

# Costs of Climate Change on the Prairies

ClimateWest Forum: The benefits of early adaptation action | May 3-4, 2023

**Dr. Richard Boyd, Director Research and Economics**

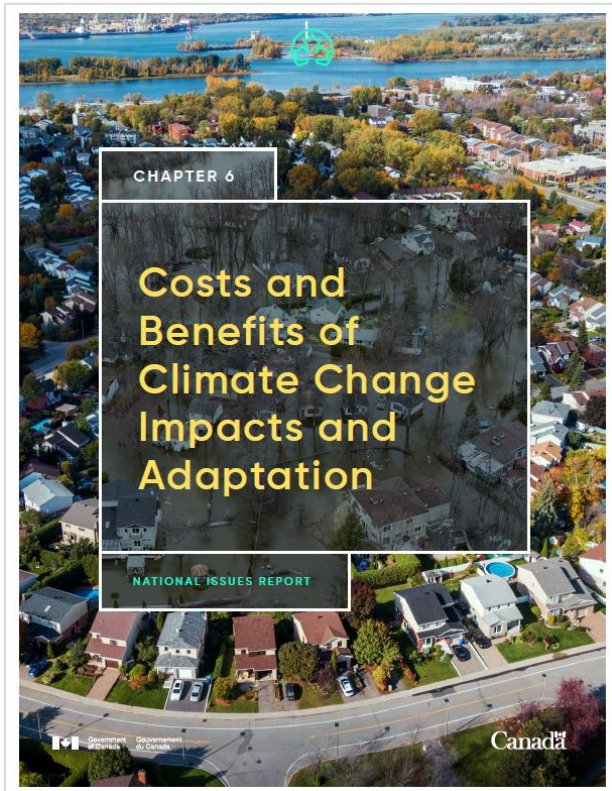
All One Sky Foundation



# “Costs of inaction” Phrase of the moment, but useful to know?

**Cost of inaction:** *“economic consequences that result from allowing climate change to continue unabated and without further planned adaptation.”*

Source: Boyd and Markandya, 2021



- ➔ Quantify scale of challenge presented by impacts of climate change over time in units familiar to decision-makers
- ➔ Inform the distribution of economic impacts across the community
- ➔ Support the prioritization of threats and opportunities
- ➔ Justify and inform level, timing and sequencing of investment in adaptation, and what specific actions

# What we know about projected annual cost of climate change on Prairies



**\$11.5B** (2050s) to **\$28.9B** (2080s) losses from health impacts



**\$0.7B** to **\$1.8B** losses from reduced labour supply



**\$1.6B** to **\$3.8B** damages to road & rail infrastructure and associated delays



**\$0.6B** to **\$1.1B** damages to electricity T&D infrastructure and changes in electricity demand



**\$1.2B** to **\$1.8B** losses from river and stormwater flood damages to buildings and contents



**\$3.4B** to **\$4.3B** increases in farmland values from improved productivity

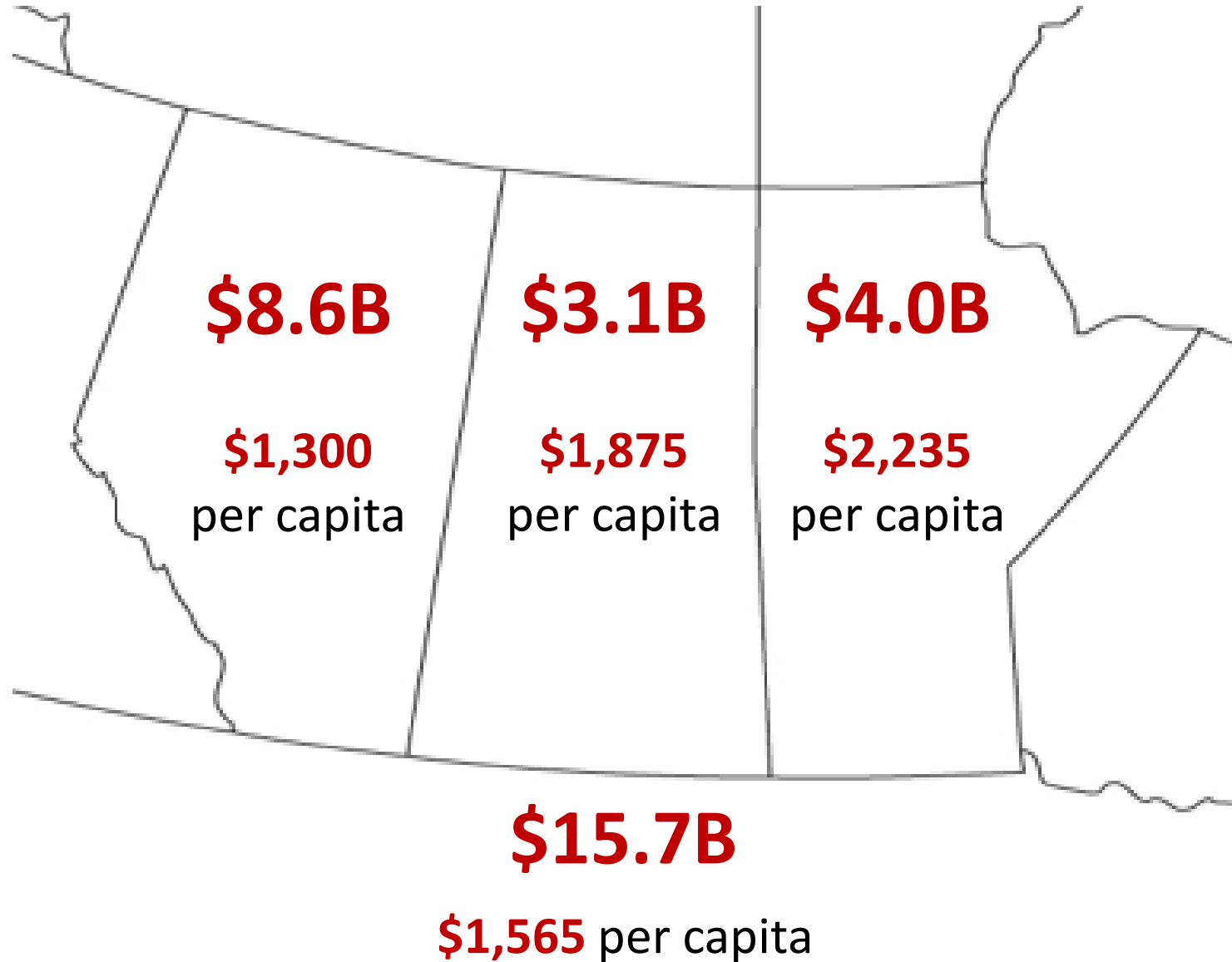


**\$3.4B** annual average GDP losses for Prairies, Yukon and NWT from reduced timber supply

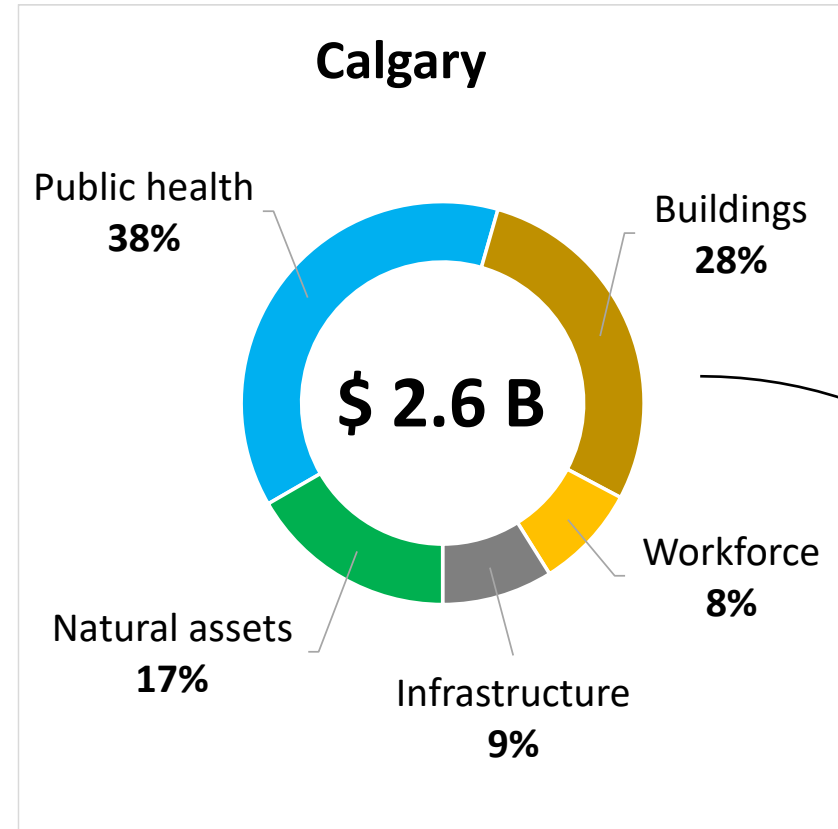
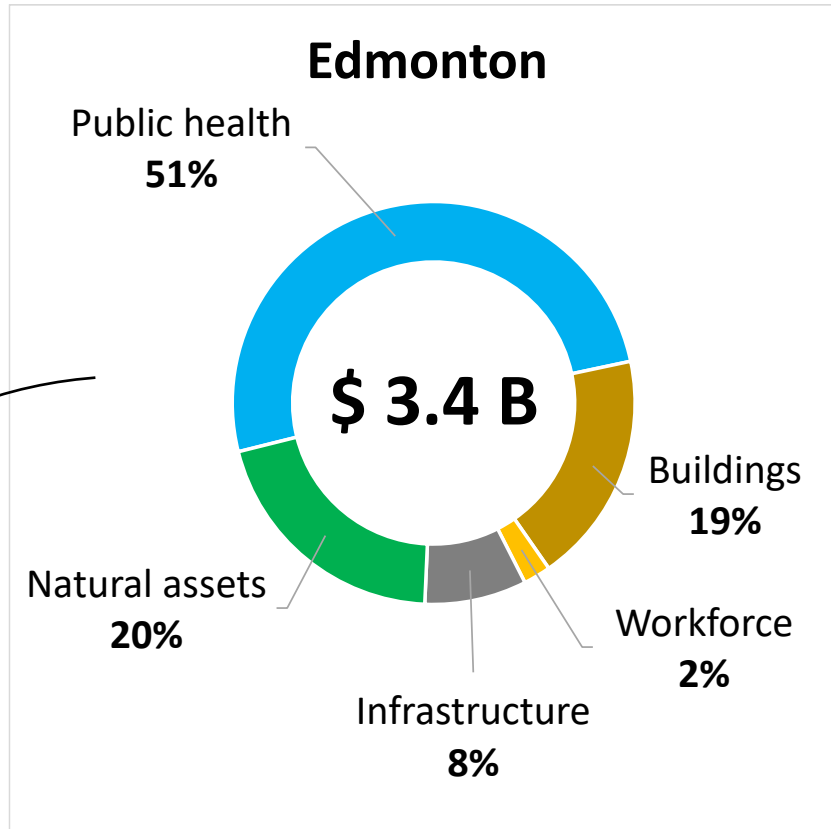


**\$3.3B** losses from excess deaths due to historic wildfire smoke-PM2.5 (2013-2018)

# Projected total annual costs mask differential risk levels across Prairies (2050s)



# Projected direct and secondary annual costs for Calgary and Edmonton in 2055



Direct tangible costs

Tax revenues	<b>\$0.1 B</b>
Labour income	<b>\$1.3 B</b>
Gross output	<b>\$ 5.5 B</b>
GDP	<b>\$ 2.2 B</b>

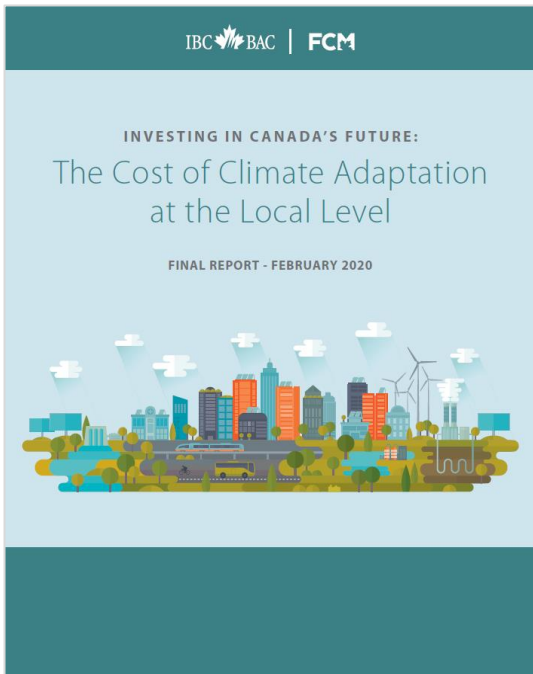
Direct tangible costs

Tax revenues	<b>\$0.1 B</b>
Labour income	<b>\$1.2 B</b>
Gross output	<b>\$ 5.2 B</b>
GDP	<b>\$ 2.2 B</b>

## Only a hint of a much larger problem?

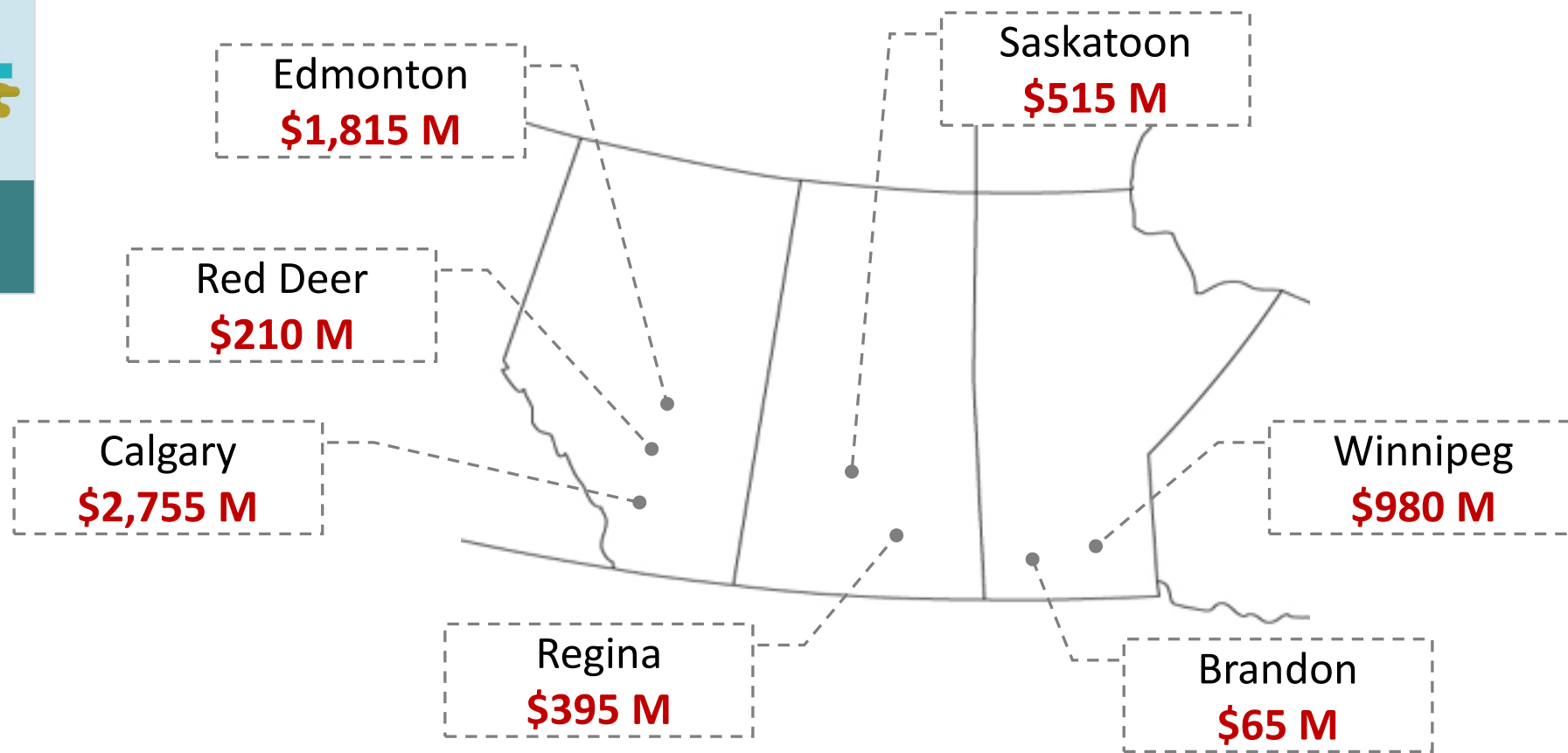
- ➔ Loss or disruption to services flows from infrastructure
- ➔ Focus on slow-onset climate impacts over acute, rapid-onset climate impacts
- ➔ Missing climate-sensitive sectors
- ➔ No account for compounding effects – e.g., impact chains occurring simultaneously (extreme heat, drought, fire) or in sequence (atmospheric rivers in BC 2021)
- ➔ No account for cascading effects – direct biophysical effects cause indirect biophysical impacts (usually across interdependent infrastructure)
- ➔ Adaptation decisions largely made at local (municipal) level; yet few city-level assessments

# Clear need for climate adaptation! But what will it cost?



Investment  $\cong$  **0.26%** of GDP per year nationally [*estimated* annual expenditures in Canadian *municipal* adaptation plans]

Source: FCM & IBC, 2019



# The good news ... investing \$1 in proactive adaptation will return ...

**\$10.5**

From 'soft' engineered measures for coastal flooding, low water levels in Great Lakes, heat-related deaths, forestry

Source: Boyd and Markandya (2021)

**\$3**

From 'hard' engineered measures for coastal flooding and low water levels in Great Lakes

Source: Boyd and Markandya (2021)

**\$5.5**

Installing "shading technologies" on 50% of manufacturing buildings to reduce hours lost to heat exposure

Source: Boyd et al.(2021)

**\$1.7**

Adoption of "green roofs" on 75% of viable urban buildings to reduce heat-related deaths

Source: Boyd et al.(2021)

**\$5.1**

From flood mitigation measures

Source: Rose et al (2007) (evaluation of +5000 US FEMA projects)

**\$9**

From strengthening early warning systems

Source: Global Commission on Adaptation

**\$4.1**

From strengthening building codes for storms and flooding

Source: US National Institute of Building Science

**\$4.9**

From making infrastructure more resilient

Source: Global Commission on Adaptation



# How much investment in adaptation is adequate? Case of Edmonton

Investment Strategy	10-year adaptation investment plan (2025-2035)	Present value lifetime benefits of adaptation investment	Reduction in projected damages (2025-2060)	Present value residual losses (2025-2060)
	(\$2022 B)	(\$2022 B)	(% of baseline costs)	(% of baseline costs)
Invest <b>0.26%</b> of projected GDP				
<b>\$1 returns \$3</b>	1.8 <i>\$1,590 / person</i>	5.4	18%	82%
<b>\$1 returns \$4</b>		7.3	24%	76%
<b>\$1 returns \$5</b>		9.1	30%	70%
Invest <b>1%</b> of projected GDP				
<b>\$1 returns \$3</b>	7.0 <i>\$6,060 / person</i>	20.9	68%	32%
<b>\$1 returns \$4</b> ★		27.9	91%	9%
<b>\$1 returns \$5</b> ★		30.7	100%	0%

Different levels of investment

Different returns on that investment

# Thank you! Merci!

Contact:

Richard Boyd | [richard@allonesky.ca](mailto:richard@allonesky.ca) | +1.403.612.4470

