



Institute for Catastrophic
Loss Reduction

Building resilient communities

Institut de Prévention
des Sinistres Catastrophiques

Construction de résilient communities

Catastrophic loss trends in Canada

Glenn McGillivray
Managing Director

Institute for Catastrophic Loss Reduction
June 22, 2017



ICLR



- Mission - reduce loss of life and property caused by severe weather and earthquakes
- Created in 1997 by the insurance community to confront rising disaster losses
- Multi-disciplinary research and education provides an essential foundation for 'science to action'
- 30 scientists / 100+ students / 12+ universities / 350+ research papers / \$50+ million in research
- Western University affiliated

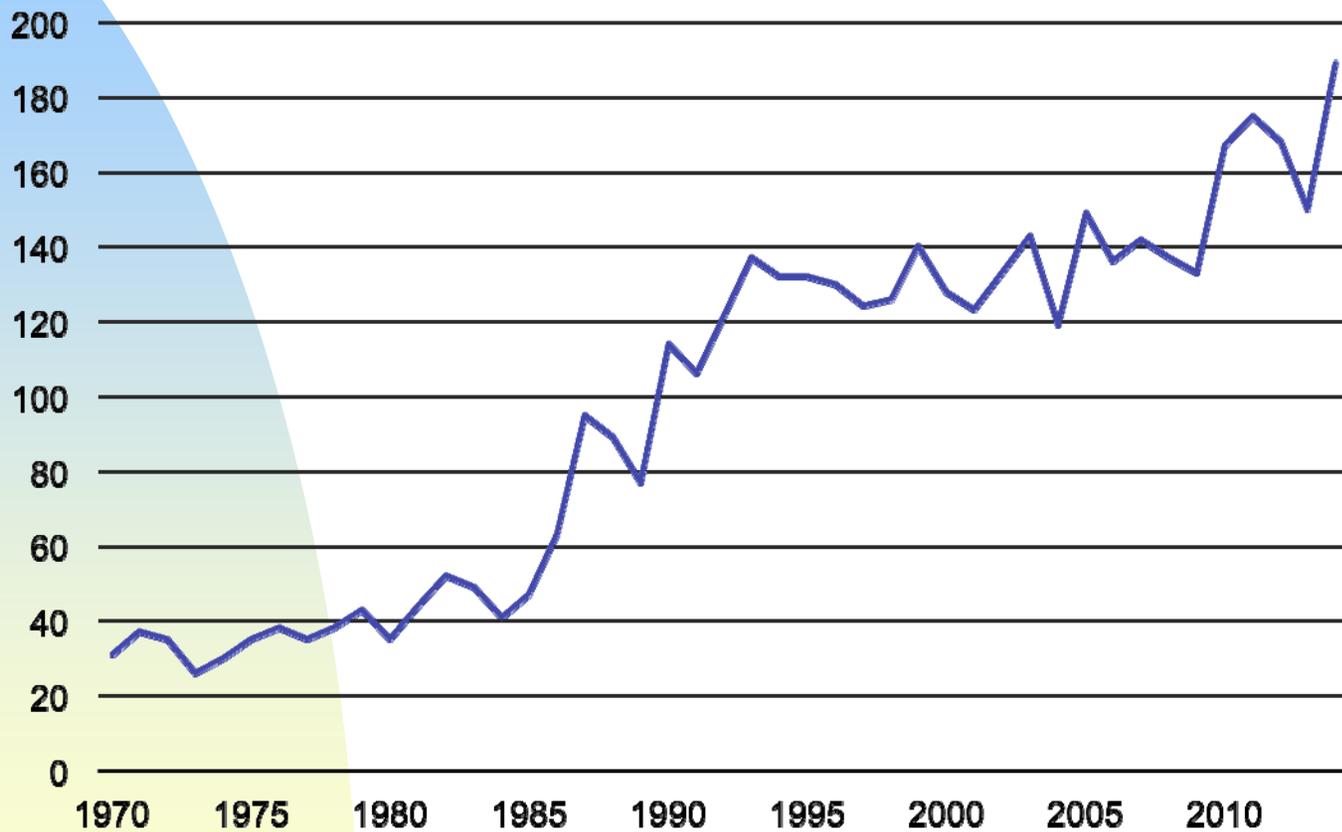
In the media



Considerations

- Disasters are a growing threat
- Losses are rising. Why?
- What can be done about it?

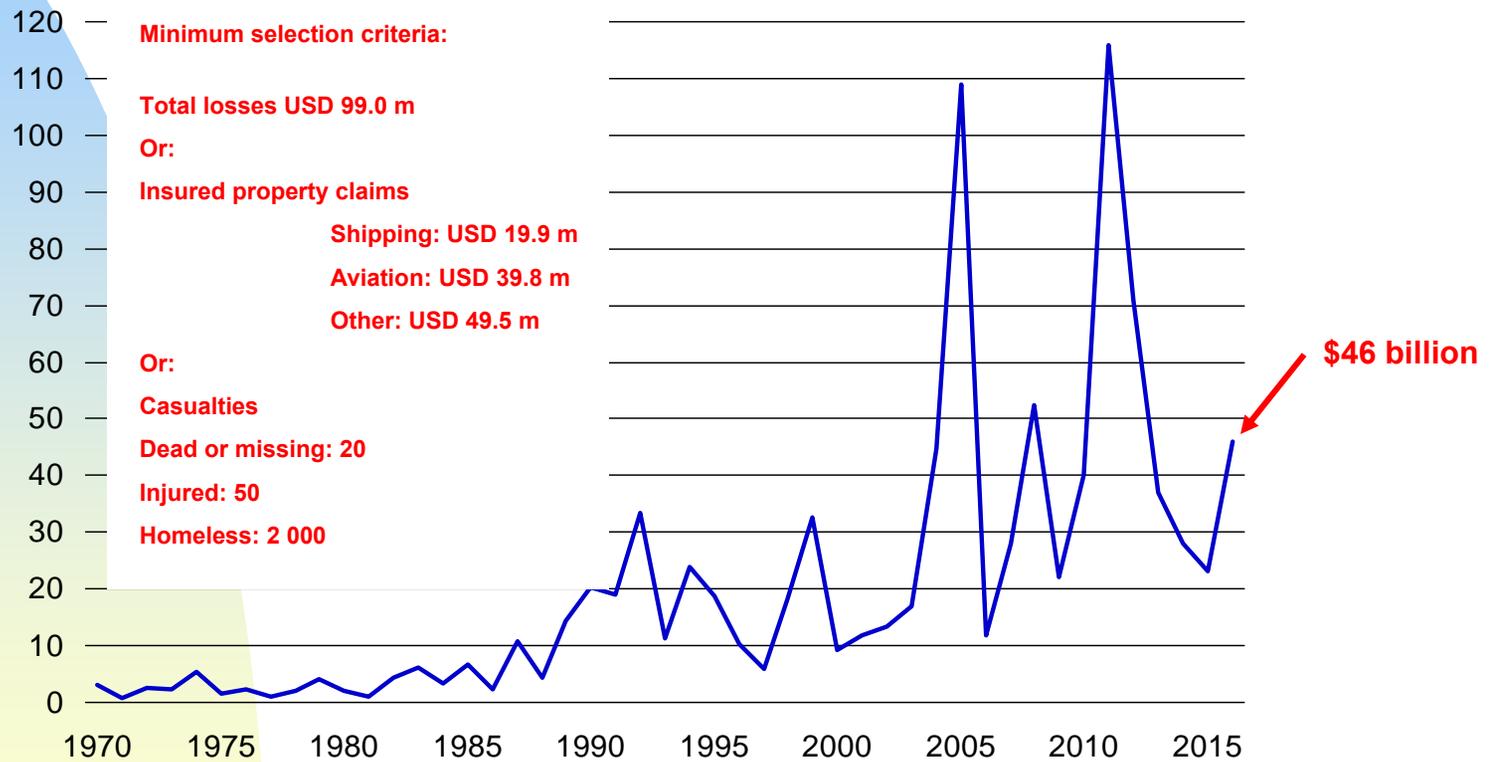
Number of cat. events 1970-2016



Source: Swiss Re, sigma

Insured losses 1970-2016

USD billion at 2005 prices



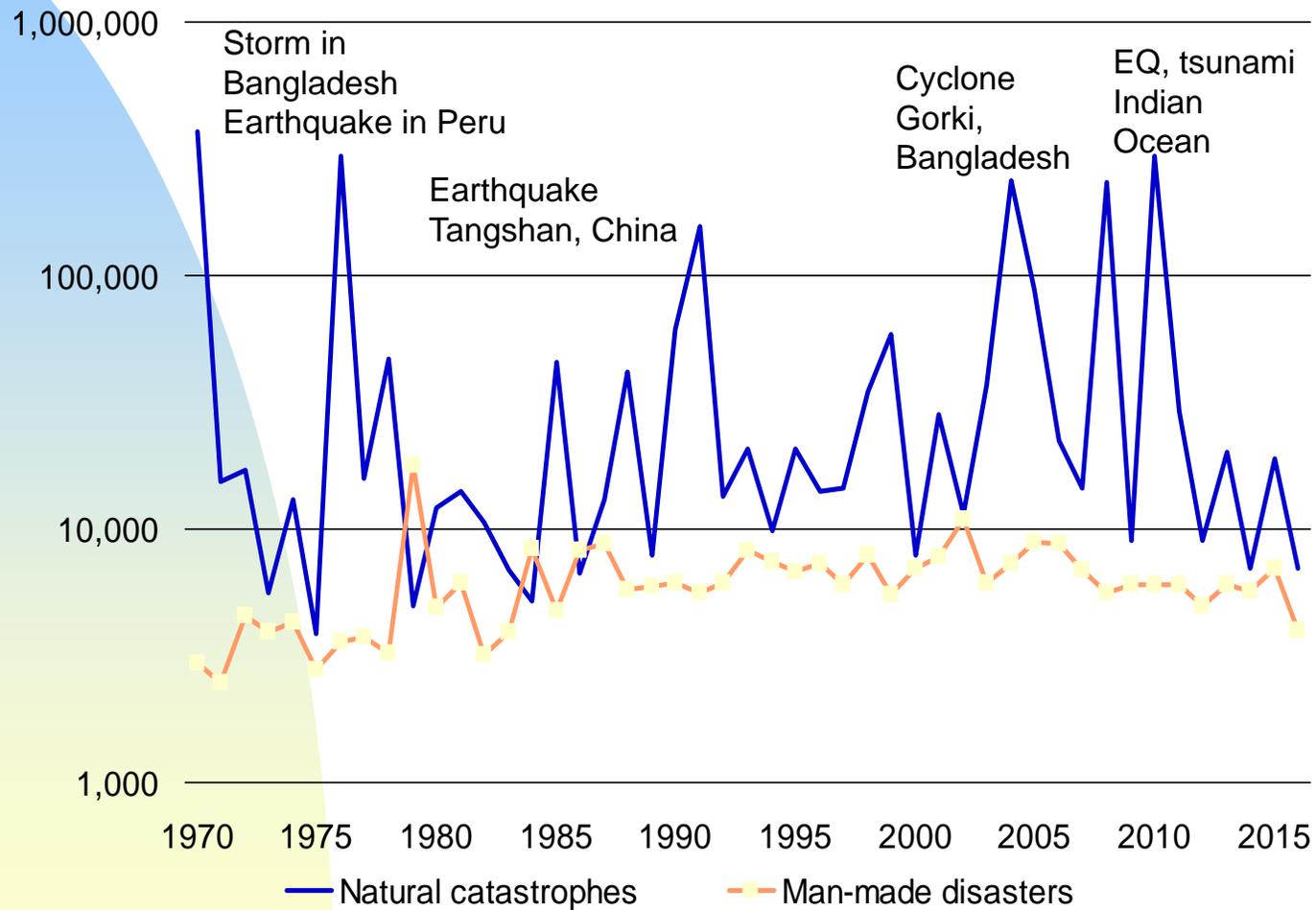
Source: Swiss Re, sigma

Insured losses by peril

Number of loss events 1980-2016



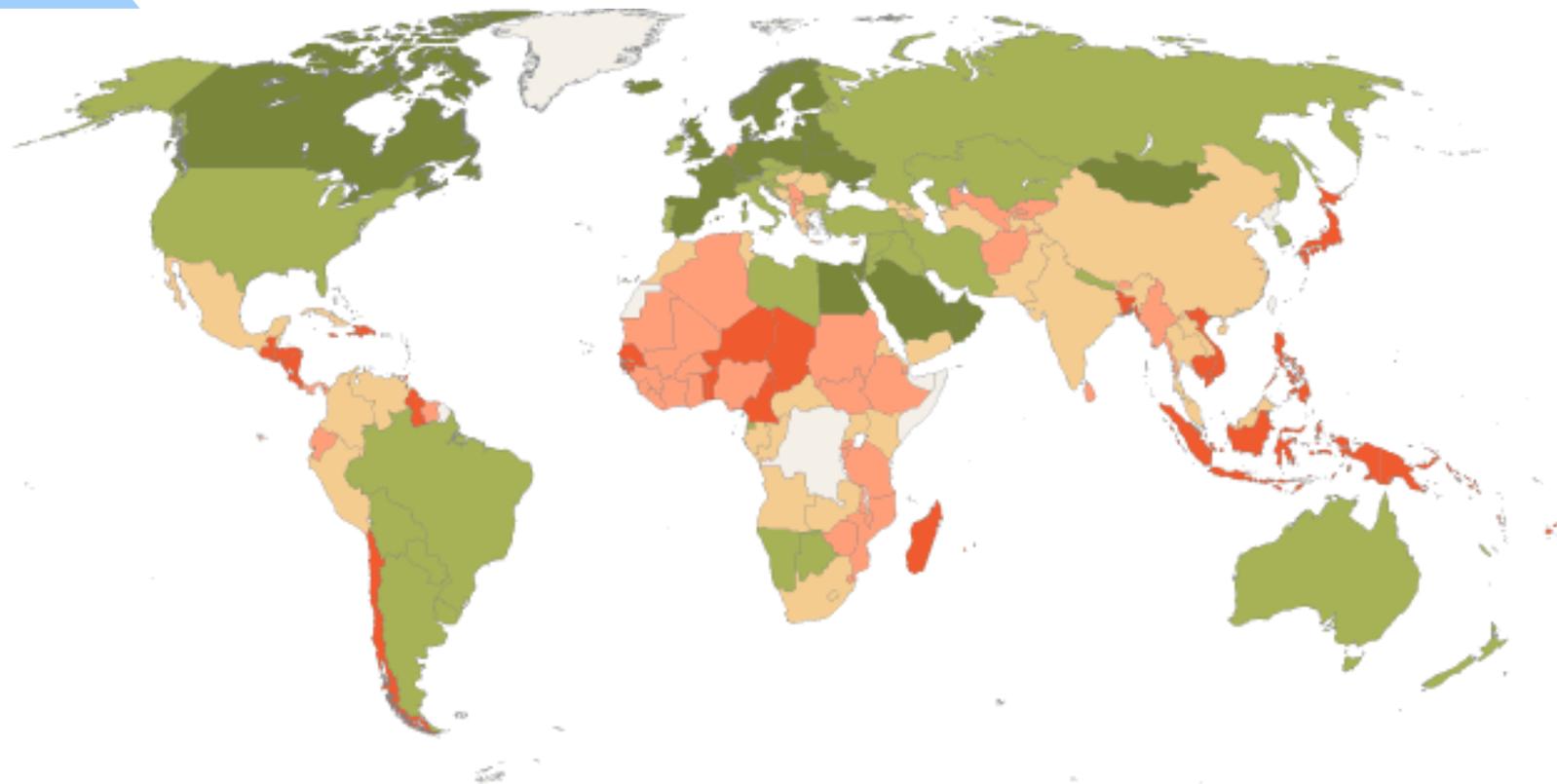
Number of victims 1970-2016



Left hand scale: logarithmic. Source: Swiss Re, sigma No 2/2006

Canadian catastrophes

World risk index



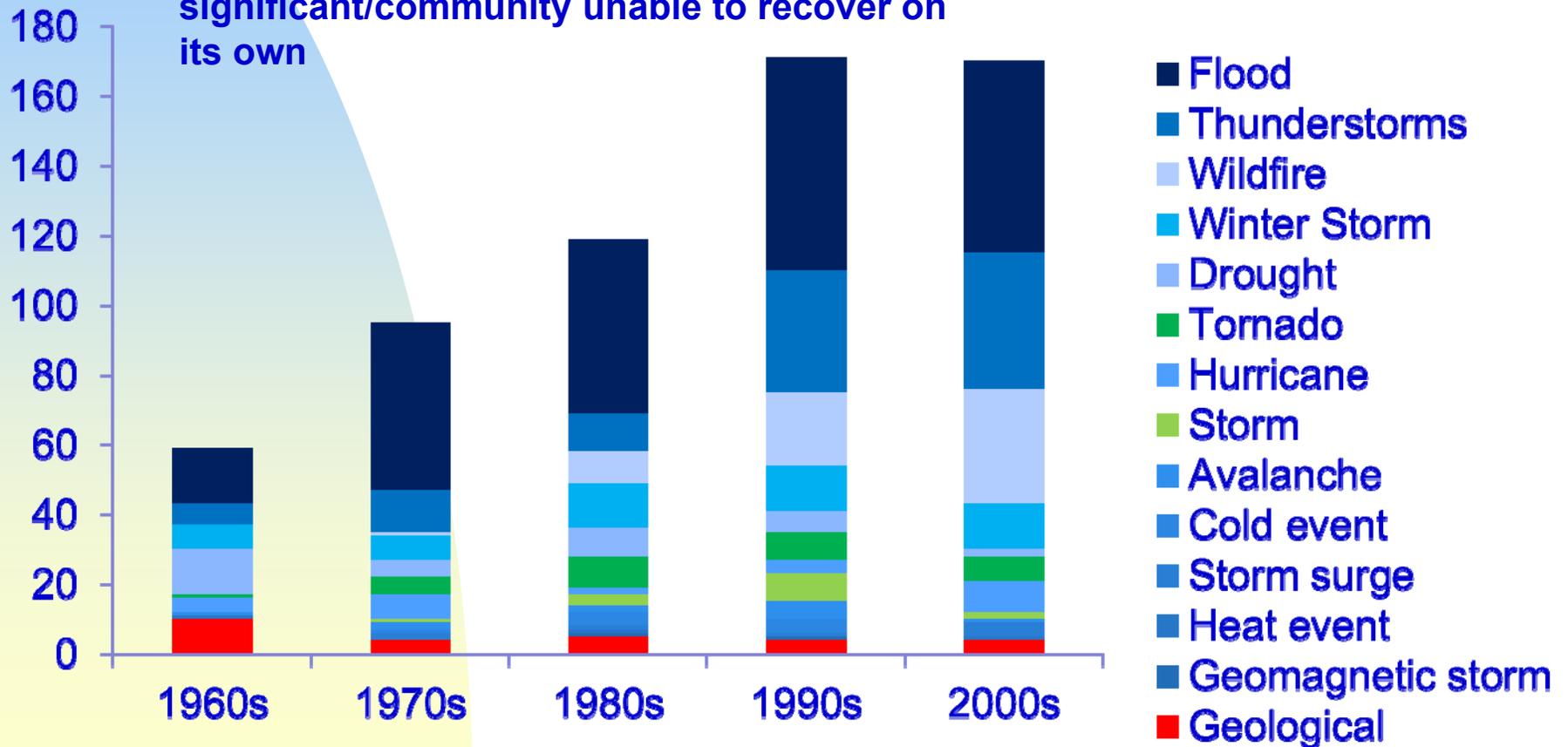
VERY LOW	0,10 – 3,65 %	HIGH	7,45 – 10,58 %
LOW	3,66 – 5,72 %	VERY HIGH	10,59 – 36,31 %
MEDIUM	5,73 – 7,44 %	NO DATA AVAILABLE	

MAX. RISK = 100%

Classification according to the quantile method

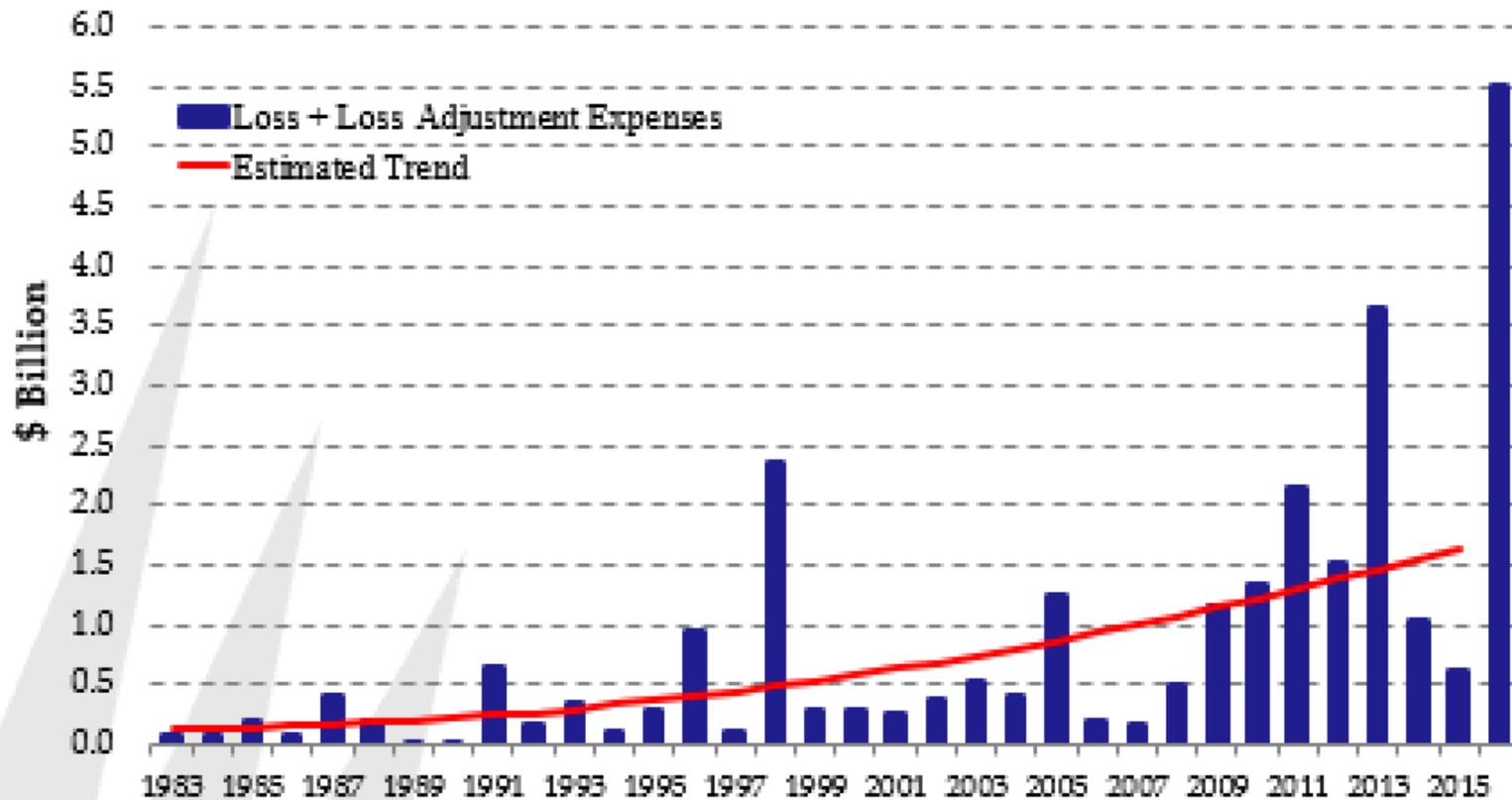
Canadian catastrophes

10 killed/100 evacuated/community assistance required/historically significant/community unable to recover on its own



Based on data from the Canadian Disaster Database, Public Safety Canada

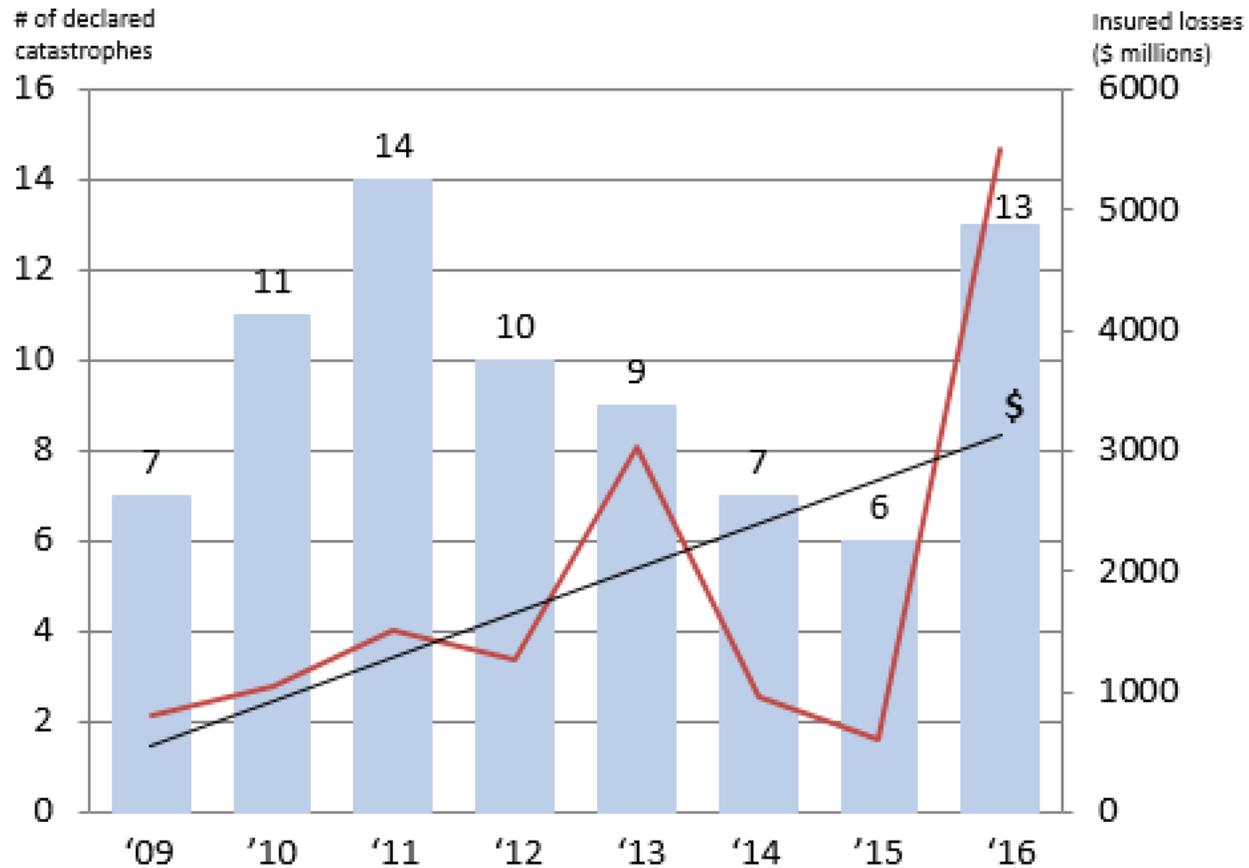
Canadian disaster damage



1983 to 2008 = \$400m average

2009 to 2013 = \$1b average

Frequency & Severity



Catastrophe = event of \geq \$25 million in insurance claims

Data: Catastrophe Indices and Quantification Inc. (CatIQ Inc.)

Canadian cats 2009

- Winter storms in eastern Canada (Feb. 2)
 - ◆ **\$25 million**
- Hamilton rain (July 26)
 - ◆ **\$100- to \$150 million**
- Alberta wind etc. (August 2-3)
 - ◆ **\$500 million**
- Mont Laurier tornado (August 4)
 - ◆ **\$6 million**
- Manitoba hail etc. (August 13-15)
 - ◆ **\$50- to \$75 million**
- Ontario tornadoes (August 20)
 - ◆ **\$50- to \$100 million**
- Tropical storms Bill & Danny (August 23 & 29)
 - ◆ **\$10 & 25 million**

Source: Aon Benfield (Canada)

Canadian cats 2010

- Saskatchewan storms (Spring)
- Leamington & Harrow tornadoes (June 6)
- Midland tornado (June 23)
- Calgary hailstorm (July 12)
 - ◆ **>\$400 million**
- Hurricane Igor (September 21)

Canadian cats 2011

- Storms in Ontario & Quebec (March)
- Storms in Ontario & Quebec (April)
- Wildfire in Slave Lake, Alberta (May 15)
 - ◆ **\$700 million**
- Flooding in Saskatchewan, Manitoba, Quebec (Spring)
- Hail, tornadoes and wind in Alberta, Man. & Sask. (July 18/19)
- Tornado in Goderich (August 21)
- Hurricane Irene (August 28 to 30)
- Alberta windstorm (November 27)

Canadian cats 2012

- Flooding and wind in Ontario and Quebec (May 26 to 29)
- Flooding, wind and hail in Alberta (July 12)
- Flooding, wind and hail in Ontario (July 23)
- Hail and wind in Alberta (July 26)
- Flooding, wind and hail in Alberta (August 12)

Canadian cats 2013

- Two small events early in the year
- Southern Alberta flood (June 19-21)
 - ◆ **\$1.7 billion**
- GTA flood (July 8-9)
 - ◆ **\$940 million**
- Ontario/Quebec storm (July 19)
- Ontario/Quebec/Atlantic ice storm (December 22-26)
 - ◆ **\$200+ million**

High River, Alberta





© 2013 Reuters/Andy Clark

Trans-Canada Highway, Alberta



Calgary, Alberta

An aerial photograph of Calgary, Alberta, Canada, showing extensive flooding. The city's downtown skyline is visible in the upper center, with numerous high-rise buildings. The surrounding residential and commercial areas are heavily inundated with brown, muddy floodwater. A large, white, dome-shaped structure, likely a sports arena, is partially submerged in the lower center. The floodwater has surrounded many buildings and streets, leaving only rooftops and some trees visible above the water level. The sky is clear and blue, and the overall scene depicts a major natural disaster.

**>\$1.7 billion insured
damage**

Toronto, Ontario





© 2013 AP Photo/The Canadian Press, Frank Gunn



A photograph of a car driving through deep floodwaters at night. The car's headlights are on, illuminating the water. The car is positioned in the center of the frame, moving away from the viewer. The water is dark, and the car's lights create a bright path through the water. A dark, diagonal line, possibly a road divider or a shadow, runs across the water from the top right towards the bottom right.

**>\$940 million insured
damage**

A photograph showing a large, thick tree branch that has fallen onto a dark-colored car. The car is partially obscured by the branch and is parked on a street. In the background, there are houses with lit windows, suggesting a residential neighborhood. The scene is set in winter, as the trees are bare and there is snow on the ground.

Toronto, Ontario

**\$225 million
insured damage**

2013 high water marks

- Canada's costliest and third costliest insured loss events within two weeks of each other
- Ice storm now the second costliest – took 15 years!
- Two billion dollar natural catastrophes in one year – a first!
- Second place event (Slave Lake) fell not one, but two notches to fourth place
- 5th consecutive year of billion-dollar events

Canadian cats 2014

- Angus tornado (June 17)
 - ◆ >\$30 million
- Saskatchewan & Manitoba storms (June 28)
- Ontario storms/Burlington flood (August 4)
 - ◆ \$90 million
- Alberta wind & thunderstorms (August 7 & 8)
 - ◆ \$500+ million
- Ontario/Quebec windstorm (November 24)
 - ◆ \$880 million

Burlington, Ontario

■ August 4, 2014

**\$90 million
insured damage**

Aidrie, Alberta hailstorm

**>\$500 million
insured damage**



Canadian cats 2015

- Alberta/Saskatchewan storm (June 11 & 12)
 - ◆ \$55 million
- Alberta/Saskatchewan storm (July 21 & 22)
 - ◆ \$235 million
- Alberta storm (August 4 & 5)
 - ◆ \$100 million
- \$510 million

Canadian cats 2016

- Fort McMurray wildfire (May 1)
 - ◆ More than the 2013 flood and 1998 ice storm combined
 - ☞ Currently \$3.7 billion insured
 - ◆ 12 other 'catastrophes' declared in 2016
 - ☞ Six catastrophes involved Alberta
 - ☞ Nine featured hail
 - ◆ \$5.3 billion insured

Windsor, Canada

September 28 & 29, 2016

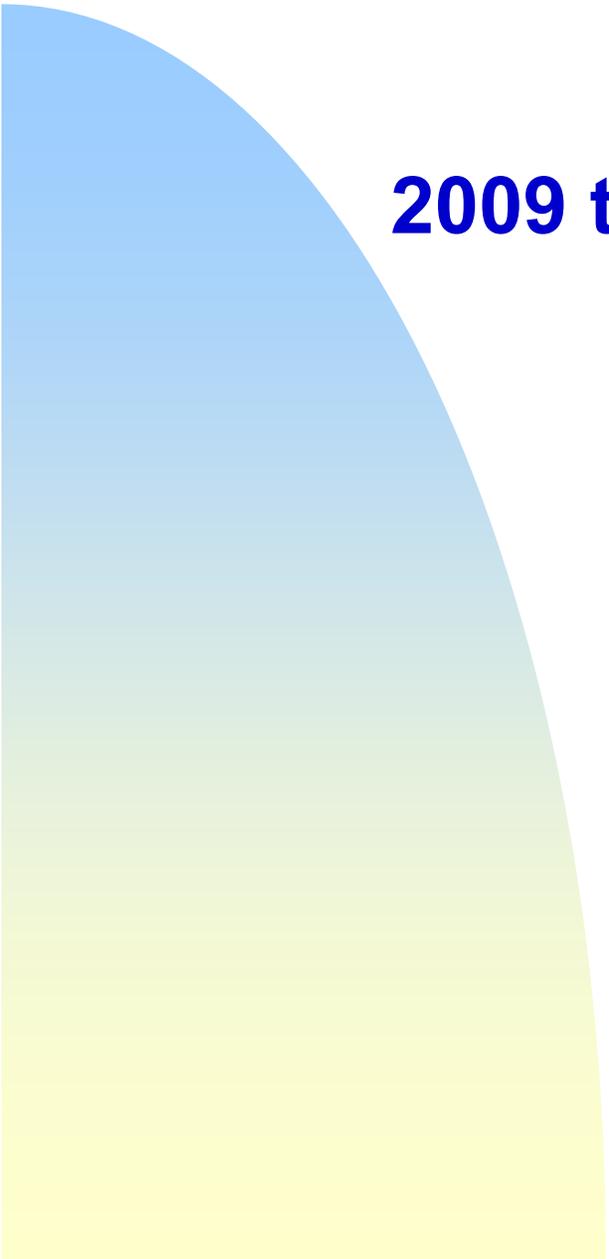
>\$108 million insured damage

Sydney, NS, Canada

October 10, 2016

>\$100 million insured damage





2009 to 2016 (y-to-d) inclusive

**\$14.2
billion**

Billion-dollar years

- 1998 – due solely to the ice storm
- 2005 – due greatly to the August 19 GTA rainstorm
- 2009 – due greatly to back-to-back windstorms in Alberta
- 2010 – due greatly to large hailstorm in Alberta
- 2011 – due greatly to Slave Lake wildfire
- 2012 – due greatly to one large and two smaller hailstorms in Alberta
- 2013 – due to the Southern Alberta flood and GTA flood
 - First time ever for two billion-dollar events
- 2014 – Due largely to the Aidrie hailstorm
- 2016 – Due almost entirely to Fort McMurray

New normal

“The Institute for Catastrophic Loss Reduction (ICLR) reports that large insured losses from extreme weather appear to be ‘the new normal’ for the Canadian insurance industry, expecting that large-loss years will no longer be rarities.”

Canadian Underwriter (November 6, 2012)

A national problem...

"The rising cost of natural disasters and the financial burden on Ottawa is the country's biggest public safety risk"...

Public Safety Canada, 2013/14, Report on Plans and Priorities

Why are losses rising?

- More people and property at risk
- Aging infrastructure
- The climate is changing

Increasing values in exposed areas

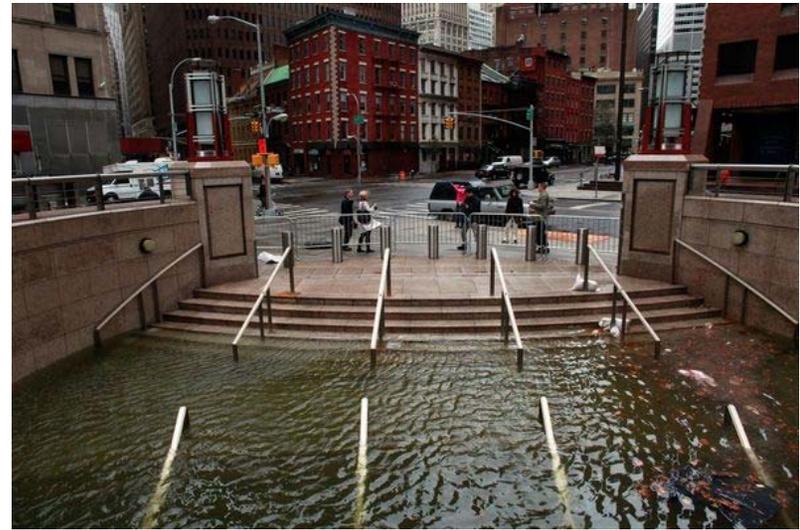


Ocean Drive, FL, 1926.



Ocean Drive, FL, 2000.

The number of residents in Florida increased by 70% between 1980 and 2001. In the same period, the state's gross domestic product soared by 130%.











Infrastructure spending

Chart 4.5

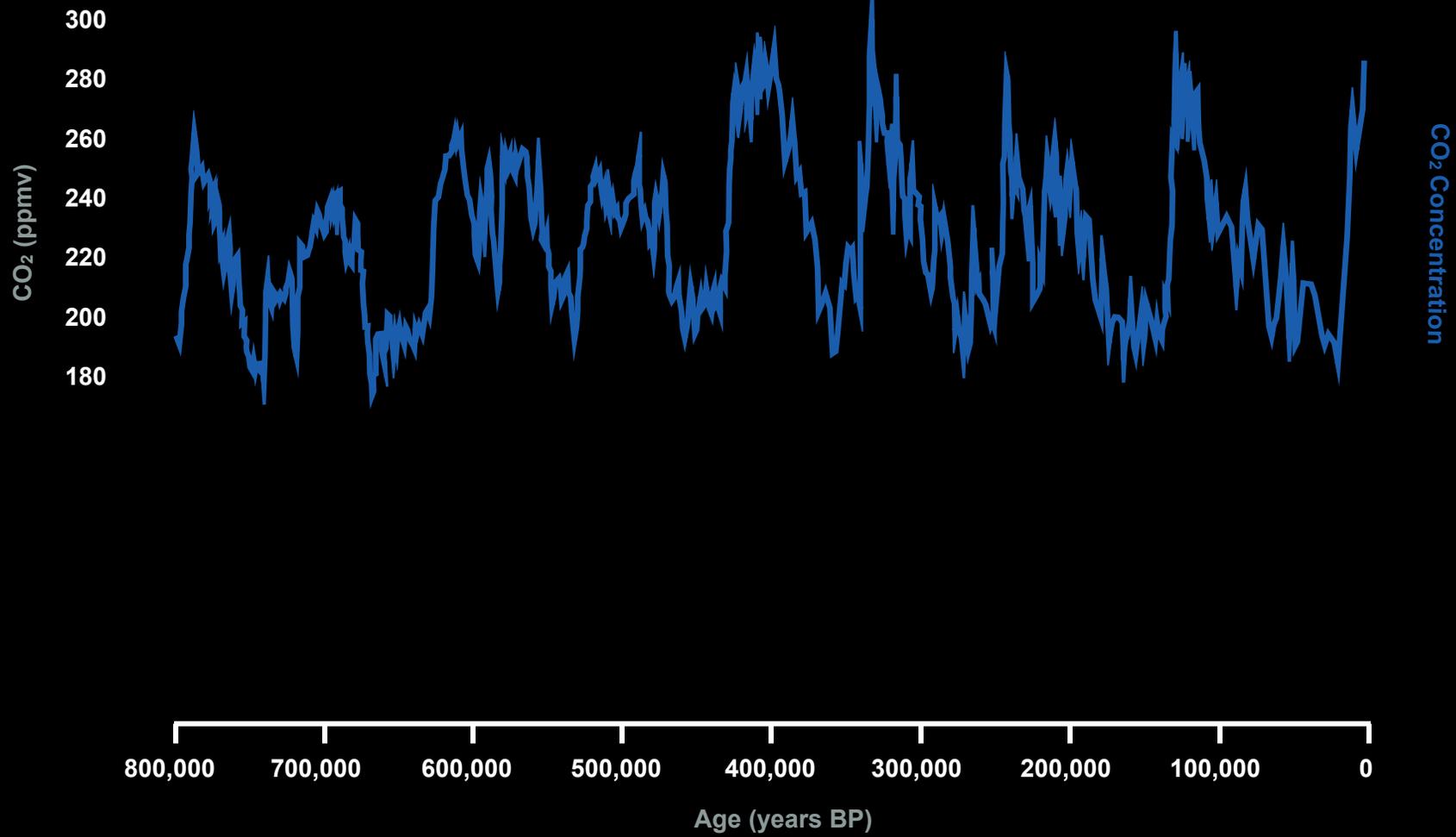
Investment in Public Infrastructure Has Been Declining as a Percentage of GDP



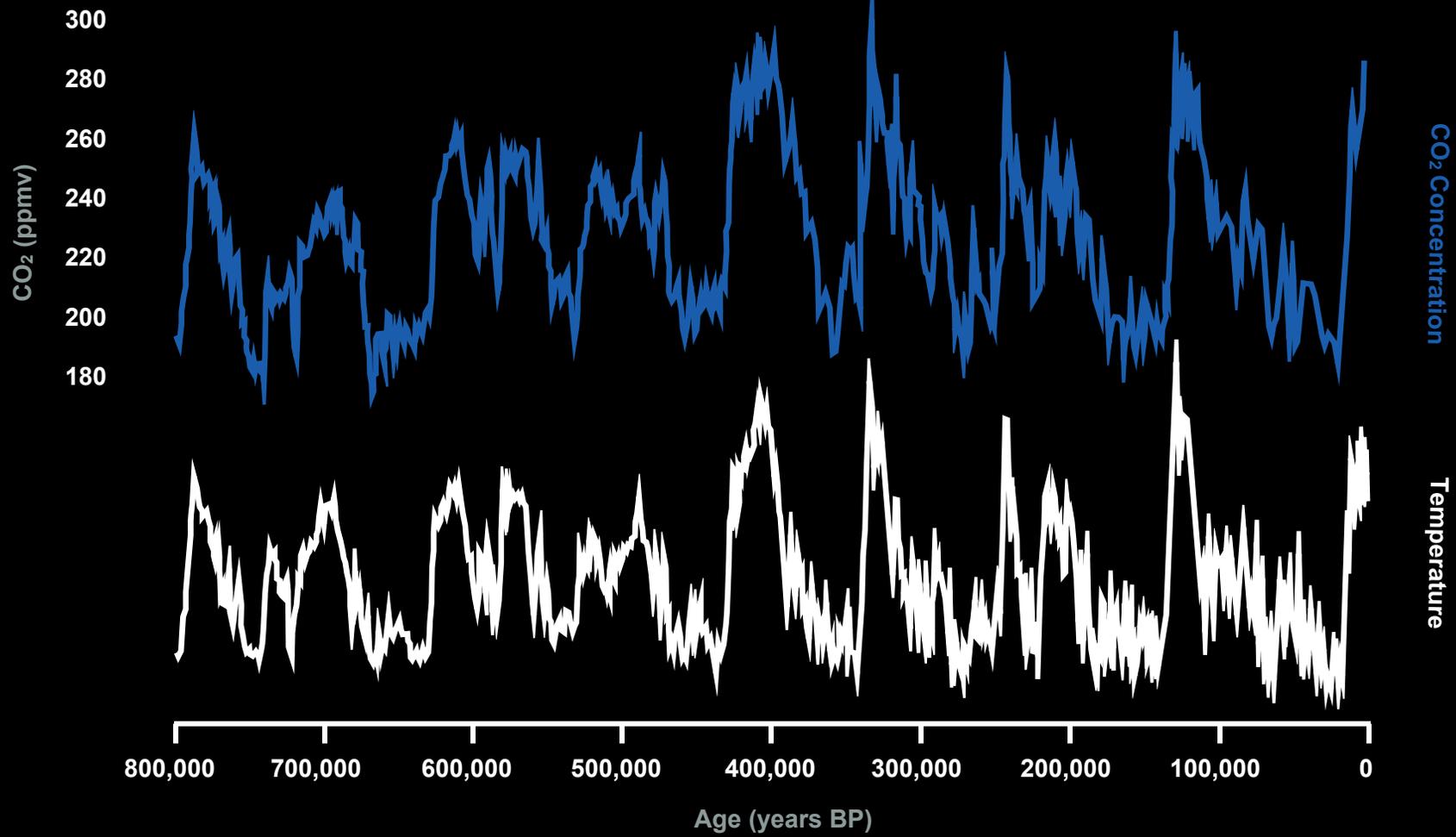
Note: Infrastructure is defined as fixed non-residential building and engineering construction of federal, provincial, territorial and local public administrations.

Source: Department of Finance Canada.

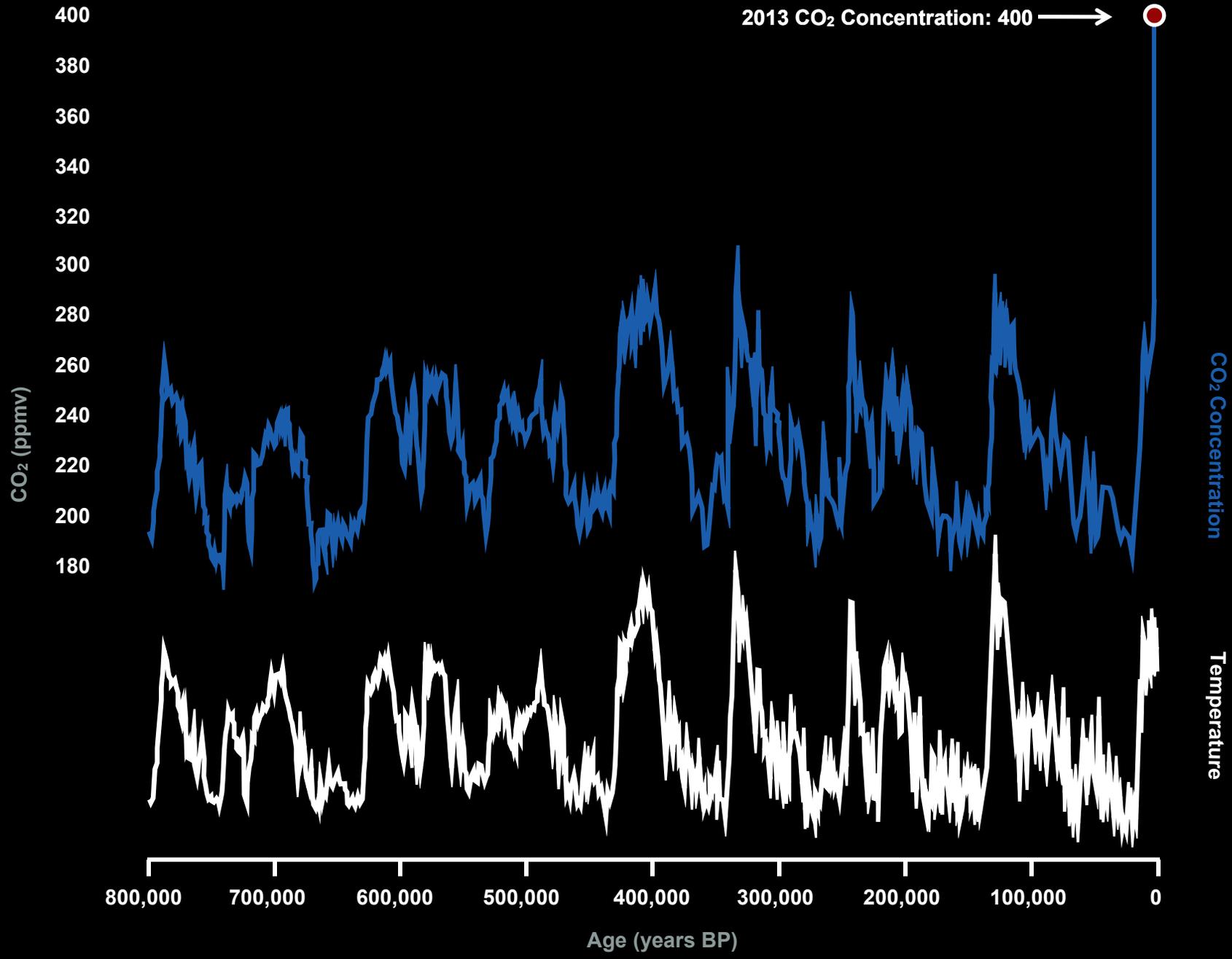




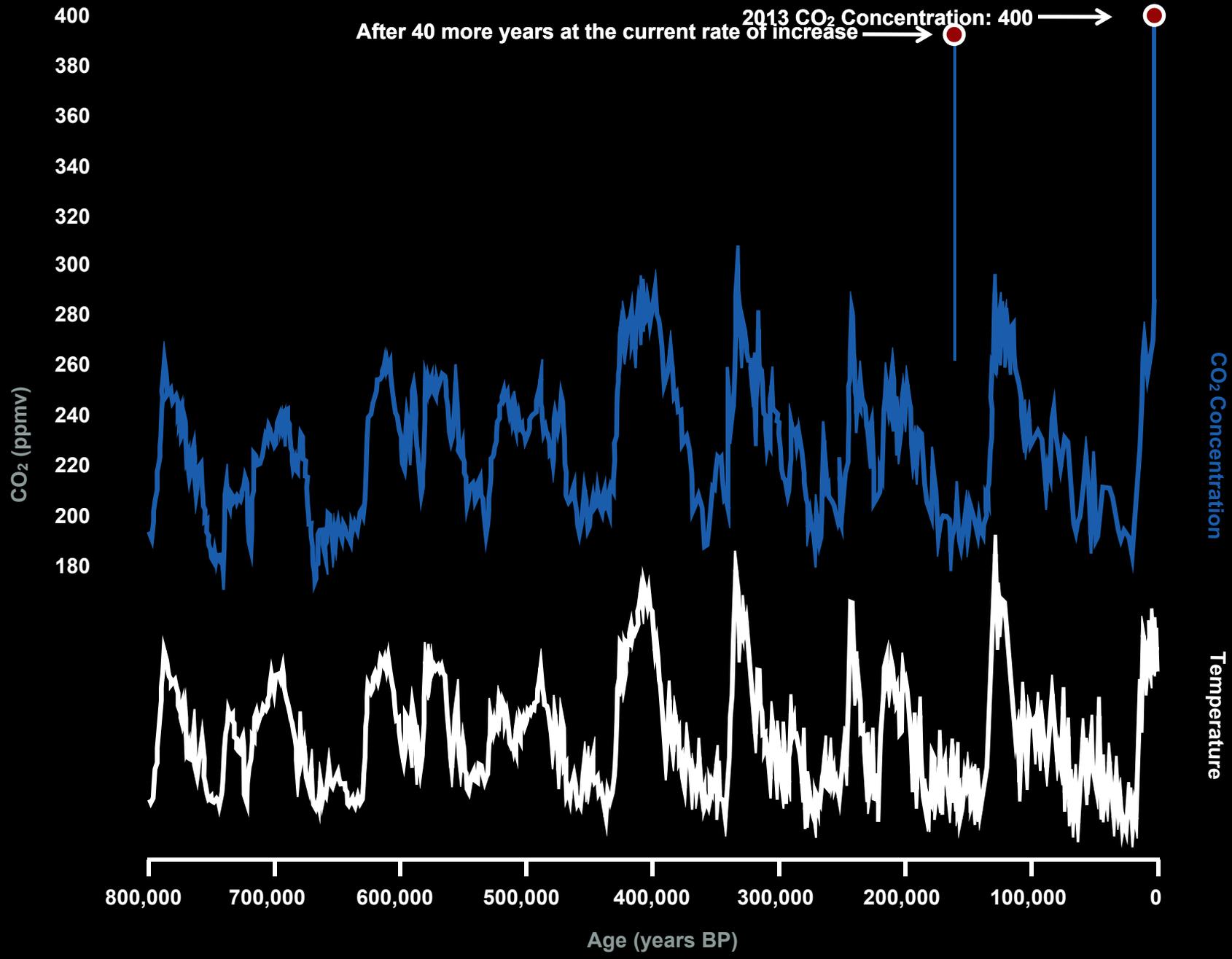
Source: National Climatic Data Center, NOAA



Source: National Climatic Data Center, NOAA



Source: National Climatic Data Center, NOAA



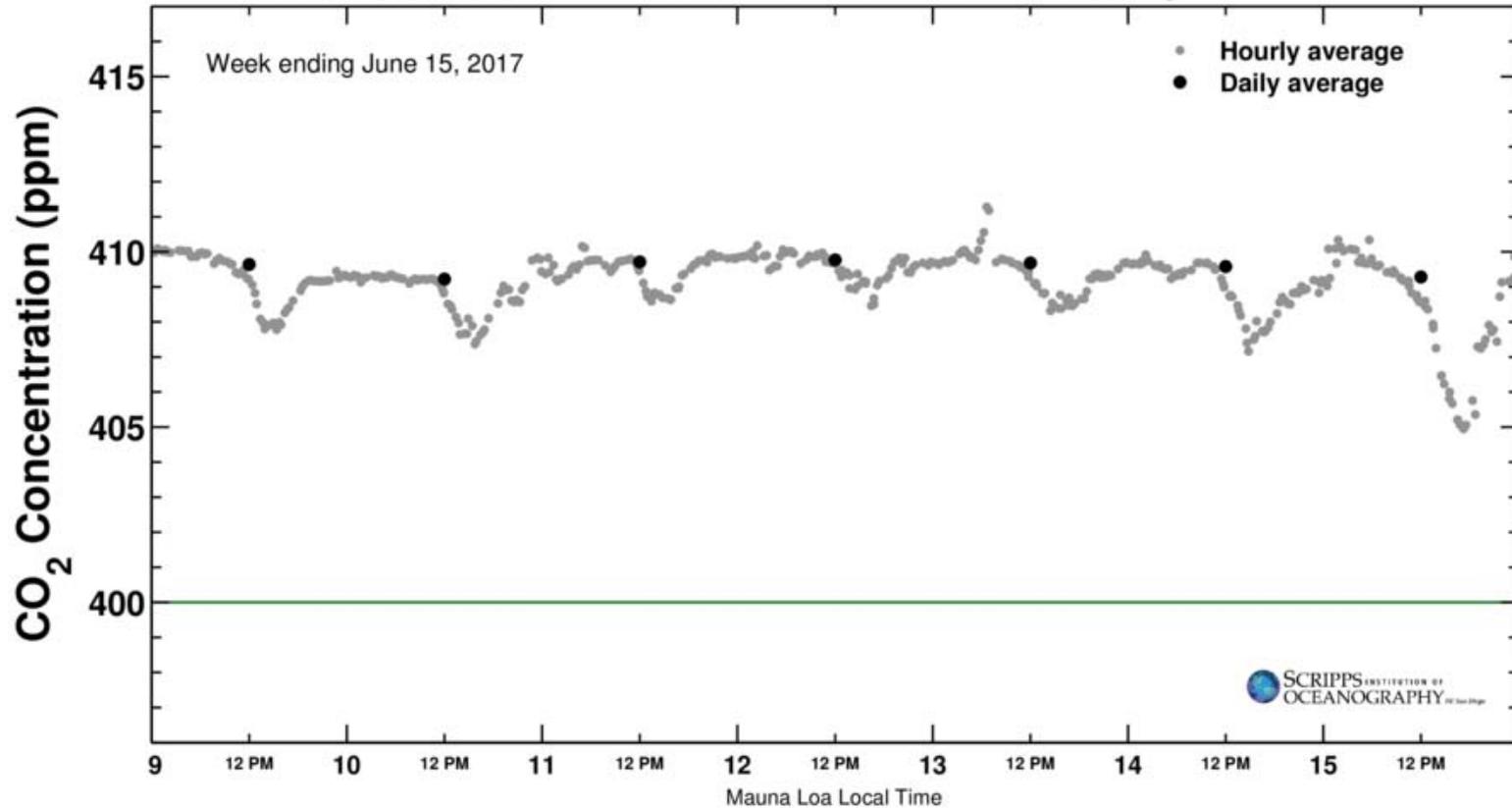
Source: National Climatic Data Center, NOAA

Keeling Curve @Keeling_curve

Latest CO₂ reading
June 15, 2017

409.28 ppm

Carbon dioxide concentration at Mauna Loa Observatory



What can be done?

- Loss prevention
- Risk transfer

Loss prevention

- Structural measures
- Non-structural measures
- Public awareness

Five-year plan

- Promote best practices to enhance the resilience of **existing homes** to damage from natural hazards
- Work with builders and others to champion resilient design and construction of **new homes**
- Partner with municipalities to advance homeowner **basement flood** risk reduction efforts

Hazard research

- Concentration on five main hazard areas
 - ◆ Wildfire
 - ◆ Earthquake
 - ◆ Wind
 - ◆ Hail
 - ◆ Water

Wildfire

- Only two costly wildfires in recent Canadian memory
- Difficult to get insurers' attention on the risk
- But it is a growing concern
 - ◆ Forest Service cutbacks and downscaling of science
 - ◆ Aging wildfire fighting equipment
 - ◆ Climate change
 - ◆ More people and assets in the Wildland/Urban interface
 - ☞ Bringing an urban attitude toward wildland fire

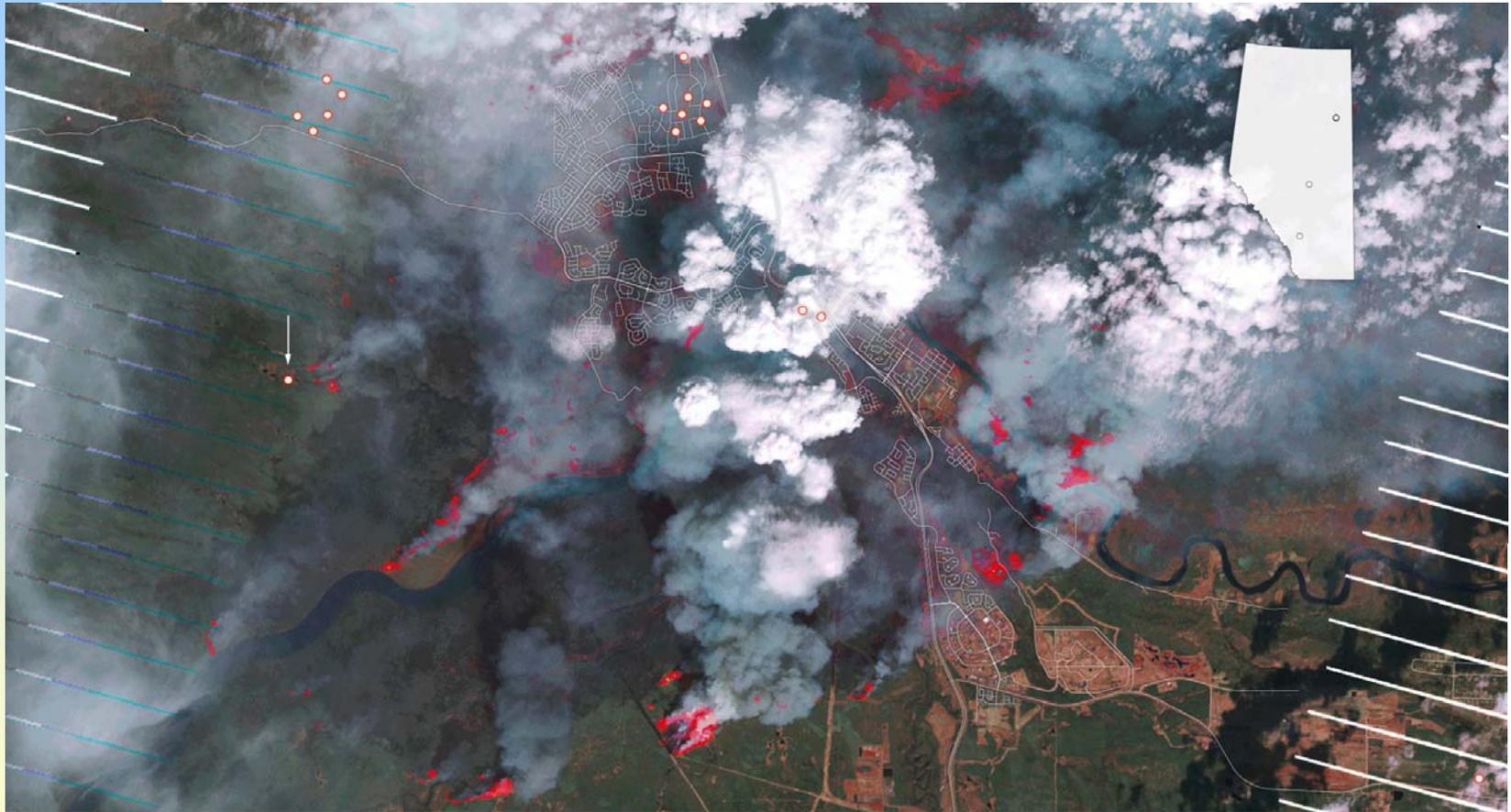
Wildfire

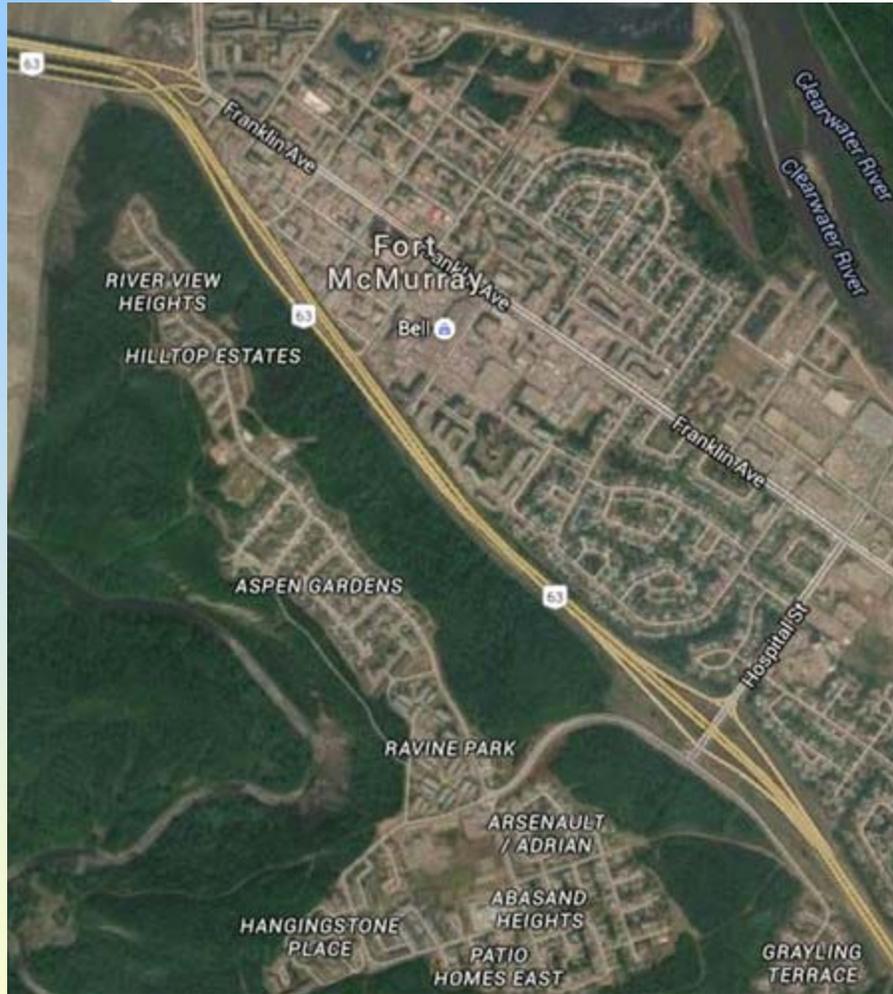
- Two main ways of addressing the risk in an institutionalized manner
 - ◆ Planning legislation
 - ◆ Building code
- Planning – where we allow construction
- Building code changes would have to relate to
 - ◆ Roofing materials (eg. No untreated wood shakes)
 - ◆ Siding materials (eg. AB requirement for fire resistant ply-board under vinyl siding on side exposures)
 - ◆ Building materials for decks etc
 - ◆ Venting grate size

And then 'everything' changed...

- Horse River Wildfire (May 3-19, 2016)
- Fort McMurray, Alberta
- Human caused (likely accidental)
- ~2,400 structures lost (approx 10% of town)
- ~45,000 claims filed
- Insured damage estimate \$3.58b (has since been adjusted upward)
 - ◆ Largest insured loss in Canadian history
 - ◆ Included in the Top 50 costliest insured catastrophe losses of all time

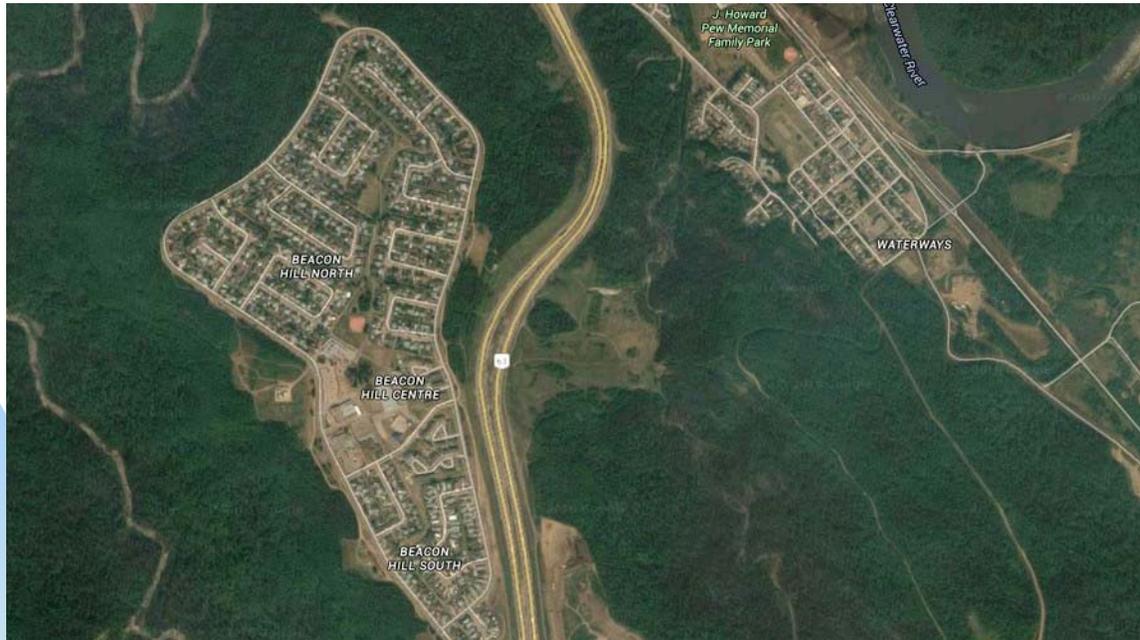
Fort McMurray













Why do homes ignite?

- ‘Why some homes survived: Learning from the Fort McMurray wildfire disaster’
- Why did some homes survive this wildland/urban interface disaster with little or no damage, while others were vulnerable to ignition and destroyed?
- “...wind-driven embers were the most probable cause for the majority of early home ignitions...”
- Preliminary findings at www.iclr.org
- Final report due out in 4Q



Why do homes ignite?



[Photo Credits: Bill Bereska]



[John Gibbins/U-T San Diego/ZUMA Press]

Why do homes ignite?

- Not all homes with key vulnerabilities (eg. vinyl siding) ignited
- Positive structural features and absence or low levels of combustibles (eg. vegetation) can prevent ignition by embers



Why do homes ignite?

- Old stucco siding beneath new vinyl siding, fire resistant asphalt roofing and landscaping choices were key reasons for survival of this home



Why do homes ignite?

- Long-lasting sources of intense heat frequently lead to ignition of adjacent structures
- Firewood pile beside wooden shed next to home



Why do homes ignite?

- High correlation between home destruction and the presence of easily ignited, highly combustible shrubbery (eg. juniper, cedars) located in close proximity to decks and balconies



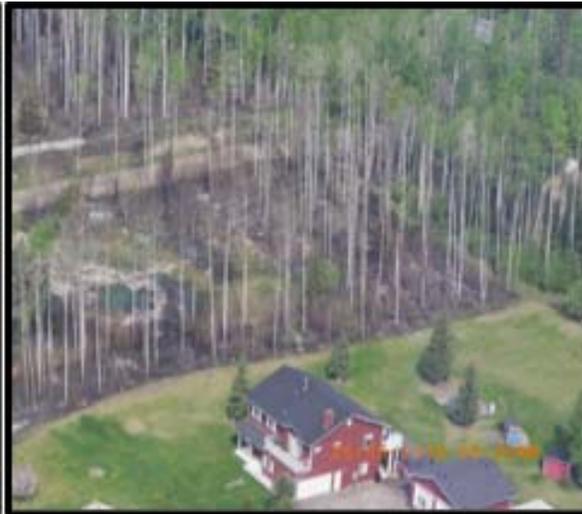
Why do homes ignite?

- Combustible ground covers allowed fire to spread into contact with homes, while non-combustible ground covers blocked fire pathways



Why do homes ignite?

- Some owners thinned forest/reduced fuel, others did not (Saprae Creek Estates)



Why do homes ignite?

- Homes that adopted FireSmart survived much more frequently
- Home survival is not random or a matter of luck. FireSmart works
- Home survival depends on conditions in the home ignition zone, for which homeowners are responsible
- While total hazard rating is important, a single critical weakness can lead to home loss

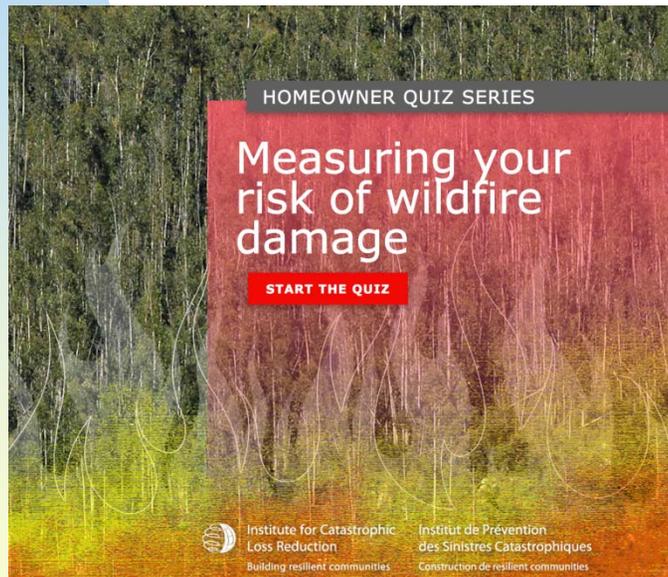


Creating defensible space



Wildfire

- As with all hazards, risk and mitigation communication to stakeholders is crucial

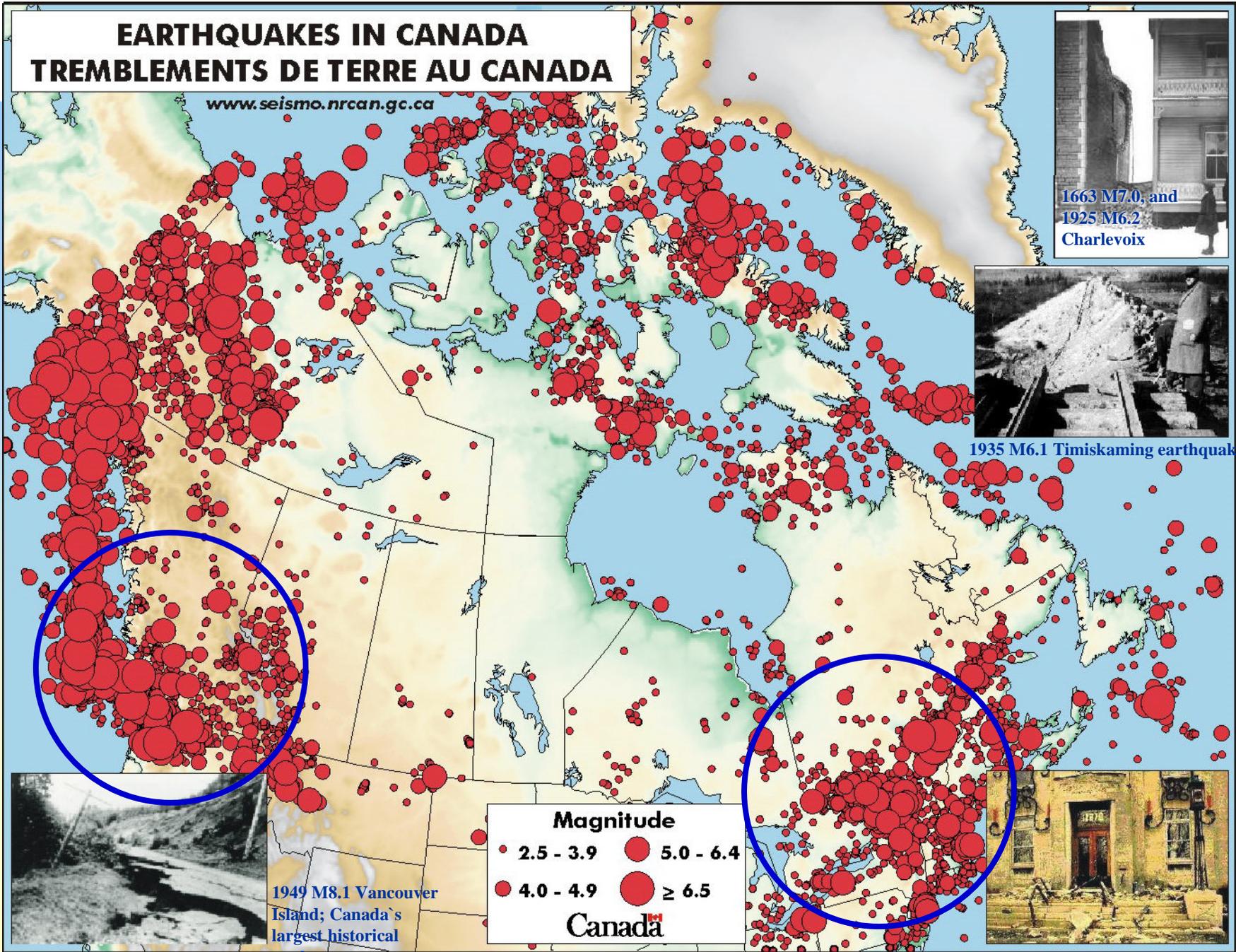


Earthquake

- 3,000 to 4,500 earthquakes a year, most undetectable without instruments
- A 'felt' earthquake occurs about once a week
- Primary concern for the insurance industry (west coast and the Ottawa/Montreal corridor)
- When (not if) a major earthquake strikes the west coast, damage will likely be severe
- Damaging quakes occur decades apart, major events on the west coast every 500 years or so
- 13 great earthquakes along this fault in the last 6,000 years
- Seven richter 7+ events in the last 130 years in southwest B.C. and northern Washington state
- Seattle earthquake, February 28, 2001, M6.8
- Haida Gwaii earthquake, October 27, 2012, M7.8
- Will happen again, just a matter of when
- Are we ready?

EARTHQUAKES IN CANADA TREMBLEMENTS DE TERRE AU CANADA

www.seismo.nrcan.gc.ca



1663 M7.0, and
1925 M6.2
Charlevoix



1935 M6.1 Timiskaming earthquake



1949 M8.1 Vancouver
Island; Canada's
largest historical
quake



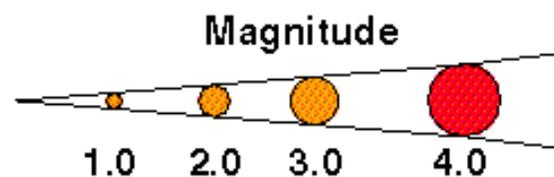
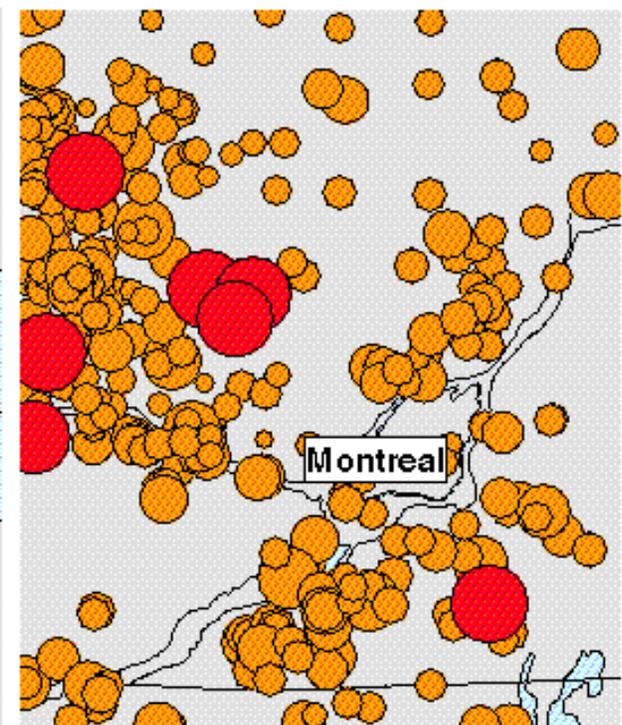
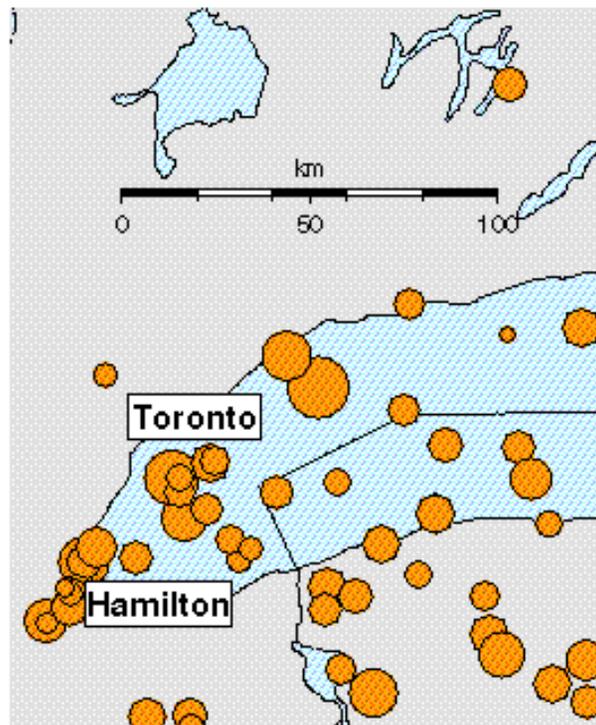
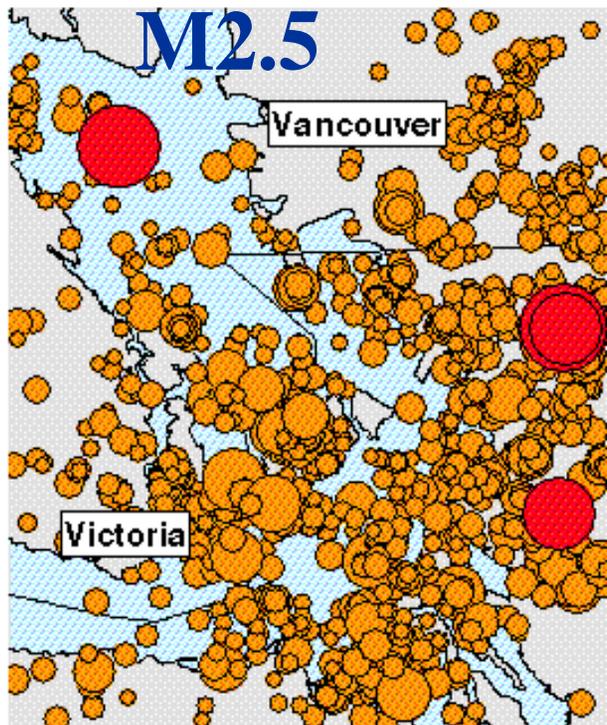
All places in Canada don't have equal seismic hazard

Earthquakes recorded 1985/01/01 - 2000/08/01

80

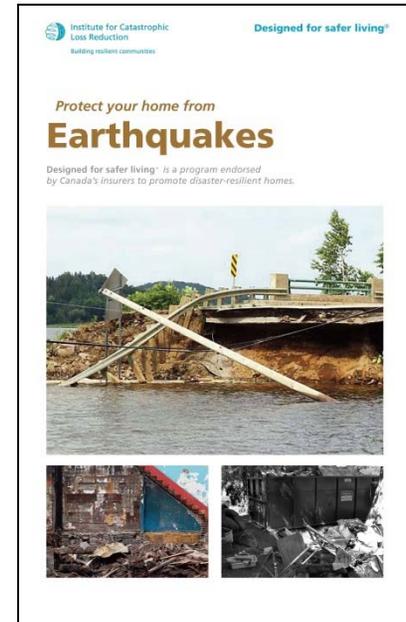
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Earthquake

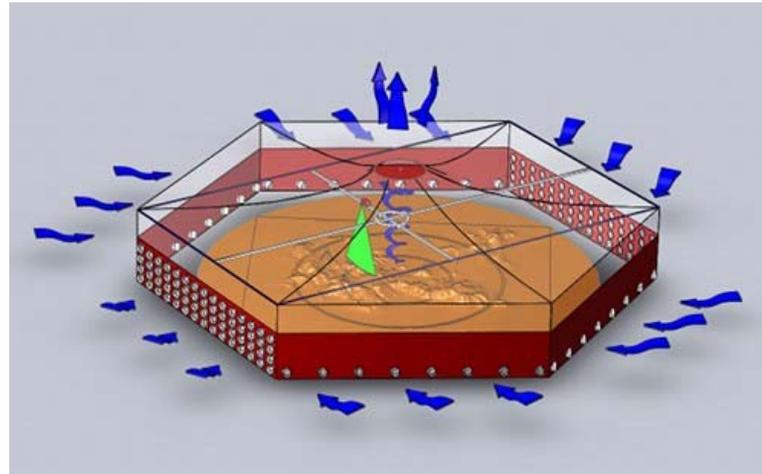
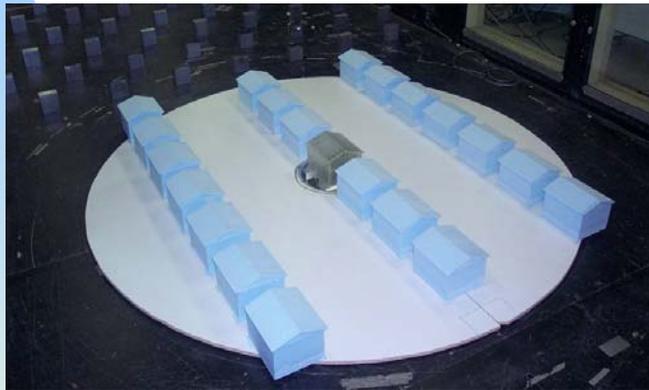
- As with all hazards, risk and mitigation communication to stakeholders is crucial



Wind

- Flat line, tornadoes, hurricanes, downbursts/microbursts etc
- Probably the second largest driver of property claims in Canada, after water
- Tornado risk rising, not due to climate change or any other change in the hazard, but due to change in the risk (i.e. development)

Lab work: World-class research



Lab findings

- To date, have completed a great deal of research into
 - ◆ Roof type (hip, gable end, complex)
 - ◆ Building height (number of storeys)
 - ◆ Roof slope
 - ◆ Sheathing thickness
 - ◆ Fastener (i.e. nail) patterns
 - ◆ Fastener type

Field work



Bornham, Ontario tornado

- May 2007
- The team's first



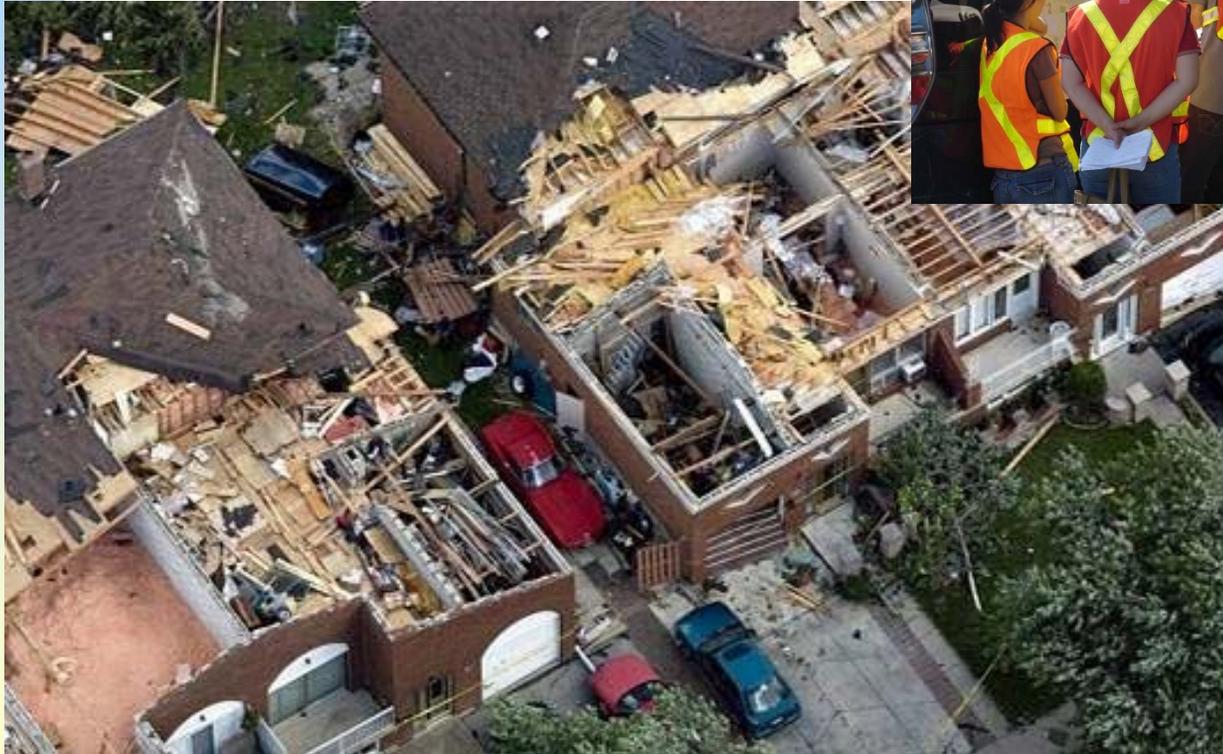
Elie, Manitoba tornado

- June 22, 2007
- Canada's first F5 tornado



Vaughan, Ont. tornadoes

- August 20, 2009
- Two F-2s



Goderich, Ontario tornado

- August 21, 2011
- F3 tornado



Angus, Ontario tornado

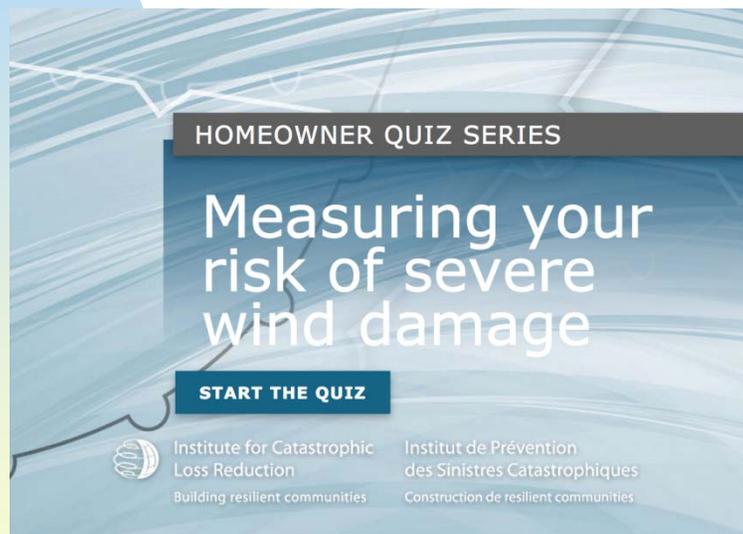
- June 17, 2014
- EF2 tornado





Wind

- As with all hazards, risk and mitigation communication to stakeholders is crucial



HOMEOWNER QUIZ SERIES

Measuring your risk of severe wind damage

START THE QUIZ

 Institute for Catastrophic Loss Reduction
Building resilient communities

Institut de Prévention des Sinistres Catastrophiques
Construction de résilient communities



 Institute for Catastrophic Loss Reduction
Building resilient communities

Designed for safer living™

Protect your home from
Severe wind

Designed for safer living™ is a program endorsed by Canada's National Fire Protection Association (NFPA)



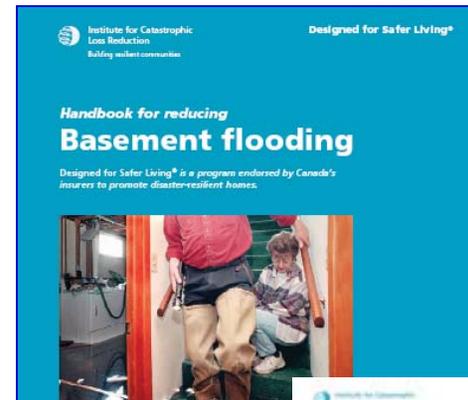
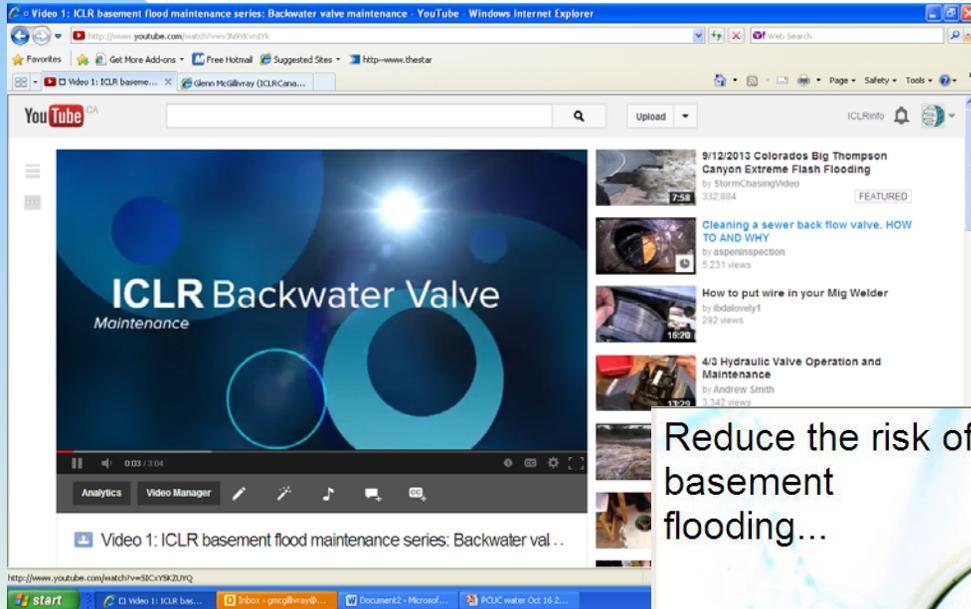
Water

- Water is the new fire
- Water losses surpassed fire losses a few years ago
- We now have a fire insurance policy that is increasingly responding to water losses
- For a number of reasons, water losses will continue to rise
 - ◆ Aging infrastructure
 - ◆ Increasing urbanization
 - ◆ Climate change
 - ◆ Changing usage of basements with no underlying change in how we construct homes with basements
 - ◆ Homeowner ignorance

Encouraging homeowner action



ICLR resources



Water damage to homes, the problem...

This Website provides information on how to reduce the chances of experiencing basement flooding and other types of water damage. It also provides some background information and descriptions of municipal sewer and stormwater management issues that have led to basement flooding problems. It is our hope that this Website will provide useful guidance to municipal governments, insurance companies and homeowners who would like to reduce the chances of experiencing basement flooding, and other forms of water damage. (More...)

- HOME
- THE PROBLEM
- FOR MUNICIPALITIES
- FOR INSURERS
- FOR HOMEOWNERS
- RESOURCES
- GLOSSARY
- LINKS



For municipalities



For insurers

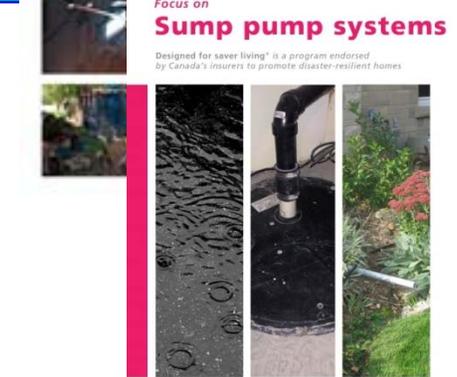


For homeowners

The Institute for Catastrophic Loss Reduction

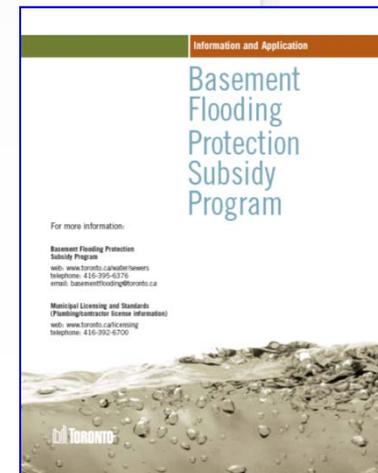
Toronto Office
 22 Balmoral Green East, Suite 210, Toronto, Ontario M3C 2S9
 Tel: (416) 324-8877
 Fax: (416) 264-8889

London Office
 Boundary Layer Wind Tunnel Laboratory
 University of Western Ontario
 1151 Richmond Street, London, Canada N6A 3B9
 Tel: (519) 661-2234
 Fax: (519) 661-4272



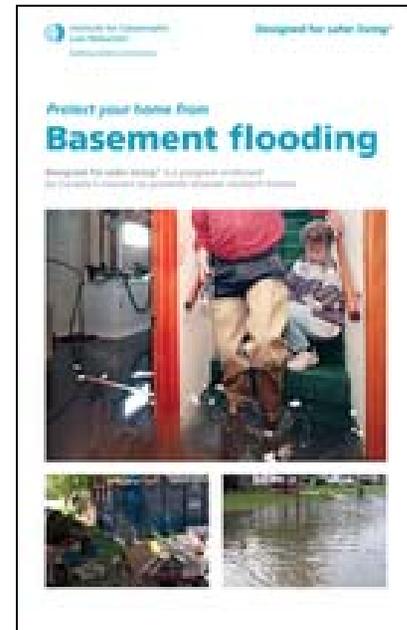
Subsidy programs

The screenshot shows the City of Toronto website interface. At the top left is the City of Toronto logo. To its right is a search bar with a 'Search' button. Below the logo is a navigation bar with four main categories: 'LIVING IN TORONTO', 'DOING BUSINESS', 'VISITING TORONTO', and 'ACCESSING CITY HALL'. A breadcrumb trail below the navigation bar reads: 'You are here: City of Toronto » ... » Stormwater Management » Basement Flooding » Basement Flooding Protection Subsidy Program'. On the left side, there is a 'Water' menu with sub-items: 'Drinking Water', 'Wastewater', 'Stormwater Management', 'Basement Flooding', 'Mandatory Downspout Disconnection', 'Environmental Monitoring & Protection', 'Water Efficiency', 'Information for Residents', and 'Information for Businesses'. The main content area is titled 'Basement Flooding' and features a 'Share' button with a count of '12'. The main heading is 'Basement Flooding Protection Subsidy Program'. Below the heading is a list of links: 'Help protect yourself against basement flooding', 'Work that is eligible', 'Eligibility requirements and information', 'How to apply for a subsidy', and 'Download the Basement Flooding Protection Subsidy Program application form'. A bullet point under the last link states: 'Our goal is to process applications within 10 weeks from the date the application is received in our office. However, we are currently receiving a high volume of applications which may affect the time it takes to process applications.'

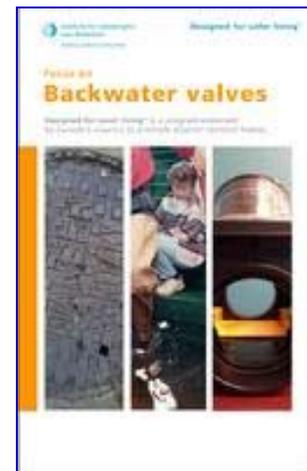
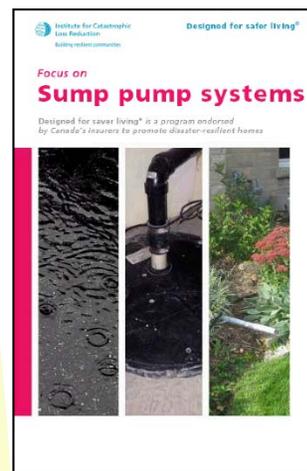
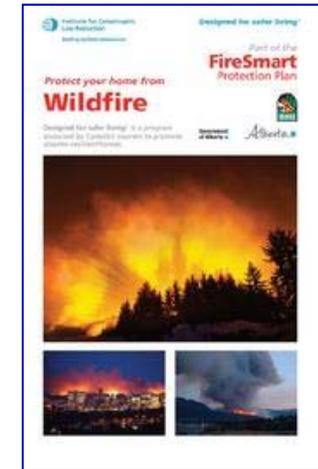
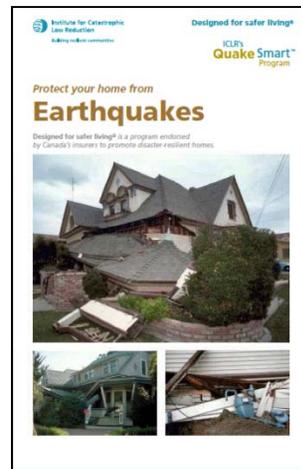


Water

- As with all hazards, risk and mitigation communication to stakeholders is crucial

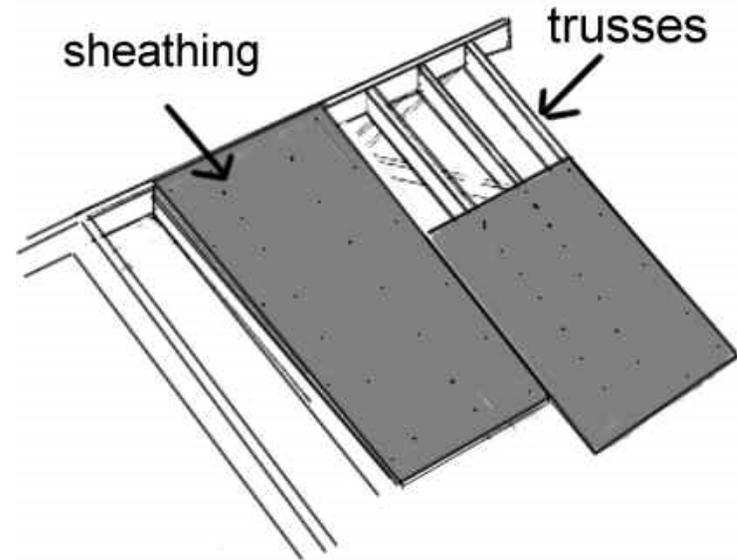
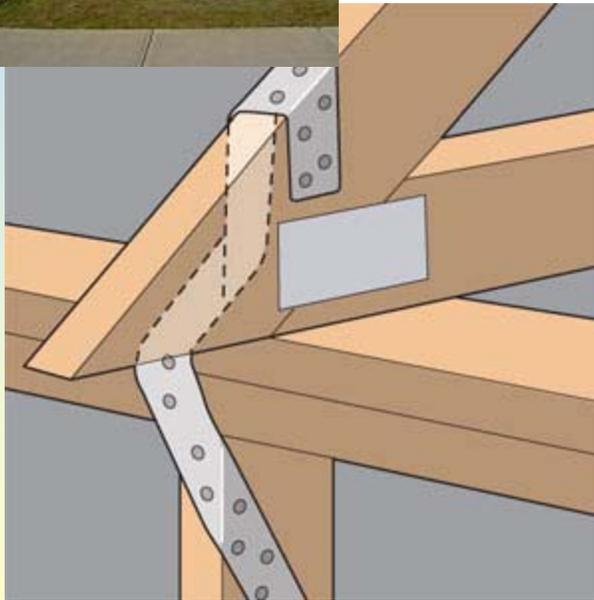


Public awareness



Wind & Water

Building code work



To recap

- Natural disasters are increasing in frequency and severity, both worldwide and in Canada
- Since 2009, Canada has seen unprecedented growth in disaster-related costs and impacts
 - ◆ Water damage is seeing the most growth
- Though there are many reasons for the international/national trend, increased urbanization, degraded infrastructure and climate change are the top three drivers
- ICLR is conducting research into resiliency on behalf of the Canadian p&c industry and society at large
- ICLR has loss control info that can be used by insureds



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