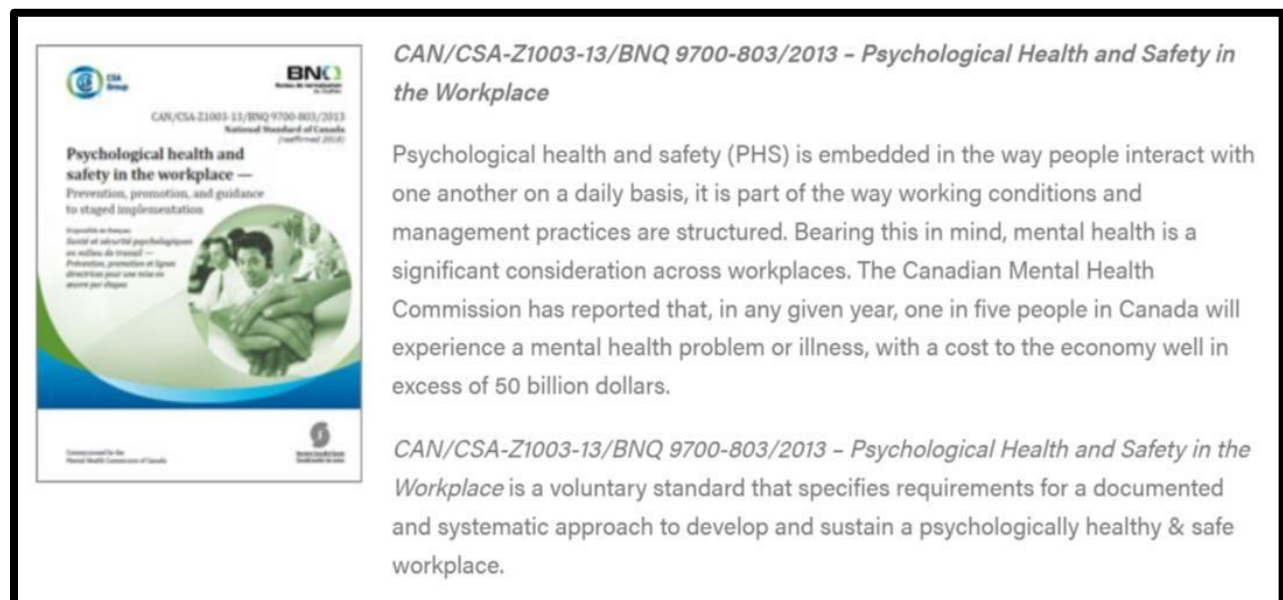
CLIMATE HAZARD	POPULATIONS AT INCREASED RISK	POTENTIAL MENTAL HEALTH OUTCOMES	INDICATORS AND MEASUREMENT TOOLS
<p>Extreme Weather Event</p> <p>(flood, hurricane, drought, mudslides, etc.)</p> <p>(continued)</p>			<p>Monitor emergency department visits after extreme weather events for an increase in patients reporting mental health problems or illness</p> <p>Review new prescription use for mental health and behavioural disorders after an extreme weather event</p> <p>Interviews</p> <ul style="list-style-type: none"> <li>Interviews with primary care physicians and mental health care providers about any surges in patients reporting mental health issues following extreme weather events</li> <li>Interviews with people who experienced an extreme weather event about their perceptions regarding their mental health related to the event</li> </ul>
<p>Vector-Borne Disease (VBD) (e.g., Lyme disease, West Nile virus)</p>	<ul style="list-style-type: none"> <li>People who are homeless</li> <li>People with pre-existing mental health conditions</li> <li>Outdoor workers</li> <li>Recreationalists (hunters, fishers, outdoor enthusiasts)</li> </ul>	<ul style="list-style-type: none"> <li>VBD disease, particularly Lyme disease or West Nile virus, that can compound mental health problems (e.g., cognitive or neurological impairment, behavioural disorders)</li> </ul>	<ul style="list-style-type: none"> <li>Interviews or questionnaires with patients who have been diagnosed with VBDs to ask about perceptions of their mental health</li> <li>Interviews with primary care physicians and mental health care providers about any mental health co-morbidities for patients diagnosed with VBDs</li> </ul>

CLIMATE HAZARD	POPULATIONS AT INCREASED RISK	POTENTIAL MENTAL HEALTH OUTCOMES	INDICATORS AND MEASUREMENT TOOLS
Sea-Level Rise or Melting Permafrost	<ul style="list-style-type: none"> <li>• People who work or live near the ocean (sea-level rise) or in the Arctic</li> <li>• Outdoor labourers</li> <li>• First Nations, Inuit, Métis</li> </ul>	<ul style="list-style-type: none"> <li>• Anxiety, worry, or fear of displacement</li> <li>• Anxiety, worry, or fear of job loss</li> <li>• Loss of place (grief, solace)</li> </ul>	<ul style="list-style-type: none"> <li>• Interviews or questionnaires with residents who have experienced or are experiencing sea-level rise or prolonged drought in their communities. Interview questions may focus on the mental health implications of: displacement, job loss associated with sea-level rise, infrastructure damage, agricultural or resource loss and resource scarcity, as well as food and water safety and security</li> </ul>
Climate Change Overall (i.e., awareness of climate change threats to human and planetary health and survival)	<ul style="list-style-type: none"> <li>• People at greater risk from and exposure to climate change</li> <li>• Researchers investigating climate change</li> <li>• Environmental and climate change activists</li> <li>• Environmental studies students</li> <li>• Outdoor recreationalists</li> <li>• First Nations, Inuit, Métis</li> </ul>	<ul style="list-style-type: none"> <li>• Anxiety</li> <li>• Worry</li> <li>• Stress</li> <li>• Fear</li> </ul>	<ul style="list-style-type: none"> <li>• Interviews or questionnaires with people who experience concern, anxiety, worry, related to awareness of climate change threats</li> <li>• Generalized Anxiety Disorder Scale (GAD-7)</li> </ul>

Source: Adapted from Hayes & Poland, 2018

The Rigolet Inuit Community Government, the Nunatsiavut Department of Health and Social Development and a team of Inuit and non-Inuit researchers have been working with the community of Rigolet, Nunatsiavut, Labrador, Canada to develop and implement the eNuk program, an Inuit-designed and -developed participatory environment and health surveillance system. Premised on Inuit values, knowledge systems, sciences and priorities, the eNuk app is designed to track, analyze and respond to the health impacts of climate change, including impacts on mental health.<sup>369</sup> The Yukon's Climate Change Secretariat report on adaptation actions identified strengthening mental health resources and building or enhancing programs that support Indigenous Peoples' reconnection to the land as a top priority.

The CSA Group has a psychological standard and its implementation handbook which is available to the public.<sup>370</sup> CSA Z1003-13 Psychological Health and Safety in the Workplace:

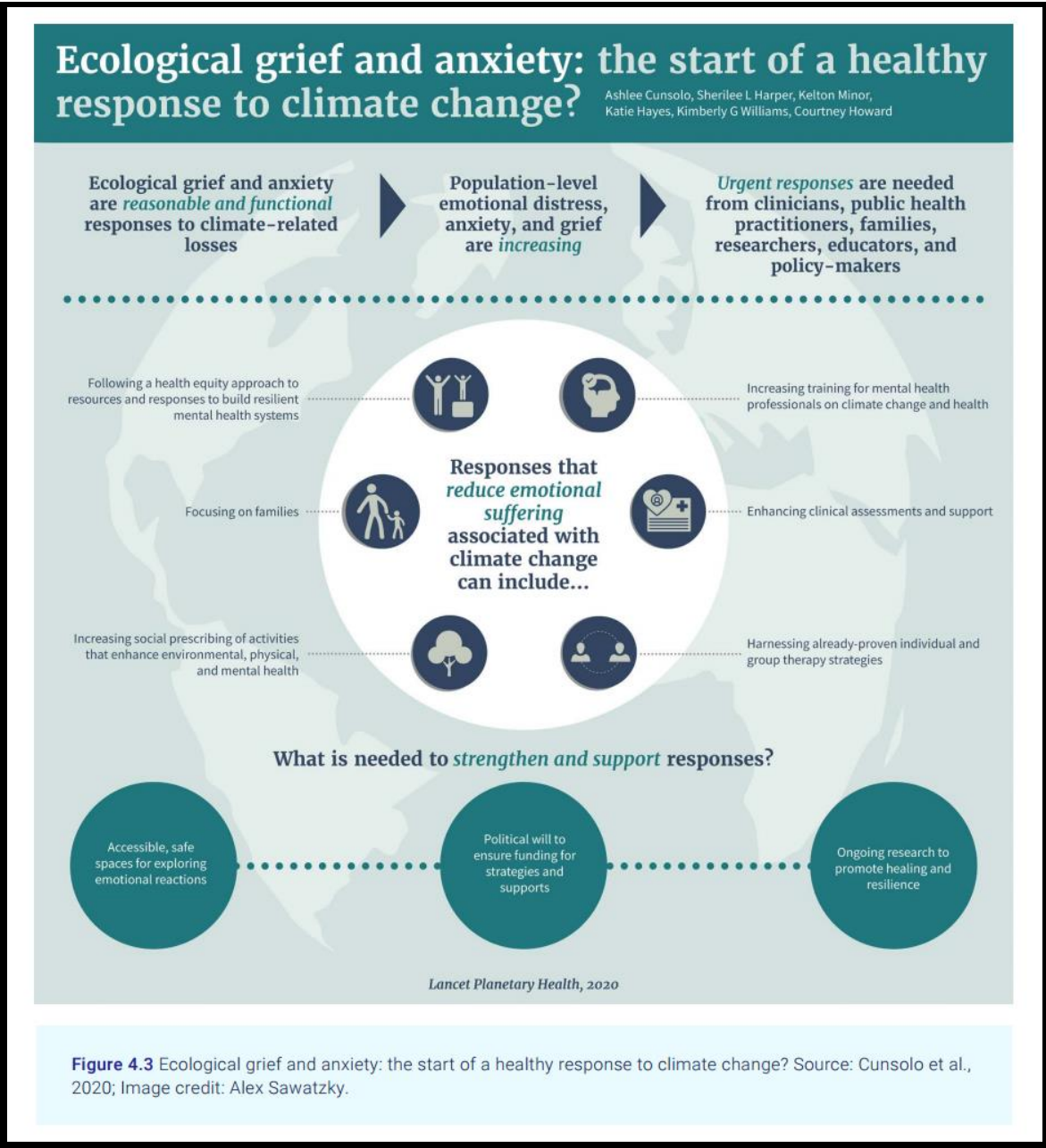


Cover page of the CSA Group CA/CSA-Z1003-13.

<sup>369</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>

<sup>370</sup> CSA Group. CSA Z1003-13 Psychological Health and Safety in the Workplace. Retrieved February 15, 2020 from <https://www.csagroup.org/article/cancca-z1003-13-bnq-9700-803-2013-r2018/> and <https://www.csagroup.org/article/spe-z1003-implementation-handbook/>

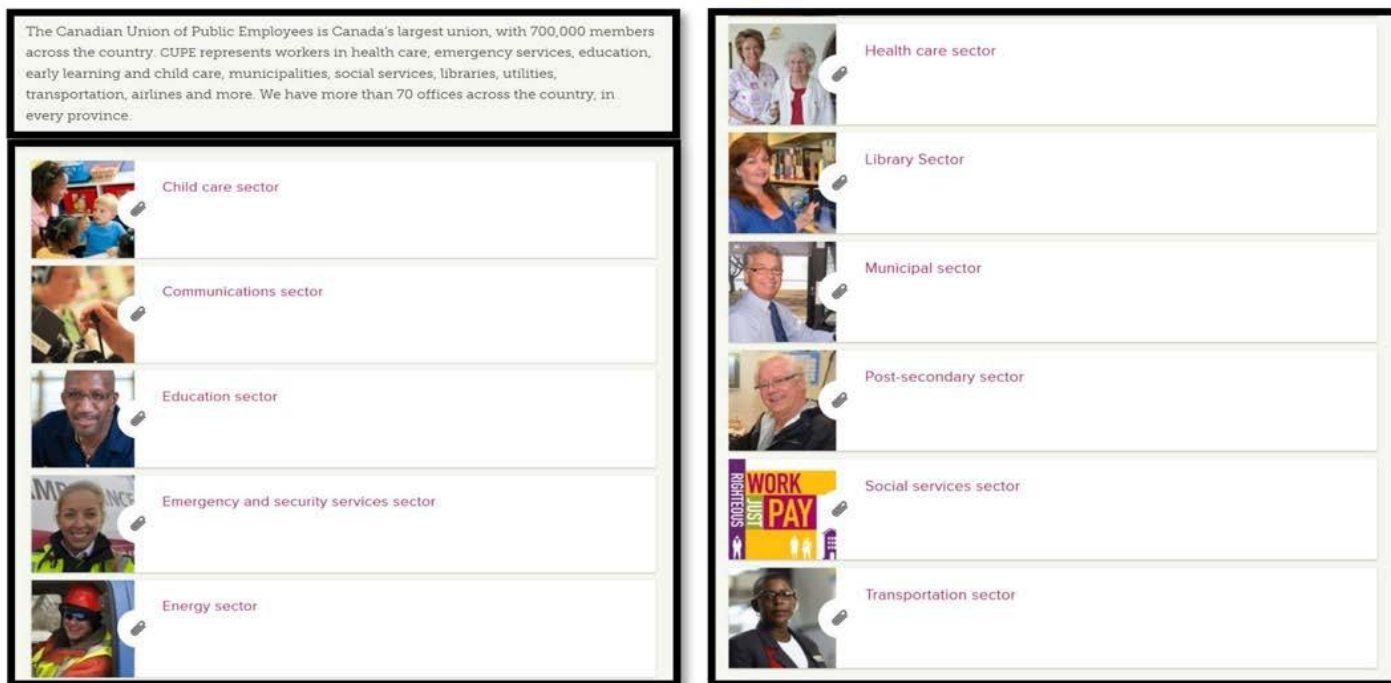
Ecological grief and anxiety are new phenomena related to climate change as per the follow figure from the report Health of Canadians in a Changing Climate (2022):<sup>371</sup>



**Figure 4.3** Ecological grief and anxiety: the start of a healthy response to climate change? Source: Cunsolo et al., 2020; Image credit: Alex Sawatzky.

<sup>371</sup> Health of Canadians in a Changing Climate. (2022). Retrieved June 08, 2022 from <https://changingclimate.ca/site/assets/uploads/sites/5/2022/02/CCHA-REPORT-EN.pdf>





### III. Sectors and Areas of CUPE Affected by Climate Change (with Sample Occupations):

The following sample illustrative tables of workplace hazards caused by climate change are based on WorkSafeBC claims data, other provincial workers compensation systems data, the Canadian Centre for Occupational Health and Safety, the Institute for Work and Health, Statistics Canada, the National Institutes of Health and the Association of Workers' Compensation Boards of Canada. This data was then applied to BC. Where there was a lack of data or it could not be applied to BC, other information was used. There are significant gaps in information and data. The following tables are a partial list of potential hazards and risks for illustration purposes only. As stated in each table:

**“This table does not replace hazard and risk assessments. This table shows general hazards and risks that may require further investigation. \* The results for the same sector and occupation may vary considerably from geographic region due to the highly regional variations of climate change and resulting impacts on workers. Regional dissimilarities should be expected. The table is based on known information. New studies are occurring weekly - this information is ONLY a guide to further investigations as opposed to a comprehensive list of definitive hazards and risks specifically caused by climate change (as opposed to other occupational factors).”**



Association of Workers' Compensation Boards of Canada. Statistics.

## Emergency Responders e.g. Paramedics

Sample Types and Levels of Hazards and Risks (include Equity Seeking Groups in the analysis of who is affected)	Hazard and Risk Levels (Likelihood of Occurrence based on studies identified occurrences specifically related to climate change)*				
Types of Hazards and Risks	Unknown	None	Low	Medium	High
Air Quality – forest fire smoke, ozone, pollen (note: pollen and mould also have their own categories below), smog, Volatile Organic Compounds					<b>X</b>
Extreme Weather (Highly region dependent) Slips, trips, falls, musculoskeletal disorders, etc. due to weather such as ice and snow; vehicular accidents					
Thunderstorms			<b>X</b>		
Other Types of Storms			<b>X</b>		
Wind, Tornadoes, Turbulence			<b>X</b>		
Precipitation and Flooding				<b>X</b>	

Forest Fires – heat, forest fire smoke, injuries e.g. burns, crush injuries, falls, lacerations, mental health injuries, musculoskeletal injuries, trips			X		
Insects and Arachnids					
Fleas	X				
Bed Bugs		X			
Spiders		X			
Wasps and Hornets		X			
Fire Ants		X			
Mosquitoes		X			
Ticks		X			
Mental Disorders (DSM diagnoses) and Mental Health Symptoms (non-DSM diagnoses)				X	

Pathogens – bacteria, mould and fungi (note: this is separate from Air Quality in this table), parasites, protozoa, viruses (highly region dependent)					
Waterborne Diseases e.g. bacteria, viruses, algal blooms e.g. red tides			X		
Non-Waterborne Diseases e.g. bacteria and viruses from food, mosquitoes, ticks, fleas			X		
Influenza			X		
Mould and Fungi (note: this is also included in Air Quality above)	X				
Plants		X			
Pollen and Allergens (note: this is also included in Air Quality above)			X		
Rodents		X			



<b>Temperatures (heat, cold, humidity)</b> Paramedics and emergency services personnel often have to work under pressure in rooms or vehicles with no air conditioning while wearing protective clothing Exposure to increased temperature can also result in reduced vigilance and increased risk of injury					<b>X</b>
<b>UV Radiation / Solar Exposure</b>			<b>X</b>		
<b>Violence</b>				<b>X</b>	

This table does not replace hazard and risk assessments. This table shows general hazards and risks that may require further investigation. **\*The results for the same sector and occupation may vary considerably from geographic region due to the highly regional variations of climate change and resulting impacts on workers. Regional dissimilarities should be expected. The table is based on known information. New studies are occurring weekly - this information is ONLY a guide to further investigations as opposed to a comprehensive list of definitive hazards and risks specifically caused by climate change (as opposed to other occupational factors).**

Education e.g. K-12 and Education Assistants

Sample Types and Levels of Hazards and Risks	Hazard and Risk Levels (Likelihood of Occurrence based on studies identified occurrences specifically related to climate change)*				
Types of Hazards and Risks	Unknown	None	Low	Medium	High
Air Quality – forest fire smoke, ozone, pollen (note: pollen and mould also have their own categories below), smog, Volatile Organic Compounds					<b>X</b>
<b>Extreme Weather (Highly region dependent)</b> Slips, trips, falls, musculoskeletal disorders, etc. due to weather such as ice and snow					
Thunderstorms			<b>X</b>		
Other Types of Storms			<b>X</b>		
Wind, Tornadoes, Turbulence			<b>X</b>		
Precipitation and Flooding				<b>X</b>	

Forest Fires – heat, forest fire smoke, injuries e.g. burns, crush injuries, falls, lacerations, mental health injuries, musculoskeletal injuries, trips			X		
Insects and Arachnids					
Fleas	X				
Bed Bugs		X			
Spiders		X			
Wasps and Hornets		X			
Fire Ants		X			
Mosquitoes		X			
Ticks		X			
Mental Disorders (DSM diagnoses) and Mental Health Symptoms (non-DSM diagnoses)				X	

Pathogens – bacteria, mould and fungi (note: this is separate from Air Quality in this table), parasites, protozoa, viruses (highly region dependent)					
Waterborne Diseases e.g. bacteria, viruses, algal blooms e.g. red tides			X		
Non-Waterborne Diseases e.g. bacteria and viruses from food, mosquitoes, ticks, fleas			X		
Influenza				X	
Mould and Fungi (note: this is also included in Air Quality above) Mould from increased precipitation, malfunctioning HVAC systems, increased humidity				X	
Plants		X			
Pollen and Allergens (note: this is also included in Air Quality above)			X		
Rodents		X			
Temperatures (heat, cold, humidity)			X		

UV Radiation / Solar Exposure			X		
Violence This only refers to heat related aggression and crime due to climate change as opposed to the high levels of violence normally experienced in this sector and by education assistants in particular			X		
<p>This table does not replace hazard and risk assessments. This table shows general hazards and risks that may require further investigation. <b>*The results for the same sector and occupation may vary considerably from geographic region due to the highly regional variations of climate change and resulting impacts on workers. Regional dissimilarities should be expected. The table is based on known information. New studies are occurring weekly - <u>this information is ONLY a guide to further investigations as opposed to a comprehensive list of definitive hazards and risks specifically caused by climate change (as opposed to other occupational factors).</u></b></p>					



Energy Sector e.g. electricity generation, distribution and transmission in hydro-electric, nuclear, wind and fossil fuel utilities as well as small-scale production

Sample Types and Levels of Hazards and Risks	Hazard and Risk Levels (Likelihood of Occurrence based on studies identified occurrences specifically related to climate change)*				
Types of Hazards and Risks	Unknown	None	Low	Medium	High
Air Quality – forest fire smoke, ozone, pollen (note: pollen and mould also have their own categories below), smog, Volatile Organic Compounds					X
Extreme Weather (Highly region dependent) Slips, trips, falls, musculoskeletal disorders, etc. due to weather such as ice and snow; vehicular accidents; injuries caused by damaged infrastructure; injuries caused by damaged or dying trees; electrical hazards caused by lightning or power lines impacted by trees					
Thunderstorms					X
Other Types of Storms					X
Wind, Tornadoes, Turbulence					X

Precipitation and Flooding					X
Forest Fires – heat, forest fire smoke, injuries e.g. burns, crush injuries, falls, lacerations, mental health injuries, musculoskeletal injuries, trips			X		
Insects and Arachnids					
Fleas	X				
Bed Bugs		X			
Spiders			X		
Wasps and Hornets			X		
Fire Ants		X			
Mosquitoes			X		
Ticks			X		

<b>Mental Disorders (DSM diagnoses) and Mental Health Symptoms (non-DSM diagnoses)</b>			<b>X</b>		
<b>Pathogens – bacteria, mould and fungi (note: this is separate from Air Quality in this table), parasites, protozoa, viruses (highly region dependent)</b>					
<b>Waterborne Diseases e.g. bacteria, viruses, algal blooms e.g. red tides</b>			<b>X</b>		
<b>Non-Waterborne Diseases e.g. bacteria and viruses from food, mosquitoes, ticks, fleas</b>			<b>X</b>		
<b>Influenza</b>			<b>X</b>		
<b>Mould and Fungi (note: this is also included in Air Quality above)</b>				<b>X</b>	
<b>Plants</b>		<b>X</b>			
<b>Pollen and Allergens (note: this is also included in Air Quality above)</b>				<b>X</b>	
<b>Rodents</b>			<b>X</b>		
<b>Temperatures (heat, cold, humidity) Exposure to increased temperature can also result in reduced vigilance and increased risk of injury</b>					<b>X</b>

UV Radiation / Solar Exposure			X		
Violence			X		
Workload e.g. due to storms				X	
<p>This table does not replace hazard and risk assessments. This table shows general hazards and risks that may require further investigation. <b>*The results for the same sector and occupation may vary considerably from geographic region due to the highly regional variations of climate change and resulting impacts on workers. Regional dissimilarities should be expected. The table is based on known information. New studies are occurring weekly - this information is ONLY a guide to further investigations as opposed to a comprehensive list of definitive hazards and risks specifically caused by climate change (as opposed to other occupational factors).</b></p>					

Fire Suppression e.g. firefighters (recognizing there are distinctions between different types of fire suppression e.g. wildfire as opposed to structural fires within municipalities)

Sample Types and Levels of Hazards and Risks	Hazard and Risk Levels (Likelihood of Occurrence based on studies identified occurrences specifically related to climate change)*				
Types of Hazards and Risks	Unknown	None	Low	Medium	High
Air Quality – forest fire smoke, ozone, pollen (note: pollen and mould also have their own categories below), smog, Volatile Organic Compounds					X
Extreme Weather (Highly region dependent) Slips, trips, falls, musculoskeletal disorders, etc. due to weather such as ice and snow; vehicular accidents; injuries caused by buildings, trees, etc.					
Thunderstorms					X
Other Types of Storms					X
Wind, Tornadoes, Turbulence					X
Precipitation and Flooding					X

Forest Fires – heat, forest fire smoke, injuries e.g. burns, crush injuries, falls, lacerations, mental health injuries, musculoskeletal injuries, trips					<b>X</b>
<b>Insects and Arachnids</b>					
Fleas	<b>X</b>				
Bed Bugs There may be calls to provide medical assistance to areas that have bed bugs			<b>X</b>		
Spiders	<b>X</b>				
Wasps and Hornets	<b>X</b>				
Fire Ants	<b>X</b>				
Mosquitoes	<b>X</b>				
Ticks	<b>X</b>				
Mental Disorders (DSM diagnoses) and Mental Health Symptoms (non-DSM diagnoses)					<b>X</b>



Pathogens – bacteria, mould and fungi (note: this is separate from Air Quality in this table), parasites, protozoa, viruses (highly region dependent)					
Waterborne Diseases e.g. bacteria, viruses, algal blooms e.g. red tides			X		
Non-Waterborne Diseases e.g. bacteria and viruses from food, mosquitoes, ticks, fleas			X		
Influenza The hazards and risks vary from forest firefighting to non-forest firefighting e.g. non-forest firefighting increased influenza	X			X	
Mould and Fungi (note: this is also included in Air Quality above)				X	
Plants		X			
Pollen and Allergens (note: this is also included in Air Quality above)				X	
Rodents			X		
Temperatures (heat, cold, humidity) Exposure to increased temperature causing reduced vigilance with increased risk of injury					X
UV Radiation / Solar Exposure				X	

Violence				X	
Workload				X	

This table does not replace hazard and risk assessments. This table shows general hazards and risks that may require further investigation.\*The results for the same sector and occupation may vary considerably from geographic region due to the highly regional variations of climate change and resulting impacts on workers. Regional dissimilarities should be expected. The table is based on known information. New studies are occurring weekly - this information is ONLY a guide to further investigations as opposed to a comprehensive list of definitive hazards and risks specifically caused by climate change (as opposed to other occupational factors).

Healthcare workers (including but not limited to hospitals, residential / long term care, community health, home care and at Canadian Blood Services (“CBS”). This is a short list for example purposes only.

Sample Types and Levels of Hazards and Risks	Hazard and Risk Levels (Likelihood of Occurrence based on studies identified occurrences specifically related to climate change)*				
Types of Hazards and Risks	Unknown	None	Low	Medium	High
Air Quality – forest fire smoke, ozone, pollen (note: pollen and mould also have their own categories below), smog, Volatile Organic Compounds				X	
Extreme Weather (Highly region dependent) Slips, trips, falls, musculoskeletal disorders, etc. due to weather such as ice and snow					
Thunderstorms			X		
Other Types of Storms			X		
Wind, Tornadoes, Turbulence			X		
Precipitation and Flooding			X		

Forest Fires – heat, forest fire smoke, injuries e.g. burns, crush injuries, falls, lacerations, mental health injuries, musculoskeletal injuries, trips			X		
<b>Insects and Arachnids</b>					
Fleas	X				
Bed Bugs			X		
Spiders	X				
Wasps and Hornets	X				
Fire Ants	X				
Mosquitoes			X		
Ticks			X		
Mental Disorders (DSM diagnoses) and Mental Health Symptoms (non-DSM diagnoses)				X	

Pathogens – bacteria, mould and fungi (note: this is separate from Air Quality in this table), parasites, protozoa, viruses (highly region dependent)					
Waterborne Diseases e.g. bacteria, viruses, algal blooms e.g. red tides This refers to direct contact with vectors that contain pathogens and indirect contact				X	
Non-Waterborne Diseases e.g. bacteria and viruses from food, mosquitoes, ticks, fleas This refers to direct contact with vectors that contain pathogens and indirect contact				X	
Influenza				X	X
Mould and Fungi (note: this is also included in Air Quality above)				X	
Plants	X				
Pollen and Allergens (note: this is also included in Air Quality above)				X	
Rodents			X		
Temperatures (heat, cold, humidity)				X	

UV Radiation / Solar Exposure			X		
Violence				X	
Workload Increased workload due to heat waves, extreme cold, air quality with resulting respiratory conditions, health issues for persons without shelter or adequate shelter, persons with pre-existing conditions that are more severely affected by climate change, etc.				X	

This table does not replace hazard and risk assessments. This table shows general hazards and risks that may require further investigation. **\*The results for the same sector and occupation may vary considerably from geographic region due to the highly regional variations of climate change and resulting impacts on workers. Regional dissimilarities should be expected. The table is based on known information. New studies are occurring weekly - this information is ONLY a guide to further investigations as opposed to a comprehensive list of definitive hazards and risks specifically caused by climate change (as opposed to other occupational factors).**



Municipal Workers (Operations; Trades; Engineering; Parks, Recreation and Culture, etc.)  
e.g. bylaw officers, horticulture, lifeguards, streets, arboriculture, sanitation services, labourers

Sample Types and Levels of Hazards and Risks	Hazard and Risk Levels (Likelihood of Occurrence based on studies identified occurrences specifically related to climate change)*				
Types of Hazards and Risks	Unknown	None	Low	Medium	High
Air Quality – forest fire smoke, ozone, pollen (note: pollen and mould also have their own categories below), smog, Volatile Organic Compounds					X
Extreme Weather (Highly region dependent) Slips, trips, falls, musculoskeletal disorders due to weather such as ice and snow; vehicular accidents; damage to infrastructure resulting in traumatic injuries such as falls, crush injuries, contusions, lacerations, etc.; electrical hazards caused by lightning or power lines impacted by trees; damaging or dying trees causing injuries					
Thunderstorms					X
Other Types of Storms					X
Wind, Tornadoes, Turbulence					X

Precipitation and Flooding					X
Forest Fires – heat, forest fire smoke, injuries e.g. burns, crush injuries, falls, lacerations, mental health injuries, musculoskeletal injuries, trips			X		
Insects and Arachnids					
Fleas	X				
Bed Bugs		X			
Spiders			X		
Wasps and Hornets Arborists and horticulture workers may come into contact with wasps and hornets much more frequently than Bylaw Officers for example				X	
Fire Ants			X		
Mosquitoes					X
Ticks					X

<b>Mental Disorders (DSM diagnoses) and Mental Health Symptoms (non-DSM diagnoses)</b>			<b>X</b>		
<b>Pathogens – bacteria, mould and fungi (note: this is separate from Air Quality in this table), parasites, protozoa, viruses (highly region dependent)</b>					
<b>Waterborne Diseases e.g. bacteria, viruses, algal blooms e.g. red tides</b>				<b>X</b>	
<b>Non-Waterborne Diseases e.g. bacteria and viruses from food, mosquitoes, ticks, fleas</b>				<b>X</b>	
<b>Influenza</b>			<b>X</b>		
<b>Mould and Fungi (note: this is also included in Air Quality above)</b>				<b>X</b>	
<b>Plants</b> This is highly region dependent e.g. where giant hogweed, poison ivy, poison oak and stinging nettle are located			<b>X</b>		
<b>Pollen and Allergens (note: this is also included in Air Quality above)</b>				<b>X</b>	
<b>Rodents</b>				<b>X</b>	
<b>Temperatures (heat, cold, humidity)</b> Exposure to increased temperature can also result in reduced vigilance and increased risk of injury					<b>X</b>

UV Radiation / Solar Exposure					X
Violence			X		
<p>This table does not replace hazard and risk assessments. This table shows general hazards and risks that may require further investigation. <b>*The results for the same sector and occupation may vary considerably from geographic region due to the highly regional variations of climate change and resulting impacts on workers. Regional dissimilarities should be expected. The table is based on known information. New studies are occurring weekly – <u>this information is ONLY a guide to further investigations as opposed to a comprehensive list of definitive hazards and risks specifically caused by climate change (as opposed to other occupational factors).</u></b></p>					

The Transportation sector includes a very wide variety of areas and occupations such as airlines, ferries, port authorities, railways, roads and highways, etc. Sample occupations include bus drivers and flight attendants

Sample Types and Levels of Hazards and Risks	Hazard and Risk Levels (Likelihood of Occurrence based on studies identified occurrences specifically related to climate change)*				
Types of Hazards and Risks	Unknown	None	Low	Medium	High
Air Quality – forest fire smoke, ozone, pollen (note: pollen and mould also have their own categories below), smog, Volatile Organic Compounds				X	
Extreme Weather (Highly region dependent) Slips, trips, falls, musculoskeletal disorders, etc. due to weather such as ice and snow; vehicular accidents					
Thunderstorms					X
Other Types of Storms					X
Wind, Tornadoes, Turbulence					X

Precipitation and Flooding					X
Forest Fires – heat, forest fire smoke, injuries e.g. burns, crush injuries, falls, lacerations, mental health injuries, musculoskeletal injuries, trips			X		
Insects and Arachnids					
Fleas	X				
Bed Bugs	X				
Spiders	X				
Wasps and Hornets	X				
Fire Ants	X				
Mosquitoes	X				
Ticks	X				
Mental Disorders (DSM diagnoses) and Mental Health Symptoms (non-DSM diagnoses)			X		



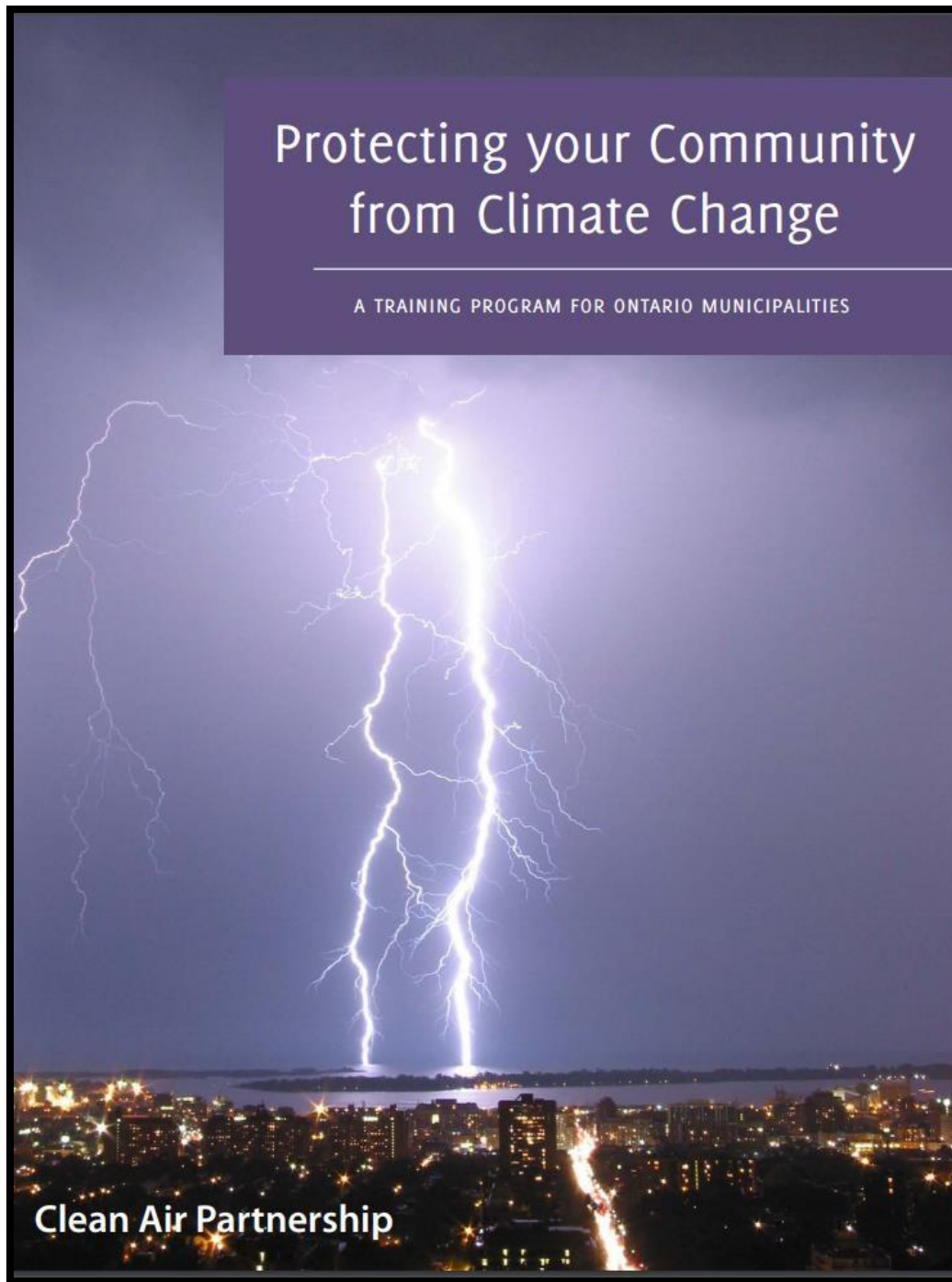
Pathogens – bacteria, mould and fungi (note: this is separate from Air Quality in this table), parasites, protozoa, viruses (highly region dependent)					
Waterborne Diseases e.g. bacteria, viruses, algal blooms e.g. red tides			X		
Non-Waterborne Diseases e.g. bacteria and viruses from food, mosquitoes, ticks, fleas			X		
Influenza				X	
Mould and Fungi (note: this is also included in Air Quality above)				X	
Plants		X			
Pollen and Allergens (note: this is also included in Air Quality above)				X	
Rodents			X		
Temperatures (heat, cold, humidity) Exposure to increased temperature can also result in reduced vigilance and increased risk of injury or lapses in safety				X	
UV Radiation / Solar Exposure			X		

Violence Violence varies considerably across this sector				X	
<p>This table does not replace hazard and risk assessments. This table shows general hazards and risks that may require further investigation.* <b>The results for the same sector and occupation may vary considerably from geographic region due to the highly regional variations of climate change and resulting impacts on workers. Regional dissimilarities should be expected. The table is based on known information. New studies are occurring weekly - <u>this information is ONLY a guide to further investigations as opposed to a comprehensive list of definitive hazards and risks specifically caused by climate change (as opposed to other occupational factors).</u></b></p>					

What does all this mean for workers? Hazard and risk assessments must occur for each sector, each occupation and each job. The tables above provide examples of what climate change is. When conducting hazard and risk assessments, remember that:

- Changes in the hazards and risks occur over time
- There may be new hazards and risks e.g. strong frequent winds aerosolizing red tide algae, new bacteria or viruses such as COVID-19, etc.
- There is an interaction between hazards and risks
- There are demographic variables – how much of the labour force will be of a certain age
- There are different hazards and risks for workers in precarious employment
- What is the percentage of workers with pre-existing conditions and co-morbid conditions and how are they affected?
- Are workers in multiple occupations / jobs?
- Are there changes in legislation and regulations?

There are hundreds of other variables. This is why hazard and risk assessment often take months for a single occupation. This Guide has included dozens of figures to show the various resources that are available.



Cover page from Protecting Your Community from Climate Change report for Ontario Municipalities.



#### **IV. Sample Occupations Affected by Climate Change (Occupation titles are generalized as there are varying definitions in each Collective Agreement and between provinces as well as coding differences between Employers and Unions):**

There are thousands of occupations within the various sectors represented by CUPE. The following fictitious stories are examples of hazards and risks for a small number of sample occupations to show what real-life hazards and risks may look like. Each sector and each Employer and Local should identify all potentially affected occupations (and jobs) and conduct a thorough hazard and risk assessment for each. The precise type of and scope of hazards and risks are unknown as the effects of climate change are not fully understood. There will likely be significant overlap between sectors, occupations and jobs.<sup>372</sup> If there are similar hazards and risks, this may indicate that a much more broad, rigorous hazard and risk control program is needed. See Section VI.I. below for a detailed example of a tool to use for this. It is very important to consider what percentage of an occupation or sector is composed of persons in precarious employment due to the significantly higher incidence of injury and occupational disease. See the CUPE BC Region Guide for “Injury Prevention for Workers in Precarious Employment & New and Young Workers 2018” at Appendix D of this Guide.

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<sup>372</sup> A sector might be healthcare. An occupation might be medicine. A job might be a pediatrician

As per the 2019 Angus Reid Institute Survey, 40% of Millennials (workers born between 1981 and 1996) have worked in the “gig” economy over the previous years (prior to 2019). As per numerous studies and CUPE reports, workers in precarious employment are already at much higher risk for injury and disease, especially male workers under the age of 25.

Here are some sample scenarios that may be encountered in the various sectors:

“I was working as a lifeguard during a red tide. Seems to happen more and more. The beach was still open. A patron was in distress and had to be rescued from the water. I inhaled the water and got a fair amount in my eyes. Two days later I have a severe eye infection and a respiratory infection. Is it from the water?”





“The city asked us to clear out some invasive hogweed. The Employer did not provide us with proper personal protective equipment. I came into contact with the sap from the hogweed plant and developed severe chemical burns all over my arms.”





“I was doing clean-up in the park. I thought I noticed something crawling on my legs. It was ticks. There were dozens of them. Now my leg looks like this! I think it is infected.”



“I was working in a school as an education assistant. There was a large forest fire several kilometers away. The town was covered in smoke – you could barely see one block. The ventilation system pulled in the smoke. My eyes and lungs felt like they were on fire. Now I have chronic bronchitis.”



“I was working a night shift as a Paramedic. We were returning to the hospital during an ice storm. We never get ice storms – just snow. The road was like a skating rink. The ambulance hit the ice and flipped over. I suffered two broken legs. My co-worker was seriously injured. I am now beginning to have nightmares constantly.”



“I work outside all day doing road work. This summer has been brutal – it feels like a sauna every day. I have been doing this job for 10 years now and the heat keeps getting worse. My wife noticed an odd mole on my face a month ago. I hope it is nothing serious. It seems to be growing so fast and it bleeds occasionally.”



“I am an animal control officer. A week ago, I was asked to check on a house that had at least 10 dogs. They were in pretty rough shape. There were fleas everywhere. I must have gotten at least 50 bites. I am now having non-stop headaches and muscle aches.”





“I am a hydro worker. There have been a ton of windstorms this fall. During the last one there must have been at least 50,000 trees that were damaged and thousands were left without power. I have been putting in 14-hour days. The other day I nearly fell 30 feet – my brain just seems really foggy and my vision is off.”





“I work for Air Canada as a flight attendant. I regularly do the Transatlantic trip. The last couple of years the turbulence has been unreal. Yesterday the plane dropped so fast and without warning that the cart lifted into the air – it weighs over 150 pounds. I grabbed it with my arms - now my back is killing me.”



“I work at the Vancouver Landfill. There have been a lot of people coming to work with chest infections – everyone is coughing. There is dust everywhere. When I go home each day I can’t catch my breath and I’m coughing my guts up. Every year with warmer summers it is getting worse.”



“I work as a secretary in a school. The building is pretty old. We have been seeing odd green and black spots on the ceilings lately. They seem to get bigger every time it rains – which feels like more and more. A few of us have been getting strange colds – almost like a minor flu that doesn’t go away. It all started when we moved to this old building.”







## Toronto's Heat Health Alert System

Proactive adaptation can help save lives now and prepare for future climate change



The City of Toronto has developed and implemented two extreme weather alert systems: Extreme-Cold Weather Alerts (in 1996), and Heat Health Alerts (in 2001). These systems are designed to protect the city's most vulnerable populations – the elderly, children, medically at-risk persons, and the homeless – from extremes of heat and cold. The Heat Health Alert System was developed proactively, in part as a response to the disastrous heat waves in Chicago (1995) and Philadelphia (1993), both of which killed hundreds of urban residents.

Environment Canada projects that by the latter part of this century, Toronto will average 65 days per year where the temperature exceeds 30°C, more than four times the historic average between 1961 and 1990. This represents a critical concern that will disproportionately impact the health and wellbeing of the city's more vulnerable populations.

Toronto has had a heat warning system since 1999. The first heat warning system used a threshold of a one-day forecast of humidex over 40°C. Since 2001, Toronto Public Health has adopted the Heat Health Alert System as the basis for declaring alerts. This system is based on a synoptic approach that assesses the historical relationship between mortality levels and weather conditions.

Toronto's Heat Health Alert System includes a three-day forecast outlook. This synoptic-based approach starts with an air mass categorization for each forecast day based on weather conditions (temperature, humidex, dew point, wind speed and direction, air pressure and cloud cover). Then an algorithm is run to predict the likelihood of excess mortality under these air mass conditions; it is this likelihood that determines whether the Heat Health Alert System forecasts an Extreme Heat Alert, a Heat Alert or neither.

The Toronto Medical Officer of Health issues a "Heat Alert" when the likelihood of excess weather-related mortality exceeds 65 percent and an "Extreme Heat Alert" when

### POPULATIONS AT RISK FROM EXTREME HEAT

The health risks increase substantially when people experience prolonged exposure to heat without significant cooling intervals. Socially isolated seniors are at highest risk of heat-related illness and death. Other at-risk groups include children, people with chronic and pre-existing illnesses including mental illness, low-income households, and adults who are marginally housed or homeless.

the likelihood of excess weather-related mortality exceeds 90 percent.

At the beginning of the summer, the City of Toronto and its partners provide the public with targeted information on the risks of extreme heat and on precautions to prevent heat-related illness and death. Various brochures are distributed and are available on the City's Web site. Declaration of an alert by Toronto's Medical Officer of Health activates specific responses under the City of Toronto Hot Weather Response Plan, which includes

- contacting local media to inform the public that a heat alert has been issued
- notifying community agencies and other response partners of the alert status, in order for them to implement agency specific protocols

City of Toronto Heat Alert System.



**V. Areas of Health and Safety Legislation and Regulation Language to Consider:**

**V.I. General Considerations:**

“Employers may not be sufficiently prepared, empowered, educated, concerned or compelled to protect their employees from the health impacts of climate change. There has not been any national regulatory action, and only limited state action, to compel employers to recognize climate change-related impacts such as sustained durations of high temperatures as occupational hazards from which they must protect their employees” (Roelefs and Wegman, 2014).<sup>373</sup>

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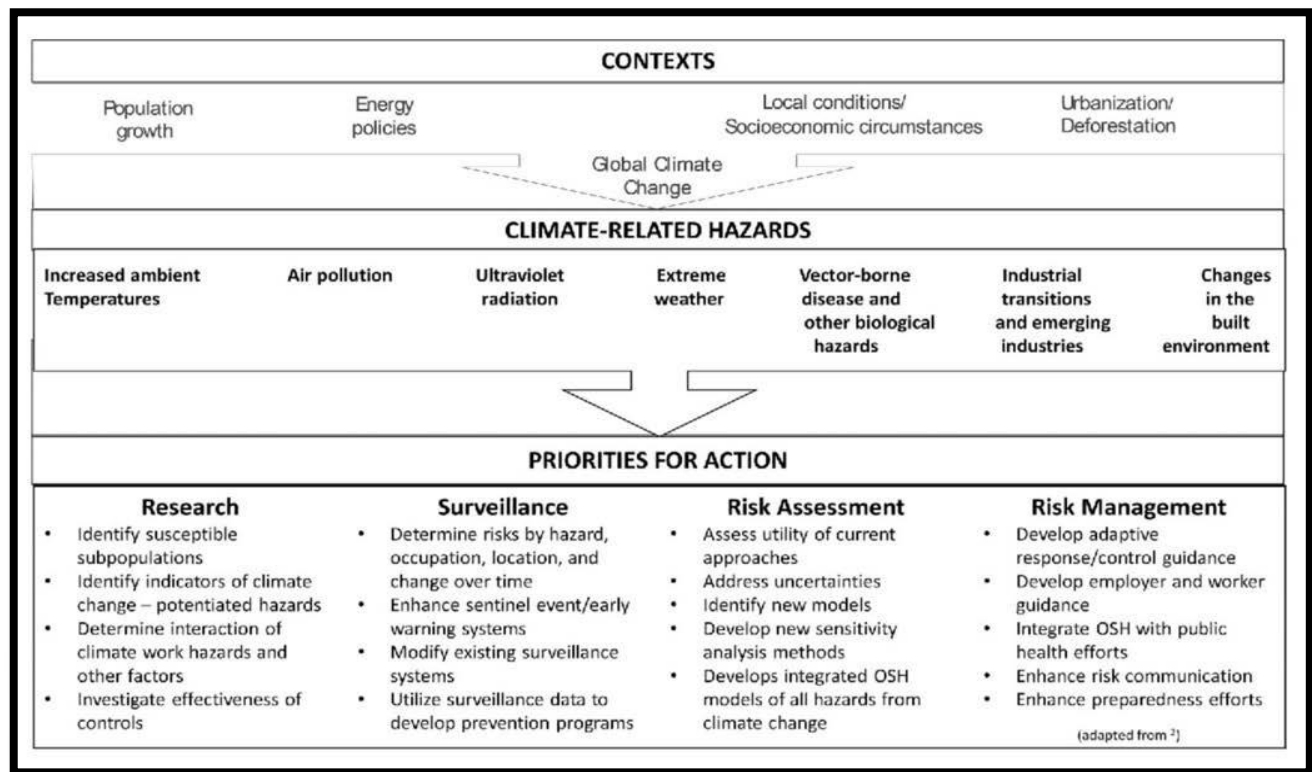
<sup>373</sup> Roelofs, C. & Wegman, D. (2014). Workers: the Climate Canaries. Retrieved February 03, 2020 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4167120/>

There are a number of areas of occupational health and safety that need to be considered and which are always subject to the hierarchy of control. These include:

- Legislation, regulations and standards e.g.:
  - Workers' compensation (claims) legislation, policies and practice directives
  - Occupational health and safety (OHS) legislation and regulations, policies and guidelines – provincial and federal
  - CCOHS
  - CSA Group Standards
  - International Organization for Standardization
  - OHCOW
  - NIOSH
- Employer policies and procedures
- Modification and improvement of hazard and risk controls
- Hazard and risk communication to workers
- Development of early warning systems and surveillance
- Prevention through design
- Education of workers
- Joint Occupational Health and Safety Committee participation



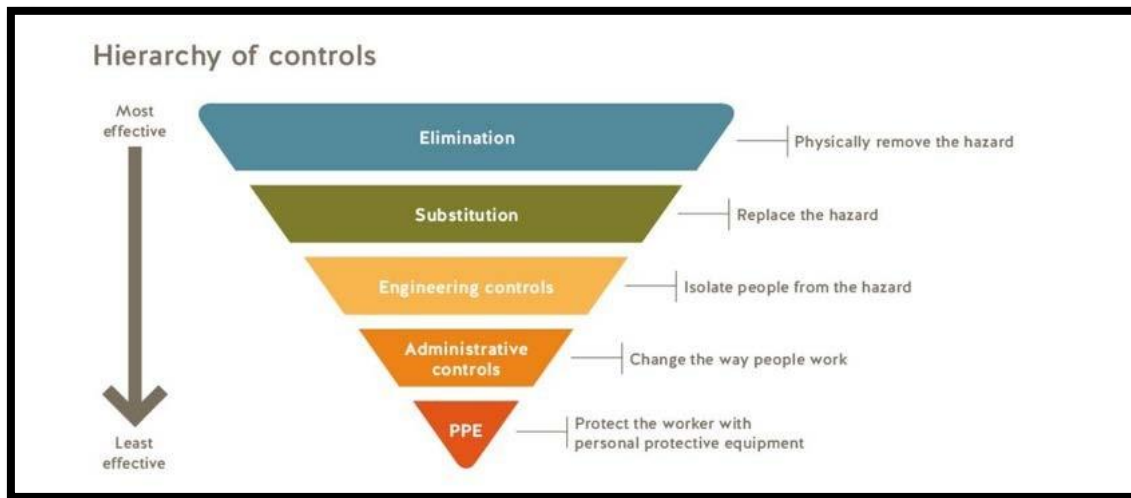
These are only a few of the dozens of considerations that need to occur. Always look at context and the relationship between various hazards and risks. As per the flow chart from Schulte et al. (2016) research, surveillance, risk assessment and risk management are linked:<sup>374</sup>



This figure is included for illustration purposes, the starting point is always hazard and risk assessment. The figure includes a very limited number of risk assessment activities. For a more comprehensive list, see the CCOHS materials, CSA Group Standards and CUPE Health and Safety Branch materials referred to in this Guide.

<sup>374</sup> Schulte, P.A., Bhattacharya, A., Butler, C.R., Chun, H.K., Jacklitsch, B., & Jacobs, T. (2016). Advancing the framework for considering the effects of climate change on worker safety and health. *Journal of Occupational and Environmental Hygiene*. Volume 12, 2016, Issue 11. Retrieved February 12, 2020 from <https://oeh.tandfonline.com/doi/full/10.1080/15459624.2016.1179388#.XkSk8GhKjFg>

The hierarchy of control should always be the starting point for prevention as per the CCOHS:



And as per the Hazard Control Infographic from the CCOHS:



## **V.II. Specific Areas of Legislation and Regulation to Consider:**

A number of other organizations have looked at legal requirements for protecting workers. One example is the Canadian Environmental Law Association and the 2019 report “Workers’ Environmental Rights in Canada”. As per page 30, Section 1.7.1 of the report:<sup>375</sup>

“Vulnerable groups, including Indigenous peoples, migrant workers, women, and children, are disproportionately impacted by violations of the right to safe and healthy work conditions. These uneven effects, she argues, emphasize the need to ratify international instruments like the ILO conventions on occupational health and safety and improve the processes for fully implementing them.”

Workers need to be aware of and apply the WorkSafeBC and other legislation pertaining to health and safety in the workplace. This especially applies to:

- Workers in precarious employment
- Younger workers
- New workers
- Newcomers
- Equity seeking groups such as persons with disabilities
- Older workers

Although the right to a healthy and safe work environment is widely recognized in international frameworks it does not address the interrelationship between work and the environment. The approaches to health and safety focuses on exposure to environmental hazards in the workplace and their effects on worker health and safety. The approach needs to be broadened. There are resources from the Canadian Environmental Law Association.

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<sup>375</sup> Workers’ Environmental Rights in Canada. A project with Adapting Canadian Work and Workplaces to Respond to Climate Change (ACW). Canadian Environmental Law Association. Retrieved June 03, 2022



## **Workers' Environmental Rights in Canada**

A project with Adapting Canadian Work and Workplaces to Respond to Climate Change (ACW)

October 2019

Canadian Environmental Law Association. Workers' Environment Rights in Canada. (2019).

The specific areas of legislation and regulation that may need to be addressed include, non exhaustively:

- General conditions
- Health and safety programs
- Due diligence
- Worker orientation
- The roles and responsibilities of the management representatives, workers, supervisors, contractors, the joint health and safety committee, worker health and safety representatives (this is a partial list. There may be more than one worksite / location).
- Hazard identification and risk assessment
- Elimination, management and control of hazards and risks
- Right to refuse
- Exposure control plans
- Development of general safety procedures
- Personal protective equipment
- Health and safety monitoring systems
- Emergency rescue plan development and implementation
- Incident investigation
- Corrective and preventative actions

- Travel / transportation to and from workplace
- Training and education
- Determining fitness for work
- Working alone

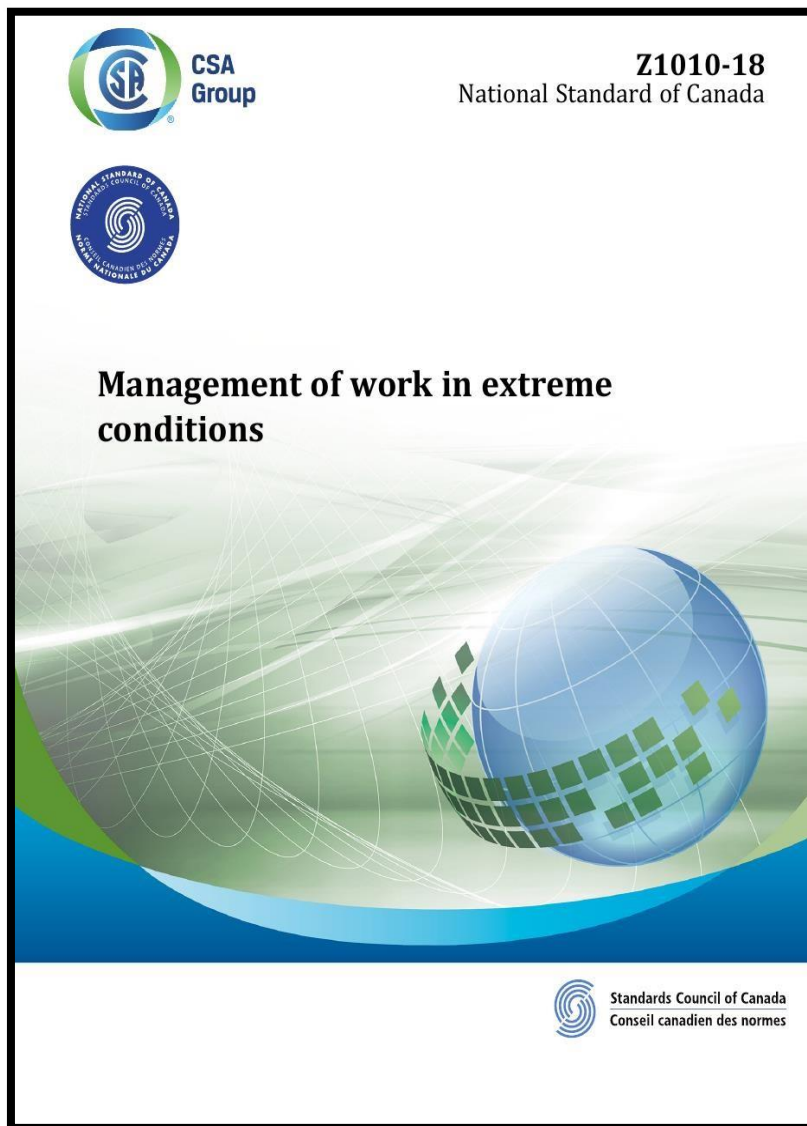
Here is an example of how to apply the hierarchy of controls to sample hazards such as UV exposure:

Control	Specific Action by Employer
Elimination	Prohibition of work in high temperatures
Substitution	Shift changes to earlier or later times
Engineering controls	Move workers inside
Administrative controls	Shorter shifts
Personal Protective Equipment	Sunglasses, hats, long sleeved shirts, sun block



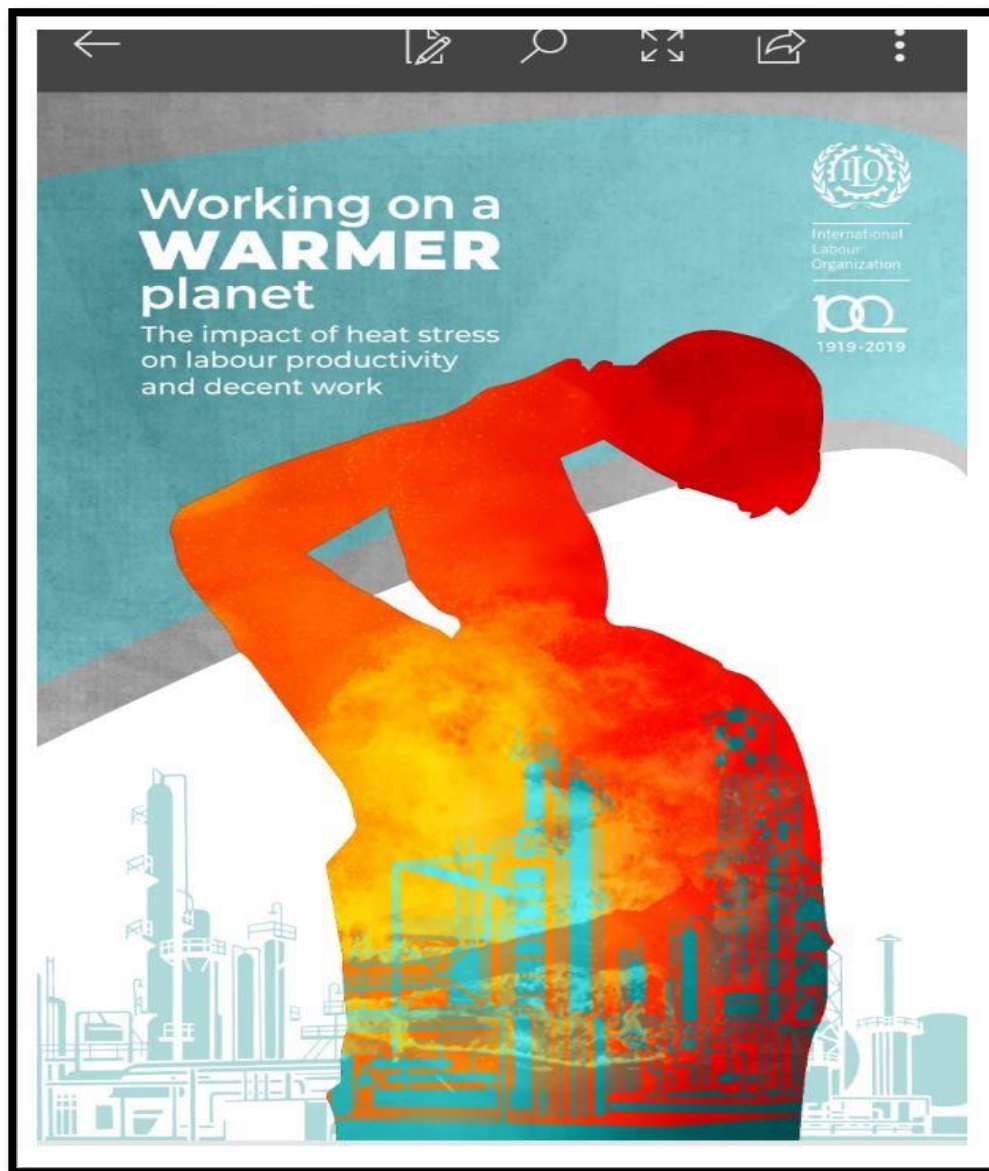
There are many other sources of information for protecting workers. These include:

- CSA Group Standards e.g. CSA Z1010-18 (or most recent version) for Management of work in extreme conditions. See Appendix A
- International standards such as International Organization for Standardization (“ISO”) e.g. ISO 7243 for heat stress
- The International Labour Organization
- The National Institute for Occupational Health and Safety (“NIOSH”)
- The Occupational Safety and Health Administration (“OSHA”)
- The Canadian Centre for Occupational Health and Safety
- *Canadian Environmental Protection Act*, 1999, SC 1999, c 33
- *Hazardous Products Act*, RSC 1985, c H-3
- *Hazardous Materials Information Review Act*, RSC 1985, c 24 (3rd Supp), Part II
- *Pest Control Products Act*, SC 2002, c 28
- *Transportation of Dangerous Goods Act*, 1992, SC 1992, c 34



Sample CSA Group Standard.

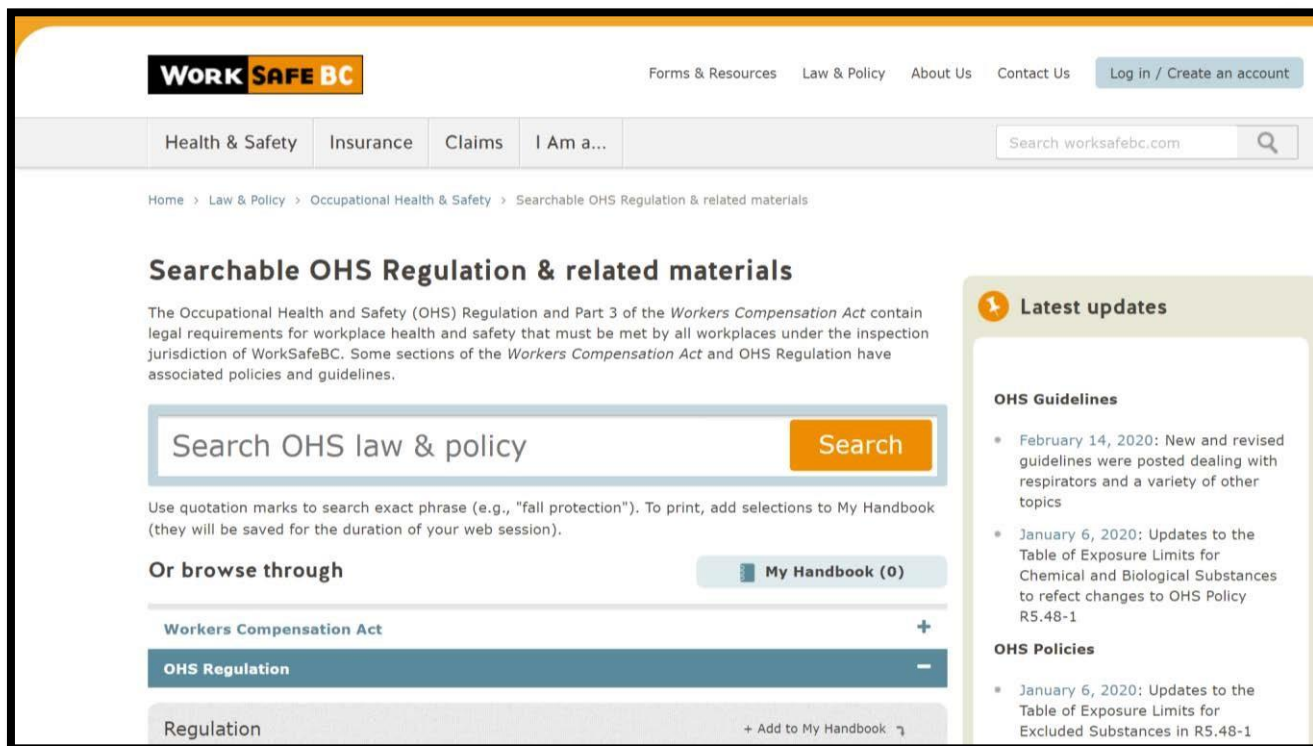
The ILO Report “Working on a Warmer Planet The impact of heat on productivity and decent work” provides a number of measures Employers and workers should take. See figure on next page.



International Labour Organization. Working on a Warmer planet.<sup>376</sup>  
The impact of heat stress on labour productivity and decent work.

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<sup>376</sup> Kjellstrom, T., Maitre, M., Saget, C., Otto, M., & Karimova, T. (July 01, 2019). International Labour Organization. Working on a Warmer Planet. Retrieved October 30, 2019 from [https://www.ilo.org/global/publications/books/WCMS\\_711919/lang-en/index.htm](https://www.ilo.org/global/publications/books/WCMS_711919/lang-en/index.htm)



### V.III. WorkSafeBC Sample OHS Regulations:

Given the thousands of occupations that may be affected, many pieces of legislation, OHS Regulations, Policies and Guidelines may apply. The following list contains some common OHS Regulations that may apply to the workplace. OHS Regulations that are more likely to apply are highlighted. OHS Regulations in red are critical to have implemented and must be adhered to. WorkSafeBC Regulations, Policies and Guidelines change very frequently. Always refer to the WorkSafeBC online materials. CUPE strongly recommends that related ISO and CSA Group / Standards be reviewed as well. Examples include the following:

- ISO 14090:2019 Adaptation to climate change – Principles, requirements and guidelines
- CSA Z1010:18 Management of work in extreme conditions
- CSA S900.1:18 Climate change adaptation for wastewater treatment plants, etc.

This Guide does not refer to federal requirements.

3. Rights and Responsibilities:

- Occupational health and safety programs
- Workplace inspections
- Correction of unsafe conditions
- Refusal of unsafe work
- Occupational first aid
- Young or new workers
- Joint health and safety committees
- Participation in investigations

4. General Conditions:

- Buildings, structures, equipment and site conditions
- Emergency preparedness and response
- Working alone or in isolation
- Work area requirements
- Storing and handling materials
- Ergonomics
- Work area guards and handrails
- Indoor (and outdoor) air quality

5. Chemical Agents and Biological Agents:

- Chemical agents and biological agents
- Substance, and general information requirement
- Workplace Hazardous Materials Information System (WHMIS)
- Controlling exposure
- Ventilation
- Hazardous wastes and emissions
- Personal hygiene
- Emergency washing facilities
- Emergency procedures

6. Substance Specific Requirements:

- Biological agents
- Pesticides

7. Noise, Vibration, Radiation and Temperature

8. Personal Protective Clothing and Equipment:

- Personal protective clothing and equipment
- General requirements
- Safety headgear
- Eye and face protection
- Limb and body protection
- High visibility and distinguishing apparel
- Buoyancy equipment
- Flame resistant clothing
- Respirators



## 9. Confined Spaces:

- Confined spaces definitions
- General requirements
- Responsibilities
- Hazard assessment and work procedures
- Identification and entry permits
- Lockout and control of harmful substances
- Verification and testing
- Cleaning, purging, venting and inerting
- Ventilation
- Standby persons
- Rescue
- Lifelines, harnesses and lifting equipment
- Personal protective equipment and other precautions

## 10. De-energization and Lockout

## 11. Fall Protection

## 19. Electrical Safety:

- Electrical safety definitions
- General electrical requirements
- Working on low voltage electrical equipment
- Working on high voltage electrical equipment
- Working on de-energized high voltage power systems
- Minimum separation distance to be maintained from energized voltage
- Electrical equipment and conductors
- Tree pruning and falling near energized conductors
- Control systems

## 20. Construction, Excavation and Demolition:

- Construction, evacuation and demolition definitions
- General requirements
- Safe work areas and safe access
- Bridges and similar structures
- Concrete falsework and formwork
- Concrete pre-stressing and post-stressing
- Open web joists and trusses
- Roof work
- Excavations
- Scaling operations
- Demotion
- Work in compressed air
- Entrance to underground working
- Ground control
- Mechanical excavation
- Fixed and mobile equipment in underground workings
- Gassy underground workings

## 31. Firefighting:

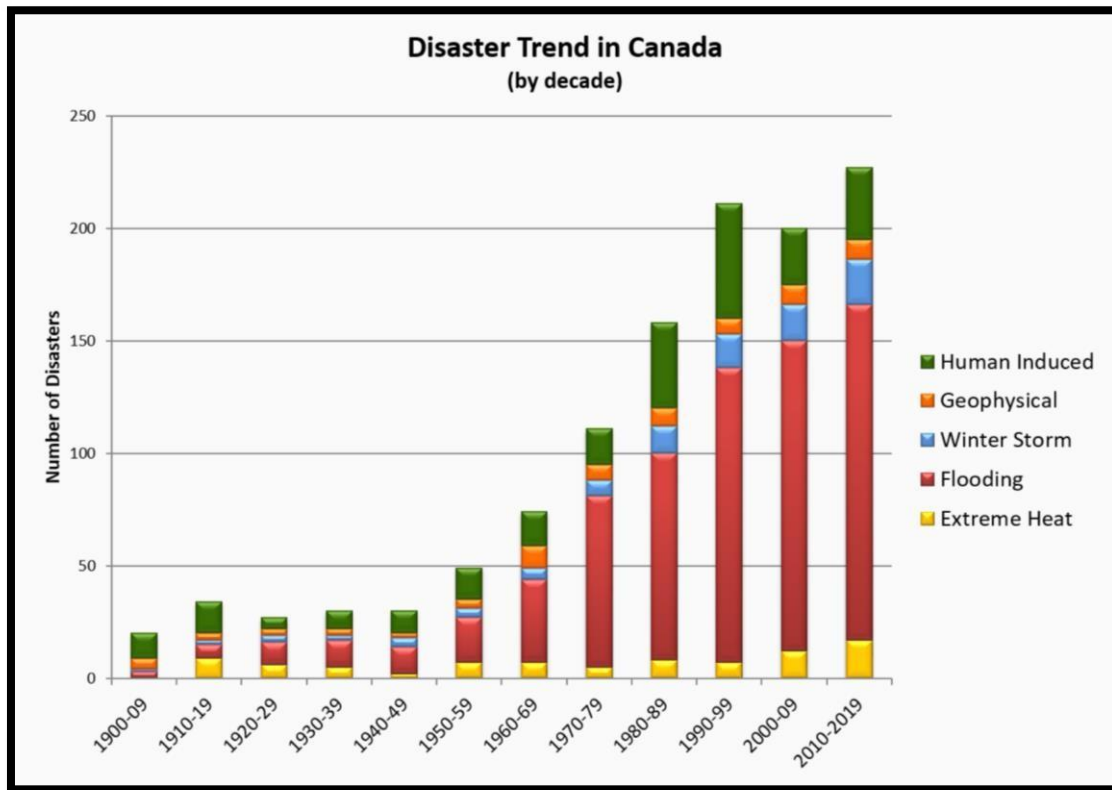
- Firefighting definitions and application
- General requirements
- Personal protective clothing and equipment
- Respirators
- Transportation
- Other equipment

## 32. Evacuation and Rescue

(Various sections)

**New and young workers require extensive orientation and training. See the CCOHS Infographic on the next page.**





Research Group at Public Safety Canada. Government of Canada.  
See <https://www.publicsafety.gc.ca/index-en.aspx>

## VI. Hazard and Risk Assessment:

Traditional views of hazard and risk assessment have viewed climate change exposure on a continuum with more exposure to certain environments being more hazardous. This is an incorrect, outdated approach. Climate change related impacts can occur anywhere. Second, a broad definition of adverse health effect must be used to coincide with this. Here are three examples to show how climate change impacts can occur anywhere:

- Mould in buildings e.g. schools, from rain and wind driven rain
- Forest fire smoke (including sub-daily exposures) entering recreation centres and offices
- Workload increases

- Bodily injury
- Disease, including mental health
- Change in the way the body functions, grows or develops
- Effects on a developing fetus (teratogenic effects, fetotoxic effects)
- Effects on children, grandchildren, etc. (inheritable genetic effects)
- Decrease in life span
- Change in mental condition resulting from stress, traumatic experiences, etc.
- Effects on the ability to accommodate additional stress

As per the CCOHS, a common way to classify hazards is by category:<sup>377</sup>

- Biological - Bacteria, viruses, insects, plants, birds, animals and humans, etc.
- Chemical - Depends on the physical, chemical and toxic properties of the chemical
- Ergonomic - Repetitive movements, improper set up of workstation, etc.
- Physical - Radiation, magnetic fields, pressure extremes (high pressure, noise, etc.)
- Psychosocial - Stress, violence, etc.
- Safety – Slipping / tripping hazards, inappropriate machine guarding, equipment malfunctions or breakdowns

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<sup>377</sup> Canadian Centre for Occupational Health and Safety. See [https://www.ccohs.ca/oshanswers/hsprograms/hazard\\_risk.html](https://www.ccohs.ca/oshanswers/hsprograms/hazard_risk.html)





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# Adapting to Climate Change



An Introduction for  
Canadian Municipalities

Federal Guide for Adapting to Climate Change.

As per the CCOHS, a risk assessment is the process where the Employer (with the Joint Health and Safety Committee).<sup>378</sup>

- Identify hazards and risk factors that have the potential to cause harm (hazard identification)
- Analyze and evaluate the risk associated with that hazard (risk analysis and risk evaluation)
- Determine appropriate ways to eliminate the hazard or control the risk when the hazard cannot be eliminated (risk control)

Risk assessment is a term used to describe the overall process or method where they:

- Identify hazards and risk factors that have the potential to cause harm (hazard identification)
- Analyze and evaluate the risk associated with that hazard (risk analysis and risk evaluation)
- Determine appropriate ways to eliminate the hazard or control the risk when the hazard cannot be eliminated (risk control)

A hazard and risk assessment is a complete review and analysis of the workplace(s), including all sites, to identify those things, situations, processes, etc. that may cause harm.

After identification is made, the Joint Health and Safety Committee should analyze and evaluate how likely and severe the hazards and risks are.

When this determination is made, the Joint Health and Safety Committee should decide what measures should be in place to effectively eliminate or control the harm from happening.

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<sup>378</sup> Canadian Centre for Occupational Health and Safety. See [https://www.ccohs.ca/oshanswers/hsprograms/risk\\_assessment.html](https://www.ccohs.ca/oshanswers/hsprograms/risk_assessment.html)

The CSA Standard Z1002 "Occupational health and safety - Hazard identification and elimination and risk assessment and control" uses the following terms:

- Risk assessment – The overall process of hazard identification, risk analysis and risk evaluation
- Hazard identification – The process of finding, listing and characterizing hazards
- Risk analysis – A process for comprehending the nature of hazards and determining the level of risk
- Risk evaluation – The process of comparing an estimated risk against given risk criteria to determine the significance of the risk
- Risk control – Actions implementing risk evaluation decisions

Hazard and risk assessments are very important as they form an integral part of an occupational health and safety management plan. They help to:

- Create awareness of hazards and risk
- Identify who may be at risk (e.g. employees, cleaners, visitors, contractors, the public)
- Determine whether a control program is required for a particular hazard
- Determine if existing control measures are adequate or if more should be done
- Prevent injuries or illnesses, especially when done at the design or planning stage
- Prioritize hazards and control measures
- Meet legal requirements where applicable

The aims and goals of the hazard and risk assessment process is to evaluate hazards, then remove that hazard or minimize the level of its risk by adding control measures, as necessary.

The goal is to try to answer the following questions:

- What can happen and under what circumstances?
- What are the possible consequences?
- How likely are the possible consequences to occur?
- Is the risk controlled effectively or is further action required?

There may be many reasons a hazard and a risk assessment are needed, including:

- Before new processes or activities are introduced
- Before changes are introduced to existing processes or activities
- When hazards and risks are identified

When planning hazard and risk assessments, determine:

- What the scope of your risk assessment will be (e.g. be specific about what you are assessing such as the lifetime of the product, the physical area where the work activity takes place or the types of hazards)
- The resources needed (e.g. train a team of individuals to carry out the assessment, the types of information sources, etc.)
- What type of risk analysis measures will be used (e.g. how exact the scale or parameters need to be in order to provide the most relevant evaluation)

- Who are the stakeholders involved (e.g. manager, supervisors, workers, worker representatives, suppliers, equity seeking groups, etc.)
- What relevant laws, regulations, codes or standards may apply in your jurisdiction, as well as organizational policies and procedures

Assessments should be done by a competent person or team of individuals, and experts as required, who have a good working knowledge of the situation being studied. Include either on the team or as sources of information, the supervisors and workers who work with the process under review as these individuals are the most familiar with the operation.

For specific types of hazards and risks, there may need to be variation in the types of risk assessments used, including accessing experts.

To address the need for closer to real-time surveillance of emerging pathogens and infectious diseases and the potential health impacts, two risk assessment strategies have been, and are being, developed: event-based surveillance (“EBS”) systems, which increasingly incorporate artificial intelligence, and risk modelling.

The general steps include:

- Identify hazards and risks
- Look at all aspects of the work
- Include non-routine activities
- Look at accident / incident / near-miss records
- Include people who work off site either at home, on other job sites, drivers, teleworkers, with clients, etc.
- Look at the way the work is organized or done (include experience of people doing the work, systems being used, etc.)

Hazard and risk assessments must take into account not only the current state of the workplace but any potential situations as well, including direct and indirect effects, multipliers and additive effects

- Look at foreseeable unusual conditions (for example: possible impact on hazard control procedures that may be unavailable in an emergency situation, power outage, etc.)
- Determine whether a product, machine or equipment can be intentionally or unintentionally changed (e.g. a safety guard that could be removed)
- Examine risks to visitors or the public
- Consider the groups of people e.g. workers in precarious employment, persons with disabilities, persons with language barriers, etc.
- Determine the likelihood of harm, such as an injury or illness occurring, and its severity - consider normal operational situations as well as non-standard events
- Review all available health and safety information about the hazard, scientific data, medical literature, information from reputable organizations, results of testing, workplace inspection reports, records of workplace incidents (accidents), including information about the type and frequency of the occurrence, illnesses, injuries, near misses, etc. such as Public Safety Canada (see Canadian Catastrophes figure below)
- Understand the minimum legislated requirements for the jurisdiction
- Identify actions necessary to eliminate the hazard or control the hazard and the risk using the hierarchy of hazard and risk control methods
- Confirm if the hazard has been eliminated or if the risk is appropriately controlled
- Monitor to make sure the control continues to be effective
- Keep all documents or records such as detailing the process used to assess the risk, outlining any evaluations or detailing how conclusions were made
- **Ensure equity seeking groups, workers in precarious employment, etc. are included**



When applying the general principles of hazard and risk assessments above to climate change related hazards and risks, consider processes such as by Schulte et al. (2016):<sup>379</sup>

- Consider what is uncertain versus what hazards and risks are known
- What are the processes for addressing a lack of information of certainty
- Develop adaptive responses due to changing climate regional variabilities
- Develop gap analysis tools especially for threat multipliers and additive effects
- Coordinate the hazard and risk management plans with all levels of government
- Improve hazard and risk communication
- Improve preparedness - Increased awareness among public health agencies, decisionmakers, occupational safety and health practitioners, Employers and workers about climate related hazards

When conducting hazard and risk assessments, remember to apply the following:

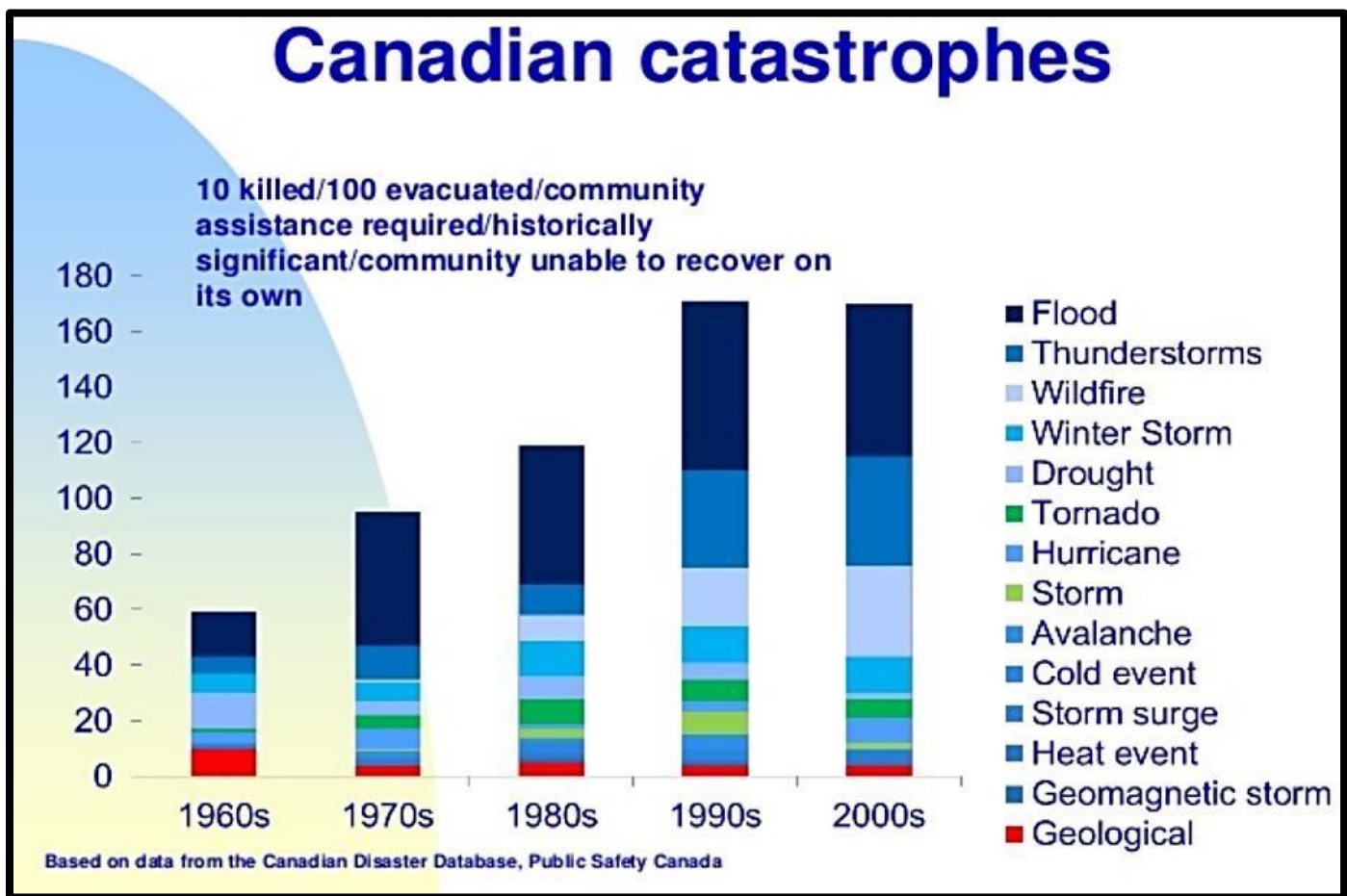
- Direct and indirect effects and consequences of hazards and risks
- Short term and long term effects and consequences of hazards and risks
- Consider demographic variables such as age and equity seeking groups
- Consider the presence of pre-existing conditions and co-morbid conditions
- Consider the impact of precarious work. **This is an important consideration**

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<sup>379</sup> Recognizing that the applicable occupational health and safety legislation and regulations shall always take precedence

- Are there non-work behaviours that may magnify the hazard or risk? The presence of smoking may aggravate the effects of air quality issues and may predispose workers to injuries and disease related to climate change<sup>380</sup> as per the analysis of the 2000-2017 National Health Interview Survey by Dong (2017)<sup>381</sup>

Hazard and risk assessments are important given the rising number of climate change impacts as per the following figure from data from the Canadian Disaster Database and Public Safety Canada.



<sup>380</sup> Disability Management Employer Coalition. See <http://dmec.org/>

<sup>381</sup> Dong, X.S. (2019). Retrieved February 22, 2020 from [https://www.researchgate.net/profile/Xiuwen\\_Dong](https://www.researchgate.net/profile/Xiuwen_Dong) and [https://www.researchgate.net/publication/334608674\\_Heat-related\\_deaths\\_among\\_construction\\_workers\\_in\\_the\\_United\\_States](https://www.researchgate.net/publication/334608674_Heat-related_deaths_among_construction_workers_in_the_United_States)

## VI.I. Sample Overview Initial Occupation Specific Hazard and Assessment:

Applying the principles of hazard and risk assessment to climate change requires a thorough analysis. As an example, hazard and risk assessments for each occupation should review the most current job description and job duties list and then apply a more comprehensive, work location specific version of the following simplified table. Consider short term and long term effects, direct or indirect effects, threat multipliers and additive effects as well. Include equity seeking groups at all levels.

### Initial Considerations for Hazard and Risk Investigation by Occupation per Job Duty

Sample Types and Levels of Hazards and Risks	Hazard and Risk Levels (ensure equity seeking groups are included)				
Types of Hazards and Risks	Unknown	None	Low	Medium	High
Air Quality – forest fire smoke, ozone, pollen (note: pollen and mould also have their own categories below), smog, Volatile Organic Compounds					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Extreme Weather					
Thunderstorms					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					

Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Other Types of Storms					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Wind, Tornadoes, Turbulence					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Precipitation and Flooding					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Forest Fires – heat, forest fire smoke, injuries e.g. burns, crush injuries, falls, lacerations, mental health injuries, musculoskeletal injuries, trips					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					

Hazard and risk controls already in place					
Insects and Arachnids					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Fleas					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Bed Bugs					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Spiders					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Wasps and Hornets					
Duration of exposure to hazard					

Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Fire Ants					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Mosquitoes					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Ticks					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Mental Disorders (DSM diagnoses) and Mental Health Symptoms (non-DSM diagnoses)					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					



<b>Pathogens – bacteria, mould and fungi (note: this is separate from Air Quality in this table), parasites, protozoa, viruses</b>					
<b>Waterborne Diseases e.g. bacteria, viruses, algal blooms e.g. red tides</b>					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
<b>Non-Waterborne Diseases e.g. bacteria and viruses from food, mosquitoes, ticks, fleas</b>					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
<b>Mould and Fungi (note: this is also included in Air Quality above)</b>					
<b>Influenza</b>					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
<b>Plants</b>					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					

Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Pollen and Allergens (note: this is also included in Air Quality above)					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Rodents					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Temperatures (heat, cold, humidity)					

Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
UV Radiation / Solar Exposure					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Violence					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
Other					
Duration of exposure to hazard					
Types of injuries and diseases that may occur					
Chance / Probability of occurrence of each type of injury or disease					
Hazard and risk controls already in place					
<p>This Table does not replace hazard and risk assessments. This Table shows general hazards and risks that may require further investigation. <b>The results for the same Sector and occupation may vary considerably from geographic region due to the highly regional variations of climate change and resulting impacts on workers. Regional dissimilarities should be expected.</b></p>					



## VII. Conclusion:

While there may be differing attitudes on the cause of climate change and the impact on workers,<sup>382</sup> the focus must be on ensuring worker health and safety. Assessment and management of immediate and long term hazards and risks, whether direct or indirect (and considering threat multipliers and additive effects) must occur. This is part of due diligence and a requirement for all workplaces.

Employers should apply the Precautionary Principle which means taking action to prevent injuries (including mental health injuries) and disease, without having to wait for scientific proof that a hazard exists or action is necessary to address the hazard.

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<sup>382</sup> Geddes, J. & Mitchell, A. (August 2019). Climate Change. Climate Change Crisis. The Apocalypse is Here. Be Afraid. Climate Change. Climate Change Averted. It Can be Beaten. Here's How. *MacLean's Monthly Magazine*. Retrieved February 16, 2020 from <https://archive.macleans.ca/issue/20190801>