

## **Training course**

# **Tackling climate change in agriculture: approaches to adaptation**

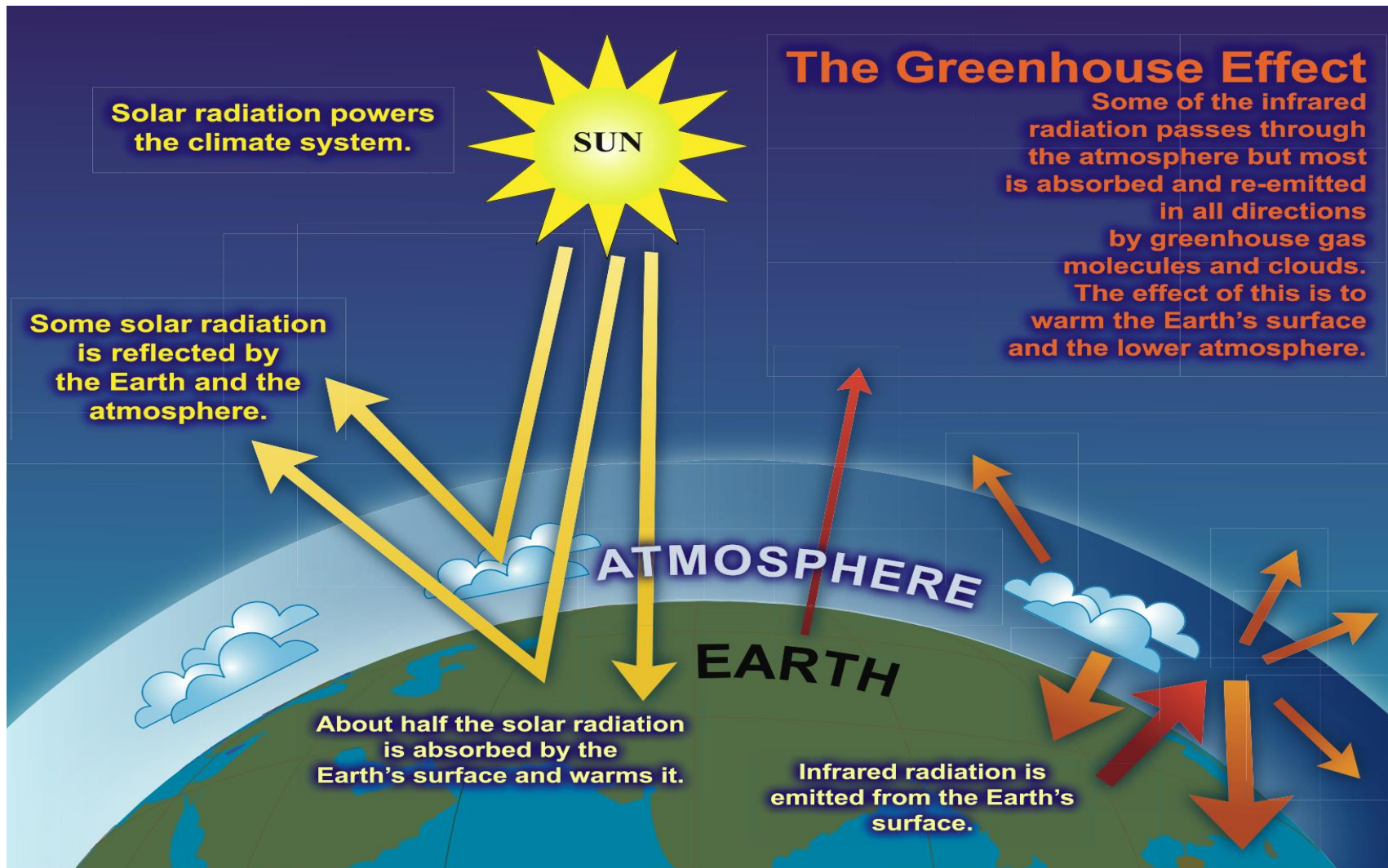
### **Clarifying basic concepts**



## Overview

- I. Climate change - basics
  - a. Terminology / glossaries
  - b. The Earth's climate system – key features
  - c. Causes of a changing climate – emissions
  - d. Impacts
- II. Taking action
  - a. Mitigation
  - b. Adaptation

# The Earth's climate system - the greenhouse effect





**Video Animation:**

**[Greenhouse Effect explained](#)**

# Key Documents



## IPCC Assessment Reports:

The Physical Science Basis

<..\hyperlink-material\ar5-spm-physical-science.pdf>

Impacts, Adaptation and Vulnerability

<..\hyperlink-material\ar5-spm-adaptation.pdf>

Mitigation

<..\hyperlink-material\ar5-spm-mitigation.pdf>

## Millennium Ecosystem Assessment

<http://www.millenniumassessment.org/en/index.html>

# Glossaries in Key Documents

**Climate Change 2014: Impacts, Adaptation and Vulnerability, Glossary:**

[..\hyperlink-material\ar5-glossary-adaptation.pdf](#)

**Climate Change 2014: Mitigation of Climate Change, Glossary:**

[..\hyperlink-material\ar5-glossary-mitigation.pdf](#)

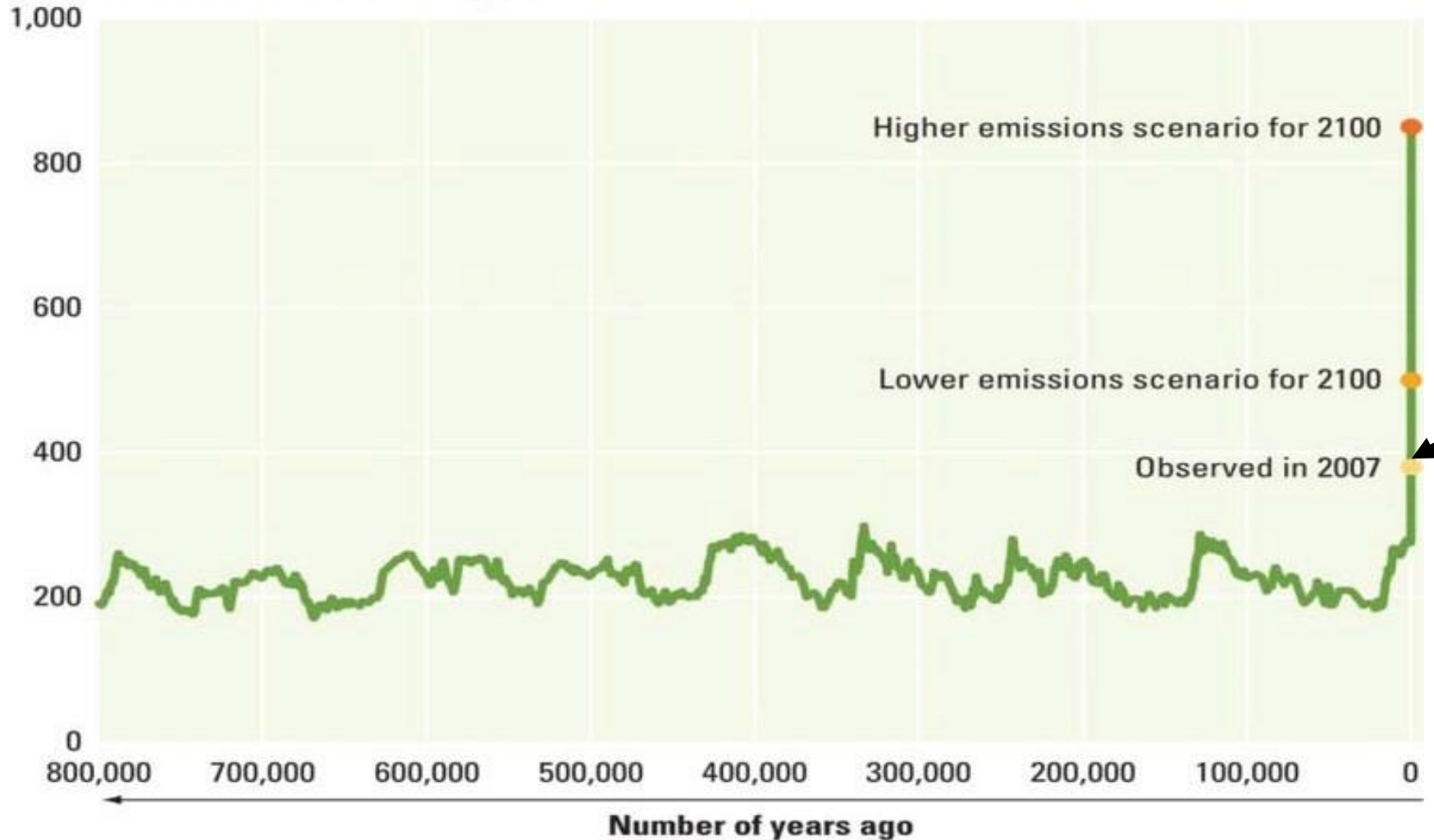
**Climate Change 2013: The Physical Science Basis, Glossary:**

[..\hyperlink-material\ar5-glossary-physical-science-basis.pdf](#)

# Greenhouse Gases

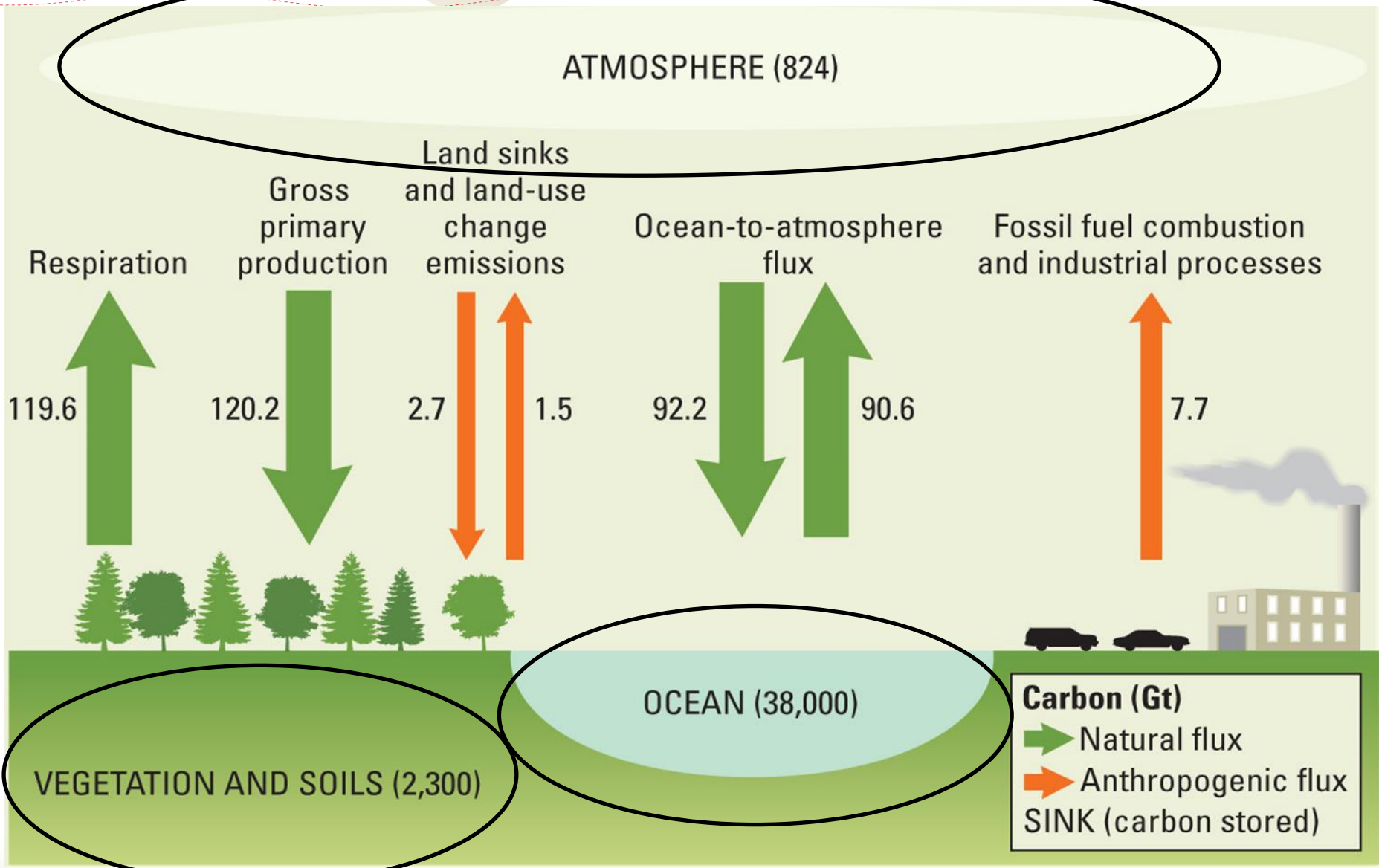


## Carbon dioxide concentration (ppm)



Source: World development Report 2010

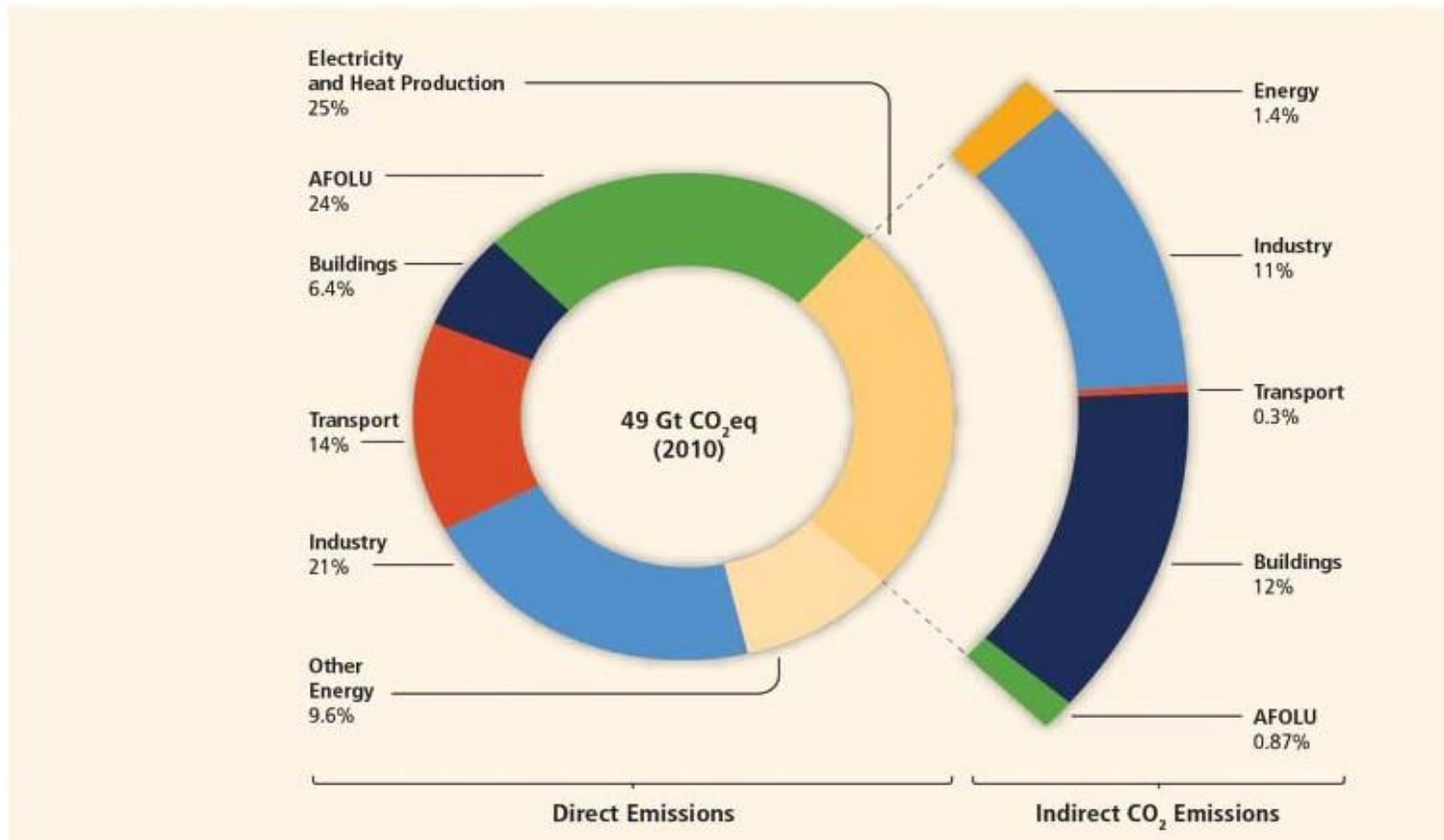
# The system earth - Thinking in systems







# Total anthropogenic GHG emissions by economic sector



Source: IPCC Climate Change 2013. The Physical Science Basis



## GETTING THE CLIMATE CHANGE MEASUREMENTS ?

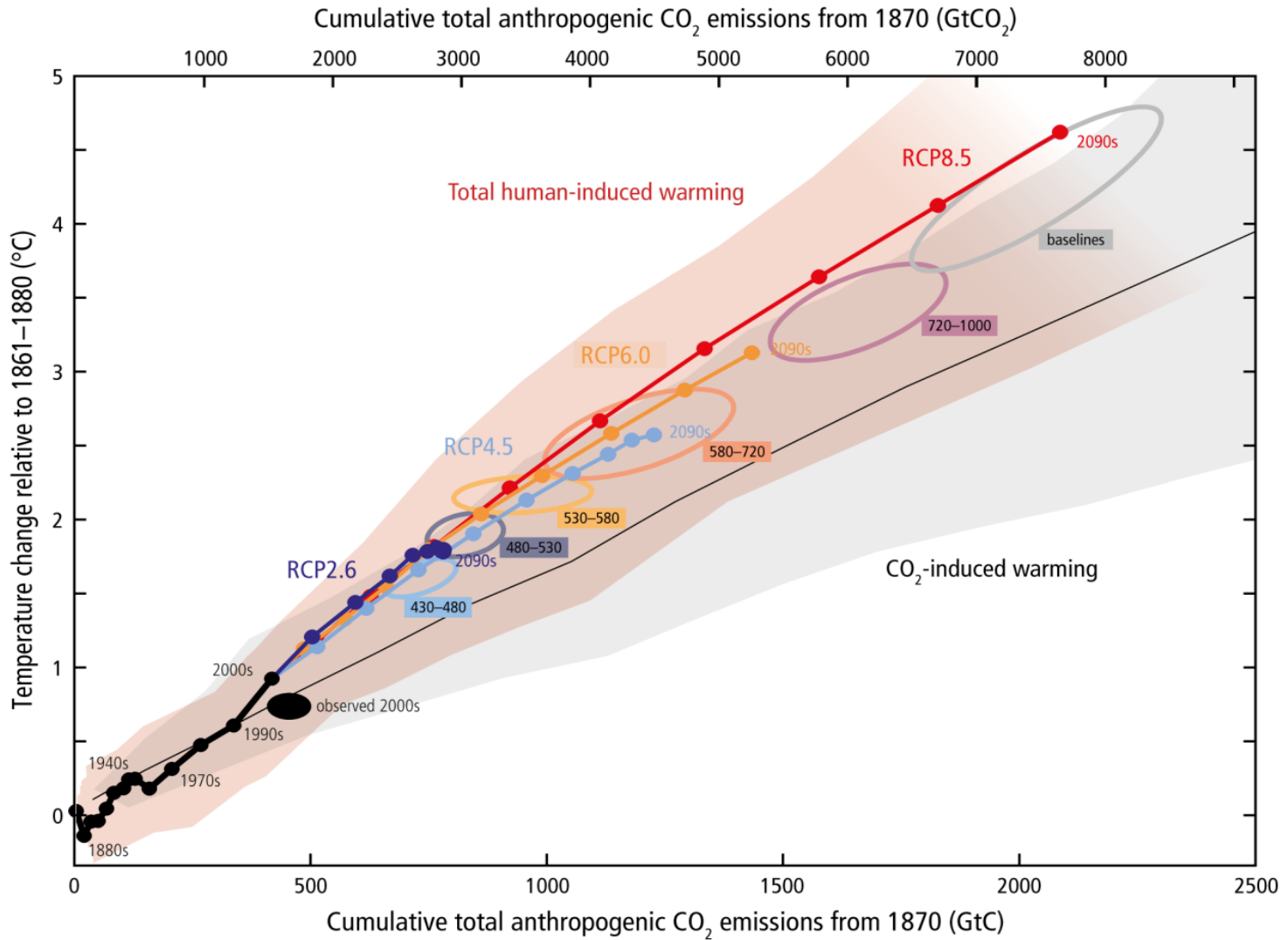
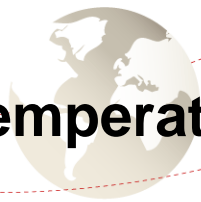
**1 Ton = 1000 kilo =  $10^6$  gram**

**1 Kiloton = 1000 tons =  $10^9$  gram**

**1 Megaton = 1000 X 1000 tons =  $10^{12}$  gram**

**1 Gigaton = 1000 megatons = 1 petagram ( $10^{15}$  gram)**

# Emmissions vs. Temperatures



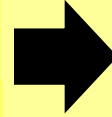
Source: IPCC Climate Change 2013: The Physical Science Basis



# From signals to tangible effects

## Climate signals

- change in temperature patterns
- change in precipitation patterns
- increase in extreme weather events (storms, heat waves...)
- melting of pole caps, glaciers and permafrost
- sea-level rise
- ocean acidification



## Effects

- droughts
- change of natural systems' productivity
- increase in forest fires
- exceptional floods
- loss of land
- health issues
- ...

- food insecurity
- loss of income
- ...

-> vulnerable livelihoods

-> economic damages

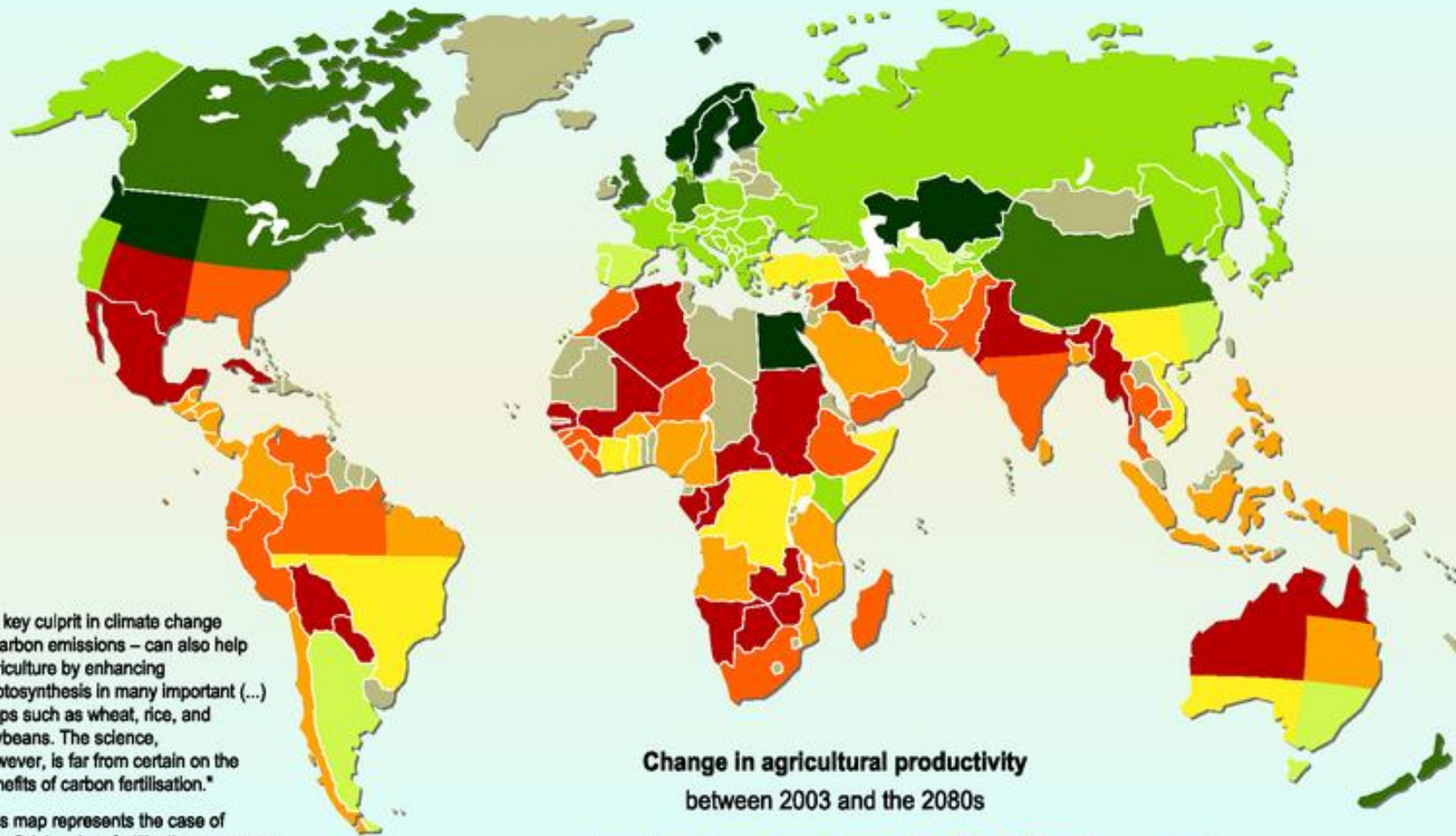


See also:

[IPCC 5. Assessment Report 'Impact, Adaptation and Vulnerability', p. 22 ff](#)



## Projected impact of climate change on agricultural yields



\* A key culprit in climate change – carbon emissions – can also help agriculture by enhancing photosynthesis in many important (...) crops such as wheat, rice, and soybeans. The science, however, is far from certain on the benefits of carbon fertilisation.\*

This map represents the case of beneficial carbon fertilisation processes.

Source: Cline W., 2007, *Global Warming and Agriculture*.



## How certain are we?

### What is – and will (partly) remain - uncertain:

- **Basis of understanding**
  - Models are representations of the Earth's system, not portrait pictures
  - Limited data availability, esp. at regional/local scale
  - Limited data quality, esp. at regional/local scale
  - Confidence levels of projections – inherent uncertainty
- **Development of GHG emissions**
  - Depends on decisions today
- **Extent of change and vulnerability**
  - Influenced by the socio-economic and ecological state AND Climate trends



# Are our systems equipped for the challenges?







## **II. Taking action**

**Technologies  
Perceptions  
Paradigms**



- Manage the un-avoidable
- **Adaptation (IPCC, 2013)** The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.
  - Incremental adaptation: Adaptation actions where the central aim is to maintain the essence and integrity of a system or process at a given scale.
  - Transformational adaptation: Adaptation that changes the fundamental attributes of a system in response to climate and its effects.
- See also: Autonomous adaptation, Evolutionary adaptation, and Transformation.



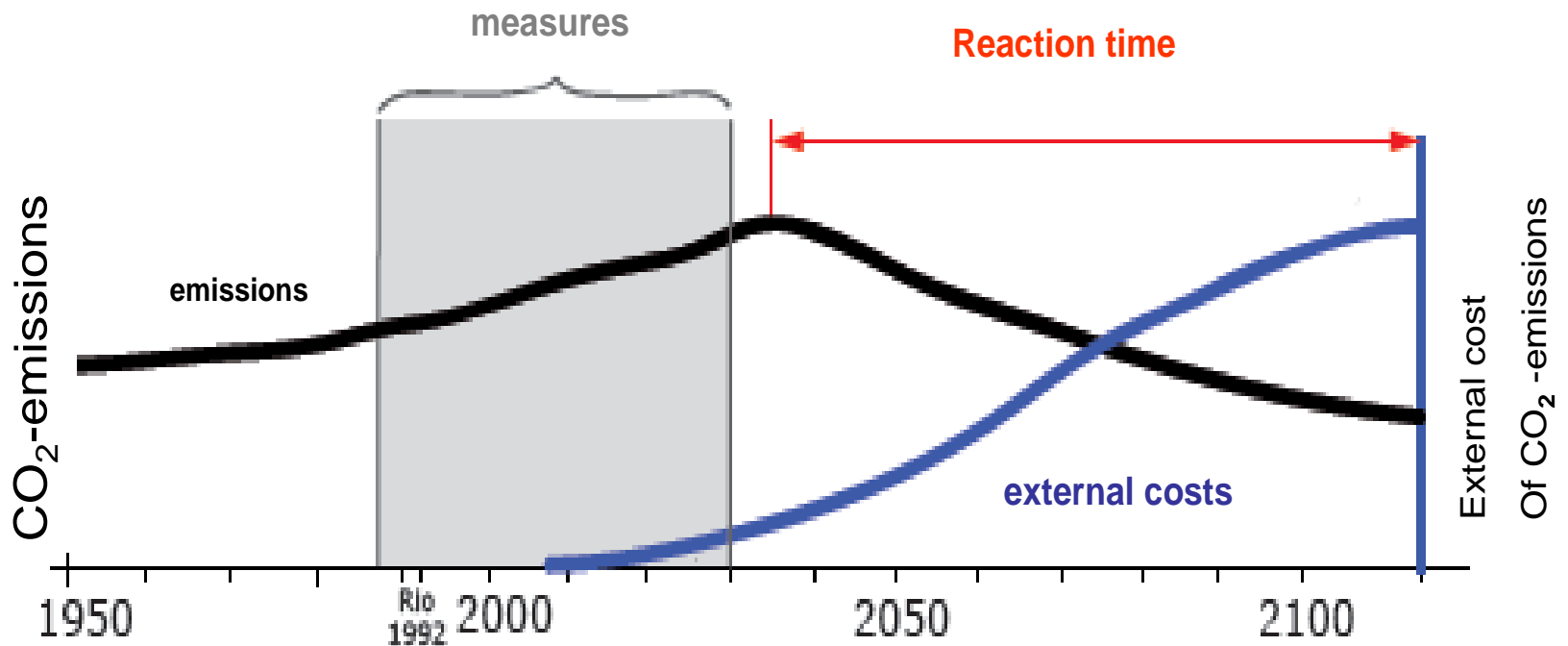
## Mitigation

*Plenum:*

*Please read aloud the IPCC definition*

- Avoid the un-manageable
- **Mitigation of climate change: (IPCC, 2013):** A human intervention to reduce the sources or enhance the sinks of greenhouse gases (GHGs).
- Copenhagen ( COP 2008): +2°C maximum
- IPCC (2013): Carbon Budget Concept

# Focus Point: Adaptation Gap



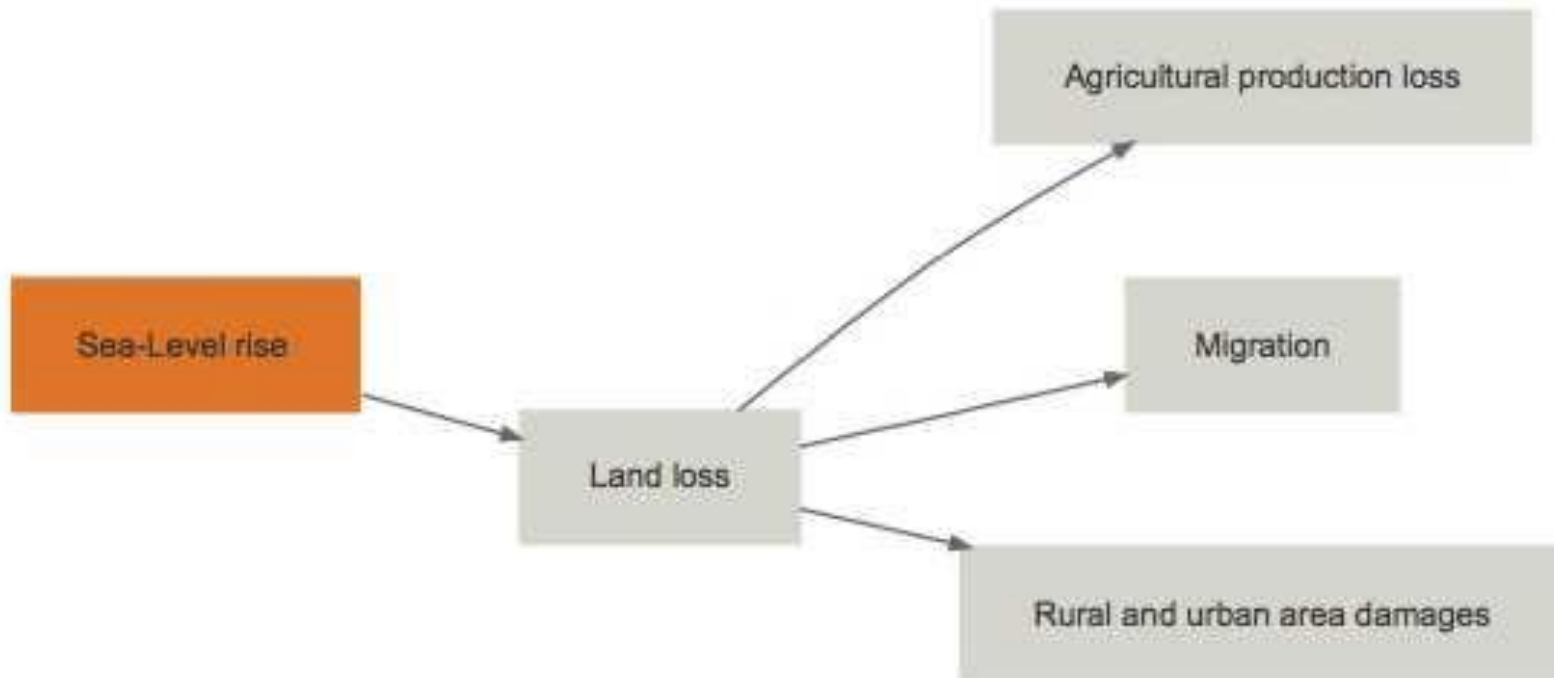
Source: Denkschrift 'Energie'. 2007. Swiss Academies of Sciences,  
<http://www.satw.ch/publikationen/schriften/Denk-Schrift>



# Adaptation - thinking in impact chains

Plenum:

Do you know examples of 'SYSTEMS? FROM YOUR WORKING  
CONTEXT?





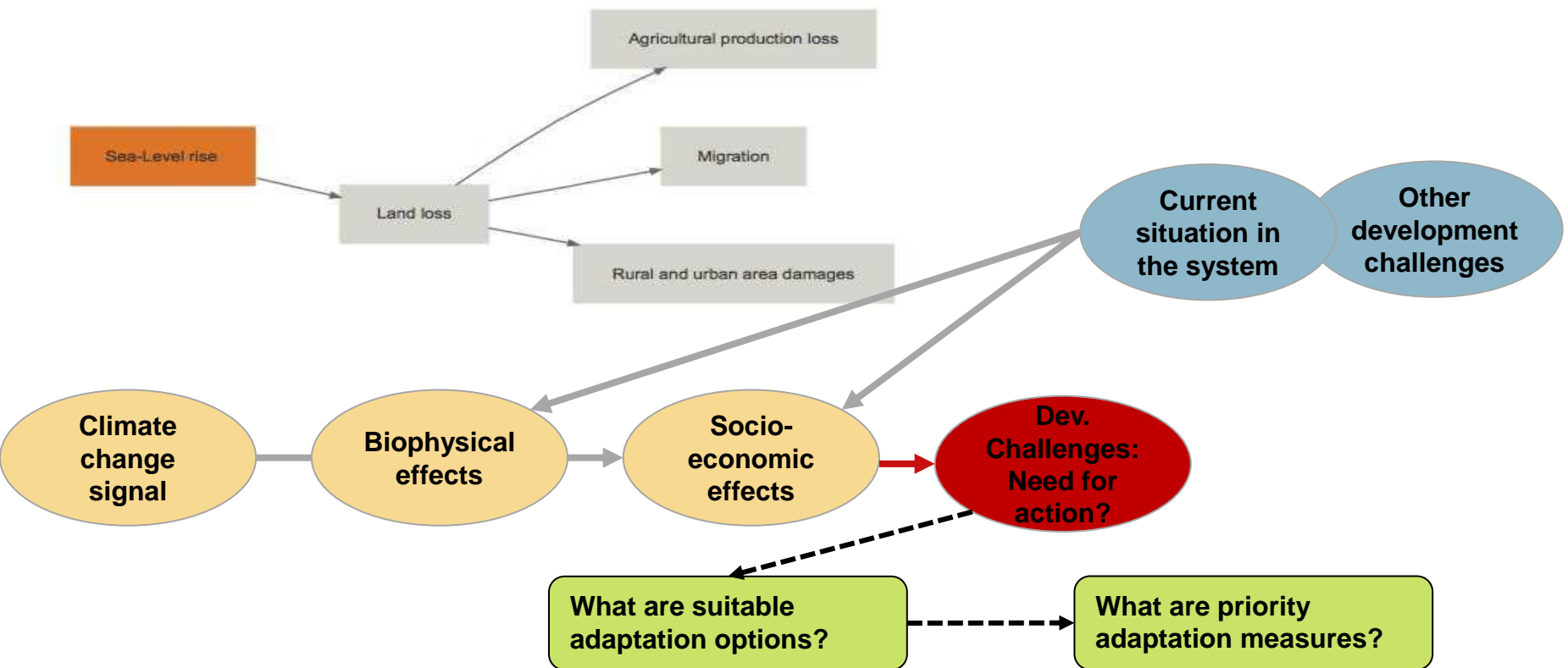
# Thinking concretely about ADAPTATION

**IPCC 5. Assessment Report 'Impact, Adaptation and Vulnerability', p. 22 ff**

Asia				
Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Increased riverine, coastal, and urban flooding leading to widespread damage to infrastructure, livelihoods, and settlements in Asia ( <i>medium confidence</i> ) [24.4]	<ul style="list-style-type: none"> <li>Exposure reduction via structural and non-structural measures, effective land-use planning, and selective relocation</li> <li>Reduction in the vulnerability of lifeline infrastructure and services (e.g., water, energy, waste management, food, biomass, mobility, local ecosystems, telecommunications)</li> <li>Construction of monitoring and early warning systems; Measures to identify exposed areas, assist vulnerable areas and households, and diversify livelihoods</li> <li>Economic diversification</li> </ul>			Very low      Medium      Very high
			Present	
			Near term (2030–2040)	
			Long term (2080–2100)	2°C 4°C
Increased risk of heat-related mortality ( <i>high confidence</i> ) [24.4]	<ul style="list-style-type: none"> <li>Heat health warning systems</li> <li>Urban planning to reduce heat islands; Improvement of the built environment; Development of sustainable cities</li> <li>New work practices to avoid heat stress among outdoor workers</li> </ul>			Very low      Medium      Very high
			Present	
			Near term (2030–2040)	
			Long term (2080–2100)	2°C 4°C
Increased risk of drought-related water and food shortage causing malnutrition ( <i>high confidence</i> ) [24.4]	<ul style="list-style-type: none"> <li>Disaster preparedness including early-warning systems and local coping strategies</li> <li>Adaptive/integrated water resource management</li> <li>Water infrastructure and reservoir development</li> <li>Diversification of water sources including water re-use</li> <li>More efficient use of water (e.g., improved agricultural practices, irrigation management, and resilient agriculture)</li> </ul>			Very low      Medium      Very high
			Present	
			Near term (2030–2040)	
			Long term (2080–2100)	2°C 4°C



# Adaptation – the climate proofing approach





***“Ecosystem-based adaptation is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change.  
(CBD, 2009)***





## Ecosystem-based adaptation - examples

Benefitting sector	Climate change impact (direct and indirect)	EbA solutions	Provisioning ecosystem
Agriculture	Accelerated soil degradation	Application of grass species with thick and deep root systems to conserve soil moisture and fixate / regenerate top soil	Grasslands
	Decreased water availability	Agroforestry: introduction of shade trees and shelterbelts to reduce crop water demand	Trees/forests
Water management	Accelerated runoff and reduced groundwater recharge due to changes in precipitation	Adapted management of catchment areas to enhance groundwater recharge and regulate runoff	Forests, grasslands, wetlands, agricultural systems
	Flooding caused by increased frequency and magnitude of rain storms	Restoration of riparian zones and floodplains contributing to flood control	Wetlands, gallery forests



# Thank You!