

PREPARING FOR A CLIMATE FUTURE OF FLOOD, FIRE AND EXTREME HEAT



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ON CLIMATE ADAPTATION

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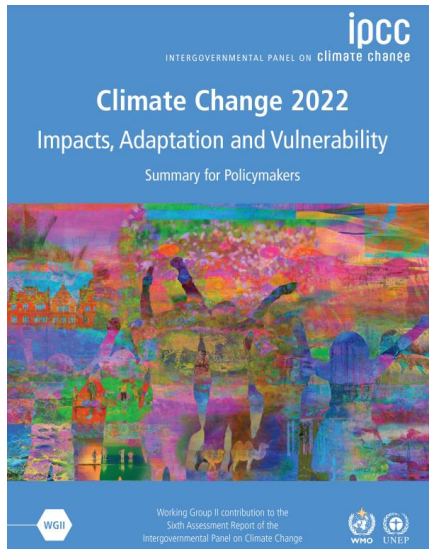


- | | |
|---------|---|
| 9:00 am | 1. Climate change is real and irreversible |
| | 2. Costs of climate change are going up |
| | 3. Flood risk: household and community level preparedness |
| 10:00 | 4. Q&A |
| 10:20 | 5. Break |
| 10:40 | 6. Fire risk: Wildland Urban Interface & FireSmart |
| 11:10 | 7. Q&A |
| 11:25 | 8. Extreme Heat (“Code Red” - <i>silent killer</i>) |
| 11:45 | 9. Q&A |
| 11:55 | 10. Conclusion |

CLIMATE CHANGE IS IRREVERSIBLE: SEVERITY OF WEATHER WILL INCREASE

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It is indisputable that human activities are causing climate change, making extreme climate events, including heat waves, heavy rainfall, and droughts, more frequent and severe

IPCC 2022



Canada's climate has warmed and will warm further in the future, driven by human influence... this warming is effectively irreversible.

ECCC/CCCR 2019

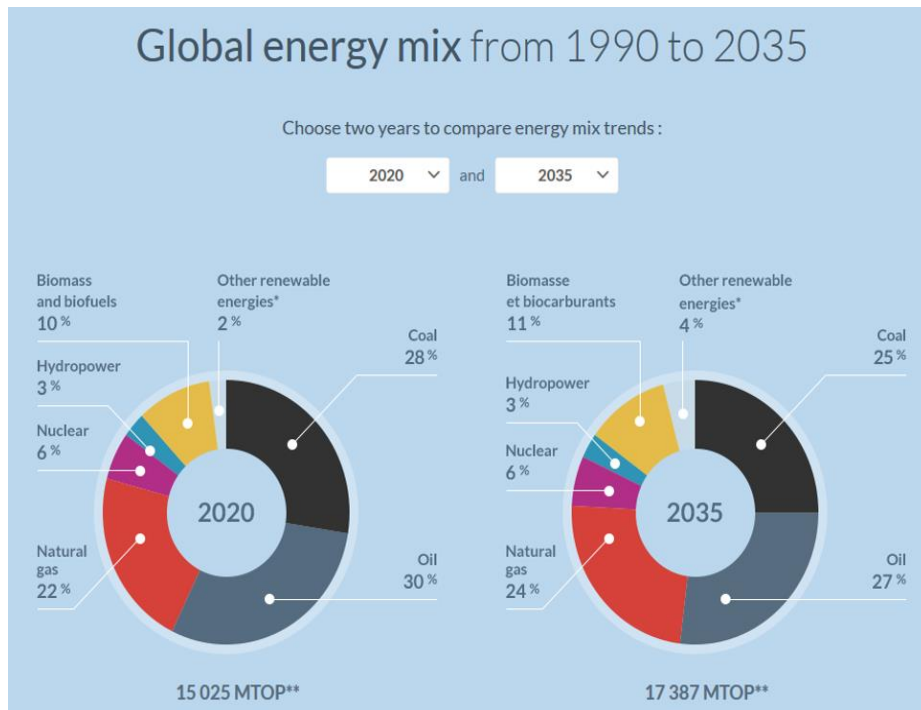
Key climate change drivers

- increasing global population (9,000 people/hr. net)
- climate change driving climate change

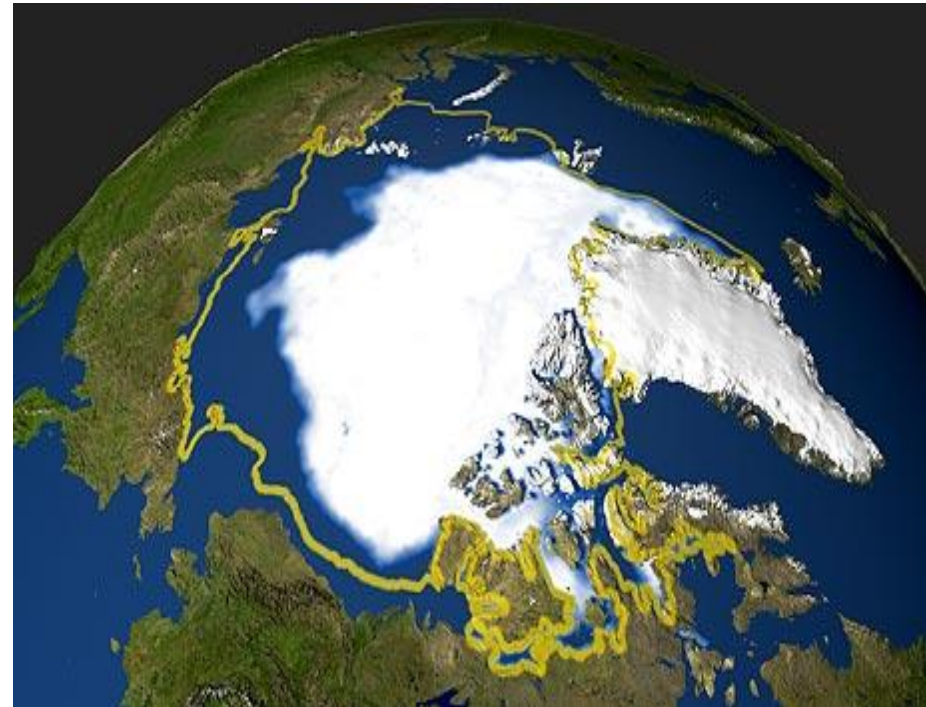
WHY CLIMATE CHANGE WILL BE MORE CHALLENGING

4

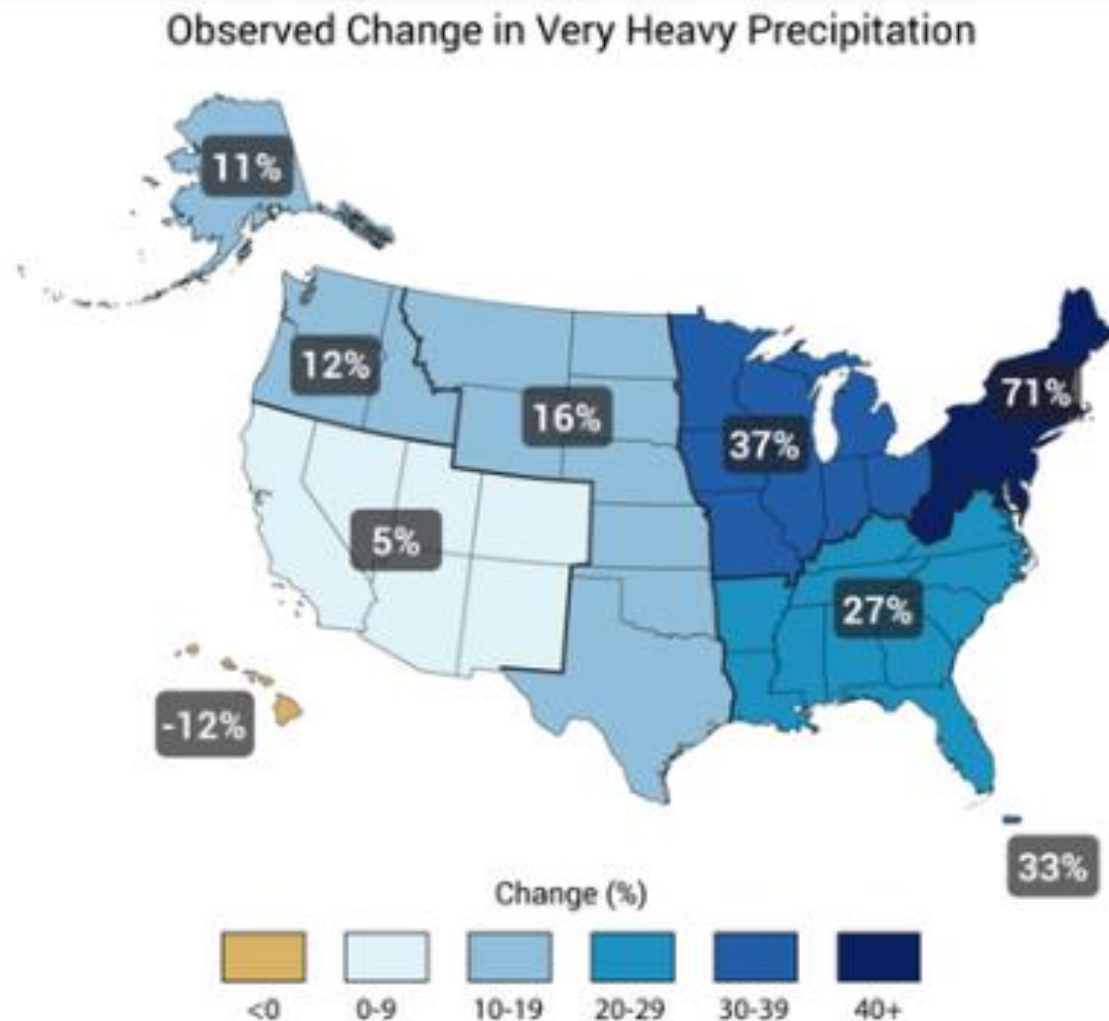
- Global energy mix will remain fossil fuel dependent (International Energy Agency)
- Key GHG driver is population growth (net global increase is now 9,000 people/hour)
- Climate change is driving climate change – three main drivers (loss of ice, loss of permafrost, loss of algae from surface of oceans)



17.4 billion tonnes of oil equivalent by 2035



CHANGES IN EXTREME PRECIPITATION: 1958 - 2012



EXTREME PRECIPITATION

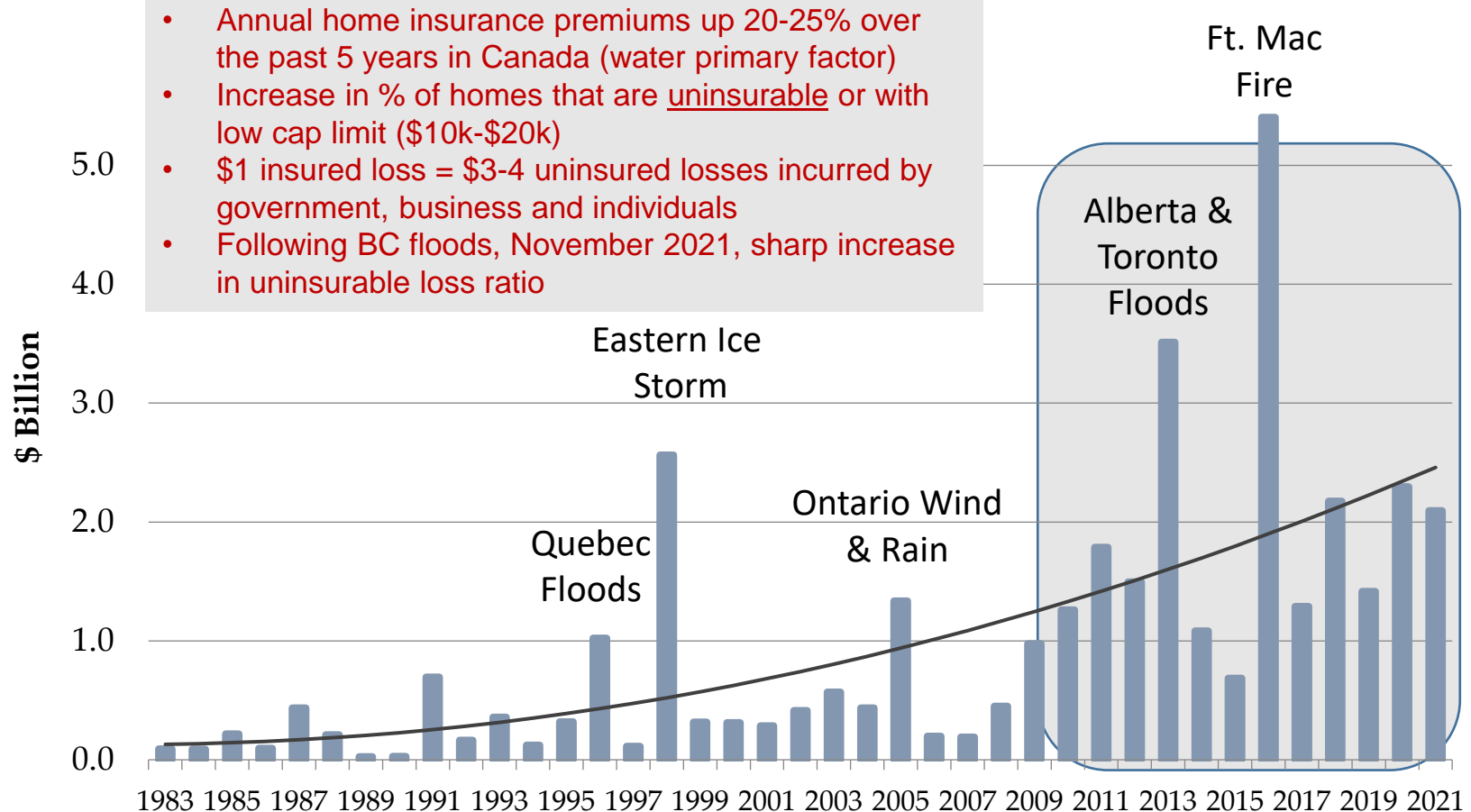
Percent change in the amount of precipitation falling in very heavy events (the heaviest 1%) from 1958 to 2012.

SOURCE: US National Climate Assessment

COSTS OF EXTREME WEATHER: CATASTROPHIC INSURABLE LOSSES (\$CAD)

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Loss + Loss Adjustment Expenses

\$2021 - total natural-catastrophe losses normalized by inflation and per-capita wealth accumulation

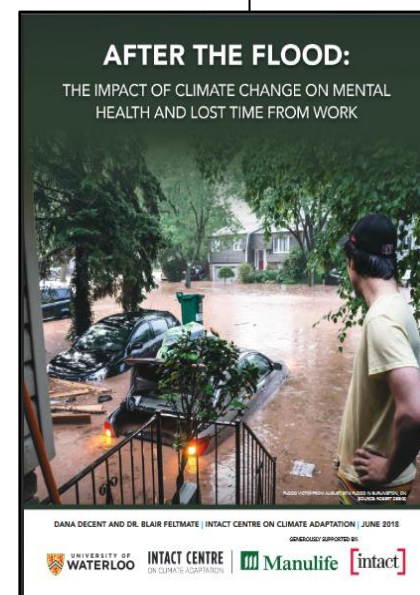
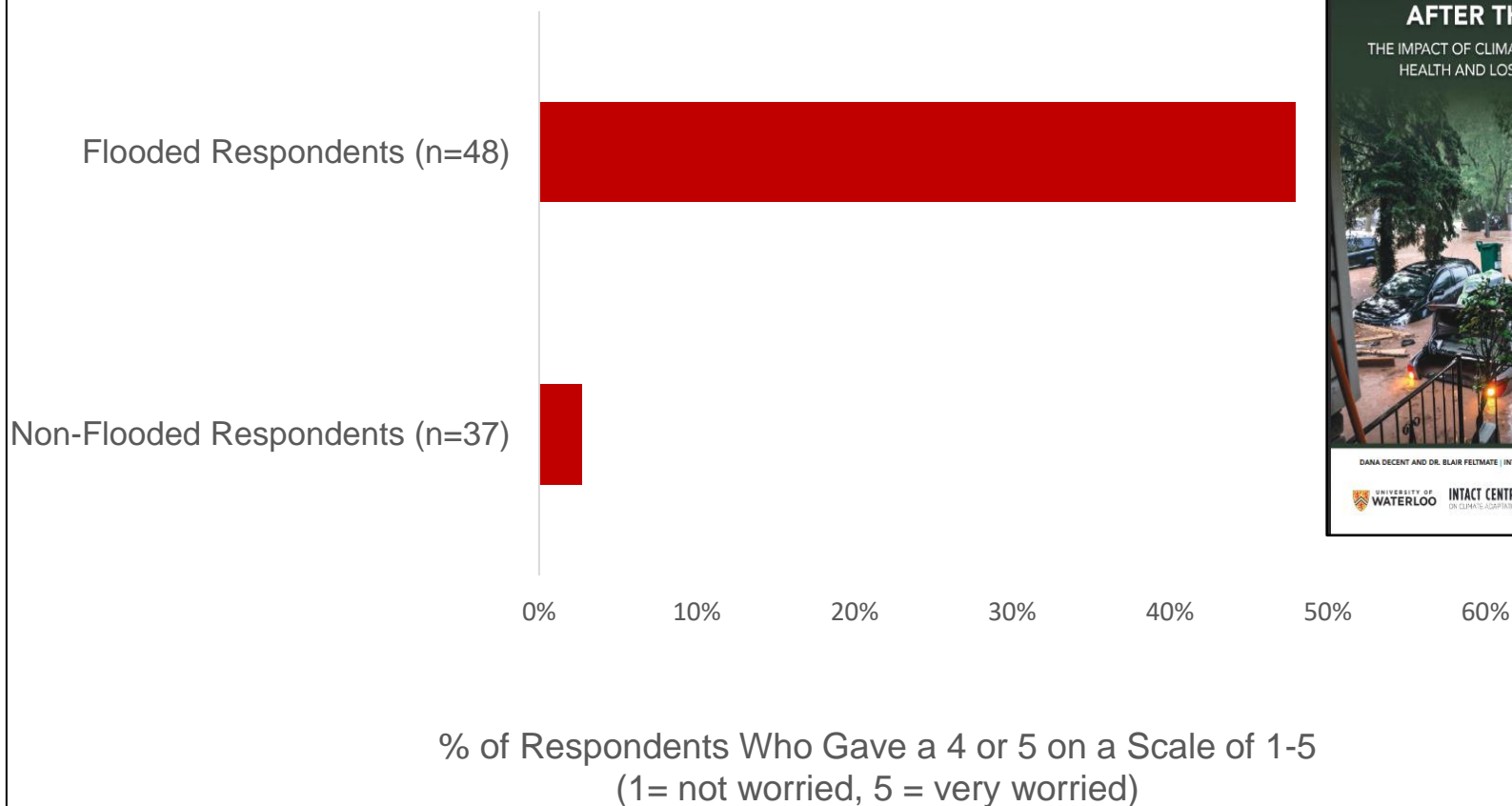
Source: CatIQ, PCS, IBC Facts Book, Statistics Canada, IMF WEO Database

MENTAL HEALTH STRESS DUE TO BASEMENT FLOODING

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Three Years After A Flood: Responses to "How Worried Do You Get When it Rains?"



FLOODING RISK REDUCTION GUIDANCE

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Home



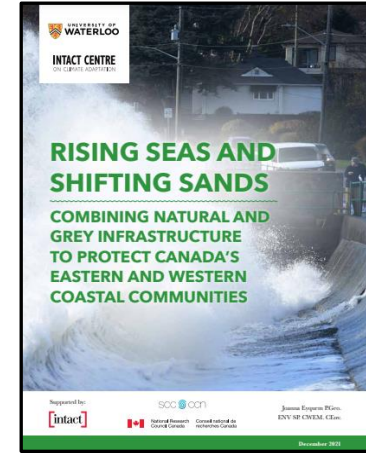
New Community



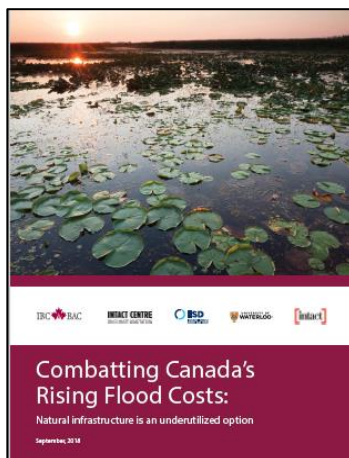
**Existing
Community**



**Commercial
Real Estate**



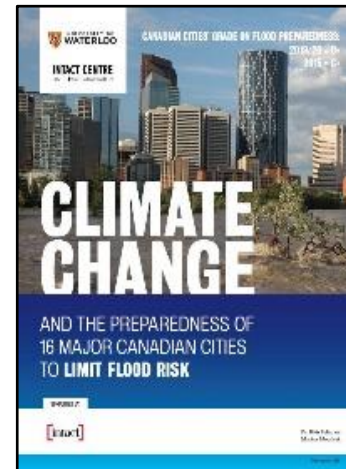
Coastal



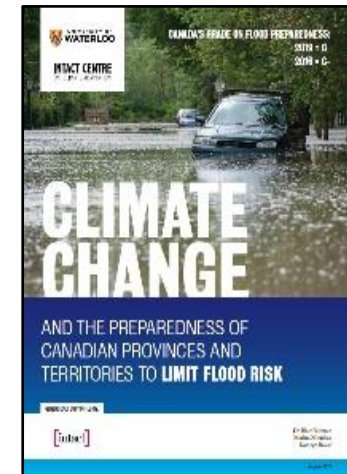
Natural Infrastructure



**Combined
Approach**



Cities



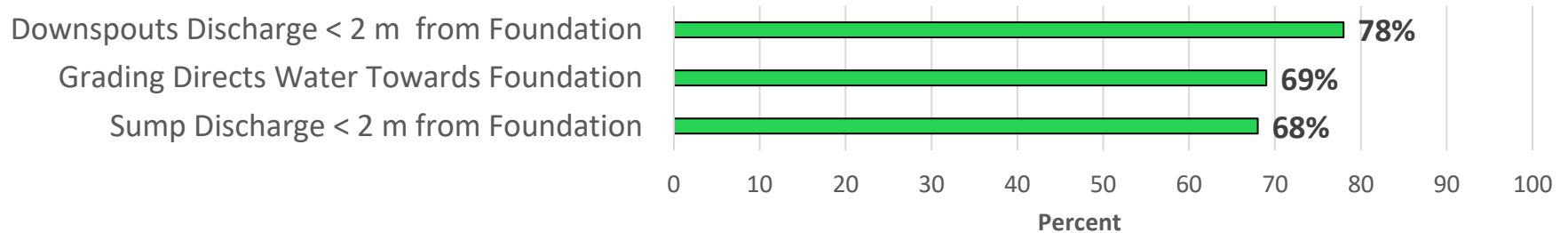
**Provinces and
Territories**

KEY FACTORS THAT AFFECT BASEMENT FLOOD RISK

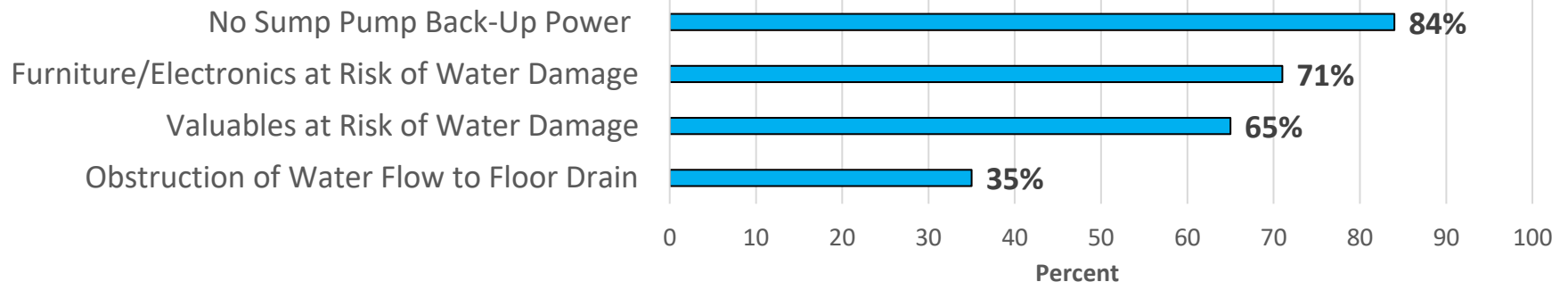
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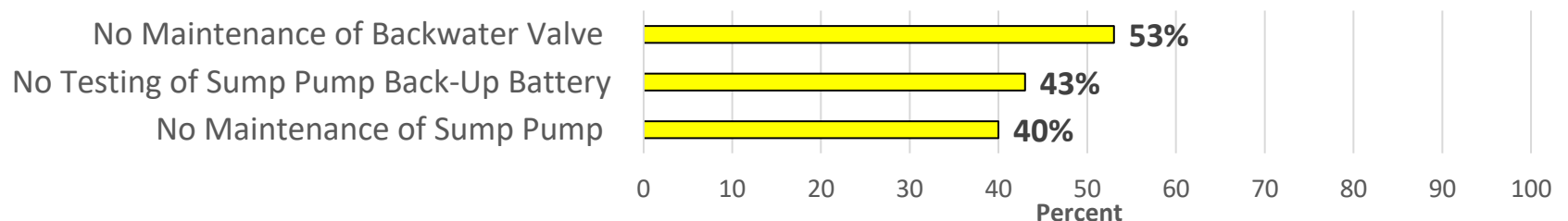
Top Flood Risks Recorded Outside the Home



Top Flood Risks Recorded Inside the Home



Top Self-Reported Maintenance Flood Risks Inside the Home



IMPACT OF FLOODING ON RESIDENTIAL HOUSING

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The cover of the report features a photograph of a flooded residential street with a blue recycling bin in the foreground. A white arrow points down from a text box indicating an 8.2% price reduction. The report title is in large white letters, and a bulleted list of topics is at the bottom left. Logos for the University of Waterloo, Intact Centre, and other partners are at the bottom.

UNIVERSITY OF WATERLOO
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Flooding Impact on House Price
-8.2%

**TREADING WATER:
IMPACT OF
CATASTROPHIC
FLOODING
ON CANADA'S
HOUSING MARKET**

- Sold Price
- Days on Market
- Houses on Market
- Mortgage Arrears & Deferrals

Supported by:
[intact] CMHC SCHL GRI GLOBAL RISK INSTITUTE

Kathryn Bakos
Dr. Blair Feltmate
Chris Chopik
Cheryl Evans

February 2022

Average Sold Price

- *8.2% reduction* in sold price

Average Number of Listings

- *44.3% decrease* in listings

Average Days on Market

- *19.8% longer* on the market

Mortgage Arrears / Deferrals

- *No material impact*

Question

Does catastrophic community level flooding (6 months pre- vs. post-flooding) impact residential real estate relative to:

- | | |
|---------------------------------|---|
| a. average sold price of houses | c. average # days on market to sell a house |
| b. average # houses on market | d. average # mortgage arrears + deferrals |

Method

Compare change regarding the above 4 variables, between flood impacted vs. non-flood impacted “control communities”, over periods of 6 months pre- vs. post flooding.

Community Selection Criteria

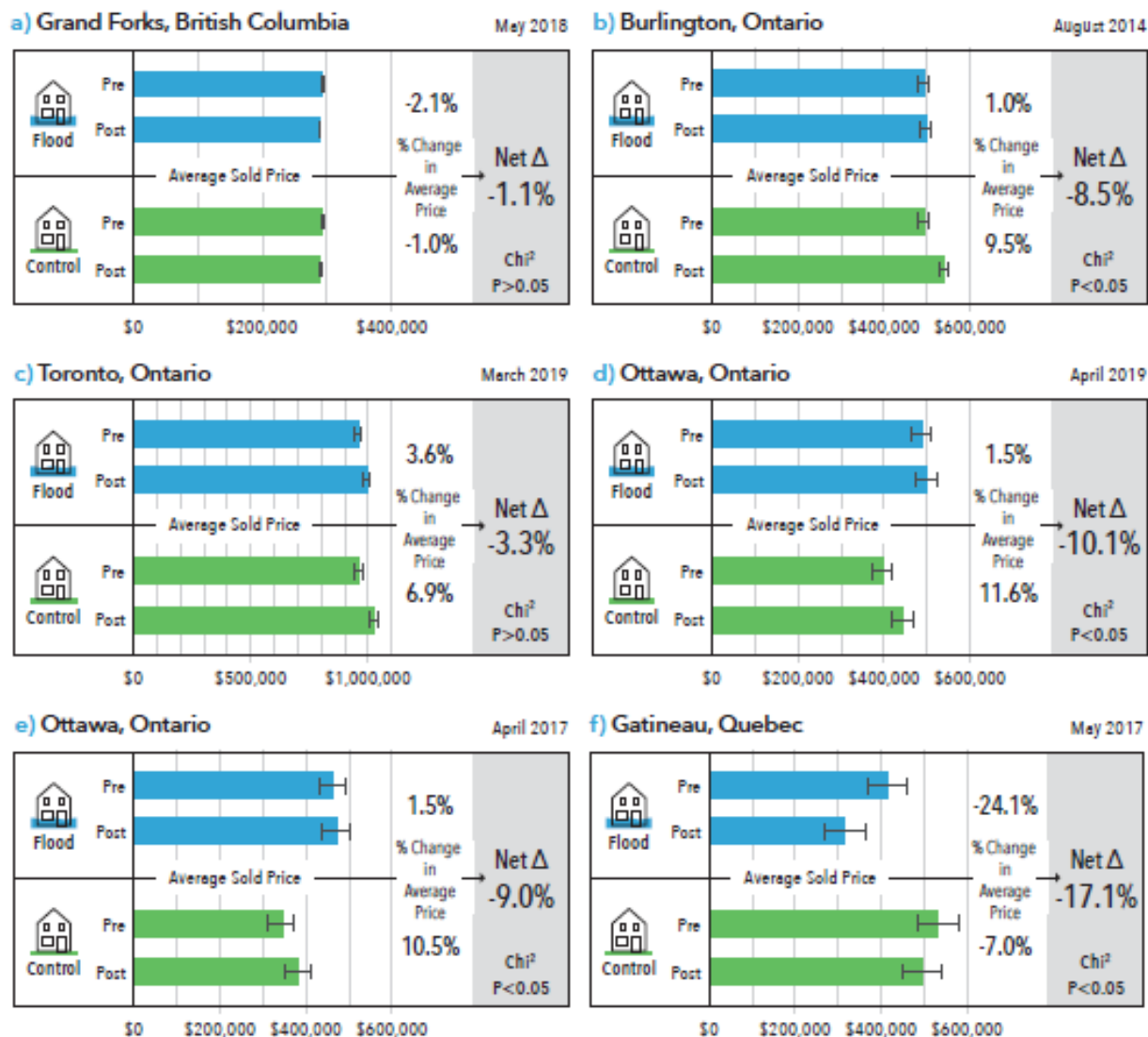
- community experienced 1-2 catastrophic flood events over 2009 – 2020 (based on CAT IQ)
- community did not have a history of annual flooding (otherwise risk priced into market)
- pan-Canadian (communities extended from western to eastern Canada)
- residential dwellings (detached, semi-detached, row housing)
- data availability

Communities

Grand Forks (BC, May 2018) **Burlington** (ON, August 2014) **Toronto** (ON, March 2019)

Ottawa (ON, April 2019 / April 2017) **Gatineau** (QB, May 2017)

SOLD PRICE: 8.2% reduction in sold price

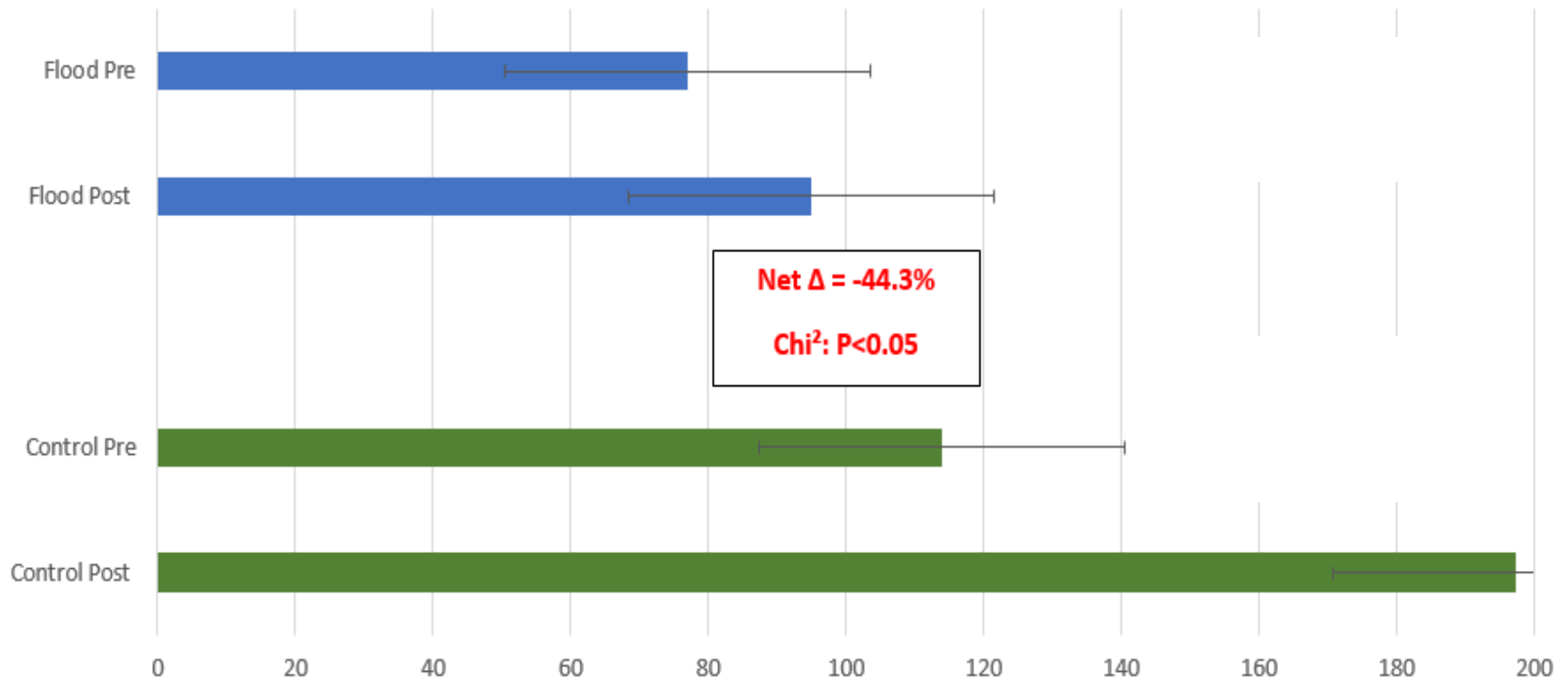


NUMBER OF LISTINGS: 44.3% *decrease* in listings

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Average Number of Homes on the Market - 5 cities / 6 events

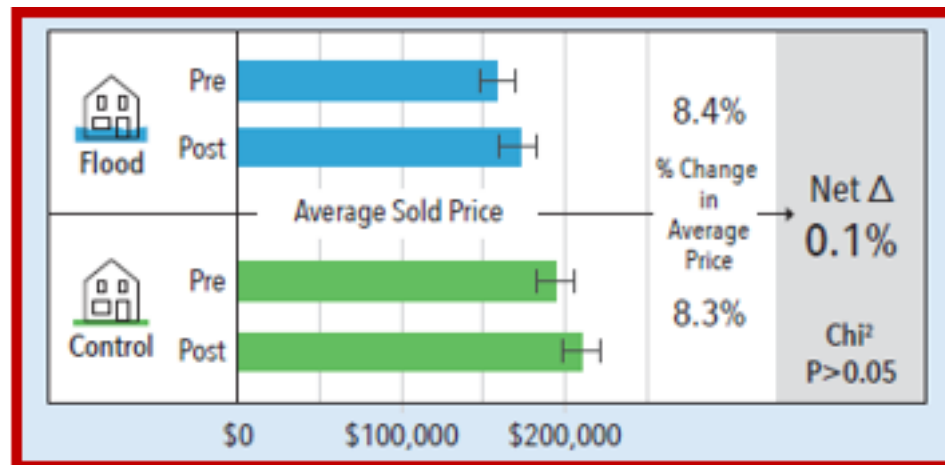


FACTORING FLOOD RISK INTO THE MARKET

Case Study - Fredericton

- major floods every year from 2008-2018, with the single exception of 2016
- floods varied in impact due to varying combinations of heavy precipitation, ice jams, snowmelt, heavy snowfall and late spring thaw
- losses due to flooding ranged from \$1.4-\$25 million in insurable claims, with average losses of \$13.4 million/year

Findings demonstrate that under conditions where flooding is “often and predictable”, the impacts of flooding are permanently factored into the real estate market.



MORTGAGE ARREARS/DEFERRALS: No Material Impact Due to Flooding

When evaluating the net impacts of catastrophic flooding on residential mortgage arrears + deferrals, for two Canadian cities, the results showed:

- no consistent or material impact
- tended to fall within market norms
- no change in homeowners' ability to make mortgage payments
- **Total arrears + deferrals in flooded and non-flooded communities ranged from 0.32/1,000 homes to 7.07/1,000 homes (over six months).**
- ***Worst Case Scenario* translated to 1.18 arrears + deferrals/1,000 homes/month**
- **Average of approximately 0.5 arrears + deferrals/1,000 homes/month**

No evidence that flooding materially impacts mortgage arrears + deferrals

Future Risk:

- **a reduction in the appraised value of a house due to flooding could influence limits on lending by mortgage providers**
- if the “value” of a mortgaged property is compromised by “unanticipated flood risk”, lenders and insurers may erroneously approve, or misprice, mortgage rates (i.e., loan-to-value ratio)
- as flood susceptibility evolves, the capital reserves of lenders might require adjustment depending on future risk

HOME FLOOD PROTECTION

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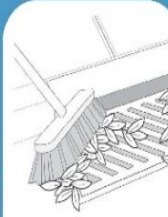
Distribute infographic to homeowners through Property Tax Notices, councilor newsletters.

Most homeowners can limit risk of basement flooding (i.e., Canada's No. 1 extreme weather cost):

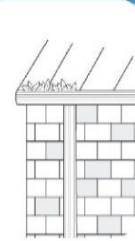
- without special expertise
- generally for less < few \$100
- often over a long weekend

Step 1: Maintain What You've Got at Least Twice per Year

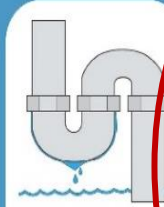
Do-It-Yourself
for \$0



Remove Debris from
Nearest Storm Drain



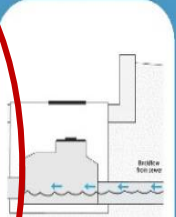
Clean Out Eaves
Troughs



Maintain Plumbing,
Fixtures and
Appliances



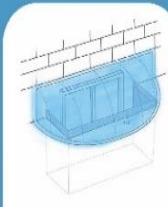
Test Your Sump Pump



Clean Out Your
Backwater Valve

Step 2: Complete Simple Upgrades

Do-It-Yourself
for Under \$250



Install Window Well
Covers



Extend Downspouts
and Sump Discharge
Pipes at Least 2m from
Foundation



Store Valuables and
Hazardous Materials in
Watertight Containers
or Remove from
Basement



Remove Obstructions
to Basement Floor
Drain



Install and Maintain
Flood Alarms

Step 3: Complete More Complex Upgrades

Work with a
Contractor for
Over \$250



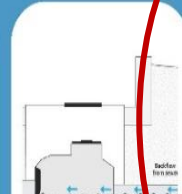
Install Window Wells
that Sit 10-15 cm
Above Ground and
Upgrade to Water
Resistant Windows



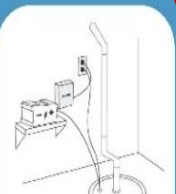
Disconnect Downspouts,
Cap Foundation Drains
and Extend Downspouts
to Direct Water at Least
2m from Foundation



Correct Grading to
Direct Water at Least
2m Away from
Foundation



Install Backwater
Valve



Install Backup Sump
Pump and Battery

*Canada will
create a Climate
Adaptation Home
Rating
Program... as a
companion to the
EnerGuide home
energy audits.*

Fighting Wildfires and Adapting to a Changing Climate

Everyday the evidence mounts that climate change is happening faster and with more intensity than many scientists expected.

The extreme heatwave and wildfires in Western Canada this summer underscore the urgency of fighting and adapting to climate change. This includes preparing for more regular extreme weather events that cause wildfires, droughts and flooding. We must remain united in our goal of ensuring affected Canadians are fully supported through this crisis. But as the mounting evidence of climate change becomes even more clear, we need to invest now to mitigate the impact of future disasters.

Training 1,000 Community-Based Firefighters

Through parts of this fire season, Canada faced a shortage of up to 1,000 fire personnel. With intensifying wildfire seasons across the globe, key allies face similar challenges, leading to shortages of fire fighting personnel and resources.

That is why a re-elected Liberal government will invest \$50 million to help train at least 1,000 firefighters in targeted wildfire risk management strategies in communities across the country. A portion of these funds will also be directed to support and expand Indigenous-led fire crews and build capacity to better incorporate Indigenous traditional knowledge strategies in fire management.

Providing firefighters with the equipment they need to stay safe and fight wildfires

As we adapt to the reality of climate change, we need to make sure provinces and territories can provide firefighters the tools they need to be able to do their job safely. That's why a re-elected Liberal government will invest \$450 million ahead of the next fire season to allow provinces and territories to invest in the equipment needed to fight wildfires and keep firefighters safe, like Canadian-made firefighter aircraft.

Protecting Homes and Communities from Floods and Wildfire

Information is power. And as climate change intensifies, it will only become more important for Canadians to understand what positive, affordable and practical measures they can take to protect their homes and communities against flood and wildfire.

To help ensure Canadians have this information, we will create a Climate Adaptation Home Rating Program that will be developed as a companion to the EnerGuide home energy audits. We will also expand the eligibility requirements of the CMHC deep home retrofit program and Canada Greener Home Grants to include more climate resilience measures.

We will also partner with the insurance industry and the private sector to develop strategies to reduce insurance premiums by finding cost-effective ways to better protect communities and homes from climate impacts, like floods and wildfires.

COMMUNITY FLOOD RISK PROTECTION

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Multiple approaches to limit flood risk in new and existing communities:

Non-structural

- Avoid developing on flood plains

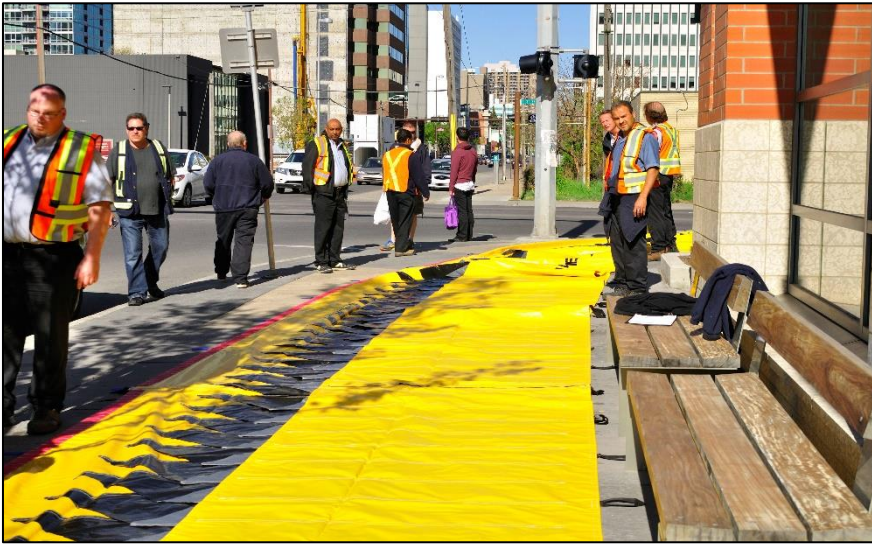
Natural Infrastructure

- Retain what you have, restore what you have lost

Built Infrastructure

- Localised berms / flood walls
- Sewer separation projects
- Cisterns/storage tanks





- Set up around 5 city blocks by a staff of 2-4 people in 1 hour
- 600 meters of protection (1 m high), cost \$165,000
- Reusable



- Fast deployment (200 m/h)
- Works well for urban flat surfaces
- Lightweight
- Reusable



NATURAL INFRASTRUCTURE: FLOOD RISK MITIGATION

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Wetlands can reduce infrastructure costs from major storms by 29 – 38%

Natural Infrastructure flood risk protocol:

- retain what you have
- restore what you have lost
- build what you must



RECOMMENDATIONS TO LIMIT HOUSE AND COMMUNITY LEVEL FLOOD RISK

- 1. Home Flood Protection Guidance:** Municipalities, banks, credit unions, real estate brokers, mortgage providers and Property & Casualty insurers are distributing this infographic, *Three Steps to Cost-Effective Home Flood Protection*, to customers/clients. https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2021/03/3-Steps-to-Home-Flood-Protection_March-2021_Space-for-Partner-Logo.pdf
- 2. Appraisal Institute of Canada:** *“AIC is making a serious effort to determine how extreme weather risk – mainly flooding – should factor into house appraisal. They will be providing additional guidance and training to its Members on how to identify if a property has been subject to a recent flood or if a property is in a high risk flood zone. This information will allow them to make necessary value adjustments and to properly inform clients that are relying on the appraisal.”*
- 3. Climate Adaptation Home Rating Program (CAHRP):** Government of Canada launched the CAHRP in 2021, as a companion to EnerGuide home energy audits. CAHRP can *help homeowners to navigate the flood (& fire) retrofit process, and expand on the eligibility requirements of the Canada Mortgage and Housing Corporation (CMHC) deep home retrofit program.* <https://liberal.ca/wp-content/uploads/sites/292/2021/08/wildfires-ENG-1.pdf>
- 4. Flood Risk Maps:** Federal, provincial, territorial and municipal governments are updating flood risk maps to aid city planners, developers, engineers and risk officers to identify and remediate areas at high risk of flooding. These maps may guide homeowners in preparedness to limit flood risk.
- 5. Residential Flood Risk Scores:** Federal government is supporting the creation of a flood portal – this would enable a flood risk score, for any residential property, based on address/postal code (as exists in the US - <https://floodfactor.com/>).
- 6. Natural Infrastructure:** Federal, provincial, territorial and municipal governments should develop and enforce guidelines and standards to retain and restore natural infrastructure (e.g., forests, fields, wetlands) to limit current and future flood risk.
- 7. Community Flood Risk Mitigation:** Through guidelines supported by the Standards Council of Canada, and the National Research Council, communities can act now to identify areas at high risk of flooding, and subsequently deploy actions to mitigate risks. <https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2019/01/Weathering-the-Storm.pdf>

BREAK
(20 minutes)

Wildfires are a Natural Hazard in Canada

- wildfires are a natural hazard in forested and grassland regions across Canada

Highest Occurrence by Location

- regions with highest wildfire occurrence are
 - British Columbia
 - Boreal forest zones in
 - Alberta
 - Saskatchewan
 - Manitoba
 - Ontario
 - Quebec
 - Yukon
 - Northwest Territories

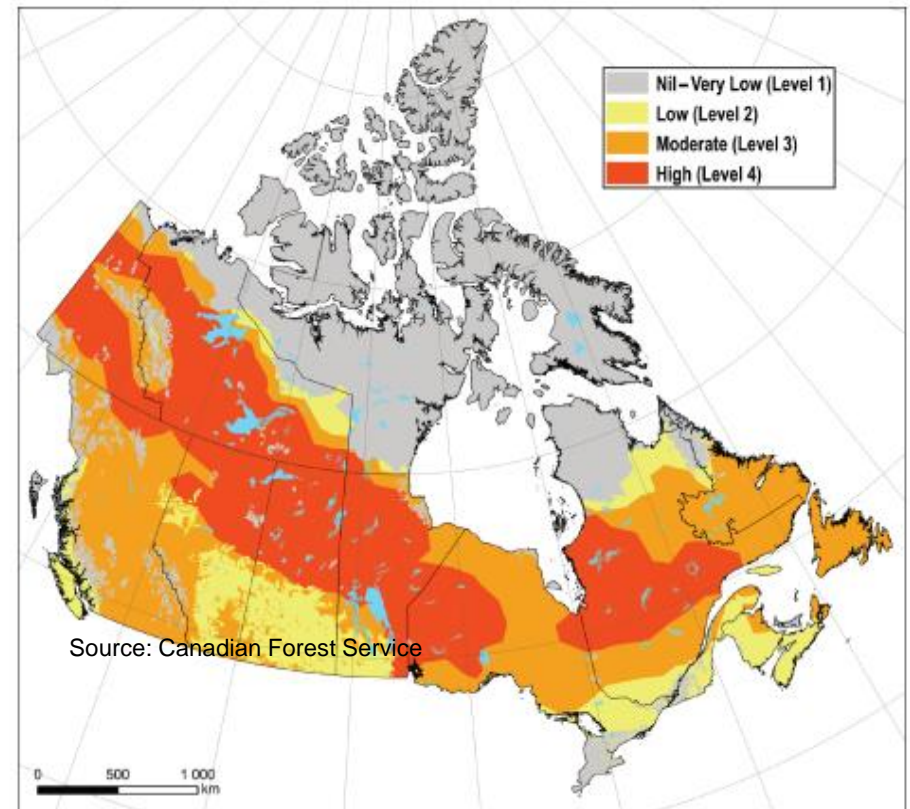
Highest Occurrence by Month

- May through September

Shifting Hazard Levels

- ❖ Climate change may shift wildfire hazard distribution in Canada

Canada's Historical Wildfire Hazard Map



CLIMATE CHANGE CONTRIBUTES TO INCREASED WILDFIRE RISK

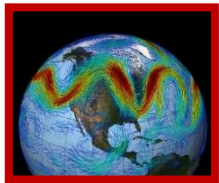
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Increase in Temperatures

- Canada's mean temperature increased by 1.7°C between 1948 and 2016; and by 2.3°C in the North over the same timeframe



Weaker Jet Stream

- Warming in the Arctic is weakening the jet stream, leading to stationary weather patterns and heat domes (extreme fires)



Increase in Lightning Activity

- 1°C increase in temperature = 10-12% more lightning. Roughly 50% of wildfires in Canada are caused by lightning



Drier Soil / Forest Disease

- Dry trees and vegetation provide fuel to the fire, which can spread fast across the landscape /
- Greater susceptibility of forest systems to pests and disease

WILDLAND URBAN INTERFACE

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**WUI fire occurs when wildland fire
embers or flames contact the ignitable
parts of a structure**

Increased Development in the Wildland Interface

- more people & property in the wildland interface
- greater likelihood of human-induced ignitions

Fire Suppression Adds Fuel to the Fire

- decades of fire suppression has lead to
 - increased fuel available to burn
 - larger areas with large fuel build ups

Lack of Investment in Prevention

- Majority of public funds are directed to respond to wildfire emergencies
- Minimal investments in prevention leave unnecessary risk in the system



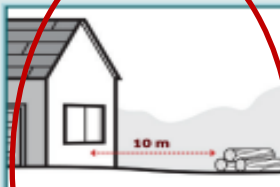
HOME WILDFIRE RESILIENCE

STEP 1: MAINTAIN WHAT YOU'VE GOT AT LEAST TWICE PER YEAR

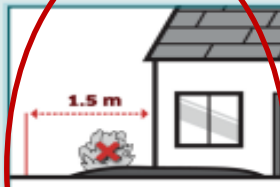
\$0 - \$300



Remove needles, leaves and other debris from gutters, roof surfaces, decks and balconies. Regularly clean vents.



Remove combustible materials (firewood and lumber) stored within 10 m of the house perimeter and under decks.



Remove all combustible ground cover (mulch and plants) within a 1.5 m of the house perimeter.



Mow the lawn to <10 cm and plant low-growing, well-spaced shrubs and other vegetation.



Prune trees to create a 2 m clearance from the ground to the lowest tree branches.

STEP 2: COMPLETE SIMPLE UPGRADES

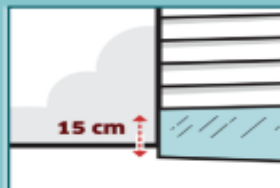
\$300 - \$3,000



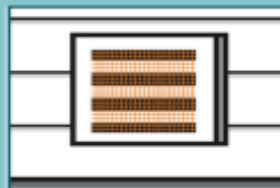
Install non-combustible fencing within 1.5m of the house (cement fiber, metal, chain link or stone).



Install non-combustible ground surfaces within 1.5 m of the house (mineral soil, rock, concrete or stone).



Create a 15 cm ground-to-siding non-combustible clearance (e.g., install cement board or metal skirting).



Add a non-combustible 3 mm screen to all external vents, except dryer vents.



Replace worn or missing weather stripping on all doors, including garage doors.

STEP 3: COMPLETE MORE COMPLEX UPGRADES

\$3,000 - \$30,000



Install Class A fire-resistant roof covering (e.g., cement fibre, metal or asphalt shingles).



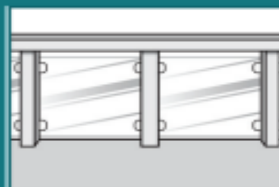
Install non-combustible siding (stucco, metal, stone, cement fibre board).



Install multi-pane or tempered glass windows and exterior fire rated doors.



Remove conifer trees that are within 10 m of the house.

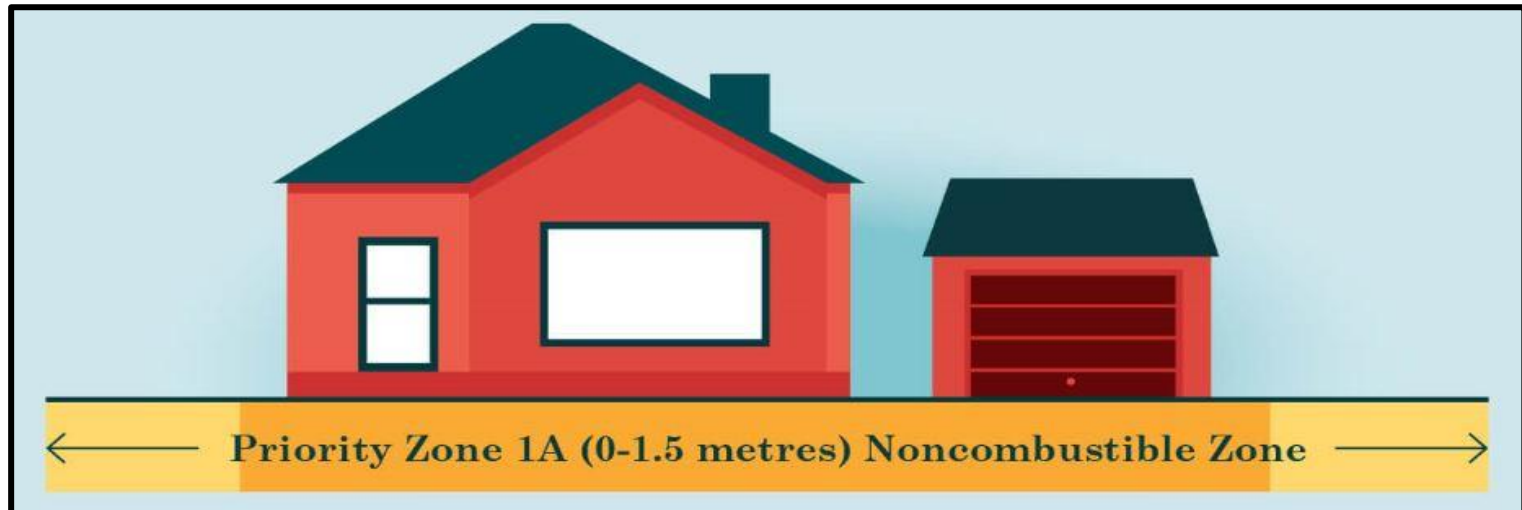


Retrofit all deck components to be fire-rated, with a continuous surface.

NOTE: Not all actions will be applicable to each home. Completing these steps does not guarantee the prevention of fire.

• Cost estimates are based on a 2,500 sq ft home.

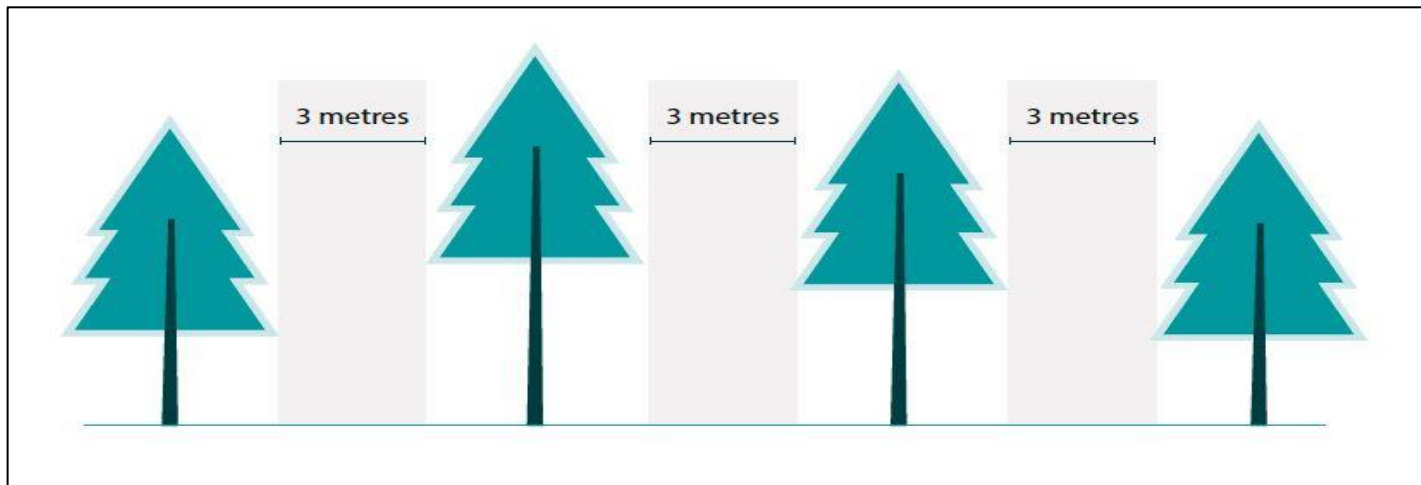
- **The most critical zone (0 to 1.5 metres from the home)**
- Remove combustible material right down to the mineral soil
- Use non-flammable materials such as gravel, brick or concrete in this critical area adjacent to your home
- Avoid having woody shrubs, trees or tree branches in this zone



- **1.5 to 10 metres from the home**
- Create a FireSmart yard so that fire will not easily transmit to your home.
- Plant low-density, fire-resistant plants and shrubs.
- Avoid planting coniferous trees (cones and needles) in this zone, since they are highly flammable.
- Keep lawns mowed.
- Move firewood piles, construction materials, storage sheds and other combustible structures out of this zone and into Zone 2.



- **10 to 30 metres from home**
- Prune and trim evergreen trees to create at least 3 metres of horizontal space between single or grouped tree crowns.
- On the remaining evergreen trees, remove all branches to a height of 2 metres above the ground.
- Regularly clean up fallen branches, dry grass and needles from the ground to eliminate potential surface fuels.



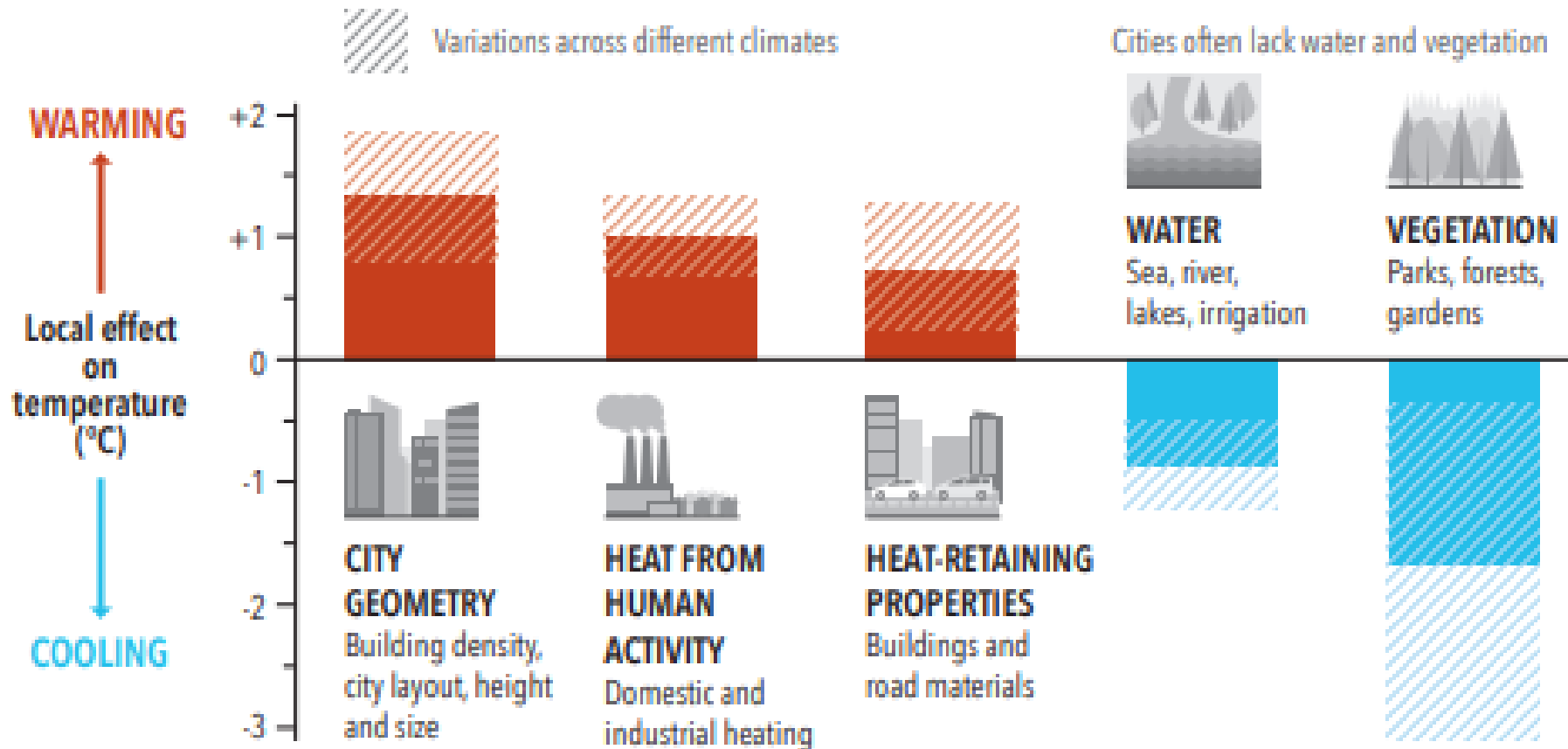
- **30 to 100 metres from home**
- Create an environment that will not support high-intensity crown fires.
- A focus on fuel reduction and conversion (rather than removal) is the main priority in this zone.
- Look for opportunities to create a fire break by creating space between trees and other flammable vegetation.



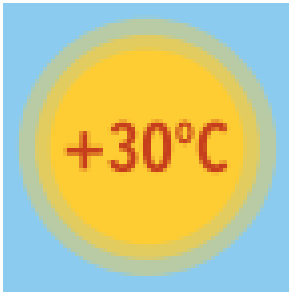
EXTREME HEAT: CANADA'S CODE RED – WHY?

32

- **Floods & Fires:** deaths generally 0 – 4 per event
- **Extreme Heat:** BC 2021 - 596 deaths; QB 2018 – 86 deaths
 - with an electricity outage = deaths in 100s or 1,000s

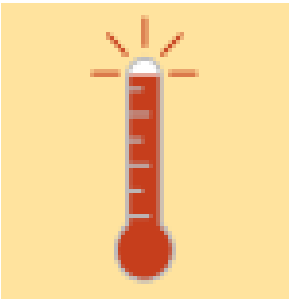
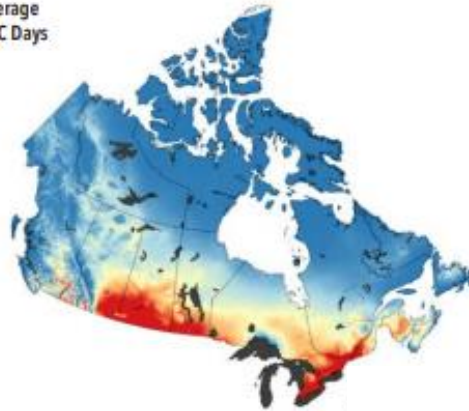
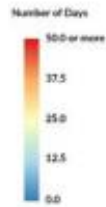


The Heat is Coming



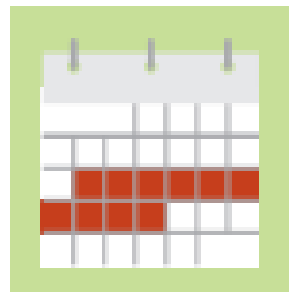
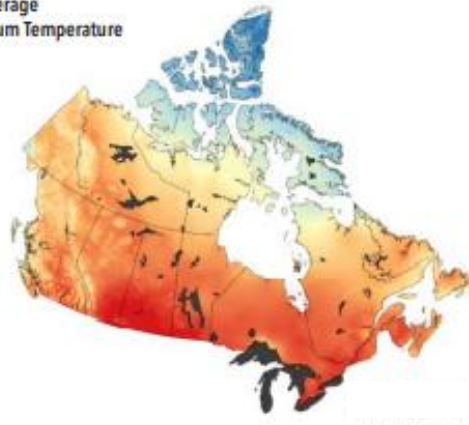
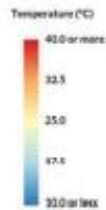
Very hot
days over
30°C

2051-2080 Projected Average
Annual Number of +30°C Days
Under the RCP8.5 scenario



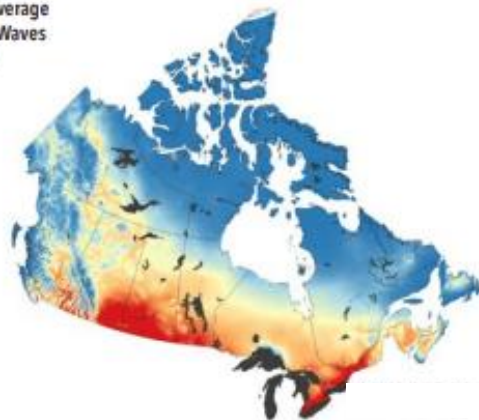
Warmest
maximum
temperature

2051-2080 Projected Average
Annual Warmest Maximum Temperature
Under the RCP8.5 scenario



Average
heat-wave
length

2051-2080 Projected Average
Annual Length of Heat Waves
Under the RCP8.5 scenario



EXTREME HEAT: SOLUTIONS

INTACT CENTRE

ON CLIMATE ADAPTATION

34

Edmonton

Days > 30 C

High Temperature

2005-2010







4

31 C

2050-2080

26

36 C

	Non-structural (planning and behavioural changes)	Green Infrastructure (working with nature)	Grey Infrastructure (improving buildings and public infrastructure)
 Individuals	Work with neighbours, friends and family to prepare	Plant and maintain trees 	Install shading devices (shutters, awnings, overhangs, blinds, heat-resistant curtains)
 Property Owners and Managers	Understand building-scale vulnerabilities to extreme heat	Install a green (vegetated) roof 	Install and maintain backup power generation (e.g. to maintain air conditioning in designated "cool" rooms)
 Communities	Develop extreme-heat emergency plan <ul style="list-style-type: none"> • elderly (living alone) • homeless 	Expand vegetated areas and water bodies and absorb more water (forming a blue-green infrastructure network) 	Adapt community infrastructure to extreme heat (e.g. transport, utilities, water supply)

1. Climate change is irreversible. Extreme weather will get more extreme
 2. ROI for adaptation: \$1 = \$3-8 in savings over 10 years
 3. Adaptation is the “gift that keeps on giving”
 4. Adaptation programs should be implemented:
 - **Home Flood Protection Education Program**
 - **Home FireSmart Education Program**
 - **Extreme Heat Community Education Program**
-
- ✓ **Adaptation and Mitigating GHG emissions should go *Hand-in-Hand***
 - ✓ **Every day you don't adapt is a day you don't have**