



Climate Resilient Retrofits for Adaptation

Webinar Series: Building Local Resilience to Climate Risks

Webinar 3 – October 23, 2023

Presenting: Cameron McGlade-Bouchard, Tyler Hull

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Building Local Resilience to Climate Risks

A P4A/Climate Caucus Joint Webinar Series

Learn what efforts are underway to
support local climate action,
adaptation and resilience – and
what you can do in your
community



Partners for Action (P4A) respectfully acknowledges that we live and work on the traditional territory of the Neutral, Anishinaabeg and Haudenosaunee peoples, whose enduring presence, contributions and knowledges we recognize.

The University of Waterloo is situated on the Haldimand Tract, the land promised to the Six Nations that includes six miles on each side of the Grand River (see <https://www.protectthetract.com/>)

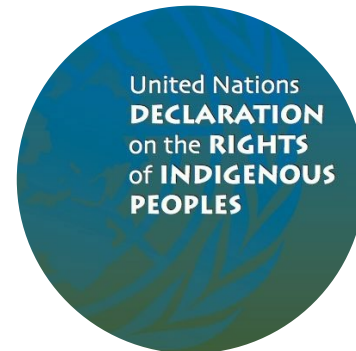
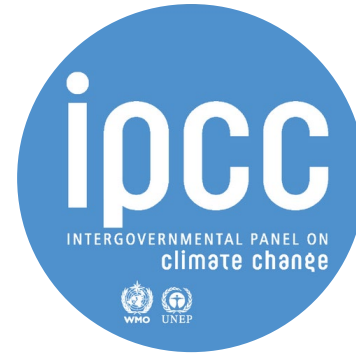
Learn about where you live and work at <https://native-land.ca/>

Today's Agenda

- **About Climate Caucus and P4A** and how our work connects to this topic of **local climate resiliency**
- Hear from **P4A's Climate Resilient Retrofits Team** on how to reduce the vulnerability of buildings to the physical impacts of climatic hazards
- Audience **Q&A** period

WHO WE ARE?

Climate Caucus (CC) is a non-partisan network of 600+ local elected climate leaders working collectively to address the Climate, Ecological, and Social Justice crises.



MISSION →

Connect, support, and advocate for locally elected leaders to accelerate the transformation for communities to thrive

VISION →

Communities are leading the transformation needed to thrive* within planetary boundaries

** Thrive means communities are resilient, healthy, regenerative, decarbonized and socially just*

About P4A:

Partners for Action is a research initiative that seeks to **empower Canadians** to become **flood resilient** by promoting **awareness and preparedness actions** that are **inclusive** and **evidence-based**.



An initiative of the Faculty of Environment

With founding support provided by:

Contact: p4a.info@uwaterloo.ca



UWATERLOO.CA/PARTNERS-FOR-ACTION/

Recent directions

- To apply an **equity and justice lens** to climate action and adaptation work
 - all-of-society
 - multi-hazard
 - interdisciplinary research
 - applied / community-engaged



Meet the P4A Project Team



Climate Resilient Retrofits Team



Sharmalene Mendis-Millard
Senior Manager
Research Partnerships and Evaluation



**Cameron
McGlade-Bouchard**



**Tyler
Hull**



**Kalindi
Shah**



**Niloofar
Mohtat**



**Rachel
Krueger**



**Monika
Mikhail**



**Devon
Jones**

Mentimeter polls

- *Where are you from?*
- *What hazards are you most concerned about in your community?*

Join at [menti.com](https://www.menti.com) use code 15 52 99 1

Instructions

Go to

www.menti.com

Enter the code

15 52 99 1



Or use QR code
















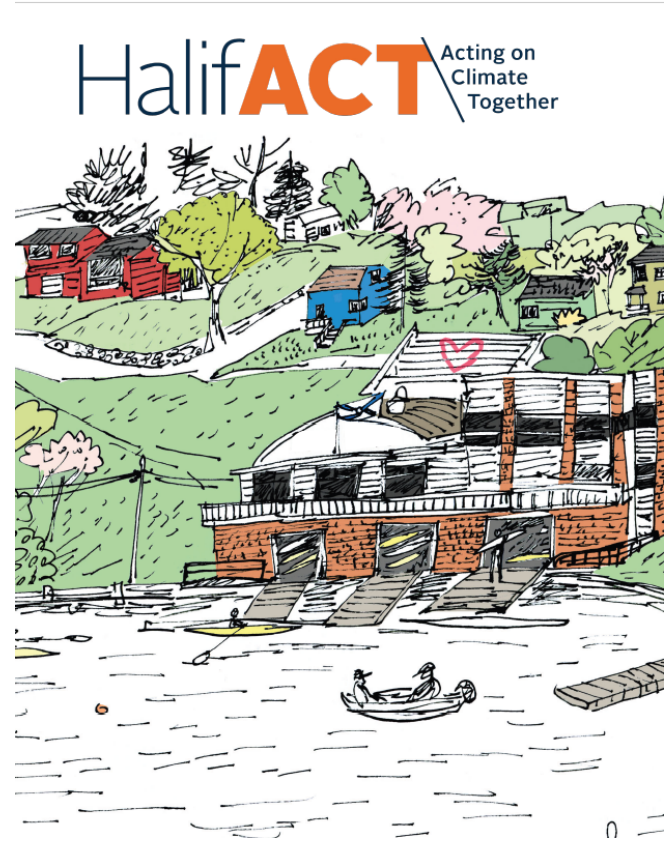
As our world warms, climate scientists say these extreme events will only become **more frequent and widespread**

Climate Resilient Retrofits

How do we protect our existing homes & infrastructure?



A big **thank you** to
Halifax Regional Municipality
for the funding and support to
carry out this research

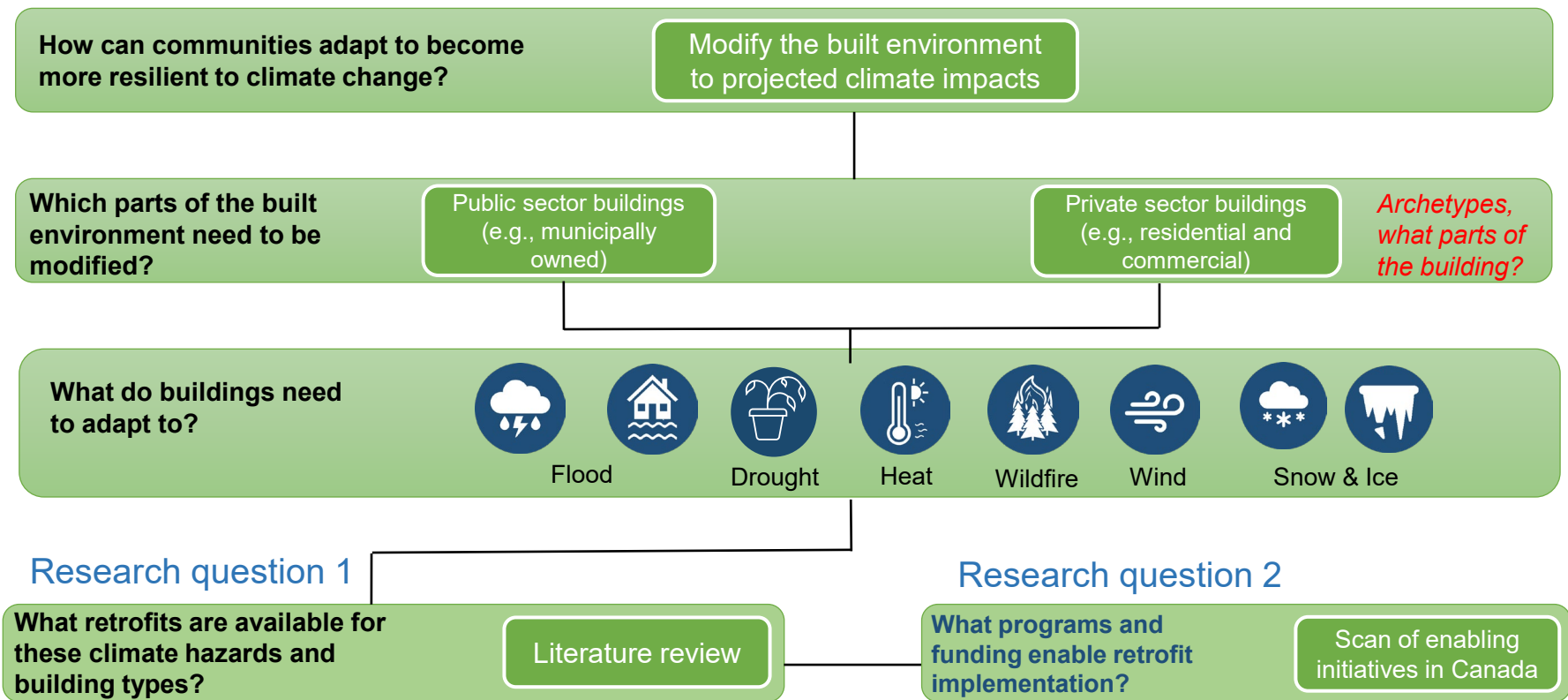


Research Questions

- 1) What **retrofits** are available for **5 building archetypes** that may **reduce the impacts of 8* climate hazards**?
- 2) What **property-level** and **municipal-level initiatives in Canada** **enable** the implementation of climate resilient retrofits?

** We ended up combining these into 6*

Framework: Thinking through how to make buildings resilient to climate change



Halifax-Specific Building Archetypes

Developed to represent HRM's various existing building types

1) Single Family Residential

- 1-2 storey wood framed buildings

2) Municipally Owned and Operated

- **Type 1:** larger steel-framed
- **Type 2:** smaller wood-framed

3) Commercial Building

- 1 storey steel joist framed building with flat metal roof

4) Multi-Residential

- 3-4 storey stacked apartment building often of wood-framed construction

5) Heritage


- 2 storey circa 1920's row house style buildings

Objective

To establish a common vision about what aspects of each building to address



Projected Climate Change Impacts & How Hazards Affect Buildings

Climate Hazard	Description of climate change impacts	Impacts on building systems
 <p>Floods</p>	<p>Riverine and Pluvial Flooding – Total annual precipitation and seasonal precipitation is projected to increase, particularly in the spring and winter. More precipitation is predicted to fall as rain instead of snow in the spring and winter due to warmer conditions, which will lead to more variable or increased spring runoff.</p> <p>The greatest increase in precipitation across Canada between 1948–2012 occurred in Atlantic Canada.²⁸</p> <p>The total annual amount of precipitation (rain, drizzle, snow and sleet) is projected to increase by 79 mm and 131 mm for the periods 2021-2050 and 2051-2080, respectively.</p> <p>Coastal Flooding (from Sea Level Rise, Storm Surge, and Wave Effects) – Most of the Canadian coastline along the Atlantic Ocean is expected to experience sea level rise. Parts of Atlantic Canada are projected to experience relative sea-level change that is higher than the global average for the next century due to land subsidence.</p>	<ul style="list-style-type: none"> • Inundation of building basement or lower levels • Damage to building materials or building contents • Damage to structure (from hydrostatic pressure or impact loading) • Erosion at building foundation • Increased corrosion of building materials • Potable water scarcity from sewer overflow • Capacity of drainage systems exceeded (wastewater and/or stormwater) • Limited or restricted building access

Objective

Answer the question, *resilient to what?*

Inventory of Retrofits & Initiatives

Views	All data	Hide fields	Filter	Group	Sort	Color	Share and sync	
1	Swales	Floods	Water damage Contamination	Water damage can be caused by non-flood-resistant materials coming in contact with floodwaters. Contamination is a risk as floodwaters pi...	A shallow, sloped channel to carry stormwater to a catchment.	Pluvial	Structural	
2	Elevating and securing HVAC components	Floods Extreme wind			Ductwork, condensers, air handlers, and electrical components of Heating, Ventilation, and Air Conditioning systems should be located above the design flood elevation. Any exterior elements should be both elevated an...	Coastal Pluvial	Structural	
3	"Water square"	Extreme pre... Floods	Water damage Sewer overwhelm	Water damage can be caused by non-flood-resistant materials coming in contact with floodwaters. Overwhelmed sewers can cause floodin...	Transformation of public plazas or squares into stormwater retention ponds/pools.	Pluvial	Structural	Most times of year, the pools are dry and can be used as recreational spaces. Good for placemaking (Eppig, 2019)

Objectives



To provide a searchable list of retrofits *by hazard and building type*

To identify retrofits resilient to multiple hazard impacts (searching until data saturation)

To identify the retrofits Clean can implement on 10 homes

ONLINE DATABASES (NOT YET PUBLIC)

RETROFITS COMMUNITIES SCAN OF A) INITIATIVES AND B) FUNDING FOR

Database of Funding Programs Municipalities can Access for Resilient Retrofits

Program	Program description	Targeted province	Funding type	Link	Who is this for
1 Disaster Mitigation and Adaptation Fund	The DMAF is a national, competitive, and merit-based contribution program intended to support infrastructure projects designed to ...	Canada-wide	Federal funding	https://www.infrastructure.gc.ca/dmaf-faac/details-eng.html	Gov-local Gov-Provincial Not-for-profit Territories Indigenous peoples
2 The Sustainable Communities Challenge Fund	The Fund intends to put financial resources into the hands of Nova Scotia municipalities, First Nations, non-profits, and post-secondary institutio...	Nova Scotia	Provincial funding	https://nschallengefund.ca/	Gov-local Not-for-profit First Nations
3 Green and Inclusive Community Buildings Program (GICB)	A national merit-based Program with the objective of improving the availability and condition of community buildings in Canadian communities ...	Canada-wide	Federal funding	https://www.infrastructure.gc.ca/gjcb-bcvi/applicant-guide-demandeur-eng.html	Gov-local Gov-Provincial Not-for-profit First Nations
4 Deep Retrofit Accelerator Initiative (DRAI)	The \$200-million Deep Retrofit Accelerator Initiative will invest in projects that support the development of deep retrofits in commercial, ...	Canada-wide	Federal funding	https://www.canada.ca/en/natural-resources-canada/news/2023/02/the-government-of-canada-announces-calls-for-applications-for-green-...	Territories Gov-local Not-for-profit Private sector Gov-Provincial First Nations

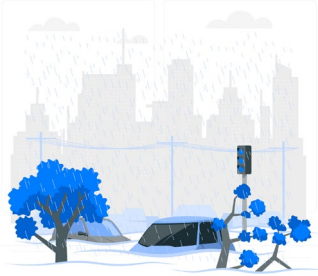
Objective



To gain a comprehensive understanding of who is promoting resilient retrofits for each building type, and how (what those efforts entail)

WHAT WE FOUND: RETROFITS FOR ADAPTING TO CLIMATE CHANGE

HAZARDS REVIEWED



Extreme precipitation and flooding



Wildfire



Snow and ice



Drought



Extreme wind



Extreme heat



Retrofitting for Flood Resilience

The Hazard

Pluvial



Coastal



Riverine



Drainage failure



The Impacts

Structural damage,
water damage,
debris damage,
contamination or
sewer overwhelming

The Options

Dry Floodproofing
Stop water from entering

Wet Floodproofing
Allow water to enter harmlessly

Elevate
Move structure above flood levels

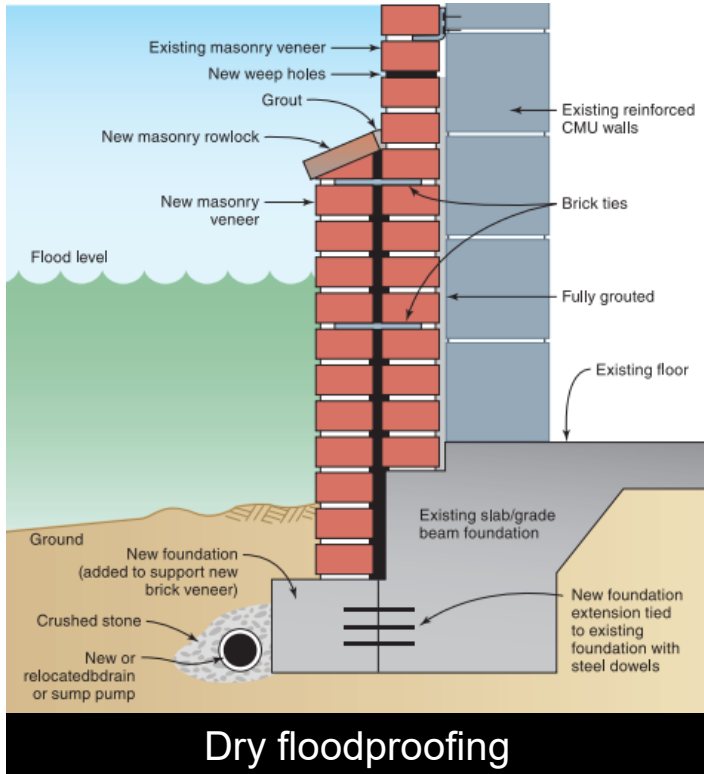
Barrier
Prevent water from reaching the structure

Relocate
Move structure out of the floodplain

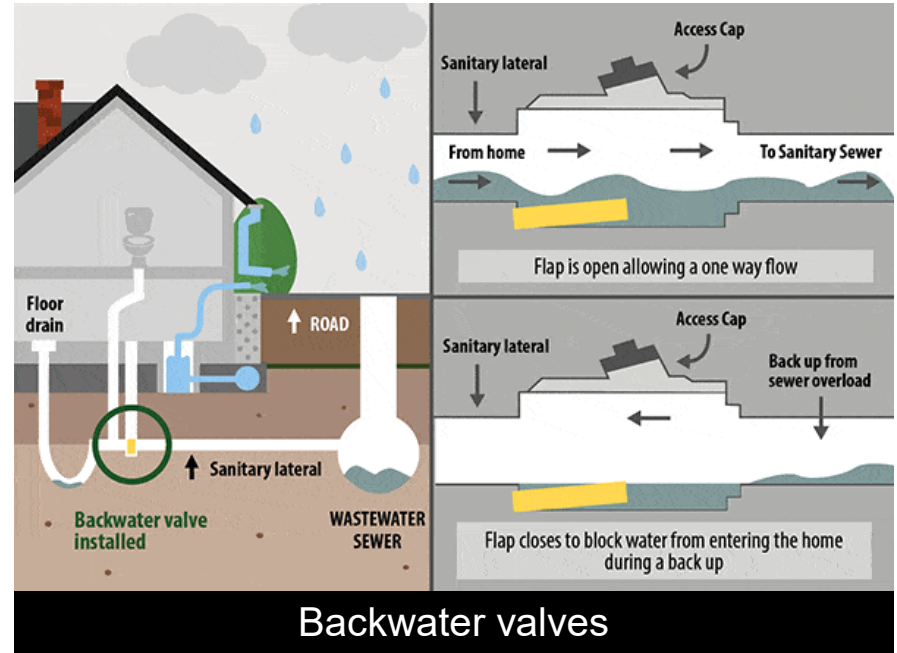





Example Retrofits - Flooding



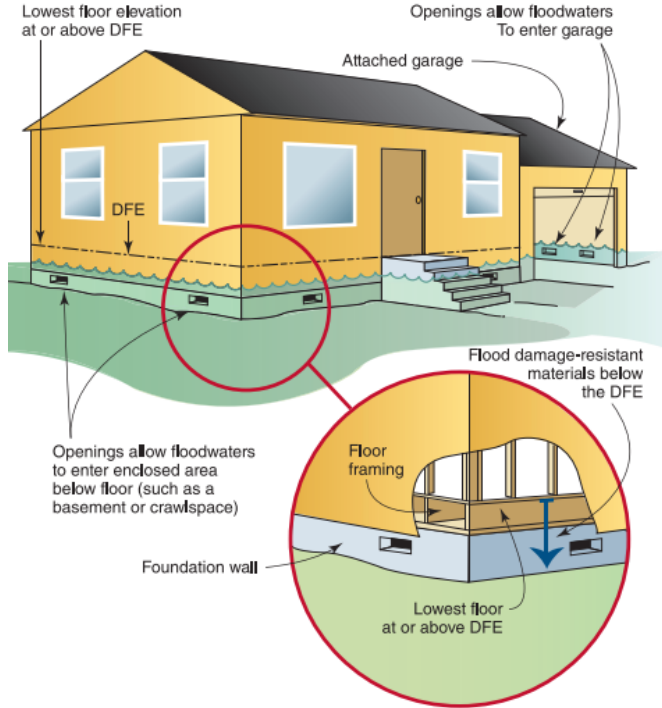
Source: FEMA



Source: Out of This World Plumbing Ottawa

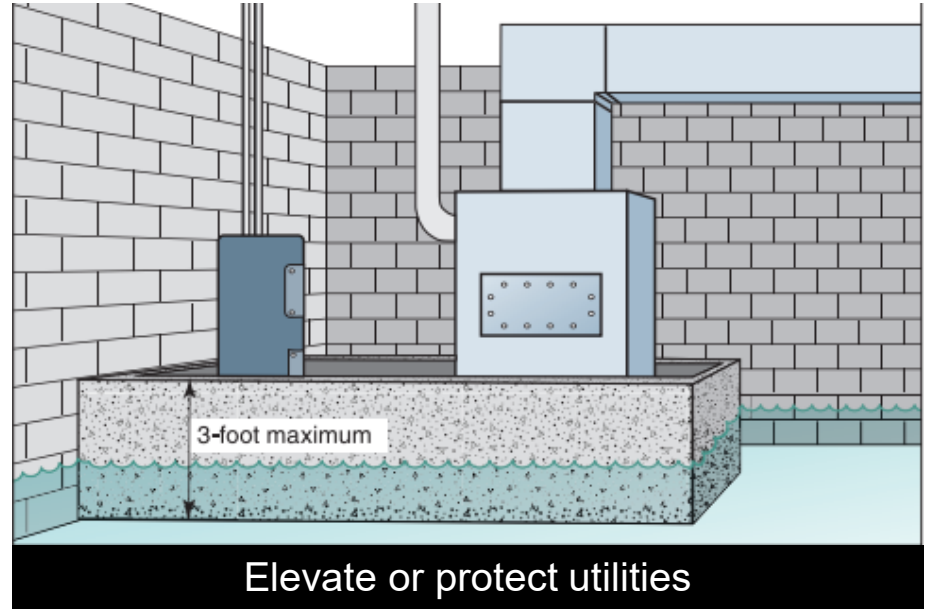



Example Retrofits - Flooding



Wet floodproofing

Source: FEMA



Source: FEMA

What Would Help You Do This? Enabling Initiatives

Examples

- *Stormwater Credit* (City of Kitchener)




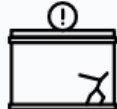
Resources

- Reep Green Solutions:
 - *Rain Smart Neighbourhoods*
 - *Healthy yards*
- Green Communities Canada's *Soak it up! Toolkit*



Retrofitting for Extreme Wind Resilience

The Hazard

- Lift off foundation 
- Lift forces on roof 
- Flying debris 
- Exterior damage 

The Impacts

Structural damage, water penetration, objects uplifting, roof coming off building, total collapse

The Options

Secure roof
Improve connections

Anchor to foundation
Secure walls soundly to foundation

Reinforce doors and windows
Allow winds into building

Improve roofing material
Withstand winds and protect interior from elements





Retrofitting for Extreme Wind Resilience

The Impacts



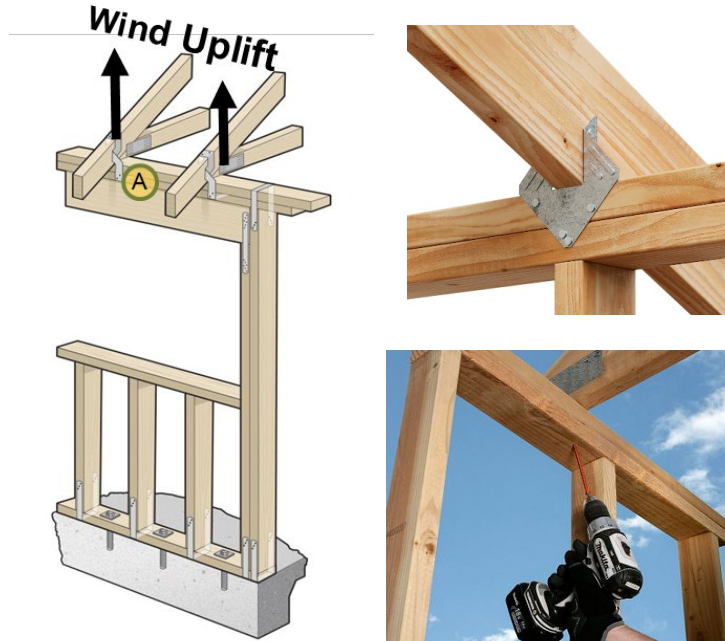
Structural damage,
water penetration,
objects uplifting, roof
coming off building,
total collapse

Sources: Canadian Wood Council, Cory Zurell, CBC



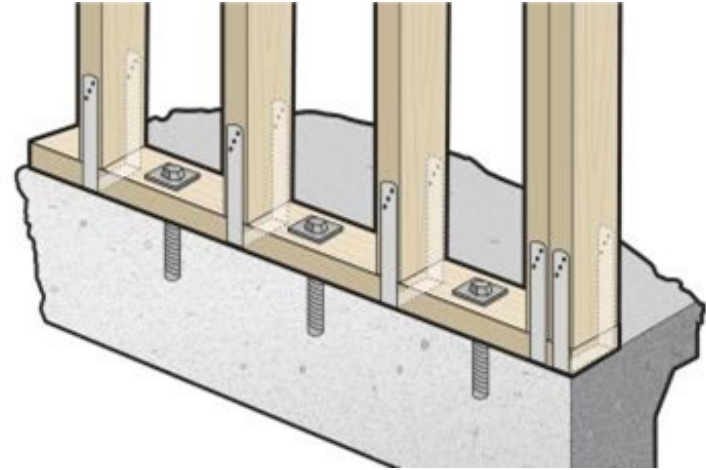


Example Retrofits – Extreme Wind



Roof connection strengthening

Source: Simpson Strong-Tie



Foundation attachment strengthening

Source: Simpson Strong-Tie



Example Retrofits – Extreme Wind



Opening protection (garage doors/windows)

Source: Raynor Garage Doors



Secondary waterproofing layer

Source: Tag & Stick



What Would Help You Do This? Enabling Initiatives

Examples

- *Homeowner's Guide: My Safe Florida Home Program* (Florida Department of Financial Services)

Resources

- Institute for Catastrophic Loss and Reduction's paper *Increasing High Wind Safety for Canadian Homes: A Foundational Document for Low-Rise Residential and Small Buildings*
- *Insurance Bureau Canada's Hurricane & Tropical Storms webpage*

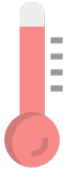




Retrofitting for Extreme Heat Resilience

The Hazard

Increased internal building temperatures



Increased external building temperatures



The Impacts

Threats to human health

The Options

Increase shading

Increase ventilation

Create and keep cool air in the building

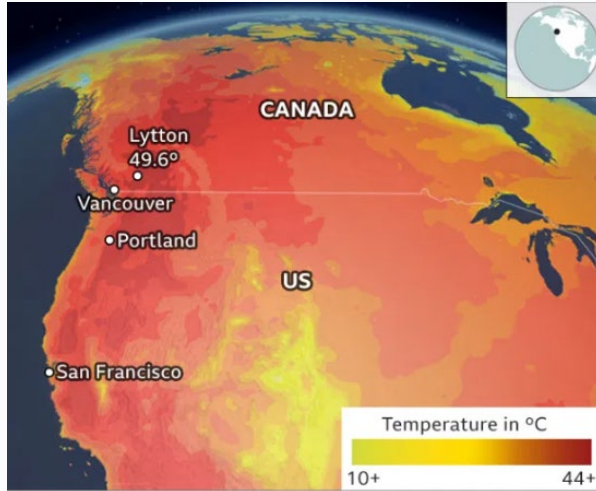


Use cooling roof and wall materials

Improve energy efficiency



Retrofitting for Extreme Heat Resilience



Source: BBC Weather

BBC

The Impacts

Threats to human health, energy consumption



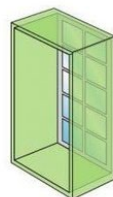


Example Retrofits – Extreme Heat

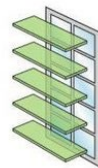


Green spaces/roofs

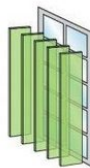
Source: World Economic Forum



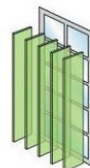
Recessed window



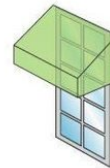
Horizontal fixed shade



Vertical movable shade



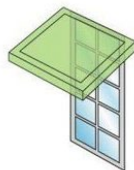
Vertical fixed shade



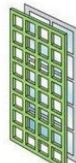
Awning



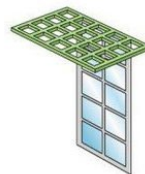
Exterior operable shade



Bahama shutter



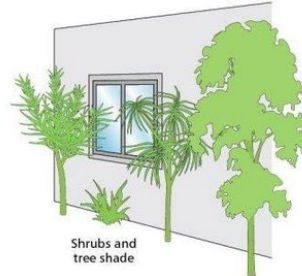
Trellis



Perforated horizontal overhang



Vegetation on window



Shrubs and tree shade

Window shading (interior or exterior)

Source: Al-Yasiri and Szabo (2021)



Example Retrofits – Extreme Heat



Increase airtightness

Source: EverLog Systems



Roof/attic insulation

Source: Fine home Building



What Would Help You Do This? Enabling Initiatives

Examples

- *Eco-Roof Incentive Program* (City of Toronto)

Resources

- BC Housing Research Centre's *Design Discussion Primer- Heat waves*
- FCM's *Climate Resilient Home adaptation tool*





Retrofitting for Wildfire Resilience

The Hazard

Fires entering buildings



Fires encroaching on buildings



Poor air quality



Fires caused by people



Fires caused by fallen powerlines



The Impacts

Damage to infrastructure, bad air quality, threats to human life and health

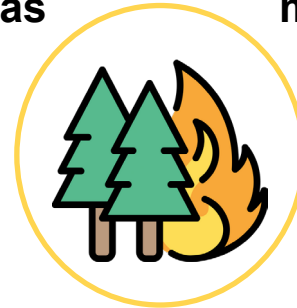
The Options

Watering natural areas

Forest management

Reduce openings where fires can enter buildings

Reducing use of flammable materials



Fire prevention strategies





Example Retrofits - Wildfires

Fire-suppressed Forest

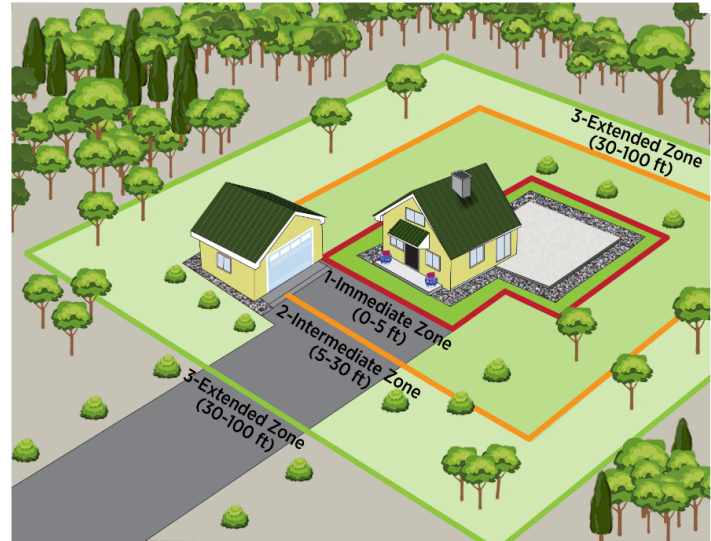


Ecologically managed Forest



Forest management

Source: The Nature Conservancy



1 - Immediate Zone (0 to 5 ft):
Install noncombustible ground cover. Use fire-resistant or noncombustible materials for decks, porches, railings, or fences that attach to the home.

2 - Intermediate Zone (5-30 ft):
Plant trees no closer than 30 feet to the home. Space tree crowns 18 feet apart or further on slopes. Trim branches up to 6 to 10 feet from ground and at least 10 feet from structures.

3 - Extended Zone (30-100 ft):
Remove vegetation next to outbuildings. For trees 30 to 60 feet from the home, space so mature canopies are at least 12 feet apart; for 60 to 100 feet from the home, space so tree canopies are at least 6 feet apart.

Defensible zone

Source: Energy.gov



What Would Help You Do This? Enabling Initiatives

Examples

- *Mi'kmaw Wildfire Resilience Initiative* (The Confederacy of Mainland Mi'kmaq)

Resources

- Government of Canada's *Get Prepared: Wildfires*
- City of Calgary provides a *Climate Ready Home Guide for Calgarians*





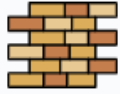
Retrofitting for Cold Weather Resilience

The Hazard

The Impacts

The Options

Weathering of masonry



Freezing pipes



Hail



Ice dams



Meltwater



Leaks, water damage, masonry damage, burst pipes, dents in roofs, broken windows, flooding

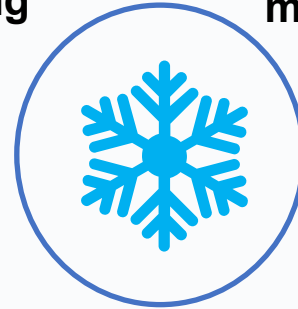
Keeping pipes above freezing

Keeping masonry dry

Removing roof temperature gradient

Flood adaptation strategies

Protecting roofs and windows from hail



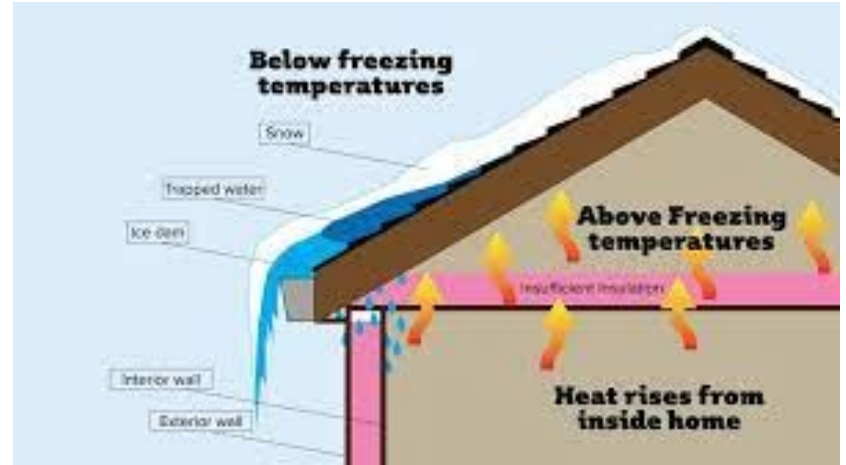


Example Retrofits – Extreme Cold



Protecting windows from hailstones

Source: Yahoo New Australia



Removing roof temperature gradient

Source: Disaster Response

What would help you do this? Enabling Initiatives

Examples

- *Frozen pipes-education campaign* (City of Toronto)

Resources

- FCM's *Climate Resilient Home adaptation tool*
- International Institute for Sustainable Development (ISSD) *Advancing the Climate Resilience of Canadian Infrastructure*



Retrofitting for Drought Resilience

The Hazard

Depleted soil
moisture



Dead
vegetation



Lack of
water in wells



The Impacts

People without water
access, damage to
ecosystems

The Options

Rain gardens



Water
efficiency
measures





Example Retrofits - Drought

Capture: A rain garden collects stormwater (rain and melted snow) that runs off your yard and driveway.



Filter: shallow depression has loose, deep soil that absorbs and naturally filters the runoff.

Less water: enters the storm system, which protects our creeks and rivers.

Rain gardens

Source: Toronto and Region Conservation Authority

Water-Saving Tips

- Protect water sources
- Skip bottled water
- Install water-saving fixtures
- Take shorter showers
- Review water bill to track usage
- Harvest your rainwater and greywater
- Turn off faucet when brushing teeth
- Maintain pipes to prevent leaks

Water efficiency measures

Source: Treehugger

What Would Help You Do This? Enabling Initiatives

Examples

- Pilot project: Water conservation, municipal project (Federal of Canadian Municipalities)

Resources

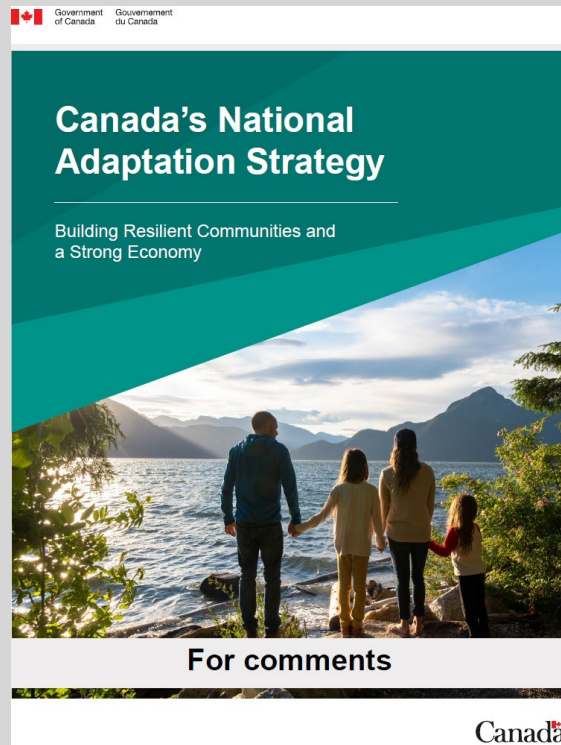
- Nova Scotia's "Saving Water in Your Neighbourhood" handout
- Rainwater harvesting at home brochure by CMHC



GOAL

*“Communities and all people living in Canada are better prepared to **prevent, mitigate, respond to, and recover** from the hazards, risks and consequences of **disasters linked to the changing climate**; the well-being and livelihoods of people living in Canada are better protected; and overall disaster risks have been reduced, particularly for vulnerable sectors, regions, and populations at greater risk.”*

CANADA'S FIRST NATIONAL ADAPTATION STRATEGY



YOUR TURN!

Type your answers in the chat or use Mentimeter!

1. What retrofits do you think would make the biggest impact in getting your community climate ready?
- 2. What is needed for the widespread adoption of resilient retrofits in your community?**

Join at [menti.com](https://www.menti.com) use code 15 52 99 1

Instructions

Go to

www.menti.com

Enter the code

15 52 99 1



Or use QR code

Q&A PERIOD

