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The aim of the Adaptation Resilience Program (ART) is to build the capacity of professionals in Alberta to adapt to climate change. This module was recorded in September, 2021.

Professionals across the Prairie region may find this training useful.

Supported by the Natural Resources Canada's Building Regional Adaptation Capacity and Expertise (BRACE) Program and the Government of Alberta



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Adaptation Resilience Training

Making Dollars and Sense of Climate Change: Economic Aspects of Adaptation

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Outline

1. Context for economic analysis
2. Net costs of inaction
3. Economic analysis and tools for decision support
4. Review of key messages

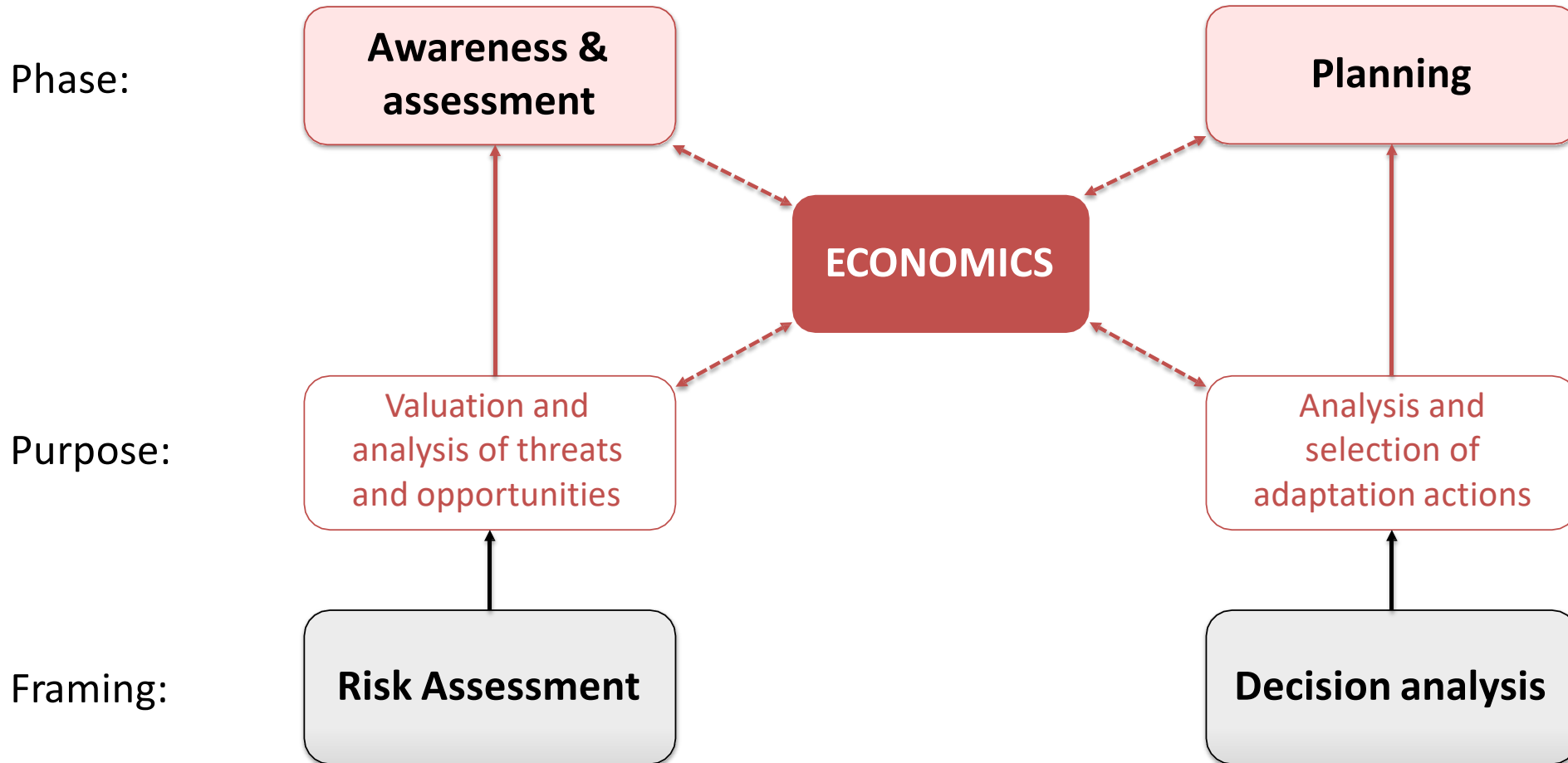
Topic 1 - Context for economic analysis

Learning objectives for Topic 1

- To understand how economic information and tools can support climate adaptation planning and risk management
- To identify the key building blocks for economic analysis of climate impacts and adaptation options
- To describe the main types of economic and social costs and benefits to capture in the analysis

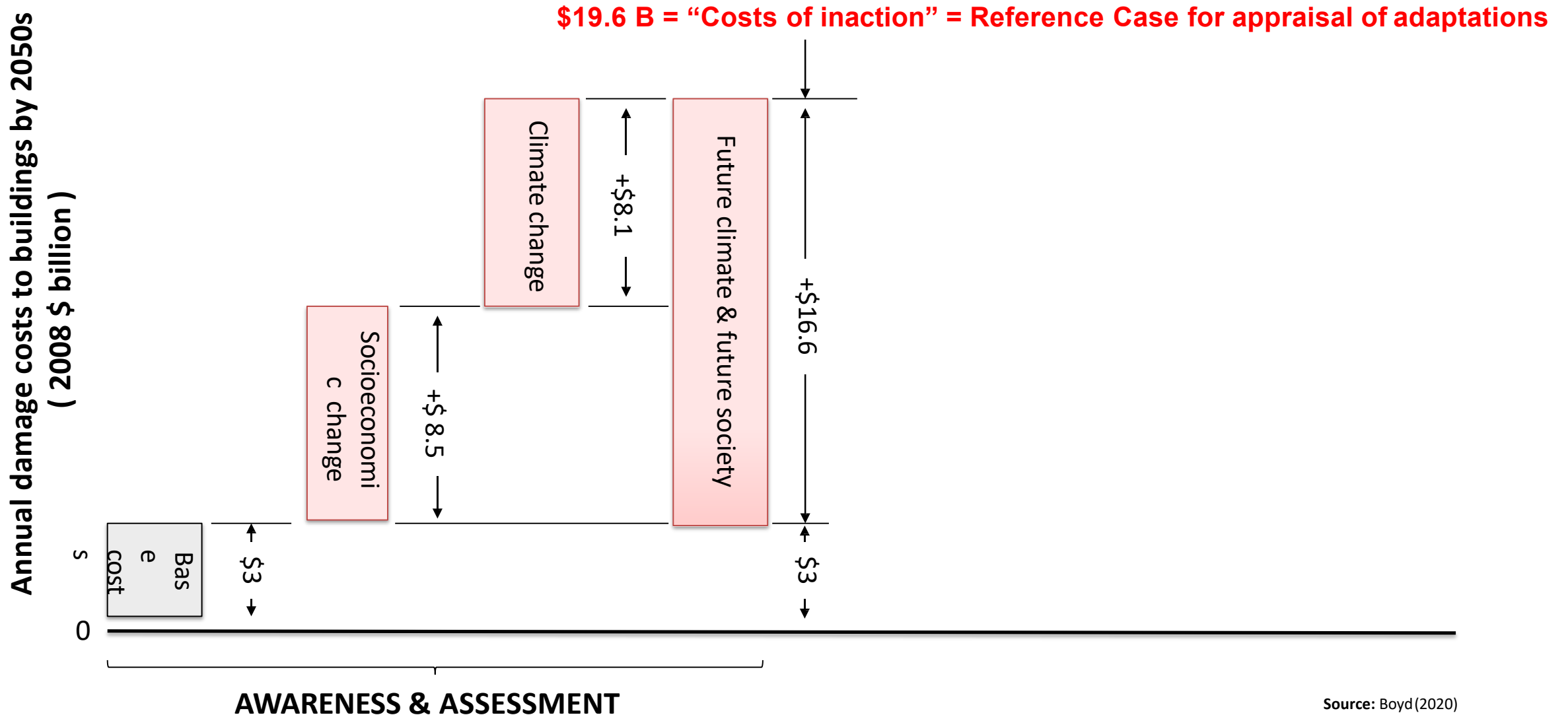
Economics support for climate risk management

Role of economic information in climate risk management

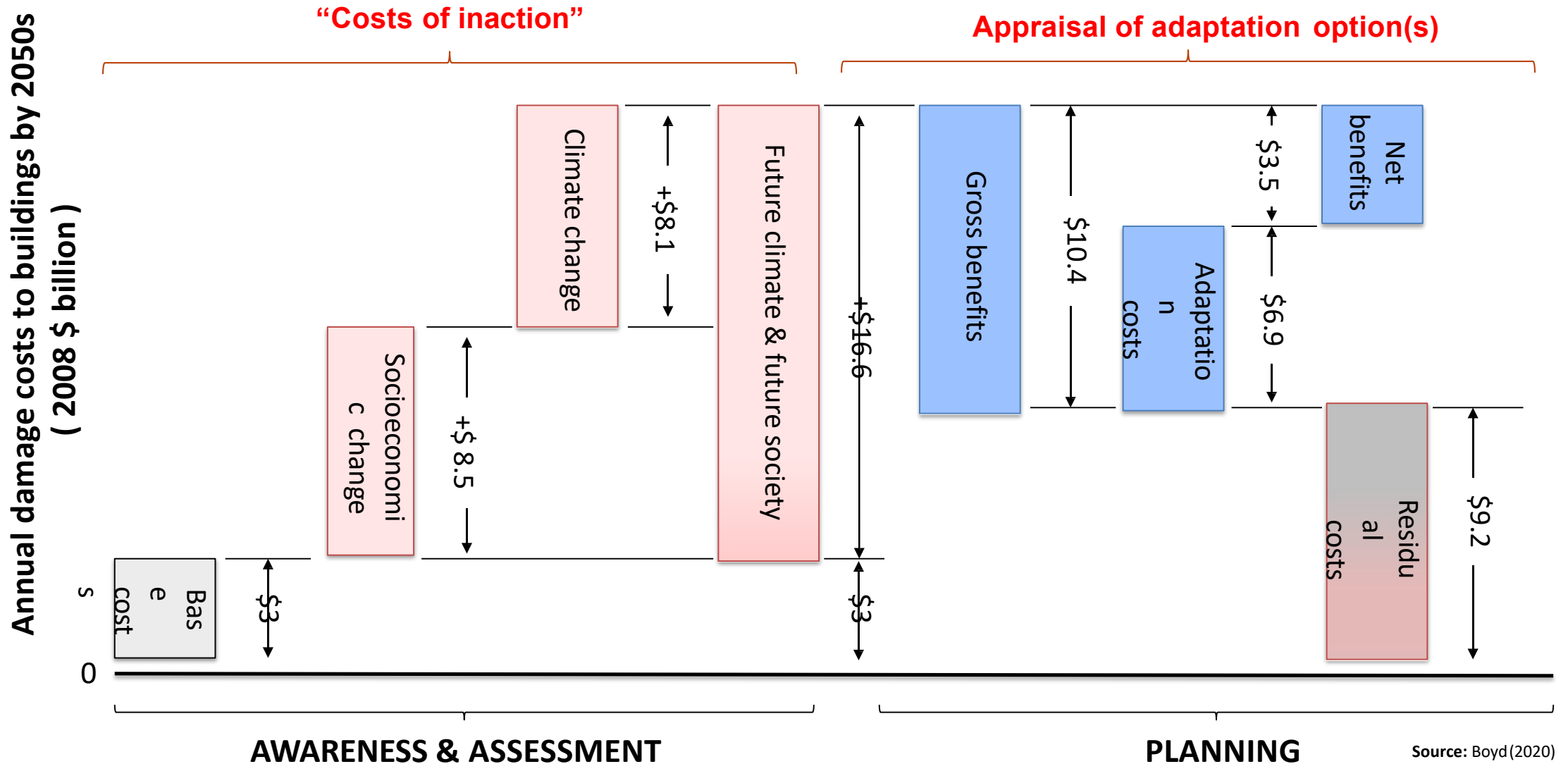


Building blocks of economic analysis

Main elements of economic analysis of climate adaptation

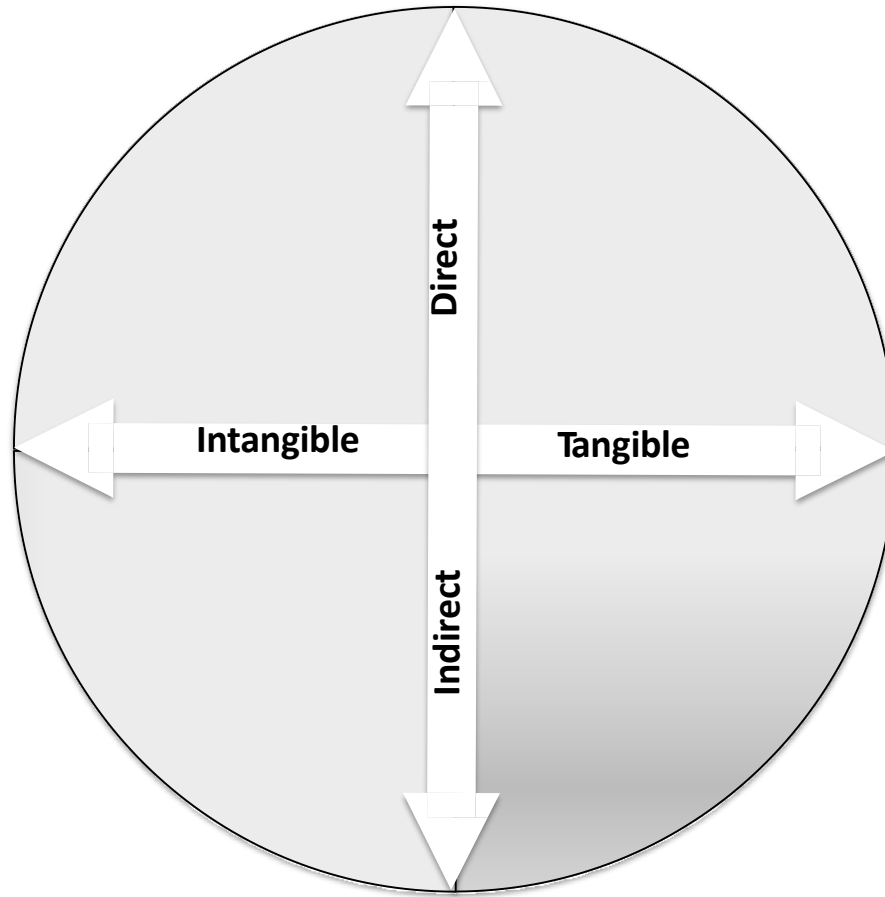


Main elements of economic analysis of climate adaptation



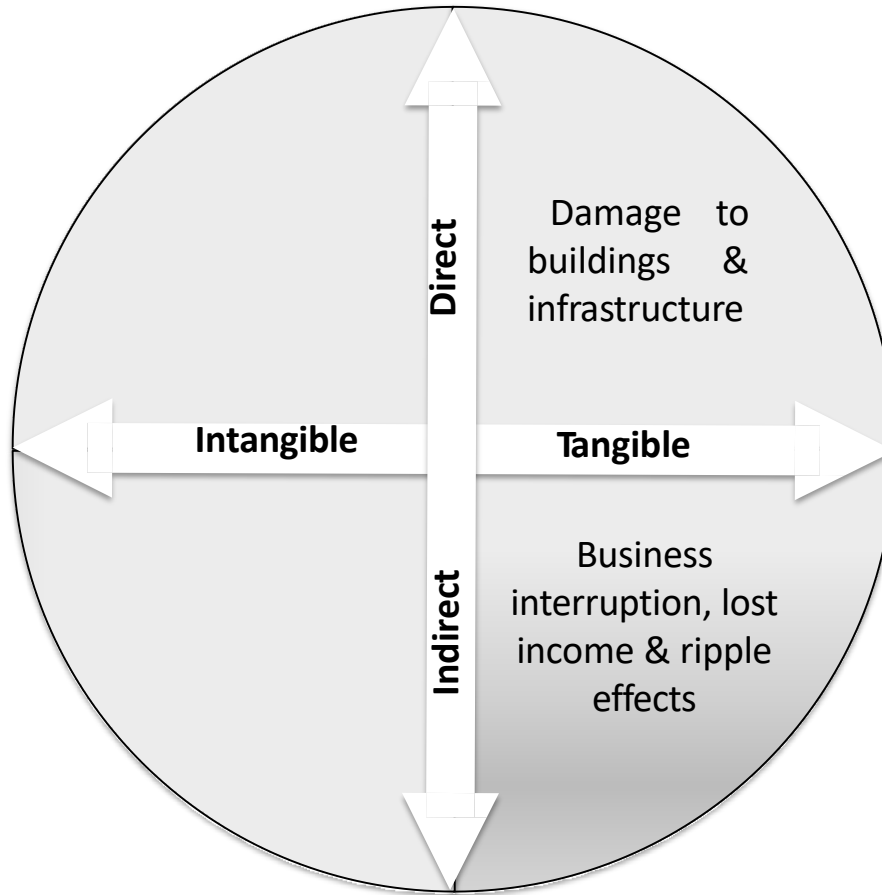
Types of relevant costs and benefits

Direct, indirect, tangible and intangible costs and benefits



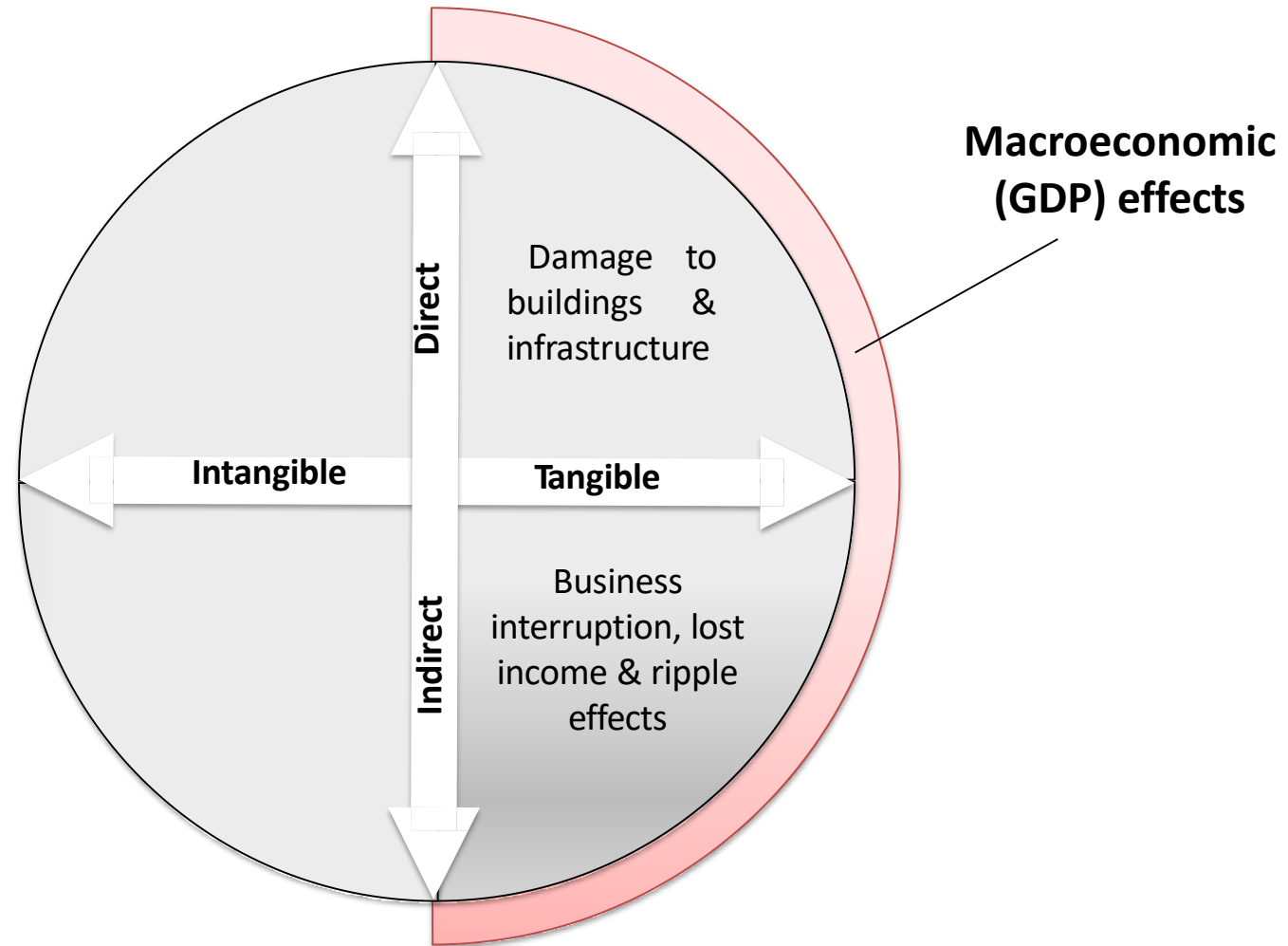
Source: Boyd (2018)

Direct, indirect, tangible and intangible costs and benefits



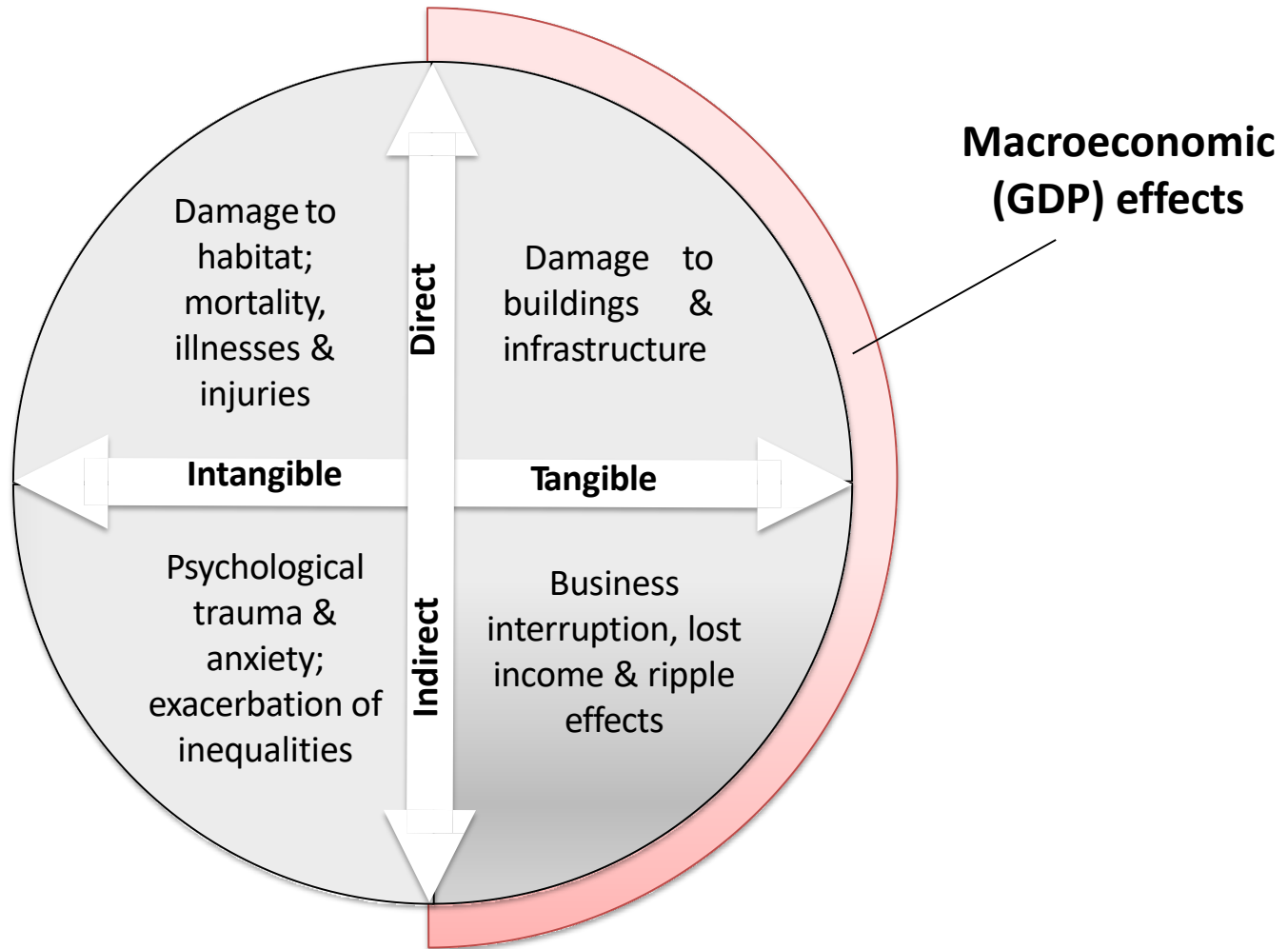
Source: Boyd (2018)

Direct, indirect, tangible and intangible costs and benefits



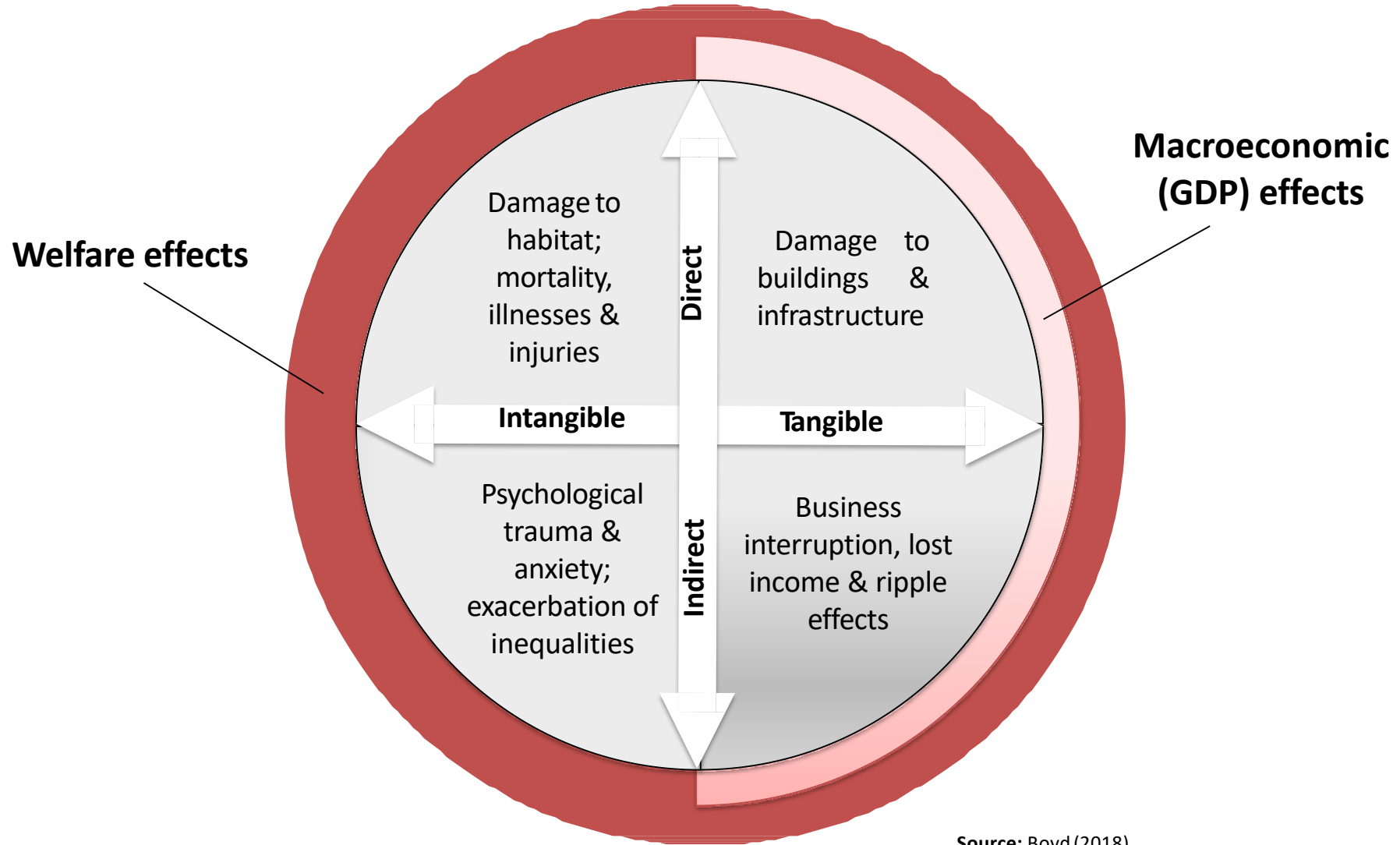
Source: Boyd (2018)

Direct, indirect, tangible and intangible costs and benefits



Source: Boyd (2018)

Direct, indirect, tangible and intangible costs and benefits



Source: Boyd (2018)

Don't forget about co-impacts when appraising options



Source: Shaw et al. (2020)

Key takeaways

- Economic information and tools can support climate adaptation planning and risk management
- Best practice economic analysis of climate impacts and adaptation options comprises several components
- Climate change can give rise to a variety of economic and social costs and benefits that need to be captured in any analyses

Polling Question

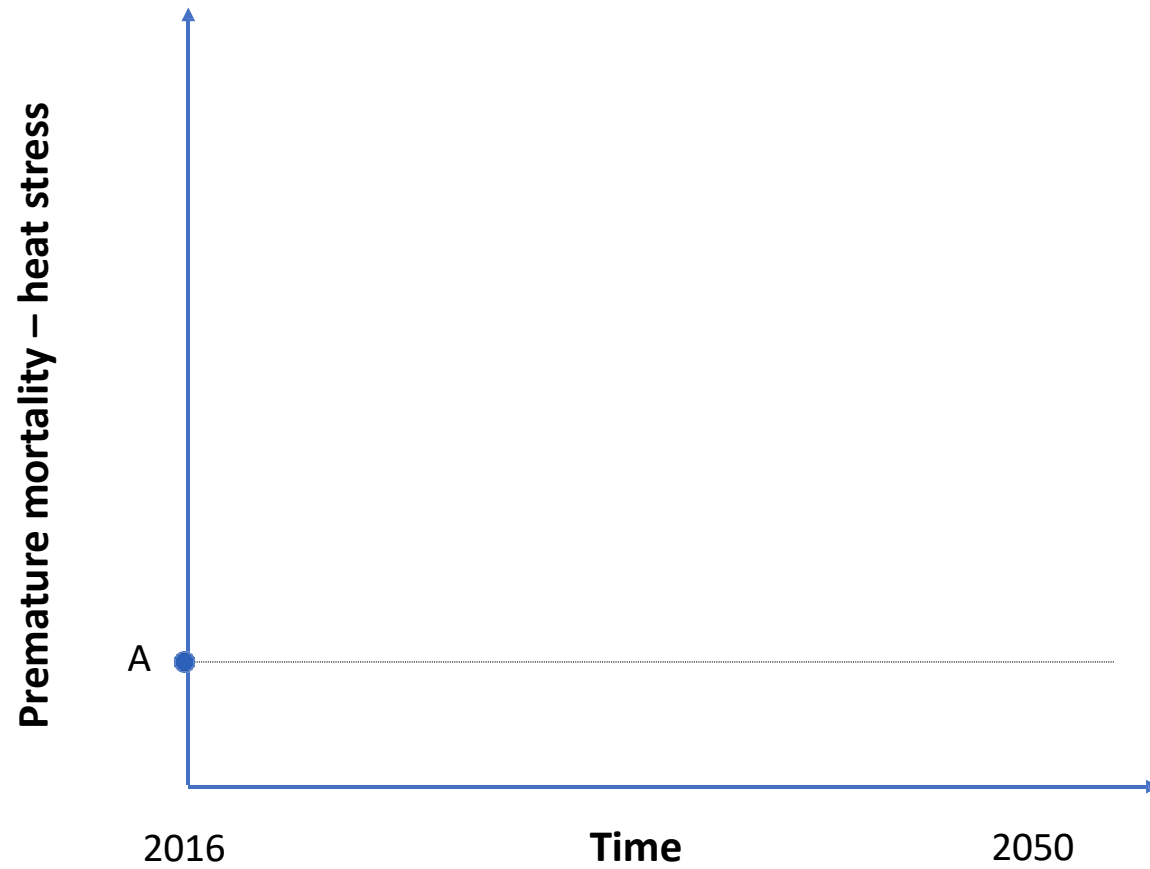
Topic 2. Net costs of inaction

Learning objectives for Topic 2

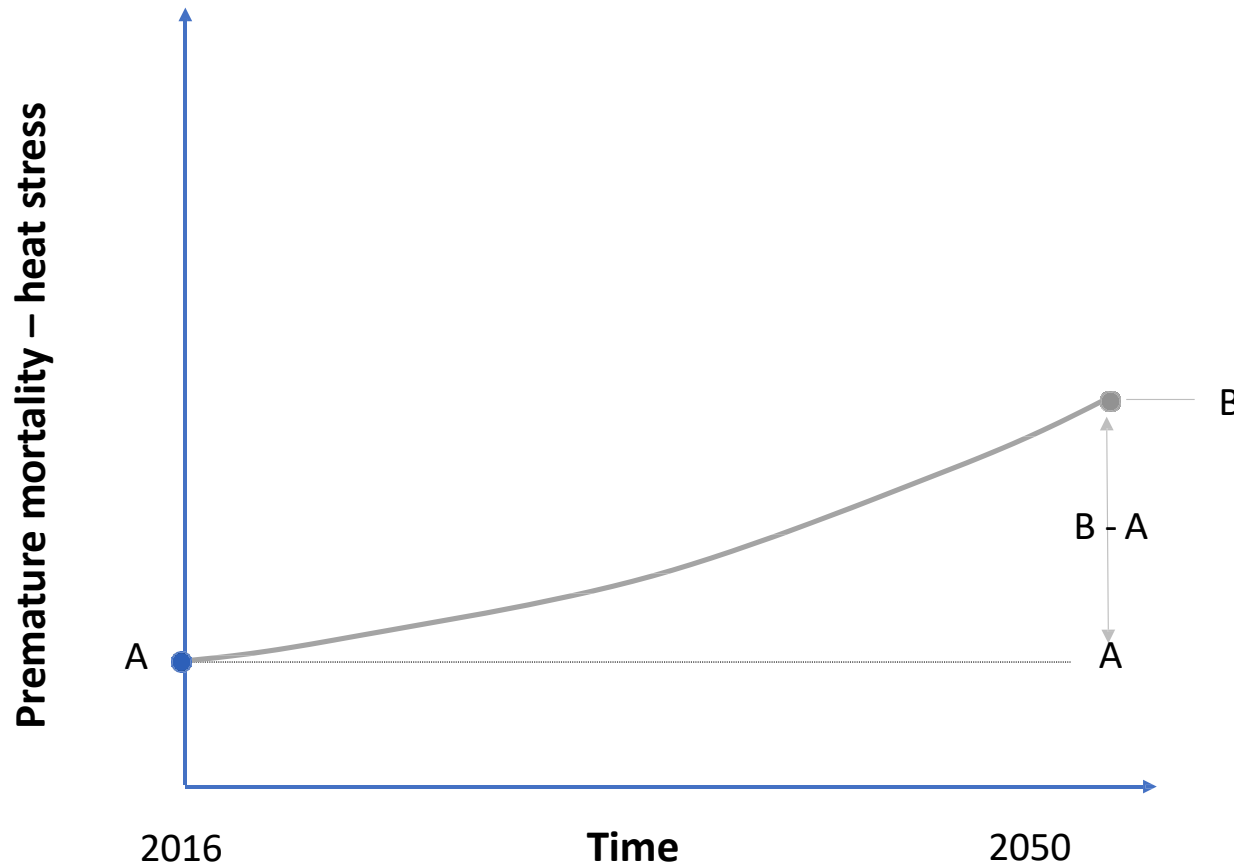
- Describe a key methodology for estimating future economic climate-related costs
- Summarize projected future costs of climate change in Alberta

Estimating the costs of climate change

Methodological steps – costs of inaction

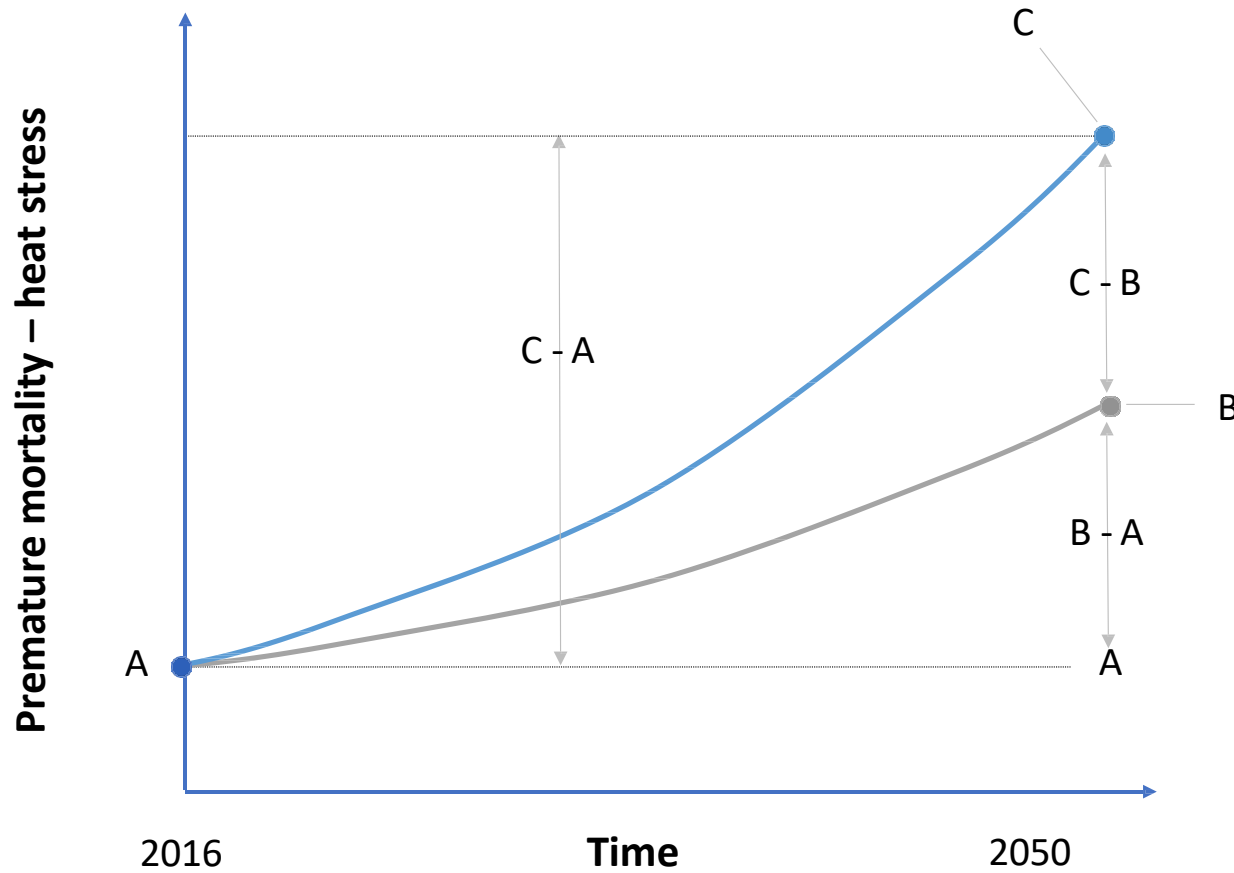


Methodological steps – costs of inaction



$B - A =$ Impact of socioeconomic change on heat-related mortality, with no climate change

Methodological steps – costs of inaction

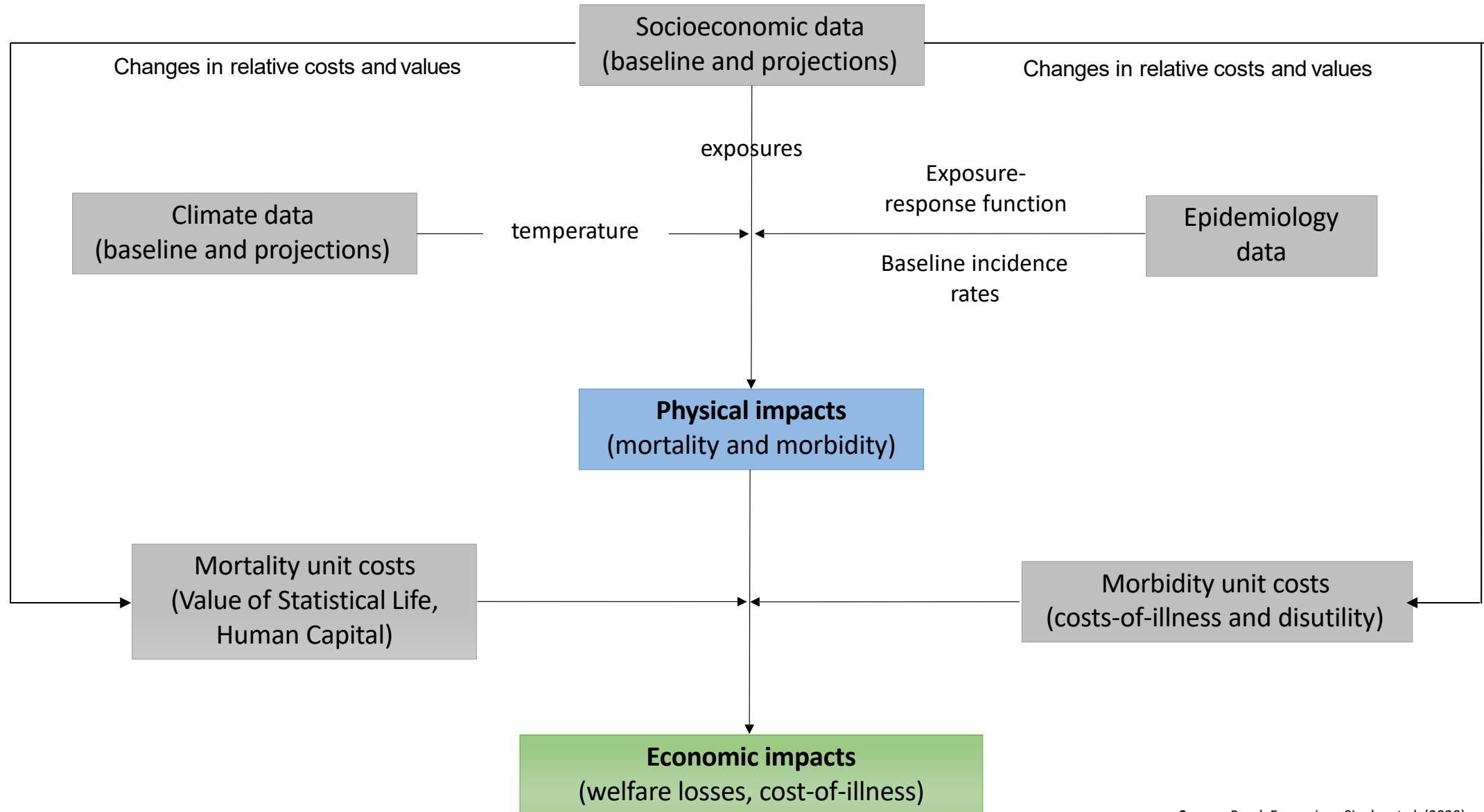


$B - A =$ Impact of socioeconomic change on heat-related mortality, with no climate change

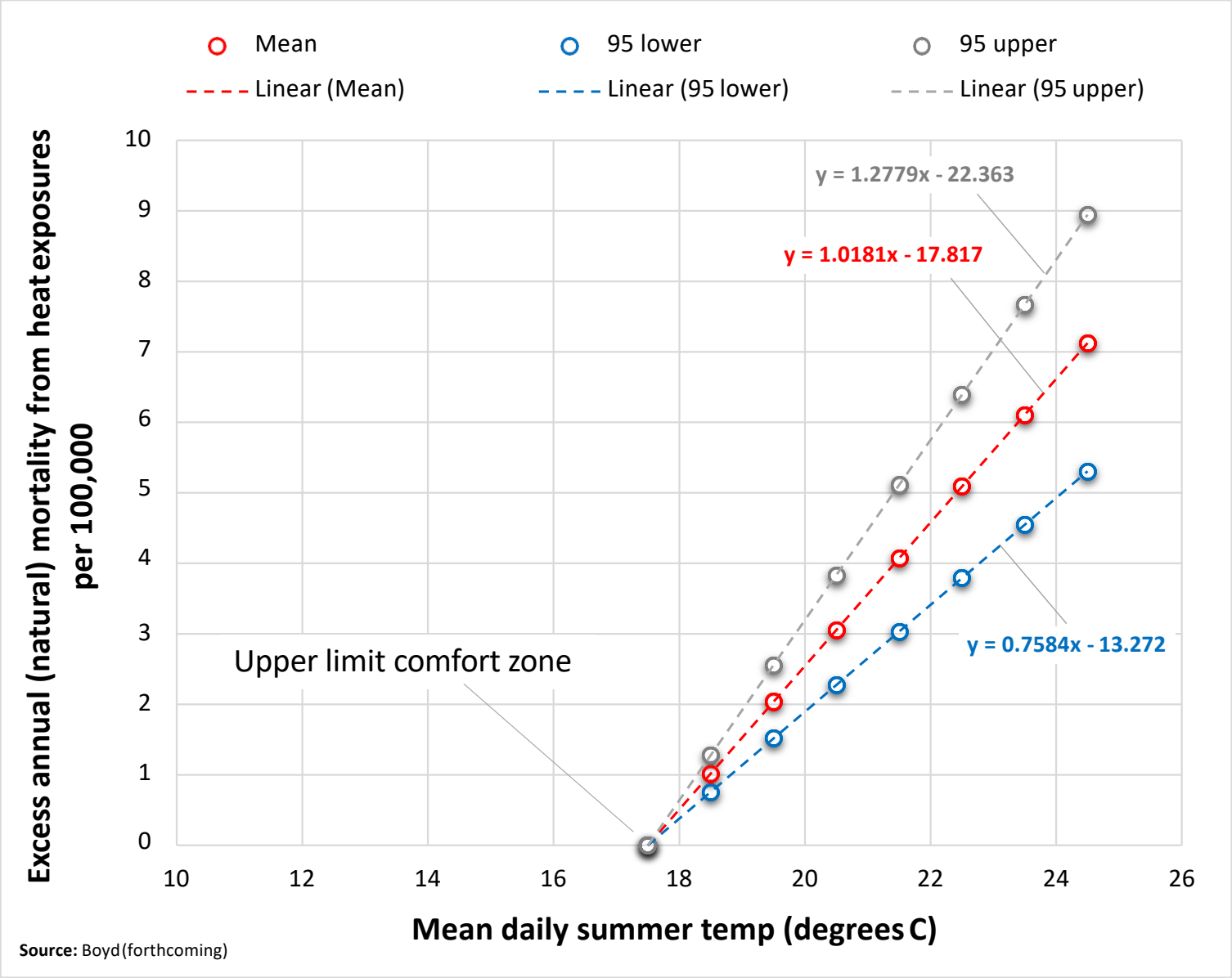
$C - A =$ Impact of socioeconomic and climate change on heat-related mortality (change in total risk)

$C - B =$ Change in heat-related mortality attributable to climate change

Process-based and statistical models of climate change costs



Exposure response functions – heat-related mortality



Projected costs of climate change in Alberta

Projected economic costs of climate change – heat exposures

Heat-related **labour supply** impacts attributable to climate change by 2080s:

\$670 million GDP losses per year

Heat-related **labour supply** impacts attributable to climate change by 2080s:

\$830 million GDP losses per year

Heat-related **labour supply** impacts attributable to climate change by 2080s:

\$185 million GDP losses per year

Heat-related **mortality** attributable to climate change by 2080s:

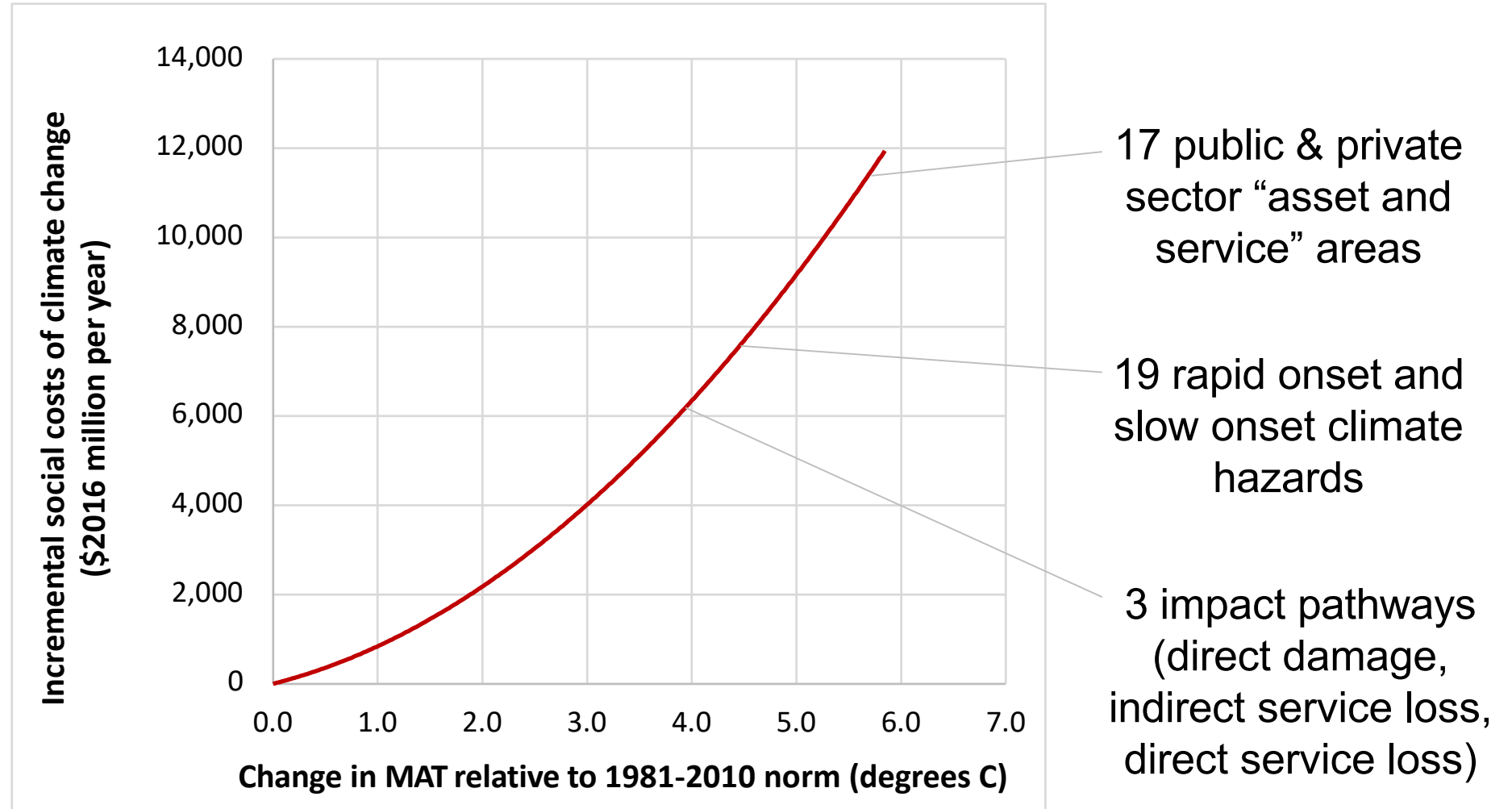
\$310 million welfare losses per year
\$35 million human capital losses per year

Heat-related **mortality** attributable to climate change by 2080s:

\$350 million welfare losses per year
\$40 million human capital losses per year

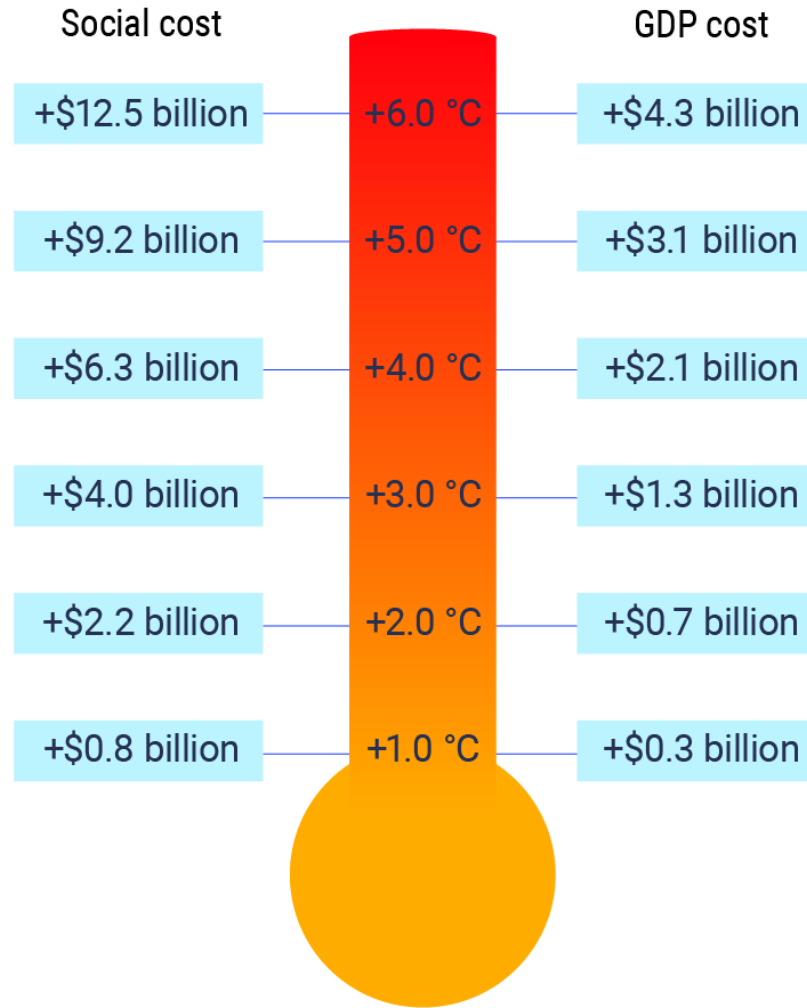


Projected economic impacts of climate change for Edmonton



Source: Boyd (2020)

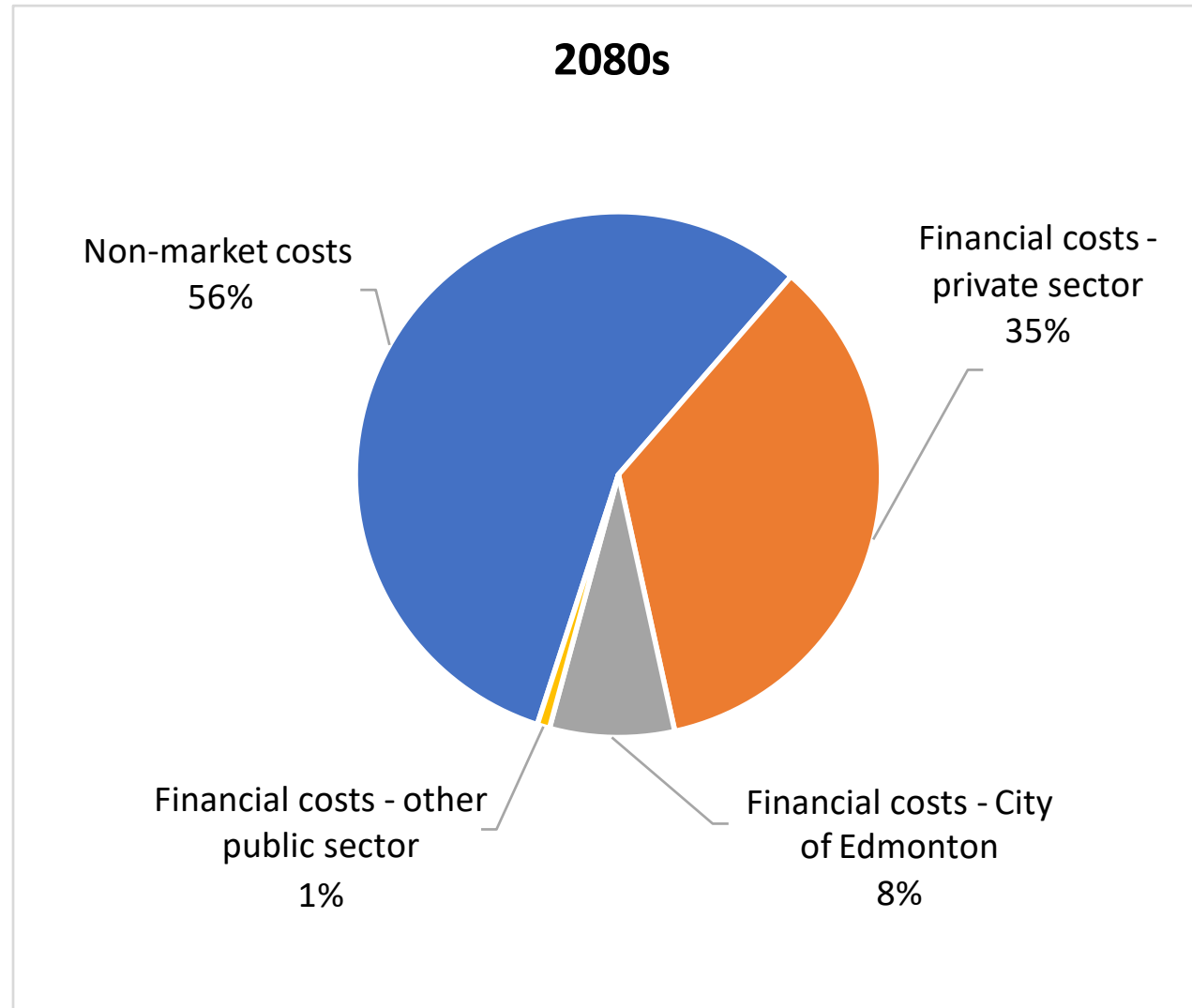
Projected economic impacts of climate change for Edmonton



Change in cost as mean annual
temperature rises from 1981–2010 average

Source: Boyd and Markandya (2021)

Projected economic impacts of climate change for Edmonton



Source: Boyd (2020)

Projected economic impacts of climate change for forestry and ag.

Forestry

\$0.2 - \$1.0 B GDP losses pa
(in 2050; 2008 \$)

Impacts on timber supply
from fire, pests and disease,
and changes in productivity
in CGE model

Forestry

+195% fire suppression costs
(by 2080s relative to 1980-2009)
Change in area burned under
RCP 8.5

Agriculture

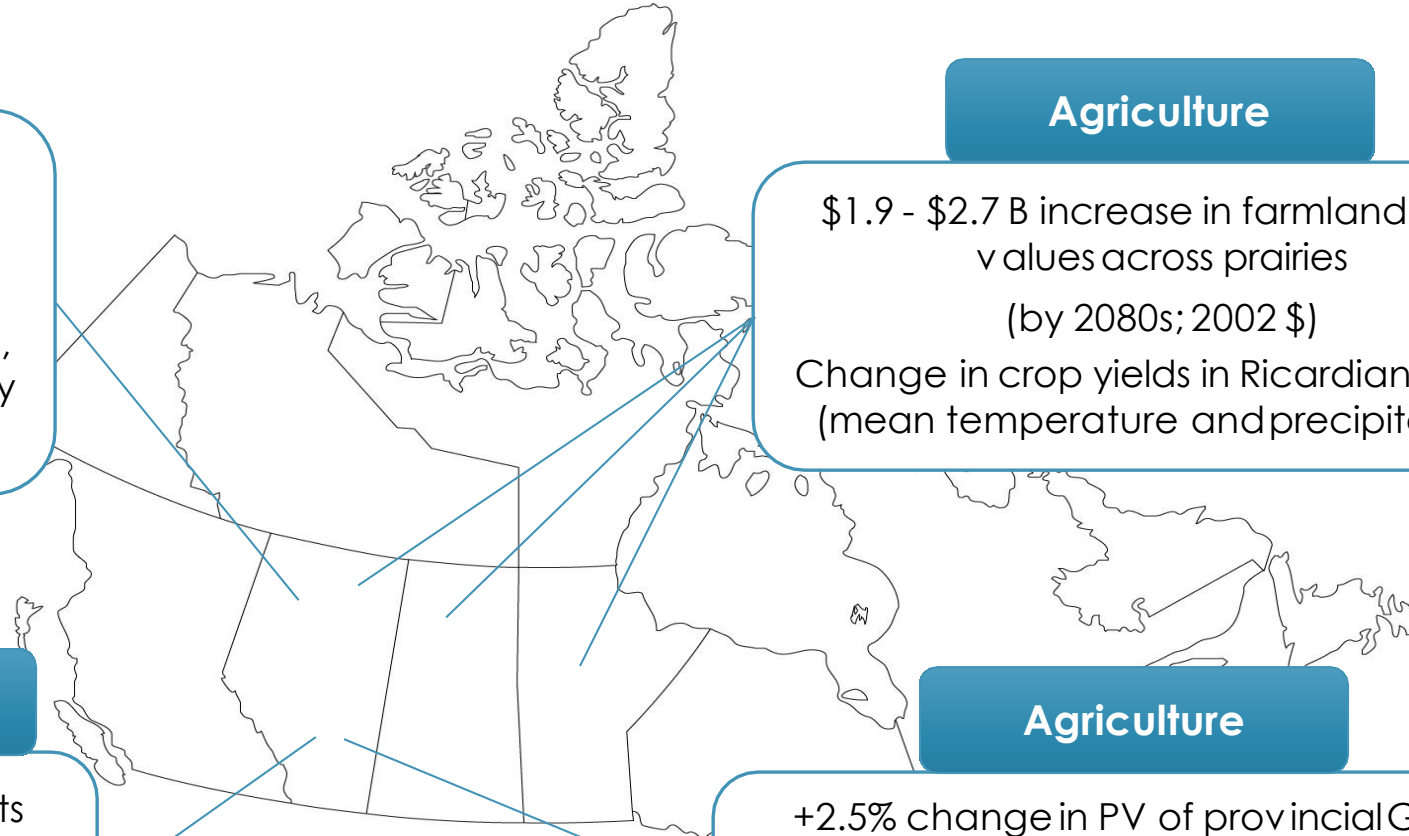
\$1.9 - \$2.7 B increase in farmland land
values across prairies
(by 2080s; 2002 \$)

Change in crop yields in Ricardian model
(mean temperature and precipitation)

Agriculture

+2.5% change in PV of provincial GDP
(2006-2051; DR = 4%)

Changes in crop yields in CGE model
(mean temperature and precipitation)



Key takeaways

- Best practice analytical framework for estimating costs of inaction overlays projected climate change and projected socioeconomic change on the current situation
- Most regional and local economic analysis of climate impacts will use a combination of process-based / statistical models that combine various biophysical and economic data sets
- Intangible costs are significant, and can be greater than tangible costs
- Fragmented picture of the projected future net costs of climate change in Alberta - many sectoral gaps

Q&A Time/Polling Questions

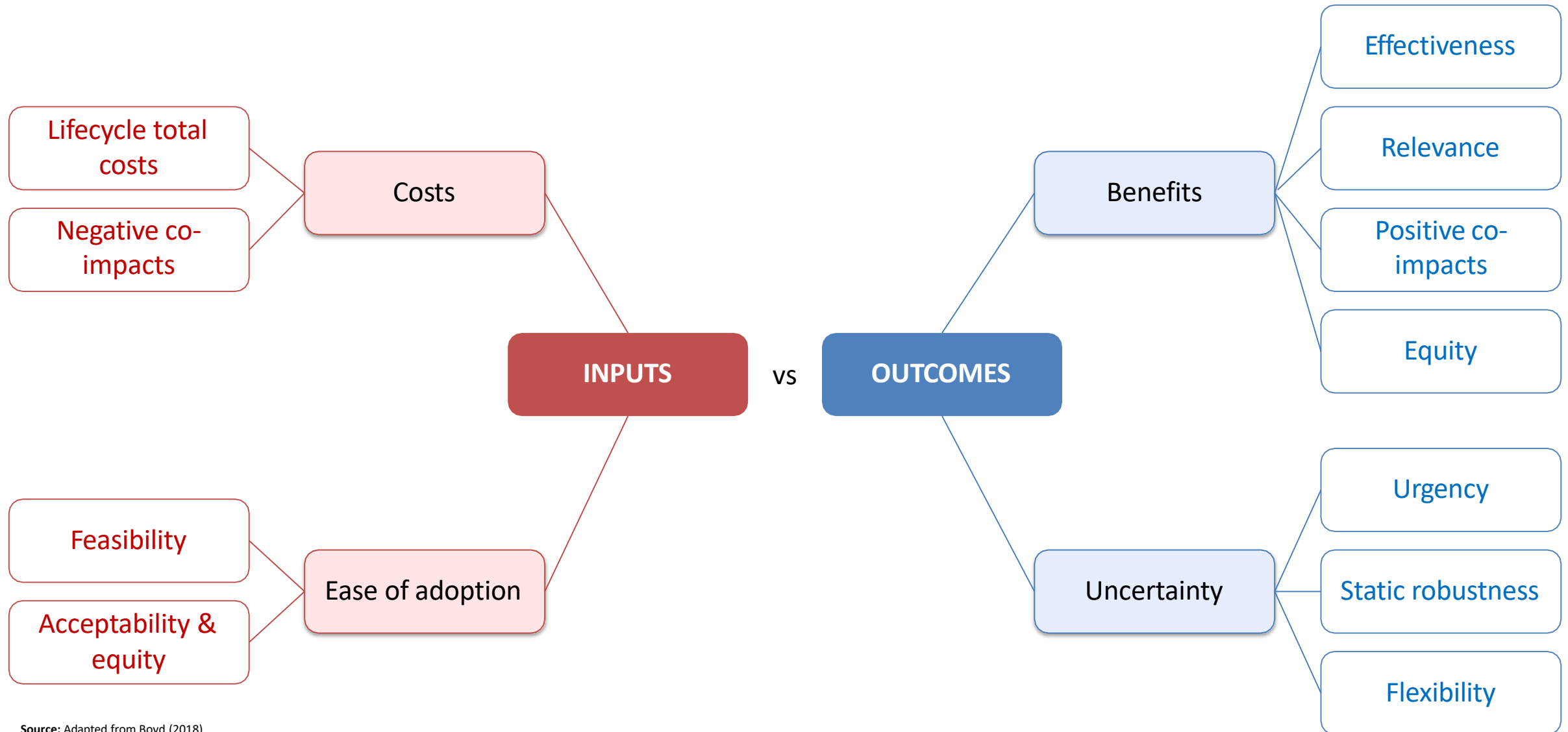
Topic 3. Economic analysis and tools for decision support

Learning objectives for Topic 3

- To contrast the three conventional economic decision support tools used to appraise adaptation options
- To explain why uncertainty and the valuation of intangible impacts are key challenges for the economic analysis of adaptation
- To describe how dynamic adaptation pathways can be used to avoid maladaptation

Key decision criteria

Analyzing trade-offs to inform adaptation decisions



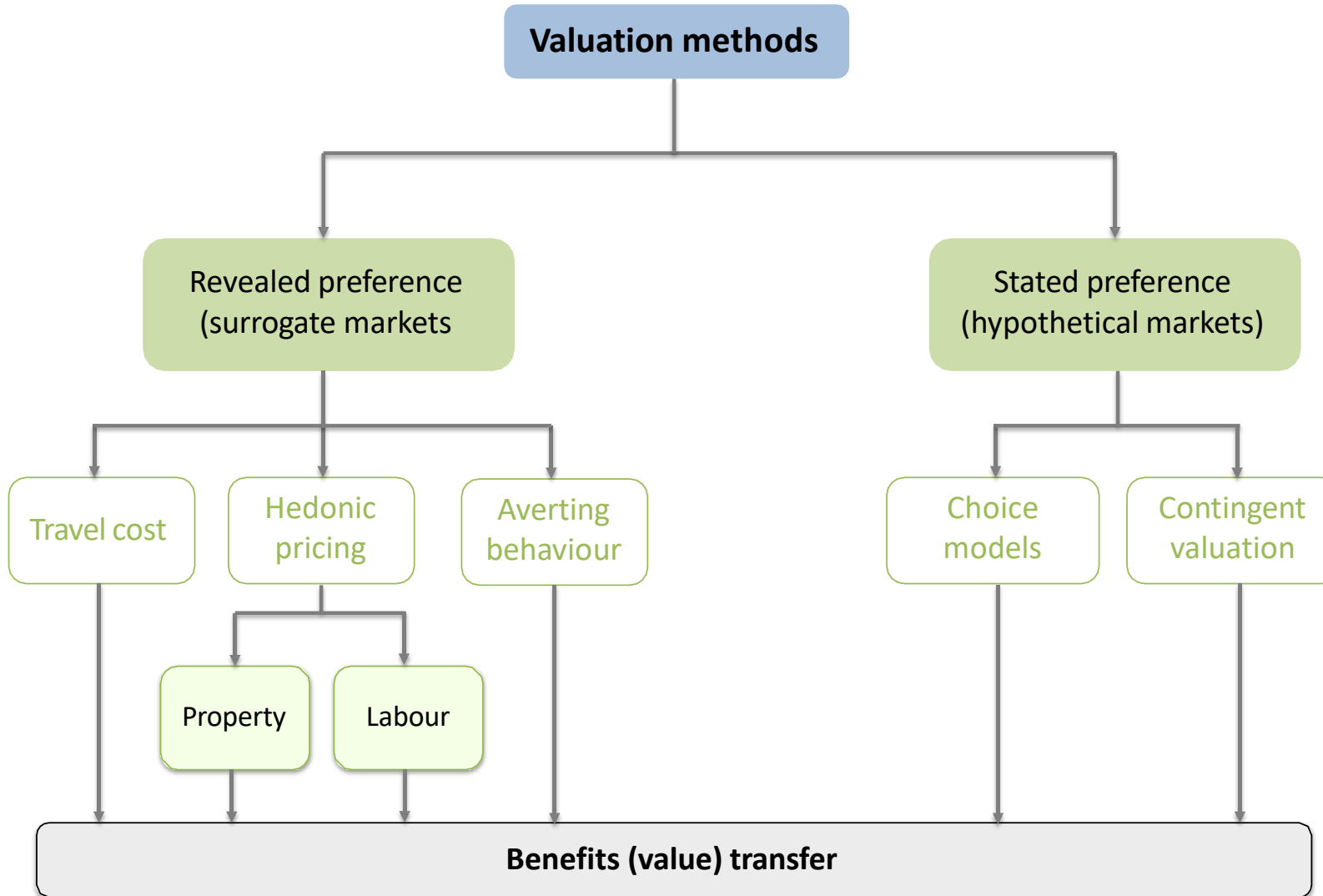
Economic decision-support tools

Main economics decision-support tools

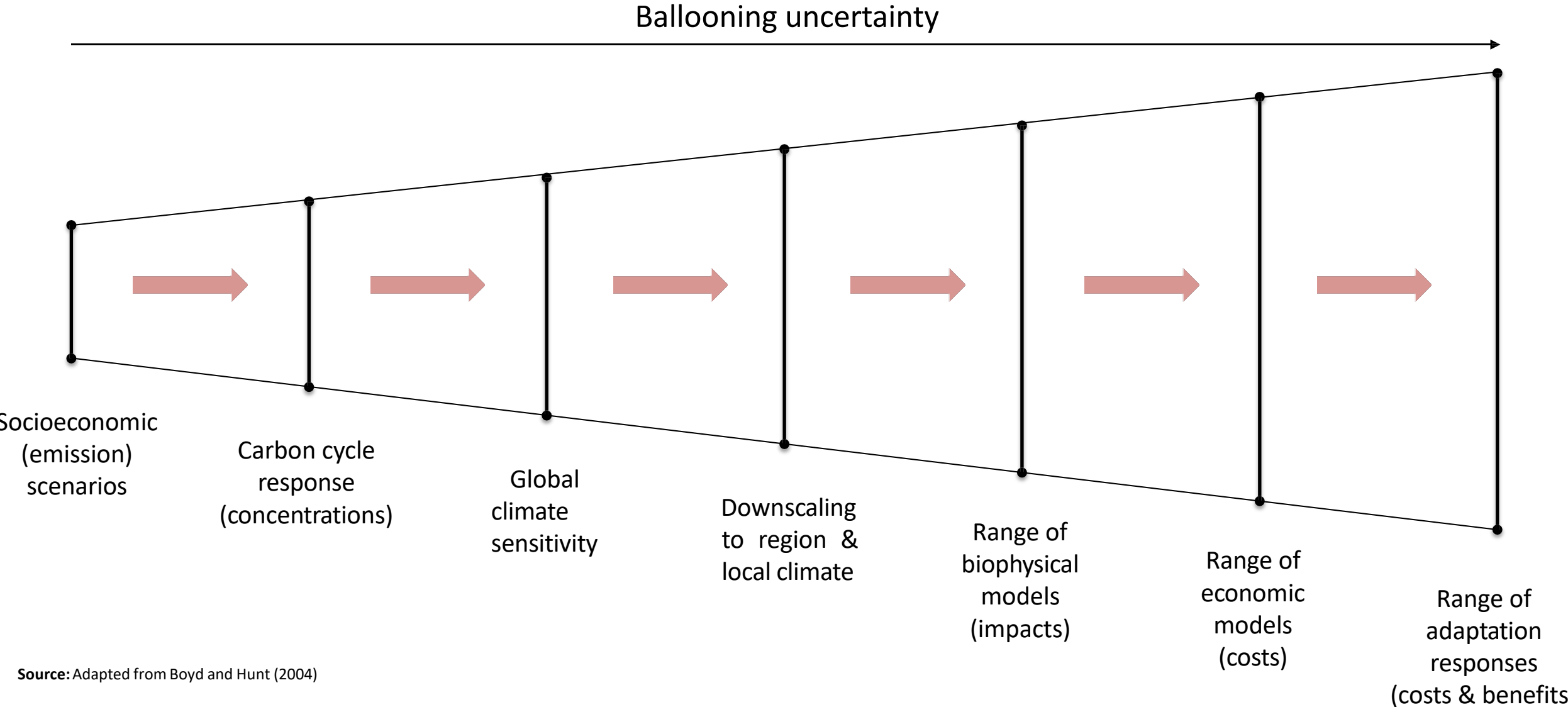
Tool	Summary	Concerns	Benefit	Complexity
CBA	<ul style="list-style-type: none"> Monetizes all costs and benefits of climate change to society Decision criterion: NPV > 0 increase social welfare Option with highest NPV is preferred 	<ul style="list-style-type: none"> Difficulty of monetizing non-market impacts and non-technical options Uncertainty limited to expected values 	Economic (dollars)	Medium
CEA	<ul style="list-style-type: none"> Compares costs against effectiveness of options to reduce risk Options are ranked ordered in terms of \$ per unit risk reduction Select least-cost option(s) till goal reached 	<ul style="list-style-type: none"> Less desirable for cross-sectoral analysis Cannot say whether adaptation is worth doing, or how much adaptation is justified Uncertainty limited to expected values 	Quantitative	Medium
MCDA	<ul style="list-style-type: none"> Allows consideration of multi-metric evaluation of options Options are ranked ordered in terms of (weighted) total score Select option(s) with highest score 	<ul style="list-style-type: none"> Scoring and weighting based on subjective judgement of experts or stakeholders Uncertainty treatment often qualitative and subjective 	Economic, quantitative or qualitative	Low to medium

Key challenges

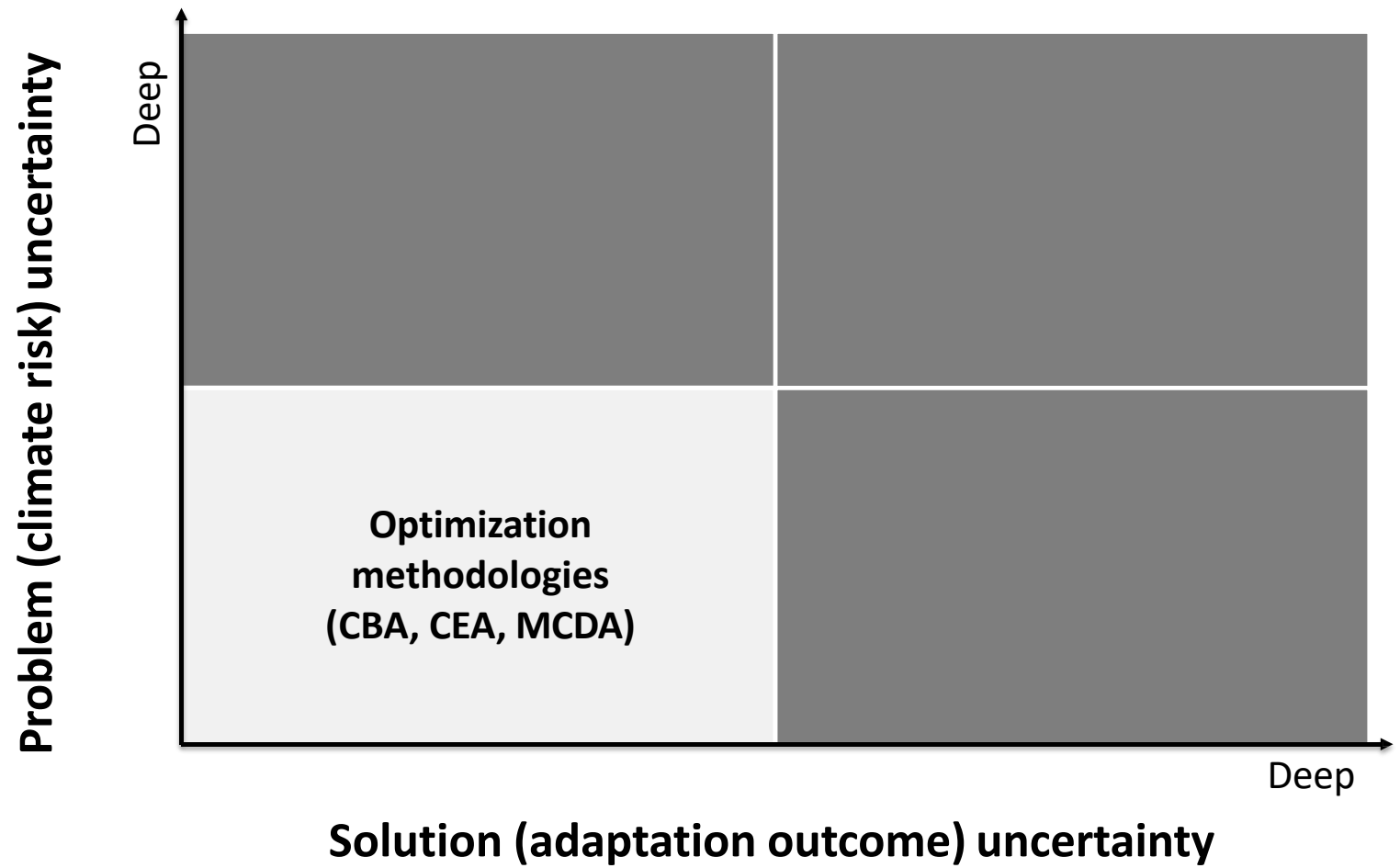
Key challenge: valuation of intangible costs and benefits



Key challenge: treatment of uncertainties

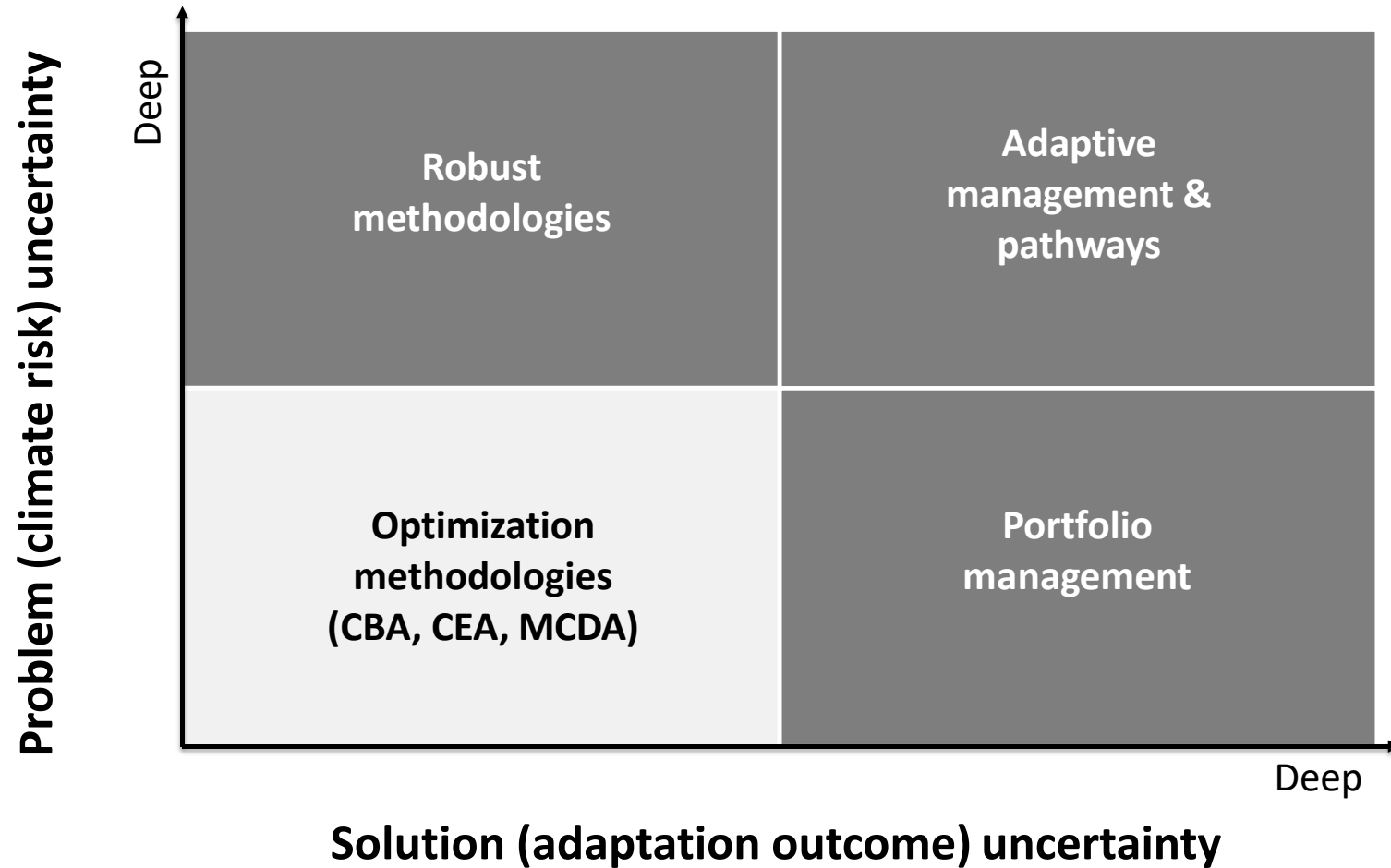


Economics decision-support tools to manage uncertainties



Source: Adapted from Jones et al (2013)

Economics decision-support tools to manage uncertainties



Source: Adapted from Jones et al (2013)

Illustration of adaption pathways to manage uncertainties

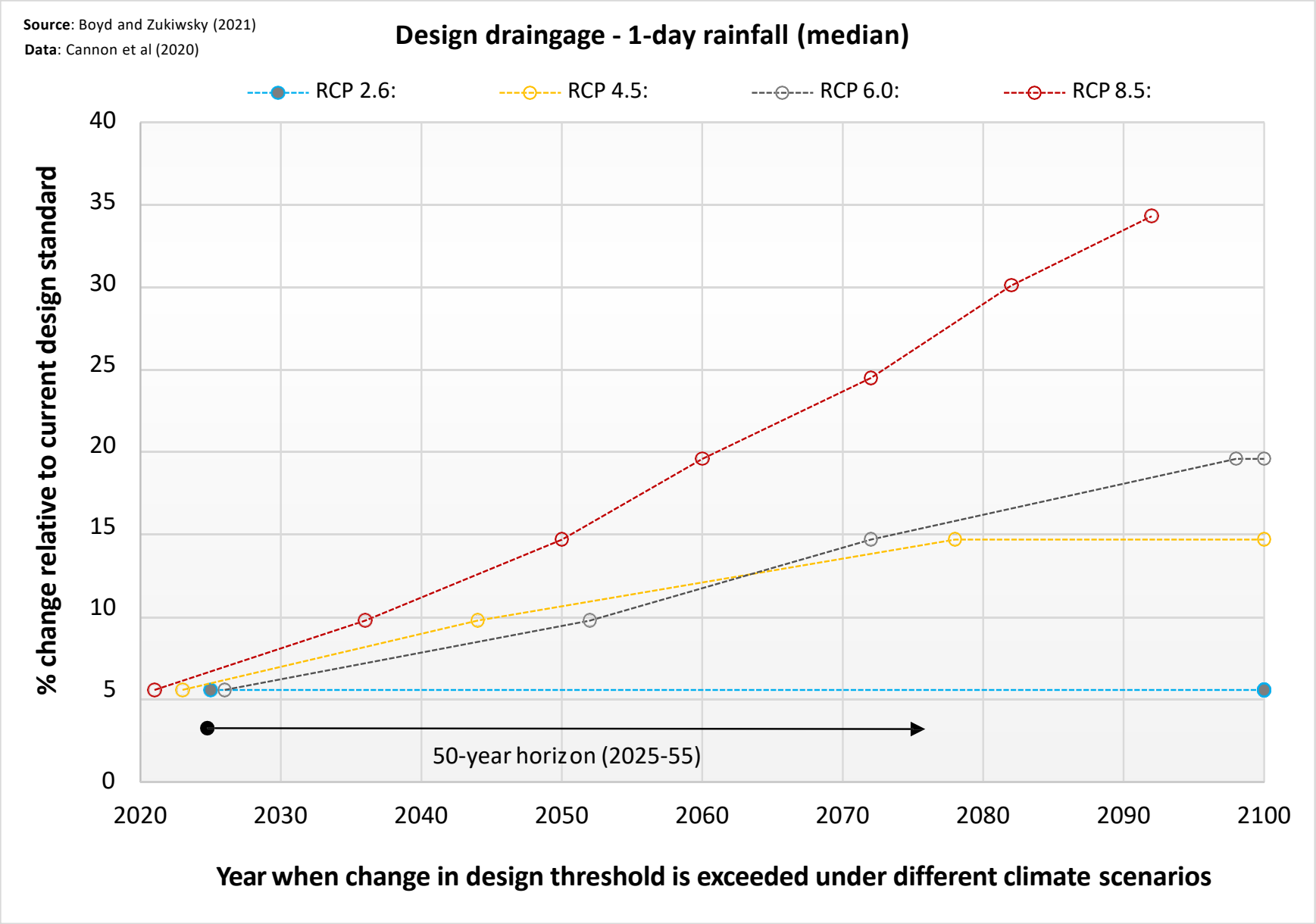


Illustration of adaption pathways to manage uncertainties

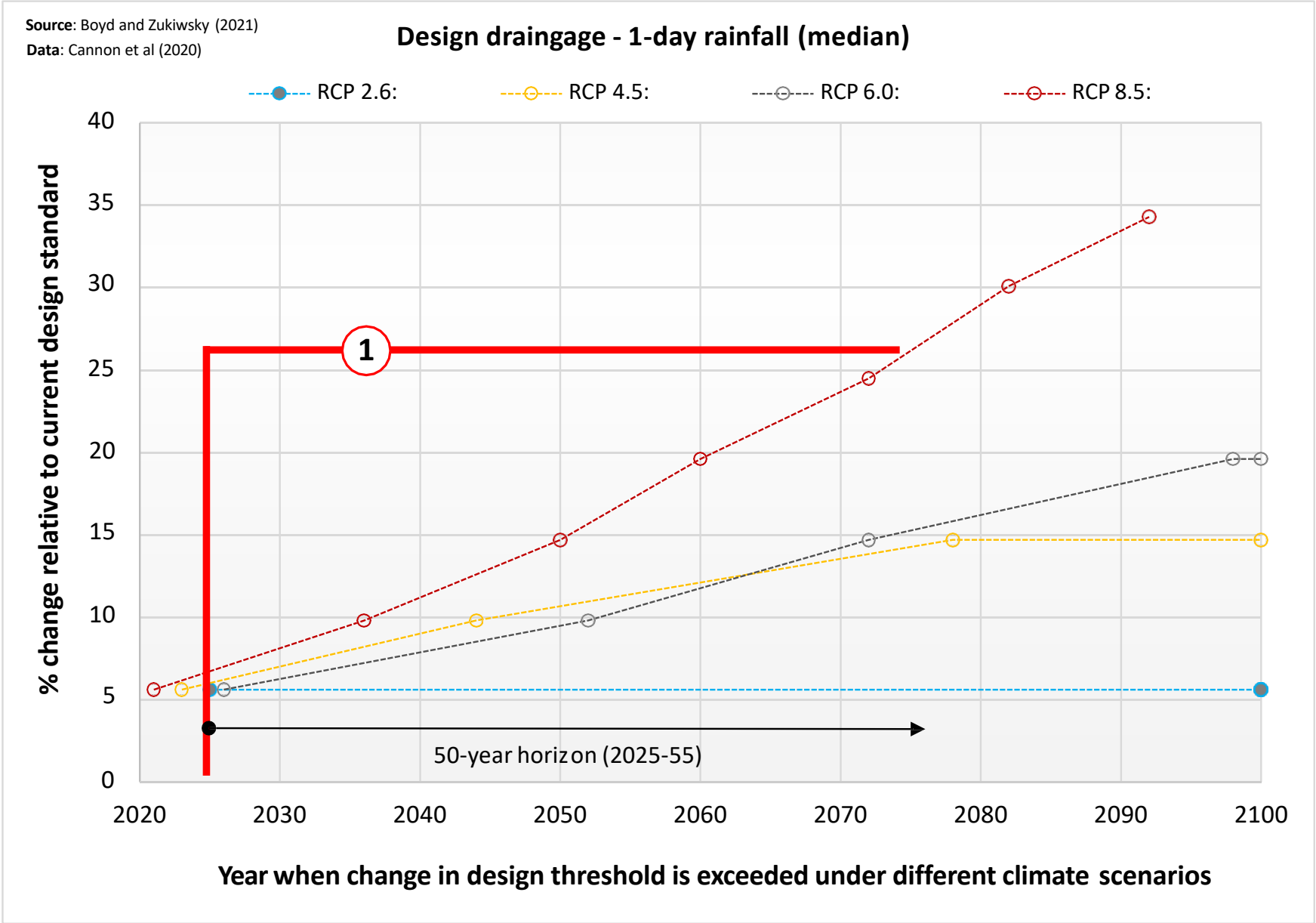


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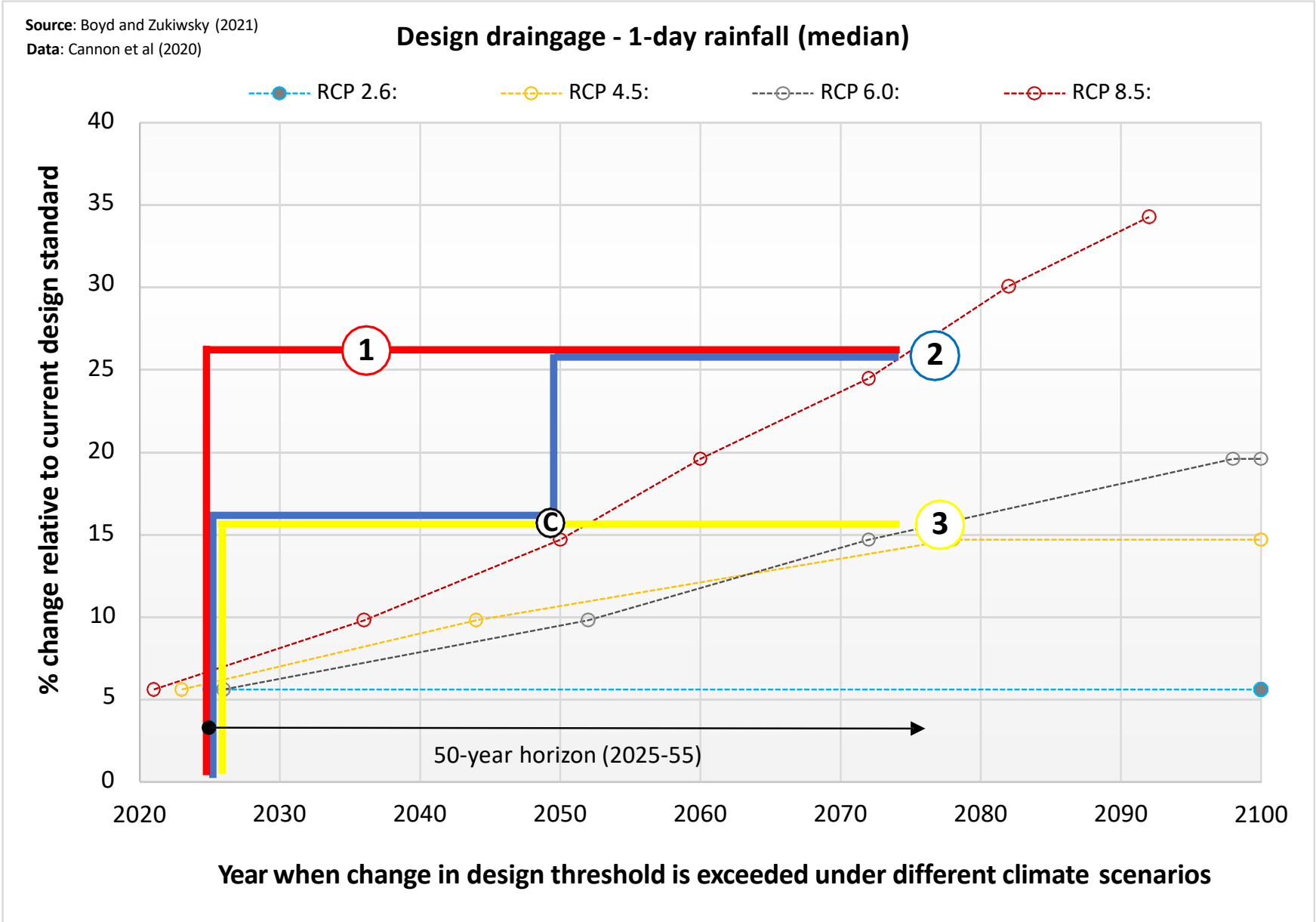
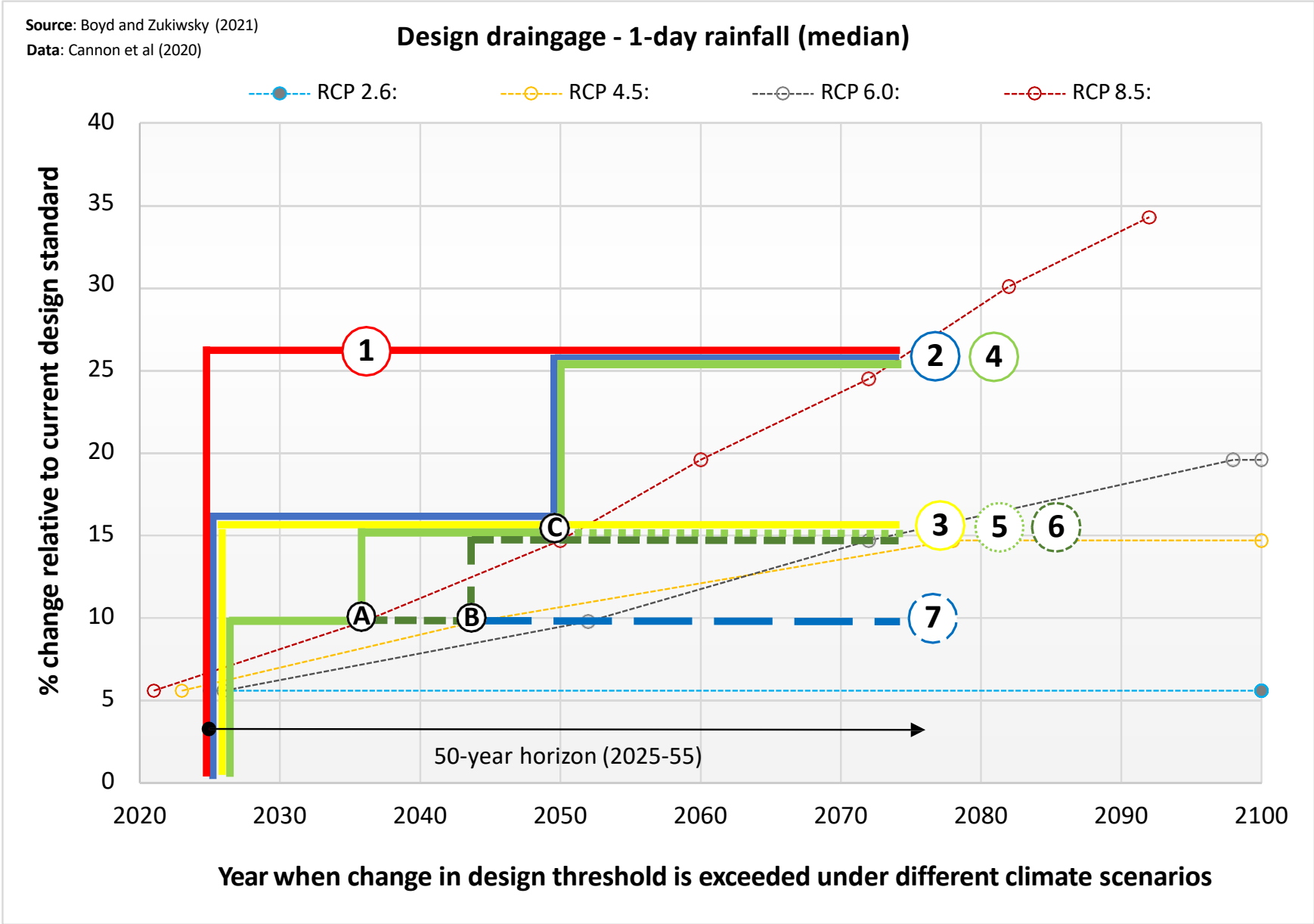
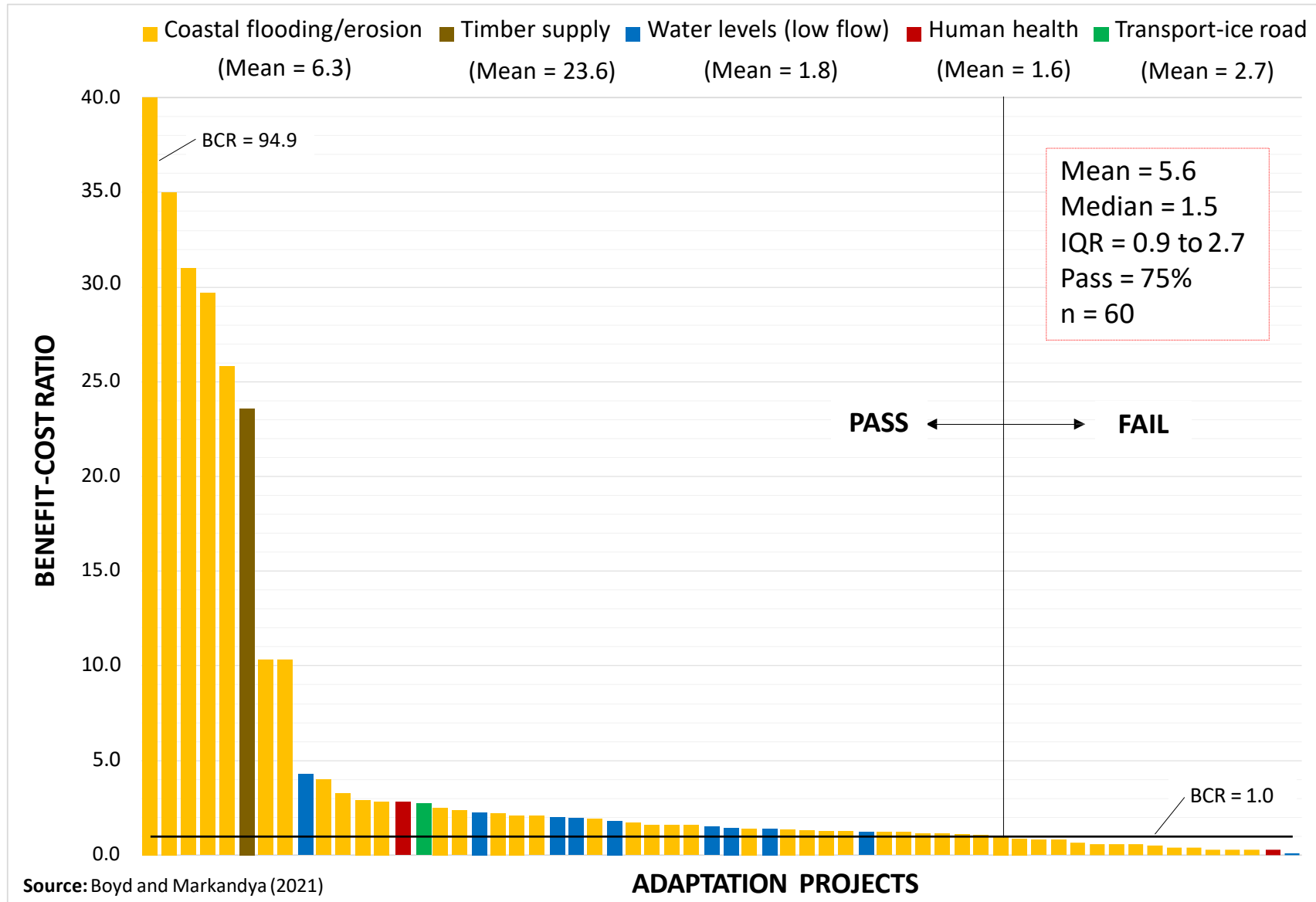


Illustration of adaption pathways to manage uncertainties

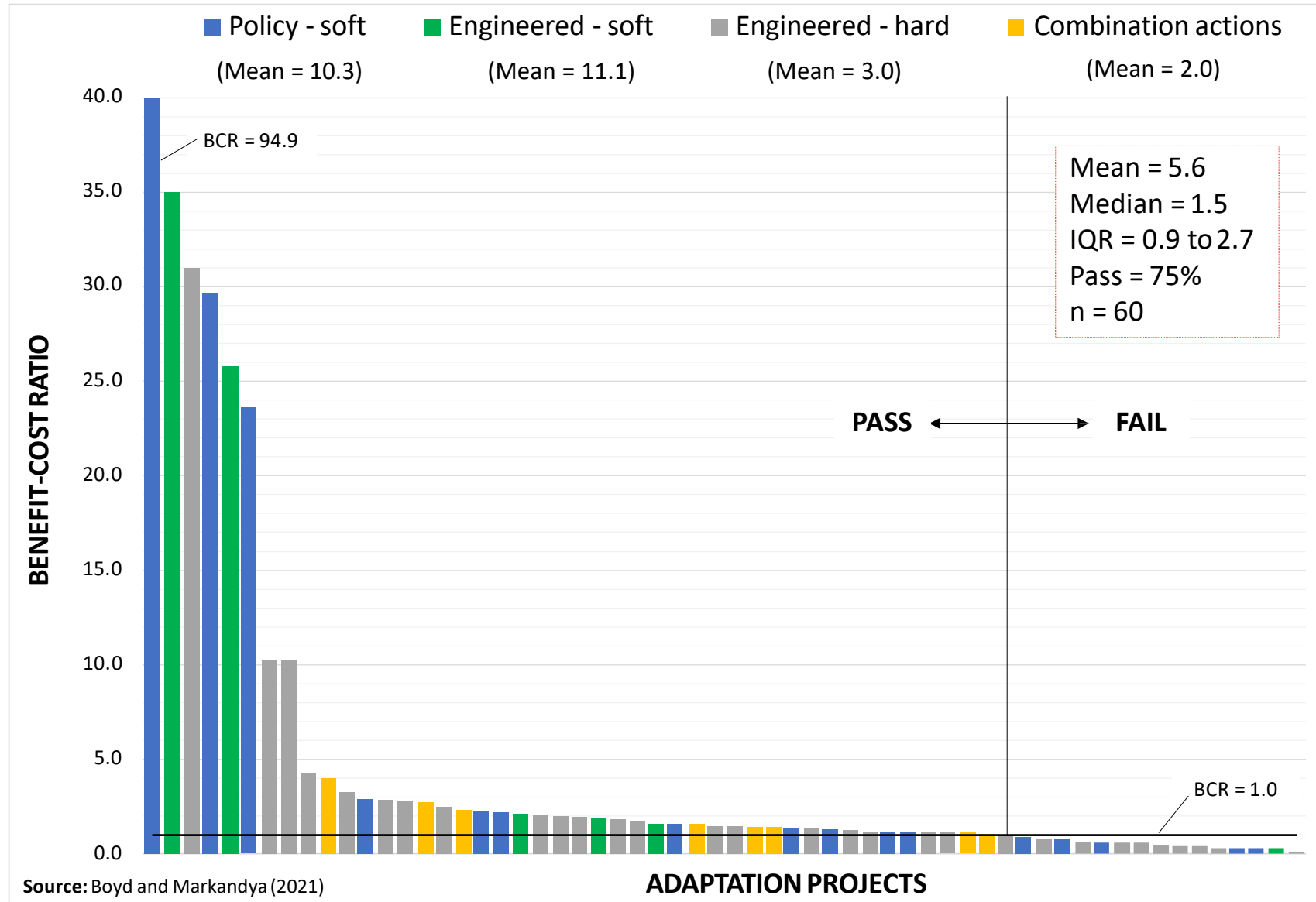


Economic appraisals of adaptation in Canada

CBA of sample of adaptation options in Canada



CBA of sample of adaptation options in Canada



CBA of living roofs to mitigate urban heat island effects

Key takeaways

- Many decision criteria and trade-offs when appraising adaptation options, the majority of which can be captured in CBA
- Conventional economic decision support tools have limited applications – can ‘price’ and include intangibles, but not so good with uncertainty
- New economic decision support tools emerging to manage uncertainties and avoid maladaptation – like dynamic adaptation pathways
- Benefits of planned adaptations generally exceed the costs, sometimes significantly, providing a good business case

Summary of key messages

Recap of key learnings

- Economic analysis supports key phases of climate risk management; awareness raising, risk assessment, and adaptation planning
- Best practice economic analysis of climate impacts and adaptation options comprises eight building blocks
- Climate change can give rise to a variety of economic and social costs and benefits that could be captured in any analyses; tangible and intangible, and direct and indirect effects

Recap of key learnings

- Best practice methodology for estimating costs of inaction overlays projected climate change and projected socioeconomic change on the current situation
- Most regional and local economic analysis of climate impacts will use a combination of process-based / statistical models that combine various biophysical and economic data sets
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