

Costs and benefits of climate change impacts and adaptation in Canada: the economic case for action

Richard Boyd, Director of Research, All One Sky Foundation

ADAPTATION CANADA 2020 | 19-21st February 2020 | Vancouver, B.C.



NATIONAL ISSUES

- Cities and towns
- Remote and rural communities
- Water resources
- Ecosystem services
- **Costs and benefits of climate impacts and adaptation**
- Economic sector perspectives
- International dimensions
- Climate Disclosure, litigation and finance

Richard Boyd, Director of Research, All One Sky Foundation

ADAPTATION CANADA 2020 | 19-21st February 2020 | Vancouver, B.C.

About All One Sky Foundation



Hedonic Property Price Analysis: Energy Home Labelling Program

Draft Report
20 May 2019

PREPARED BY:
Richard Boyd
ALL ONE SKY FOUNDATION
Justin Ryan and Charles Cault
CLIMATE RESILIENCE CONSULTANTS

SUBMITTED TO:
Robyn Webb
Senior Environmental Program Manager
Energy Transition & Policy Support and
City Environmental Strategies
Regional and Economic Development
Economic and Environmental Sustainability
City of Edmonton
107 Plaza - 10000 101 Street NW
Edmonton, AB, T5J 3P4

Contact: Richard Boyd
Tel: 403.812.4470



Weather and Climate Readiness Plan

CITY OF **Leduc**



Weather and Climate Readiness Plan

INVASIVE SPECIES MANAGEMENT IN A CHANGING CLIMATE

EDMONTON METROPOLITAN REGION CLIMATE RESILIENCE COLLABORATIVE

PROJECT GOAL
Understand how climate change may affect the vulnerability of the Edmonton Metropolitan Region (EMR) to invasive species, and develop a baseline plan to help municipalities reduce these vulnerabilities.

POTENTIAL EFFECTS OF CLIMATE CHANGE ON PESTS AND INVASIVE SPECIES IN THE EMR

- Heat Spikes**: Increased duration and frequency of heat waves.
- Increased Precipitation**: Increased precipitation and higher humidity.
- Wetland Conversion**: Conversion of wetlands to agricultural or urban areas.
- Water Shortage**: Reduced water availability for irrigation and ecosystems.
- Forest Disturbance**: Increased risk of forest fires and insect outbreaks.
- Water Vulnerability**: Increased risk of waterborne diseases and algal blooms.
- Water Vulnerability**: Increased risk of waterborne diseases and algal blooms.

WHY DOES THIS MATTER?
Invasive species and pests in the EMR have the potential to cause significant economic and environmental damage. Climate change will increase the vulnerability of the EMR to invasive species and pests.

- Health and safety risks
- Loss of biodiversity
- Loss of ecosystem services
- Loss of cultural and historical resources
- Loss of property values
- Loss of agricultural and forest products
- Loss of water quality
- Loss of recreational opportunities
- Loss of aesthetic value

THE WORST INVASIVES IN A CHANGING CLIMATE
The following are the most and most rapidly increasing invasive species in the EMR.

- Asian Hornet**: A highly invasive species that can cause significant damage to agriculture and ecosystems.
- Asian Longhorn Beetle**: A highly destructive wood-boring beetle that can cause significant damage to trees and infrastructure.
- Emerald Ash Borer**: A highly destructive wood-boring beetle that can cause significant damage to ash trees.
- European Spruce Sawfly**: A highly destructive pest that can cause significant damage to spruce trees.
- European Spruce Sawfly**: A highly destructive pest that can cause significant damage to spruce trees.
- European Spruce Sawfly**: A highly destructive pest that can cause significant damage to spruce trees.

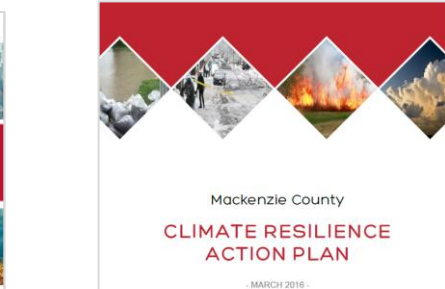
TOWN OF BRUDERHEIM CLIMATE RESILIENCE ACTION PLAN

MARCH 2016



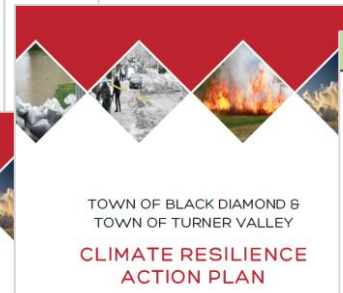
ENERGY POVERTY AN AGENDA FOR ALBERTA

R. Boyd and H. Corbett



Mackenzie County CLIMATE RESILIENCE ACTION PLAN

MARCH 2016



TOWN OF BLACK DIAMOND & TOWN OF TURNER VALLEY CLIMATE RESILIENCE ACTION PLAN

MARCH 2016



TOWN OF CANMORE CLIMATE CHANGE ADAPTATION AND RESILIENCE PLAN: BACKGROUND REPORT

August 2016

PREPARED BY:
Jeff Zelenky, Dr. Richard Boyd, Dr. Iddo Ben-Zvi, and Charles Cault

SUBMITTED TO:
Lynn Randall, Mayor
Sustainability Coordinator
TOWN OF CANMORE
802 7th Avenue
Canmore, AB, T1W 1E1
LZelenky@townofcanmore.ca
Tel: 403.878.1127

ECONOMIC GUIDANCE FOR THE APPRAISAL AND PRIORITIZATION OF ADAPTATION ACTIONS

November 2013



Dr. Richard Boyd
Aliza Gubin
Tanya Maynes
C3 (Climate Change Central)

403.917.2700 | Suite 100, 110-11th Avenue SW, Calgary, Alberta, T2P 1S1 | www.c3.ca

TOWN OF SYLVAN LAKE CLIMATE RESILIENCE EXPRESS ACTION PLAN



BEAVER COUNTY CLIMATE RESILIENCE EXPRESS ACTION PLAN

MARCH 2018





BIG LAKES COUNTY CLIMATE RESILIENCE EXPRESS ACTION PLAN

MARCH 2018






BRAZEAU COUNTY CLIMATE RESILIENCE EXPRESS ACTION PLAN

MARCH 2018



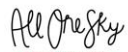
BEAVER COUNTY CLIMATE RESILIENCE EXPRESS ACTION PLAN

MARCH 2018



ENERGY POVERTY AN ENERGY POVERTY STRATEGY FOR ALBERTA

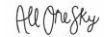
R. BOYD AND H. CORBETT



HELPING ALL PEOPLE PROSPER IN A CHANGING CLIMATE

Economic Tools for Climate Change Adaptation PRIVATE REAL ESTATE DECISIONS

September 2015
FINAL REPORT



Climate Resilience Collaborative



CITY OF SPRUCE GROVE CLIMATE RESILIENCE EXPRESS ACTION PLAN

MARCH 2018



LACOMBE COUNTY CLIMATE RESILIENCE EXPRESS ACTION PLAN

MARCH 2018



CLIMATE RESILIENT HOME

EDMONTON METROPOLITAN REGION CLIMATE RESILIENCE COLLABORATIVE

PROJECT GOAL
Develop a set of tools and resources to help homeowners understand the risks of climate change to their homes and how to reduce those risks.

POTENTIAL CLIMATE CHANGE IMPACTS TO HOMES IN THE EDMONTON METROPOLITAN REGION

- Flood**: Increased frequency and severity of flooding events.
- Heat**: Increased frequency and severity of heat waves.
- Wildfire**: Increased frequency and severity of wildfire events.

RESULTS

- 1. An interactive online tool (All One Sky Home Resilience Assessment) that helps homeowners understand the risks of climate change to their homes and how to reduce those risks.
- 2. A Checklist of potential climate change impacts to homes and how to reduce those risks.
- 3. A Checklist of potential climate change impacts to homes and how to reduce those risks.

QUESTION:
What climate-resilient design features and maintenance can be incorporated into new and existing homes to address climate impacts in the Edmonton Metropolitan Region?

HOME EXTERIOR TIPS FOR IMPROVING THE RESILIENCE OF YOUR HOME

- Roof**:
 - Inspect roof for damage.
 - Use the correct materials.
 - Check for leaks and water damage.
 - Check for mold and mildew.
 - Check for ice dams.
 - Check for snow load.
 - Check for wind damage.
- Windows and Doors**:
 - Check for drafts and leaks.
 - Check for mold and mildew.
 - Check for water damage.
 - Check for wind damage.
- Foundation**:
 - Check for cracks and leaks.
 - Check for mold and mildew.
 - Check for water damage.
 - Check for wind damage.

Edmonton Metropolitan Region Climate Resilience Collaborative: A framework for ongoing regional collaboration

FINAL
December 31, 2019

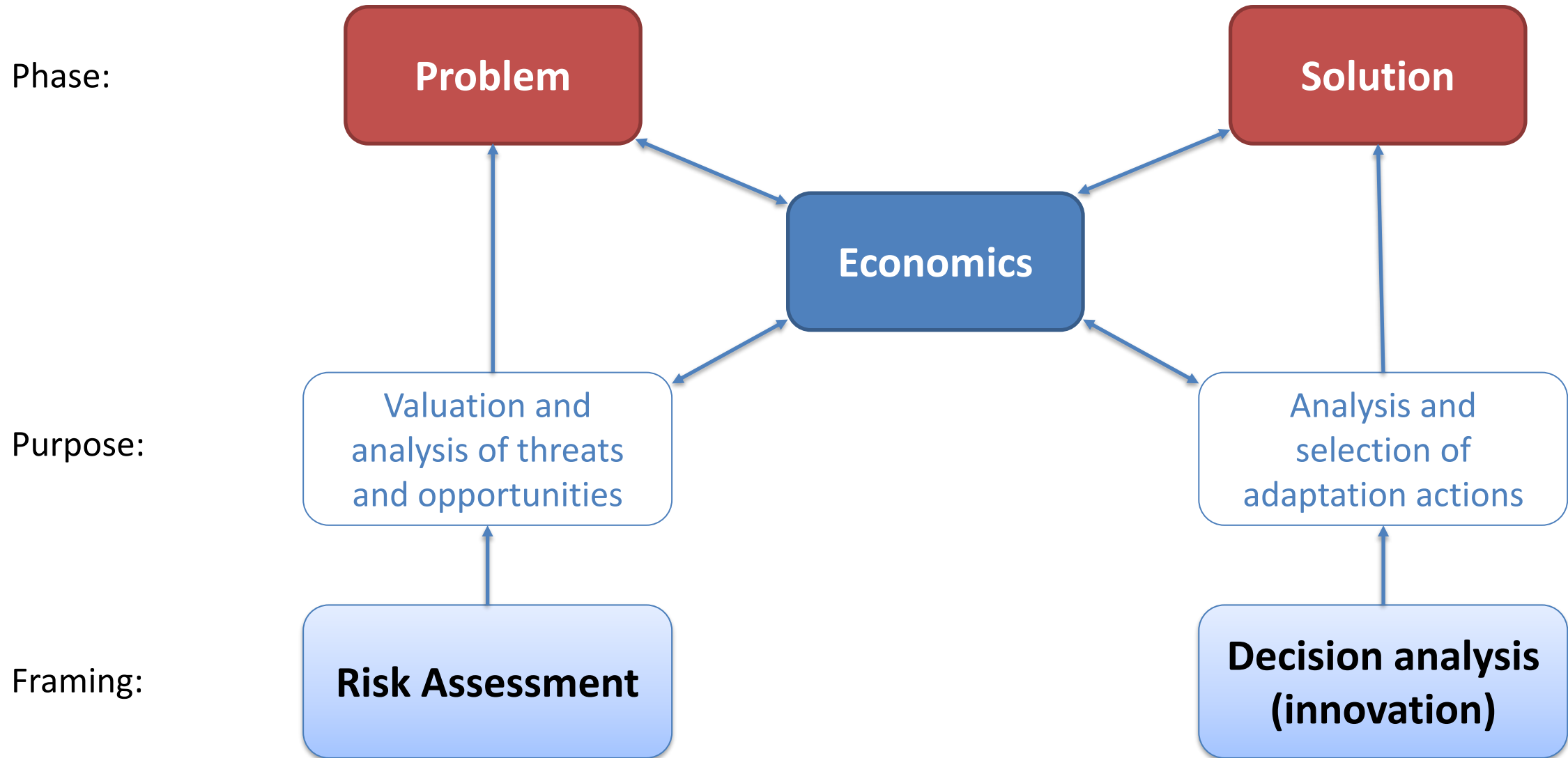
Agenda

1. Context for economic analysis
2. Observed costs of extreme weather
3. Projected future costs of climate change
4. Evaluation of adaptation options
5. Economic limits to adaptation
6. Key messages



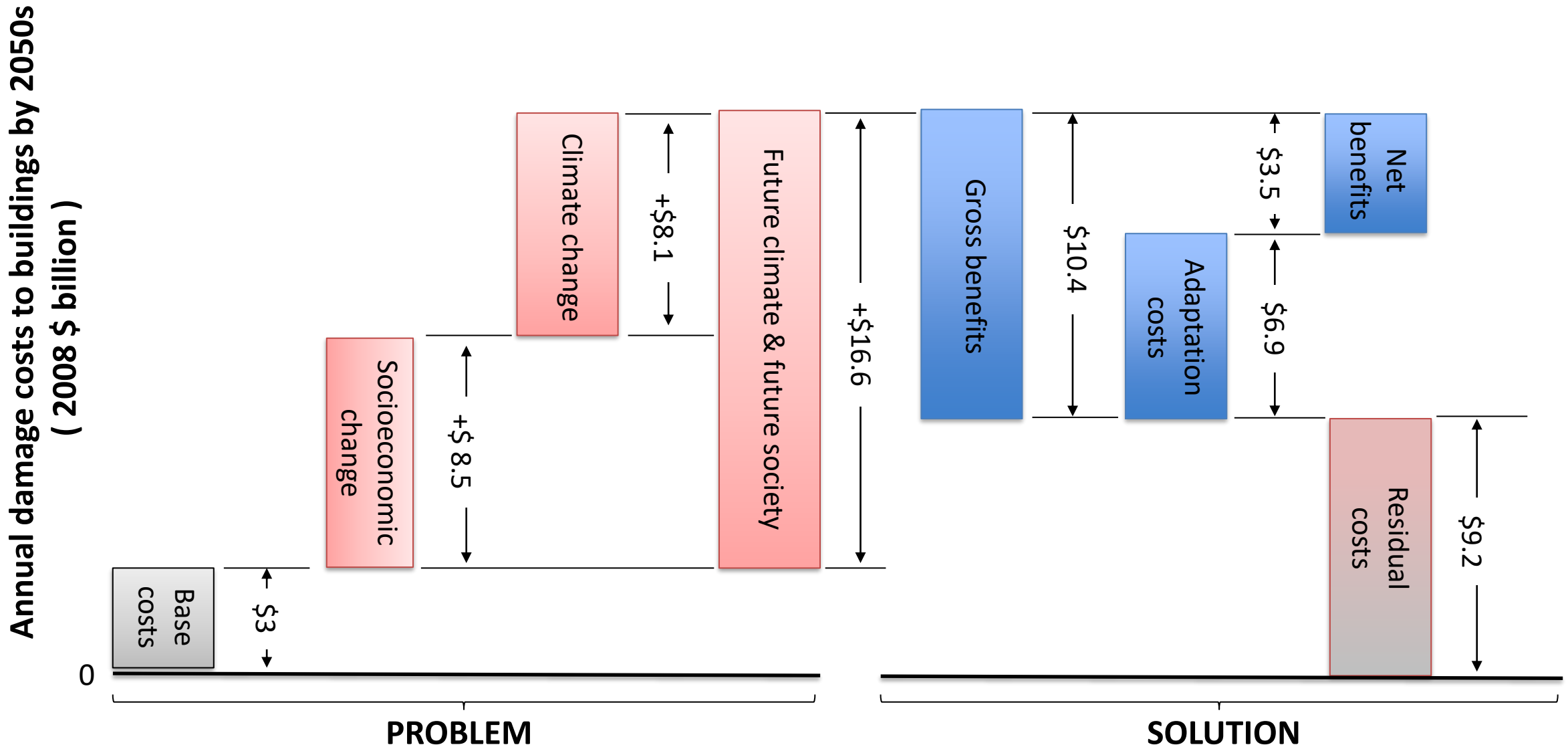
1. Context for economic analysis

Role of economics in iterative climate risk management



Source: Adapted from Jones et al (2013)

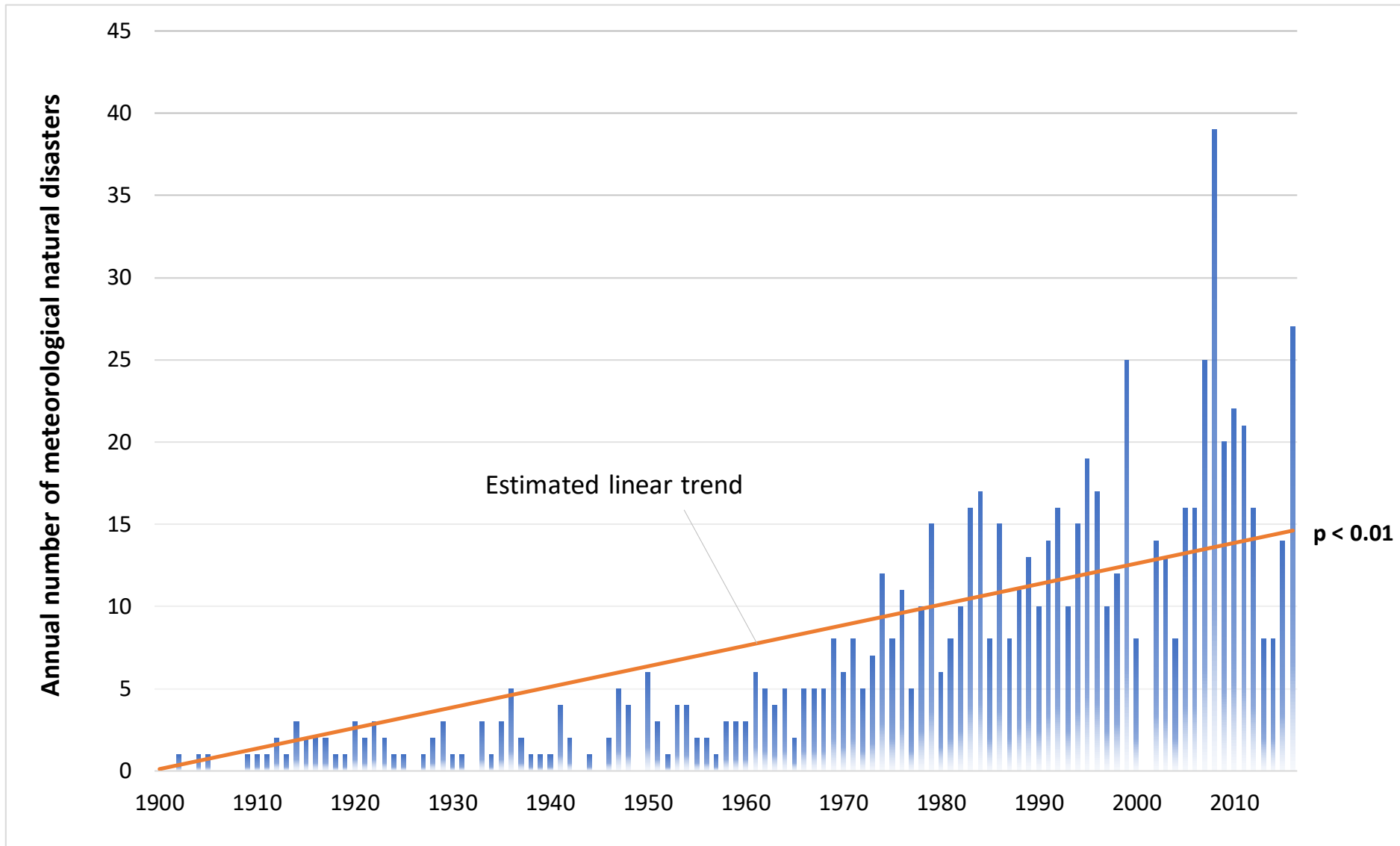
Economics of adaptation





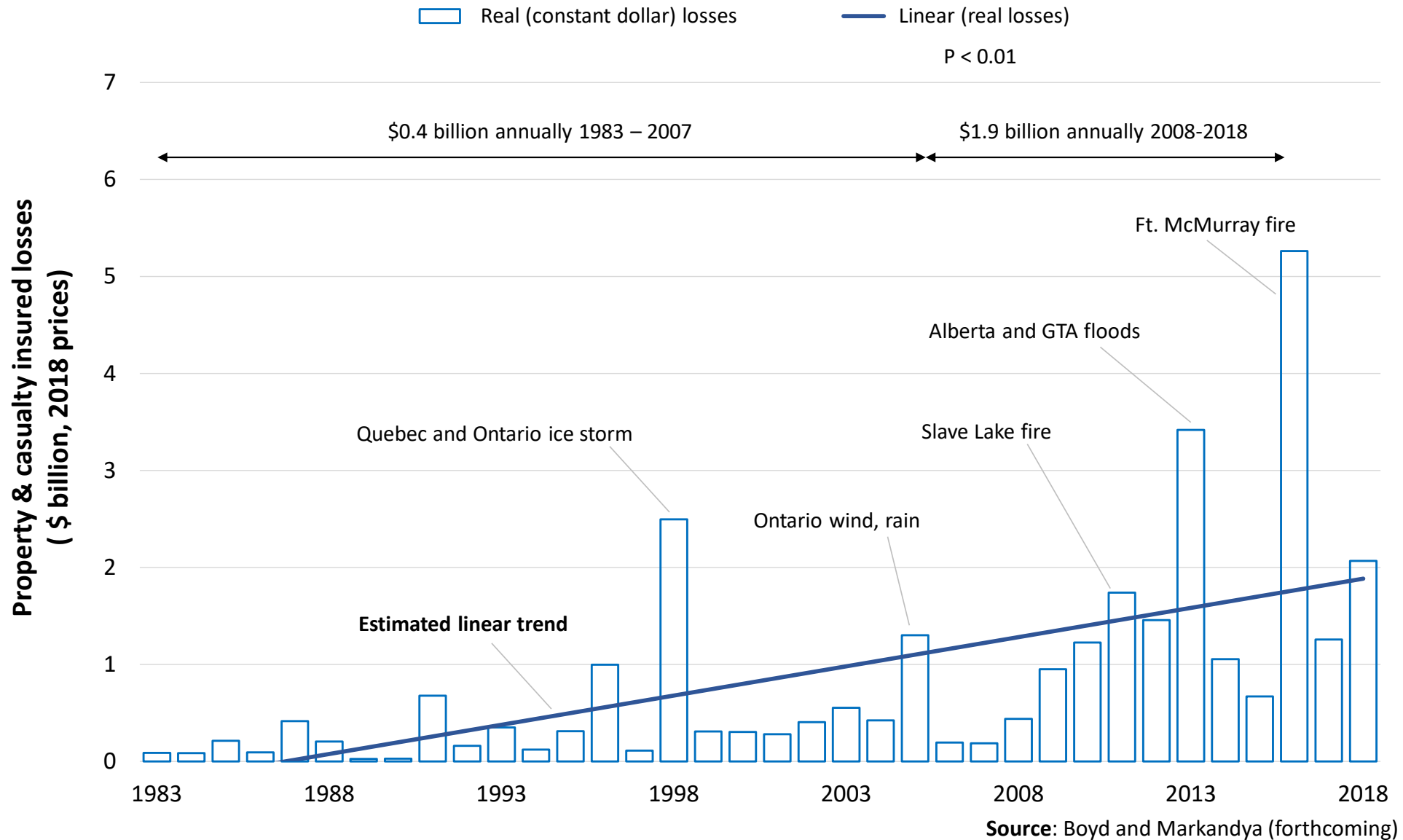
2. Observed costs of extreme weather

Trends in meteorological natural disasters in Canada



Source: Canadian Disaster Database (Public Safety Canada)

Trends in meteorological natural disasters in Canada

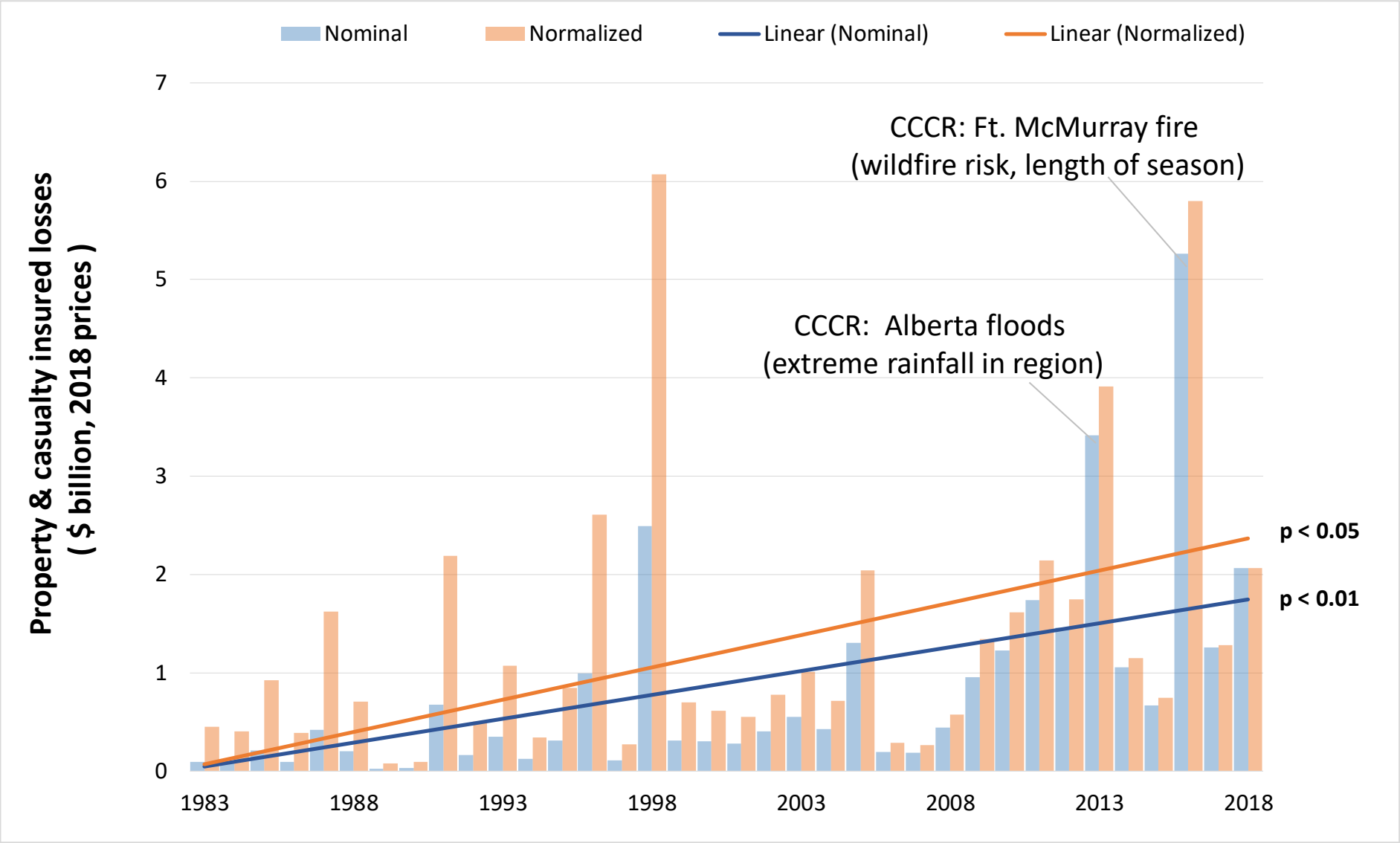


“Alberta has become the place where bad weather pays a visit more often”

DATE	PLACE	EVENT TYPE	LOSSES (current \$ million)	LOSSES (2018 \$ million)
2016	May 3–19, Fort McMurray AB	Fire	3,750	3,900
1998	Jan., southern Quebec	Ice storm	1,380	2,020
2013	June 19–24, southern Alberta	Flooding/Water	1,600	1,740
2013	July 8, Greater Toronto Area ON	Flooding/Lightning/Water	920	1,000
2005	Aug. 19, Ontario	Hail/Tornadoes/Wind	630	780
2018	May 4, Hamilton and GTA ON; Quebec	Windstorm/Water	680	680
2011	May 15–16, Slave Lake AB	Fire/Windstorm	530	590
2014	Aug. 7, central Alberta	Hail/Windstorm/Lightning/Water	550	580
2012	Aug. 12, Calgary AB	Hail/Lightning/Water	520	570
2010	July 12, Calgary AB	Hail/Flooding/Windstorm/Lightning	490	560

Source: IBC 2019 Facts

Trends in damages from (catastrophic) extreme weather events



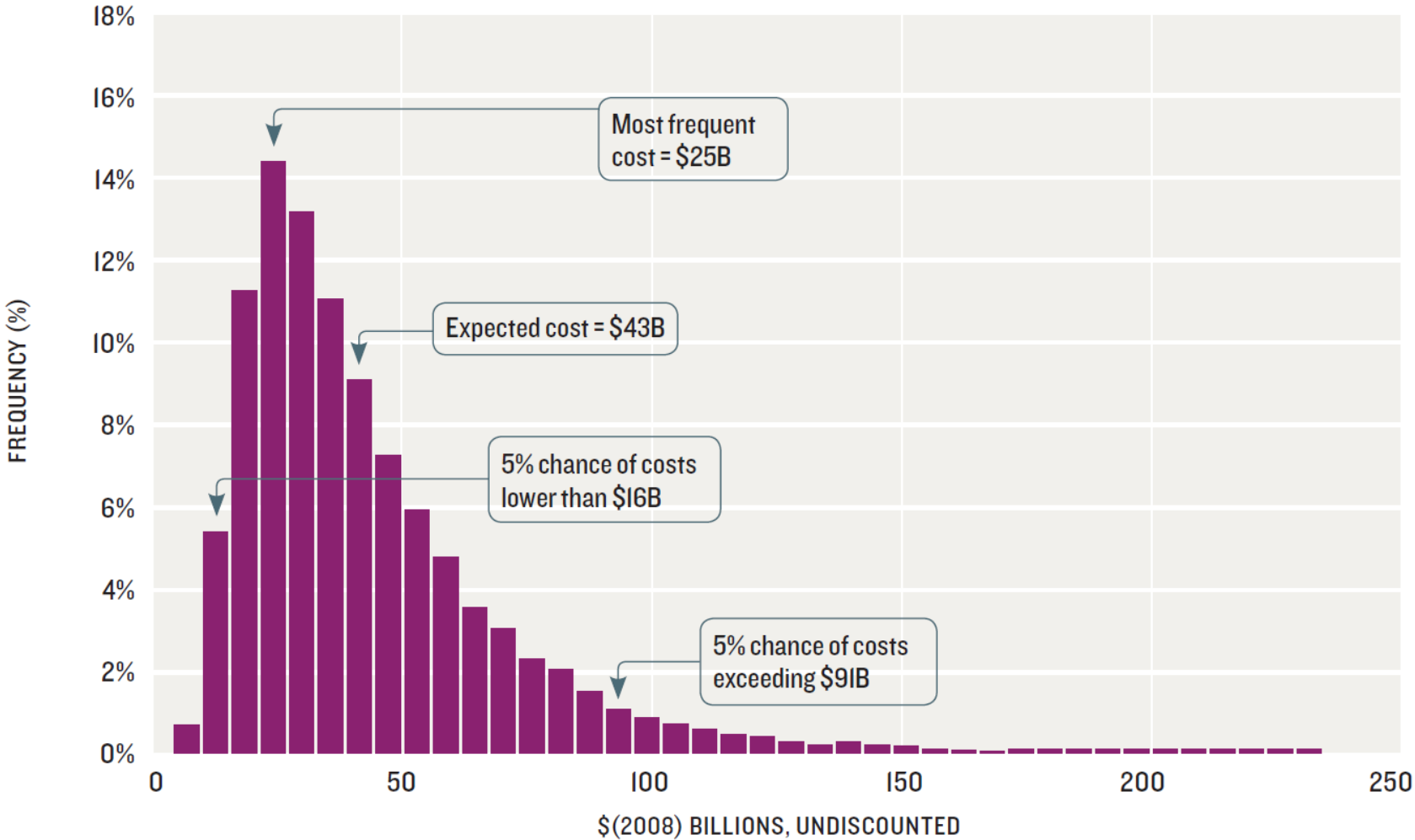
Source: Boyd and Markandya (forthcoming)



3. Projected economic consequences of climate change

Projected future economic impacts of climate change - national

DISTRIBUTION OF POSSIBLE COSTS IN HIGH CLIMATE CHANGE- RAPID GROWTH SCENARIO, 2050



Source: NRTEE (2011)

Projected future economic impacts of climate change – regions & sectors

Coasts - national

\$109-\$379 Bn. PV costs
(2011-2100; DR = 3%; 2008 \$)
Damages to dwellings from
SLR and storm surge

Forestry - national

\$1,070 Bn. PV GDP costs
(2010-2080; DR = 3%; 2008 \$)
Impacts on timber supply from
fire, pests and disease, and
changes in productivity

Crops - national

1.7% increase in PV of GDP
(2006-2051; DR = 4%)
Improvements in crop yields

Quebec

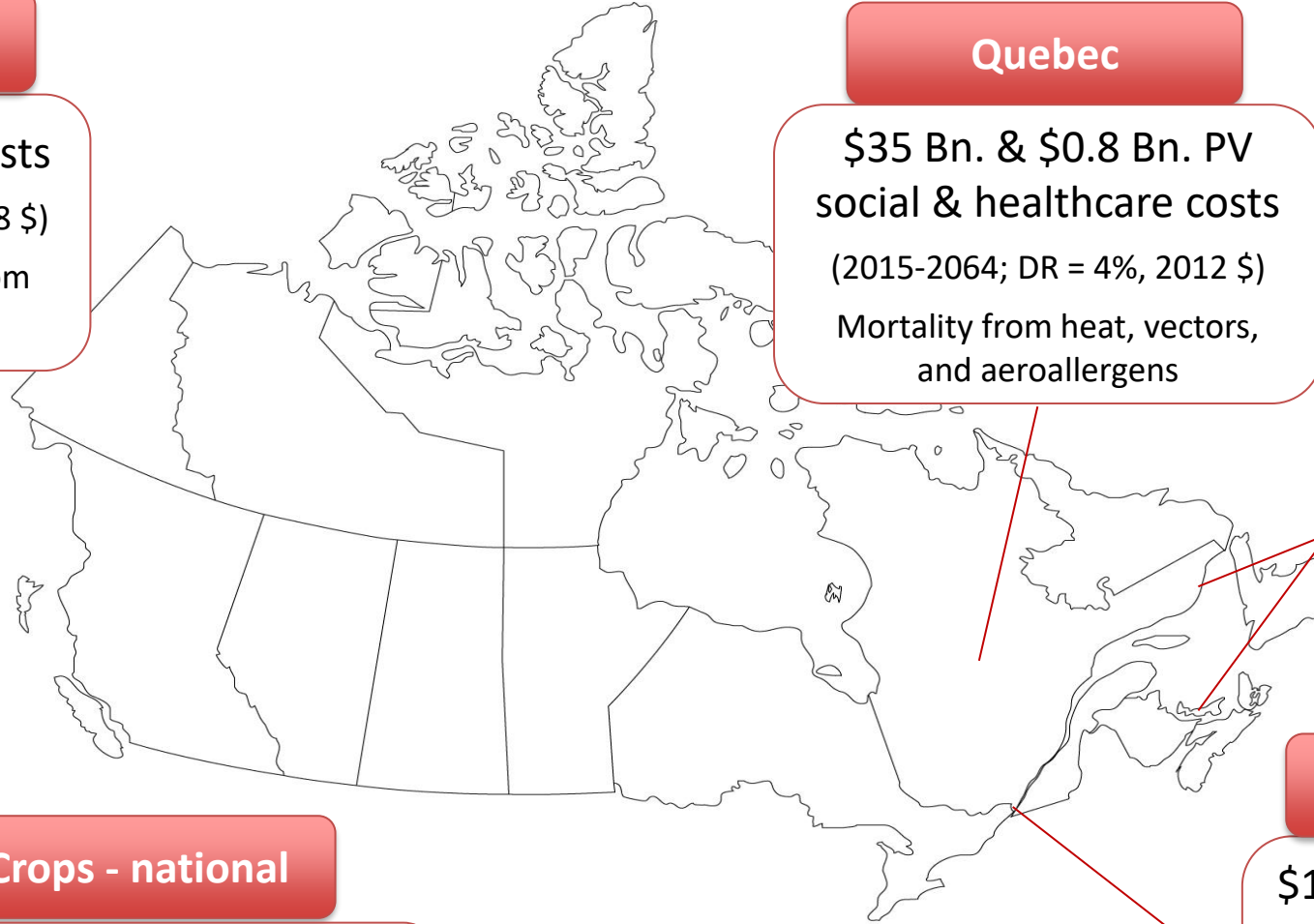
\$35 Bn. & \$0.8 Bn. PV
social & healthcare costs
(2015-2064; DR = 4%, 2012 \$)
Mortality from heat, vectors,
and aeroallergens

Eastern coast

\$1.2 Bn. PV costs
(2015-2064; DR = 4%; 2012 \$)
Market & non-market
damages from SLR, storm
surge and erosion

St. Lawrence & lakes

\$11.4-\$11.7 Bn. PV costs
(2015-2064; DR = 4%; 2012 \$)
Low flow impacts to hydro,
recreation, waterfront
property, shipping



Projected future economic impacts of climate change - municipalities

Edmonton

\$10.5 Bn. social costs pa
(2080s relative to 1980s)
Damage to health, built and natural environment from 17 climate hazards (2018 \$)

Vancouver

\$36-\$48 Bn. present value social costs
(2010-2100; DR = 4%; 2008 \$)
Mortality from heat and poor air quality

Mississauga

\$58-\$101 Mn. cumulative GDP costs
(2040 relative to 2015)
Damages from stormwater and freezing rain (2013 \$)

3 ski resorts

29% reduction in net income
(2050 relative to 2020)
Increased operating costs & reduced usage

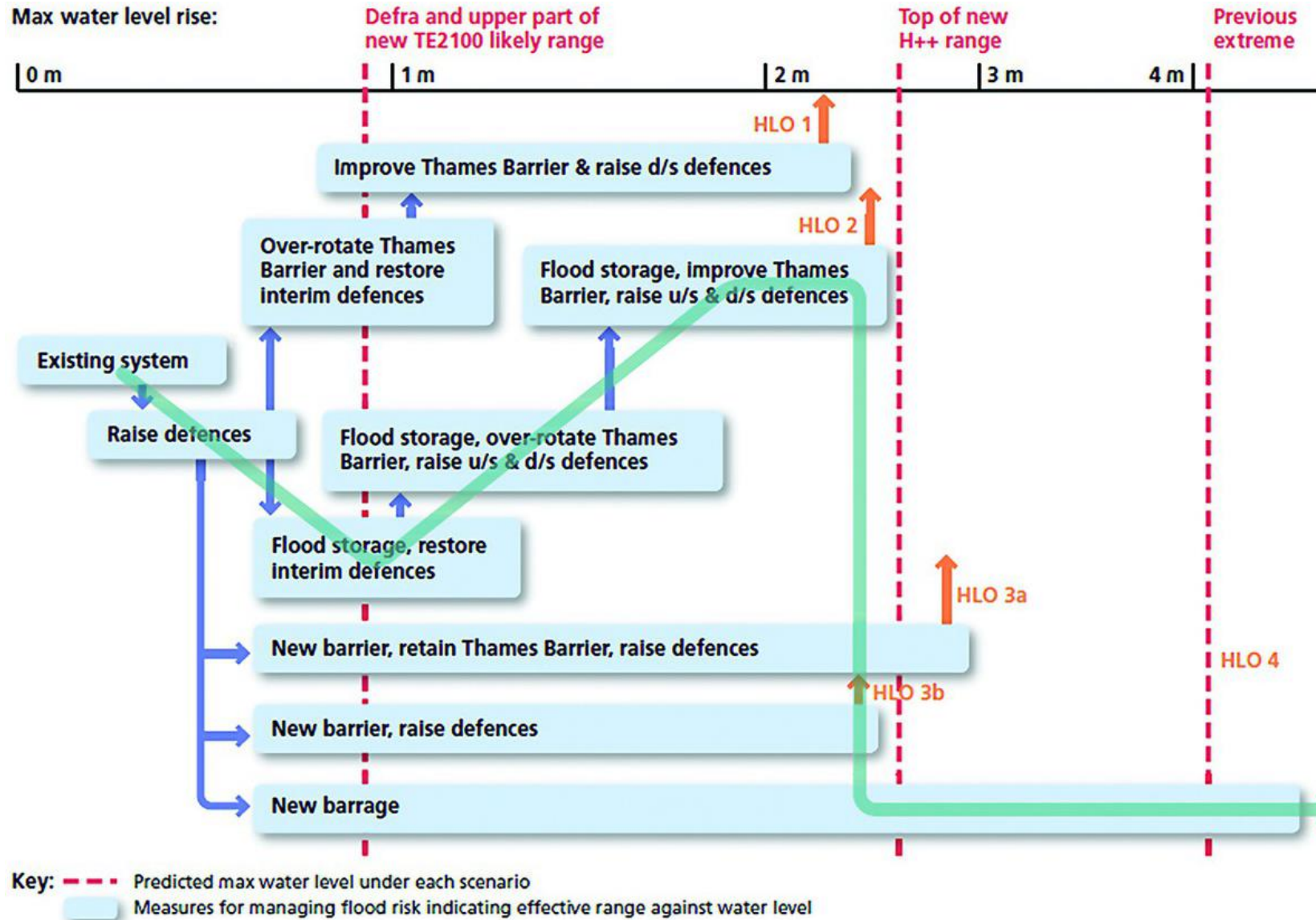
Halifax

\$90-\$175 Mn. cumulative GDP costs
(2040 relative to 2015)
Damages from storm surge and high winds (2013 \$)

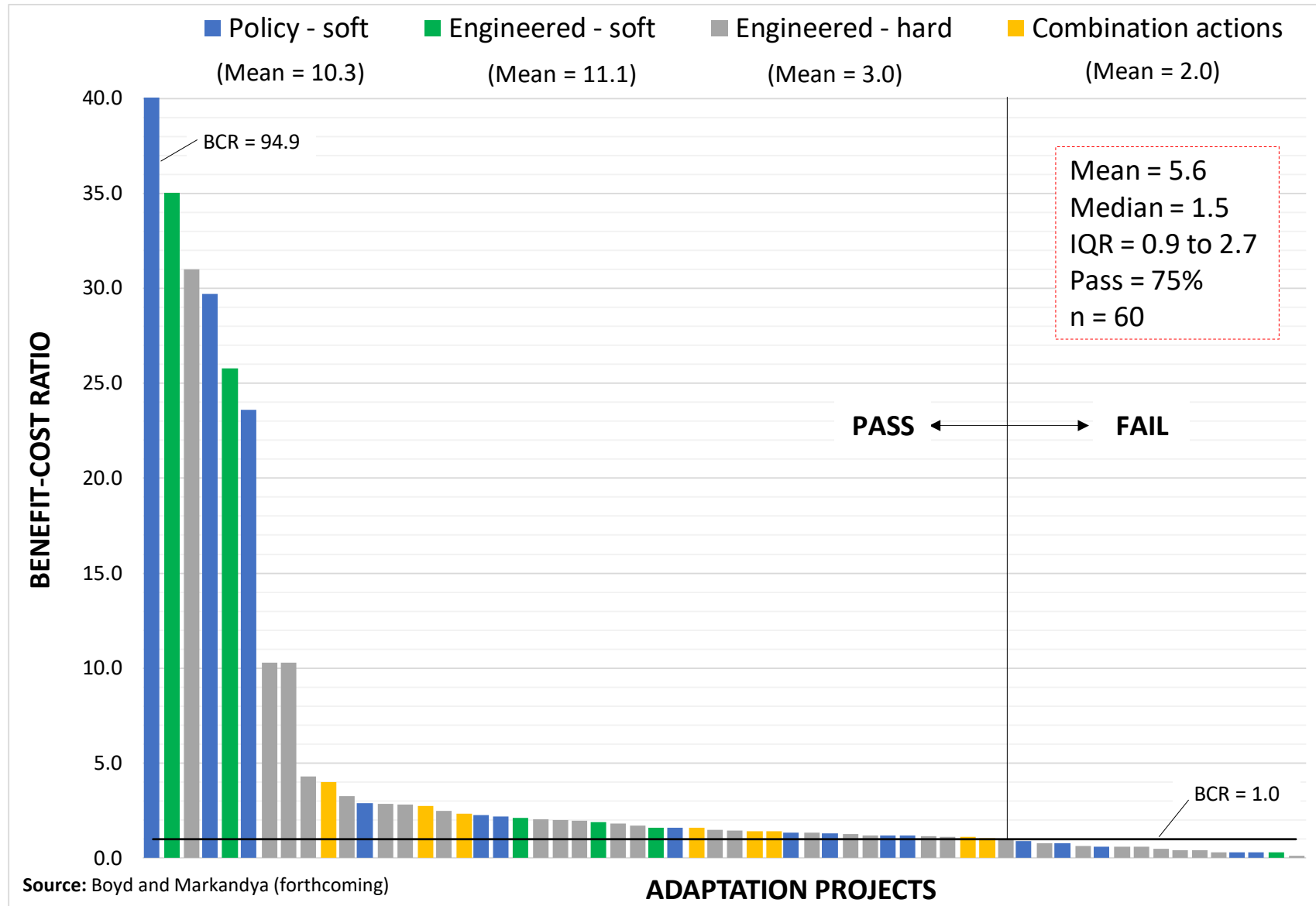
Toronto

\$65-\$96 Bn. present value social costs
(2010-2100; DR = 4%; 2008 \$)
Mortality from heat and poor air quality

Illustration of adaption pathways to manage uncertainties



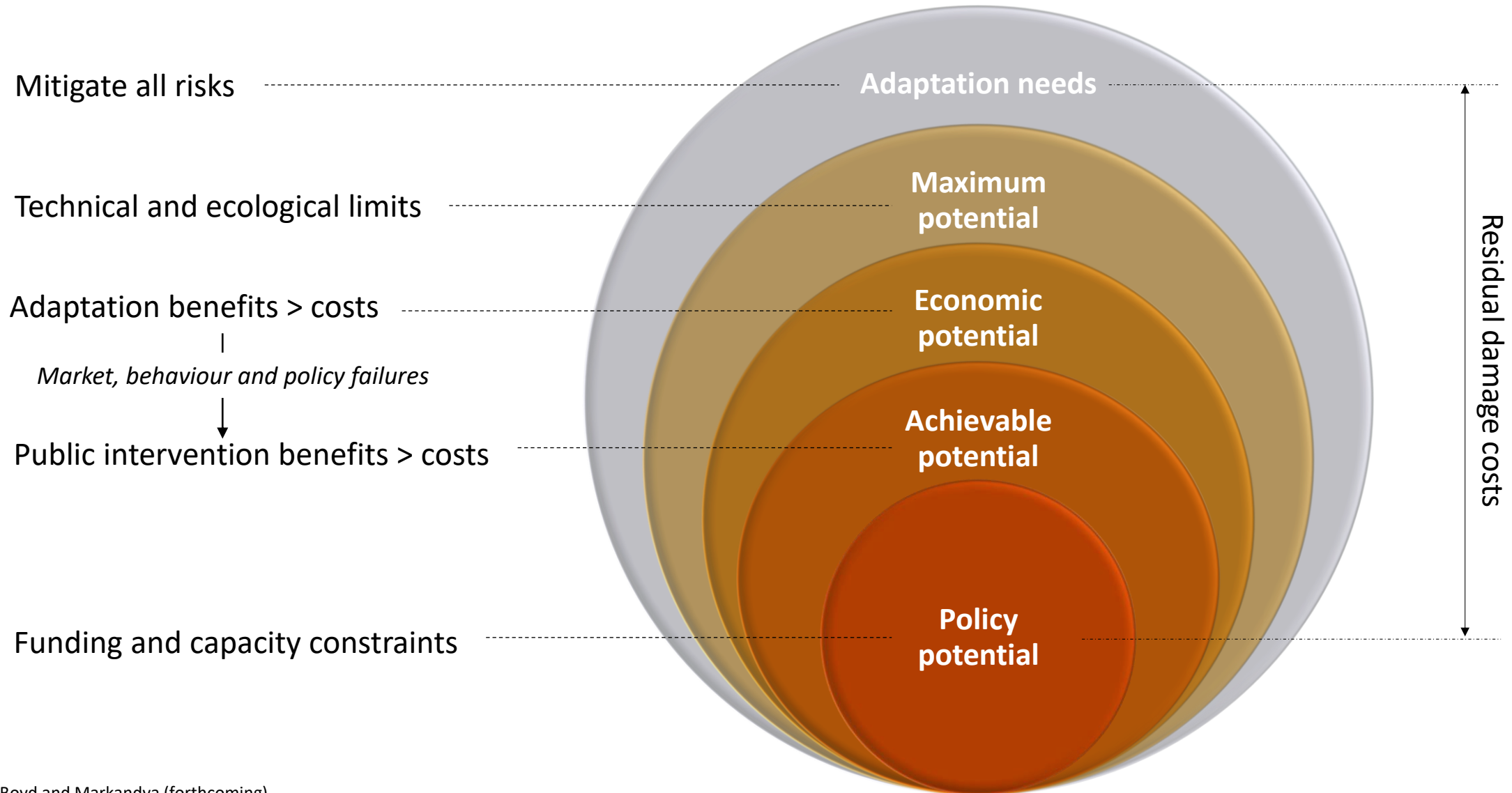
CBA of sample of adaptation options in Canada





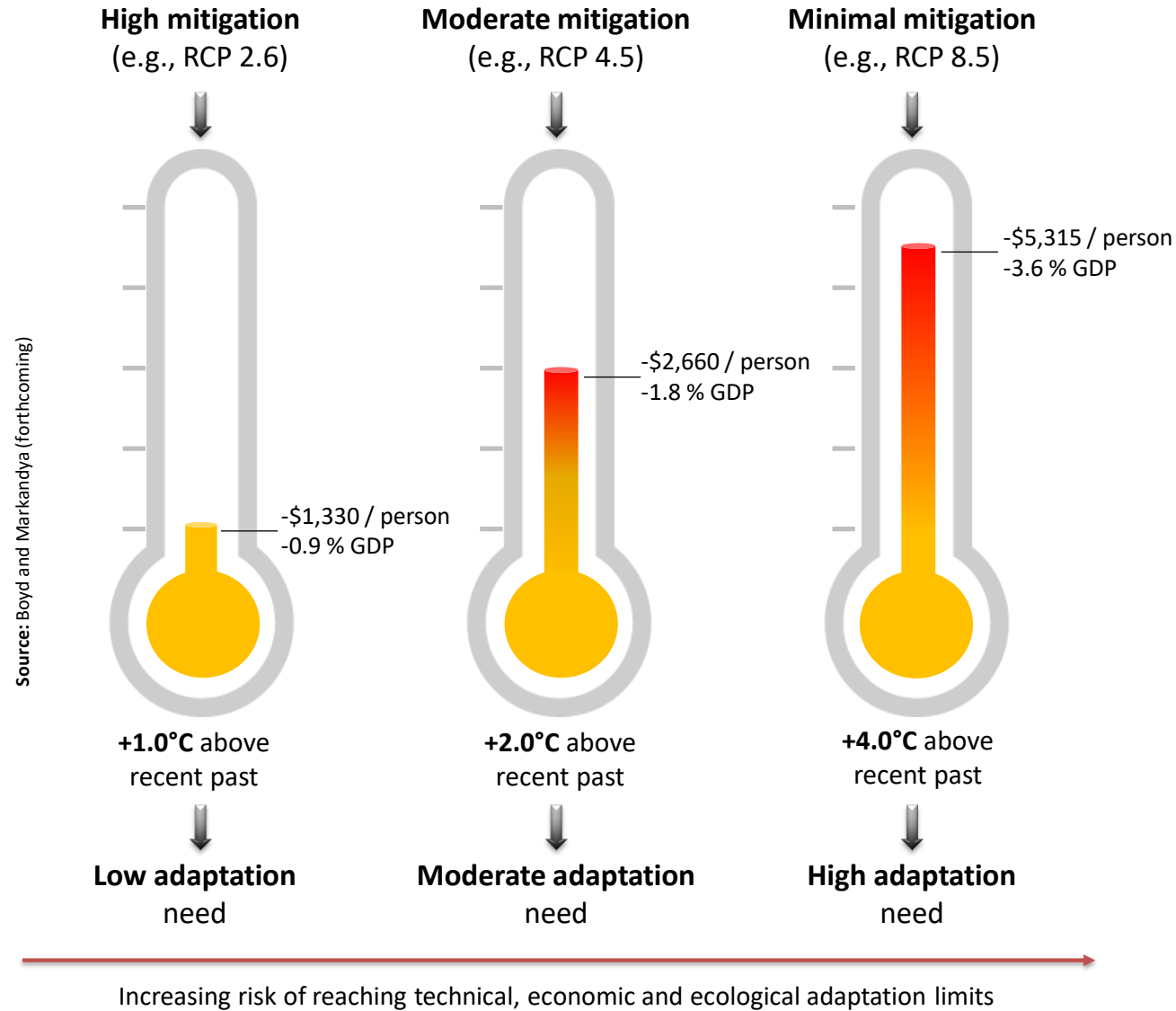
5. Economic barriers and limits to adaptation

Economic barriers and limits to meeting all adaptation needs



Source: Boyd and Markandya (forthcoming)

Climate mitigation, adaptation needs and limits





5. Key messages

Key messages

1. Insured losses significant and rising (+\$60 million per year)
2. Climate link? Adaptation deficit (potential for no-regret options)?
4. Significant projected future costs for regions, sensitive sectors (except crops) and cities
5. Many gaps in coverage
6. Much more to know about cost of adaptation
7. Strong economic case for adaptation, though returns variable and context specific
8. Uncertainty not reason for delay
9. Economic limits to adaptation, expect residual costs



Contact:

Richard Boyd | richard@allonesky.ca | +1.403.612.4470

All One Sky
— FOUNDATION —