Assessment of vulnerabilities and adaptive responses

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Centre for Global Environmental Research

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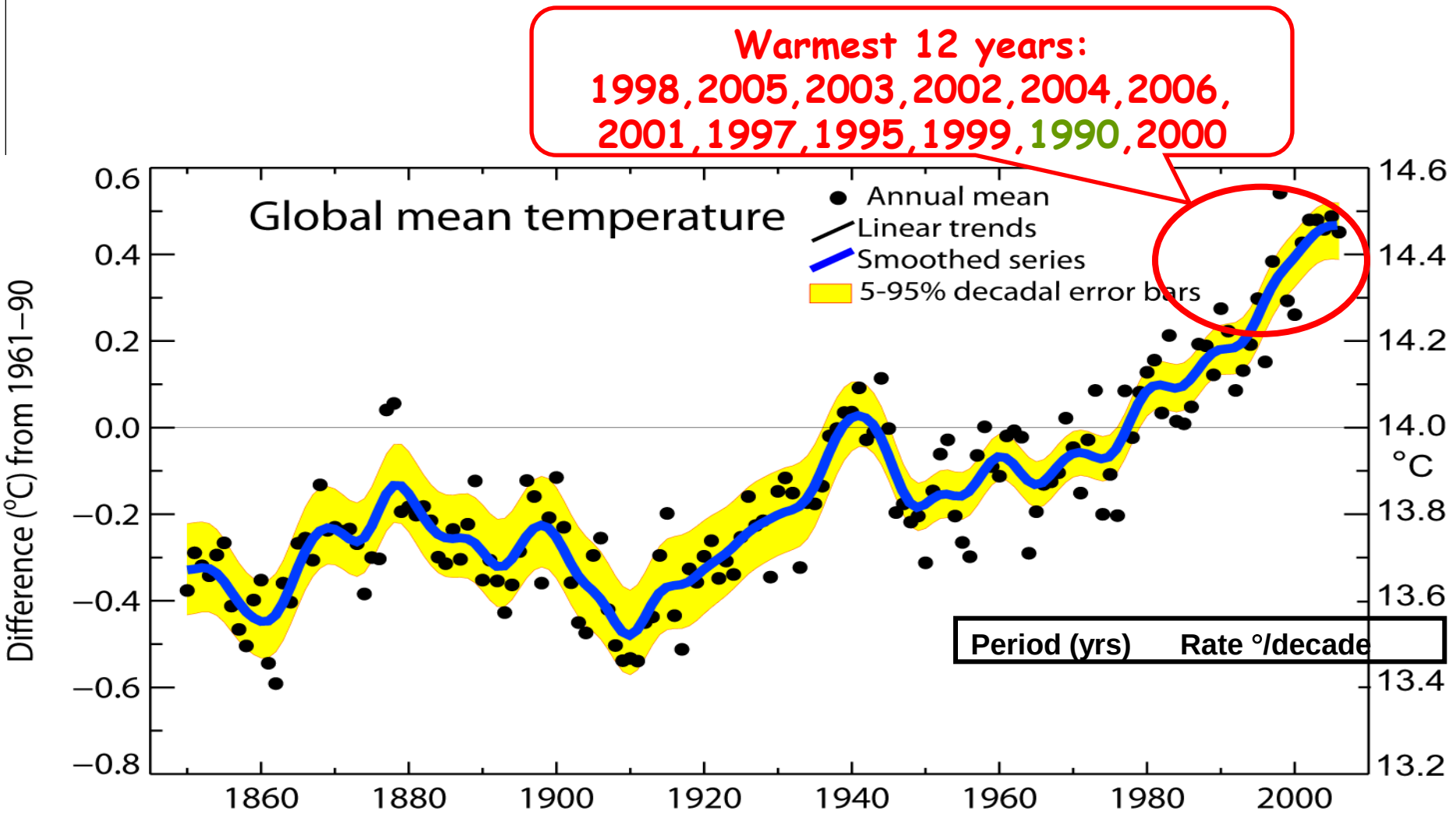
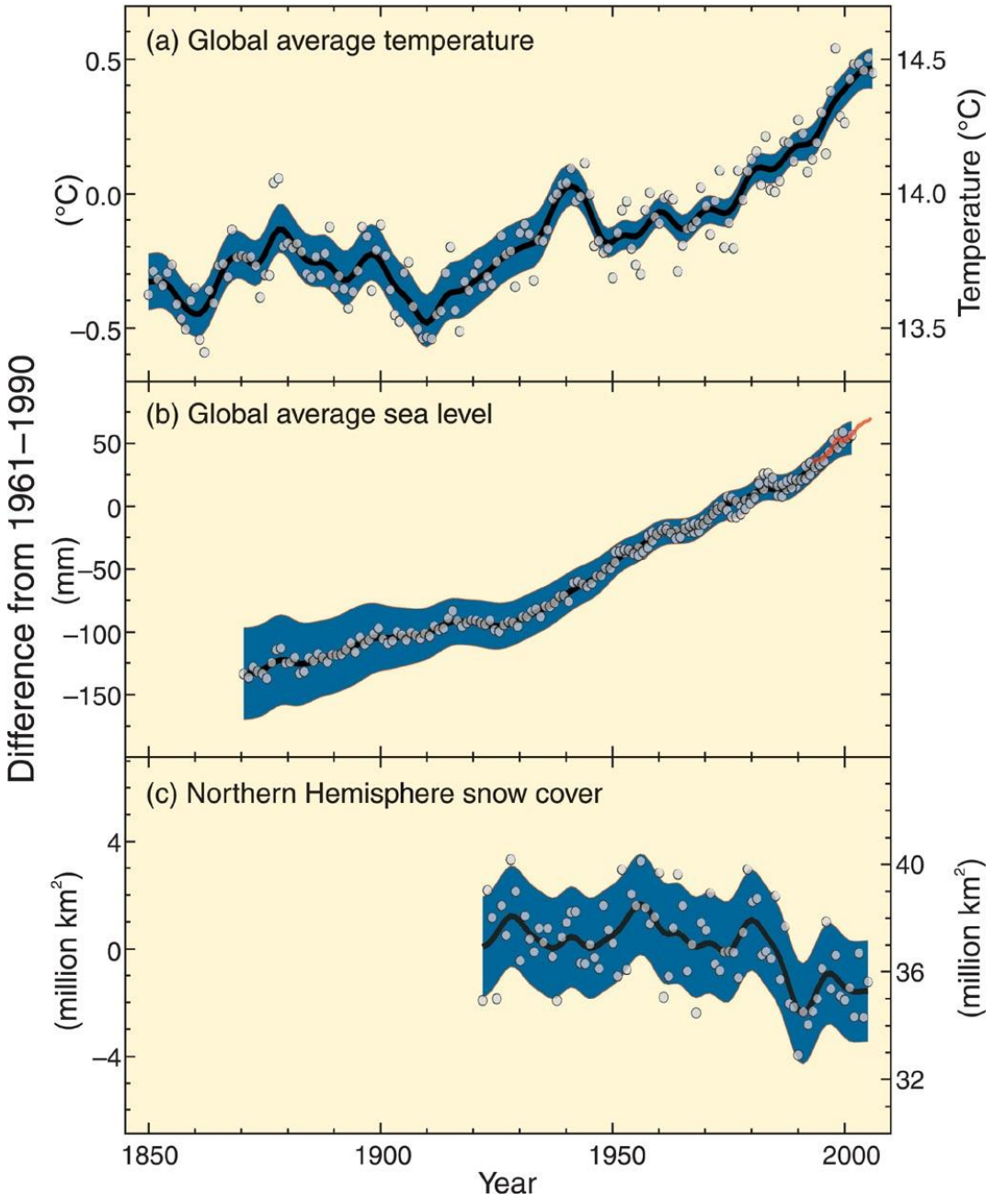
Overview

- Impacts of changes in climate variables
- Assessments of vulnerability
- Adaptation vs. Good development
- Policymaking under uncertainty
- Recommendations and concluding thoughts

Global mean temperatures are rising faster with time



IPCC 2007



- Increase in global air and ocean temperatures
- Rise in global average sea level
- Decrease in snow and ice

IPCC 2007

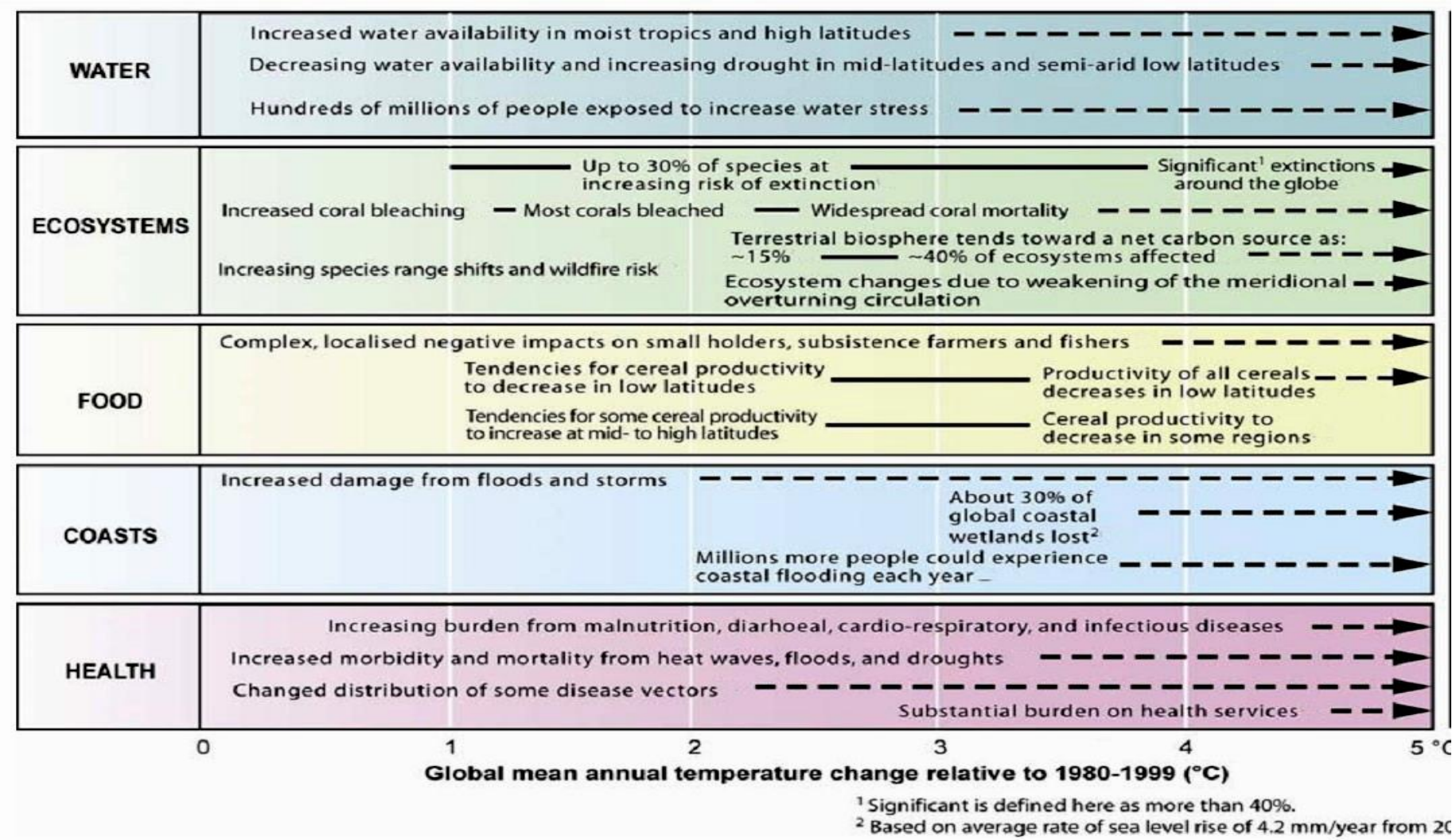
Projected changes in climate globally

By 2100:

- Global average surface temperature is projected to increase by 1.8 to 4^{o}C
- The global mean sea level is projected to rise by 0.18 to 0.59 meters
- *Very likely* that hot extremes, heat waves, and heavy precipitation events will continue to become more frequent
- *Likely* that future tropical cyclones will become more intense, with larger peak wind speeds and more heavy precipitation

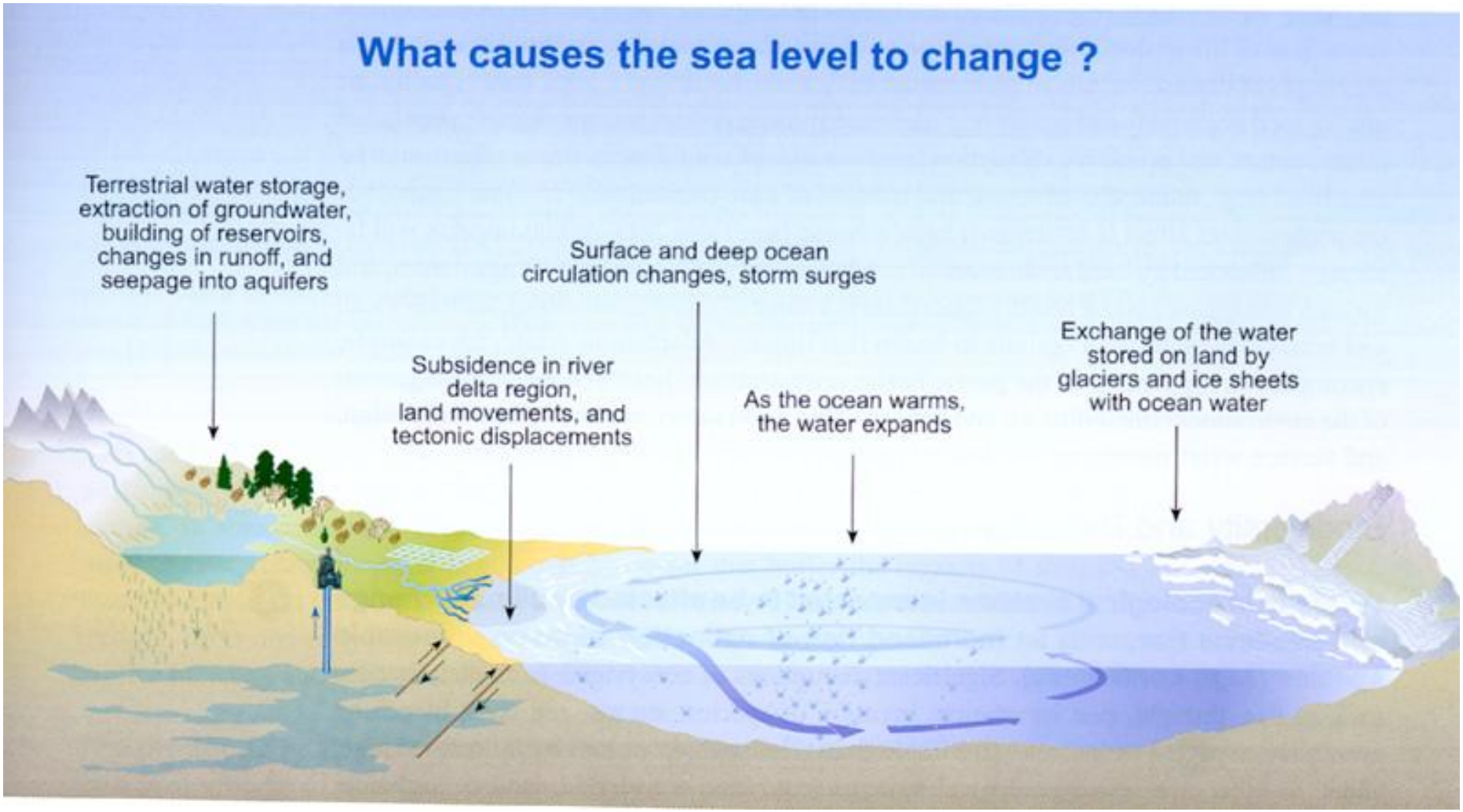
IPCC Summary for Policy Makers- WG1, AR4, 2007

Key impacts as a function of increasing global average temperature

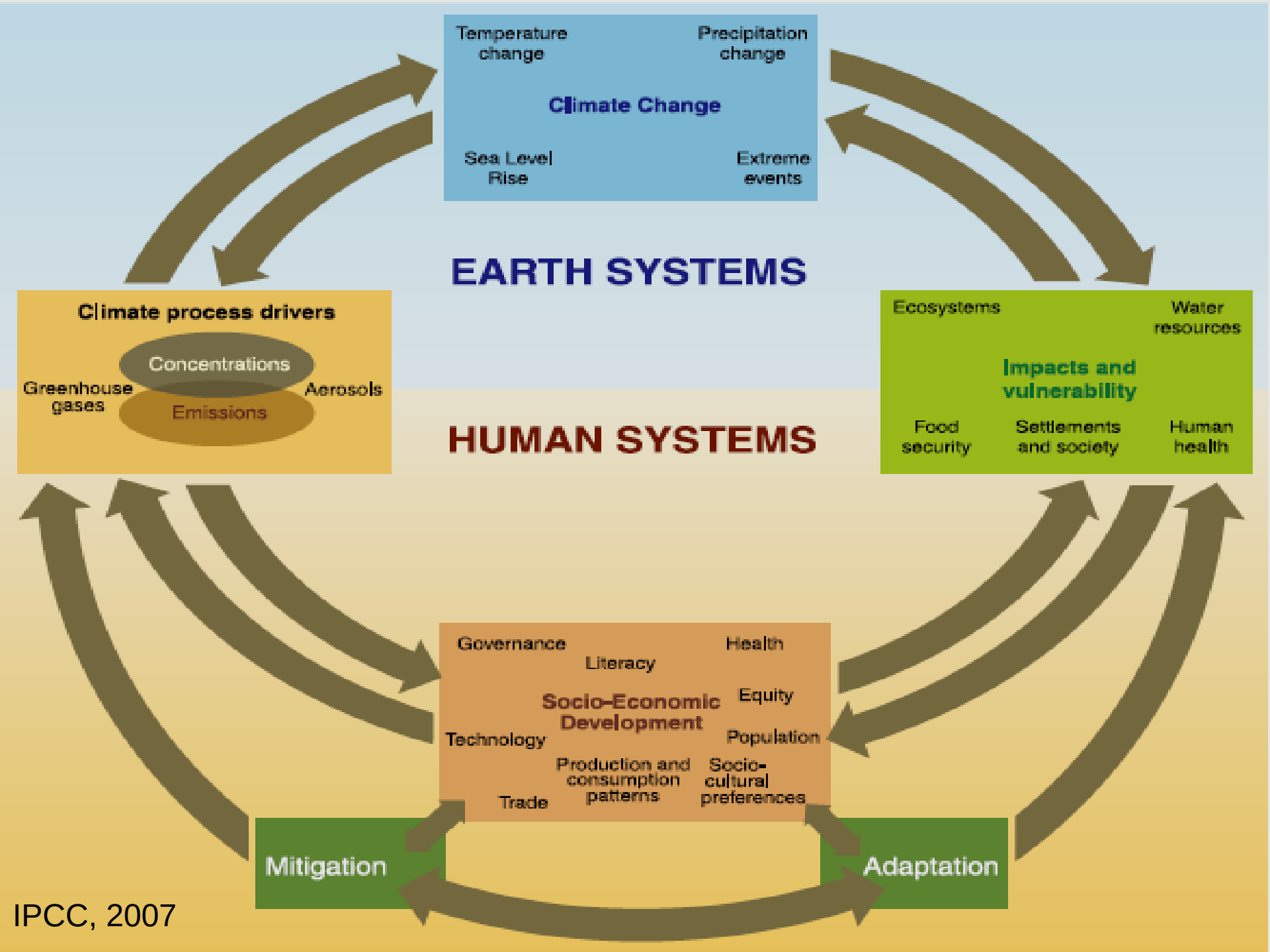


IPCC, 2007

Sea level rise

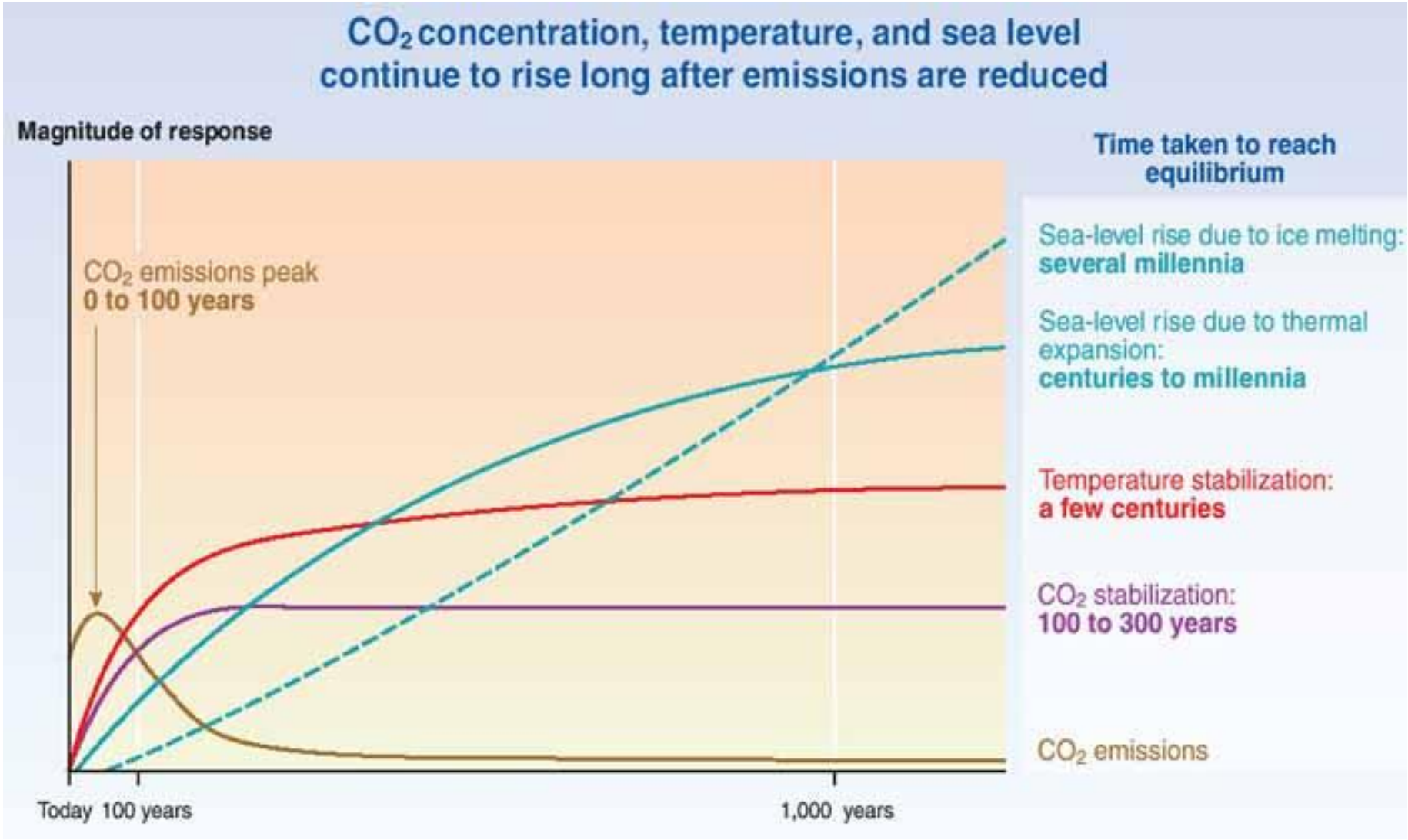


Source: IPCC, 2001


Temperature change
Precipitation change
Climate Change
Sea Level Rise
Extreme events
EARTH SYSTEMS
Climate process drivers
Concentrations
Greenhouse gases
Aerosols
Emissions
HUMAN SYSTEMS
Ecosystems
Water resources
Impacts and vulnerability
Food security
Settlements and society
Human health
Governance
Health
Literacy
Socio-Economic Development
Equity
Technology
Population
Production and consumption patterns
Socio-cultural preferences
Trade
Mitigation
Adaptation

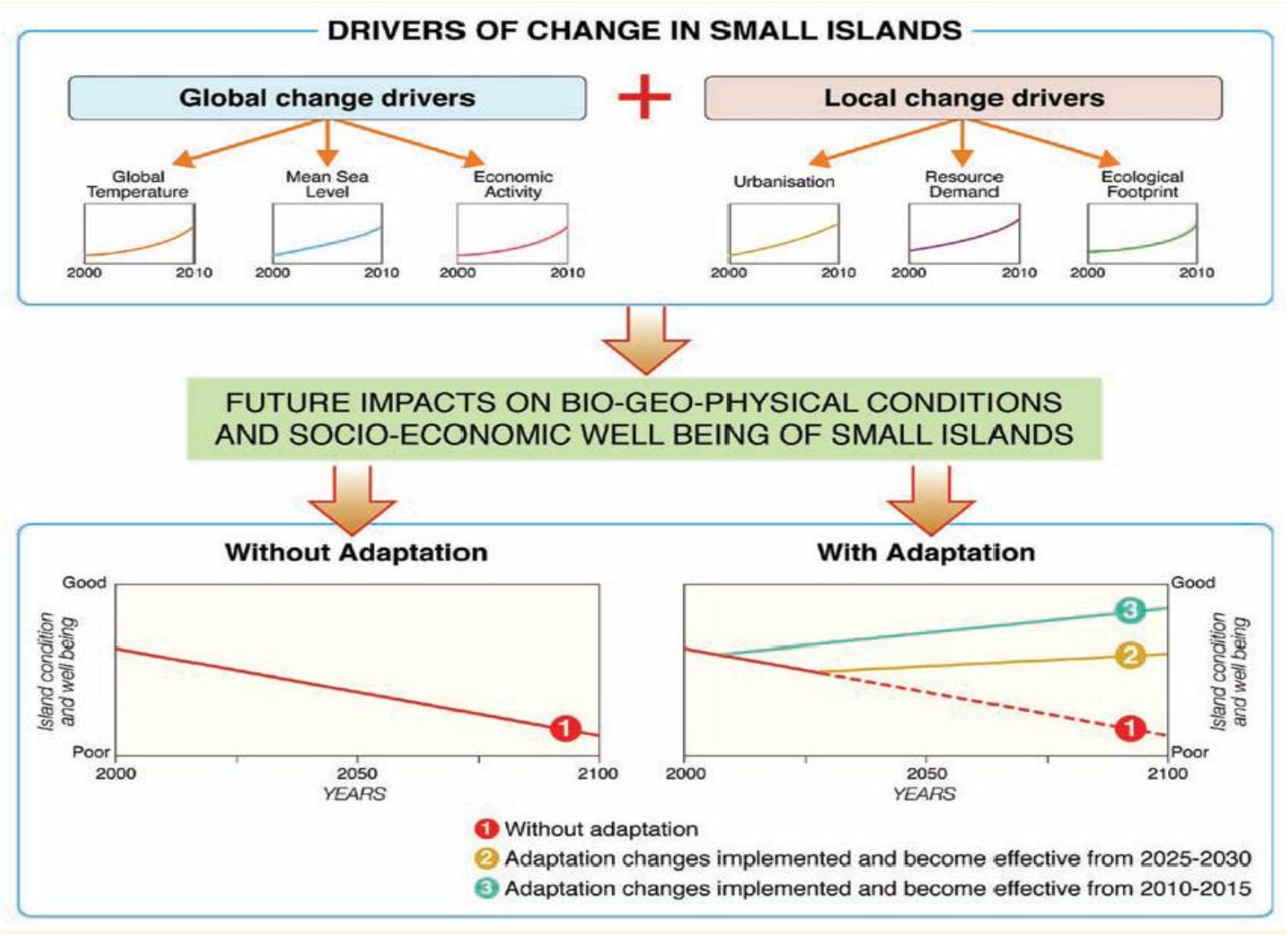
IPCC, 2007

No either or: Mitigate AND adapt



IPCC, 2001

Building the case for adaptation



Responding to Structured and unstructured problems

Unstructured problems are characterized by uncertainty and difference in perception about the problem, its cause and solution; boundaries of the problem are nebulous.

Agreement on perception about the problem

Certainty about knowledge

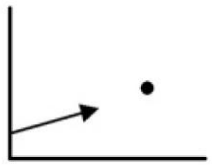
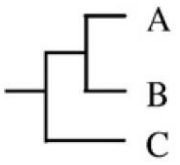
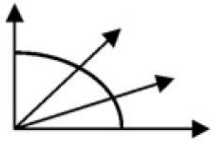
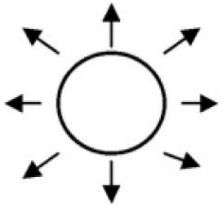
	No	Yes
No	Unstructured problem	Moderately structured problem
Yes	Moderately structured problem	Structured problem

Hisschemoller and Hoppe,1989

Understanding Uncertainty

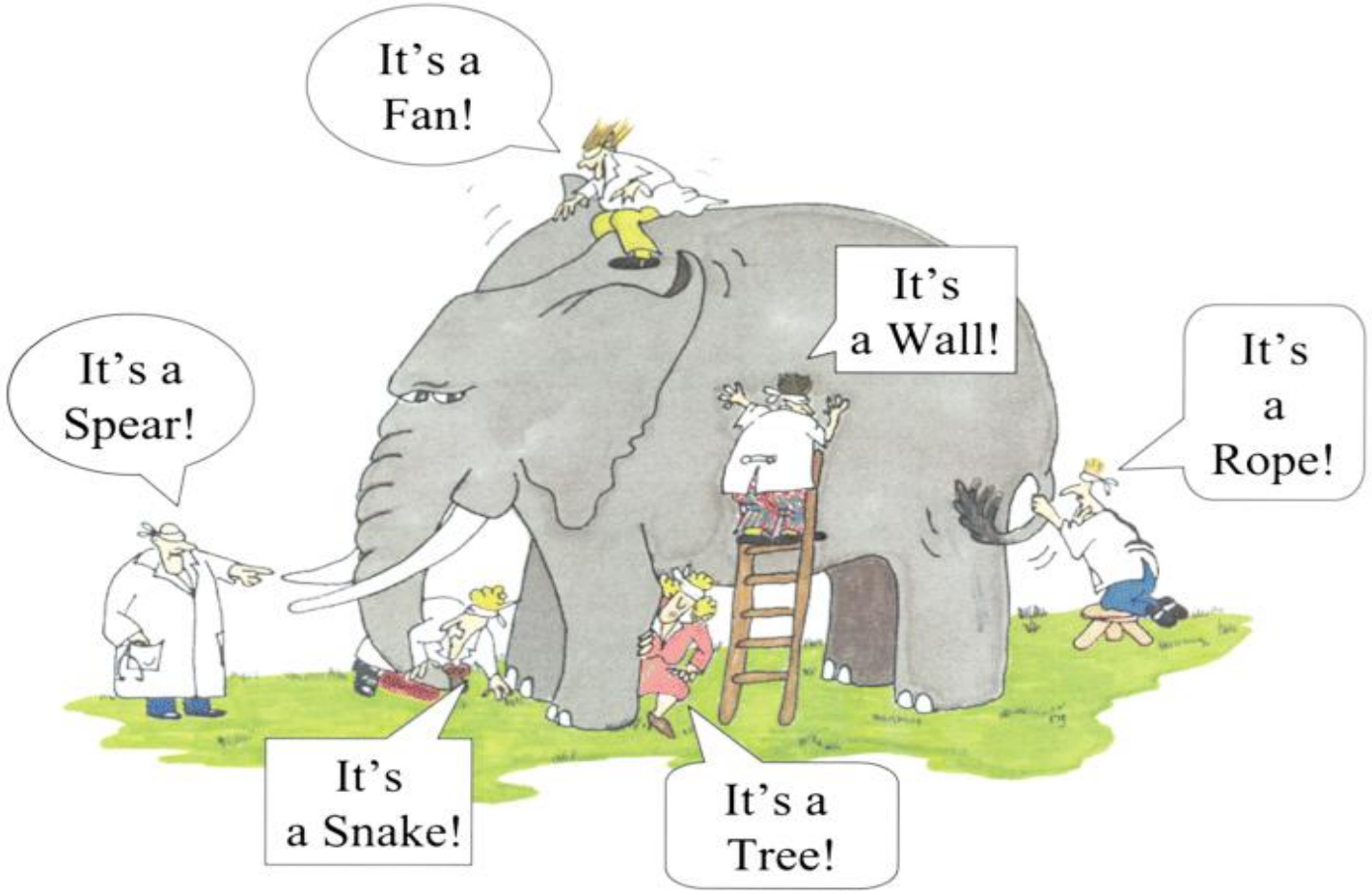
- Adaptive responses may be elicited across a continuum of uncertainty: moving from

Determinism, TO Complete ignorance

Level 1	Level 2	Level 3	Level 4
		Deep Uncertainty	
A clear enough future	Alternate futures (with probabilities)	A multiplicity of plausible futures	Unknown future
			

Walker et al 2010

Mis-interpretation Vs. Misrepresentation

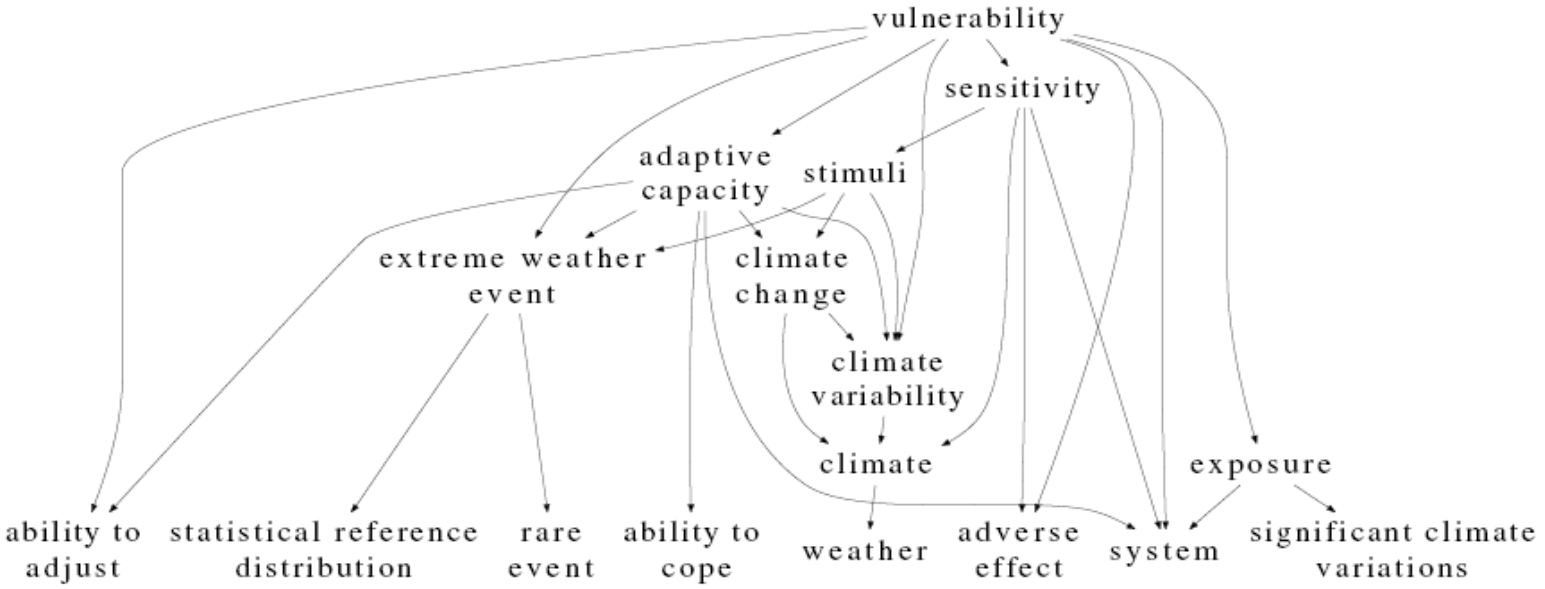


http://www.nature.com/ki/journal/v62/n5/images/4493262f1b.gif

Assessments of vulnerability

What defines vulnerability?

“the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity” (McCarthy et al., 2001).



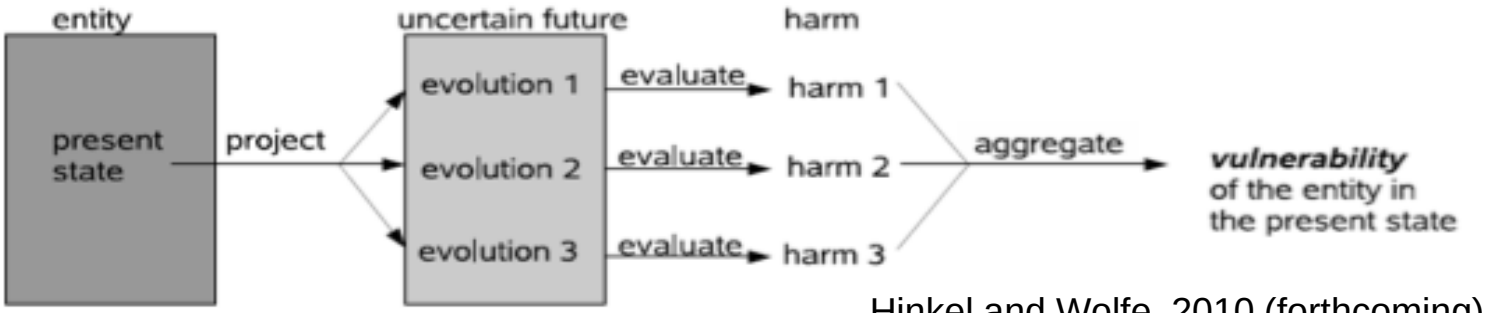
Source: Hinkel 2010

Challenges for vulnerability assessments

- Often sectoral, comparability across sectors missing
- Limitations in addressing scale issues
- Limitations in addressing dynamism of vulnerability
  - How and where to establish the baseline?
- Need to isolate the ‘climate signal’
  - Consider spread and ‘extremes’
  - Lack of time-series data especially in sectors such as health
- Scale mismatch
  - Timescale of projected impacts vs. policy planning process
- Data or Information barrier?
  - Lack of awareness, lack of relevant information, usability issues- *a strong case for capacity building of end-users*

Methodologies for vulnerability assessments

1. *Top-down methods* (global or regional scale, typically address impacts and vulnerability due to future climate change)
2. *Bottom-up methods* (Local scale and assessments typically address current vulnerability)



Hinkel and Wolfe, 2010 (forthcoming)

Case study 1: Macro and micro assessments

Impacts of climate change and globalization on Indian agriculture

Adaptive capacity

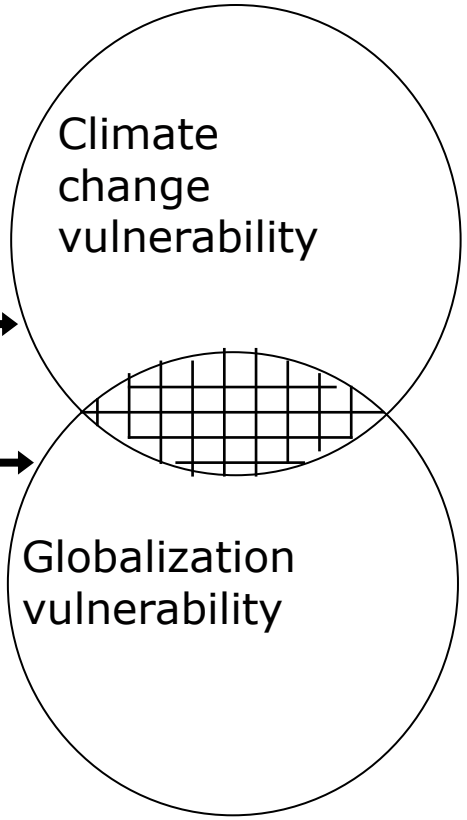
Biophysical vulnerability
- Soil degradation and cover
- Groundwater availability

Social vulnerability
- Agricultural workers and labourers
- Literacy
- Gender discrimination
- Child mortality and fertility

Technological vulnerability
- Irrigation
- Infrastructure

Climate sensitivity (monsoon dependence and dryness)

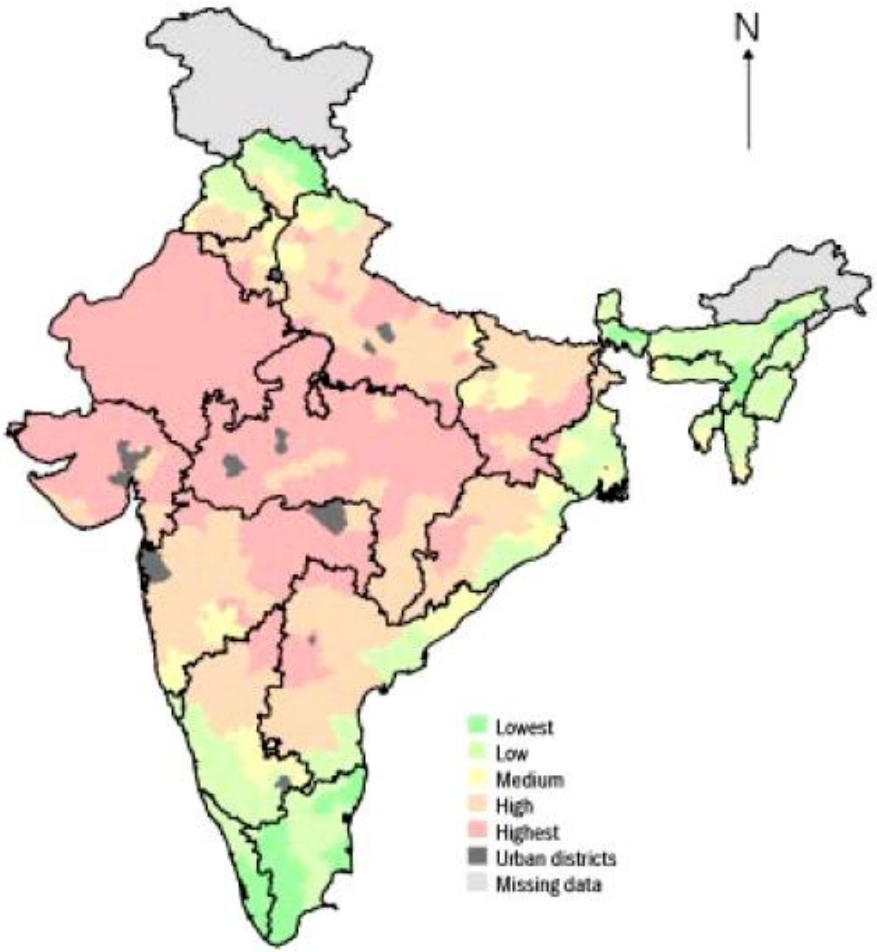
Trade sensitivity (port distance and import-sensitive crops)



Source: TERI, 2003

Vulnerability profiles

Regions with highest climate sensitivity and exposure are not necessarily the most vulnerable



Assessment of vulnerability of Indian agriculture to 'double exposure' (climate change and globalization)- a case study (Source: TERI, 2003)

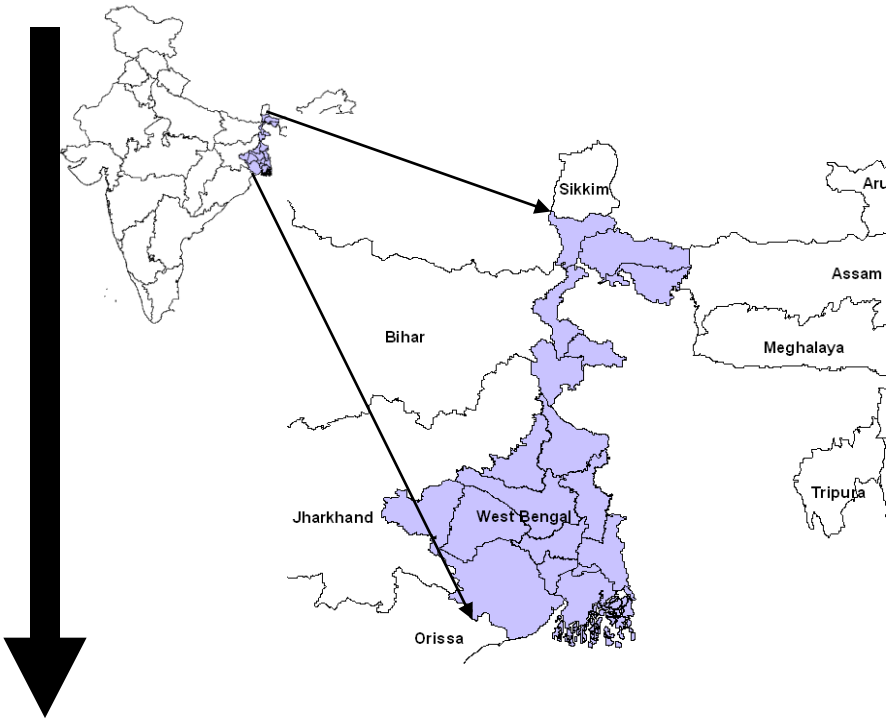
Case Study 2: Coastal Vulnerability Assessment using Regional Climate and Impact Assessment Model over West Bengal - Ongoing

Regional Climate Model projections over the West Bengal region using PRECIS for 50km x 50km scale

Impact Assessments of sea level rise, storm surge, water, agriculture and health sectors

Determination of hotspots and multi-hazard mapping in GIS platform including socio-economic projections

Policy Recommendations

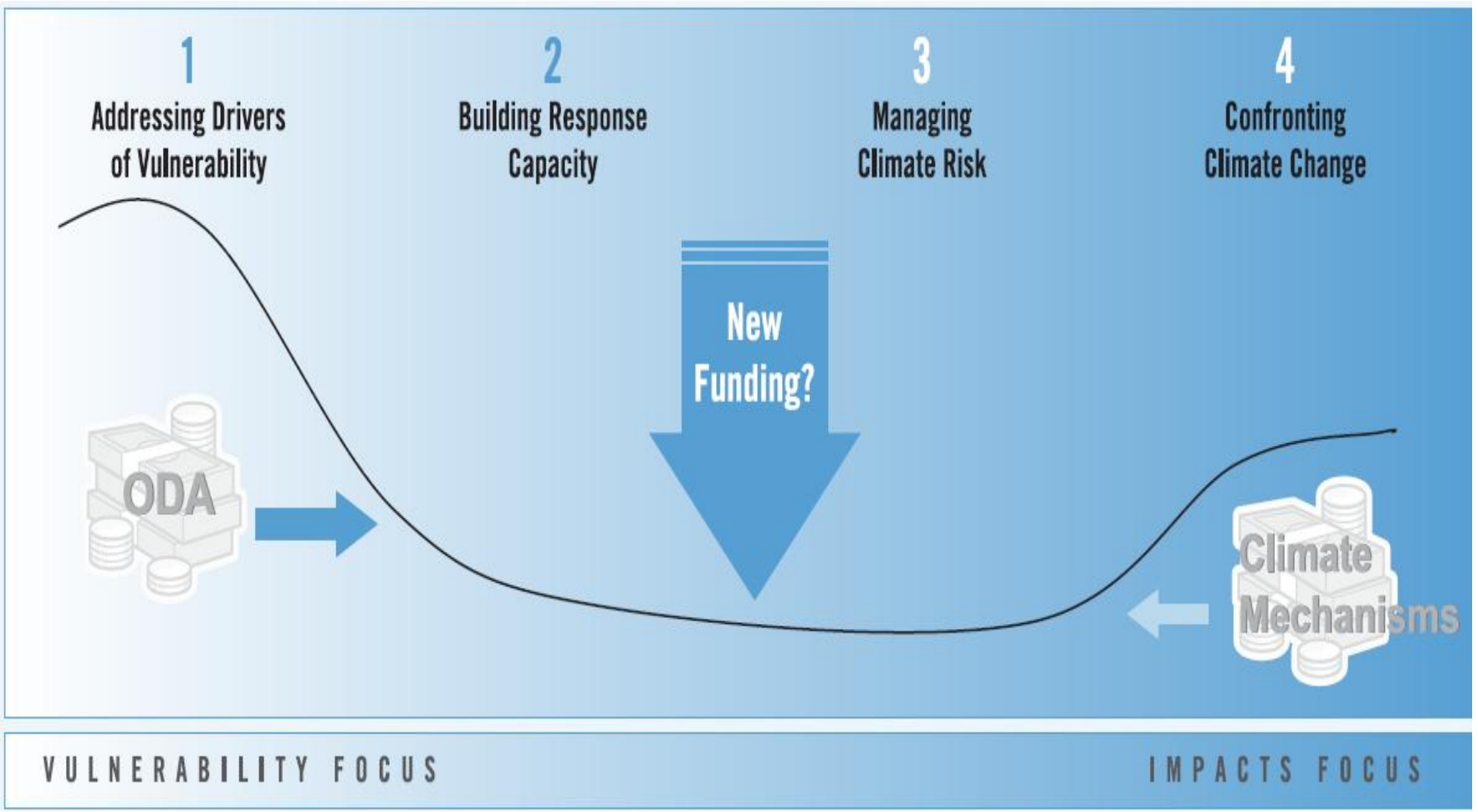


Determination of Storm surge impact over the West Bengal coast

- ADCIRC (ADvanced CIRCulation) is a finite element hydrodynamic model that solves the generalized form of the wave continuity equation for elevation and the non-conservative momentum equation for the velocity field.
- The model is used for
  - Predicting surges due to hurricanes and other storms
  - Producing tidal charts for coastal areas
  - Studying general circulation patterns in near-shore and oceanic waters.
- The model was originally developed for the U.S. Army Corps of Engineers over 18 years ago, by R. Luettich and J.J. Westerink, and has been modified by many others since then

Adaptation Vs. Good Development

Adaptation- development continuum

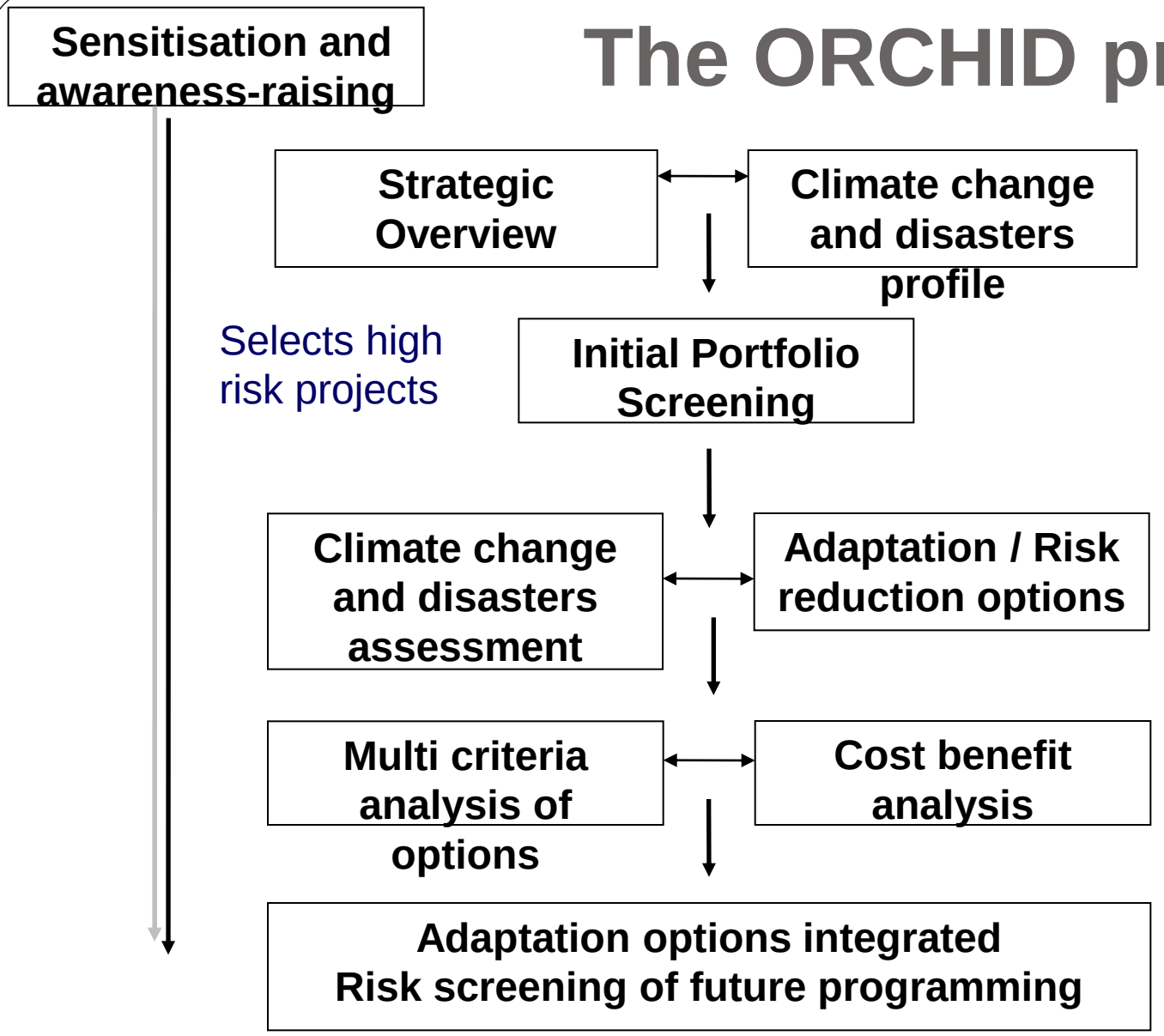


World Resources Institute (2007)

Case study 3: Climate risk screening

Climate risk assessment as a tool/approach for reducing climatic risks to developmental objectives and integrating adaptation options within developmental programmes at the national and sub-national levels

The ORCHID process



1. Climate science
2. Vulnerability
3. Economic impacts

Risk assessment and adaptation options

Cost benefit analysis

Climate-risk screening of projects

- Criteria for climate risk screening: comparison of scenarios
  - No programme scenario: without interventions
  - Programme scenario: partial risk reduction due to programme implementation
  - Programme plus scenario: risk reduction with additional components added within the present programme portfolio

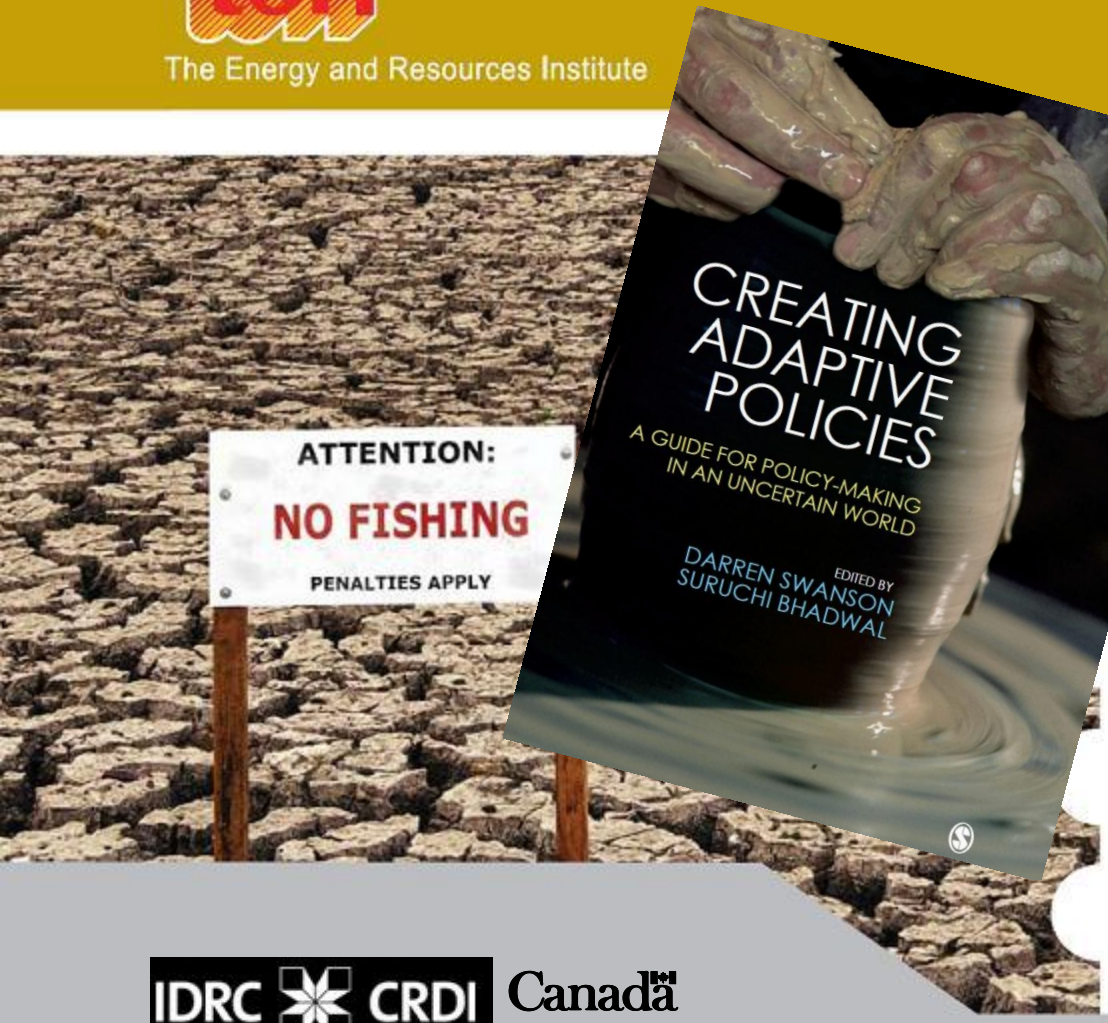
Source: Tanner et al, 2007

Policymaking under uncertainty

iisd International Institute for Sustainable Development / Institut international du développement durable

teri The Energy and Resources Institute

ADAPTIVE POLICIES



Guidance for Designing Policies in Today's Complex, Dynamic and Uncertain World

IDRC CRDI Canada

Adaptive Policy

Ability of policy to adapt to **anticipated** conditions	Ability of policy to adapt to **unanticipated** conditions
(based on a good understanding of cause and effect)	(based on a good understanding of system dynamics and complexity)

Adaptive policies are *'designed to function more effectively under complex, dynamic and uncertain conditions'.*

Swanson and Bhadwal, Creating Adaptive Policies: IISD-IDRC-TERI 2009

Recommendations

- Monitoring of changes in sea level to be done to assess relative sea level change at regional and local scale
- Enhance skills for climate (mean air temperature, tropical cyclones, wind direction and strength, sea surface temperatures).
- Expand coverage of observational networks.
- Integrated impacts assessments- between sectors, integrating changes in socio-economic conditions with climate and impact projections.
- Convergence of traditional knowledge and modern technologies, along with technology transfer and skill building is required
- Capacity building for resilience planning and strengthening adaptive capacities
- Enhanced regional cooperation and strengthening existing networks

IPCC 2007

Some concluding thoughts

- Establish baseline for M& E of adaptation efforts
- Engaging the civil society: “Fatal impression” – *‘it is a global problem to be solved at global level’* ….need to engage the civil society
- Communication of climate risks
- Limits to adaptation
- Synergies: across research domains, from research to policy, from top-down to bottom-up
- ***For what we can change***……Better management of our resources and Sustainable lifestyles
- ***For what we cannot change***…….Enhance coping abilities (enhance asset base- in terms of development and knowledge/ skills) for better preparedness

Thank you for your attention

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