Tackling the Storm out of the Norm: Climate Risk Management Strategies for Canadian Cities

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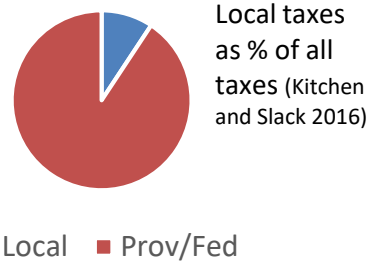
IMFG Institute on Municipal Finance & Governance at the Munk School of Global Affairs, University of Toronto

Municipal climate change risk

Concentrated exposure

- Populations, property, interdependent infrastructure

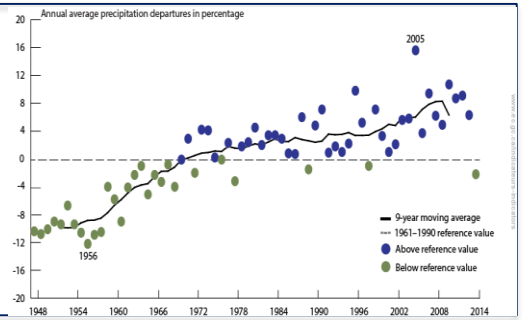
Limited capacity to spread costs



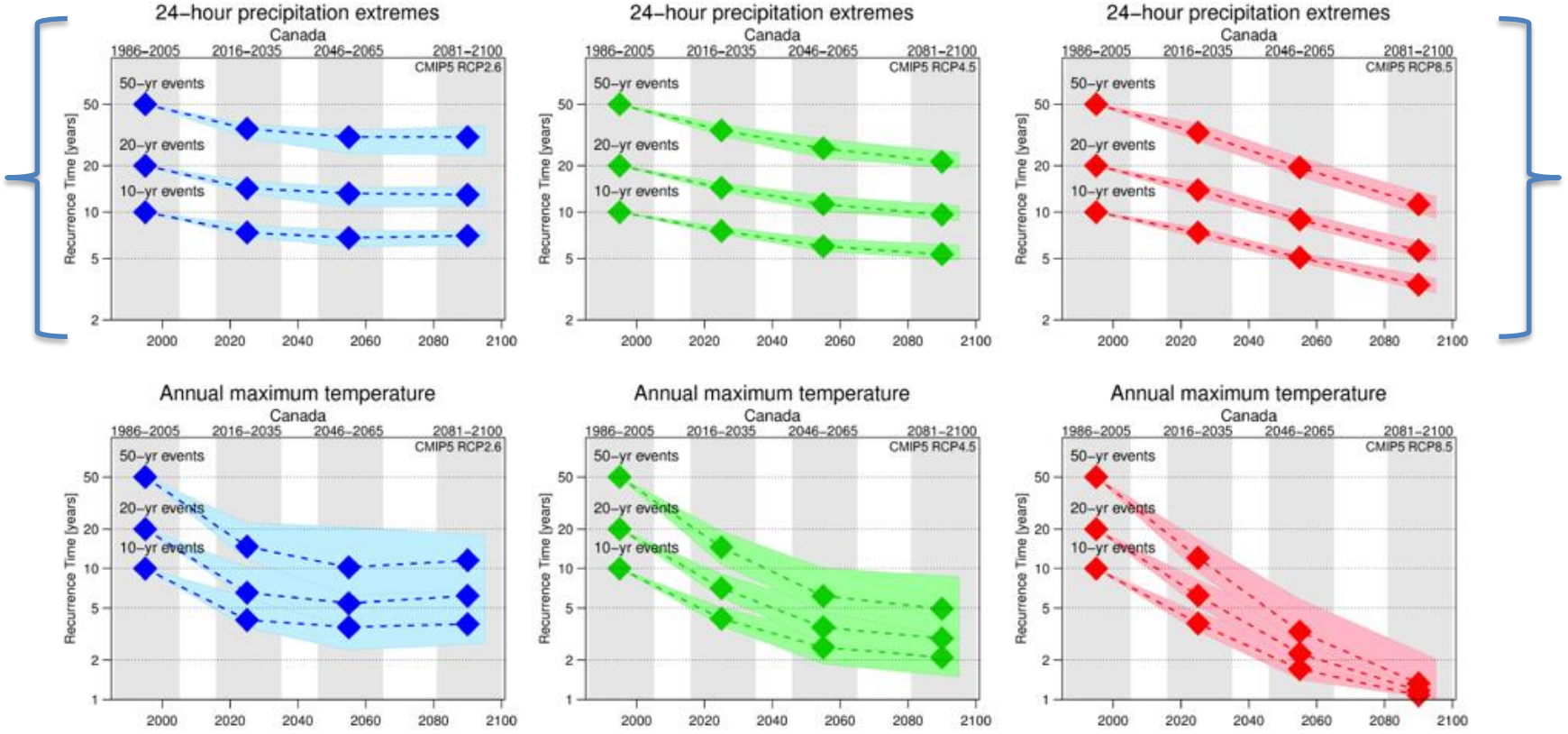
Local taxes as % of all taxes (Kitchen and Slack 2016)

Climate risk increasing

- More extreme weather



Flood risk increases with climate change

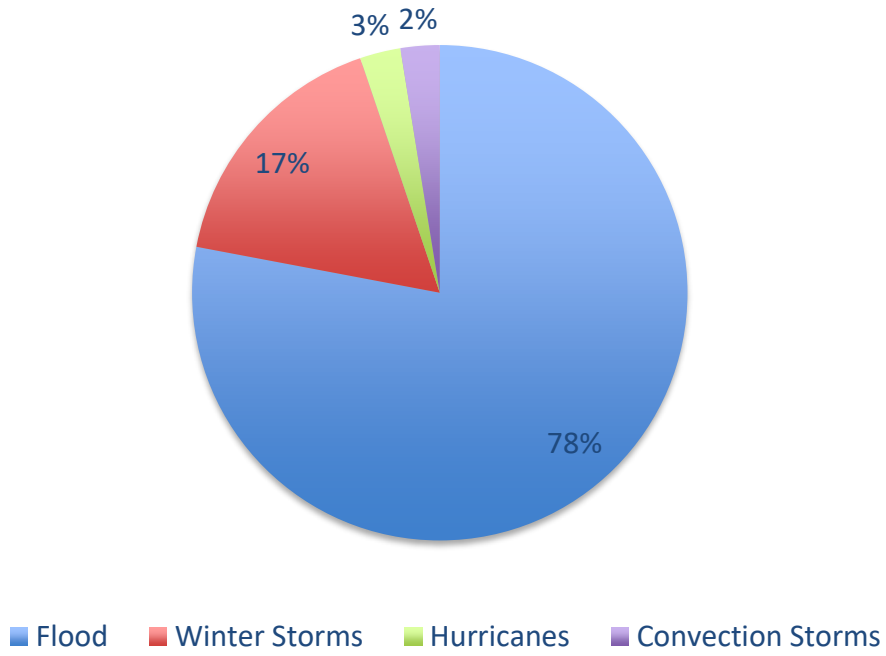


Environment and Climate Change Canada 2016

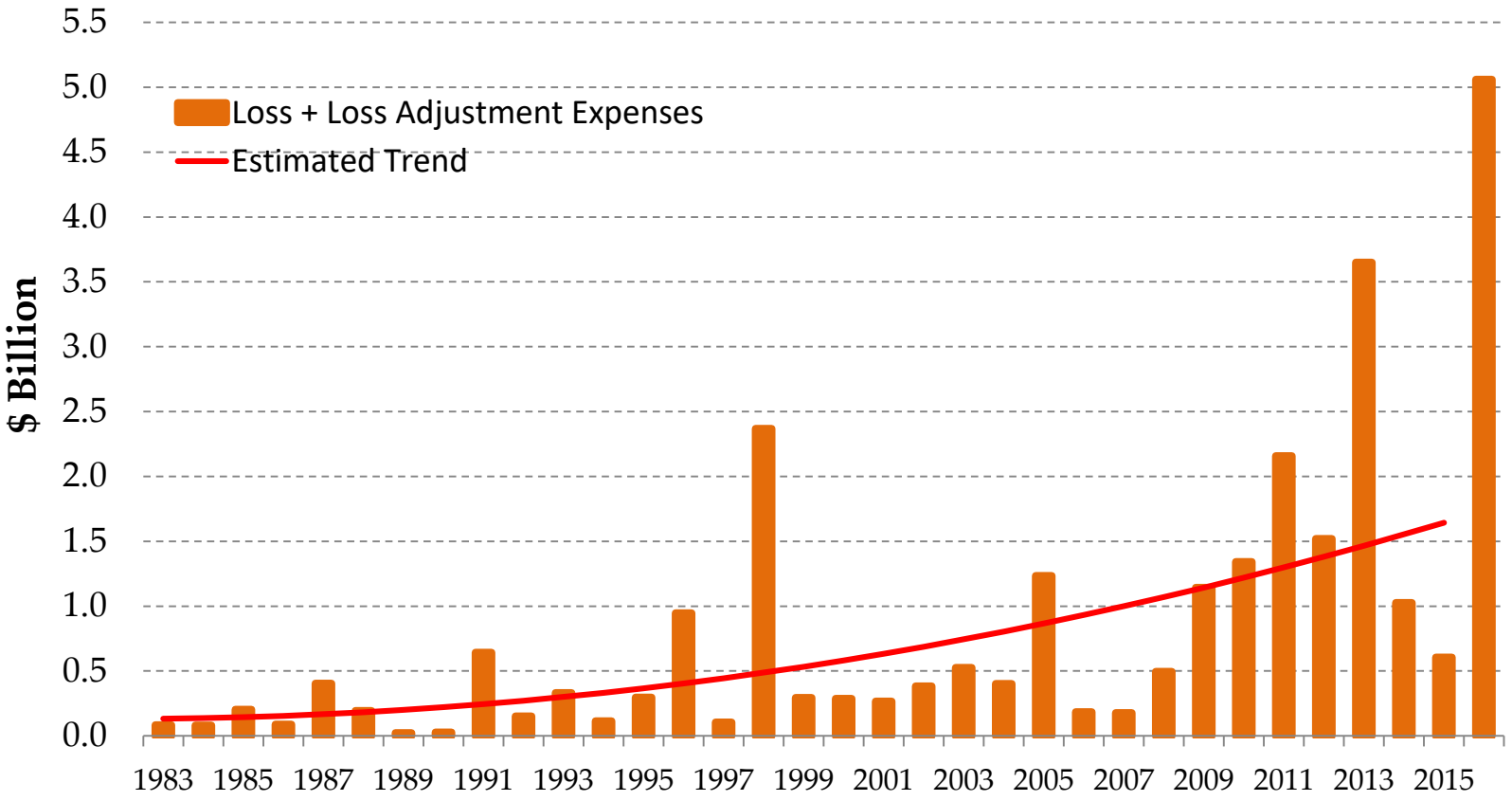
Why flood risk?

- Most costly and frequent hazard
- Increase over last two decades, particularly urban flooding
- Outdated structural and non-structural defenses
- Disaster assistance and insurance costs unsustainable
- Legal liability growing

Historical DFAA Payments by Catastrophe 1970-2014 ($ Millions CDN - adapted from PBO 2016)

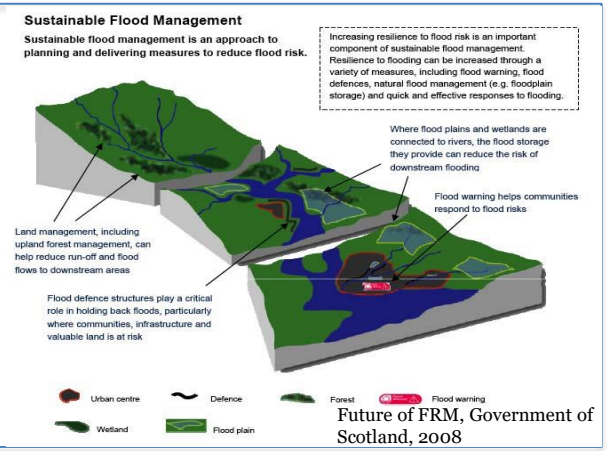


Why flood risk?



Source: IBC Facts Book, PCS, CatIQ, Swiss Re, Munich Re & Deloitte
Values in 2015 $ CAN

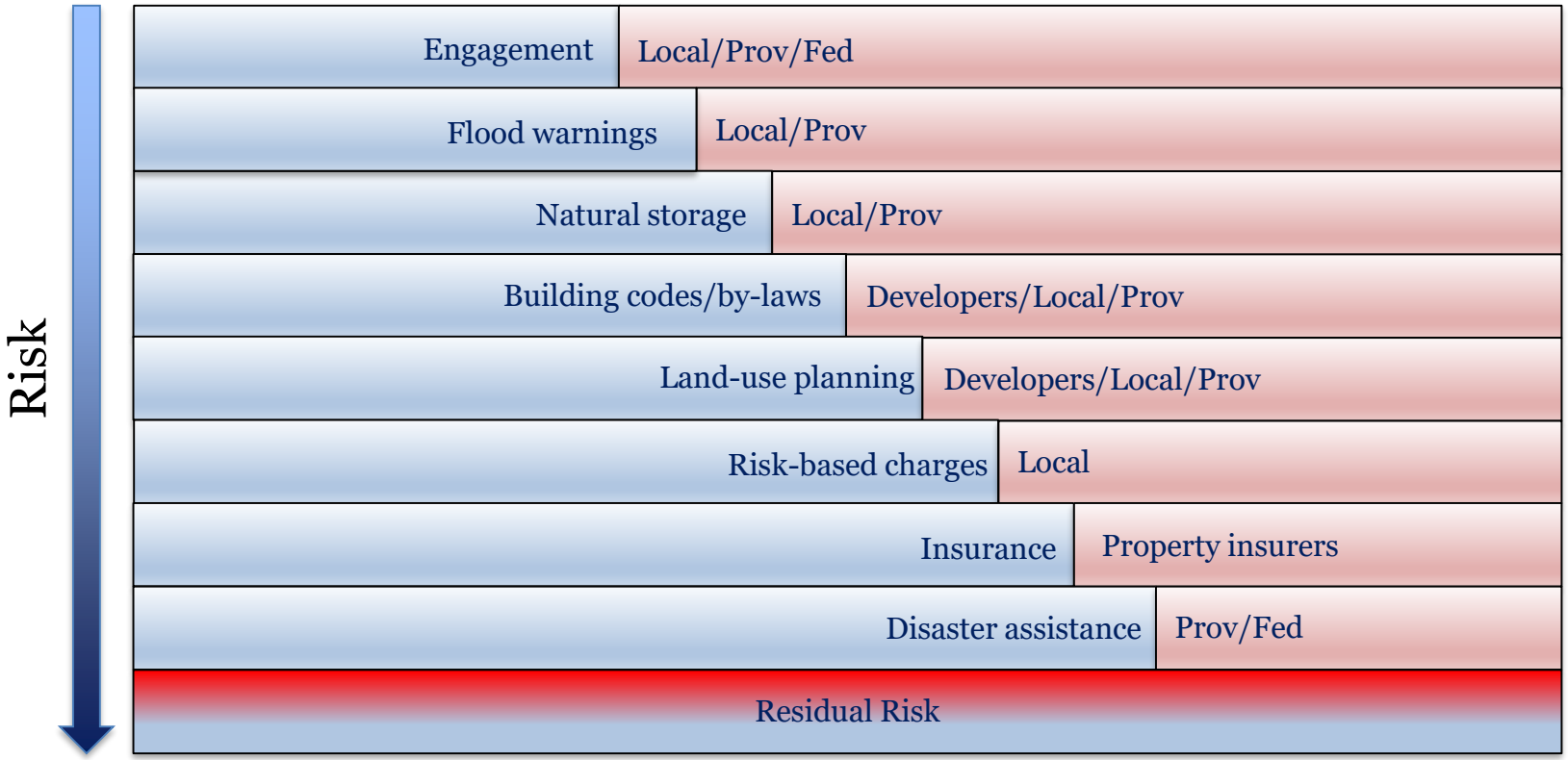
Flood risk management

Policy Emphasis	Design	Example
Flood Management	Historical likelihood of hazard (1-in-100 year)	 Conestoga Dam
Flood Risk Management	Risk (hazard likelihood, exposure and vulnerability of people and infrastructure)	 Future of FRM, Government of Scotland, 2008

Principles of flood risk management

1. Absolute protection impossible
   - Equal priority between protection, mitigation, response and recovery
2. Manage consequences
   - Risk assessment includes exposure, vulnerability in addition to hazard
3. Portfolio of instruments
   - Multiple technological, social, economic and institutional measures to reduce and share responsibility
4. Share responsibility
   - Property owners, businesses, developers, governments

Risk sharing



Instrument analysis

Tool or mechanism of governance that leverages state authority to influence behaviour.

- Risk sharing instrument:
  1. Share responsibility and costs with appropriate stakeholder
  2. Designed to absorb risk (exposure, vulnerability in addition to hazard)

Risk sharing

1. Sharing burden of loss:
   - Distribution of flood related financial loss
2. Sharing responsibility for risk reduction:
   - Distribution of responsibility for risk reduction among non-governmental stakeholders
3. Sharing costs of risk reduction:
   - Distribution of costs from publicly funded risk-reduction measures

Table 3. Instruments of flood risk sharing

Objective & Instrument	Description
SHARING BURDEN OF LOSS	
Disaster financial assistance	Shares recovery costs between governments
Private insurance	Transfers recovery costs from individuals and municipalities to insurers in exchange for premium
SHARING RESPONSIBILITY FOR RISK REDUCTION	
Stakeholder engagement	Collaboration with stakeholders affected by decisions, or capacity to implement instruments
Public participation	Engaging public in risk reduction
Warning systems	Informing residents of flood threat
Hazard disclosure	Informing buyers of real estate about flood risk
Subsidies	Direct financial support for property level flood protection
Credits	Reduction of financial obligation in exchange for risk mitigation
Land use planning	Regulating location, type, scale, density of development and infrastructure
Flood mapping	Graphic measures of probable flood events
By-laws	Rules with conditions on development
Integrated stormwater management	Guidance on site-level stormwater diversion and retention
SHARING COSTS OF RISK REDUCTION	
Corrective tax	Tax that discourages risk behaviour, raise revenue to offset its costs
Risk-based charge	Fee levied proportionate to property's contribution to flood risk
Special surcharge	Fee added to property tax to fund flood mitigation initiatives

Alberta 2013: $6 billion

Toronto 2013: +$800 million

Burden of loss

Disaster assistance/Insurance

- Shared with provinces/feds when non-insured losses exceed “three percent of taxation levy” in Ontario, or are “extraordinary” and “widespread” in Alberta.
- Shared with insurers through risk-adjusted premiums

TORONTO

- Did not qualify for 2013 flooding.
- Private insurance covered residential and commercial losses.

CALGARY

- Qualified for 2013 flooding ($2B).
- Private insurance covered some residential losses.

- Sharing is inconsistent across country.
- DFAA not risk-based (covers riverine, not urban flooding).
- Conditions on assistance and insurance increasing.

Risk responsibility > Stakeholder engagement

- Mobilize actors and public towards risk management.
  - Risk dialogues, advisory groups
  - Public participation

TORONTO

- Toronto Region Conservation Authority (TRCA) responsible for riverine.
- Basement Flooding Protection. Program (BFPP).
- #TOflood

CALGARY

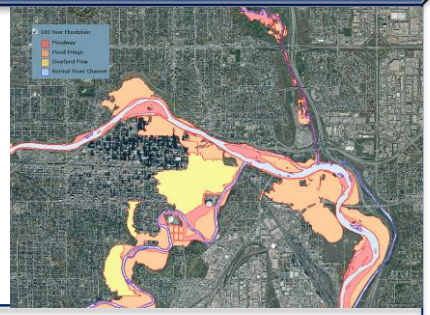
- Bow River Basin Council (BRBC) responsible for riverine.
- Flood Risk Mitigation Committee (2005).
- Expert Management Panel on River Flood Mitigation (2013).
- #ABflood

- Focused on riverine.
- Gaps in public participation and use of technology.
- Risk dialogues emerging.

Risk responsibility

Land-use/flood mapping

- Sharing with developers and property owners via land-use planning that determines location, type, scale, and density of development and the infrastructure that supports community life.
- Flood mapping informs planning through spatial information on exposure.



TORONTO

- TRCA responsible for riverine mapping and regulation
- Hurricane Hazel design standard (1-in-200 yr)
- Toronto controls stormwater source controls and by-laws

CALGARY

- Province develops maps (1-in-100 yr), municipal responsible for regulation
- By-laws for development in floodway, fringe, overland flow areas
- Calgary controls stormwater source controls and by-laws

- AB municipalities cannot use their own maps
- Not risk based (use historical flood and stormwater likelihood)
- Urban flood risk maps needed

Risk responsibility

Integrated stormwater management

- Share responsibility with developers and property owners by requiring or offering guidance on retaining stormwater source controls such as bioswales, infiltration trenches, retention ponds, and pervious pavements.

TORONTO

- Guidelines via Low Impact Development Stormwater Management Guide
- Developing quantification methods
- Demonstration projects

CALGARY

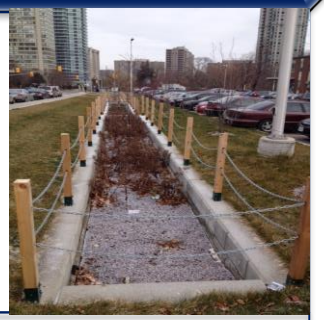
- Guidelines via stormwater design manual and management report.
- Alberta Low-Impact Development Partnership
- Developing quantification methods
- Demonstration projects

- Critical tool for urban flooding
- Not mandatory
- Does not differentiate spatial risk

Costs of risk reduction

Corrective taxes, risk-based charges, surcharges

- Corrective tax: allocates costs of mitigation to inhabitants of risky areas.
- Risk-based: charge proportionate to property's contribution to flood risk.
- Surcharge: municipality wide fee



TORONTO

- Developing stormwater charge to replace water rate.
- Flat rates for residential, contribution to run-off for properties that exceed 1ha.
- No corrective tax, or surcharge

CALGARY

- Flat rate drainage service charge
- Considering adoption of risk-based charge.
- No corrective tax or surcharge.

- Use of risk varies in stormwater charges
- Provincial legislation restricts tax authority
- Underutilized

Results

OBJECTIVE & INSTRUMENT	RISK-BASED	SHARES RESPONSIBILITY
SHARING BURDEN OF LOSS		
Disaster financial assistance		
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SHARING RESPONSIBILITY FOR RISK REDUCTION		
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Public participation		
Warning systems		
Hazard disclosure		
Subsidies		
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Land use planning		
Flood mapping		
By-laws		
Integrated stormwater management		
SHARING COSTS OF RISK REDUCTION		
Corrective tax		
Risk-based charge		
Special surcharge		

Instrument is risk-based and shares responsibility with other stakeholders

Instrument is hazard based and is not employed to share responsibility with other stakeholders

Summary and conclusions

1. Wide range of risk sharing instruments available
2. Calgary and Toronto (like other municipalities) have not embraced full range of tools
   - Cities encourage source controls, but lack economic incentives for developers & property owners
3. Current policies are hazard-based and historical
   - Standards are static regardless of vulnerability and exposure

Implications

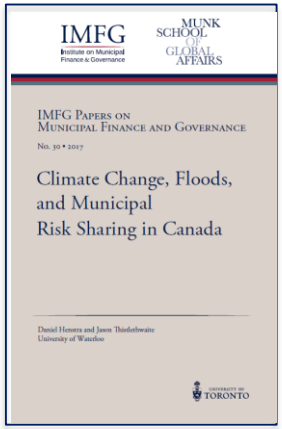
1. Limited use of instruments concentrates climate change risk in municipalities.
2. Failures in insurance markets, more stringent conditions on disaster assistance and increasing legal liability.
3. Justifies more thorough research on risk sharing in municipalities
   - Identify challenges involved in risk sharing & management.
   - Define role of the provinces and federal government.

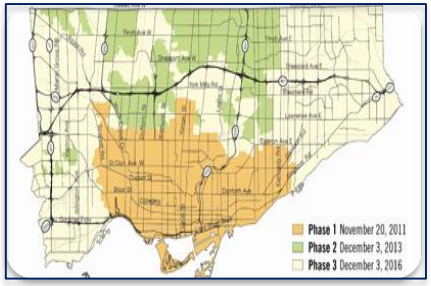
Future research: Understand policy uncertainty on climate change risk management

Wide range of instruments available, but underutilized

Engage municipal, stormwater and flood officials to evaluate against criteria that measures suitability

Recommendations on feasible instruments and appropriate division of responsibility





Sustainable flood risk management in an era of climate change

2015-2017

Technical uncertainty
- Collective action problem limits risk understanding as PSC, insurers, provinces, and municipalities try to manage growing financial exposure. (Thistlethwaite 2016, Henstra and Thistlethwaite 2016).

Social uncertainty
- Canadians unaware of flood risk, their responsibility, but support risk management according to UW survey (N=2300) (Thistlethwaite, Henstra, Brown and Scott 2016).

Policy uncertainty
- Wide portfolio of flood risk instruments available, but underutilized and not aligned with appropriate stakeholders (Henstra and Thistlethwaite, 2016).

2017-2020

1. Risk analysis
- climate change scenarios for flood risk at community level

2. Risk evaluation
- Stakeholder and public engagement to assess social acceptability of risk

3. Risk controls
- Instrument analysis on who does what and how based on risk tolerance

Sustainable flood risk management in Canada

UNIVERSITY OF WATERLOO

Interdisciplinary Centre on Climate Change IC3

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THANK YOU!

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