

# Environment and Development Challenges: The Imperative to Act

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Blue Planet Laureates for Rio+20

University of Maryland

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# Environment and Development Challenges: The Imperative to Act

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Barefoot College, Conservation International, International institute for Environment and Development, and International Union for the Conservation of Nature

# Current Situation

- **Unacceptable levels of poverty and income inequality**
- **Unacceptable levels of hunger**
- **Lack of access to clean water and energy**
- **Significant increases in population**
- **Unsustainable economic system**
- **Rapid Environmental changes**
  - **Climate change**
  - **Loss of biodiversity and ecosystem degradation**
  - **Land degradation**
  - **Water pollution**
  - **Local and regional air pollution**

# The Blue Planet Laureates Dream

## A world

- without poverty
- that is equitable
- that respects human rights
- with increased and improved ethical behavior
- that is environmentally, socially and economically sustainable, where the challenges such as climate change and loss of biodiversity have been successfully addressed

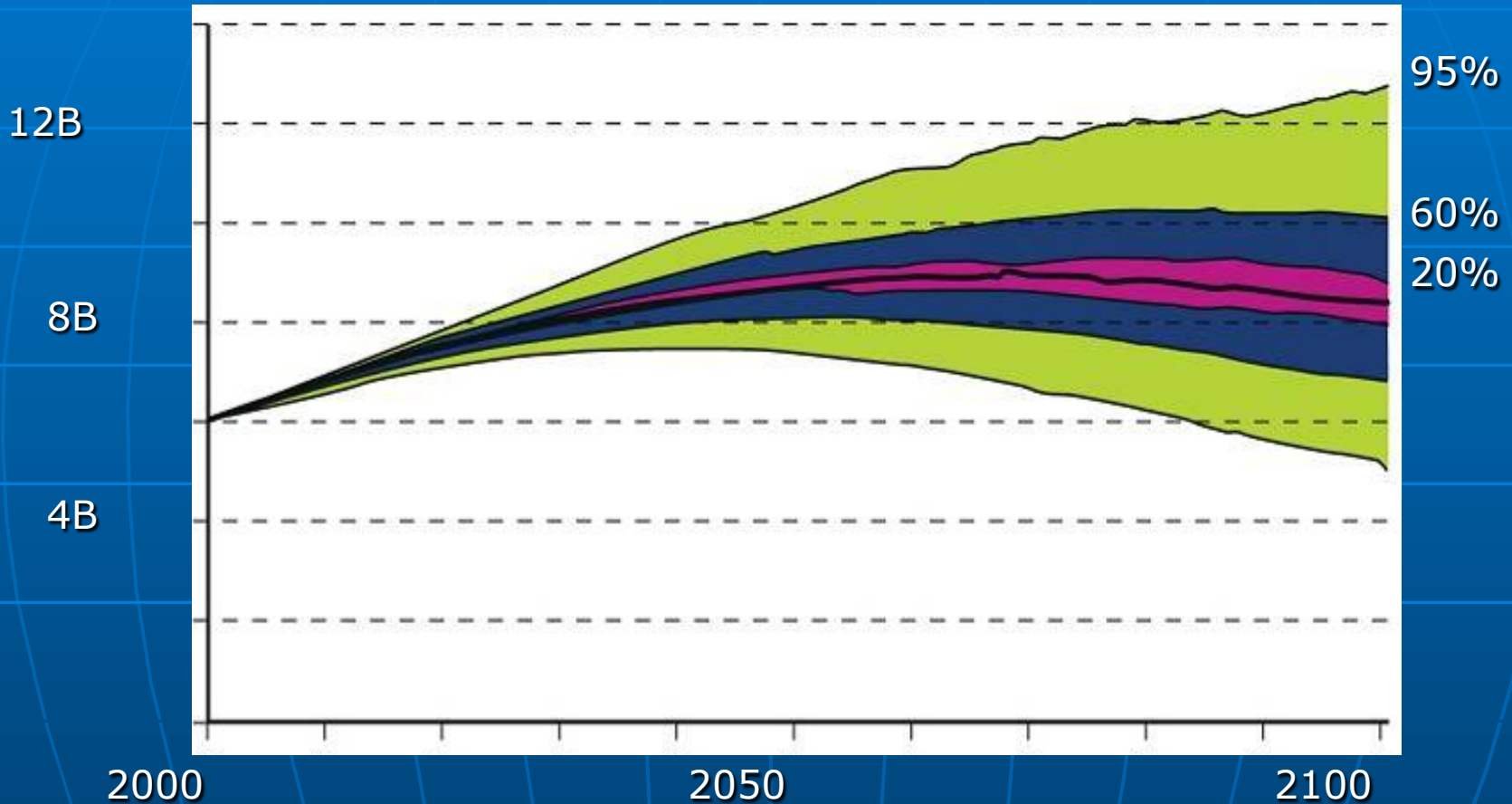
This is an achievable dream, but the current system is deeply flawed and our current pathway will not realize it

# The time to act is now

- **Address population – education of girls, empowerment of women and access to modern forms of contraception**
- **Improve resource efficiency – production and use**
- **Transition to a low-carbon economy, coupled with adaptation to climate change**
- **Address the drivers of biodiversity loss and the degradation of ecosystem services**
- **Go beyond GDP – complement with the five forms of capital – built, financial, human, social and natural**
- **Eliminate subsidies and create functioning markets to pay for ecosystem services**
- **Address failures of governance at the local, national and global level – eliminate the power of vested interests - create systems that are multi-sectoral**
- **Scale up grass-roots actions**
- **Enhanced levels of education, training, R&D and assessments**

# Population

**Population projection** (Lutz & Samir 2010)



**Action needed – education of girls, empowerment of women, health care of children and the elderly, and making modern contraception accessible to all**

# Sustainable Production and Consumption

- There is an urgent need to break the link between production and consumption on the one hand and environmental destruction on the other
- This would allow raising material living standards for a period that would allow us to overcome world poverty
- However, indefinite material growth on a planet with finite and often fragile natural resources will eventually be unsustainable
- We need to get the economics right – see upcoming slides

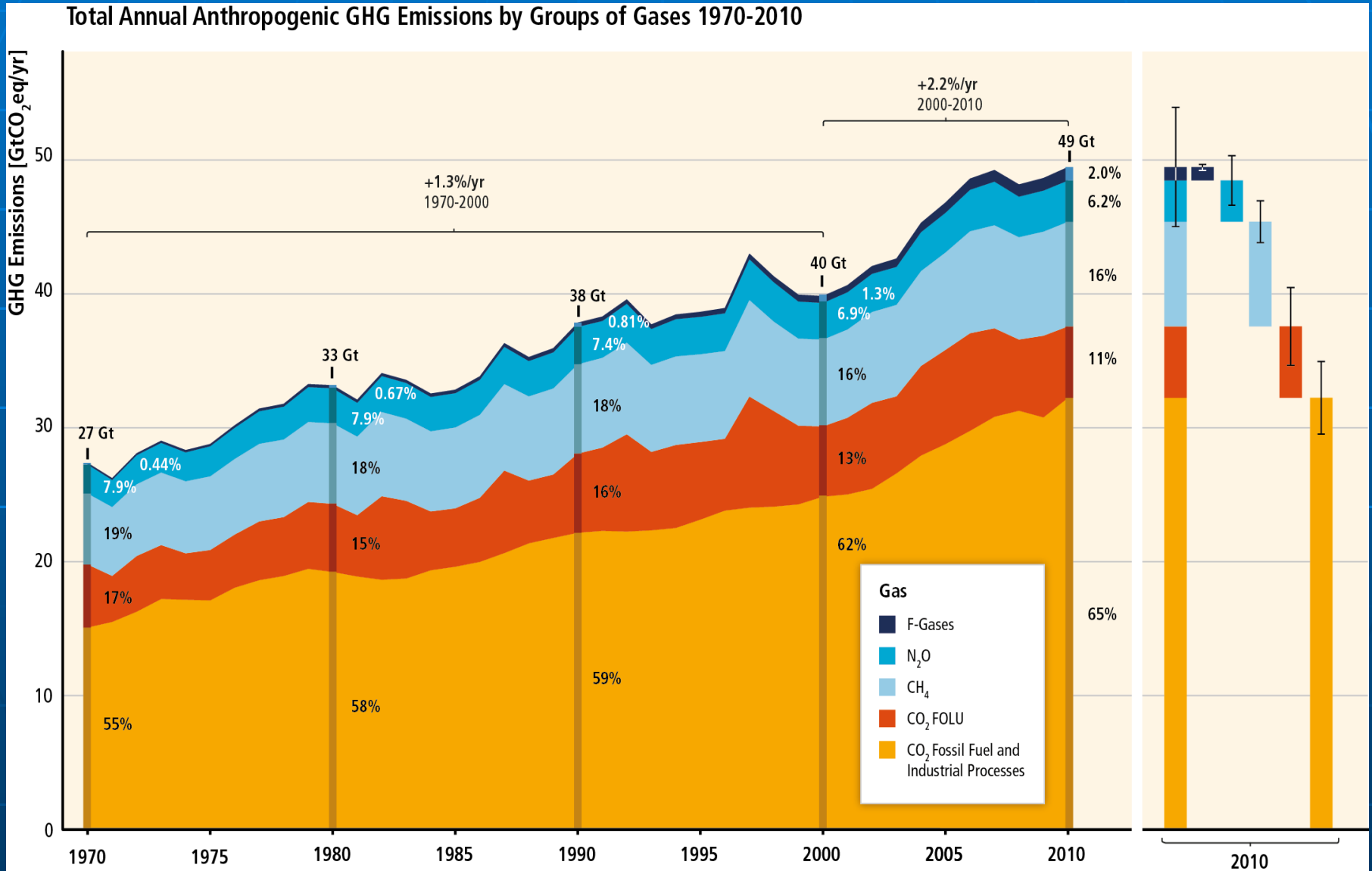
# Climate Change



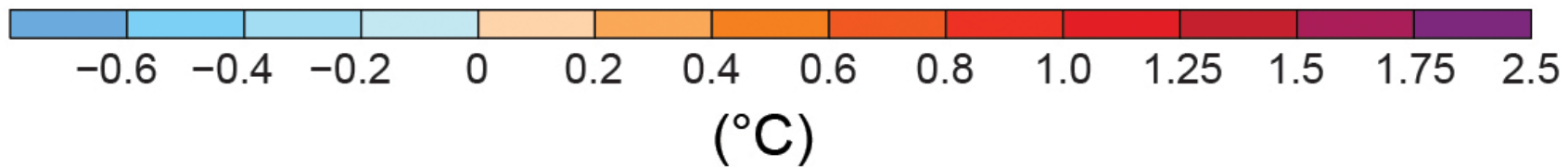
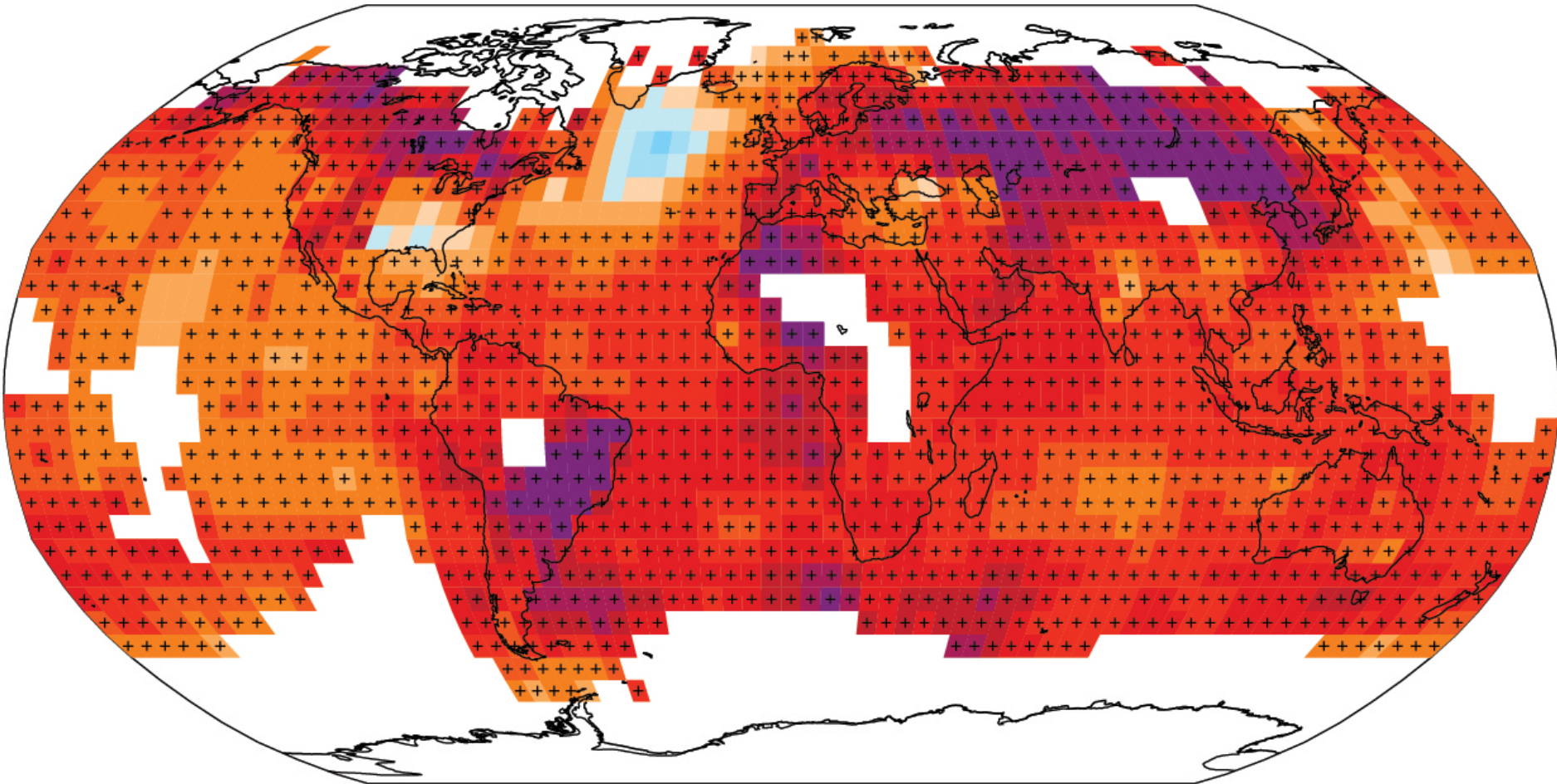
# Climate Change

- The composition of the atmosphere, and the Earth's climate has changed, mostly due to human activities (highly certain), and is projected to continue to change, globally and regionally:
  - Increased greenhouse gases and aerosols
  - Warmer temperatures
  - Changing precipitation patterns – spatially and temporally
  - Higher sea levels – higher storm surges
  - Retreating mountain glaciers
  - Melting of the Greenland ice cap
  - Reduced arctic sea ice
  - More frequent extreme weather events
    - heat waves, floods and droughts
  - More intense cyclonic events, e.g., hurricanes in the Atlantic

# GHG emissions accelerate despite reduction efforts. Most emission growth is CO<sub>2</sub> from fossil fuel combustion and industrial processes



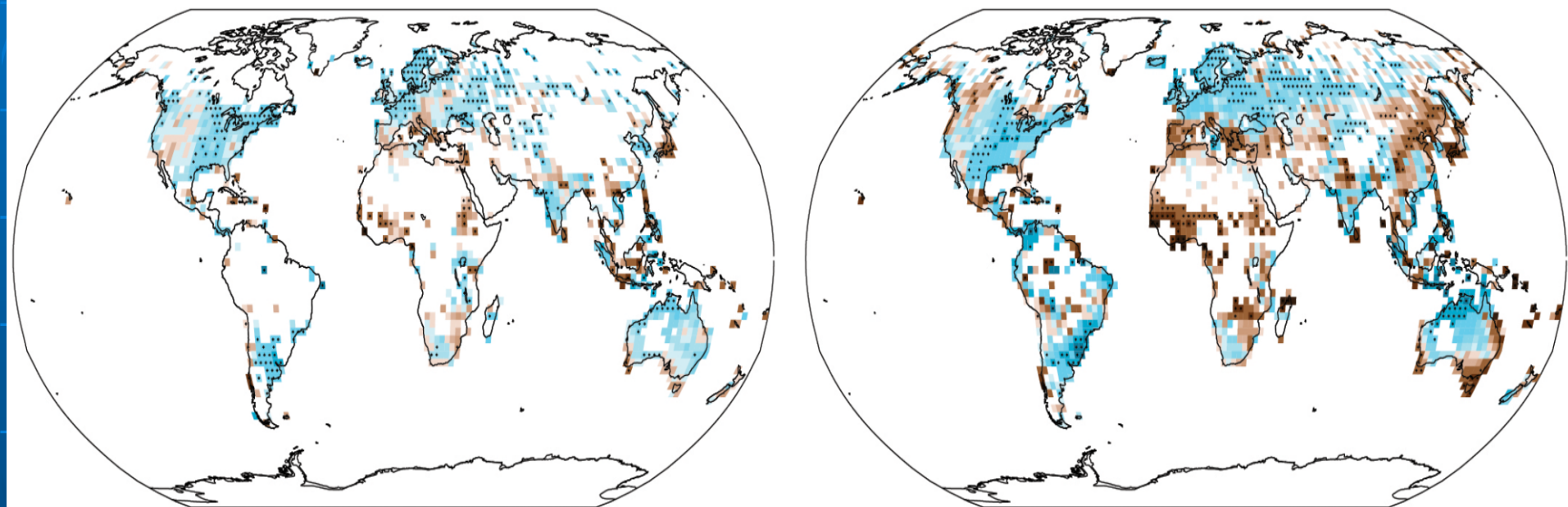
# Observed change in surface temperature 1901-2012



# Observed change in annual precipitation over land

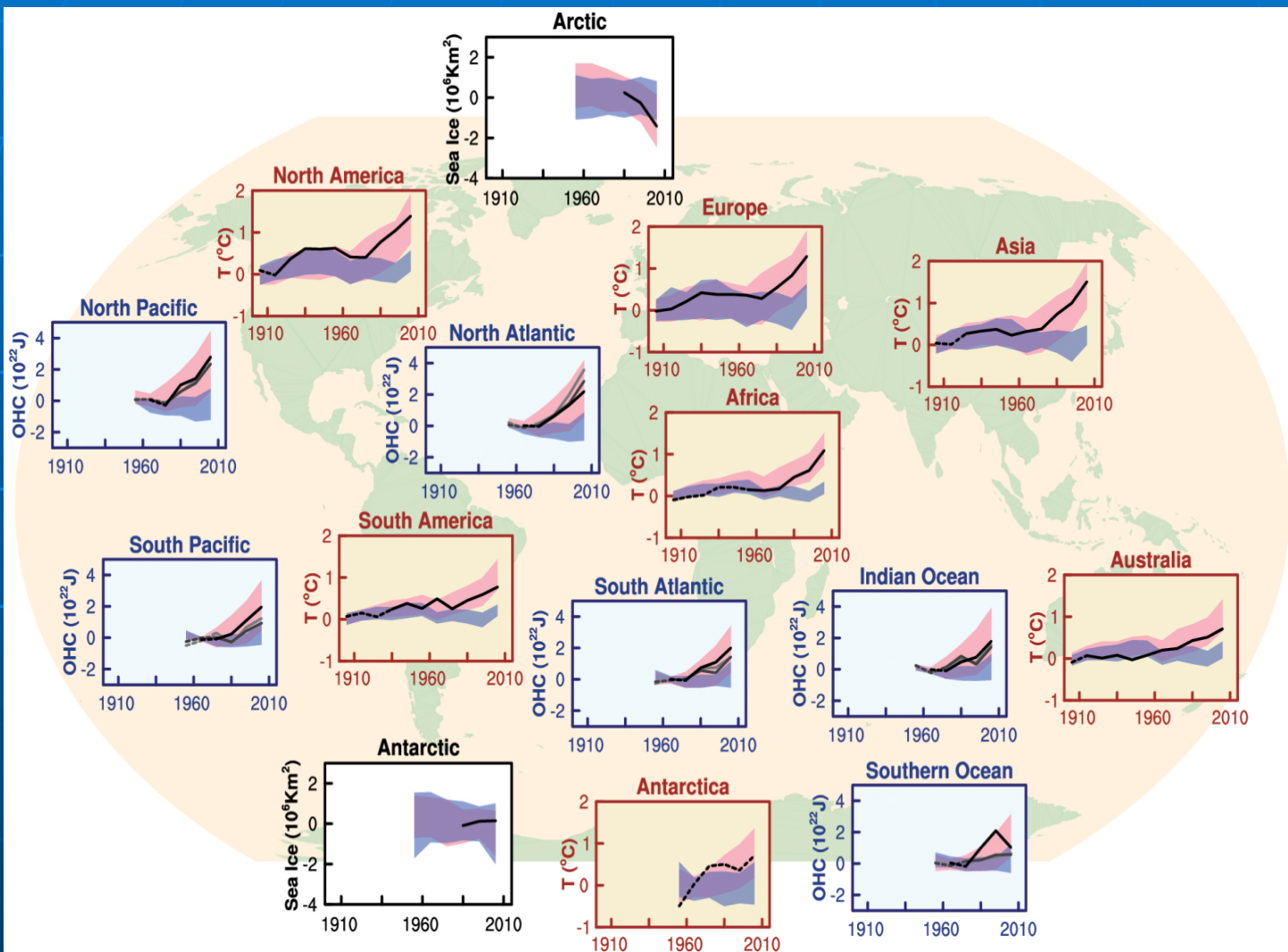
1901–2010

1951–2010

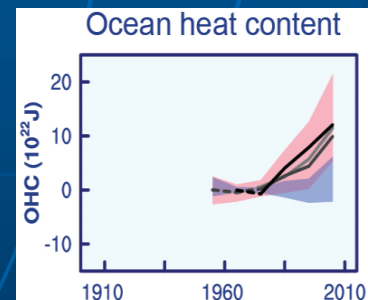
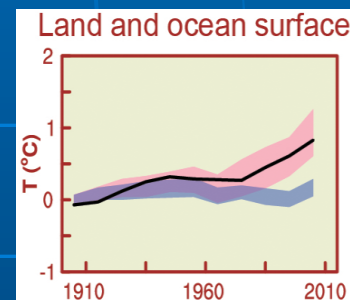
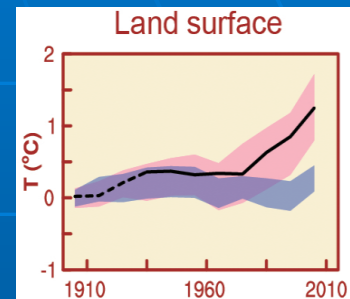


# Comparison of observed and simulated climate change

All figures © IPCC 2013



Global averages



≡ Observations

■ Models using only natural forcings

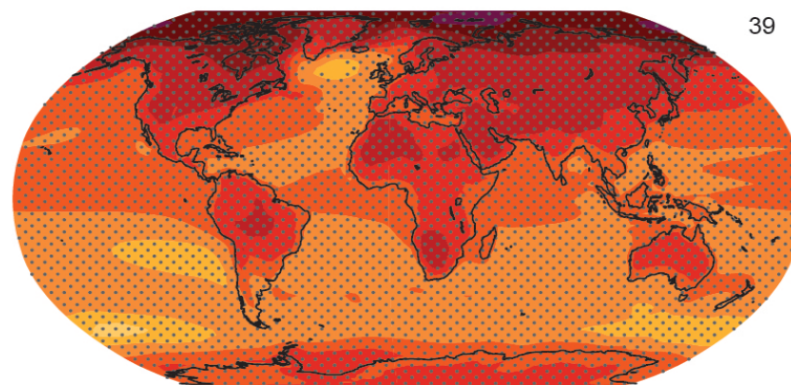
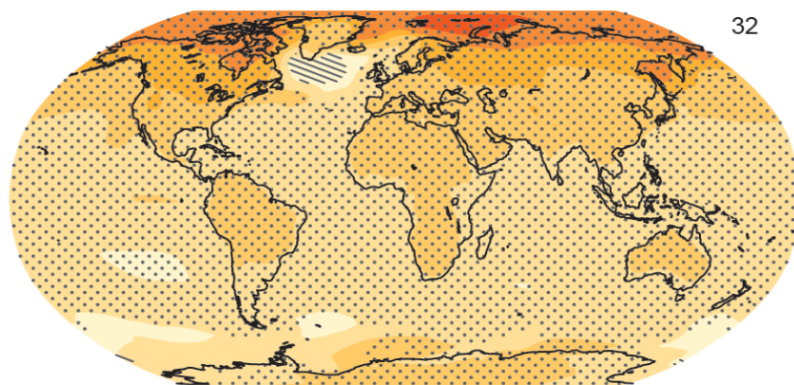
■ Models using both natural and anthropogenic forcings

# Maps of CMIP5 multi-model mean results

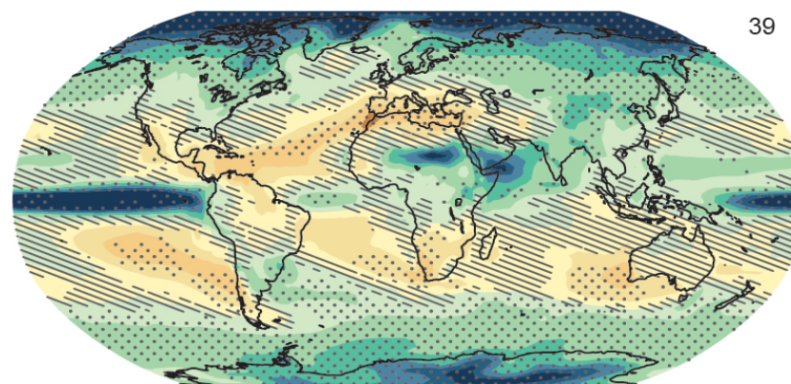
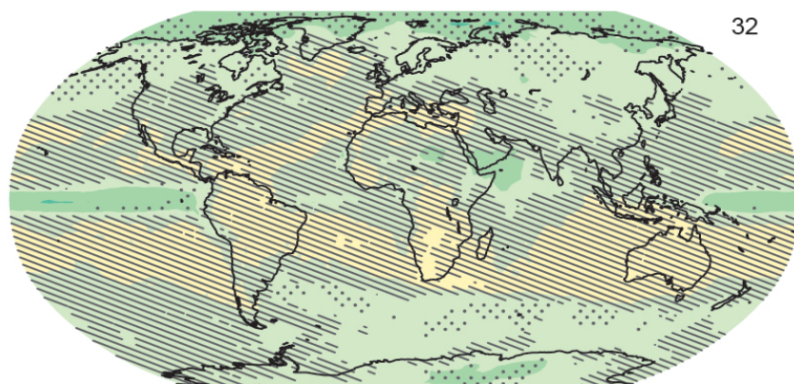
RCP 2.6

RCP 8.5

(a) Change in average surface temperature (1986–2005 to 2081–2100)

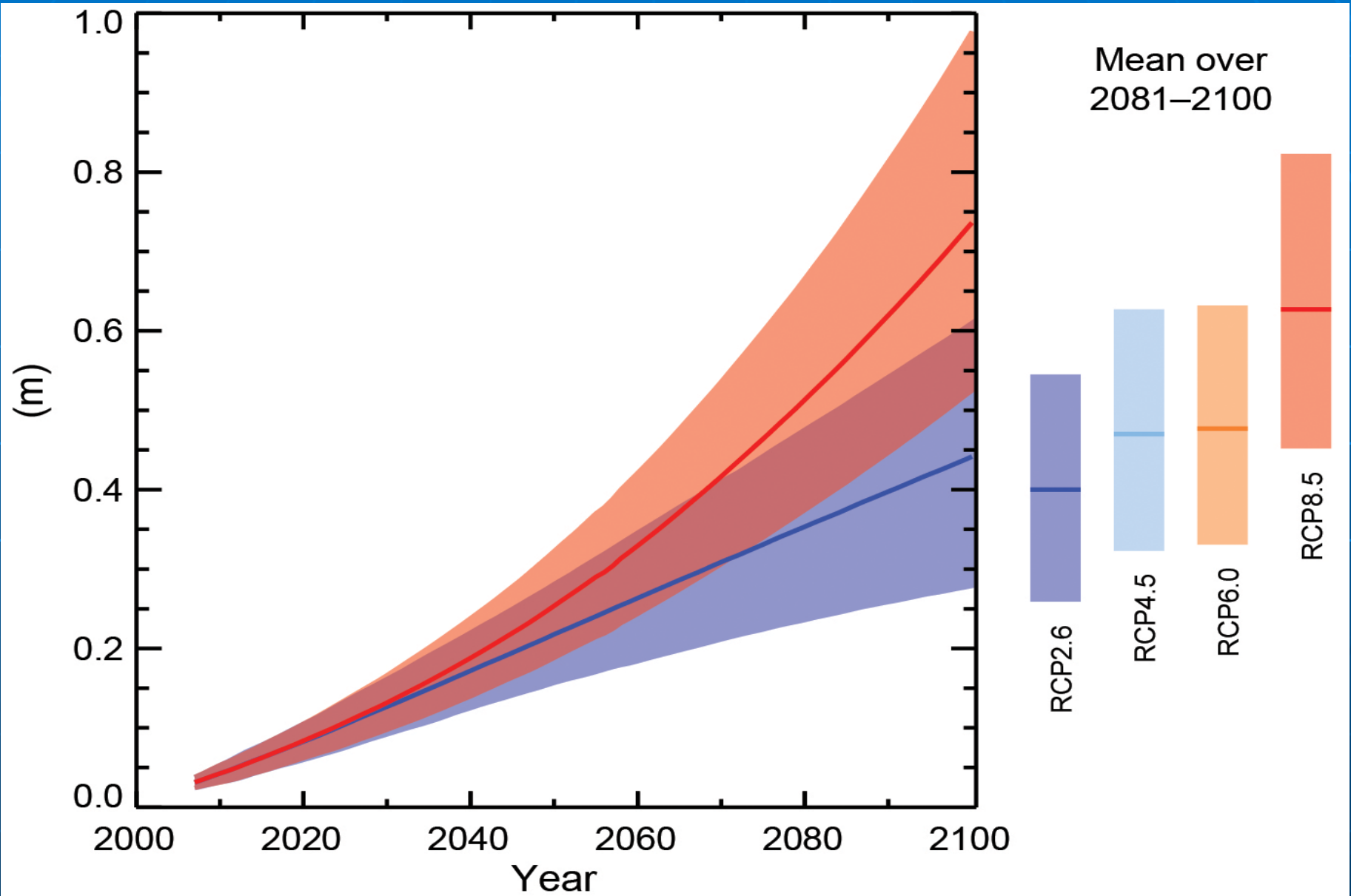


(b) Change in average precipitation (1986–2005 to 2081–2100)

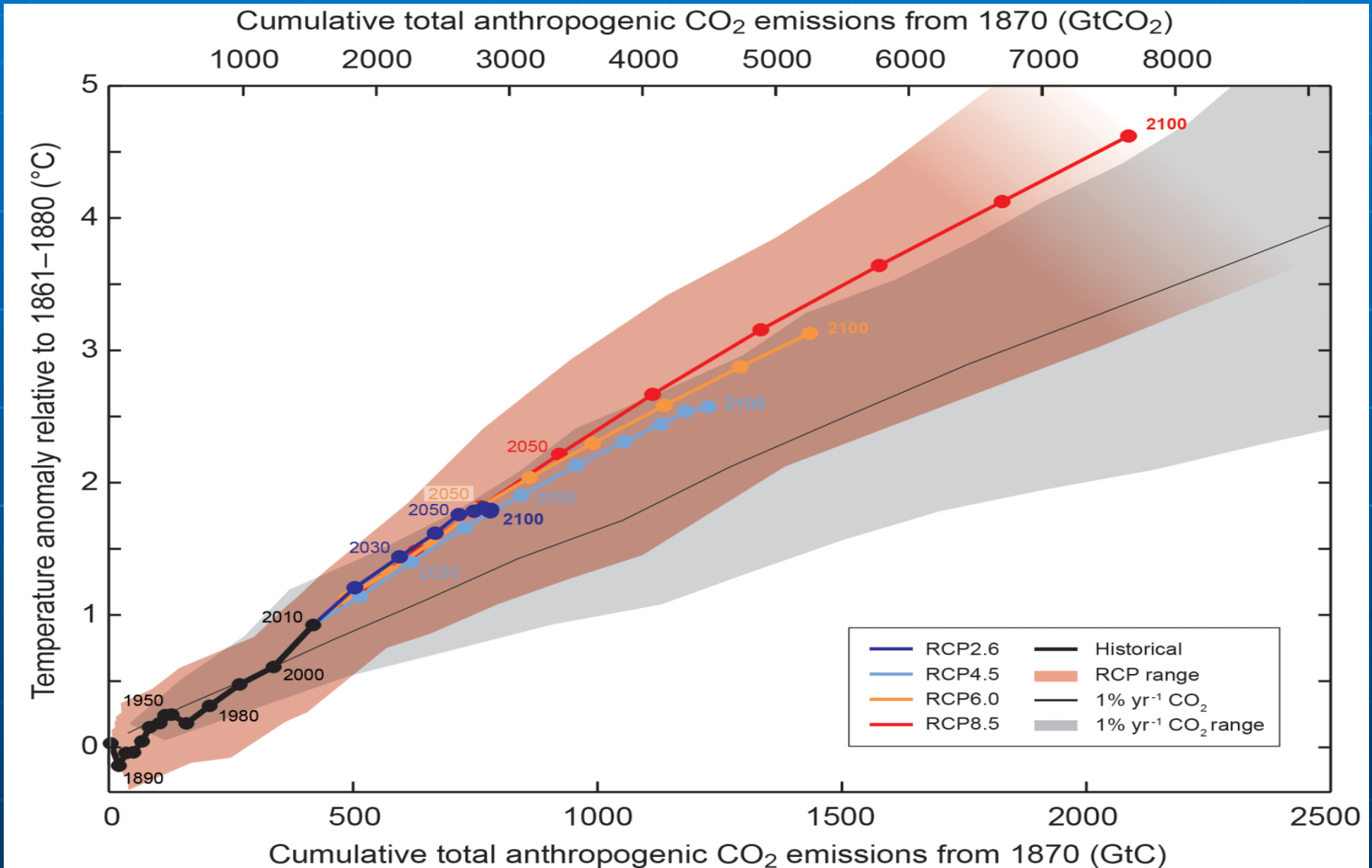


# Global mean sea level rise

All Figures © IPCC 2013

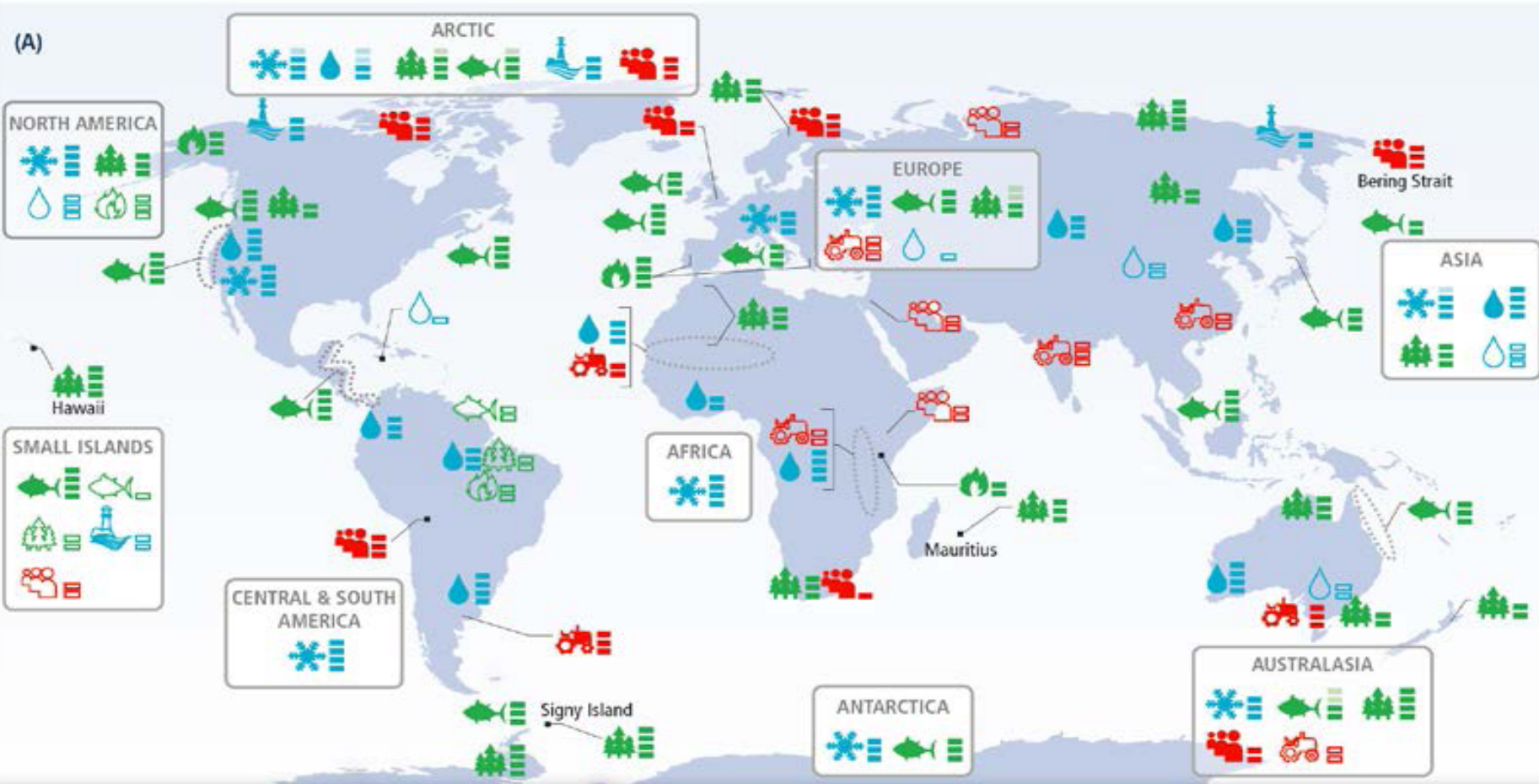


# Temperature increase and cumulative carbon emissions

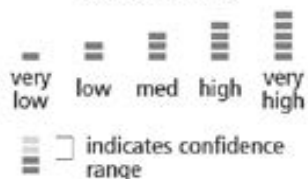




# Observed Impacts Due to Climate Change



Confidence in attribution to climate change



Observed impacts attributed to climate change for

**Physical Systems**



**Biological Systems**



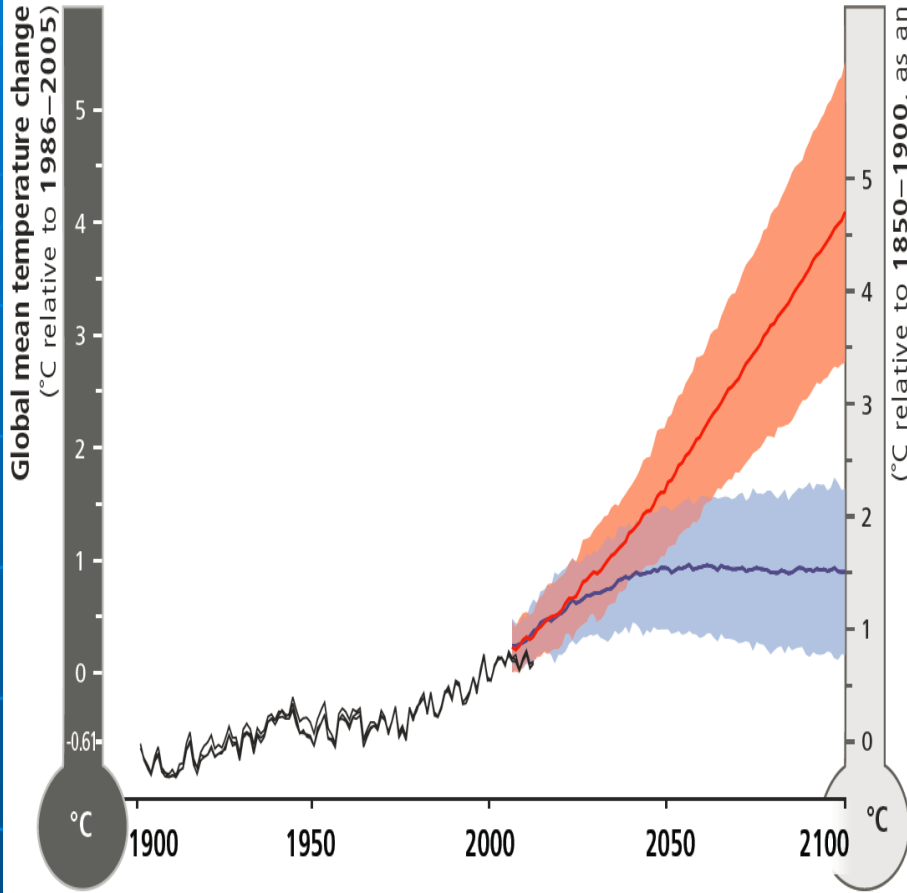
**Human & Managed Systems**



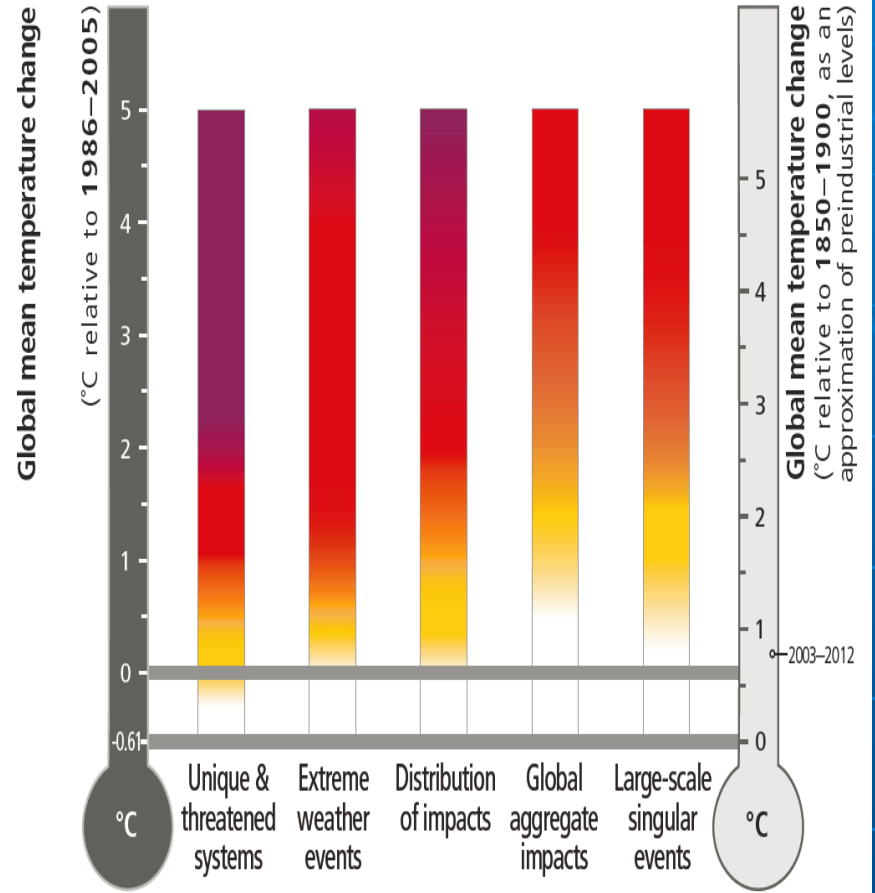
Unfilled Symbols = Minor contribution of climate change  
Filled Symbols = Major contribution of climate change

# Projected Impacts of Human-induced Climate Change

- Decrease water availability and water quality in many arid- and semi-arid regions – increased risk of floods and droughts in many regions
- Decrease agricultural productivity for almost any warming in the tropics and sub-tropics and adverse impacts on fisheries
- Increase the incidence of vector- (e.g., malaria and dengue) and water-borne (e.g., cholera) diseases, heat stress mortality, threats nutrition in developing countries, increase in extreme weather event deaths
- Adversely effect ecological systems, especially coral reefs, and exacerbate the loss of biodiversity and critical ecosystem services



- Observed
- RCP8.5 (a high-emission scenario)
- Overlap
- RCP2.6 (a low-emission mitigation scenario)



# Climate change, loss of biodiversity, ecosystem degradation and development

- Climate change, loss of biodiversity and ecosystem degradation are environment, development and security issues, i.e., they undermine:
  - food, water and human security
  - the economy (loss of natural capital)
  - poverty alleviation and the livelihoods of the poor
  - human health
  - personal, national and regional security
- Climate change, biodiversity loss and ecosystem degradation are inter- and intra-generational equity issues:
  - developing countries and poor people in developing countries are the most vulnerable
  - the actions of today will affect future generations

# Climate change, biodiversity, and ecosystem services

- Climate change affects biodiversity, and changes in biodiversity and ecosystem functioning affect climate change.
  - The carbon and water cycles, two important large-scale processes for life on Earth, both depend on biodiversity — at genetic, species and ecosystem levels
- Climate change is/will be a dominant driver of biodiversity loss.
  - The Millennium Ecosystem Assessment scenarios highlight the fundamental interdependence between climate change, energy, biodiversity, wetlands, desertification, food, health, trade and the economy
- Climate change is projected to further adversely affect key development challenges.
  - Including provision of clean water, energy services, and food; maintaining a healthy environment; and conserving ecological systems, their biodiversity, and associated ecological goods and services

# Transition to a Low-Carbon Economy

- Universal access to clean energy services is vital for the poor
- A transition to a low carbon economy will require rapid technological evolution in the efficiency of energy use, environmentally sound low-carbon renewable energy sources and carbon capture and storage
- The longer we wait to transition to a low carbon economy the more we are locked into a high carbon energy system with consequent environmental damage to ecological and socio-economic systems, including infrastructure

# Mitigation Strategy

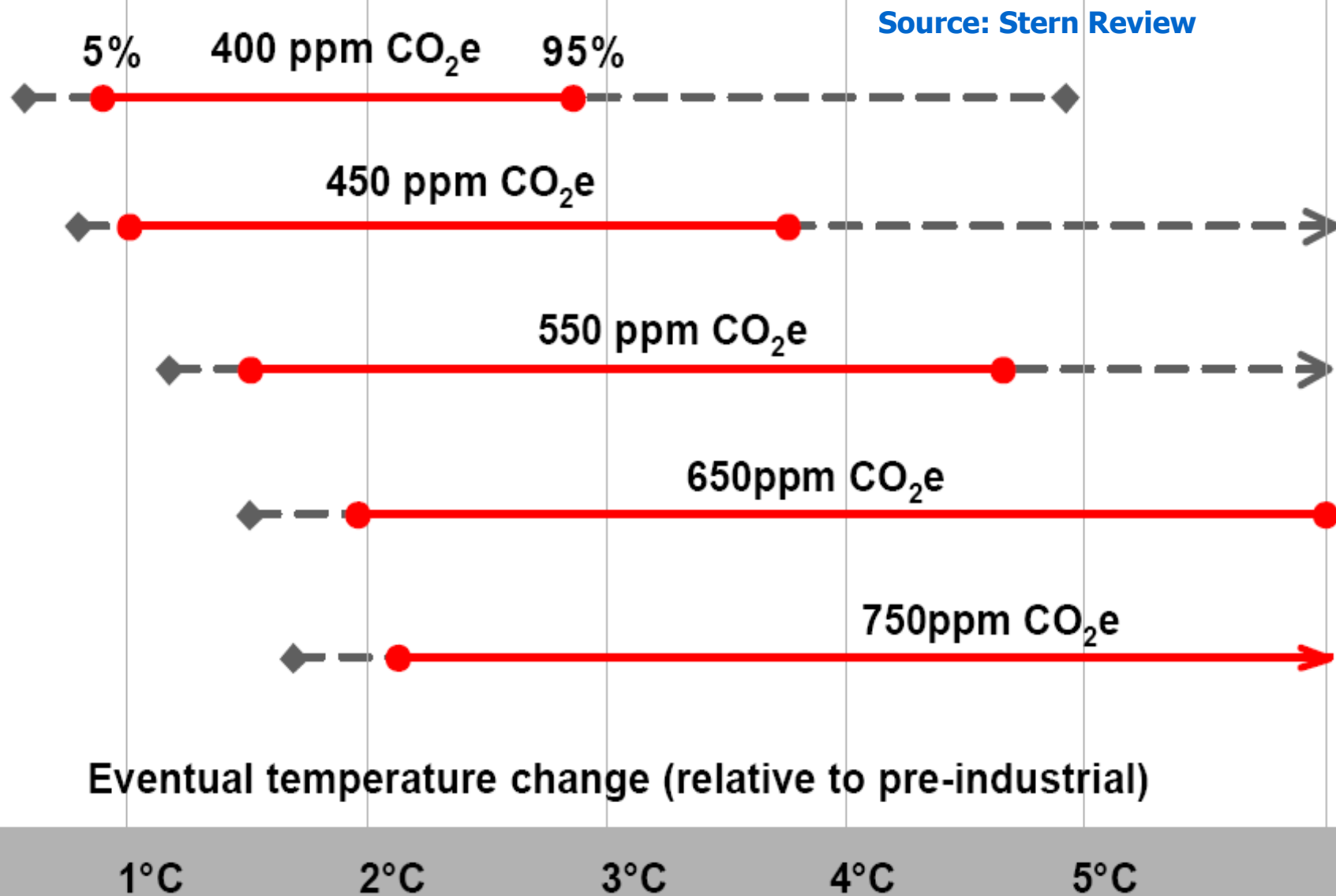
- Putting a price on carbon through
  - emissions trading
  - taxation
  - regulation - national, regional and global
- Technology transformation
  - Carbon capture and storage
  - Future generation biofuels
- Mobilising behaviour change
  - Citizens
  - Business
  - Public sector

# Potential technological options

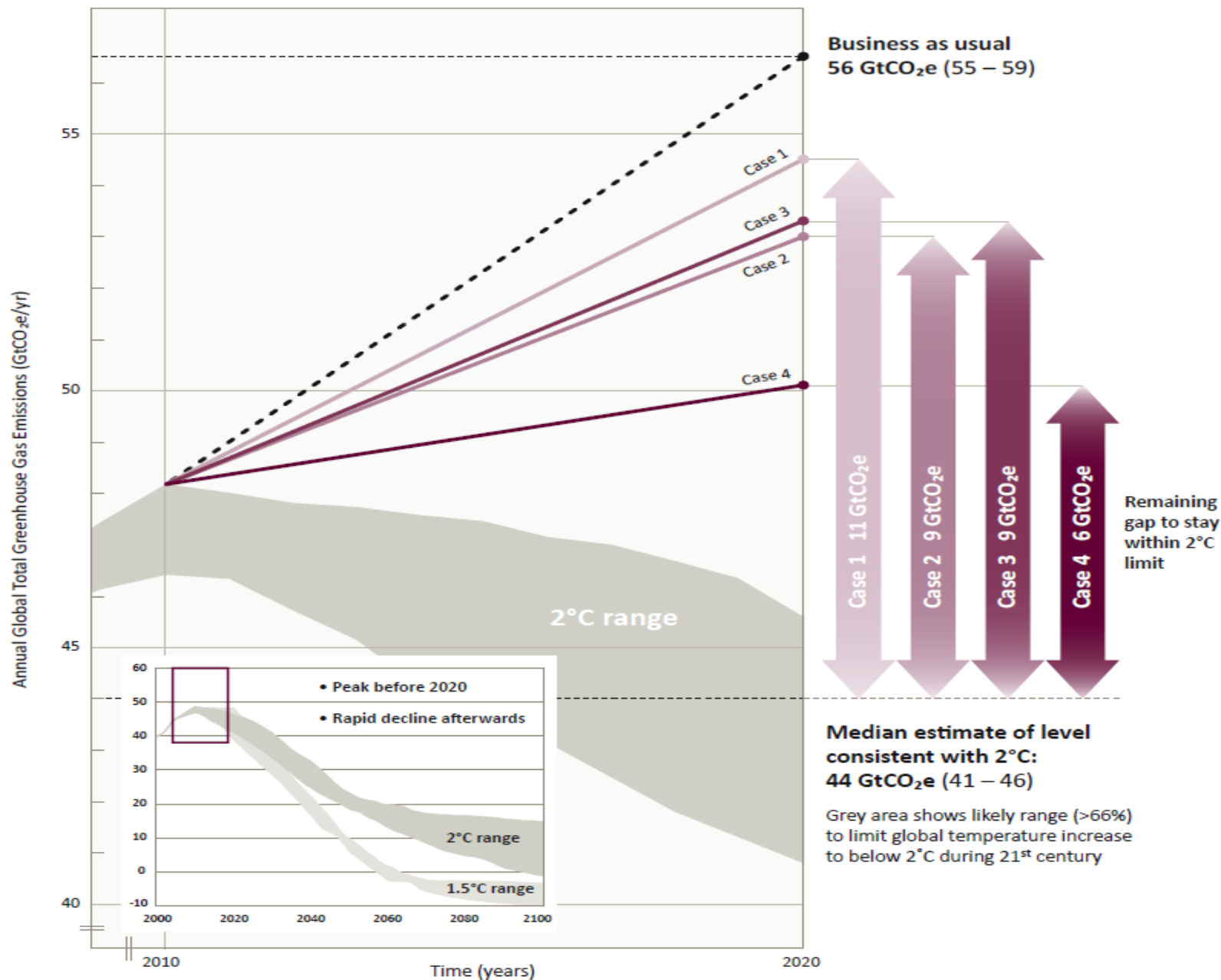
- **Efficient production and use of energy:** coal plants (e.g., re-powering old inefficient plants and developing IGCC); vehicles (e.g., fuel cell cars) and reduced use of vehicles (e.g., mass transit and urban planning), buildings, and industries
- **Fuel shift: coal to gas**
- **Renewable Energy and Fuels:** Wind power; solar PV and solar thermal; wave and tidal power; small and large-scale hydropower; bio-energy
- **CO<sub>2</sub> Capture and Storage:** Capture CO<sub>2</sub> in the production of electricity followed by geological storage (e.g., IGCC – CCS)
- **Nuclear fission:** Nuclear power
- **Forests and Agricultural Soils:** Reduced deforestation and degradation; reforestation; afforestation; conservation tillage; reduced fertilizer use



# Emissions Paths to Stabilization

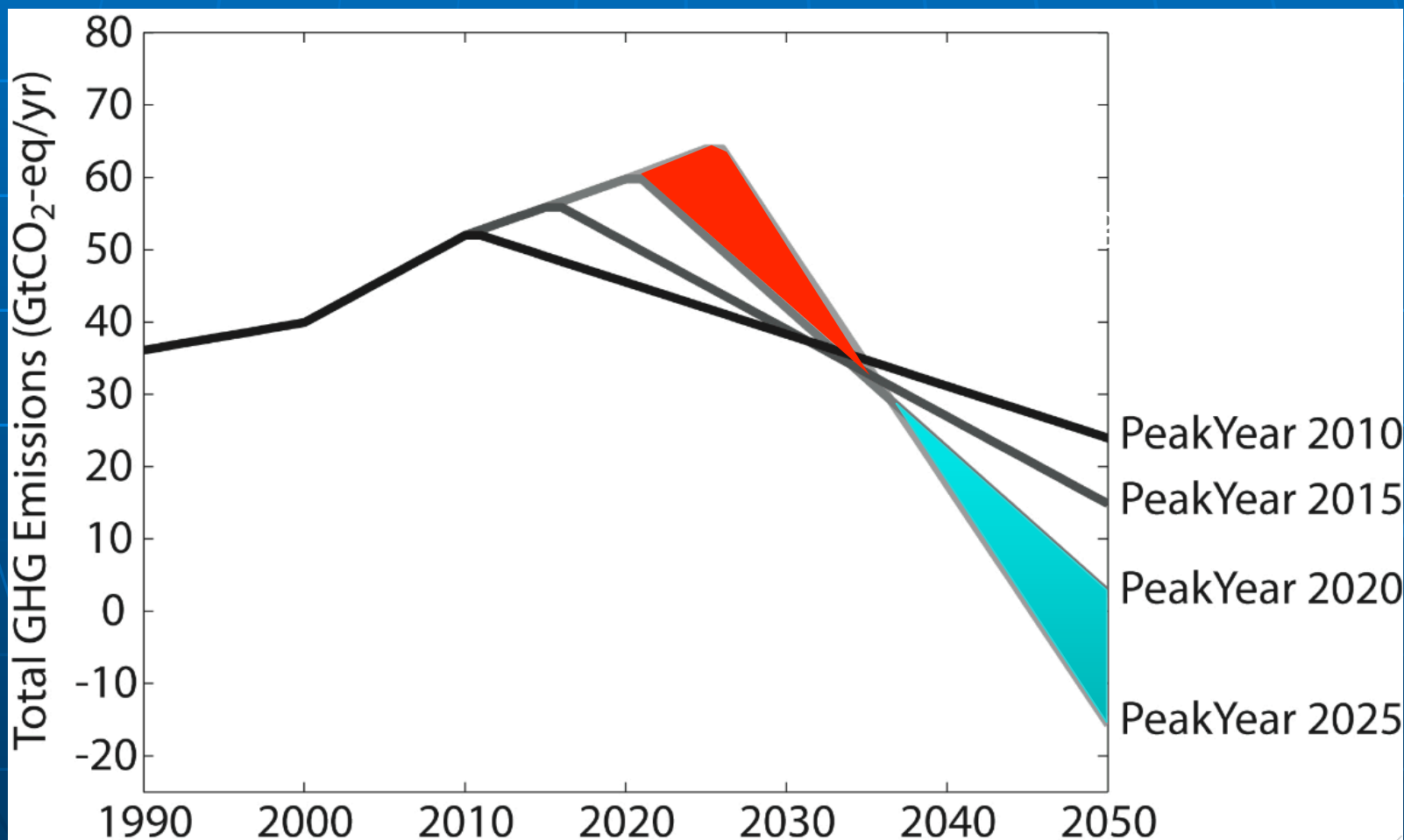


## The emissions gap



# Delay: later reductions require faster AND deeper reductions

(2000 GtCO<sub>2</sub>eq between 2000 and 2050)



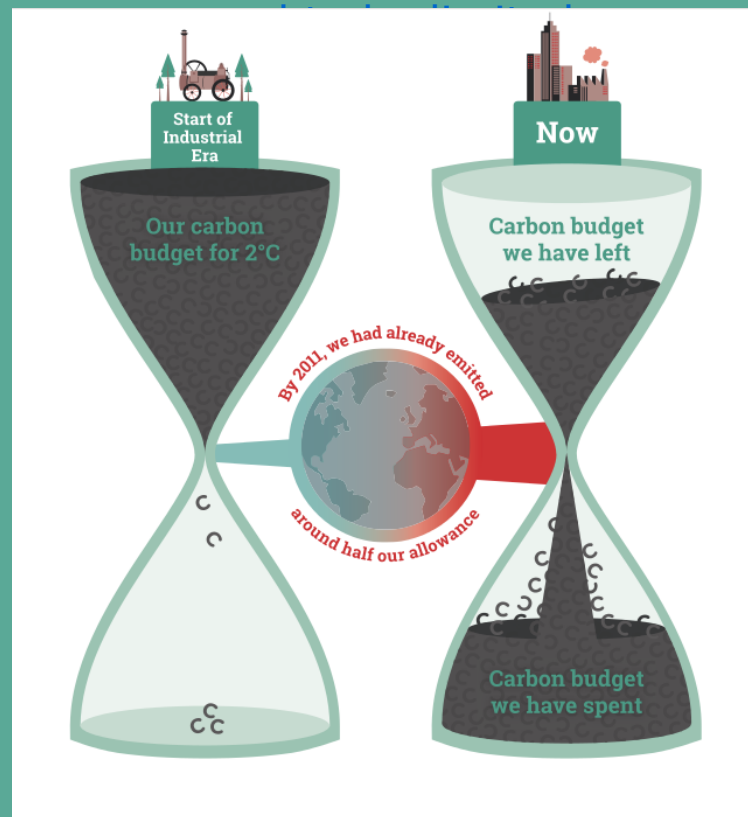
# WGI Key Findings: Limiting warming

Limiting climate change will require substantial and sustained reductions of greenhouse gas and CO<sub>2</sub> emissions

## 2° Target

Parties to the 2010 UN Framework Convention on Climate Change (UNFCCC) agreed to commit to a maximum temperature rise of 2°C above pre-industrial levels to prevent the most severe impacts of climate change, and to consider lowering that maximum to 1.5°C in the near future.

## Total cumulative human CO<sub>2</sub> emissions since the industrial era

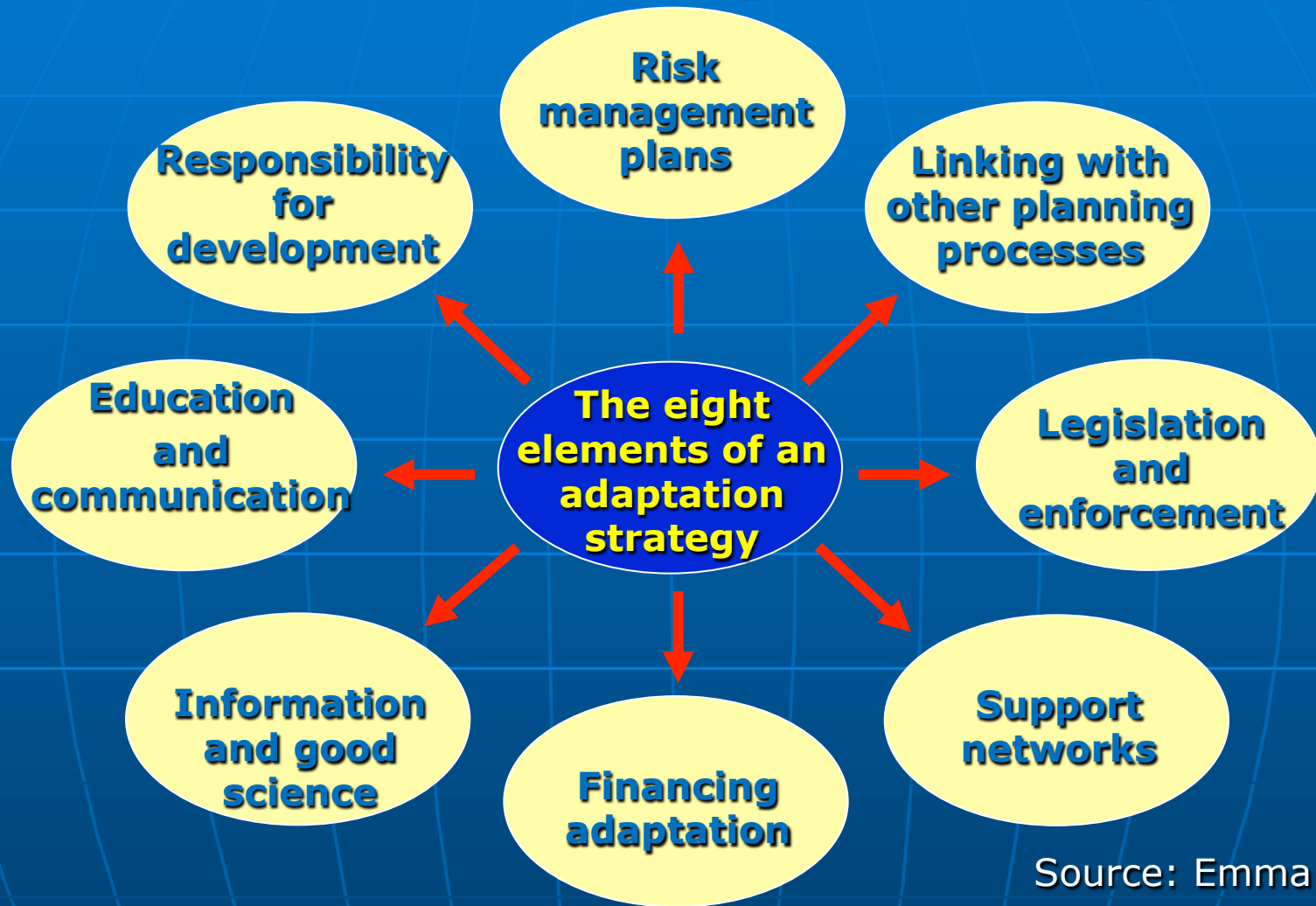


About **half** already emitted  
by 2011

# Estimates for mitigation costs vary widely.

- Reaching 450ppm CO<sub>2</sub>eq entails consumption losses of 1.7% (1%-4%) by 2030, 3.4% (2% to 6%) by 2050 and 4.8% (3%-11%) by 2100 relative to baseline (which grows between 300% to 900% over the course of the century).
- This is equivalent to a reduction in consumption growth over the 21<sup>st</sup> century by about 0.06 (0.04-0.14) percentage points a year (relative to annualized consumption growth that is between 1.6% and 3% per year).
- Cost estimates exclude benefits of mitigation (reduced impacts from climate change). They also exclude other benefits (e.g. improvements for local air quality).
- Cost estimates are based on a series of assumptions.

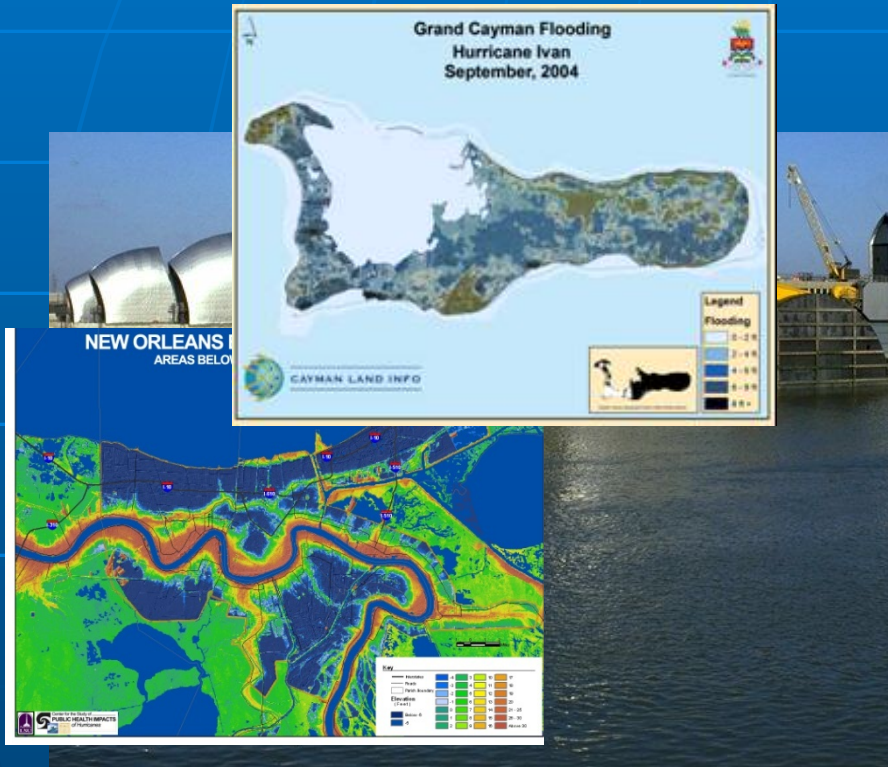
# Elements of an adaptation strategy



Source: Emma Tompkins

- Delivery of adaptive responses depends on **governance** mechanisms
- Adaptive capacity and society's self-organisation is determined by **governance**

# There limits to adaption: physical, behavioural, technological, financial



**Physical limits:** there are physical limits to potential adaptation on small low lying islands

**Behavioural limits:** there are behavioural constraints that influence where we live and why

**Technological limits:** there are technological limits to the flood defences that can be constructed

# Biodiversity Loss and Ecosystem Degradation



# What is biodiversity?

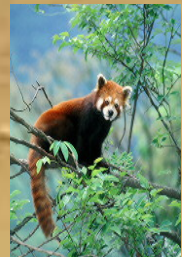
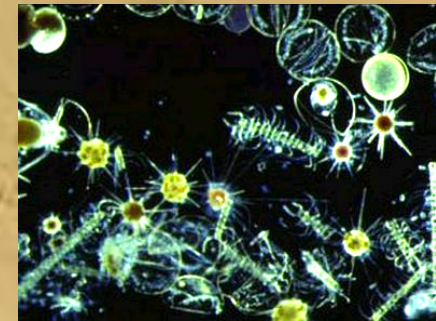
## The variety of life

at all levels...

.... genes, populations, species and ecosystems...

.... land, water and air.

.... and the interactions between living things



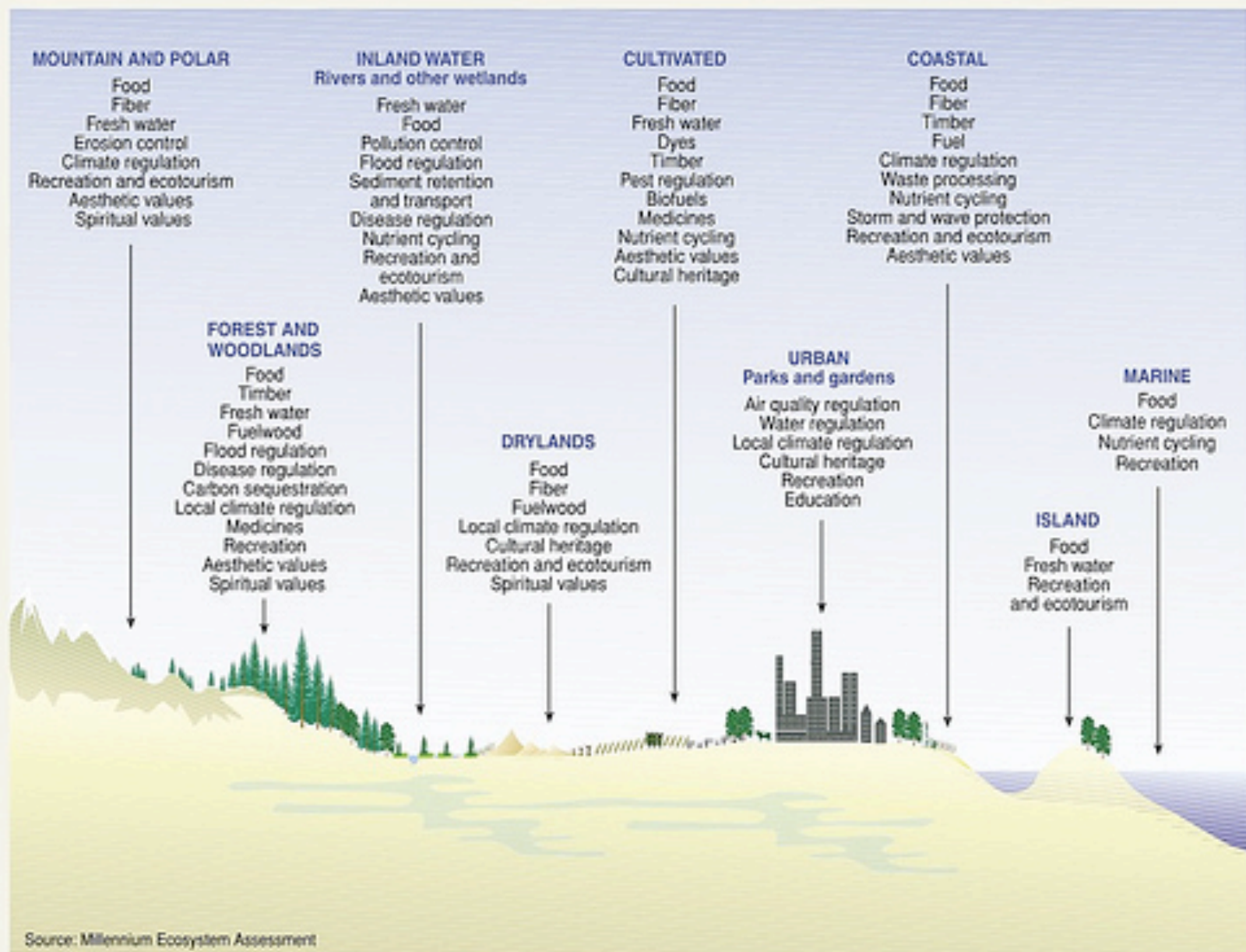
# What are ecosystem services?

The benefits people derive from ecosystems

Ecosystem service type	Final ecosystem services (example of goods)	Intermediate ecosystem services and processes
Provisioning	Crops, livestock, fish ( <i>food</i> ) Trees, standing vegetation, peat ( <i>fibre, energy, carbon seq.</i> ) Water supply ( <i>domestic and industrial water</i> ) Wild species diversity ( <i>Recreation, food, disease/pest control</i> )	
Cultural	Meaningful places ( <i>Recreation, tourism, Spiritual/religious</i> ) Socially valued land/waterscapes ( <i>Recreation, tourism, spiritual/religious</i> )	
Regulating	Climate regulation ( <i>equable climate</i> ) Pollination Hazard regulation ( <i>erosion control, flood control</i> ) Noise regulation ( <i>noise control</i> ) Waste detoxification and purification ( <i>pollution control</i> ) Disease and pest regulation ( <i>disease and pest control</i> )	Pollination
Supporting		Primary production Decomposition Soil formation Nutrient cycling Water cycling Weathering Ecological interactions Evolutionary processes

## ECOSYSTEMS AND SOME SERVICES THEY PROVIDE

Different combinations of services are provided to human populations from the various types of ecosystems represented here. Their ability to deliver the services depends on complex biological, chemical, and physical interactions, which are in turn affected by human activities.



# Drivers of Biodiversity Loss

## Indirect drivers

Economic

Demo-  
graphic

Socio-  
political

Cultural &  
religious

Science &  
Technology

## Direct drivers

Habitat  
Change

Climate  
Change

Invasive  
Species

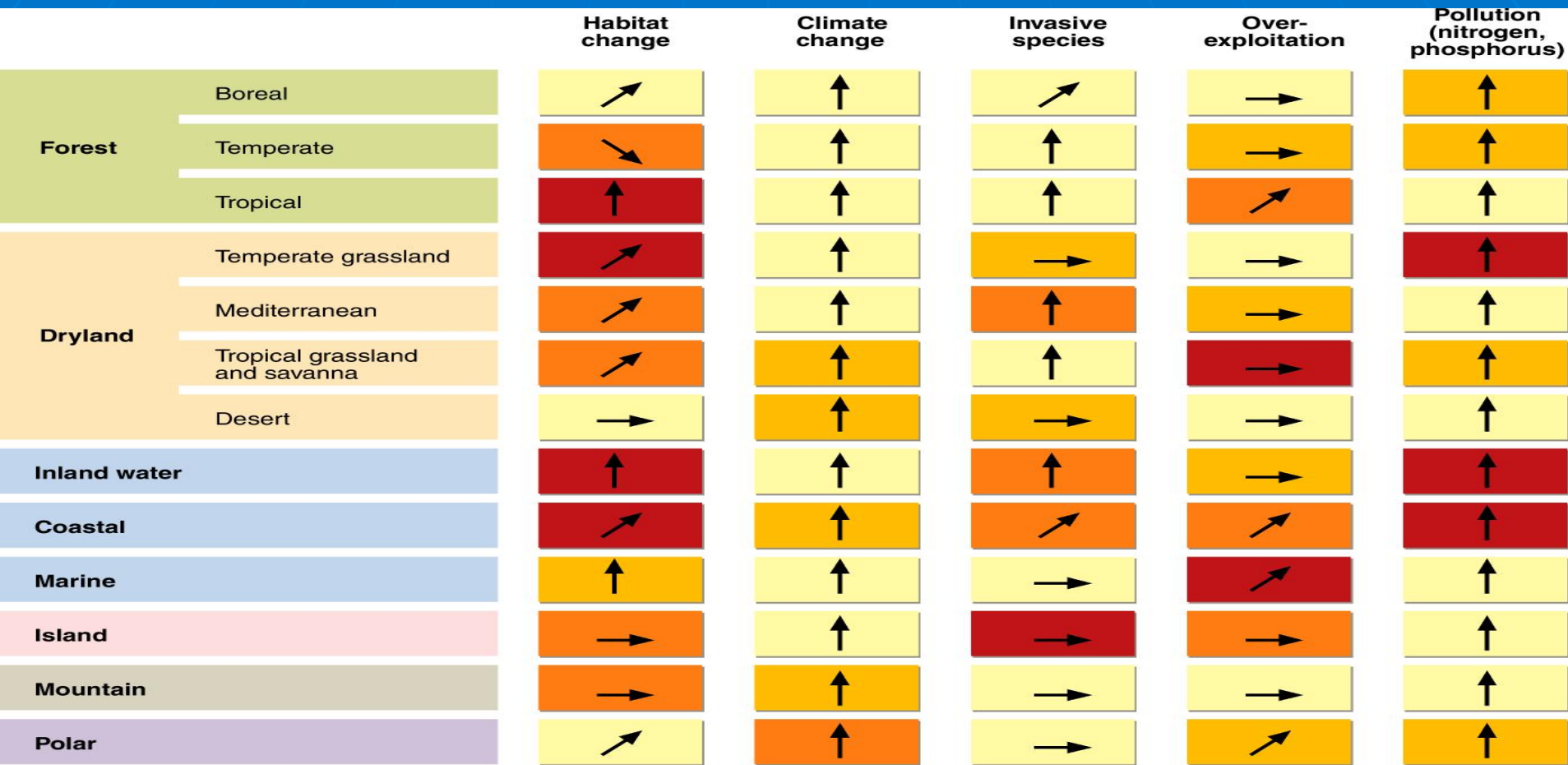
Over-  
exploitation

Nutrients  
& pollution

**Biodiversity Loss**

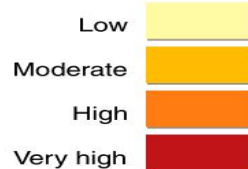
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graph TD; subgraph Indirect; E[Economic]; D[Demographic]; S[Socio-political]; C[Cultural & religious]; T[Science & Technology]; end; subgraph Direct; H[Habitat Change]; Cl[Climate Change]; I[Invasive Species]; O[Over-exploitation]; N[Nutrients & pollution]; end; B[Biodiversity Loss]; E --> H; D --> Cl; S --> I; C --> O; T --> N; H --> B; Cl --> B; I --> B; O --> B; N --> B;
```

# Drivers of biodiversity loss growing



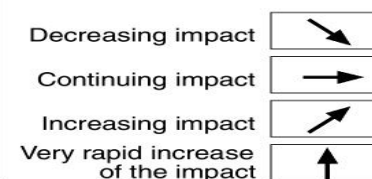
## RESULT OF PAST EVOLUTION

Driver's impact on biodiversity over the last century

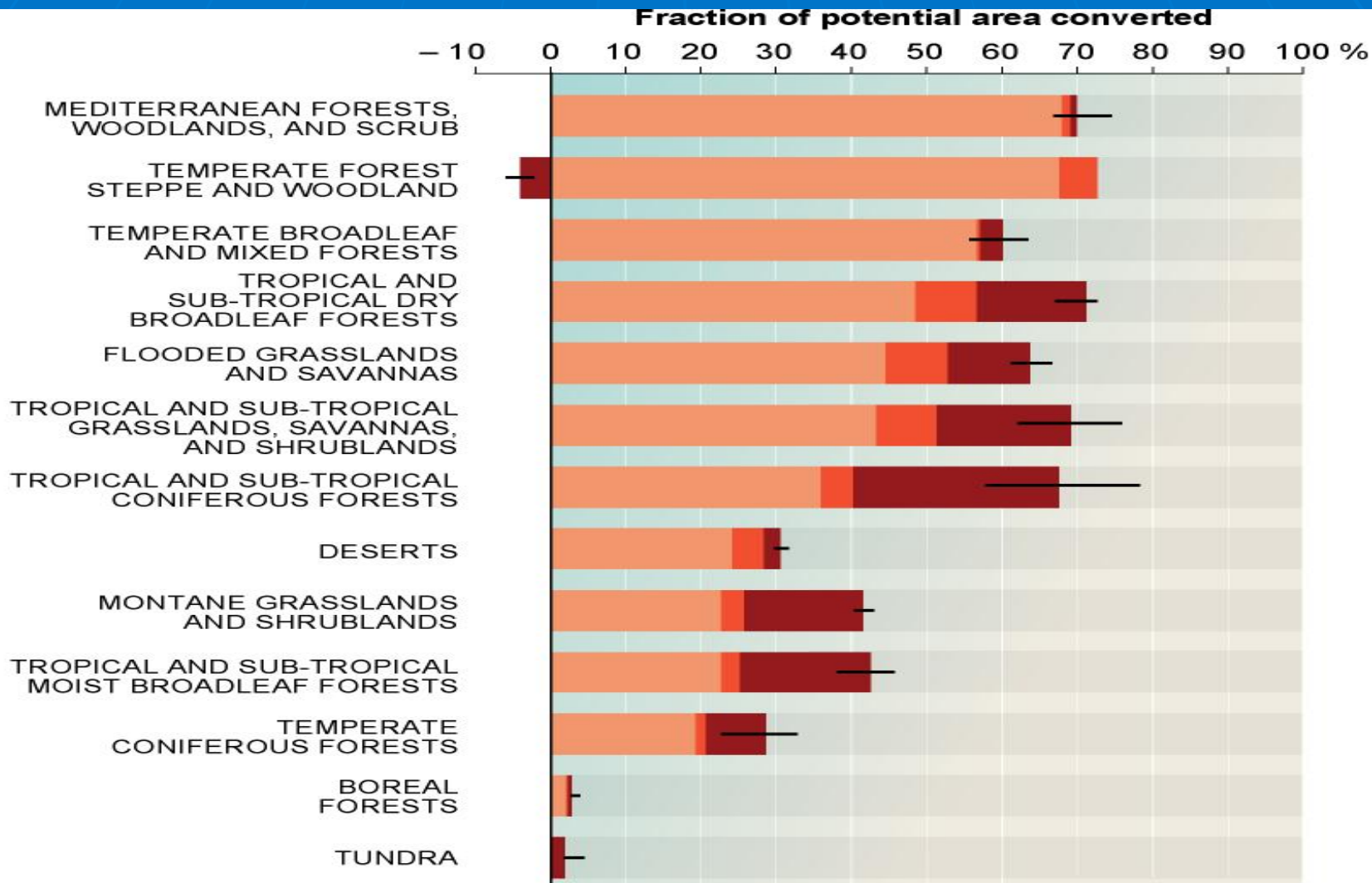


## WHAT HAPPENS TODAY

Driver's actual trends



# Unprecedented change: Ecosystems



**Conversion of original biomes**

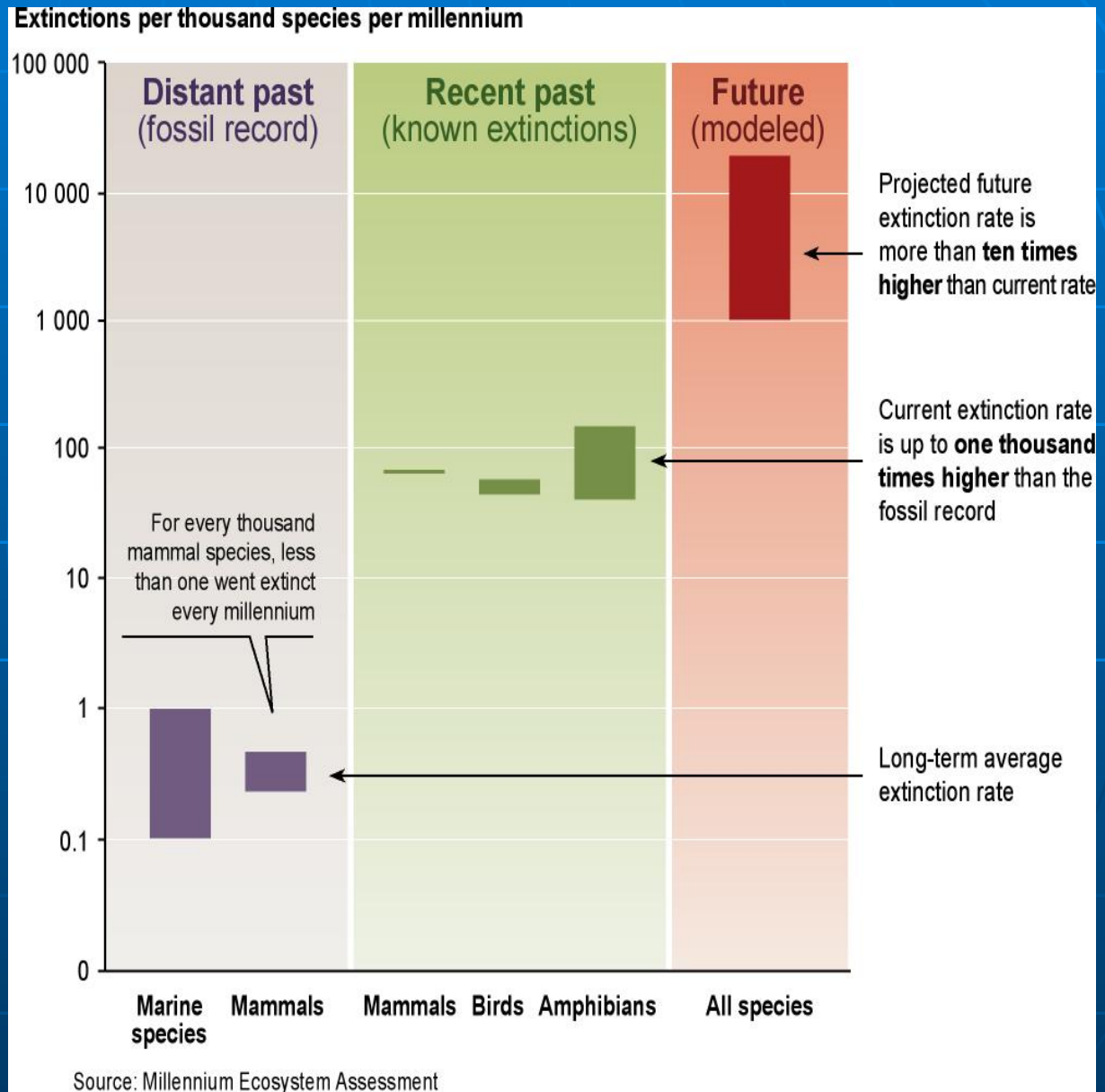
Loss by 1950

Loss between 1950 and 1990

Projected loss by 2050<sup>b</sup>

# Species extinctions

Human activities have taken the planet to the edge of a massive wave of species extinctions, further threatening our own well-being



# Change the economic background to decision-making to implement ecosystem-based activities

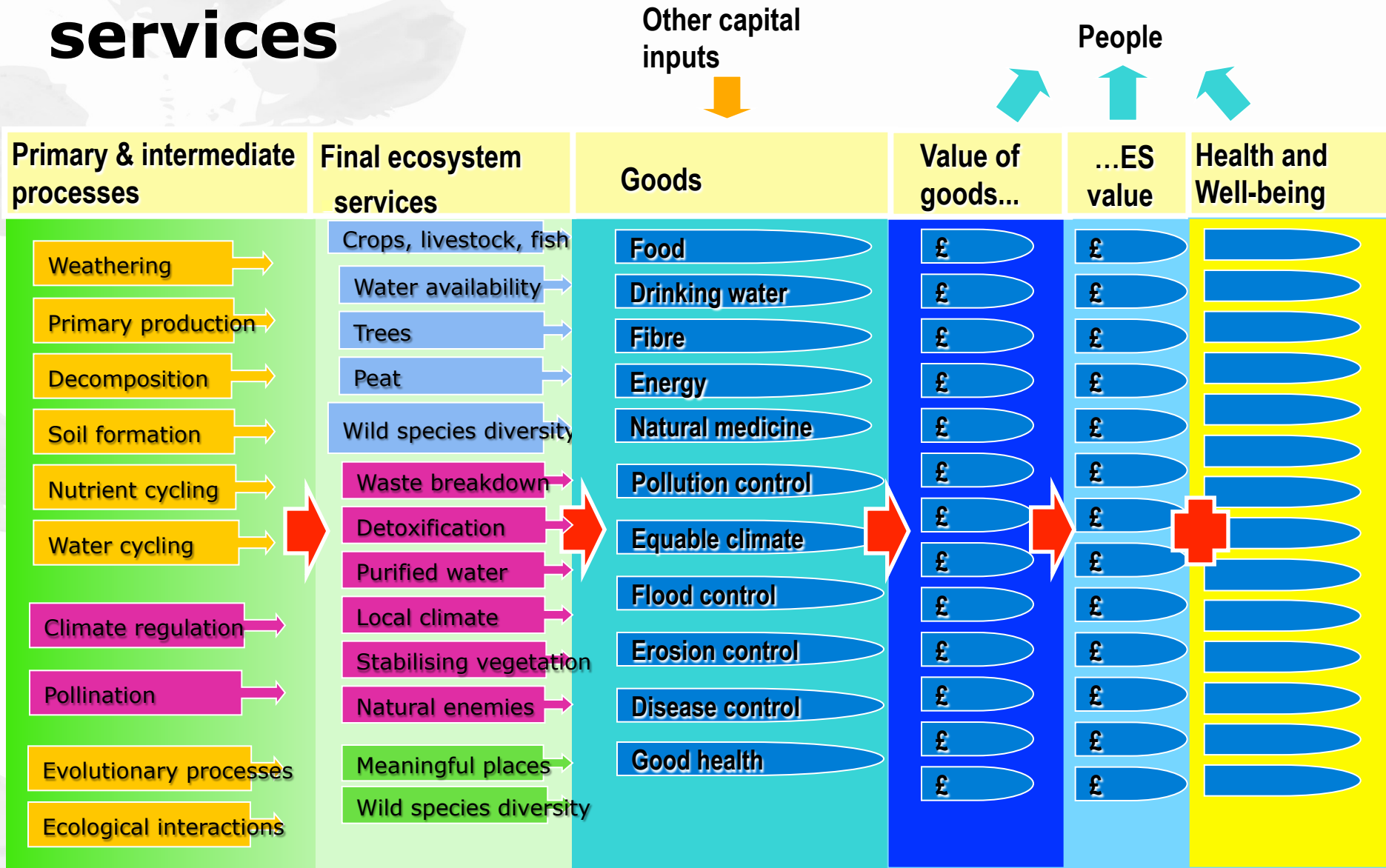
- Make sure the value of all ecosystem services, not just those bought and sold in the market, are taken into account when making decisions
- Remove subsidies to agriculture, fisheries, and energy
- Payments to landowners in return for managing their lands in ways that protect and enhance ecosystem services
- Appropriate pricing policies for natural resources, e.g., water
- Apply fees, taxes, levies and tariffs to discourage activities that degrade biodiversity and ecosystem services
- Establish market mechanisms to reduce nutrient releases and carbon emissions in the most cost-effective way



# Getting the Economics Right: Beyond GDP

- Governments should recognize the serious limitations of GDP as a measure of economic activity and complement it with measures of the five forms of capital: built, financial, natural, human and social capital
- Green taxes and the elimination of environmentally-damaging subsidies in areas such as energy, transportation and agriculture and should be eliminated
- external environmental and social costs should be internalized
- market and non-market economic values, and cultural and shared social values, of ecosystem goods and services should be taken into account in decision-making

# Valuation of goods and ecosystem services



# NEA: Ecosystem Service and Environmental Resource Related Goods

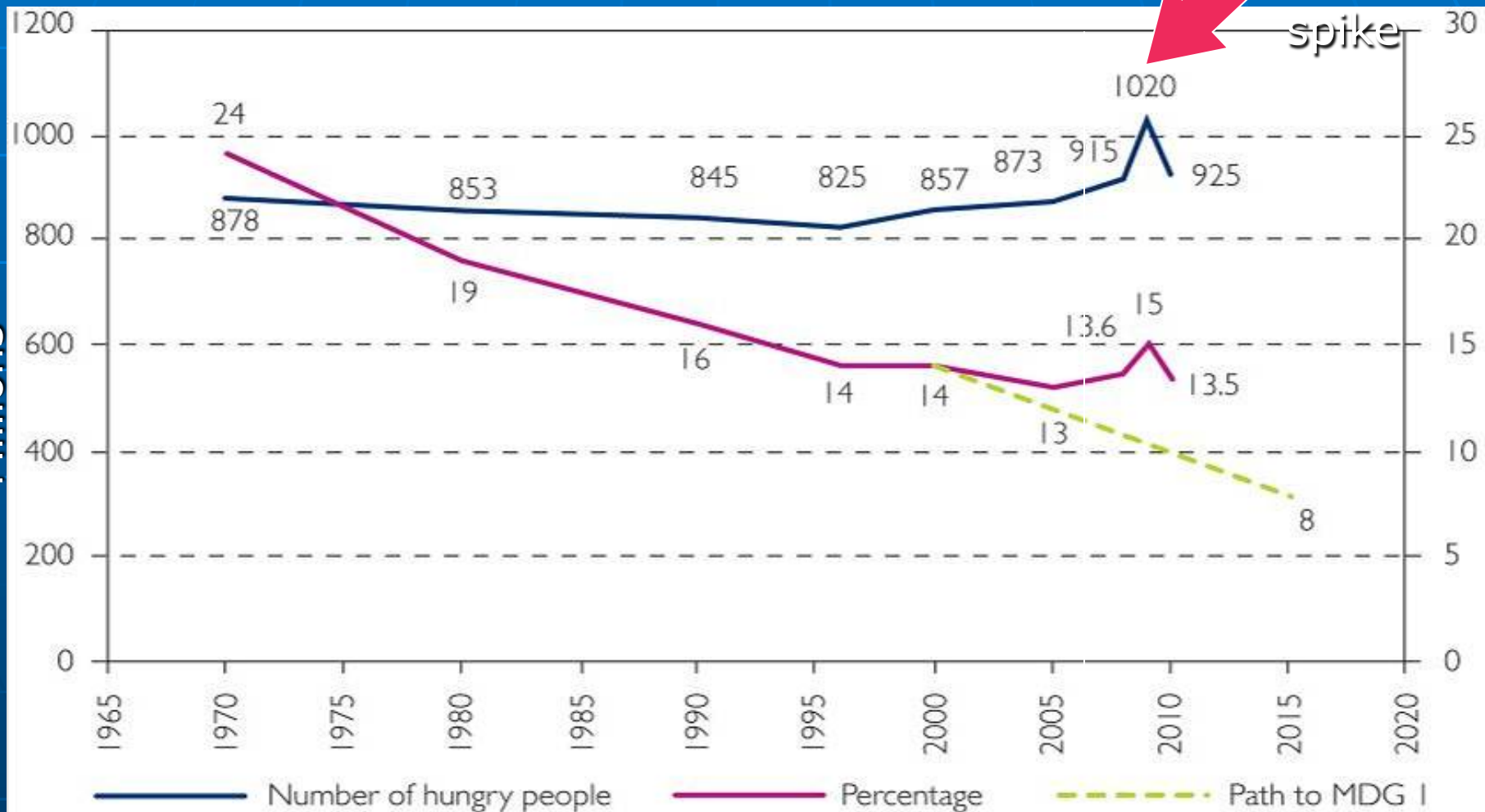
- Food production (agricultural, marine, other)
  - Biodiversity: Use values (pollination, pest control, wildlife, sport)
  - Biodiversity: Non-use values (existence values)
  - Raw materials (timber, aggregates, other)
  - Climate regulation (carbon storage, GHG)
  - Water quantity and quality
  - Flood prevention (inland and coastal)
  - Pollution remediation
  - Energy
  - Amenity values (landscape, urban greenspace, climate amenity, etc)
  - Recreation and tourism
  - Environmental effects upon health
- Valued via adjusted market prices
- Valued via contribution to output
- Valued via avoided costs
- Valued via observed behaviour
- Valued via stated preferences

# Food Security

# Failing to end hunger

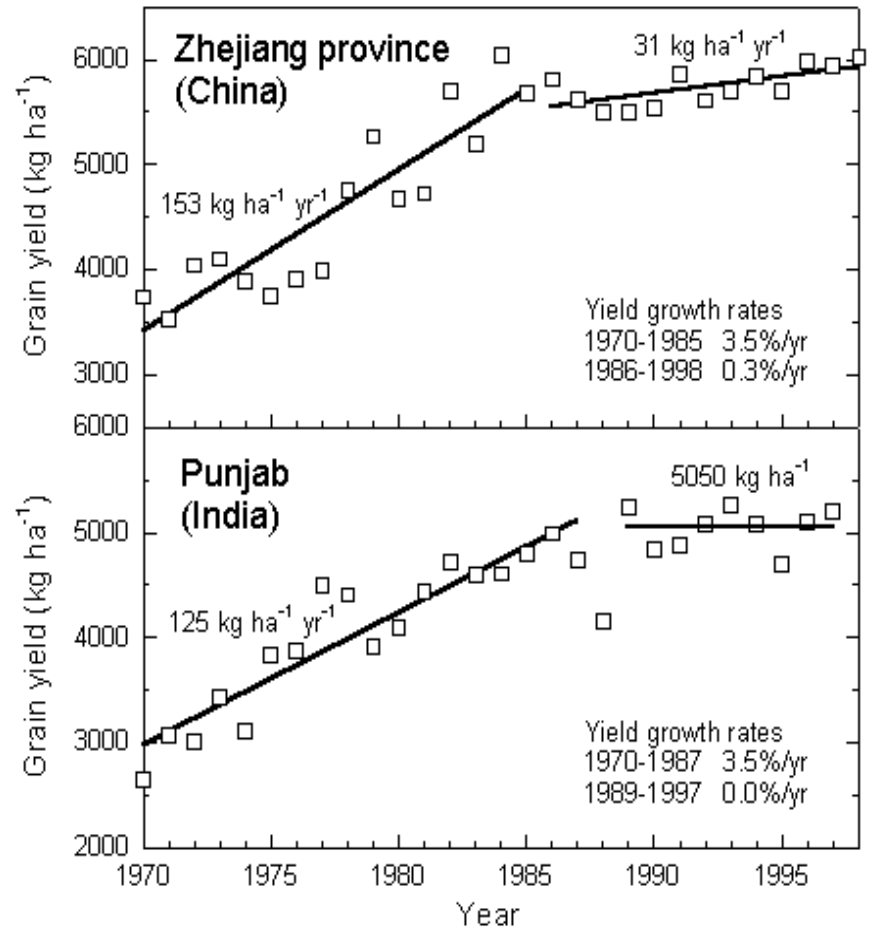
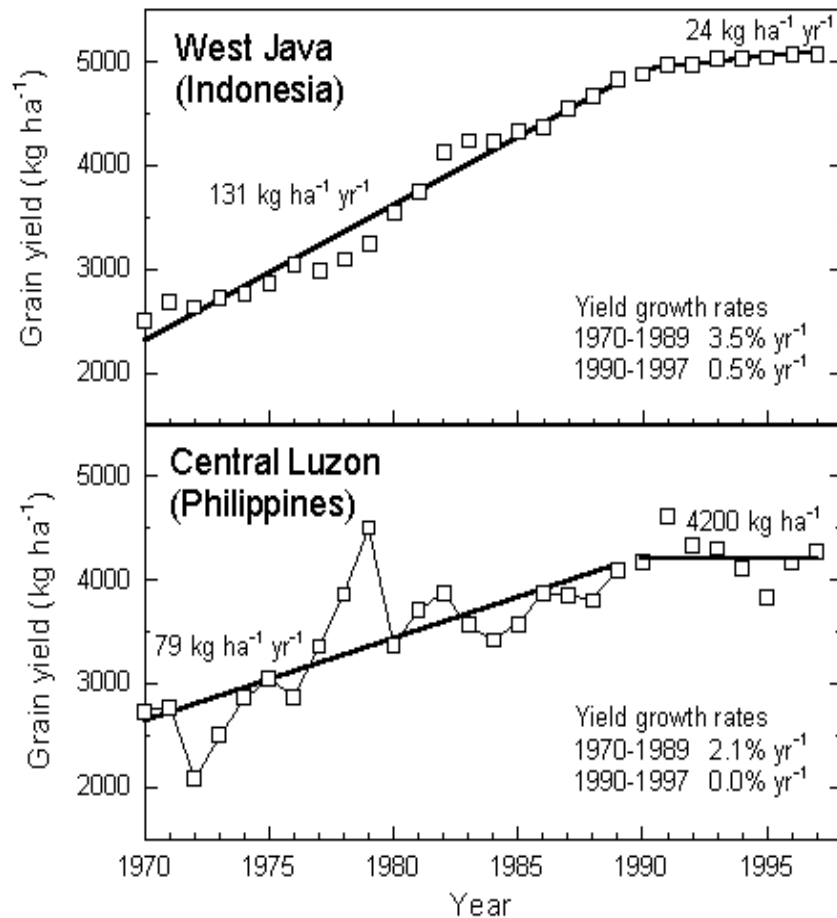
2007-08  
Food price  
spike

Undernourishment data versus the MDG

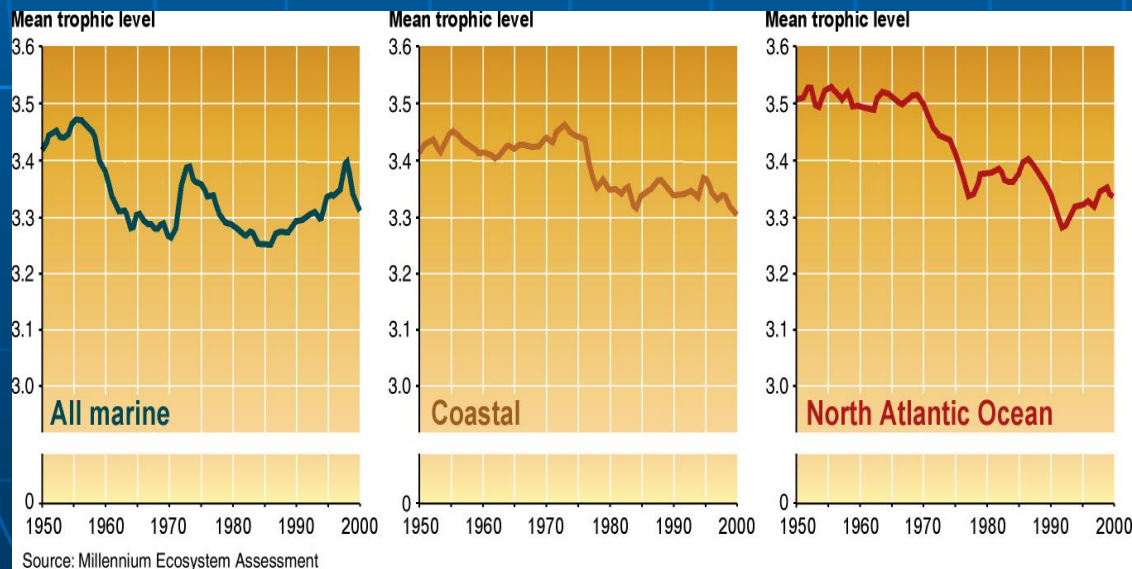
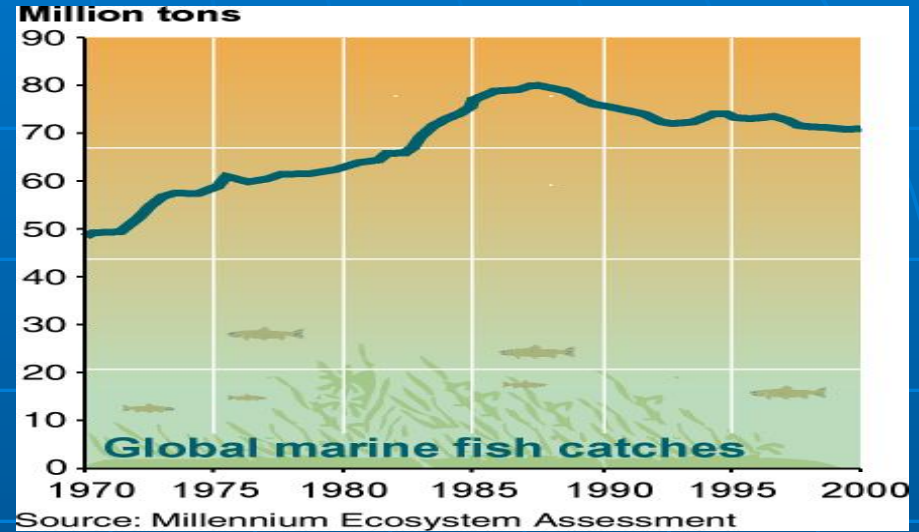
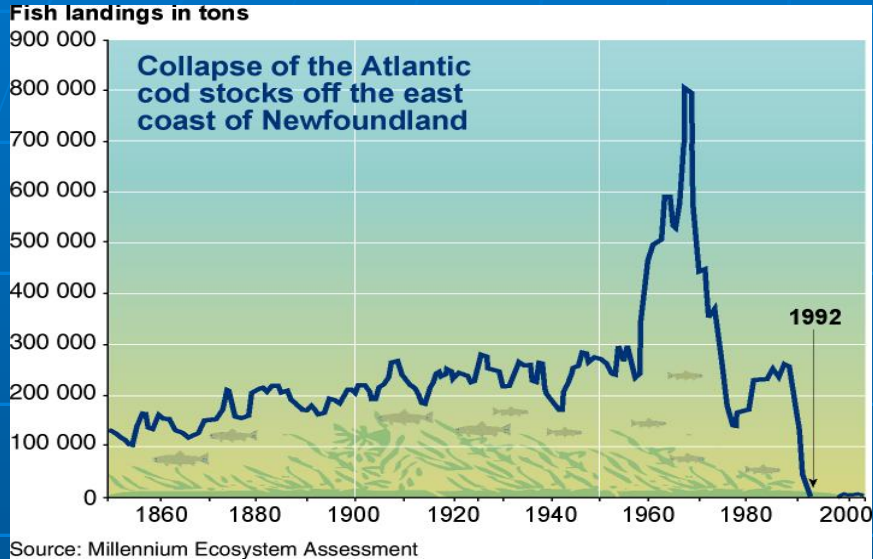


Source: Oxfam (2010) Data cited from FAO Hunger Statistics (from 1969 to 2006);

# Cereal Yield Increases

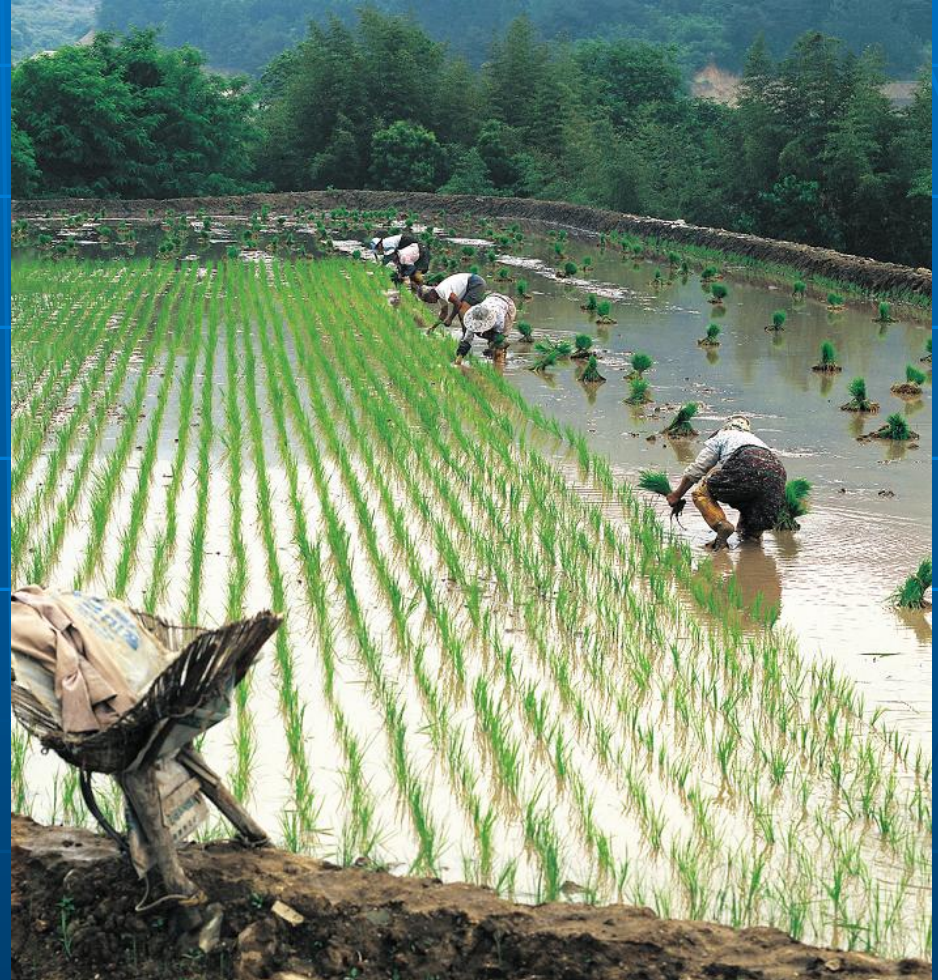


# Fisheries Collapse



# The food system is failing on sustainability...

- Agriculture consumes 70% of total global water withdrawals from rivers and aquifers
- Agriculture directly contributes 10-12% of GHG emissions
- Extensification - loss of biodiversity and ecosystem degradation
- Eutrophication - degradation of aquatic habitats
- Acidification - biodiversity impacts

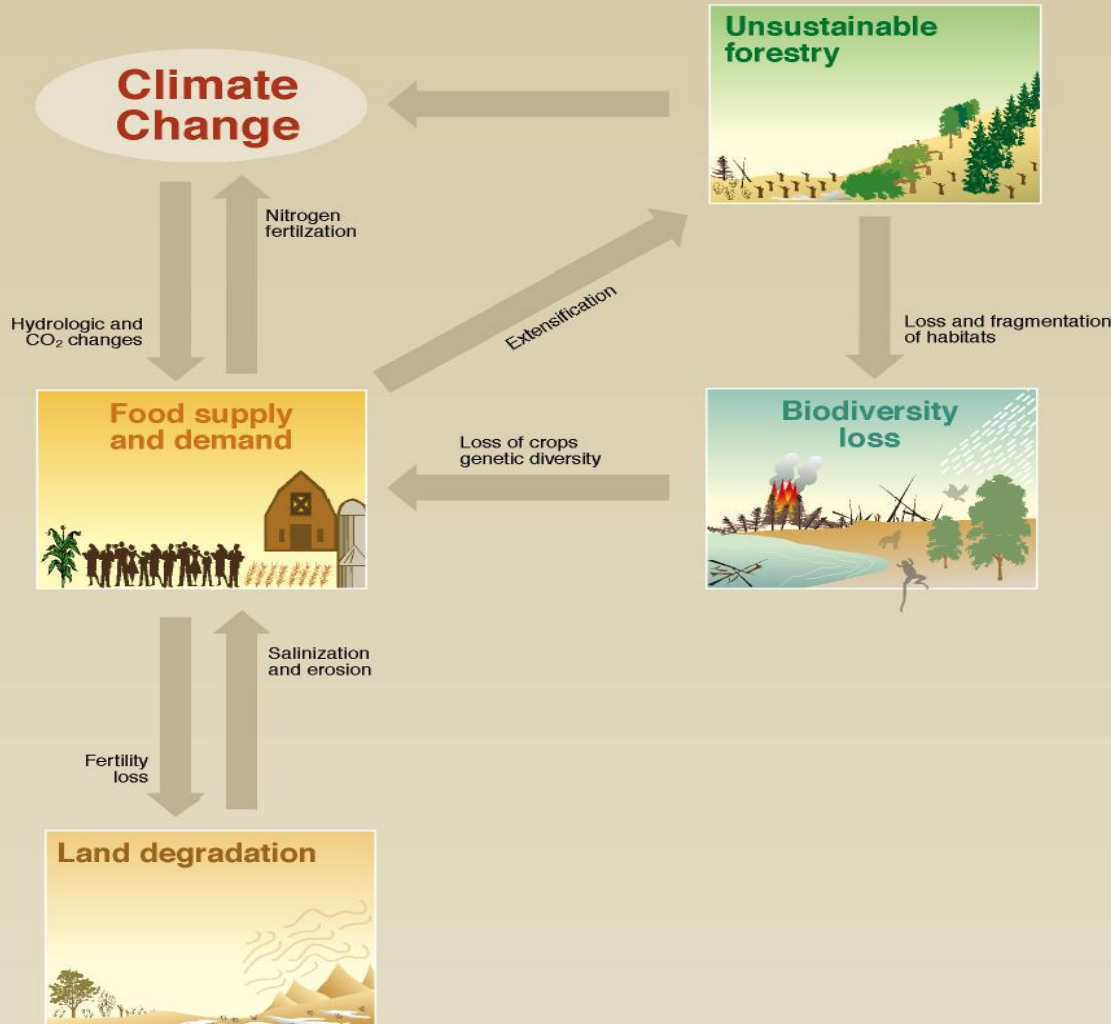




# Agriculture and Environmental Degradation

FIGURE 8.2

## Climate change and food



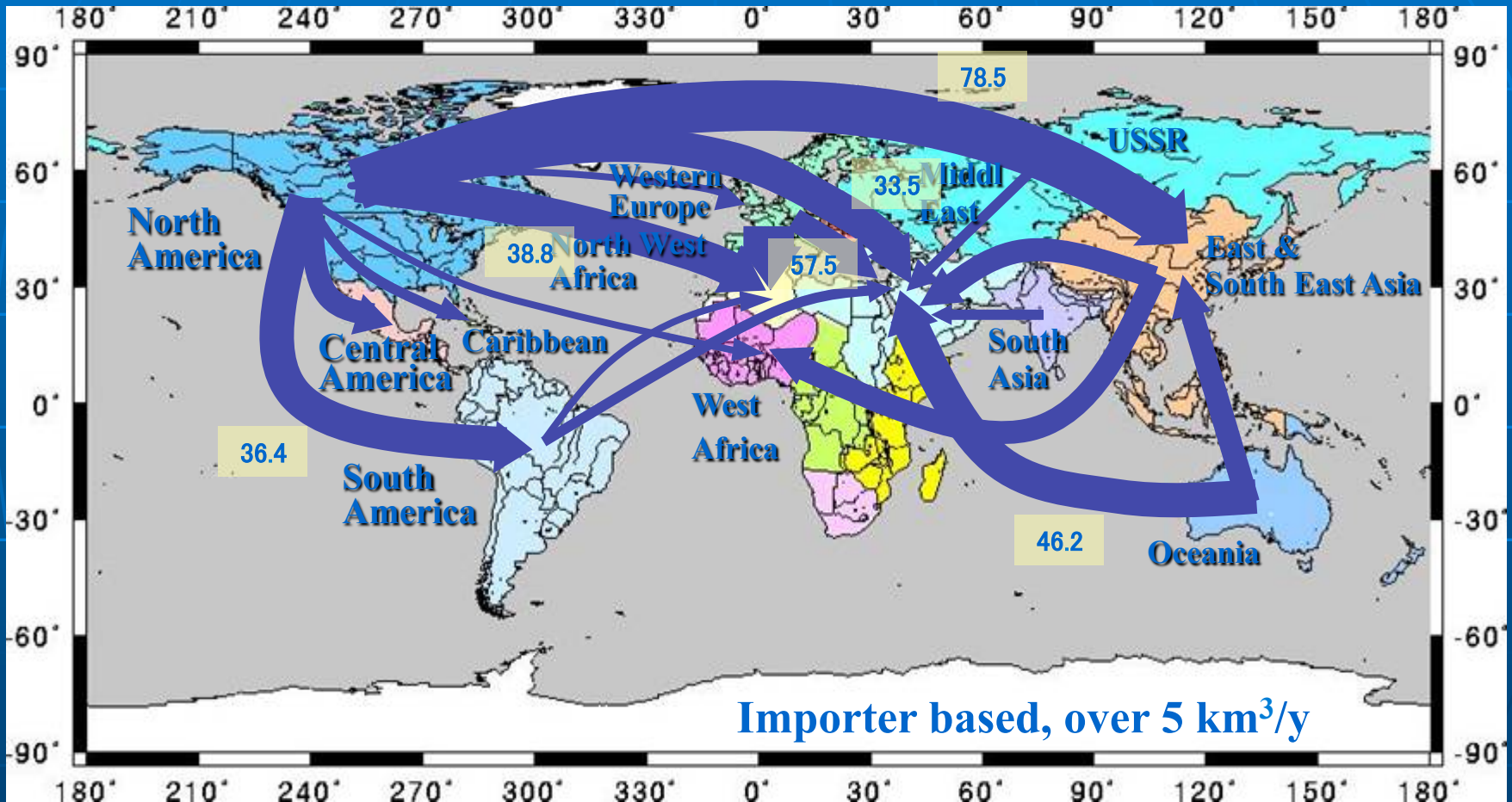
Can GHG emissions be reduced without impacting productivity

How will the loss of genetic diversity affect future agriculture?

Can soil and water degradation be reversed and productivity enhanced?

Can crop, animal and fish traits be improved to address the projected changes in climate – what are the roles of traditional breeding and modern forms of biotechnology – genomics?

# Economic Globalization: Virtual Water Flows (Cereals only)



# Food Security

## The future Challenge

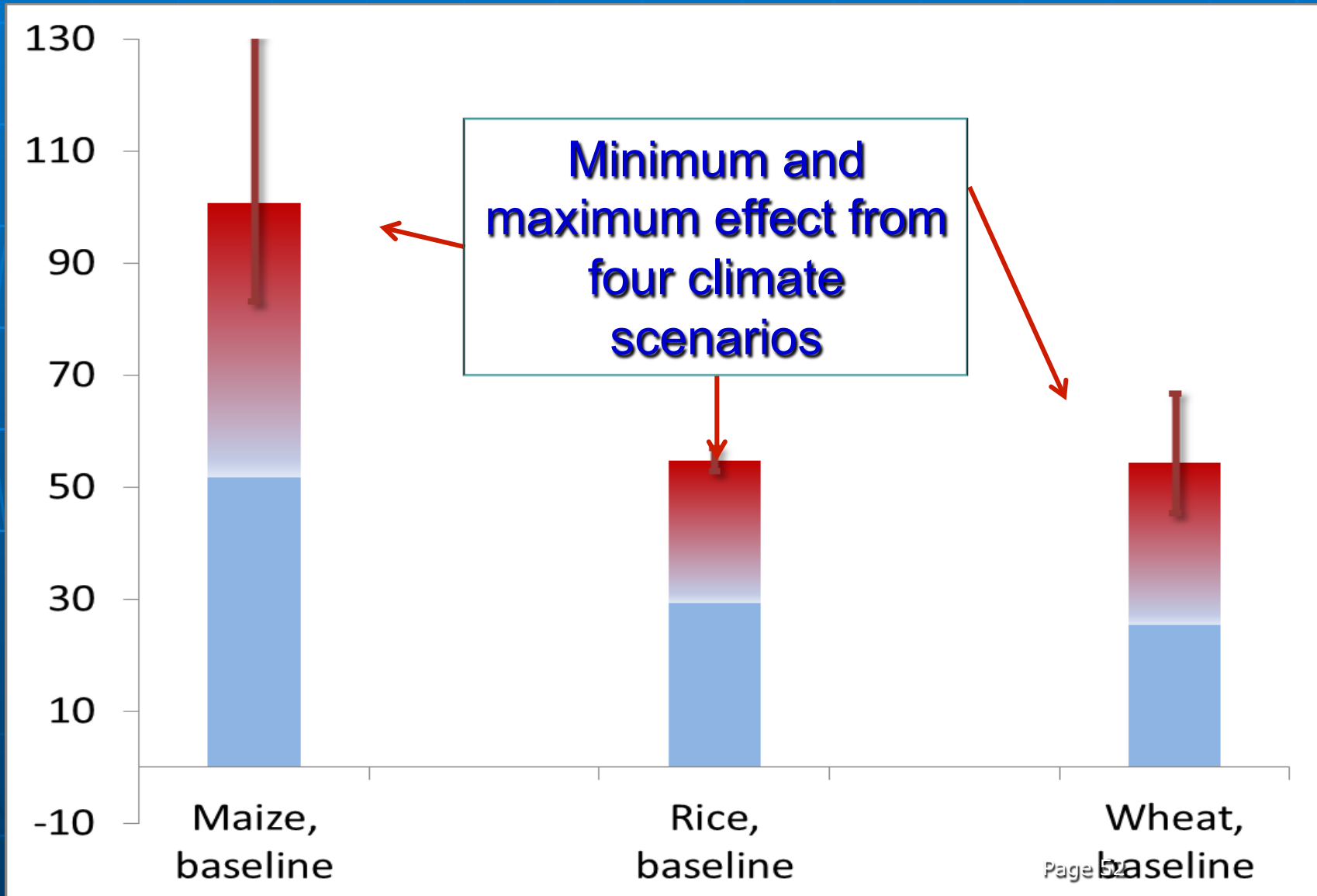
- The demand for food will double within the next 25-50 years, primarily in developing countries, **and** the type and nutritional quality of food demanded will change
- We need sustained growth in the agricultural sector to feed the world, enhance rural livelihoods and stimulate economic growth, while meeting food safety standards

## Context

- Less labor - diseases and rural to urban migration
- Less water – competition from other sectors and climate change in arid/semi-arid areas
- Yield increases are slowing dramatically
- Less arable land – competition, e.g., bio-energy
- Increasing land policy conflicts
- Loss of biodiversity: genetic, species and ecosystem
- Increasing levels of pollution – ozone and acid deposition
- A changing climate – temperature and precipitation

# Climate change scenario effects differ

(price increase (%), 2010 – 2050, Baseline economy and demography)



# Food security: options to increase production

- Embed economic, environmental and social sustainability into agricultural policies, practices and technologies
- Today's hunger problems can be addressed with appropriate use of current technologies, emphasizing agro-ecological practices (e.g., no/low till, IPM, INRM), coupled with decreased post-harvest losses
  - Small-scale farmers need access to the best seeds, financing and access to markets
  - Advances in S&T are always a needed but cannot be fully utilized without rural development, institutional and governance reform
- Advanced biotechnologies (genomics) may be needed to address future demands for increased productivity and emerging issues such as climate change and new plant and animal pests – but the risks and benefits must be fully understood
- Access to financing, better seeds, and markets (improved roads)

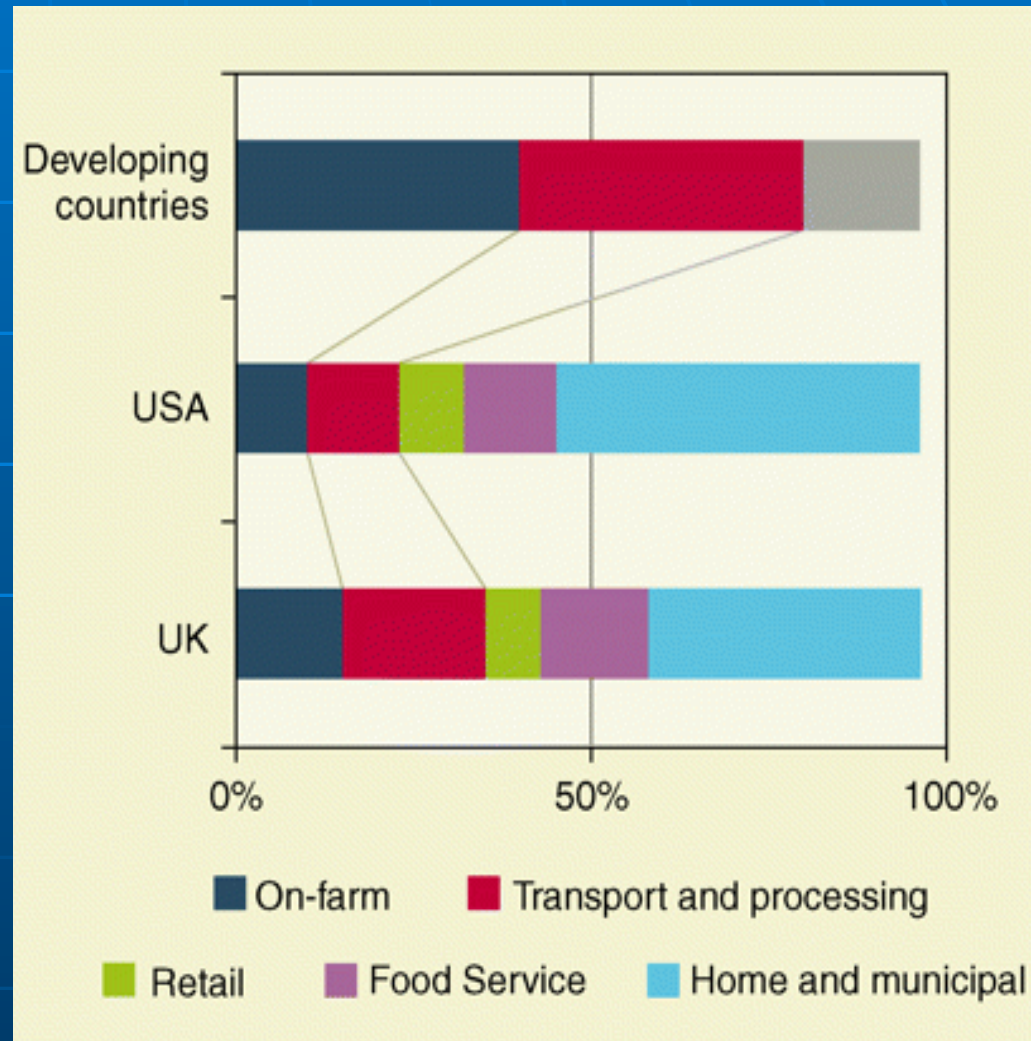
# Food security: options to increase production

- Provide payments to the farmer for maintaining and enhancing ecosystem services
- Empower women – gender sensitive extension services, access to financing, property rights
- Reform international trade, e.g., eliminate OECD production subsidies, eliminate tariff escalation on processed products, recognize the special needs of the least developed countries through non-reciprocal market access
- Increase public and private sector investment in research and development, and weather and market information
- Improve public-private-CSO involvement in AKST with accountability for social and environmental outcomes

# Action on waste and demand

- Determines supply challenge
- Incentivising the public and private sector
- Empowering the consumer
- Need to stimulate the debate on meat

Waste in different countries



# Governance, Grass Roots, Education, Training and Knowledge



# Better Governance is Essential

- There are serious short-comings in the decision making systems at local, national and global levels
- The rules and institutions for decision making are influenced by vested interests with an interest in the status quo
- Effective change in governance demands action to establish transparent means for holding those in power to account
  - Local level public hearings and social audits to give voice to marginalized groups
  - National level, parliamentary and press oversight
  - Globally, we must find better means to agree and implement measures to achieve collective goals
- Governance failures also occur because decisions are being made in sectoral compartments, with environmental, social and economic dimensions addressed by separate, competing structures

# Learn from Grass Roots Actions

- Decision makers should learn from ongoing grass-roots actions and knowledge in areas such as energy, food, water, natural resources, finance and governance
- This is key, not the least in rural communities with a view to their management, control and ownership of these resources
- There is a need to scale-up the grass roots actions by bringing together a complementary top-down and bottom-up approach to addressing these issues
- Global cooperation can be improved by building on ongoing regional cooperation to deal with common sustainable development issues

# Training, Education, Research and Assessments are Critical

- Effective training programs for decision makers in business and government to learn how to:
  - integrate programs and policies within sustainability constraints, and
  - acquire the skills to strategically move towards such sustainability goals
- Increase investments in education for all
- Multi-disciplinary research – “Future Earth Initiative”
- Assessments of knowledge – need to be coordinated

# Summary

- **The world is long on rhetoric – short on action**
  - **Climate change – atmospheric concentrations of greenhouse gases are increasing rapidly - no legally binding post-Kyoto targets agreed**
  - **Biodiversity is being lost at an unprecedented rate – we need to implement actions to achieve the Aichi targets**
- **We need the right mix of policies, practices, technologies and behavior change, particularly:**
  - **we must get the economics right – eliminate subsidies, internalize environmental externalities and value all ecosystem services (market and non-market) into national accounts and decision-making**
- **We must address the economic, environmental, and social aspects of all development issues simultaneously**

**So what is the international community doing??**

# International Sustainable Development Processes

- In 2015 the MDG process is scheduled to be completed, with some successes and some shortcomings
- In 2012 Ban Ki Moon established a High-Level Panel to advise on a post-2015 Development Framework, and a Sustainable Development Solutions Network
- Governments at the Rio+20 Conference in 2012 established an Intergovernmental Open Working Group to advise the General Assembly on a set of Sustainable Development Goals, applicable to all nations
- The High-level Panel report and the SDSN report are providing input to the UN Open Working Group, who will report to the UN General Assembly in September 2014, whom will make any final decisions

MDG's	Open Working Group -focus	SDSN	HLP
Eradicate extreme poverty and hunger	Poverty eradication, building shared prosperity and promoting equality	End extreme poverty including hunger	End poverty
Achieve universal primary education	Sustainable agriculture, food security and nutrition	Achieve development within planetary boundaries	Provide quality education & lifelong learning
Promote gender equality and empower women	Health and population dynamics	Ensure effective learning for all children and youth for life and livelihood	Empower girls and women and achieve gender equality
Reduce child mortality	Education and life-long learning	Achieve gender equality, social inclusion, and human rights	Ensure healthy lives
Improve maternal health	Gender equality and women's empowerment	Achieve health and wellbeing at all ages	Ensure food security and good nutrition
Combat HIV/AIDs malaria and other diseases	Water and sanitation	Improve agriculture systems and raise rural prosperity	Achieve universal access to water and sanitation
Ensure environmental sustainability	Energy	Empower inclusive, productive and resilient cities	Secure sustainable energy
Global partnership for development	Economic growth, employment and infrastructure	Curb human induced climate change and ensure clean energy for all	Create jobs, sustainable livelihoods and equitable growth
	Industrialization and promoting equality among nations	Secure ecosystem services, biodiversity etc	Ensure good governance and effective institutions
	Sustainable cities and human settlements	Transform governance for sustainable development	Manage natural resource assets sustainably
	Sustainable consumption and productions patterns		Create and global enabling framework and catalyse long term finance
	Climate change		Ensure stable and peaceful societies
	Conservation and sustainable use of marine resources, oceans and seas		
	Ecosystems and biodiversity		
	Means of implementation/Global partnership for sustainable development		
	Peaceful and inclusive societies, rule of		

# Outcome Document of the Open Working Group on Sustainable Development Goals

1. End Extreme Poverty in all its forms everywhere
2. End hunger, improve food security and improved nutrition, and promote sustainable agriculture
3. Ensure healthy lives and promote well-being for all ages
4. Ensure inclusive and equitable quality education and promote life-long learning opportunities for all
5. Achieve gender equality and empower all woman and girls
6. Ensure availability and sustainable management of water and sanitation for all
7. Ensure access to affordable, reliable, sustainable and modern energy for all
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10. Reduce inequality within and among countries

# Outcome Document of the Open Working Group on Sustainable Development Goals

- 11: Make cities and human settlements inclusive, safe, resilient and sustainable
- 12: Ensure sustainable consumption and production patterns
- 13: Take urgent action to combat climate change and its impacts
- 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development
- 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
- 16; Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
- 17; Strengthen the means of implementation and revitalize global partnerships for sustainable development



# The Time to Act is Now

**If we are to achieve our dream, the time to act is now, given:**

- The inertia in the socio-economic system
- The adverse effects of climate change and loss of biodiversity cannot be reversed for centuries or are irreversible (for example, species loss)
- We know enough to act - we are facing a problem of risk management on an immense scale
- Failure to act will impoverish current and future generations