



Developing scenarios within a global context

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"The future is always present, as a promise, a lure and a temptation."

Karl Popper

Content:

Drivers of global change

What are scenarios?

Traditional scenario development

Qualitative scenario development by the GSG

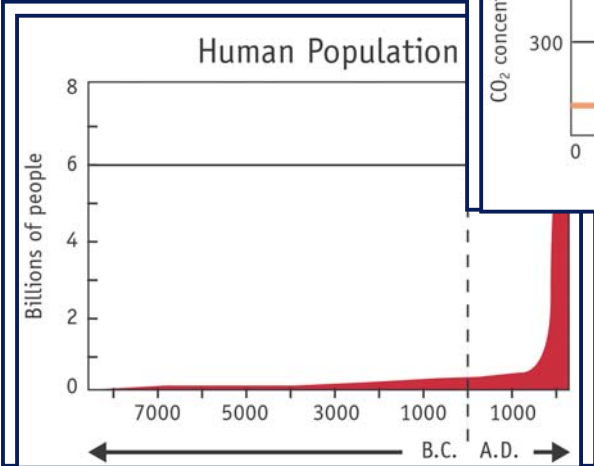
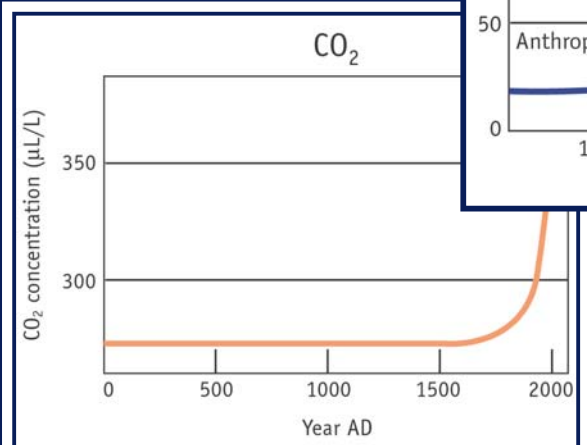
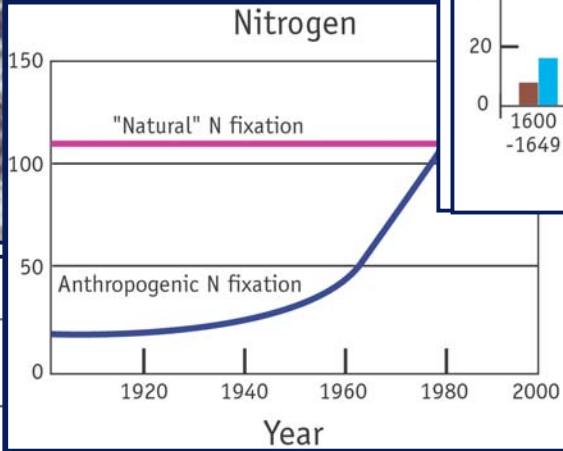
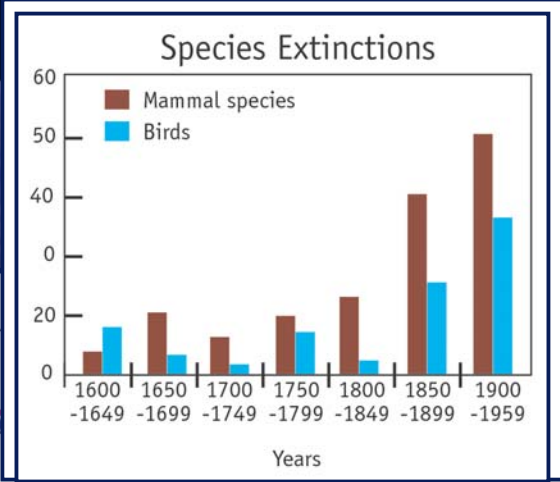
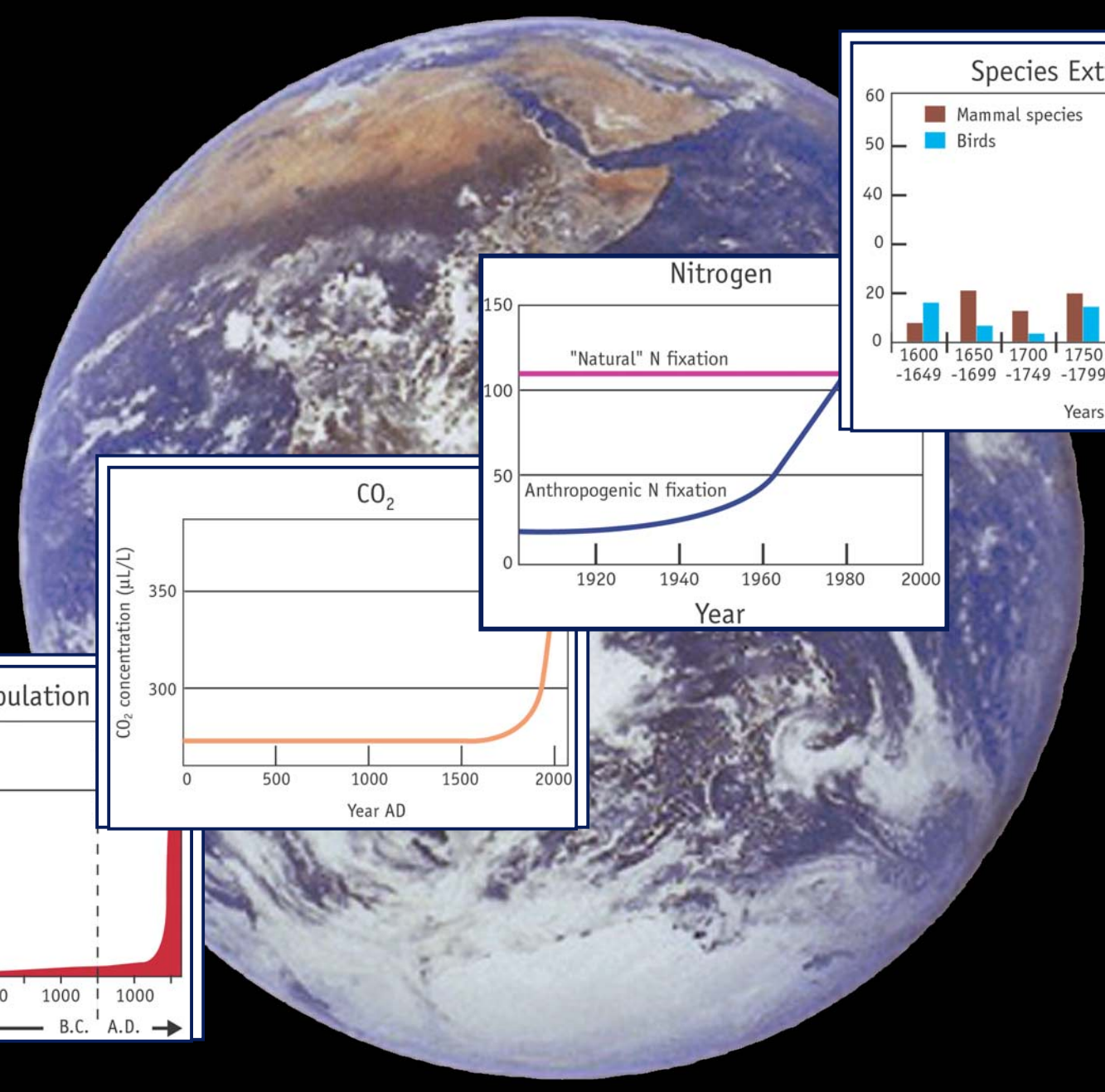
Stakeholder involvement in scenarios

The IPCC SRES scenarios of IMAGE 2





Drivers of global change



Understanding global environmental change

➔ WHAT?

➔ WHERE?

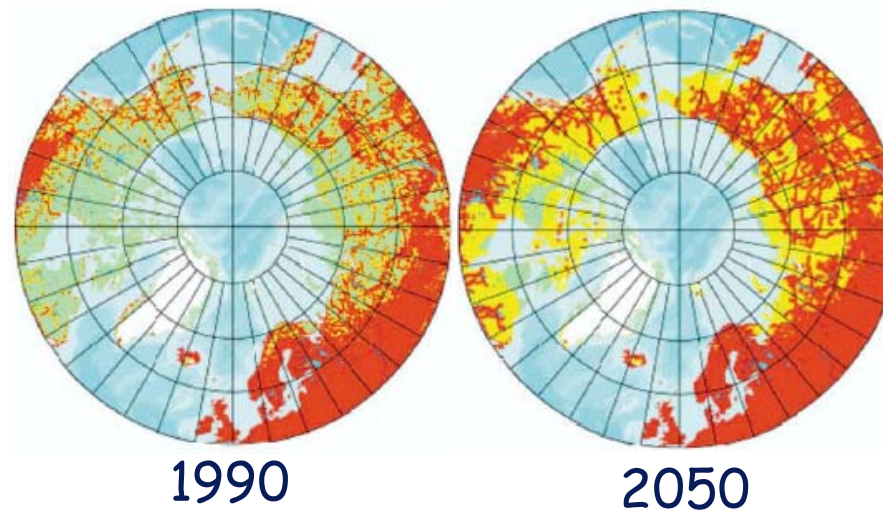
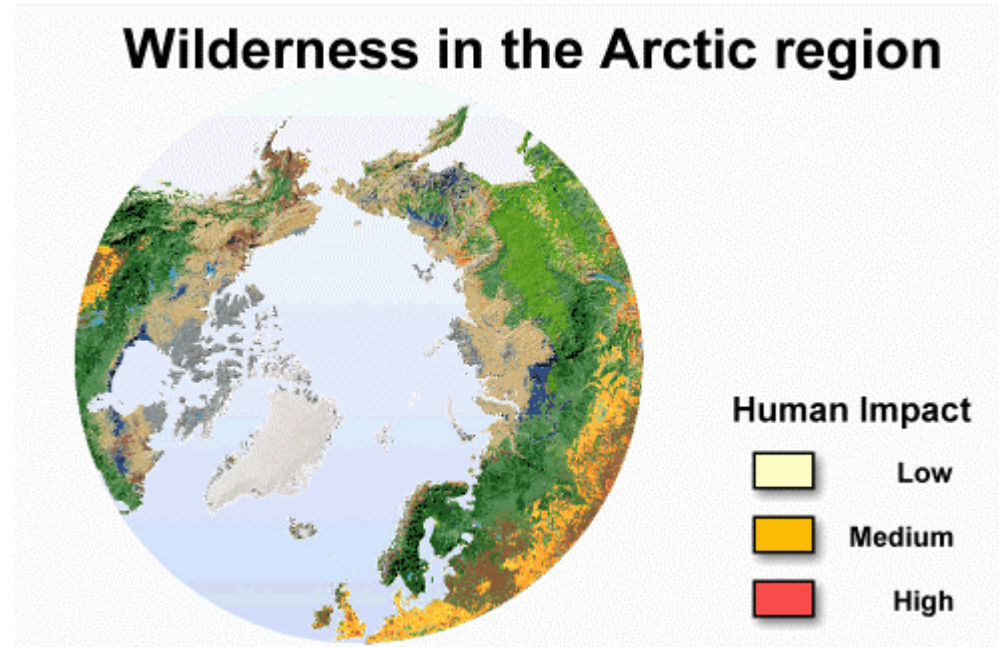
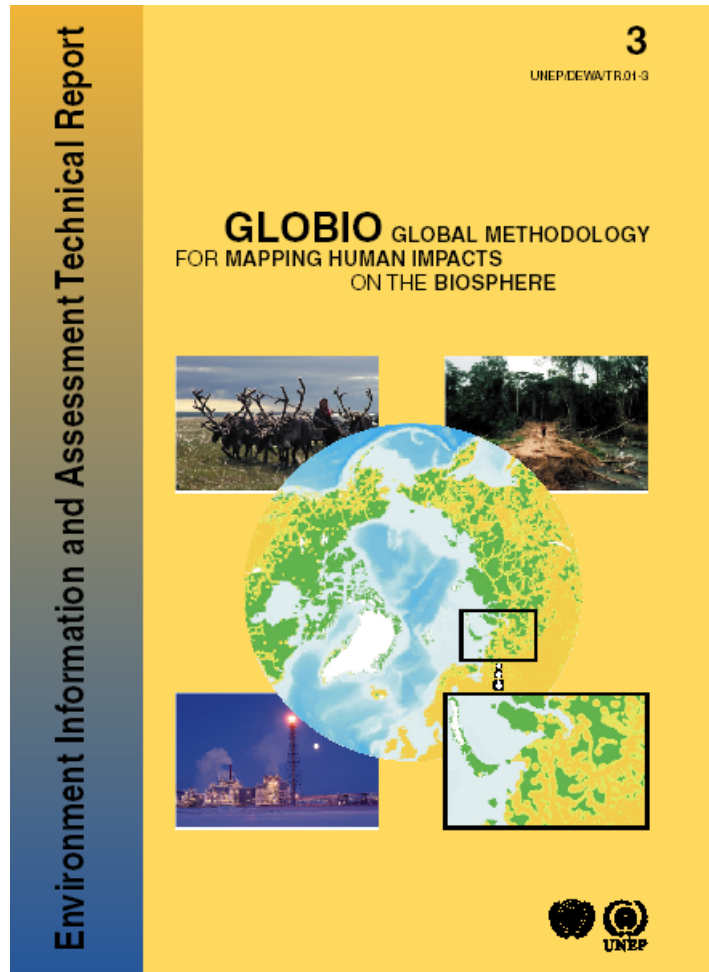
➔ HOW?

➔ WHY?

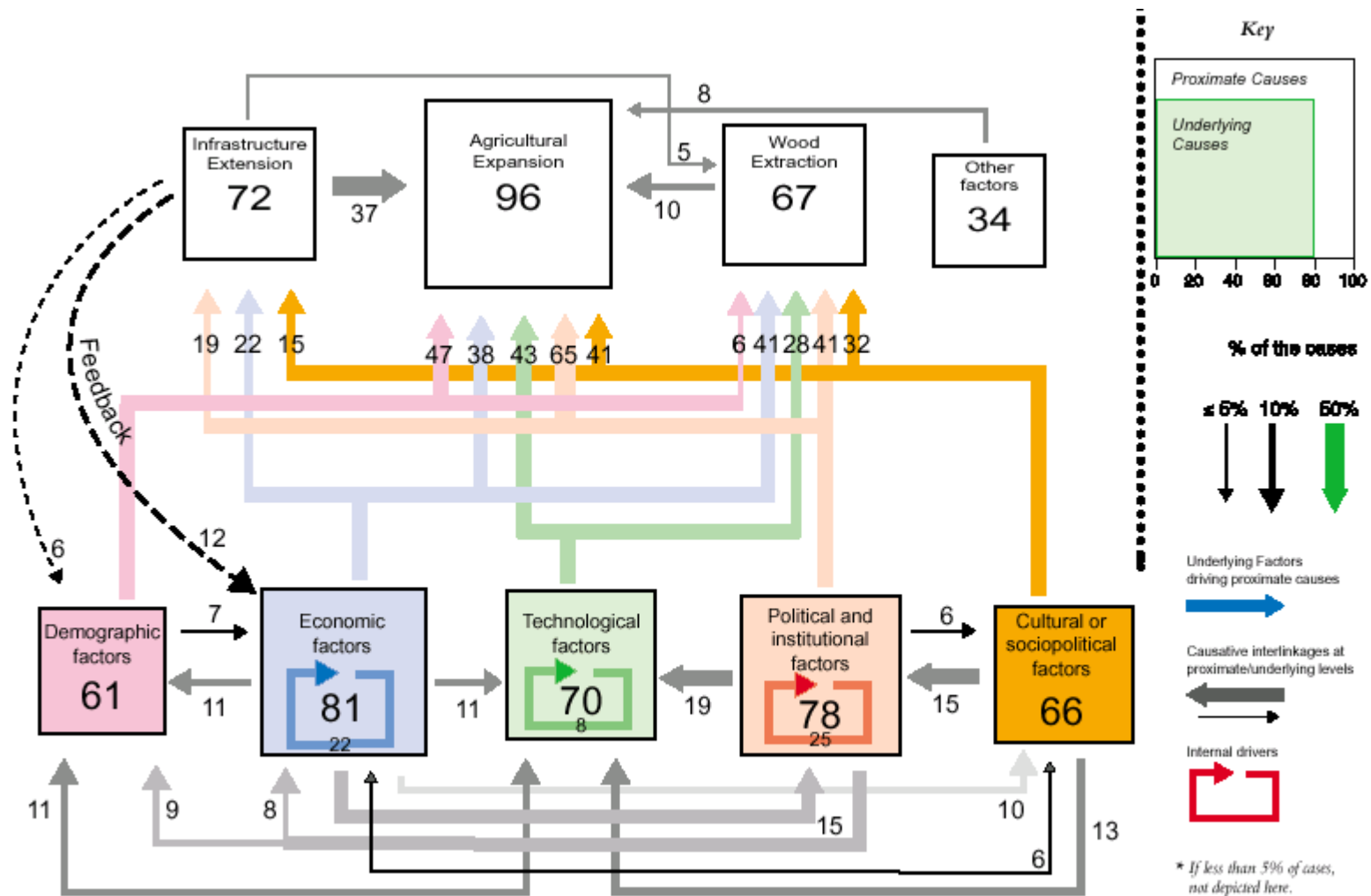
How will global change evolve into the future and how can we respond?



GLOBIO: mapping human impacts



What drives deforestation?



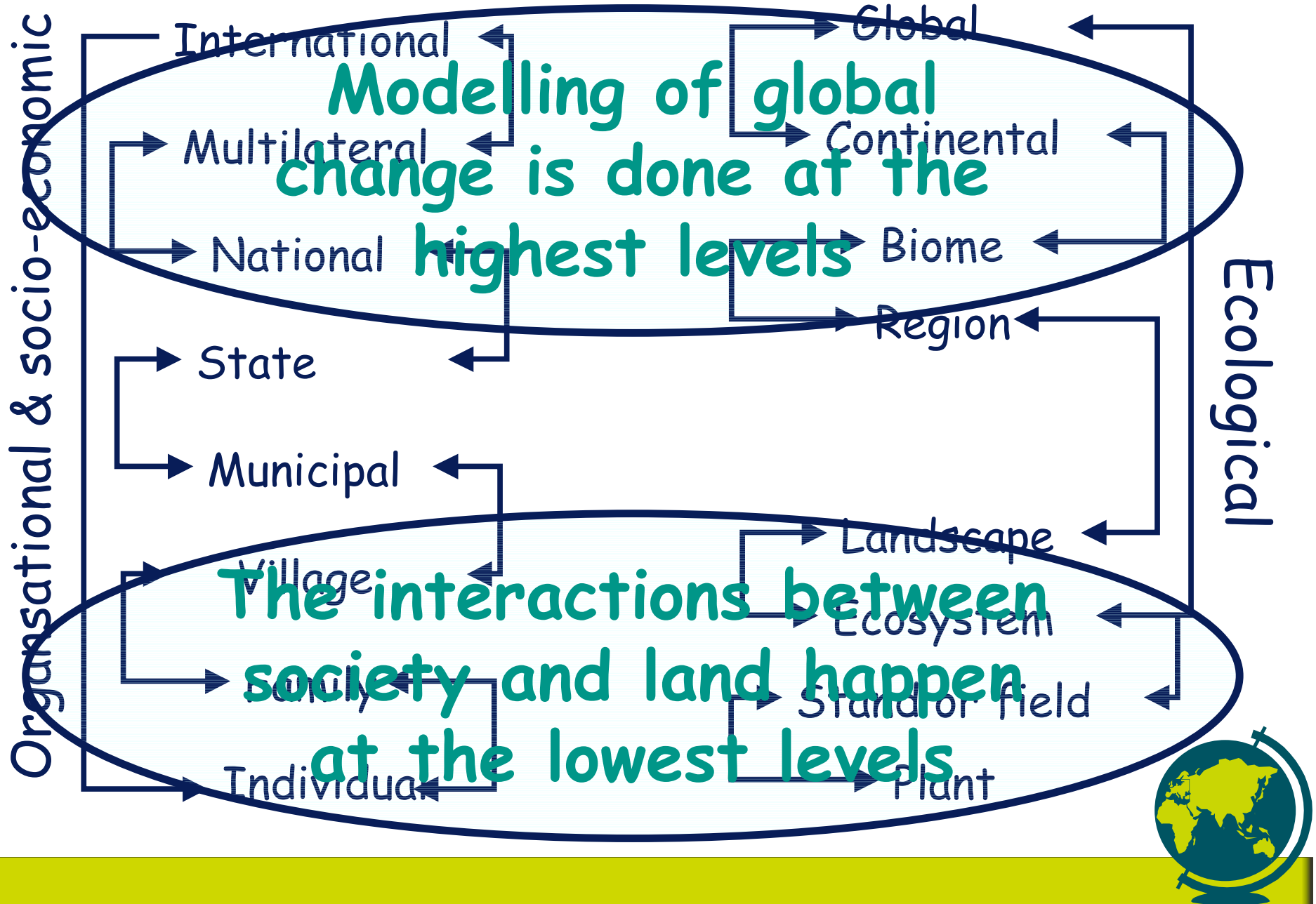
The causes of deforestation (Geist & Lambin, 2001)



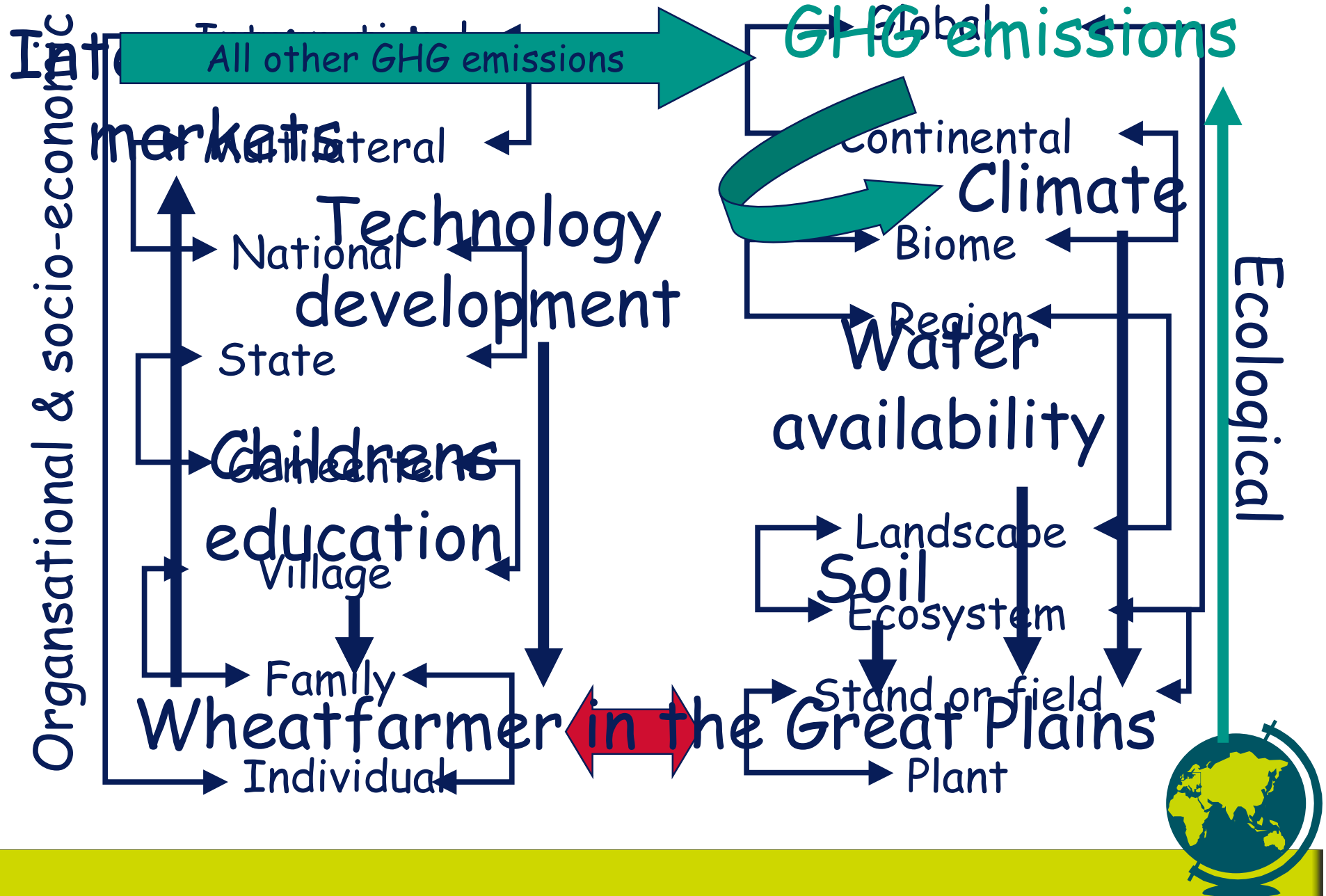
Coupling biophysical and human components



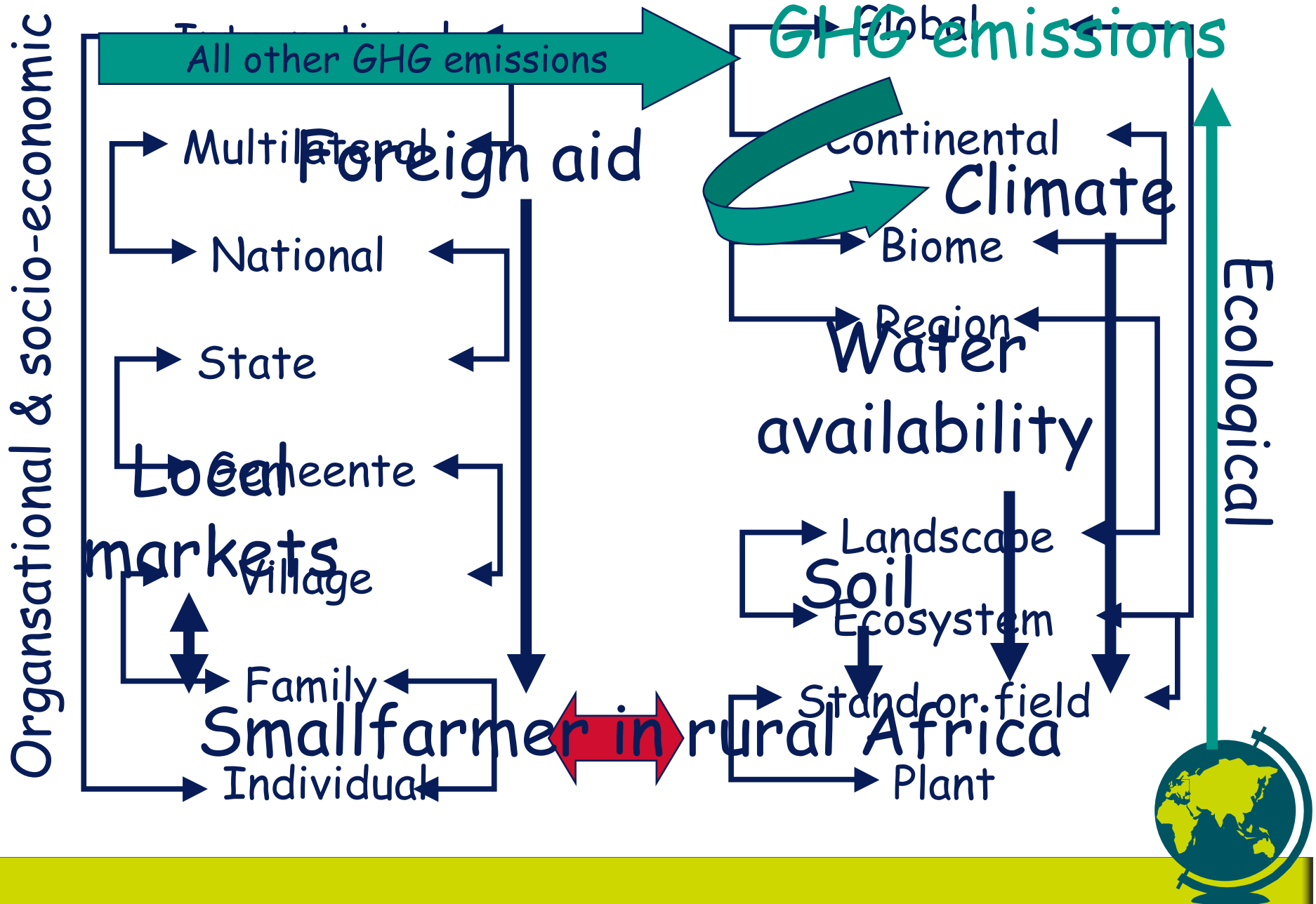
Different dimensions of land use



Different dimensions of land use



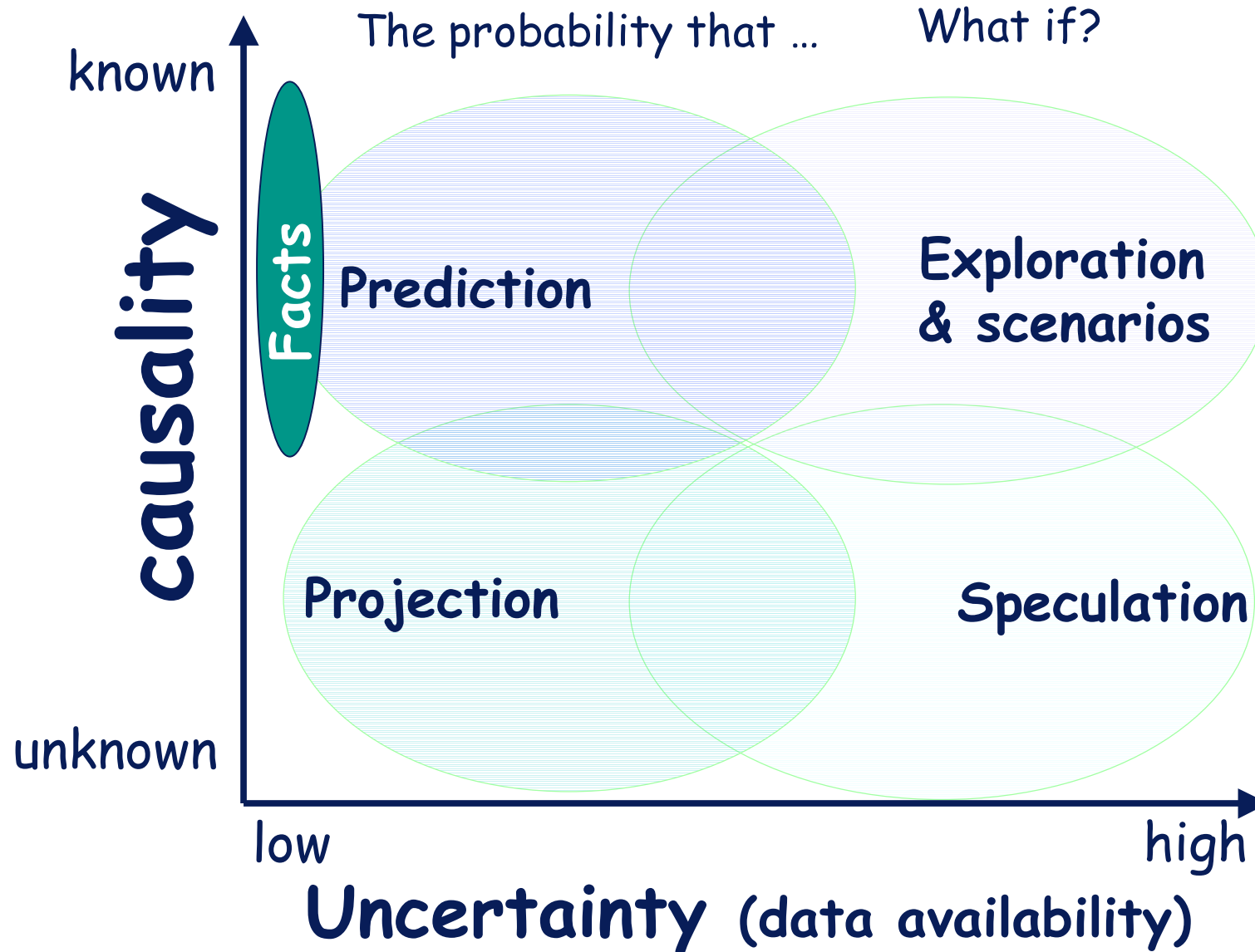
Different dimensions of land use



A satellite image of Earth showing the Americas, with the Atlantic Ocean to the east and the Pacific Ocean to the west. The text "What are scenarios?" is overlaid in the center.

What are scenarios?

What are scenarios?



All scenario definitions include:

- ✓ Scenarios are *hypothetical*, describing possible future pathways
- ✓ Scenarios describe *dynamic processes*, representing sequences of events over a period of time
- ✓ Scenarios consist of *states, driving forces, events, consequences and actions*, which are causally related
- ✓ Scenarios start from an *initial or desired* state, depicting a *final state or path* at a fixed time horizon.



Examples of scenario studies throughout the centuries

Malthus	'Essay on the Principle of population'	1798
George	'Progress and Poverty'	1879
Boserup	'The conditions of Agricultural Growth'	1965
The Club of Rome	'Limits to the Growth'	1972
OECD	'INTERFUTURES'	1979
Berendt <i>et al.</i>	'Global 2000 report to the President'	1980
Brundtland Commission	'Our Common Future'	1987
Meadows <i>et al.</i>	'Beyond the limits'	1992
WRR	'Ground for choices'	1992
FAO	'Agriculture towards 2010'	1995
UNEP	'Global Environmental Outlook'	1999
IPCC	'SRES'	2000
WSG	The Great transition	2001

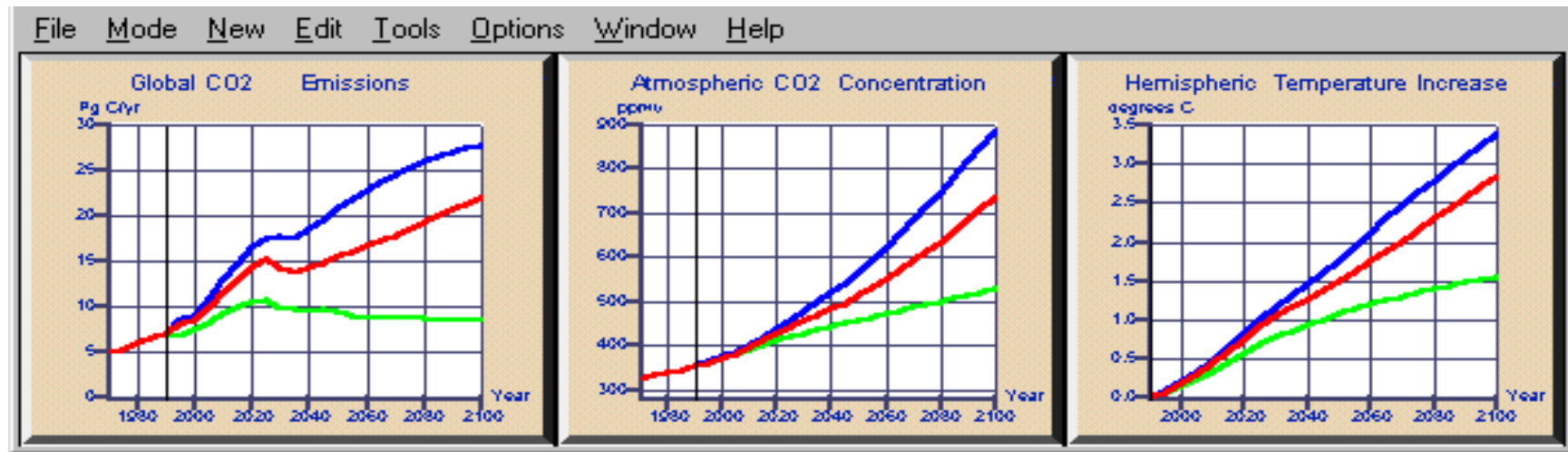


Traditional scenario development

- ✓ Use of expert judgment for the most likely future development of driving forces
- ✓ Limited consistency between driving forces
- ✓ Use of simple aggregated models to quantify the consequences of these drivers
- ✓ Neglecting important interactions and feedbacks



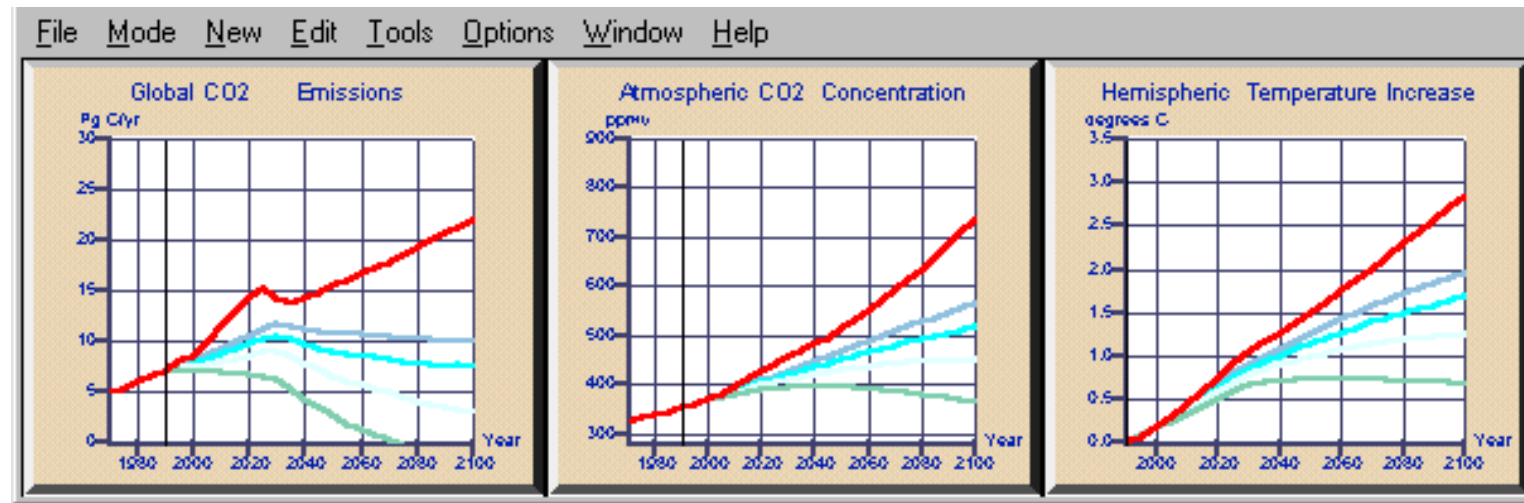
Baseline scenarios



- ✓ Emissions increase relative to 1990
- ✓ Atmospheric concentrations continue to increase
- ✓ Impacts are significant and affect all regions



Stabilising concentration scenarios

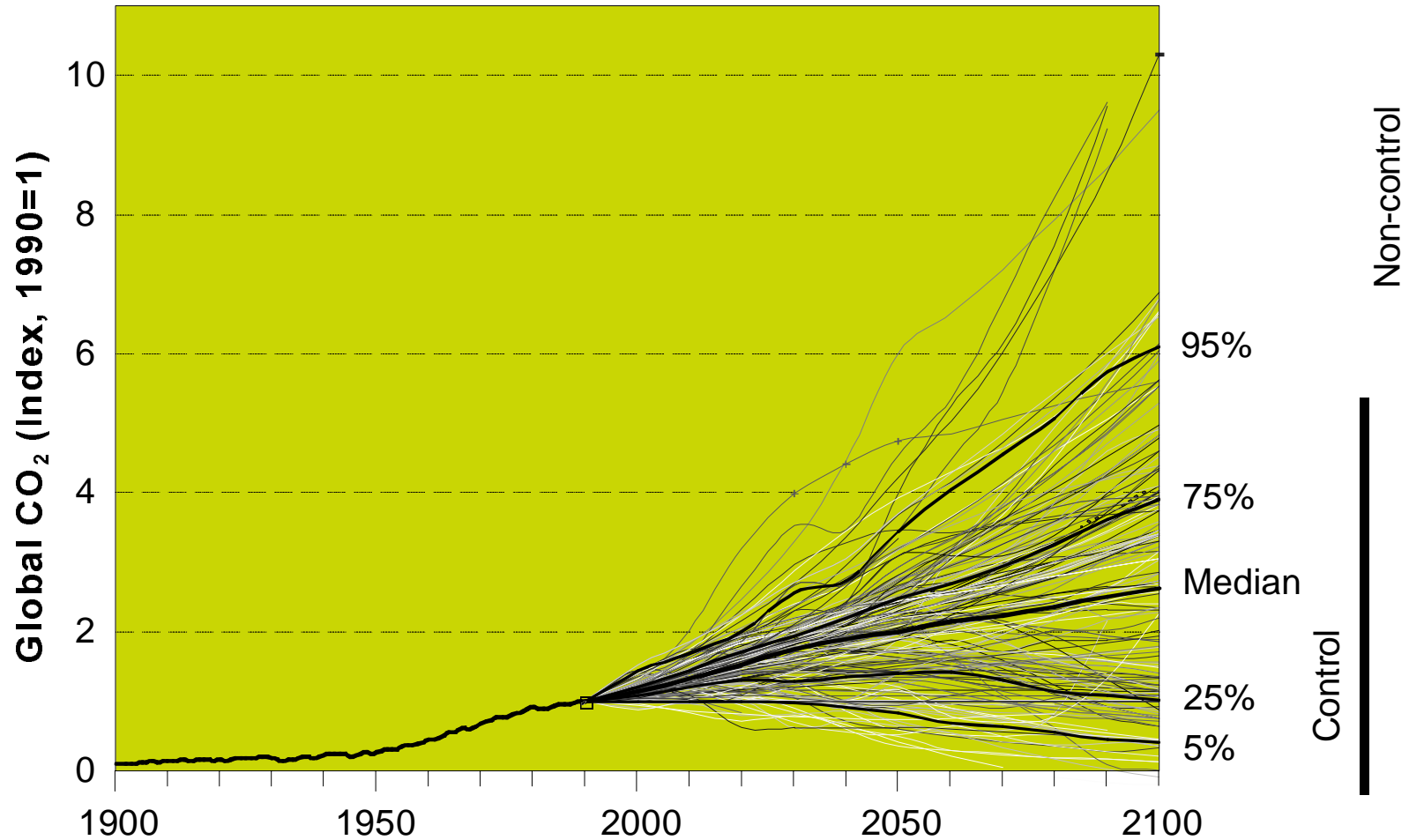


Targets at 350, 450, 550 and 650 ppmv in 2100

- ✓ To stabilise, emissions must be reduced by 60%
- ✓ Above 450 ppmv, temperature and impacts increase
- ✓ Below 450 ppmv, they tend to stabilise
- ✓ Some climate change seems unavoidable

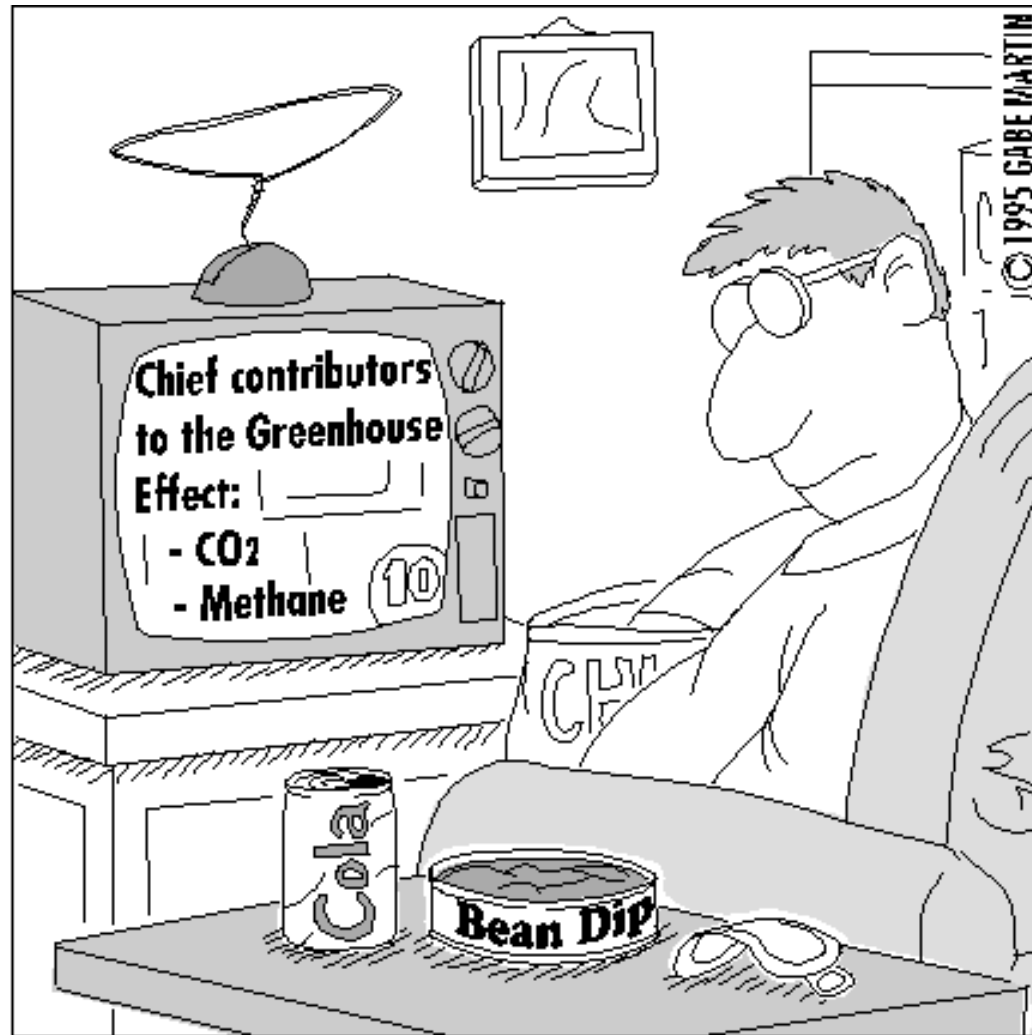


Available emission scenarios



The **BORDERLINE**

By Gabe Martin



Suddenly, Bob realizes that he's "part of the problem"



Global Scenarios Group (GSG) at SEI

Branch Points:
Global Scenarios and Human Choice
Gilberto Gallopin, Al Hammond, Paul Raskin and Rob Swart
A Resource Paper of the *Global Scenario Group*



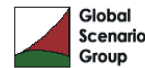
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Bending the Curve: Toward Global Sustainability

Paul Raskin, Gilberto Gallopin, Pablo Gutman, Al Hammond and Rob Swart

A report of the *Global Scenario Group*



Great Transition The Promise and Lure of the Times Ahead



PAUL RASKIN
TARIQ BANURI
GILBERTO GALLOPIN
PABLO GUTMAN
AL HAMMOND
ROBERT KATES
ROB SWART

A scenario development with the **Polestar** system, a transparent tool for synthesizing global data sets, organizing sectoral linkages and introducing assumptions

See: www.tellus.org/seib/publications/ps2000.pdf

To our grandparents, who laboured and dreamed for us.
To grandchildren the world over, for whom we labour and dream.



The content of the GSG's report

1. Where Are We?

Historical Transitions; Branch Points

2. Where Are We Headed?

Many Futures; Global Scenarios; Driving Forces

3. Where Do We Want To Go?

Goals for a Sustainable World; Bending the Curve; Limits of the Reform Path

4. How Do We Get There?

Strategies; Change Agents; Dimensions of Transition; Values and Knowledge; Demography and Social Change; Economy and Governance; Technology and the Environment; Civilizing Globalization

5. History of the Future

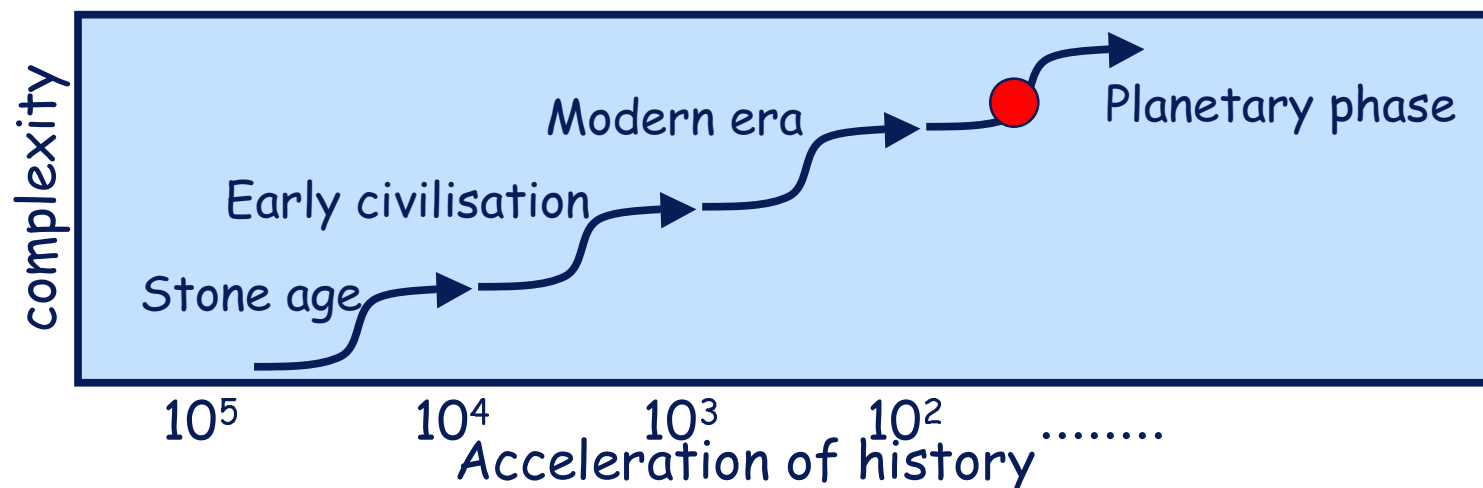
Prologue; Market Euphoria, Interruption and Revival; The Crisis; Global Reform; Great Transition

6. The Shape of Transition

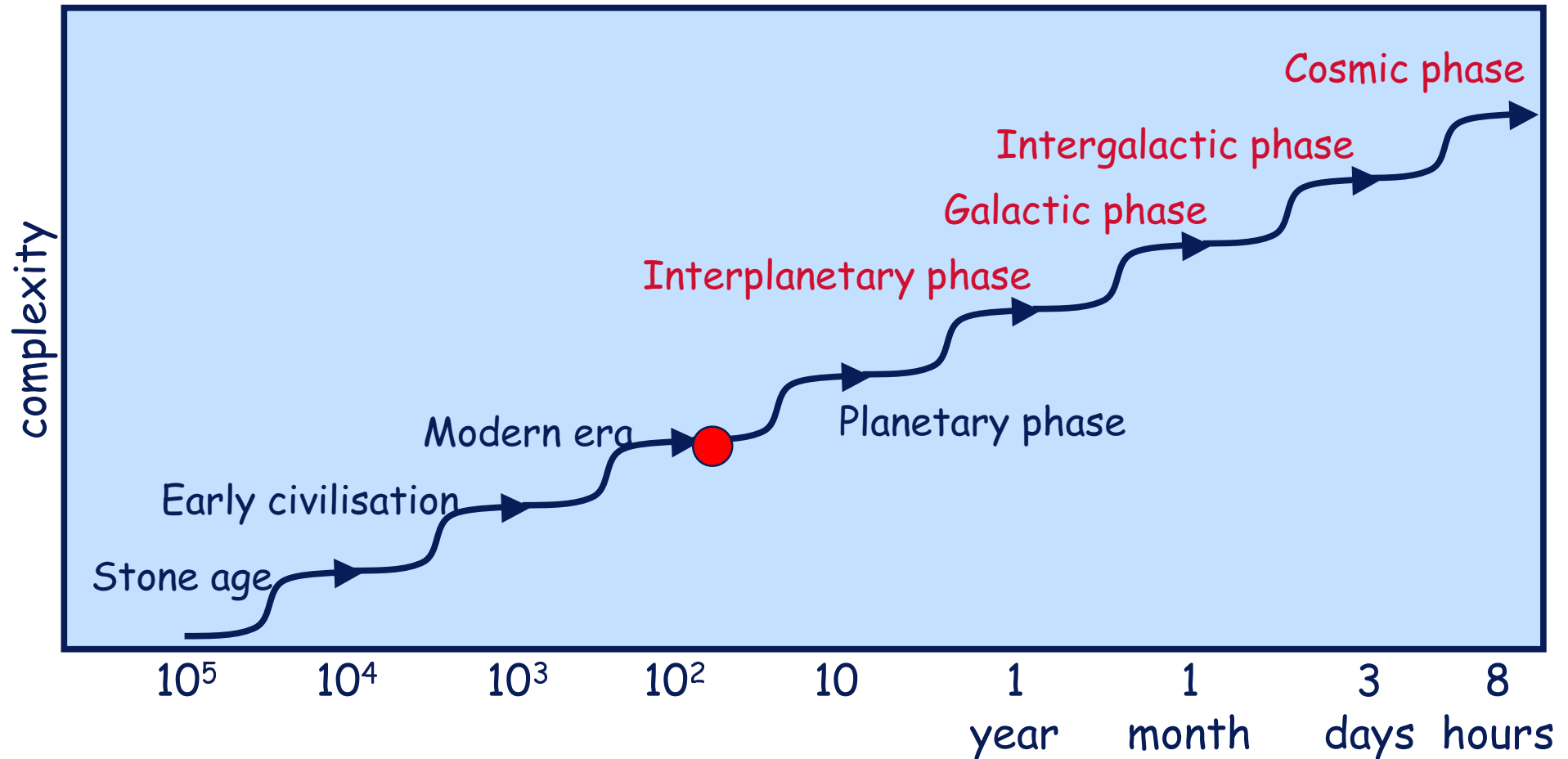


Characteristics of Historical Eras

	Stone Age	Early Civilization	Modern Era	Planetary Phase
Organization:	Tribe/village	City-state kingdom	Nation-state	Global governance
Economy:	Hunting and gathering	Settled agriculture	Industrial system	Globalization
Communications:	Language	Writing	Printing	Internet



The acceleration of history - extrapolated (with apologies to Raskin *et al.*, 2002)



Acceleration of history

Cosmic Phase reached at 3.30 a.m. on 3 Feb 2103 (Antecedent: James Ussher, 1654)



The basic scenario assumptions

- ✓ **Conventional Worlds** assume an evolution without major surprise, sharp discontinuity, or fundamental transformation in the basis of human civilization. The dominant forces and values currently driving globalization shape the future. Incremental market and policy adjustments are able to cope with social, economic and environmental problems as they arise.
- ✓ **Barbarization** foresees the possibilities that these problems are not managed. Instead, they cascade into self-amplifying crises that overwhelm the coping capacity of conventional institutions. Civilization descends into anarchy or tyranny.
- ✓ **Great Transitions** envisions profound historical transformations in fundamental societal values and organizing principles. New paradigms ascend that emphasize the quality of life and material sufficiency, human solidarity and global equity, and affinity with nature and environmental sustainability.



The basic scenario assumptions

conventional worlds

Breakdown, conflict and crises
 spiral out of control
 institutions collapse

Eco-communalism is a vision of bio-regionalism, localism, face-to-face democracy and economic autarky.

Policy Reform assumes that comprehensive and coordinated government action is initiated for poverty reduction and environmental sustainability.

Fortress World features an aggressive response to the threat of global environmental collapse as a result of climate change and resource depletion.

The **New Sustainability Paradigm** validates global solidarity, cultural cross-fertilization and economic connectedness while seeking a liberatory, humanistic and ecological transition.

market forces

In **Market Forces**, competitive, open and integrated global markets drive world development. Social and environmental concerns are secondary.











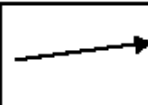
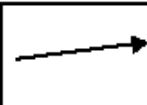
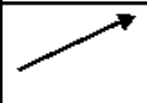
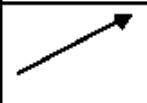
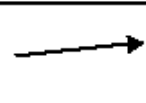
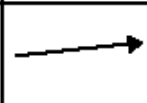
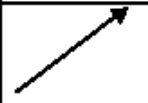
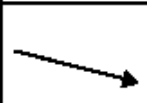
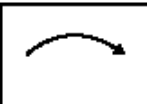


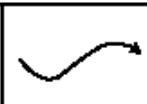


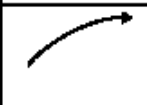
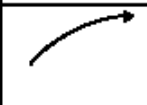


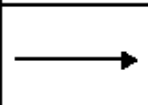




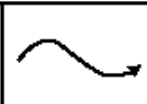
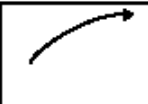
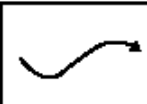
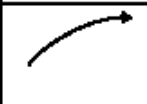
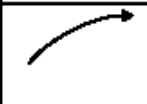
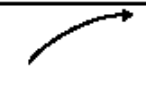



policy reform

fortress world

new sustainability



Scenario assumptions through time

Scenario	 Population	 Economy	 Environment	 Equity	 Technology	 Conflict
Conventional Worlds						
<i>Market Forces</i>						
<i>Policy Reform</i>						
Barbarization						
<i>Breakdown</i>						
<i>Fortress World</i>						
Great Transitions						
<i>Eco-Communalism</i>						
<i>New Sustainability Paradigm</i>						



Toward the New Sustainability Paradigm

Pushes

Anxiety about the future

Concern that policy adjustments are insufficient to avoid crises

Fear of loss of freedom and choice

Alienation from dominant culture

Stressful lifestyles

Pulls

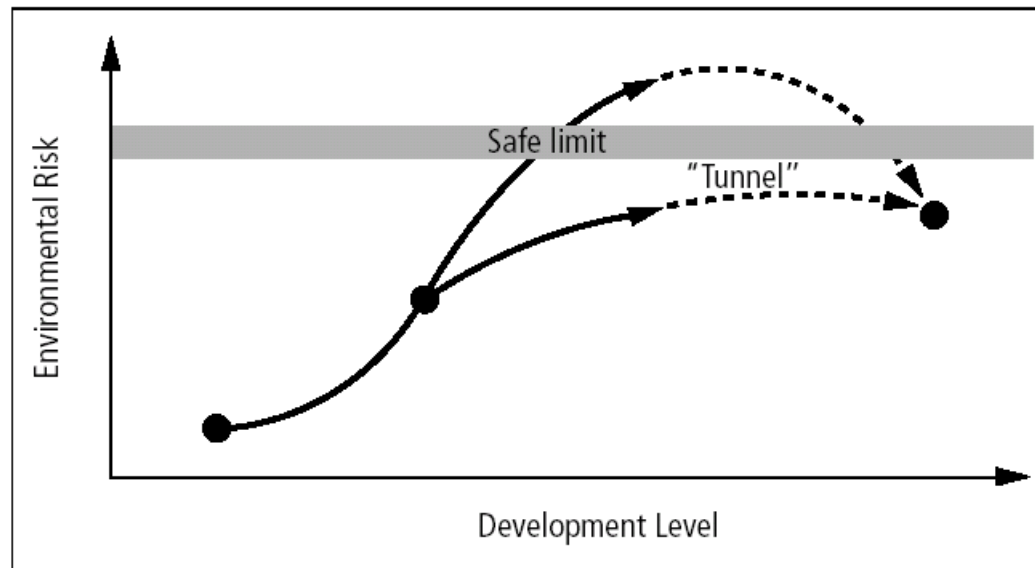
Promise of security and solidarity

Ethics of taking responsibility for others, nature and the future

Participation in community, political and cultural life

Pursuit of meaning and purpose

Time for personal endeavors and stronger connection to nature



Worldview of each scenario

	Antecedents	Philosophy	Motto
Conventional Worlds			
Market	Smith	Market optimism; hidden & enlightened hand	Don't worry, be happy
Policy Reform	Keynes & Brundtland	Policy stewardship	Growth, environment, equity through better technology & management
Barbarization			
Breakdown	Malthus	Existential gloom; population/resource catastrophe	The end is coming
Fortress World	Hobbes	Social chaos; nasty nature of man	Order through strong leaders
Great Transitions			
Eco-communalism	Morris & social utopians; Ghandhi	Pastoral romance; human goodness; evil of industrialism	Small is beautiful
New Sustainability Paradigm	Mill	Sustainability as progressive global social evolution	Human solidarity, new values, the art of living
Muddling Through			
	Your brother-in- law (probably)	No grand philosophies	Que será, será



A satellite view of the Earth, showing the Americas and surrounding oceans. The text is overlaid on the image.

Involving stakeholders in scenario development

Shell's scenario philosophy

- ✓ Scenarios are coherent and credible stories describing different paths that lead to alternative futures
- ✓ Scenarios provide a way of making sense of uncertainties and of challenging our assumptions about what the future holds
- ✓ The process of producing and using scenarios is as important as the scenario stories themselves and must involve stakeholders
- ✓ Building and using scenarios is about asking questions and not just providing answers



Shell's scenario planning approach

- ✓ The key idea was that it isn't possible to predict the future (*in fact, the idea that you could predict a future could lead to a fatal 'tunnel vision'*)
- ✓ The approach was to inquire broadly with stakeholders what was happening in the world and then to construct two or four scenarios about how things **might** turn out
- ✓ These scenarios about the world then became the basis for exploring different options for the company and deciding what to do.
- ✓ The emphasis was on building the capacity of the company (and stakeholders) to learn
- ✓ **Building and using scenarios is thus about asking questions and not just providing answers**



Shell's most recent scenarios

- ✓ *Business Class*, explores what happens when globalisation leads the world towards greater economic integration. The influence of national governments weakens, while businesses pursue *cutting-edge strategies* to increase competitiveness. Gas is '*the great game*' in energy because consumers want it for health and environmental reasons and the growth of fuel cells relies on it.
- ✓ *Prism* questions global integration and explores, instead, the pursuit of multiple solutions in a *new regionalism*. In these diverse environments, the *heart of business* is the ability to gain access and trust. Oil remains the dominant global fuel for several decades, supporting a *long oil game* and allowing successful energy companies to build a platform for transition to a post-oil world.



The Mont Fleur project in South Africa

- ✓ Mont Fleur was intended to influence the future of South Africa through the development of several scenarios about how things might unfold over the coming decades
- ✓ The project took place right in the middle of a complex period of many kinds of negotiations about how to make the transition away from apartheid
- ✓ The Mont Fleur work was done by a team of leaders drawn from organizations that ranged across the political map: community activists, conservative politicians, ANC officials, trade unionists, academics, establishment economists, top corporate executives

Adam Kahane, Generon



The Mont Fleur scenarios

- ✓ *Ostrich* was a story of the white government believing that it could avoid a negotiated settlement with the black majority, burying its head in the sand, and thereby making matters worse in the end
- ✓ *Lame Duck* told the story of a prolonged transition where the new government is hobbled by compromises built into the constitution and, because "it purports to respond to all but satisfies none", it doesn't address the country's problems
- ✓ *Icarus* described a strong black majority government coming to power on a wave of popular support and embarking on a huge, unsustainable public spending spree that crashes the economy
- ✓ *Flight of the Flamingos* was a story about how the new government could avoid the pitfalls of the first three scenarios and gradually rebuild a successful economy



One of the reasons the future is unpredictable is because we can influence it!

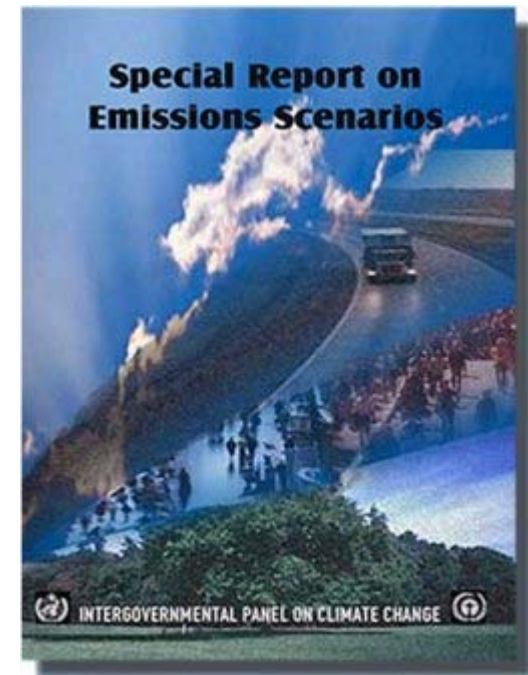




**The IPCC scenarios,
simulated with IMAGE 2**

The IPCC mandate for the Special Report on Emission Scenarios (SRES)

- ✓ Review existing emission scenarios
- ✓ Update and improve the IPCC scenarios from 1992 by involving a large expert community
- ✓ Develop a set of scenarios that do not consider specific climate policies
- ✓ Enhance the applicability of the scenarios for the user community
- ✓ Conduct a thorough expert and government review

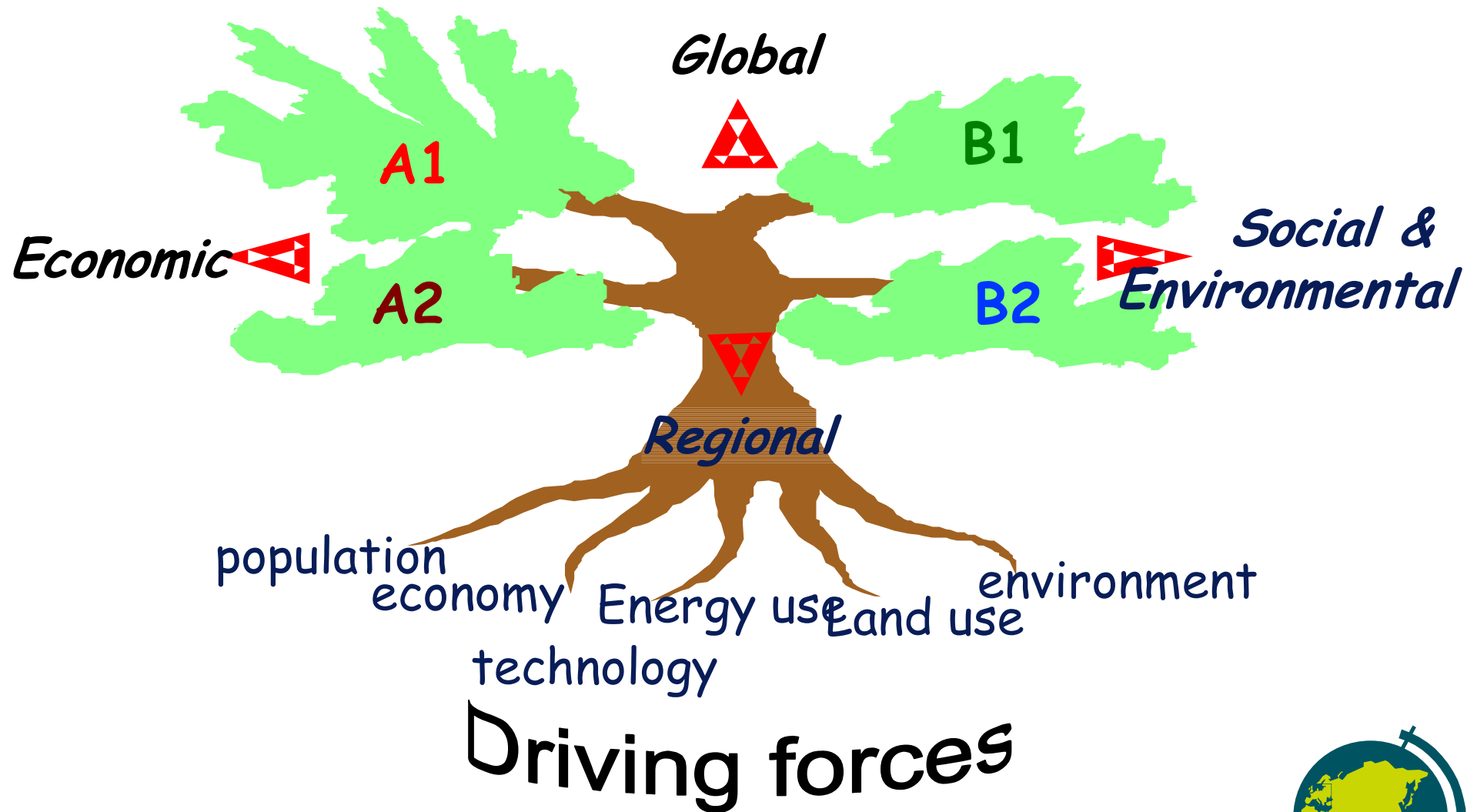


The reasons to develop storylines for IPCC-SRES

- ✓ to add coherency about the complex interplay between driving forces within and across scenarios
- ✓ to make it easier to explain the scenarios to the various user communities
- ✓ to make the scenarios more valuable, in particular to assess a system's vulnerability
- ✓ to provide a guide for additional assumptions to be made in detailed climate impact and mitigation analyses



IPCC-SRES reference scenarios



The A1 scenario 'Economic Golden Age'

- Globalization
- Stabilizing population
- Very high economic growth rate
- Orientation on profits and opportunities
- Rapid diffusion of technology; no trade barriers



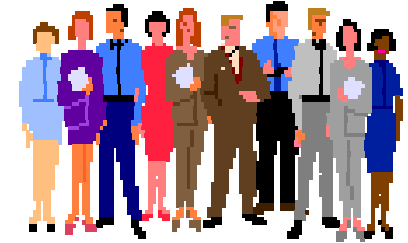
Energy system dynamics:

- Innovations and high capital turnover
- preference for clean fuels
- more efficiency and zero-carbon options



The A2 scenario 'Cultural diversity'

- Focus on regional identity; environment low priority
- Population keeps growing: low income growth slows down demographic transition
- Trade barriers; No regional income convergence; slow diffusion of technology



Energy system dynamics:

- coal use rises in many regions
- oil and gas expensive or not available everywhere
- low rate of innovations; slow transition to zero-carbon options



The B1 scenario 'Sustainable Development'

- Globalization; high-growth, high-tech
- Stabilizing population
- Orientation on sustainable development; non-material quality of life
- International cooperation and diffusion of resource-efficient technology



Energy system dynamics

- energy efficiency and sufficiency
- large preference for clean fuels
- learning-by-doing
- rapid transitions



The B2 scenario 'Regional solutions'

- Population keeps growing: low income growth slows down demographic transition
- Focus on regional identity; environment high priority: Local solutions
- Modest diffusion of technology; trade barriers

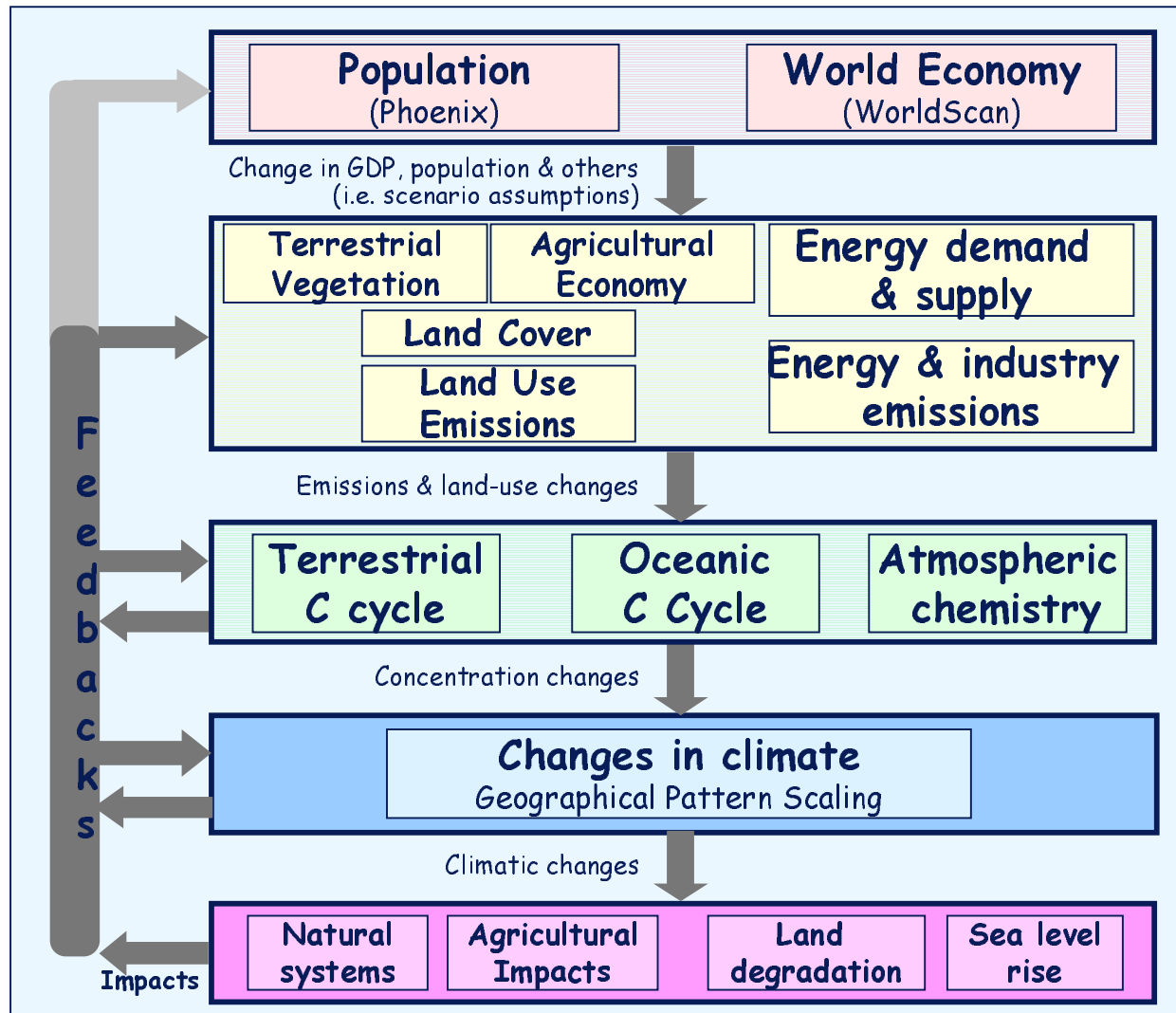


Energy system dynamics:

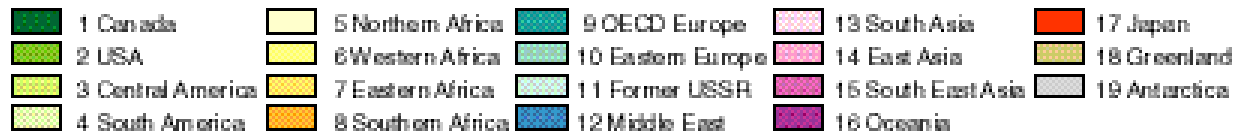
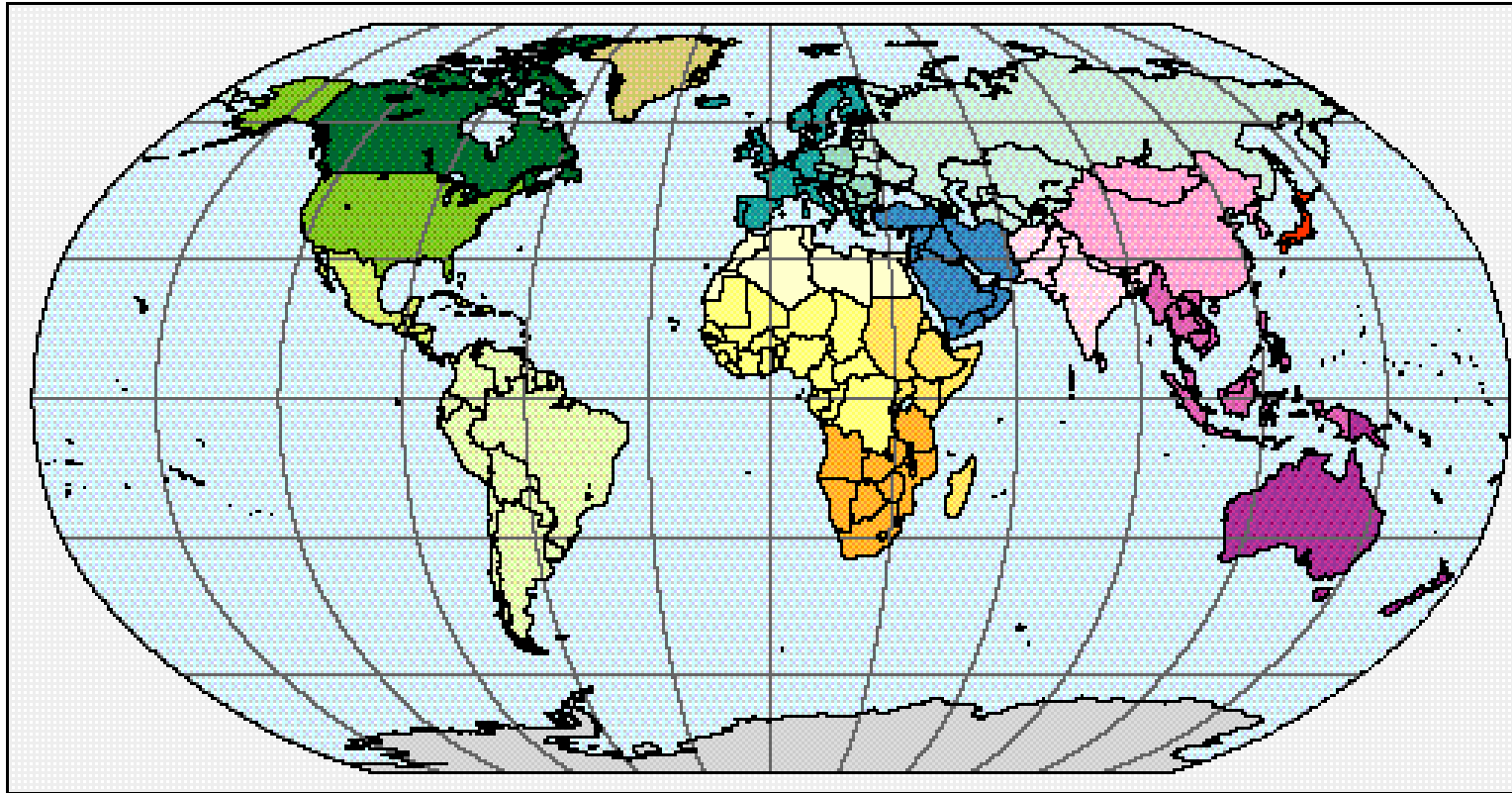
- modest rate of energy efficiency
- in several regions clean coal use
- others solar/wind, other fossil fuels or hydro
- slow transitions



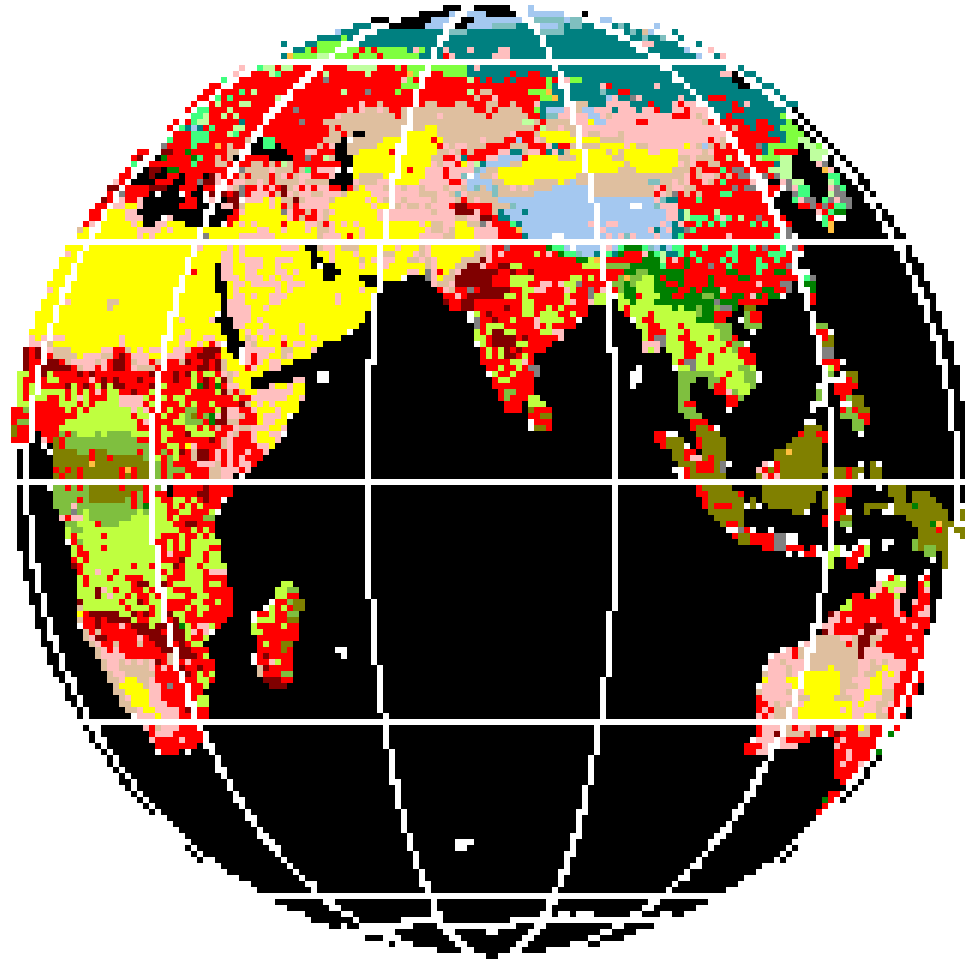
Structure of IMAGE 2.2

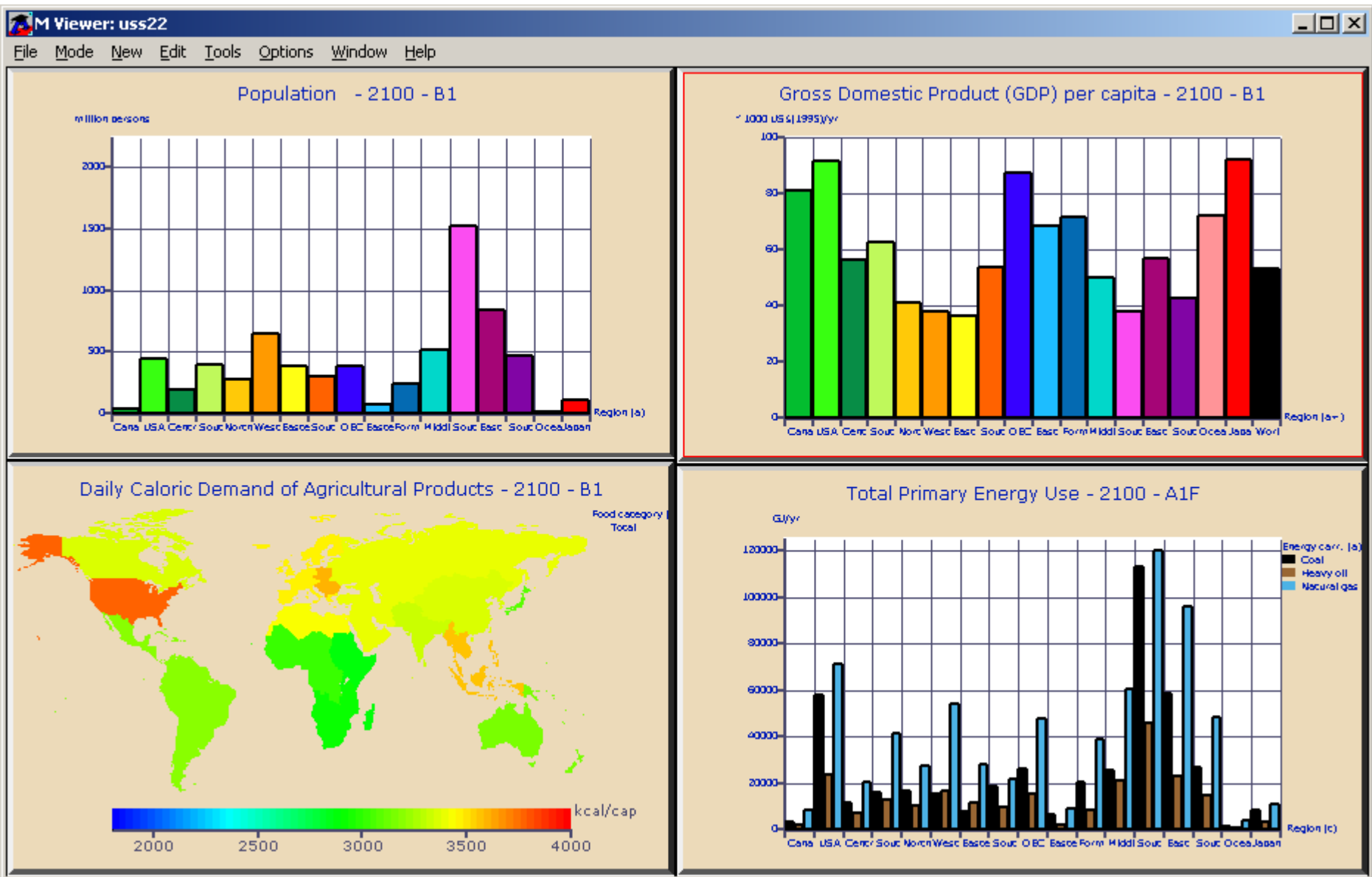


Regional resolution for socio-economic aspects



0.5x0.5° grid resolution for environmental factors

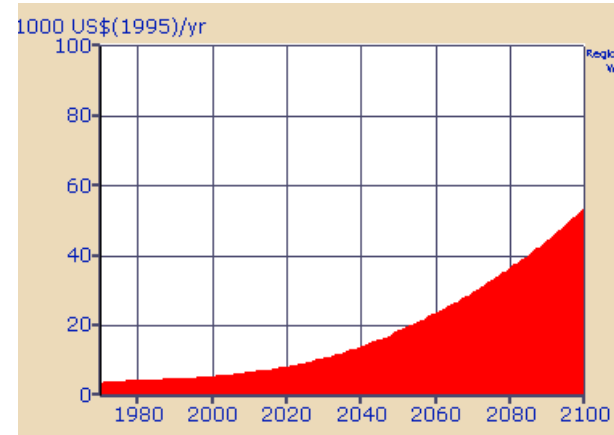
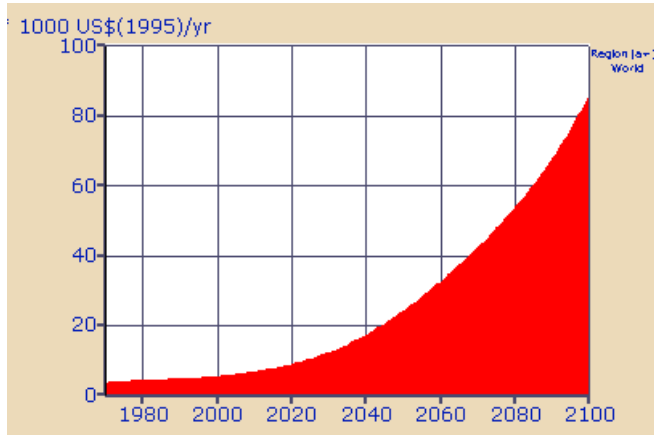




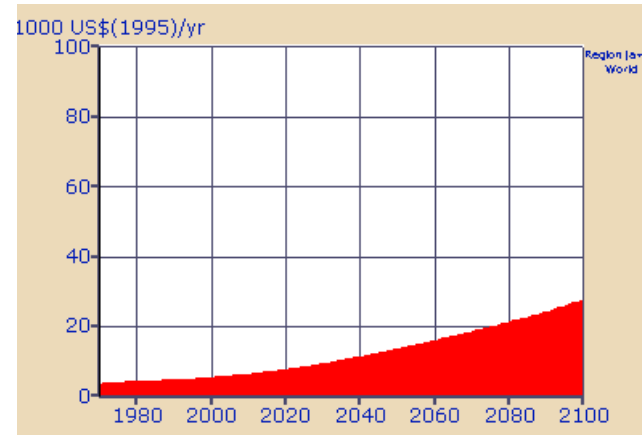
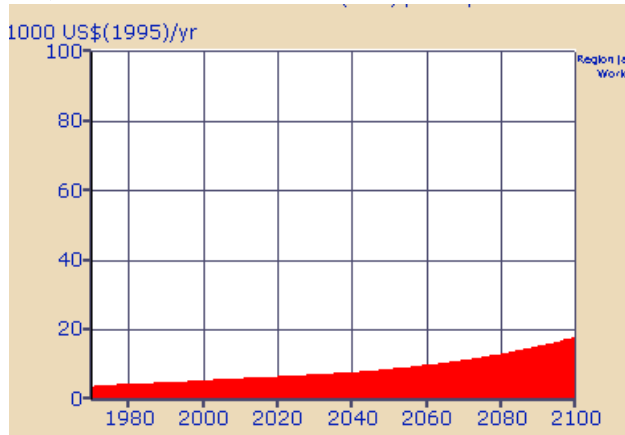
The IPCC scenarios: economy

Complete globalisation

Emphasis on material wealth



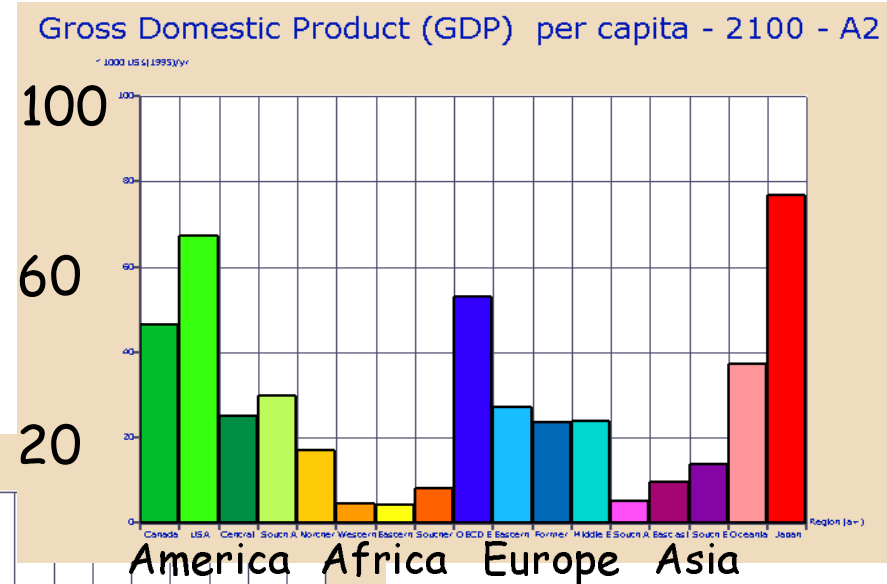
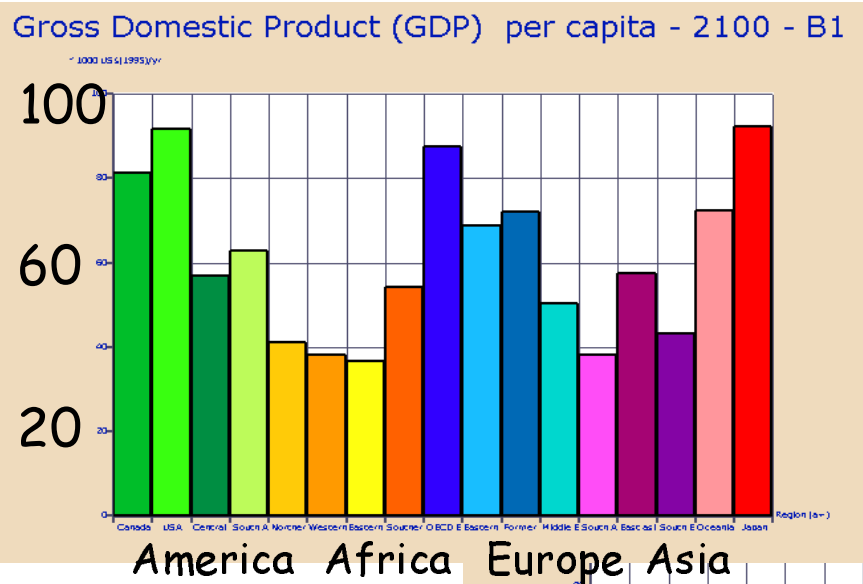
Emphasis on sustainability and equity



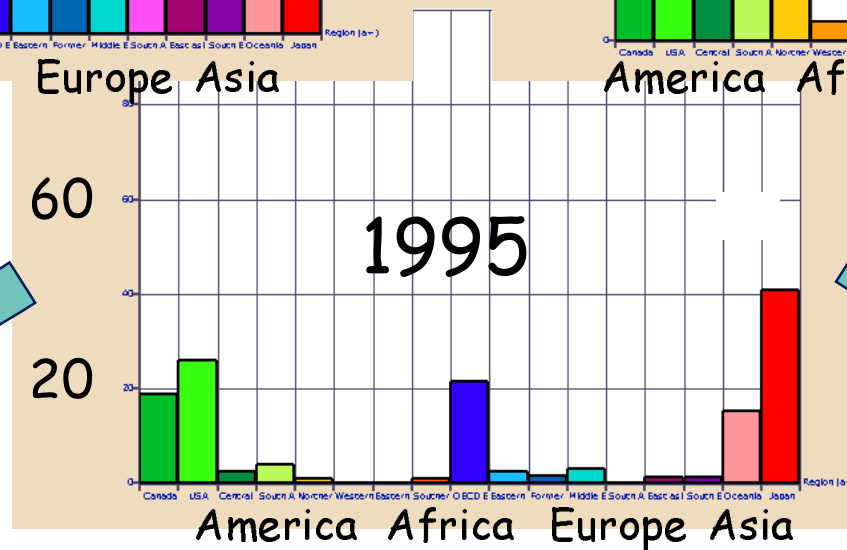
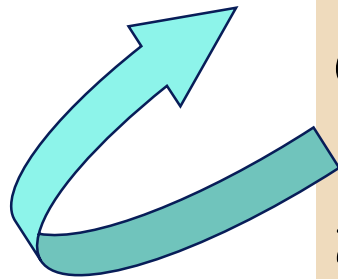
Strong regionalisation



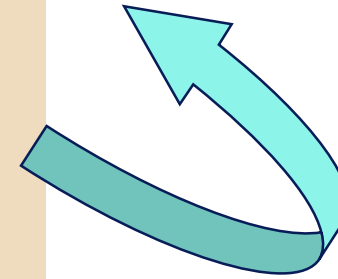
An important global issue: Income convergence



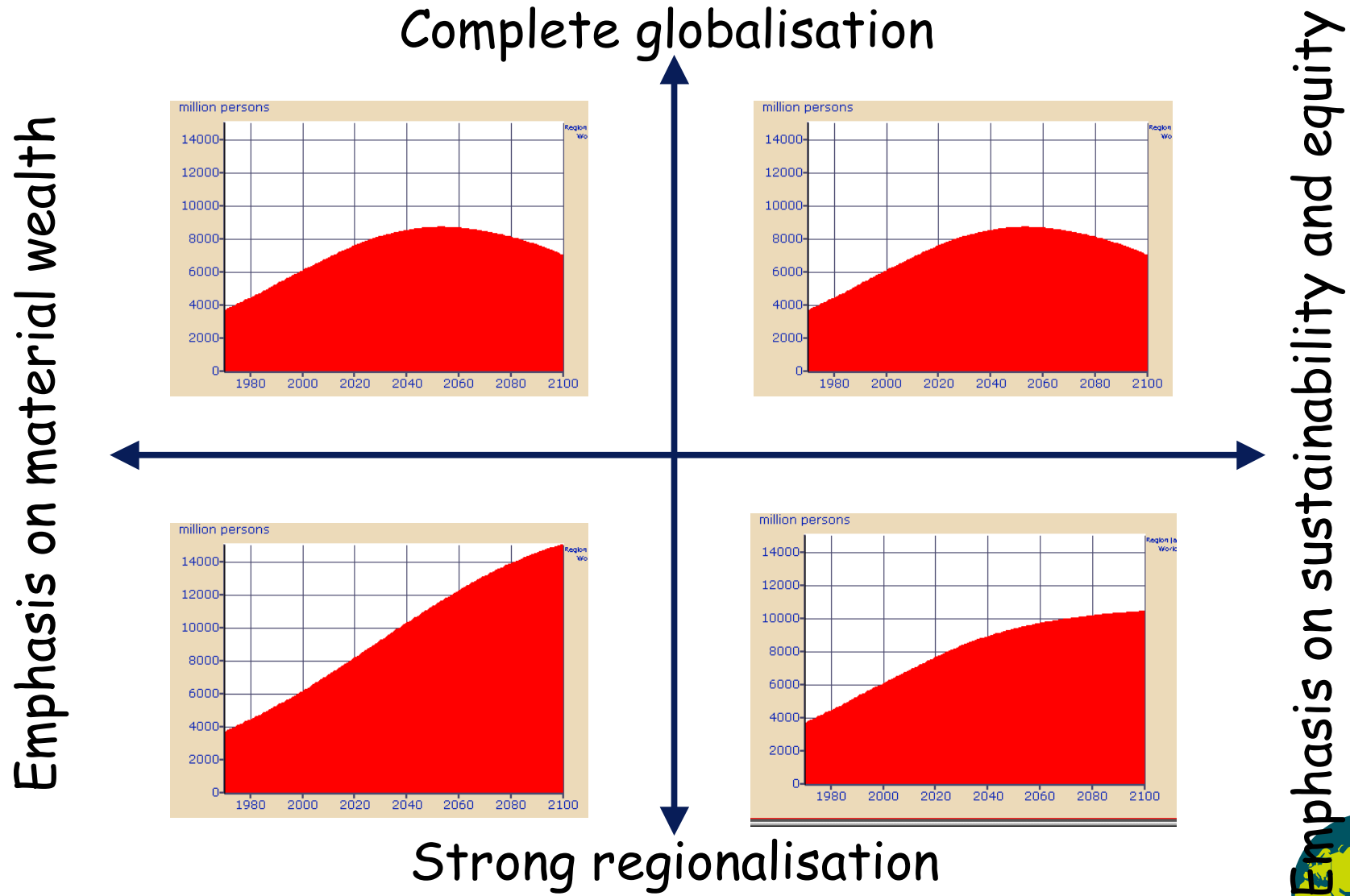
B1



A2



The IPCC scenarios: population

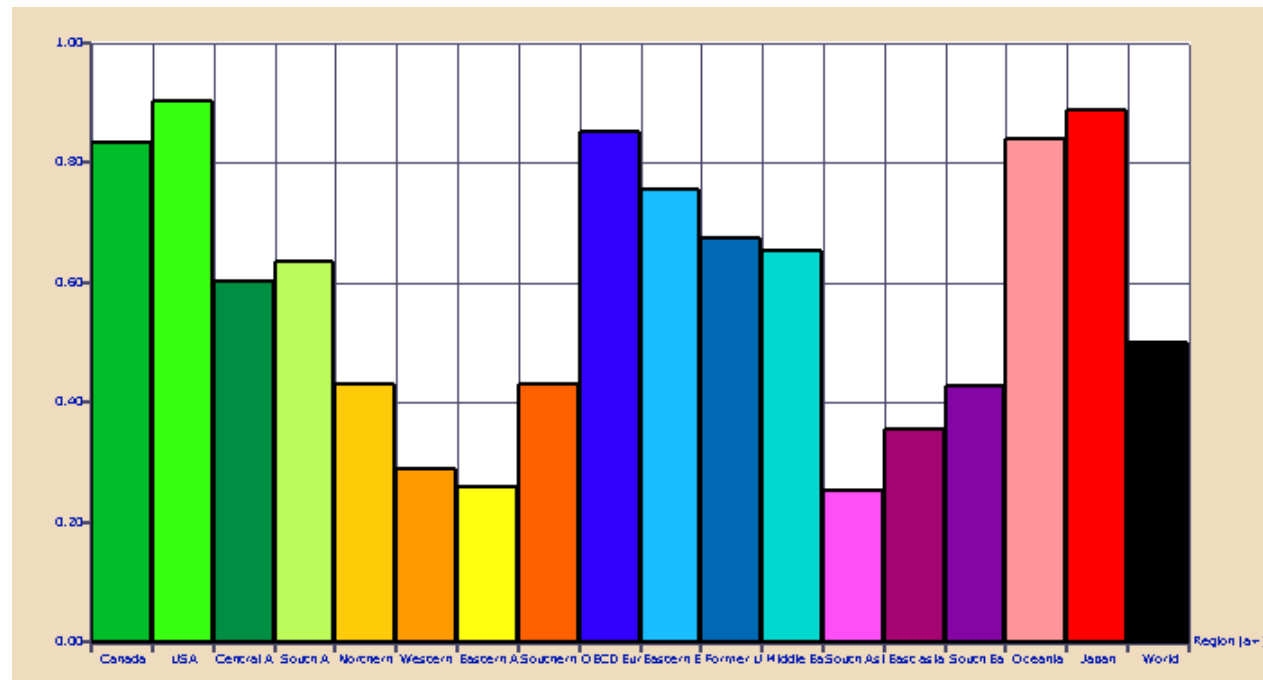


Human Development Index

The human development index (UNDP) represents the level of development

The HDI contains the following three dimensions:

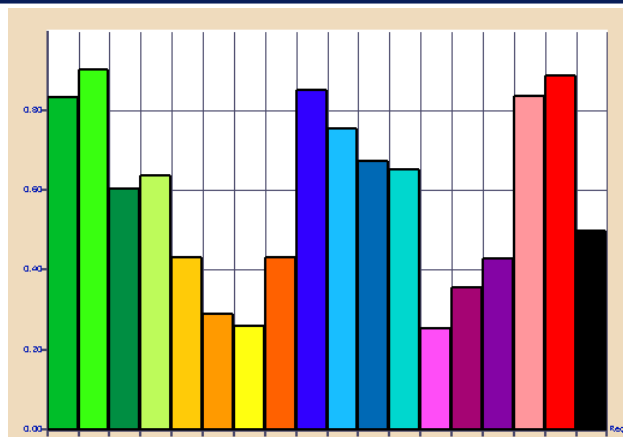
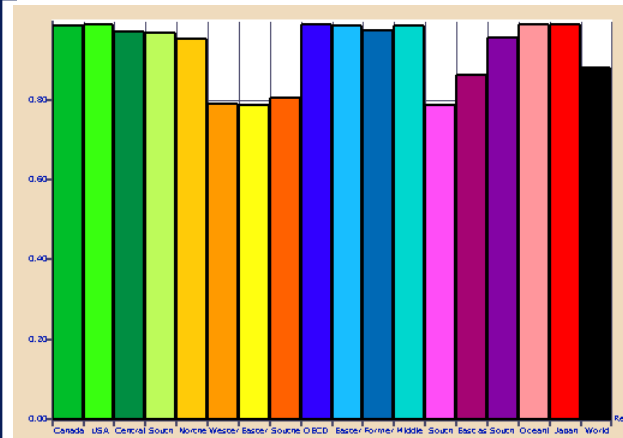
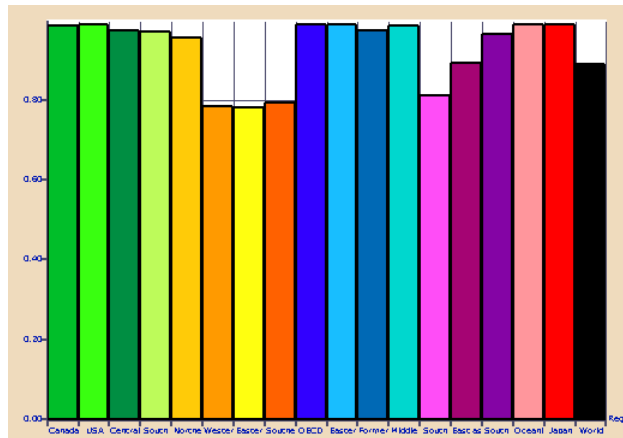
- ✓ life expectancy at birth, representing a long and healthy life
- ✓ educational attainment, representing knowledge
- ✓ real gross domestic product (GDP in purchasing power parity, PPP dollars). This represents a decent standard of living ([UNDP, 1995](#)).



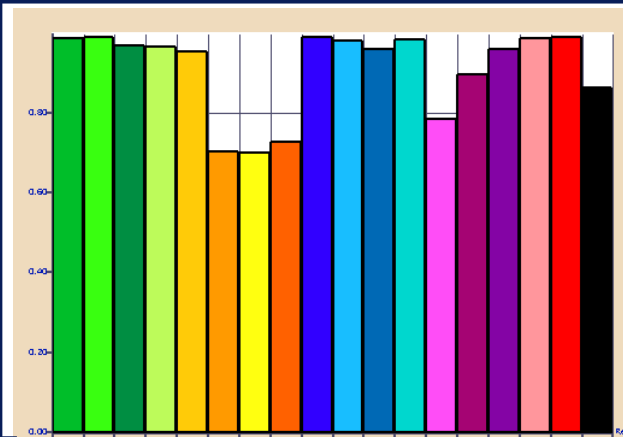
The IPCC scenarios: HDI

Emphasis on material wealth

Complete globalisation



Strong regionalisation



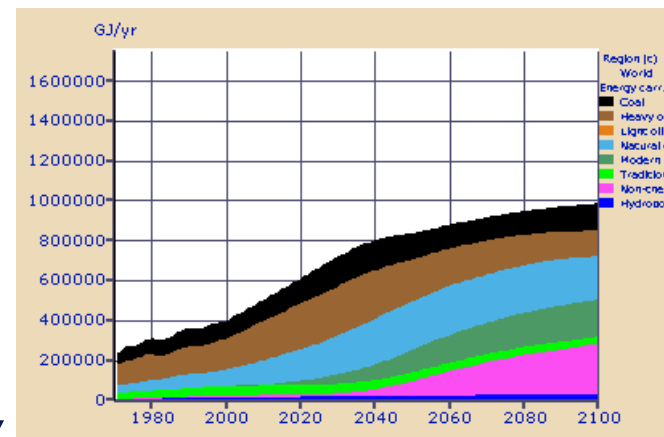
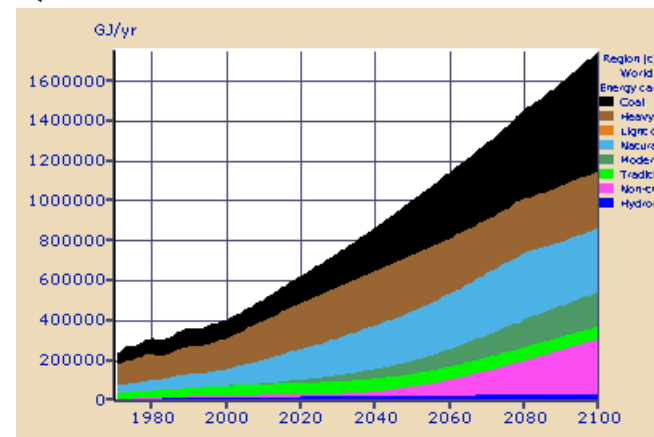
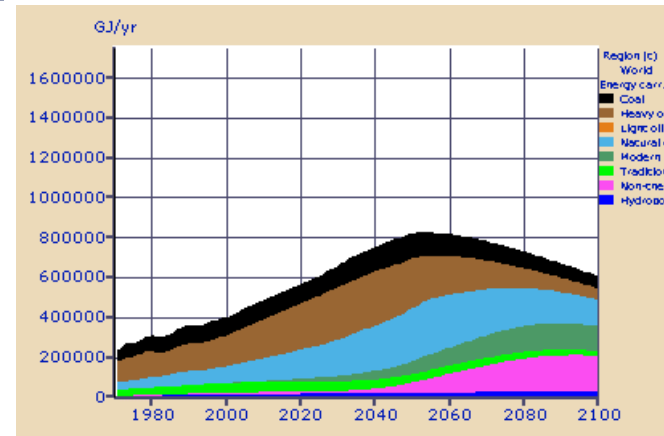
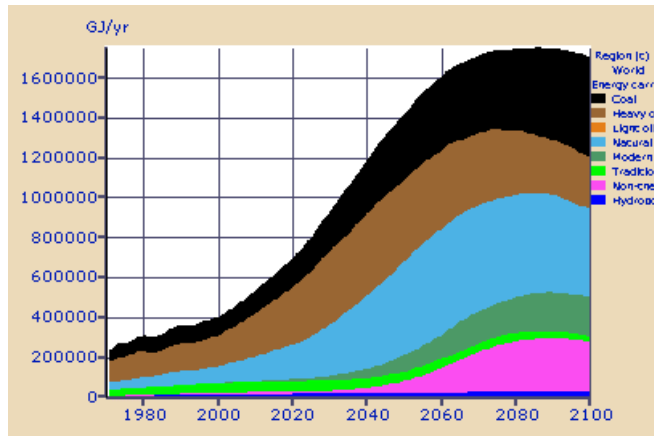
Emphasis on sustainability and equity



The IPCC scenarios: energy use

Complete globalisation

Emphasis on material wealth

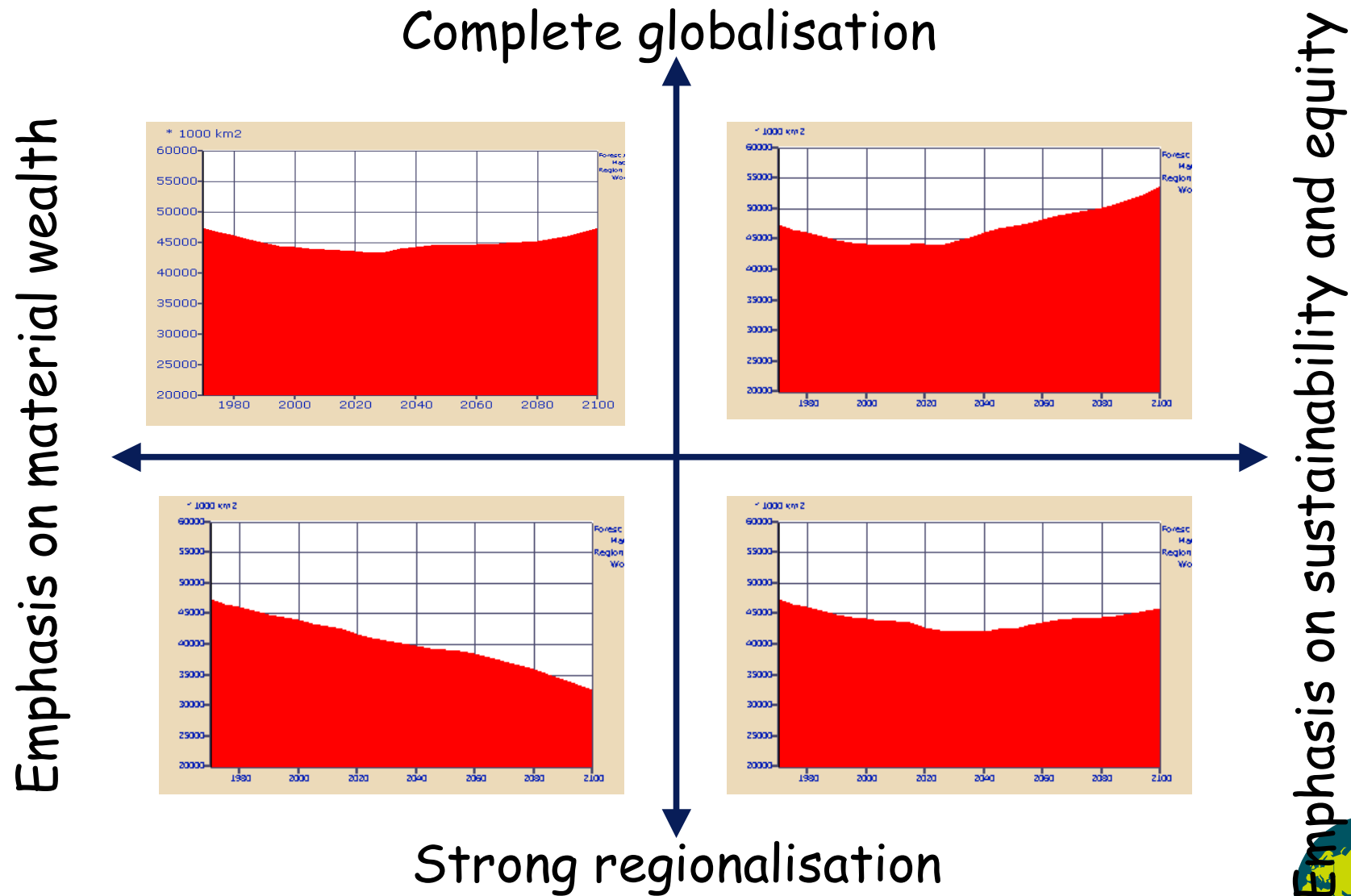


Strong regionalisation

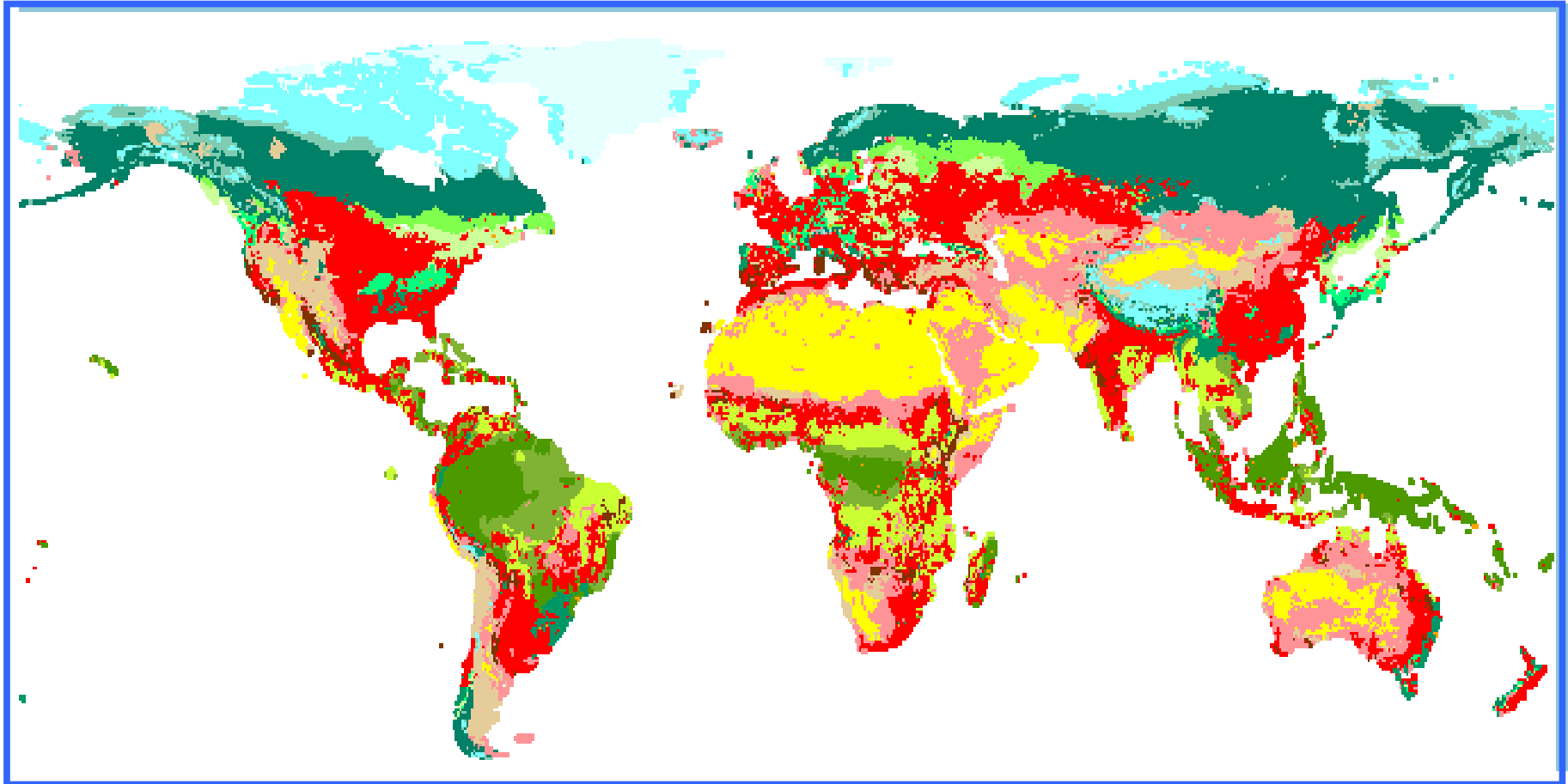
Emphasis on sustainability and equity



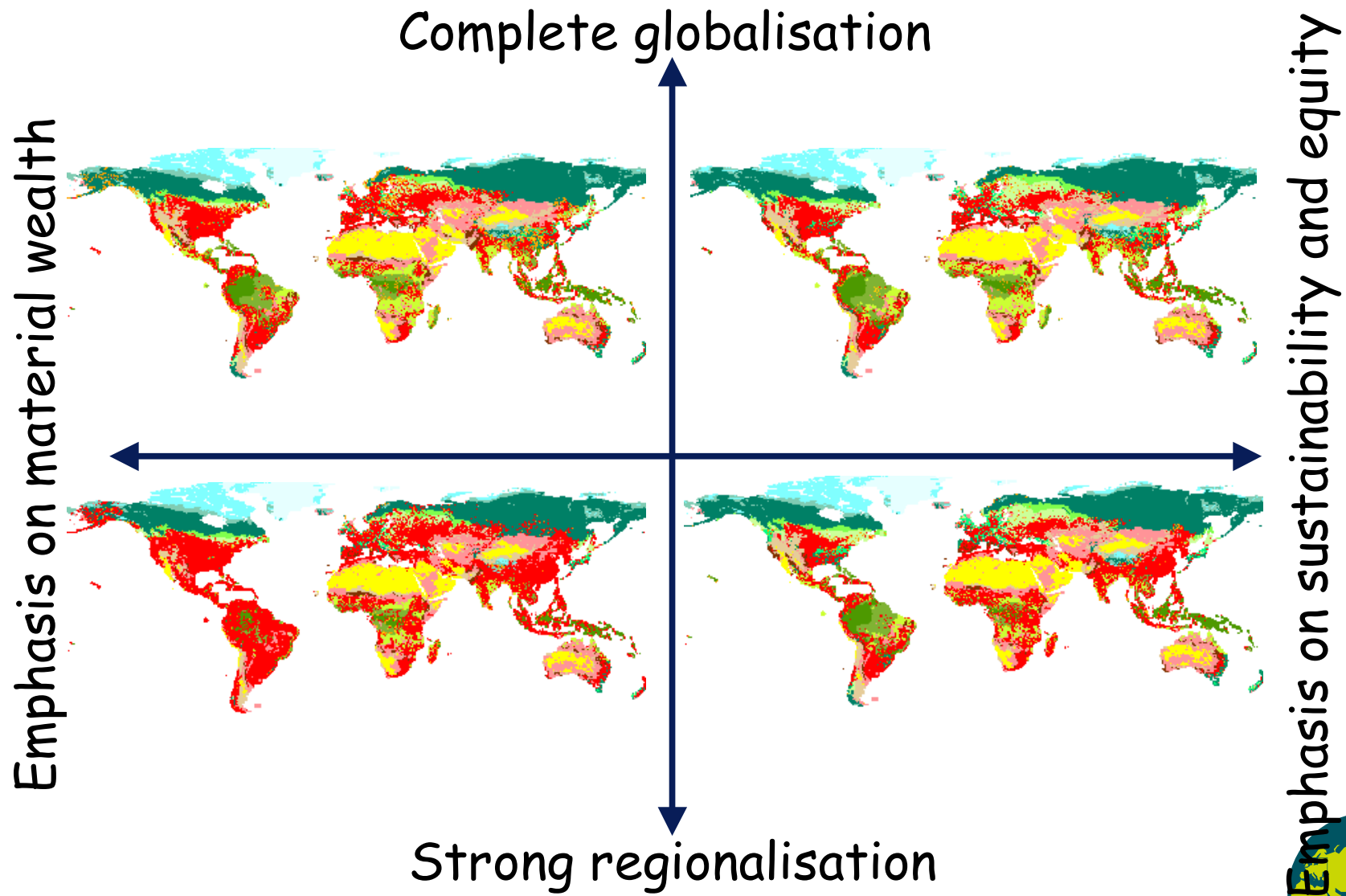
The IPCC scenarios: forest area



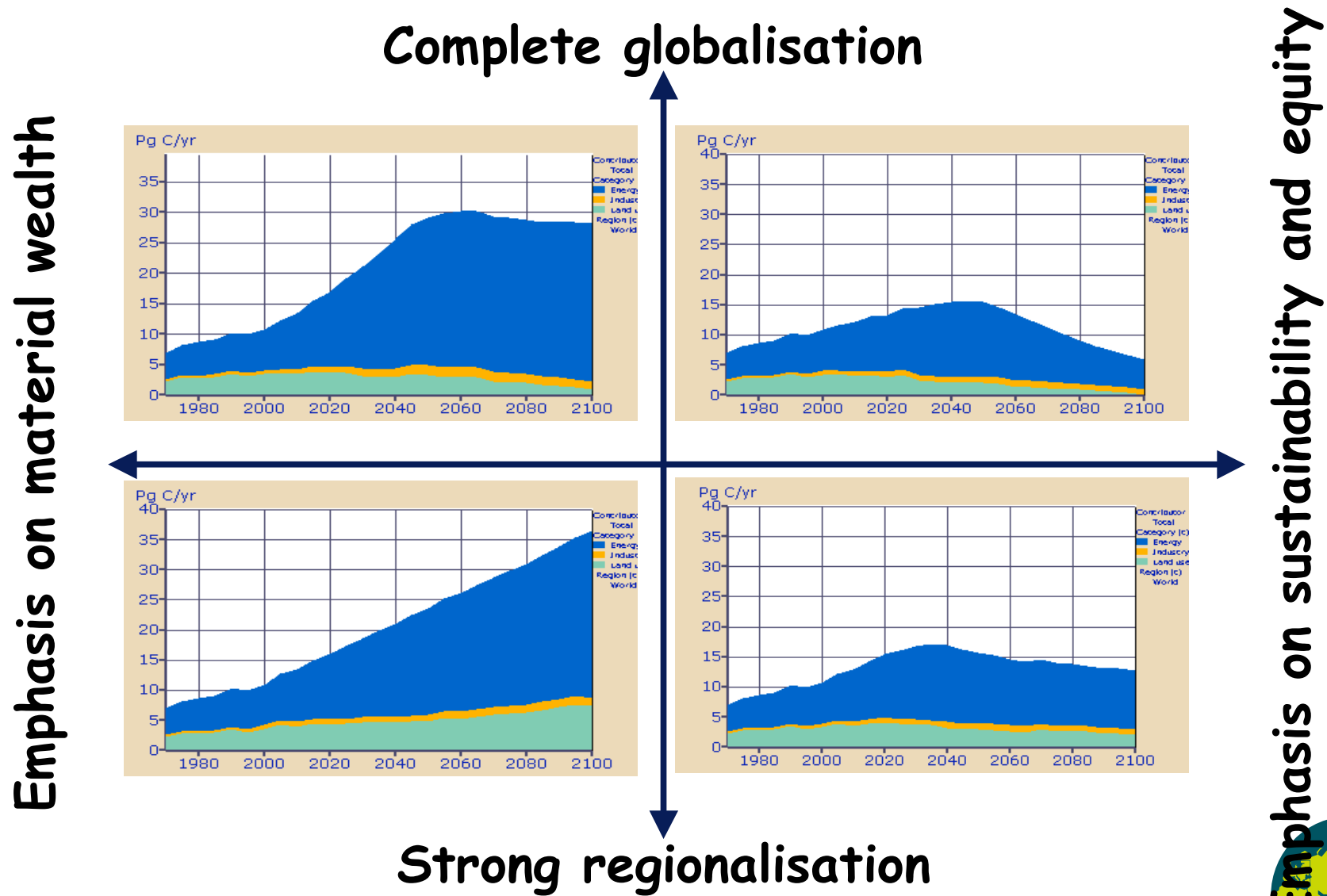
Current land-use and land-cover patterns



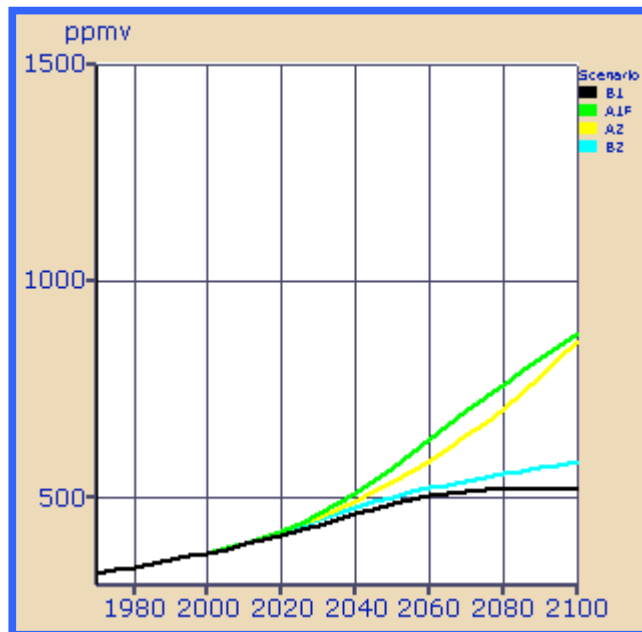
The IPCC scenarios: land cover in 2100



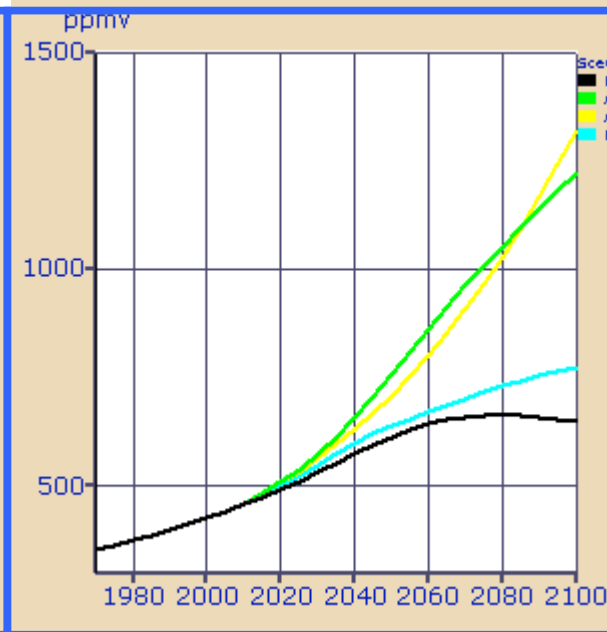
The IPCC scenarios: GHG emissions



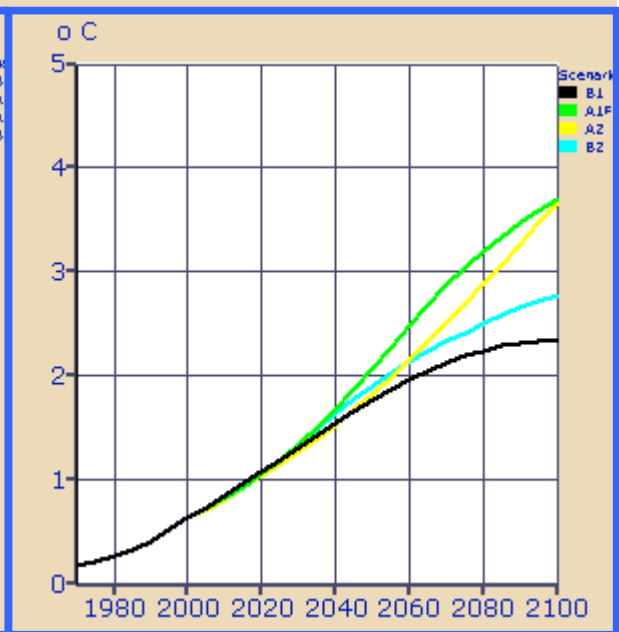
Atmospheric change in the scenarios



CO₂ concentrations



Concentrations of all greenhouse gasses



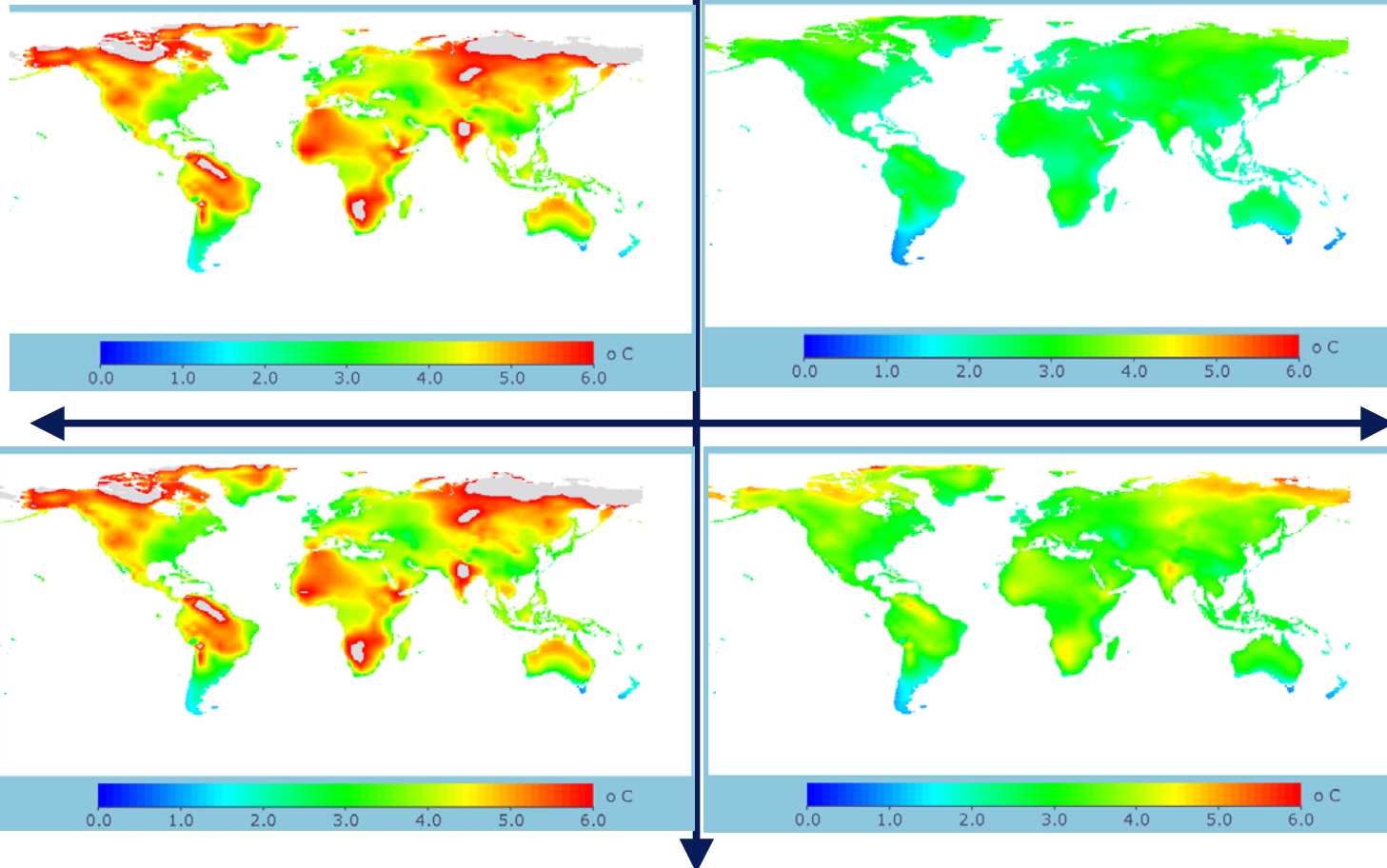
Global temperature



Temperature change

Complete globalisation

Emphasis on material wealth



Strong regionalisation

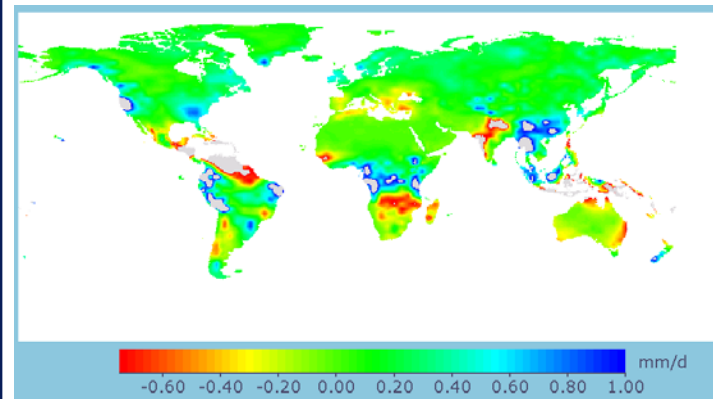
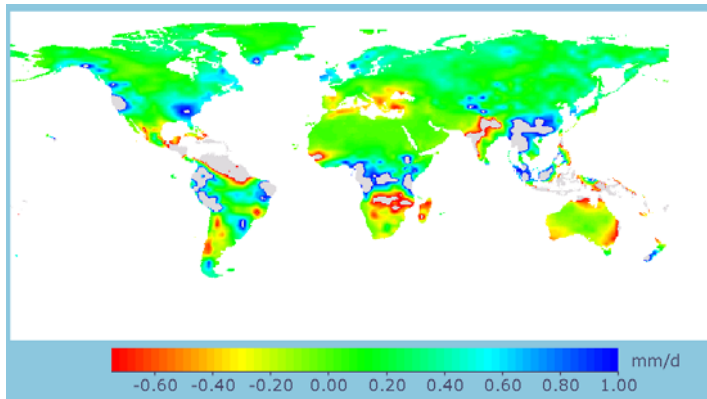
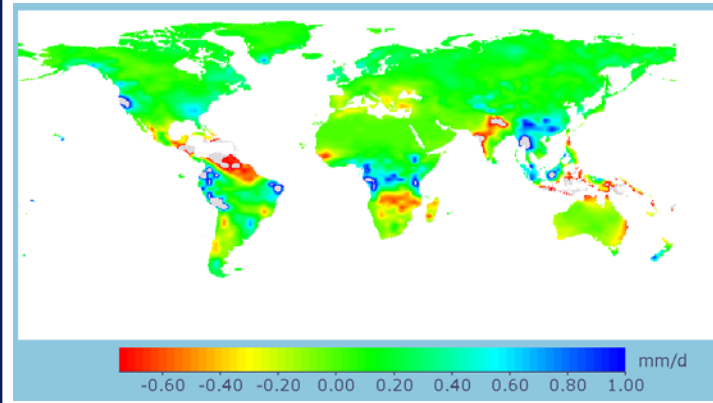
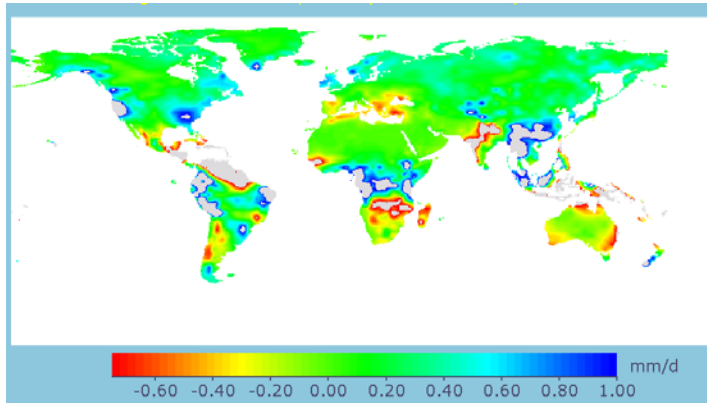
Emphasis on sustainability and equity



Precipitation change

Complete globalisation

Emphasis on material wealth



Strong regionalisation

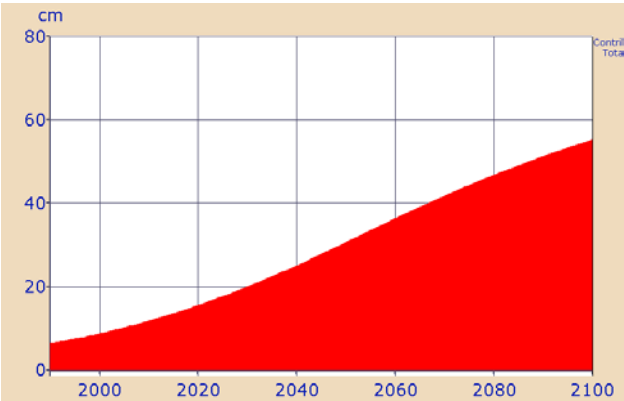
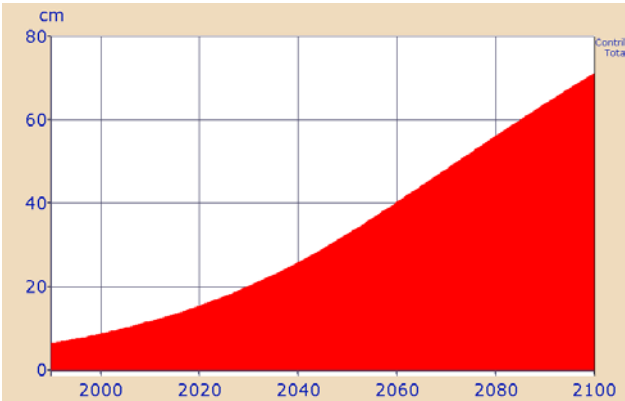
Emphasis on sustainability and equity



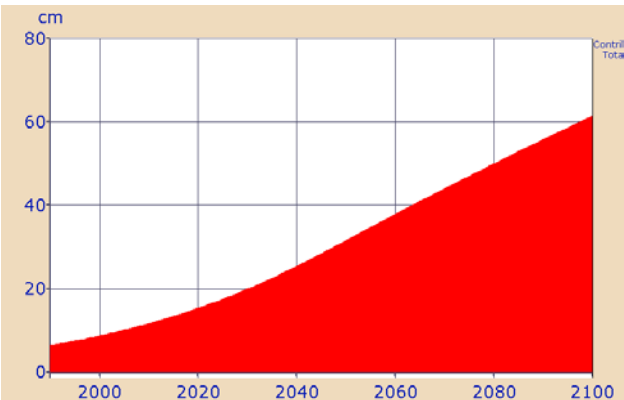
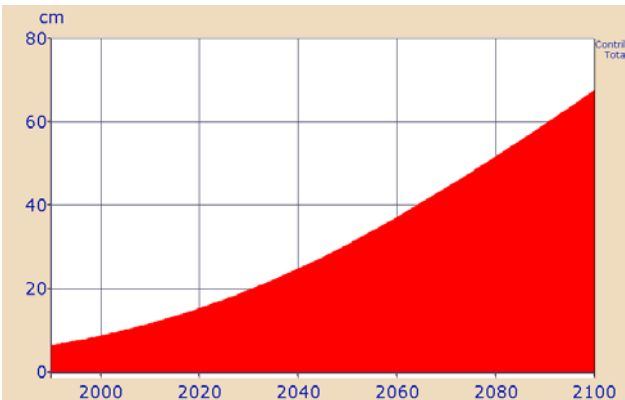
Sea-level rise

Complete globalisation

Emphasis on material wealth



Emphasis on sustainability and equity



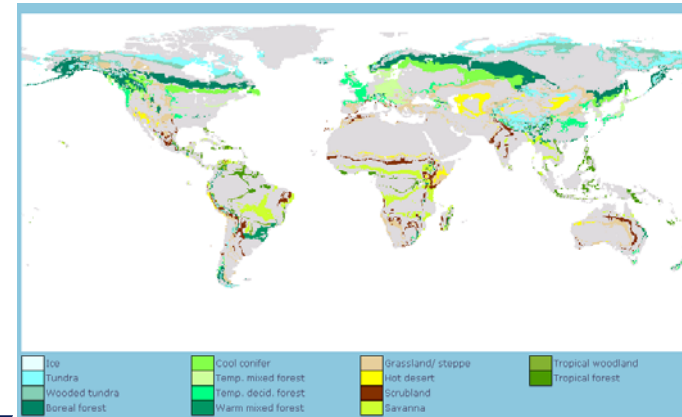
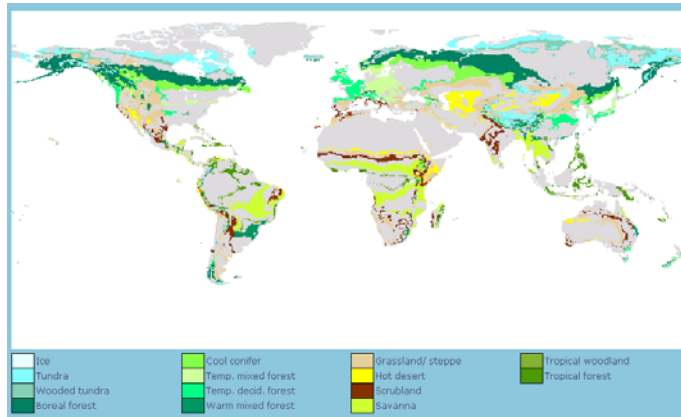
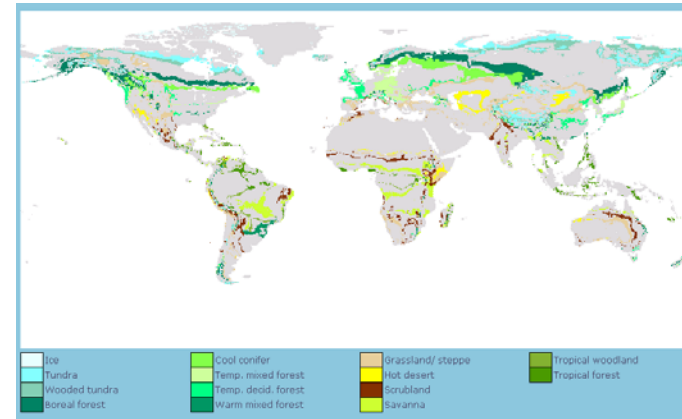
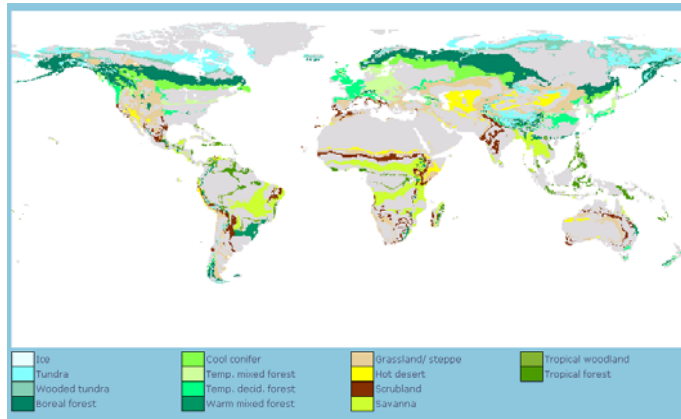
Strong regionalisation



Shifts in ecosystems

Complete globalisation

Emphasis on material wealth

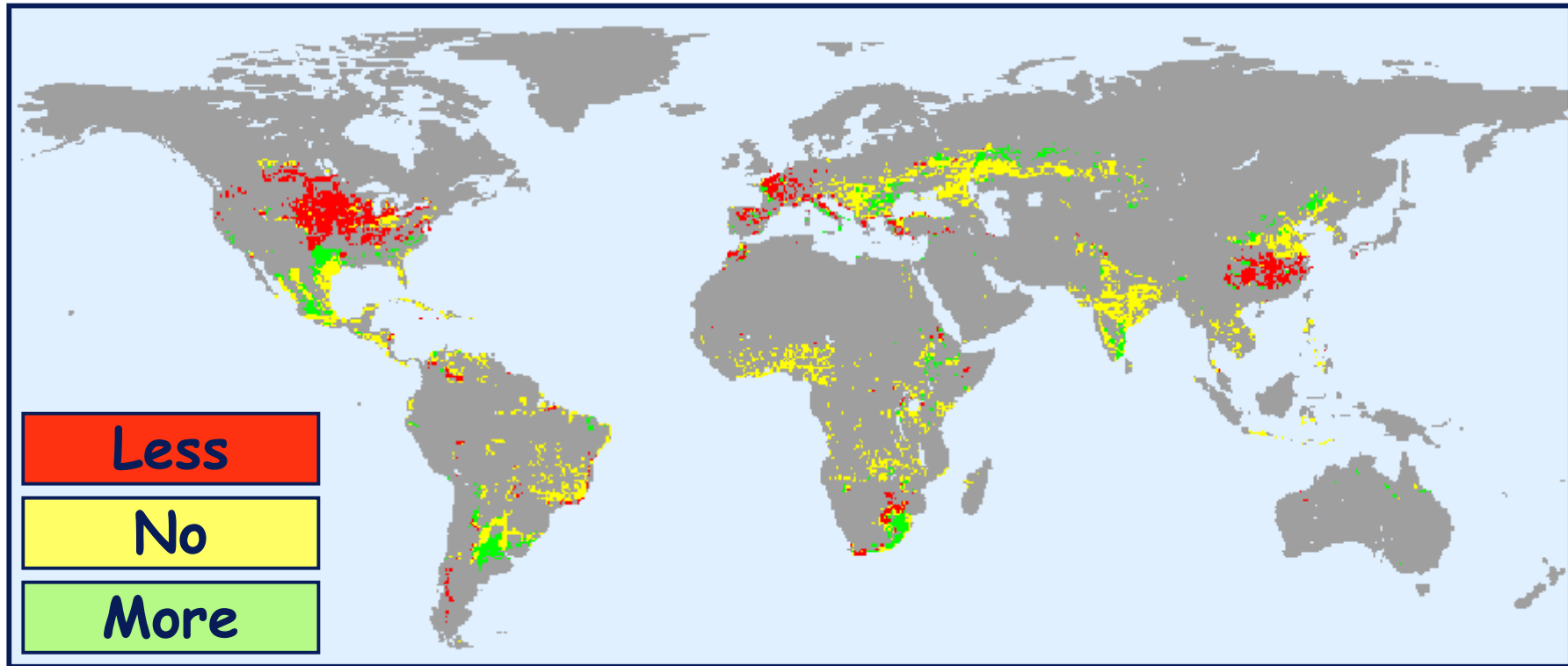


Strong regionalisation

Emphasis on sustainability and equity



Impact on the yield of corn



The regional yield can change: some regions improve while others decline (mainly driven by drought)



UNEP's Global Environmental Outlook (GEO)



1. Markets First
2. Policy First
3. Sustainability First
4. Security First



UNEP's GEO scenarios

- ✓ Based on experiences from SRES and the Global Scenario Group
- ✓ qualitative narratives take centre stage with the quantitative tools playing a supporting role. *GEO is a tale of 'four futures'*
- ✓ 17 Regional consultations to interpret the scenario narratives (Africa; Asia and the Pacific; Europe; Latin America and the Caribbean; North America; West Asia & the Polar Regions)
- ✓ IMAGE 2, AIM, Polestar and GLOBIO used to illustrate the quantification of these scenarios
- ✓ Publication includes 50 pages with regional presentation of the narratives and only 30 pages with graphs, tables and maps



Environmental Impacts

Markets First 2032



Policy First 2032



Security First 2032



Sustainability First 2032



Potential increase in nitrogen loading on coastal ecosystems

	North America	Latin America and the Caribbean	Africa	Europe and Central Asia (without Turkey)	West Asia (with Iran and Turkey)	Asia and the Pacific (without Iran)
Markets First	●●	●●●●	●●	●●	●●●●	●●●●
Policy First	●	●●●●	●●	●	●	●●●●
Security First	●	●●●	●	●	●●	●●
Sustainability First	●	●	●	●	●	●●

Expected increase by 2032 ● small ●● large ●●● very large



The GEO Narratives: Markets First

- ✓ Most of the world adopts the values and expectations prevailing in today's industrialized countries.
- ✓ The wealth of nations and market forces dominate social and political agendas.
- ✓ Trust is placed in further globalisation and liberalization to enhance corporate wealth, create new enterprises and livelihoods, and so help people and communities to afford to insure against social and environmental problems.
- ✓ Ethical investors, together with citizen and consumer groups, try to exercise growing corrective influence but are undermined by economic imperatives.
- ✓ The powers of state officials, planners and lawmakers to regulate society, economy and the environment continue to be overwhelmed by expanding demands.



The GEO Narratives: Policy First

- ✓ Decisive initiatives are taken by governments in an attempt to reach specific social and environmental goals.
- ✓ A coordinated pro-environment and anti-poverty drive balances the momentum for economic development at any cost.
- ✓ Environmental and social costs and gains are factored into policy measures, regulatory frameworks and planning processes. All these are reinforced by fiscal levers or incentives such as carbon taxes and tax breaks.
- ✓ International 'soft law' treaties and binding instruments affecting environment and development are integrated into unified blueprints and their status in law is upgraded, though fresh provision is made for open consultation processes to allow for regional and local variants.



The GEO Narratives: Sustainability First

- ✓ **Sustainability First** assumes a world of striking disparities where inequality and conflict prevail.
- ✓ Socio-economic and environmental stresses give rise to waves of protest and counteraction.
- ✓ As such troubles become increasingly prevalent, the more powerful and wealthy groups focus on self-protection, creating enclaves akin to the present day 'gated communities'.
- ✓ Such islands of advantage provide a degree of enhanced security and economic benefits for dependent communities in their immediate surroundings but they exclude the disadvantaged mass of outsiders.
- ✓ Welfare and regulatory services fall into disuse but market forces continue to operate outside the walls.



The GEO Narratives: Security First

- ✓ A new environment and development paradigm emerges in response to the challenge of sustainability, supported by new, more equitable values and institutions.
- ✓ A more visionary state of affairs prevails, where radical shifts in the way people interact with one another and with the world around them stimulate and support sustainable policy measures and accountable corporate behaviour.
- ✓ There is much fuller collaboration between governments, citizens and other stakeholder groups in decision-making on issues of close common concern.
- ✓ A consensus is reached on what needs to be done to satisfy basic needs and realize personal goals without beggaring others or spoiling the outlook for posterity.



Lessons for the future (1/2)

- ✓ Contrasting yet plausible stories can be told for how the world and its regions will develop in the next 30 years; each has fundamentally different implications for the environment.
- ✓ There can be significant delays between human actions, including policy decisions, and associated impacts on the environment.
- ✓ Achieving widely agreed environmental and social goals will require dramatic and coordinated action starting now and continuing for a number of years. Steps must include policies based on prevention and adaptation.
- ✓ Important linkages exist between different environmental issues and between environmental and broader social issues.



Lessons for the future (2/2)

- ✓ The establishment of strong institutions for environmental governance is a prerequisite for almost all other policies.
- ✓ Ensuring timely access to accurate information is a robust policy, as it:
 - ✓ allows for early warning of environmental problems
 - ✓ can stimulate voluntary action by business and industry
 - ✓ can support formal and informal market-based mechanisms that promote good environmental conduct.
- ✓ Not all policy instruments are appropriate for all situations.
- ✓ The achievement of environmental goals will require decisive action, will encounter unforeseen eventualities and will not happen overnight. Fortunately or unfortunately, much of the success or failure of this endeavour is in our hands.



Uncertainties in scenarios

Uncertainty of future trends depends, for example, on:

- ✓ Reality of the narratives
- ✓ Socio-economic behaviour and responses
- ✓ Climate sensitivity and other systemic parameters
- ✓ Climate change patterns
- ✓ Feedbacks in biogeochemical cycles and ecological responses
- ✓ The future in general!



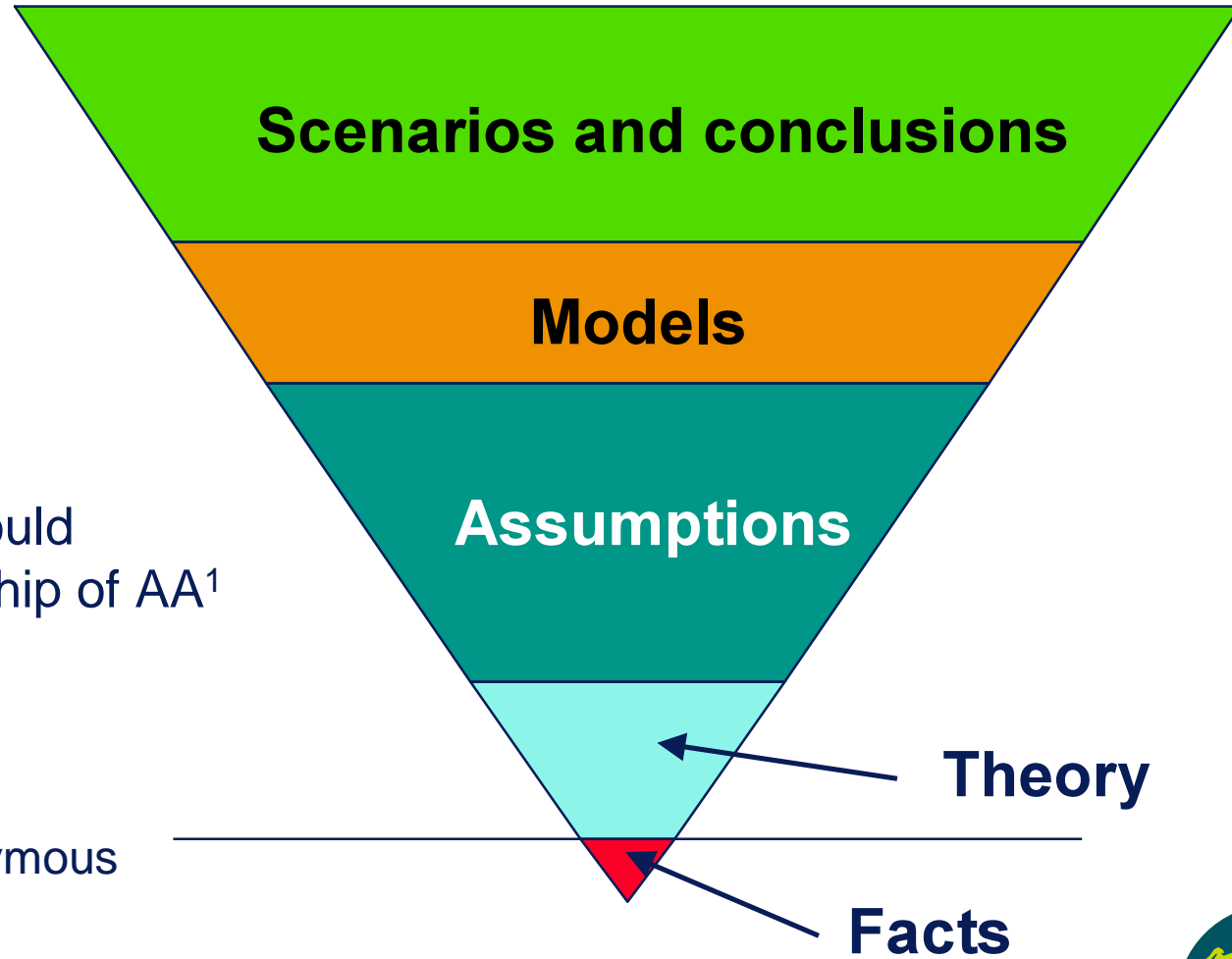
Summary of scenario development

- ✓ From narrow, disciplinary-based projections to multi-disciplinary integrated approaches
- ✓ From solely quantitative approaches with simulation models to comprehensive approaches with detailed qualitative narratives
- ✓ From expert-based to stakeholder involvement
- ✓ From "likely futures" to important lessons

But the scientific discussion on the domain, value and likelihood of scenarios continues



A common modelling and scenario structure



Why modellers should apply for membership of AA¹

¹: Assumption Anonymous

