



Decision-making around climate change: How we got into this mess, how to get out of it

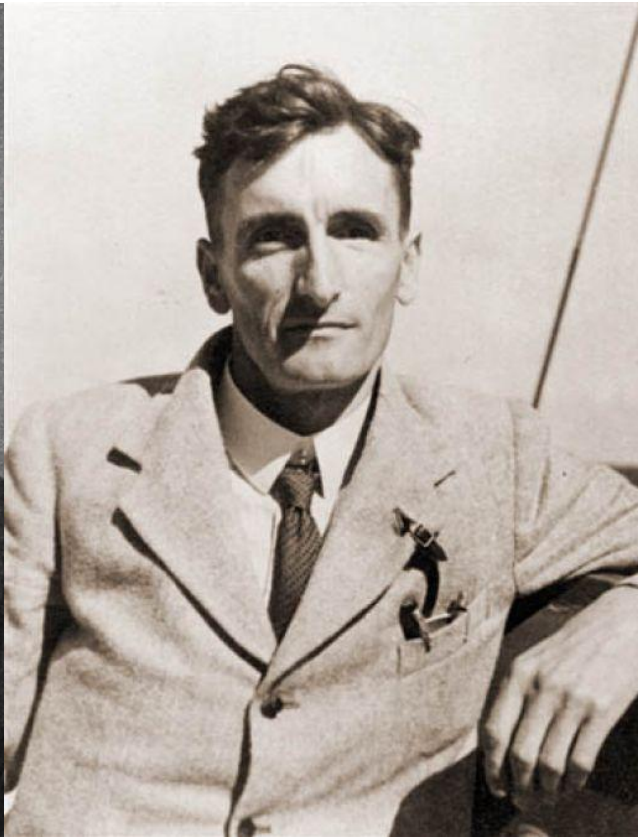
Asst. Prof. Vanessa Schweizer
Dept. of Knowledge Integration,
University of Waterloo
Third Age Learning Lecture Series,
February 19, 2019

Some foundations of climate change research



Arrhenius, 1896

CO₂ and H₂O vapor are
greenhouse gases



Callendar, 1938

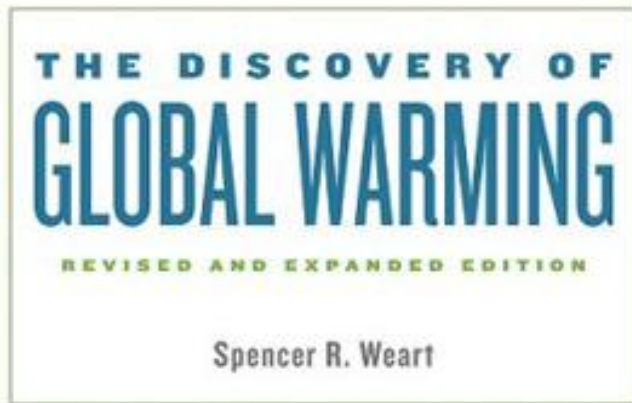
Temperatures around globe
rose in past 50 years



Keeling, 1960

Atmospheric CO₂
is clearly rising

The discovery of climate change: Knowledge integration across disciplines



- 1950s-1970s: Advances in **computer science** enhance modeling for meteorology, earth system science
- 1970s: Scientists become increasingly vocal that emissions could have large-scale effects on weather and climate

<http://www.aip.org/history/climate/index.htm>

Understanding climate change: Knowledge integration across time, processes



Early research questions:
What caused ice ages?

PHOTO CREDIT: <http://extremeicesurvey.org/photography/gallery-greenland/>

Understanding climate change: Knowledge integration across time, processes



Mid-20th century research questions:
What human processes are affecting
environmental quality?

PHOTO CREDIT: arabic.china.org.cn and wantchinatimes.com

Knowledge integration across time

DATA FROM THE PAST & PRESENT:

GEOLOGIC & CONTEMPORARY

Climatology: The study of *average* weather over a particular time (20, 30, 50, hundreds of years, etc.) in a particular place

INFORMATION REGARDING POSSIBLE FUTURES

Impact and policy studies: Forward-looking studies regarding possible effects of climate change and the capacity for responses

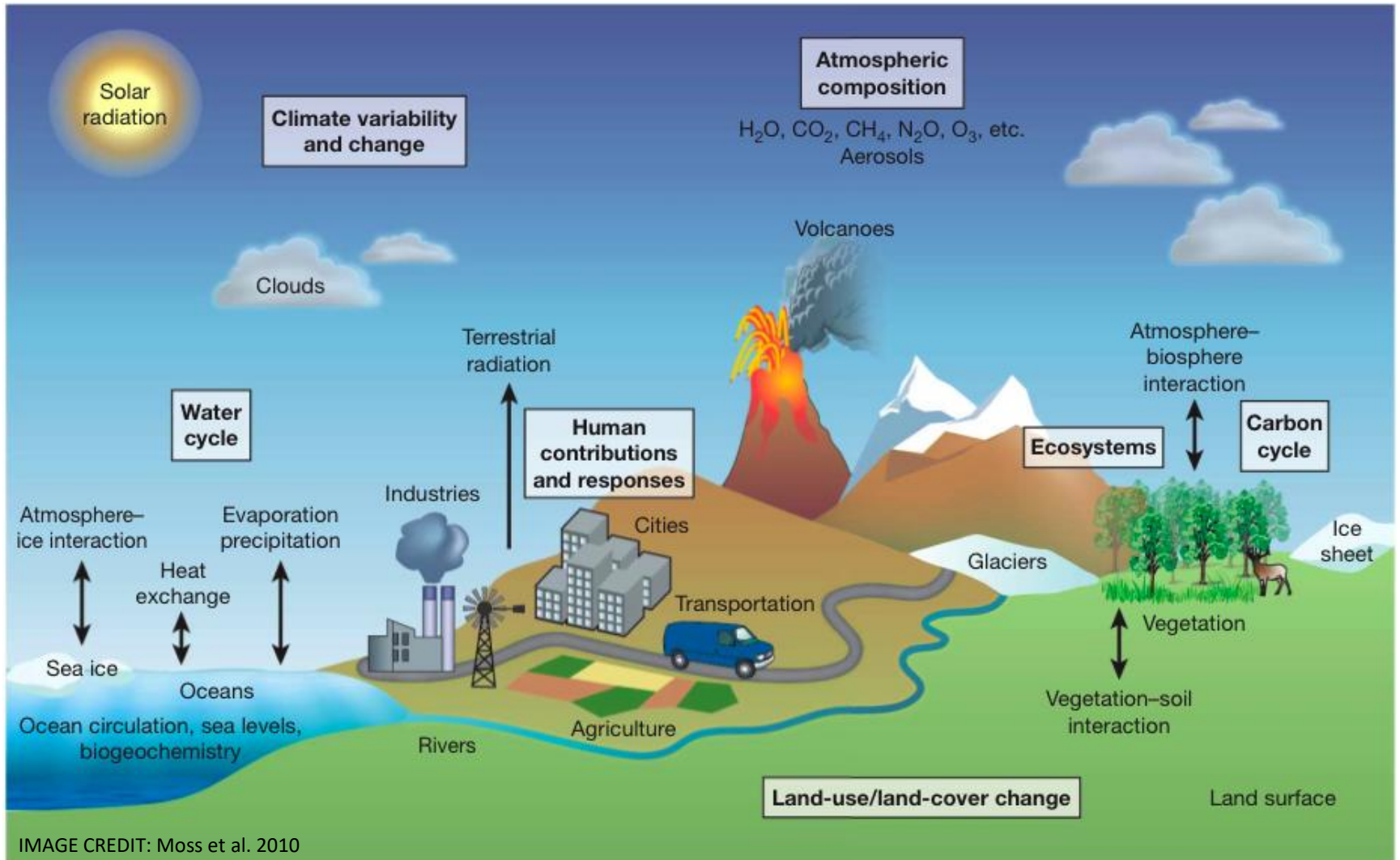
How did we get into the mess of climate change?



IMAGE CREDIT: Hanabusa Itcho (c. 1680) *Blind monks examining an elephant*, courtesy Wikimedia Commons

- Planetary systems are complex
- Scientific research organizes across disciplines
- Most science ‘artisanal’
- The frontier: ‘big’ science; international investments in infrastructure (e.g. satellites)

How did we get into the mess of climate change?

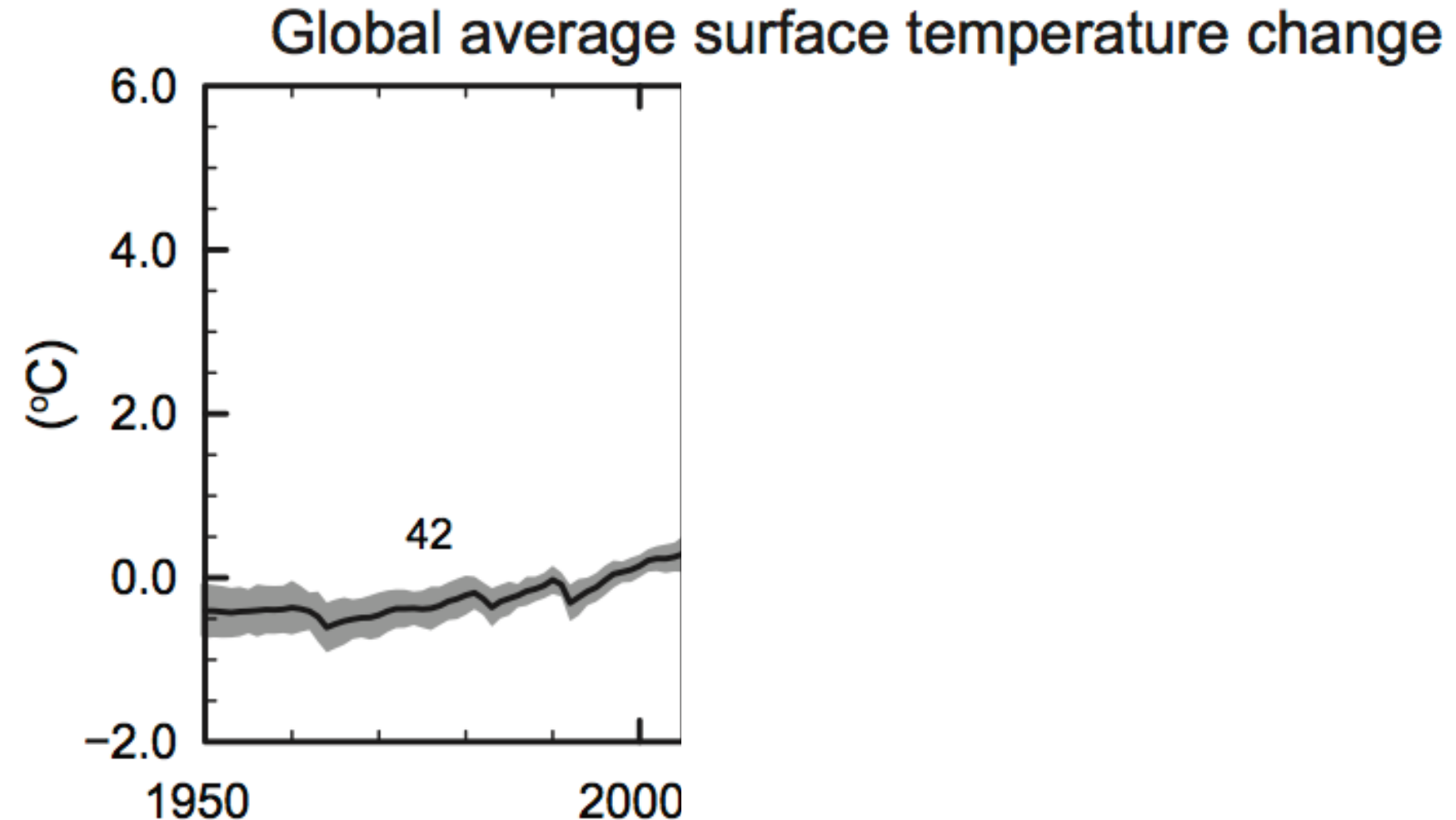


How did we get into the mess of climate change?

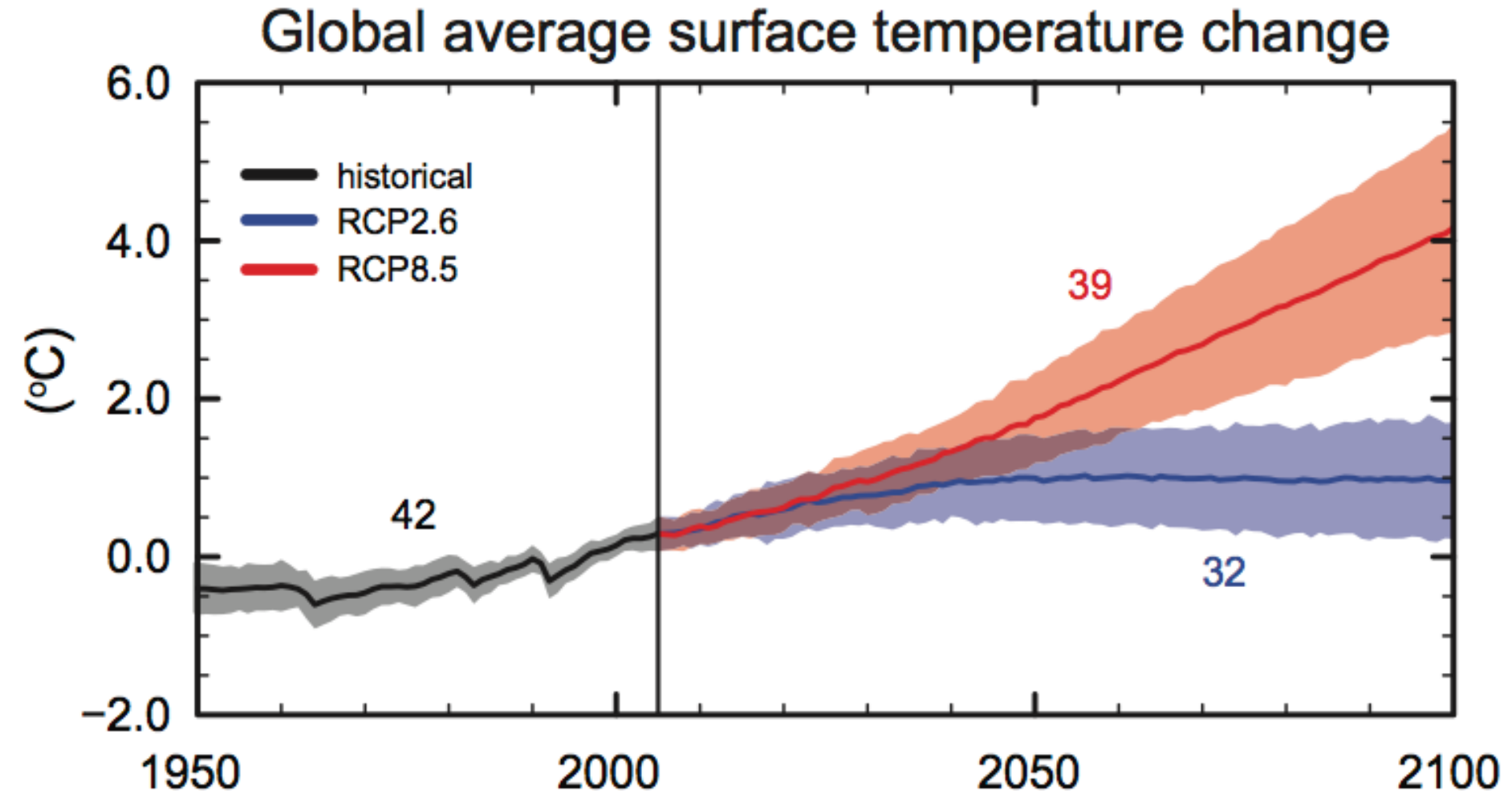


IMAGE CREDIT: Moss et al. 2010

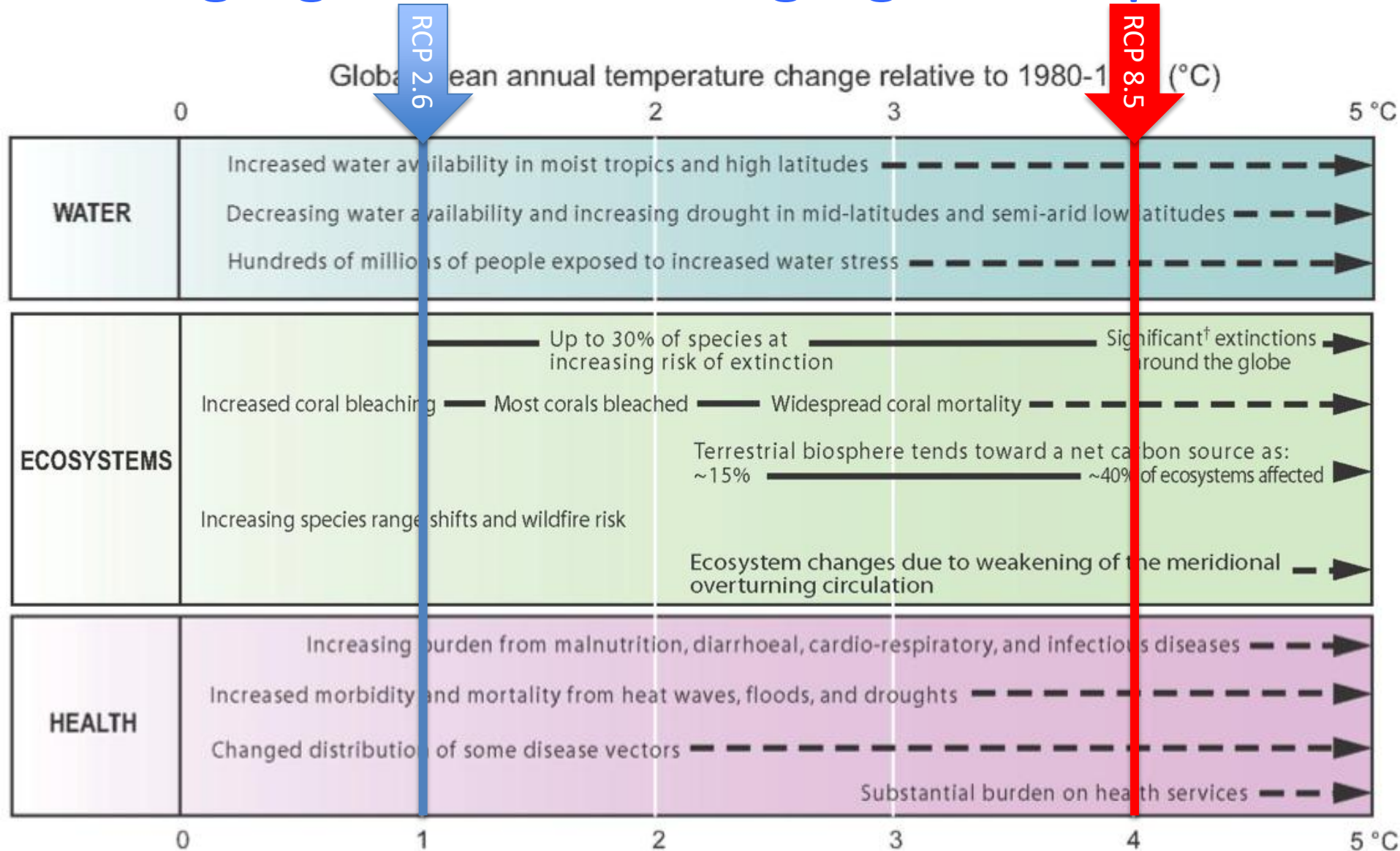
Climate at the science-policy interface



Climate at the science-policy interface



Changing climate, changing consequences



“Climate choices”: Is it that simple?



Over the next 100 years, many things will change

- Climate
- Technology
- Political priorities
- International affairs
- Values
- Etc.

How do these changes interact with climate?

A 2-part framework for climate change impacts

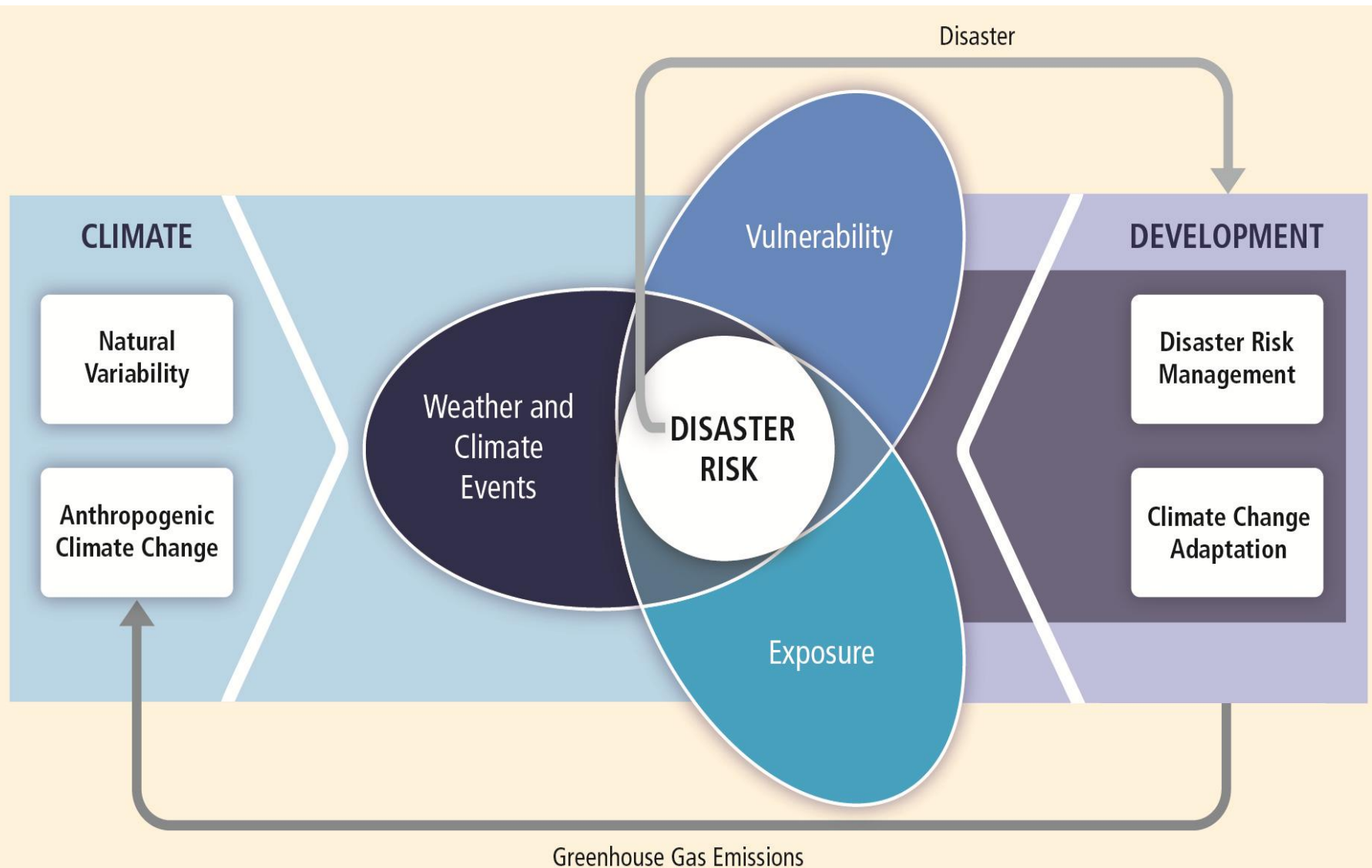


IMAGE CREDIT:

IPCC Special Report *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*, 2012

What socioeconomic futures are plausible?

	SSP1: Sustainability	SSP2: Historical Trends	SSP3: Regional Rivalry	SSP4: Inequality	SSP5: Fossil-fueled Development
Demographics					
Population growth	Relatively low	Medium	Low in rich OECD countries, high elsewhere	Low in rich OECD countries, high elsewhere	Relatively low
Mortality [SDGs 3, 2]	Low	Medium	High	High in high-fertility countries, medium elsewhere	Low
Urbanization level	High	Medium	Low	Medium in rich OECD countries, high elsewhere	High
Urbanization type [SDG 11]	Well managed	Historical pattern continues	Poorly managed	Mixed across, within cities	Better management over time, some sprawl
Human Development					
Education [SDG 4]	High	Medium	Low	Within regions, unequal education, gender equity; medium trends at best	High
Gender equality [SDG 5]	High	Medium	Low		High
Equity [SDG 10]	High	Medium	Low	Medium	High
Access to health facilities, water, sanitation [SDGs 3, 6, 9]	High	Medium	Low	Unequal within regions; medium trend at best	High
Economy & Lifestyle					
Growth (per capita) [SDG 8]	High in developing countries, medium elsewhere	Medium, uneven	Slow	Low in developing countries, medium elsewhere	High
Inequality [SDGs 10, 1]	Reduced across, within countries	Uneven moderate reduction across, within countries	High, especially across countries	High, especially within countries	Strongly reduced, especially across countries
Consumption & diet [SDG 12]	Decreasing materialism, low meat consumption	Material-intensive consumption, medium meat consumption	Material-intensive consumption	Elites: high consumption; Rest: low consumption, low mobility	Materialism, status consumption, tourism, high mobility, high meat consumption

Exploring impacts through contrasted socio-economic outcomes



Exploring impacts through contrasted socio-economic outcomes



Sustainable Development Goals (SDGs)



Exploring impacts through contrasted socio-economic outcomes



Exploring impacts through contrasted socio-economic outcomes



Exploring impacts through contrasted socio-economic outcomes



Exploring impacts through contrasted socio-economic outcomes

SSP5: Fossil-fueled Development. SDGs 12-13 fail (circular economy, climate)



★ **SSP 2:**
(Intermediate Challenges)
Middle of the Road

★ **SSP 3:**
(High Challenges)
Regional Rivalry
A Rocky Road

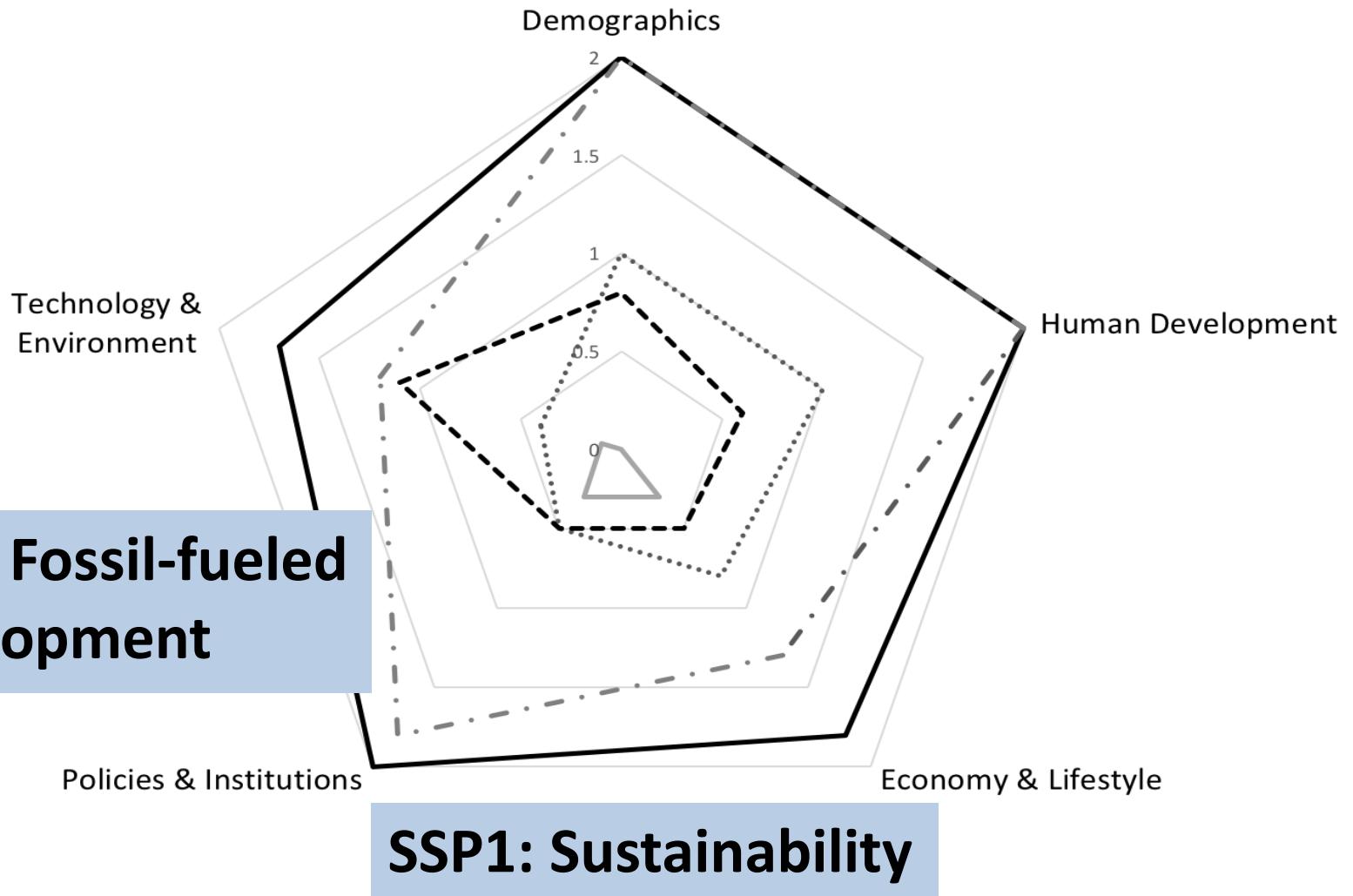
★ **SSP 1:**
(Low Challenges)
Sustainability
Taking the Green Road

★ **SSP 4:**
(Adapt. Challenges Dominate)
Inequality
A Road Divided

Socio-economic challenges
for adaptation

Alternative futures at a glance

— Sustainability (SSP1) Historical (SSP2) — Rivalry (SSP3) --- Inequality (SSP4) - · Fossil-fueled (SSP5)

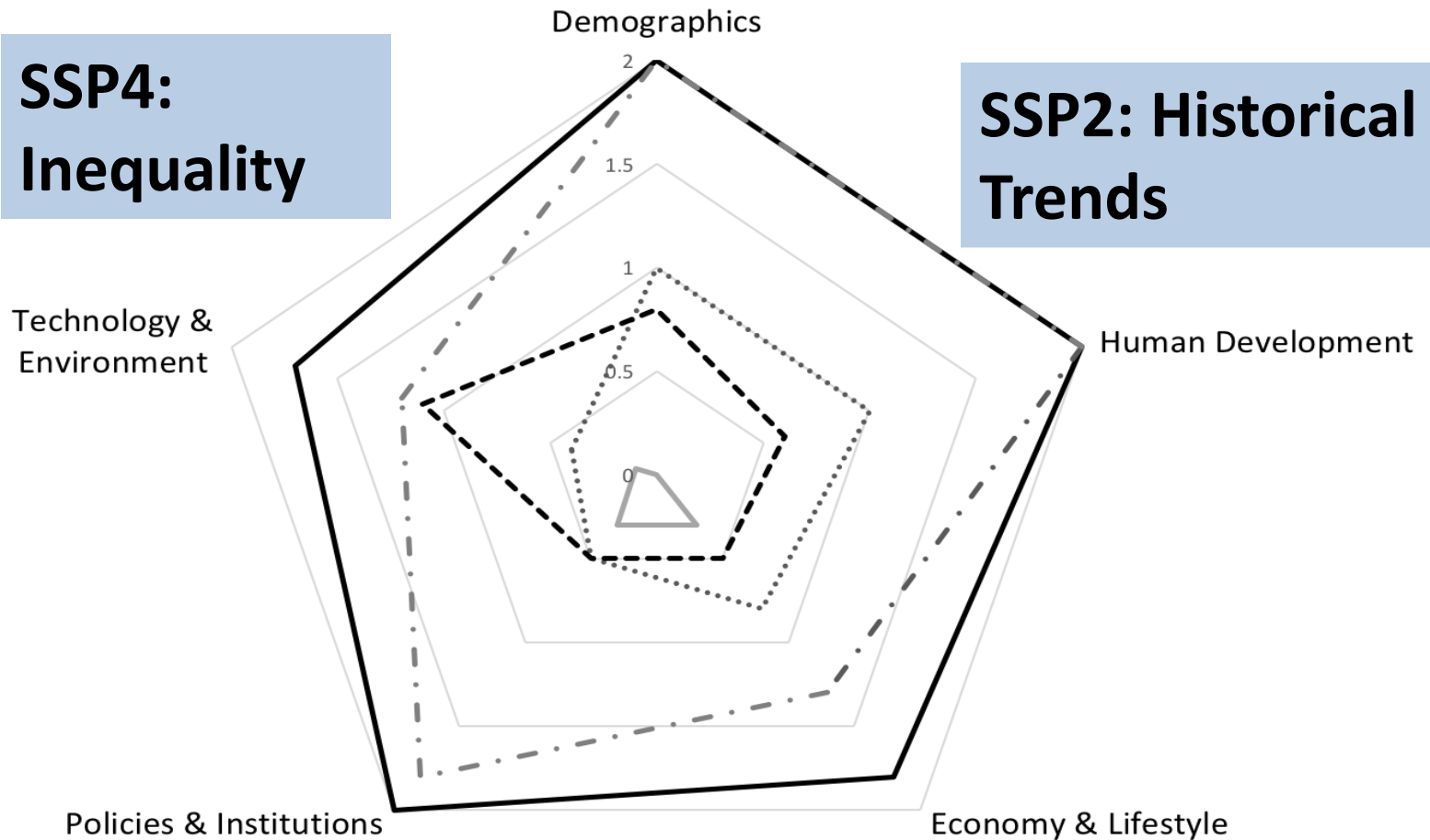


Alternative futures at a glance

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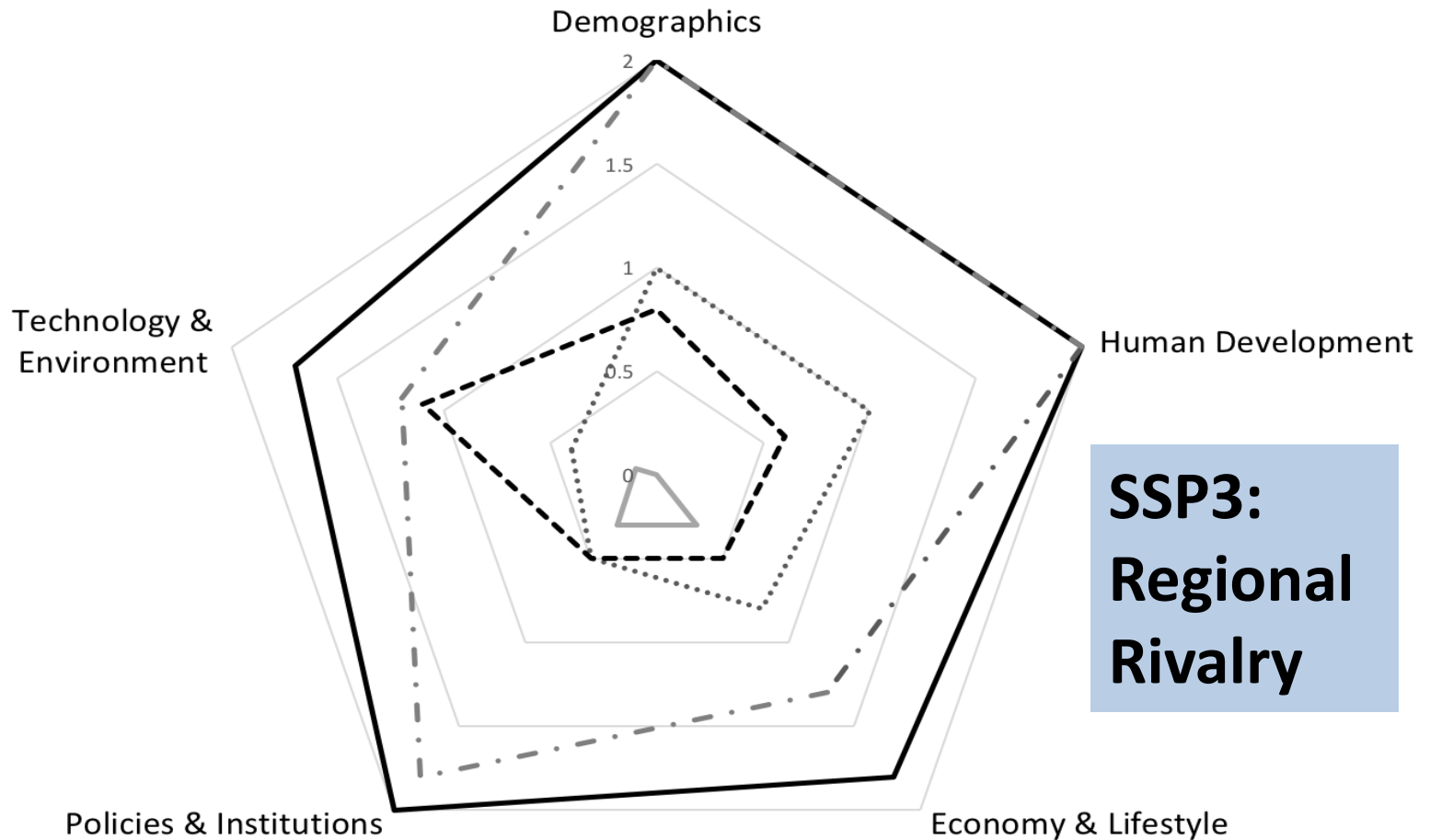
**SSP4:
Inequality**

**SSP2: Historical
Trends**



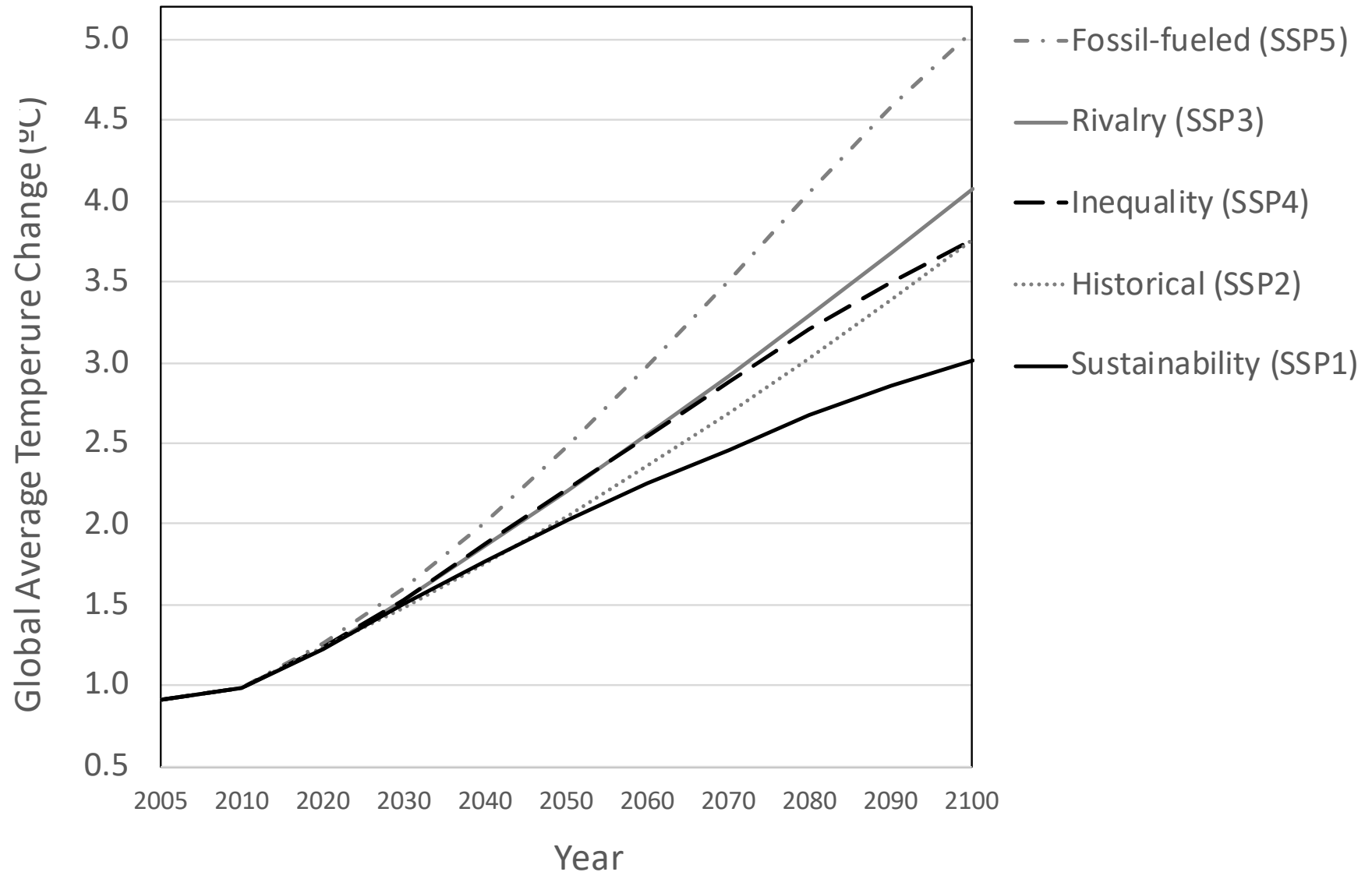
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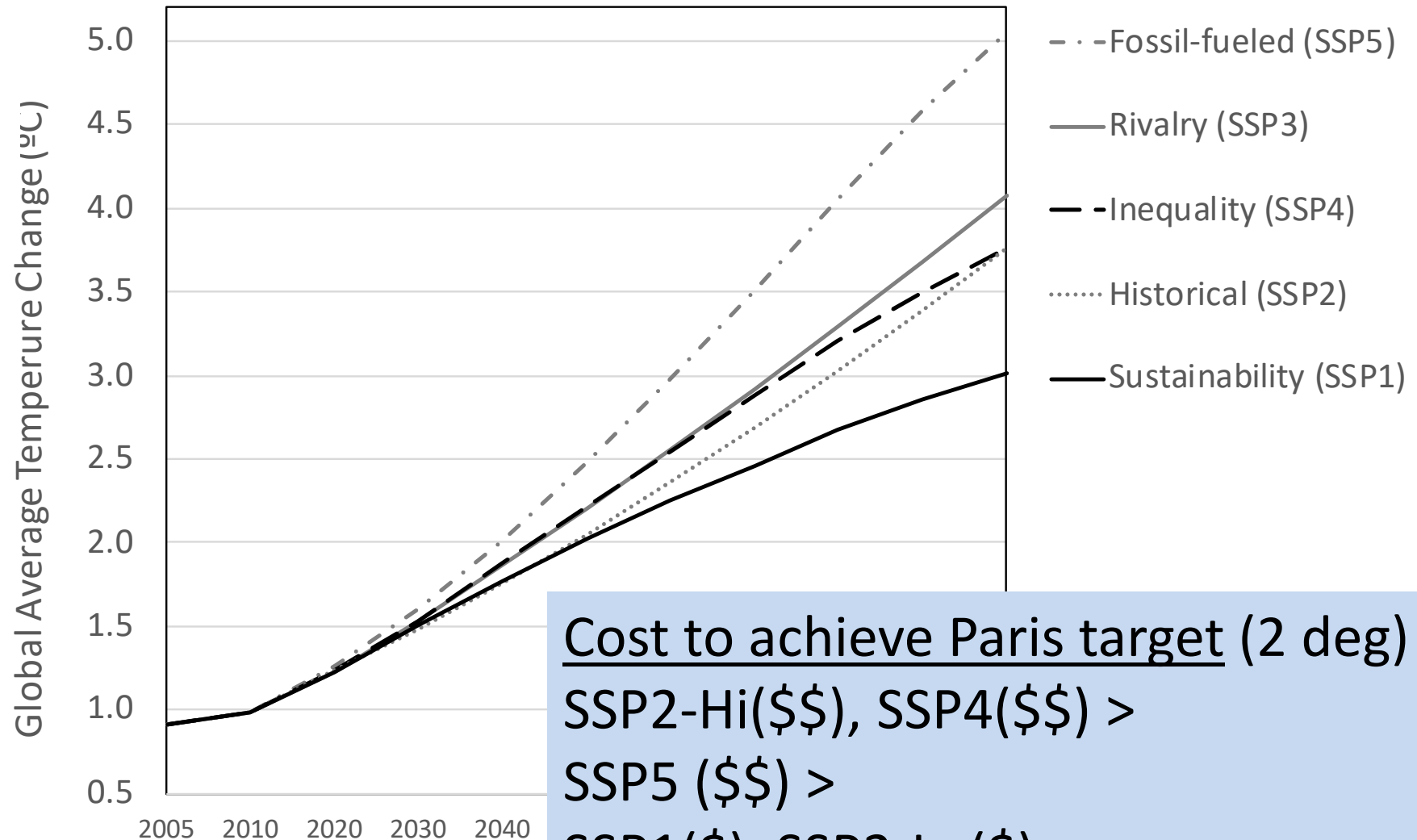


**SSP3:
Regional
Rivalry**

Simulated results of SSPs: climate outcomes



Simulated results of SSPs: climate outcomes



Cost to achieve Paris target (2 deg)

SSP2-Hi(\$\$), SSP4(\$\$) >

SSP5 (\$\$) >

SSP1(\$), SSP2-Lo(\$);

SSP3(∅)

Simulated results of SSPs:

Socioeconomic and climatic outcomes

- **The next 10 years are crucial.** The time for ‘wait-and-see’ policy approaches is over. Time for more near-term action (from “Fossil-fueled Development”, SSP5 and “Regional Rivalry” SSP3)
- SDGs must be accomplished for all, not just those with the greatest capacity (from “Inequality”, SSP4)
- ‘Old-fashioned’ sustainability still matters (material and energy efficiency improvements; smaller family sizes)
 - “Historical Trends” (SSP2) vs. “Sustainability” (SSP1) and “Fossil-fueled Development” (SSP5)
 - Key issue for reducing family size: **gender equity**

Implications for daily practice, issues to watch

Practice

- Everything counts (but incrementalism not enough)
- Has my household, business, community etc. minimized our footprint?
- What changes for the next 10 years bring us to carbon neutrality (and better yet, are carbon negative)?
- Share your concerns about climate change

Issues to watch

- Increasing the ambition of the global climate target?
2.0 degrees → 1.5 degrees → “climate restoration”
- Geoengineering & negative emissions technologies

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