Land Use Dynamics and Global Environmental Change

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MEETING – FORESIGHT GROUP
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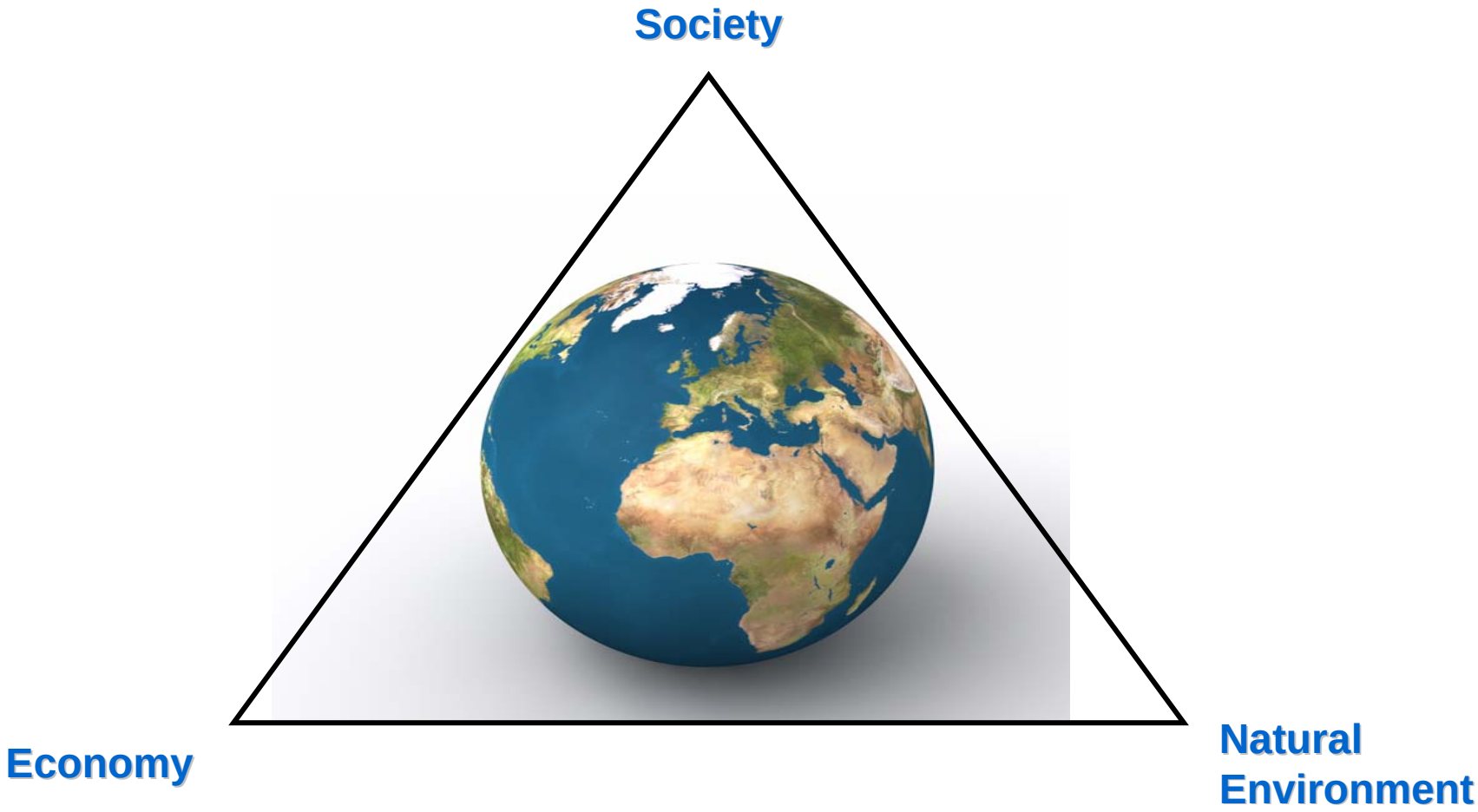
Global Environmental Change:
a multifunctional, complex phenomenon with effects where humans, society and nature simultaneously interact



Human Welfare and Land Resources

- Human welfare depends on the continued use of resources. Some of these resource stocks can be increased (human capital, physical capital). Other resource stocks can at best remain constant or decrease over time (water, fossil energy, and land).

- The world population will increase over the next 3-4 decades by roughly 50 percent thus requiring the provision of food and shelter with more or less the same amount of natural resources for an additional 3 billion people.

- Land being the focus of this discussion:
  The area of the earth will need to provide space for this increasing population in terms of
  - Food production
  - Urban Areas
  - Biodiversity
  - Bioenergy

The Challenges (1)

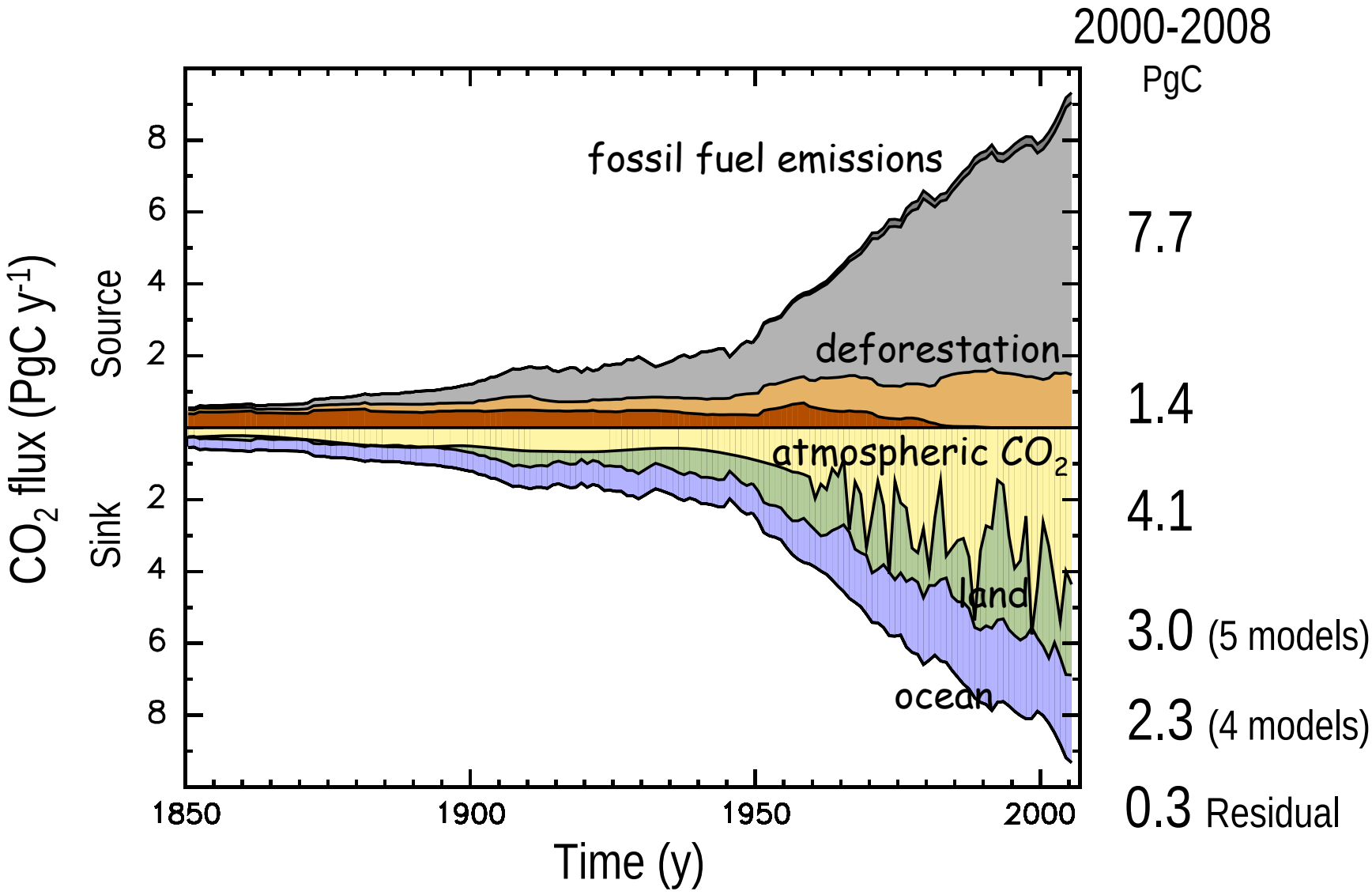
- Resource Endowments
  - Population increasing (from currently 6,5 to appr. 9 bn.)
  - Fossil energy sources decreasing
  - Land area constant (possibly with decreasing productivity)

- Renewable Resource Flows
  - Solar energy constant with largely unused potential
  - Global biomass production slightly decreasing
  - Water with regionally large differences

The Challenges (2)

- GDP Growth
  - Convergence of emerging economies (3-10 % growth/a)
  - Lifestyle changes (Food, Mobility, Housing)
- Climate Change
  - Carbon Cycle (Dynamics of Sinks, Impacts, Water cycle)
- Energy Use
  - Energy mix and climate policy
  - Determinants of demand
    - Developing countries
    - Industrialized countries
- Stability of Ecosystems
  - Ecosystem-Services

Sources and Sinks of Carbon



Global Carbon Project 2009; Le Quéré et al. 2009, Nature-geoscience

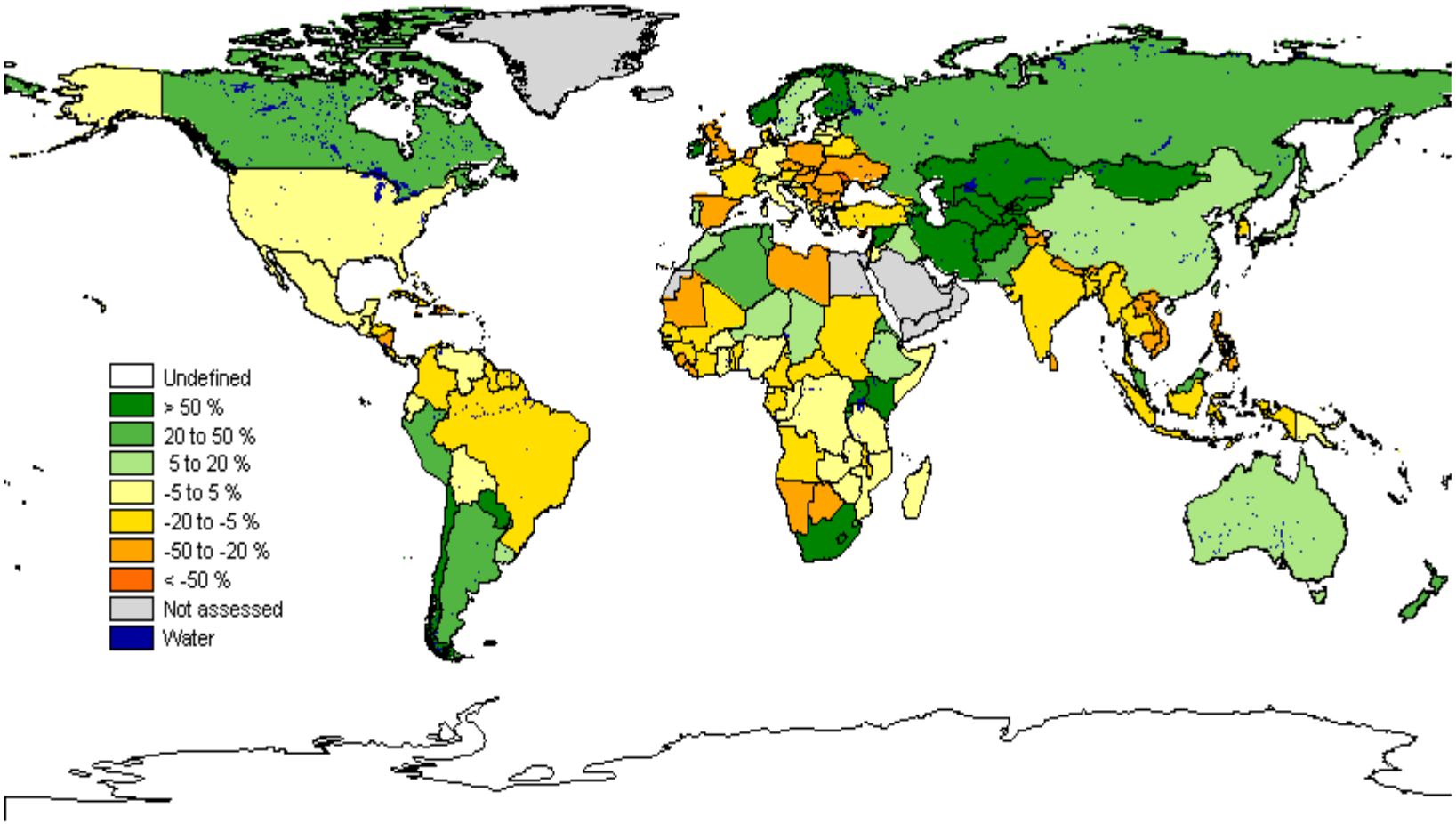
Destruction of Carbon Stocks and their value

Example: Kampar Peninsular on Sumatra

- Over a total peat area of some 8500 km^2 with an average peat depth of some 10m, this would be 11,260 Mt (11.3 Gt) of CO_2.
- (Proforest 2005)
- Development of this peatland area would lead to emissions of 40 to 100 Mt CO_2 over the next 5 decades (equivalent to between 15% and 40% of Indonesia‘s CO_2 emissions from burning fossil fuels)
- In a Post-Kyoto Carbon market this would amount to a carbon cost (at a price of 30 $/t$CO_2$) of $1.2 billion to 3 billion per year.

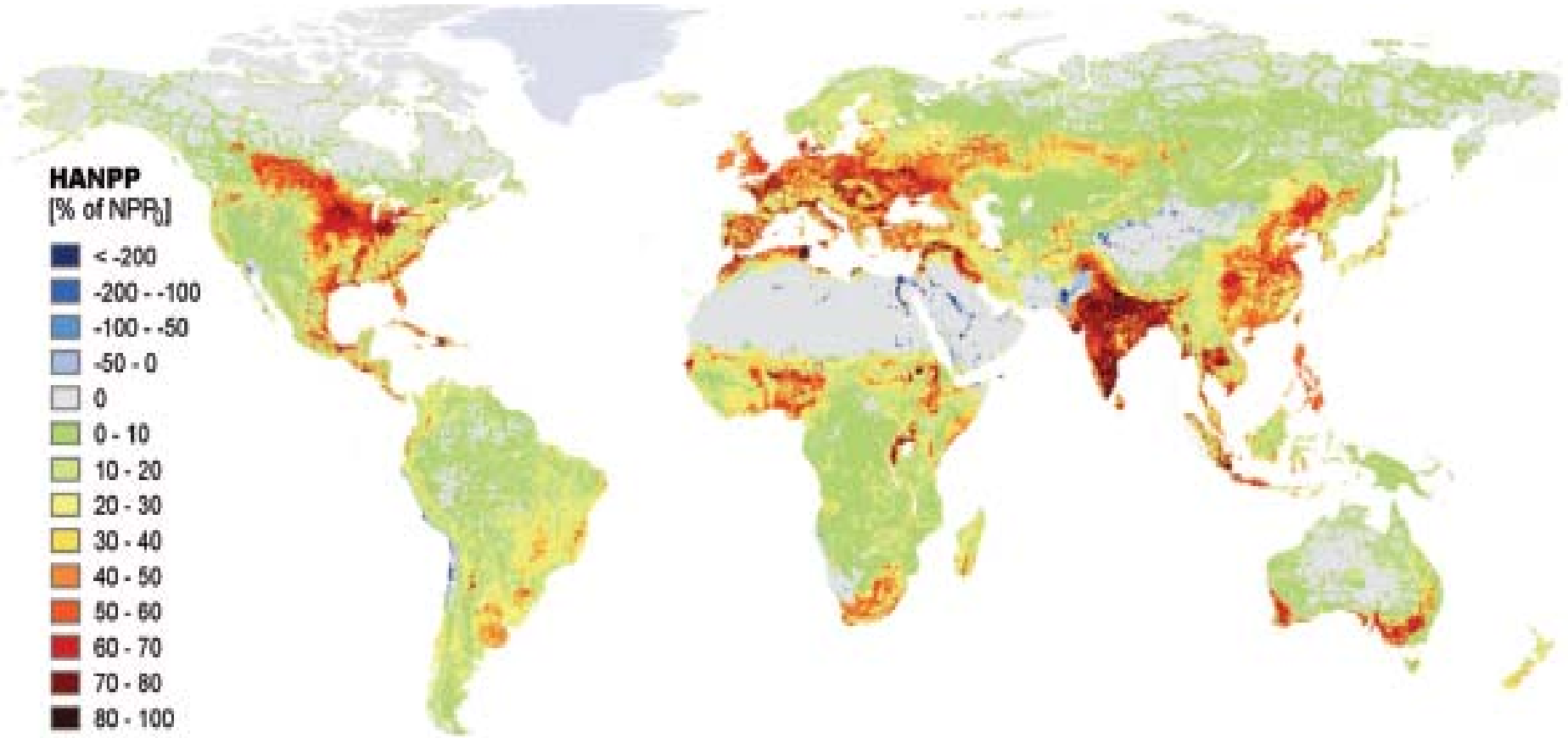
Land Use and Climate Change

Agricultural Potentials in 2080



ECHAM4 2080

“Human Appropriation of Net Primary Production”



Quelle: Haberl 2006

Feeding the World in 2050

Table S4. Feasibility analysis of all 72 scenarios.

	Crop Yields	FAO intensive	FAO intensive	Inter-mediate	Inter-mediate	Wholly organic	Wholly organic
	Land use change	Massive	Business as usual	Massive	Business as usual	Massive	Business as usual
DIET	**Livestock System**						
Western high meat	intensive	+/-	-	-	-	-	-
Western high meat	humane	-	-	-	-	-	-
Western high meat	organic	-	-	-	-	-	-
Current trend	intensive	+	+	+	+/-	-	-
Current trend	humane	+	+	+	+/-	-	-
Current trend	organic	+	+/-	+/-	+/-	-	-
Less meat	intensive	+	+	+	+	+/-	-
Less meat	humane	+	+	+	+	+/-	-
Less meat	organic	+	+	+	+	-	-
Fair less meat	intensive	++	+	++	+	+/-	+/-
Fair less meat	humane	++	+	++	+	+/-	+/-
Fair less meat	organic	++	+	++	+	+/-	-

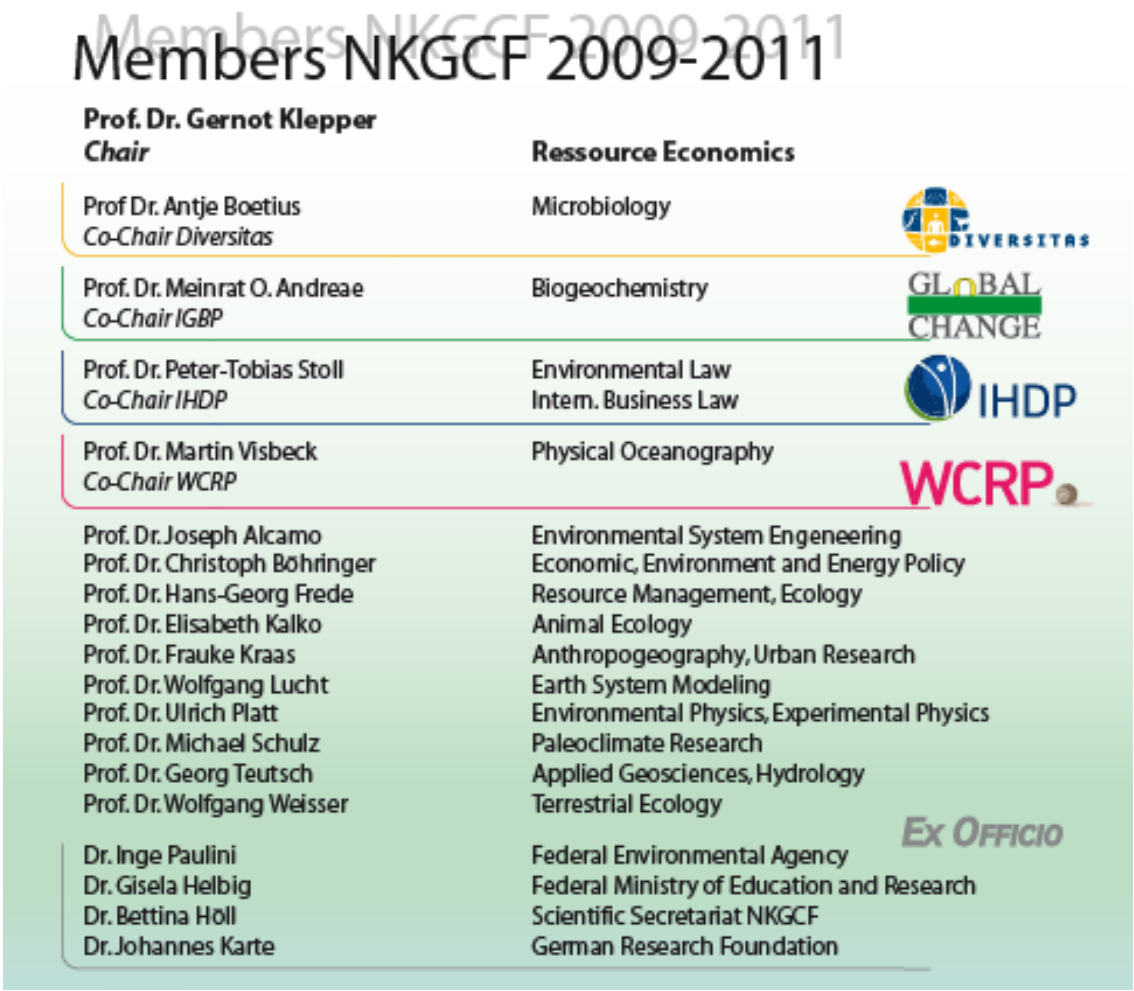
+/- **Probably feasible**

\+ **Feasible**

++ **Highly feasible**

Blank: not feasible

Members and aims of NKGCF



www.nkgcf.org

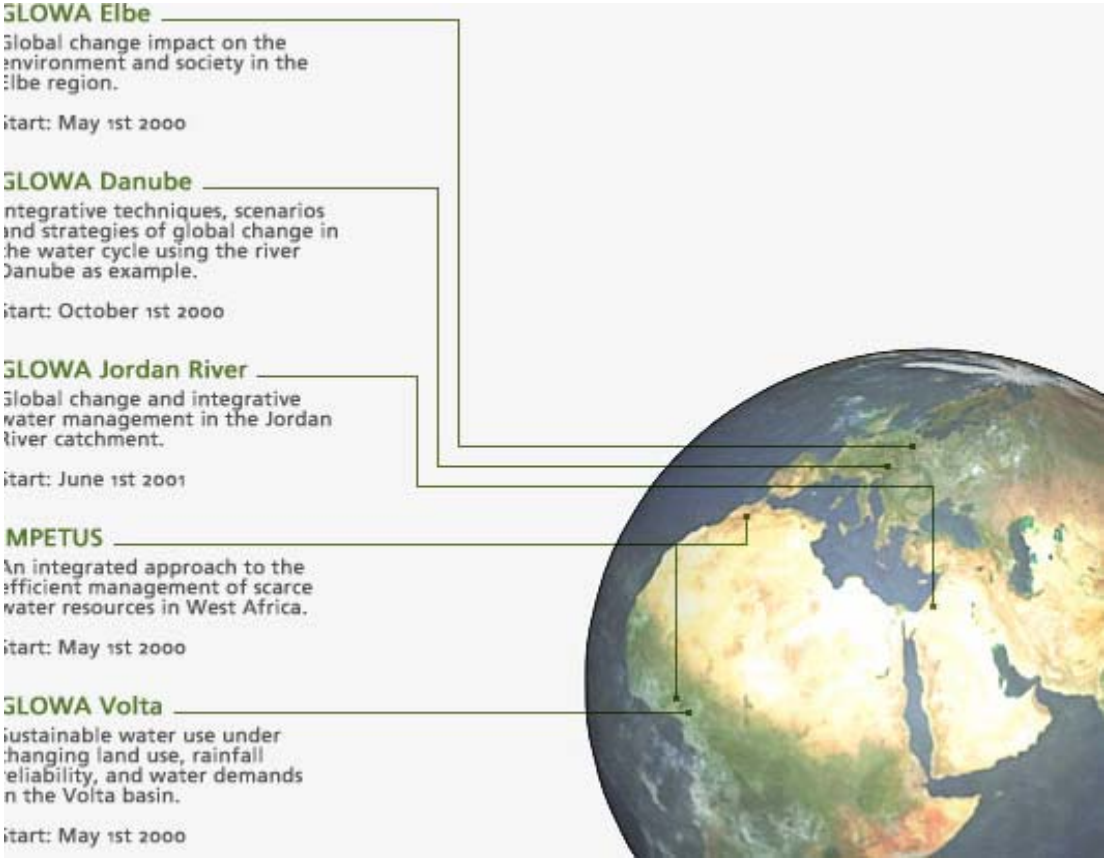
- acts as **scientific advisory committee** to the DFG and BMBF

- plays a significant role in the process of **identifying research priorities** and in **stimulating and coordinating** German contributions to the four international Global Change research programmes

- **improving the internationalisation** of German Global Change research

- acts as an **advisory committee** to the German representation to ICSU and the European Science Foundation (ESF) in the context of GEC research

Successful interdisciplinary, integrative German research initiatives: GLOWA



www.glowa.org

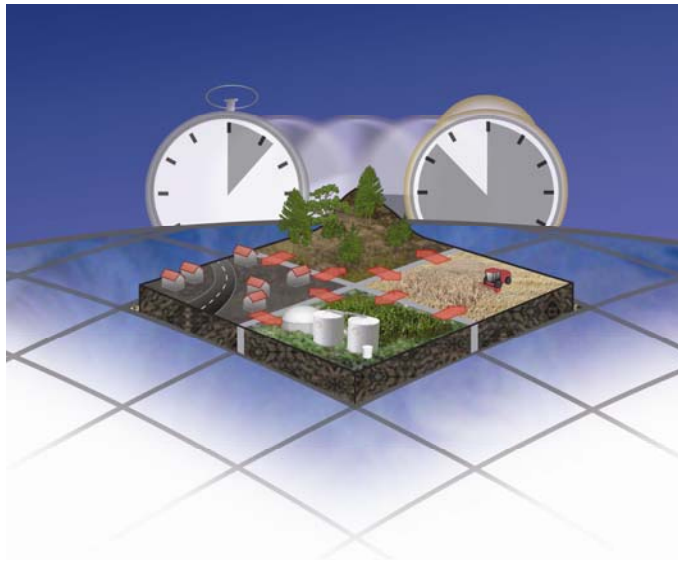
Each of the projects deals with three scientific core themes in an interdisciplinary and integrative research approach

- Natural variability of precipitation, variations caused by human activities and their effect on the hydrological cycle

- Interactions between the hydrological cycle, the biosphere and land use

- Water availability and conflicting water uses

Current interdisciplinary, integrative initiatives of NKGCF



In 2008 a new
interdisciplinary, integrative research programme

"**Coping with climate change – Land use decisions under the conflicting demands of resource conservation, food and energy**"

was suggested to national funding agencies.
The call for proposals has attracted a large research community.

Topical background of the Programme:

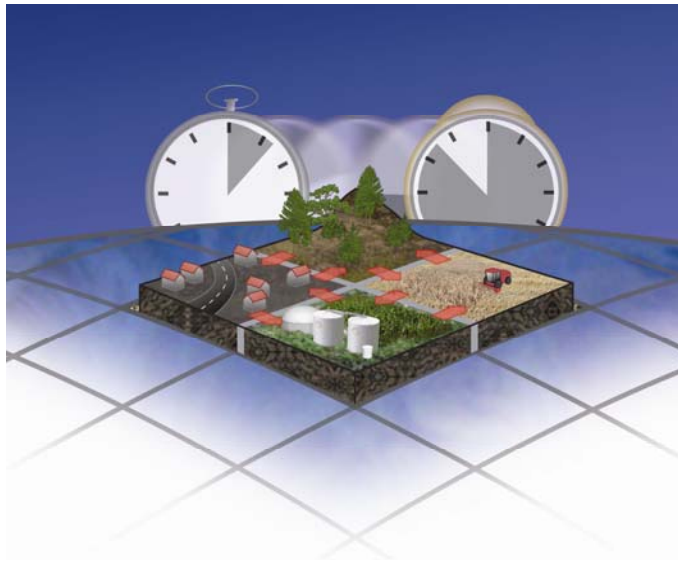
Problem:

(1) **increasing scarcity of land resources**

(2) **land use conflicts** between food, bioenergy, urban living space and the ecosystems services

(3) land use decisions are affected by multiple **global** factors and strongly influence **regional** social and economic development

Current interdisciplinary, integrative initiatives of NKGCF



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Topical background of the Programme:

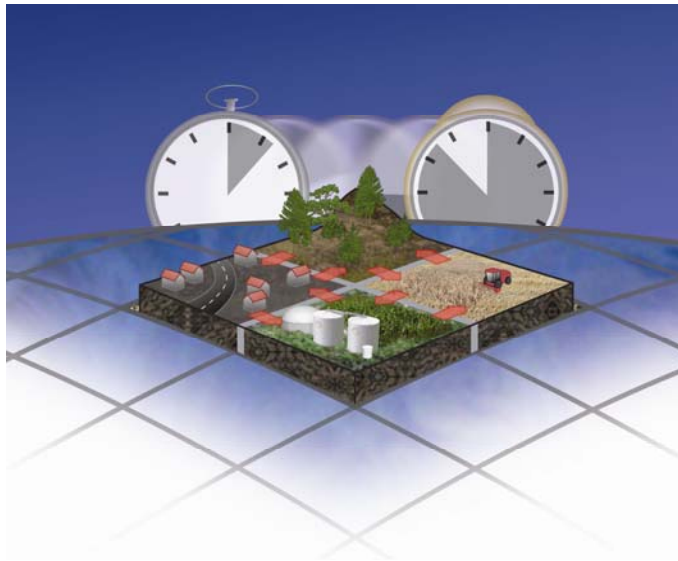
Lack of Knowledge:

(1) research methodology of integrative, interdisciplinary solution oriented analyses

(2) Understanding land use **decision mechanisms** and the **process of change**. How is land **currently allocated** and how should it be **managed and allocated in the future** taking into account climate change, and the functioning of the ecosystems?

(3) how can these processes on the Earth's surface be **designed** that they contribute in a sustainable way to the objectives of food security, biodiversity preservation, bioenergy production, and settlement demands.

Current interdisciplinary, integrative initiatives of NKGCF



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Topical background of the Programme:

Call by Ministry for Science:

Module A:

„Land management, climate change, and ecosystem services"
-Regional case studies + coordination project

Module B:

„Innovative system approaches for a sustainable land management"

Micro-level studies for Germany

Several case studies + coordination project

Thank you for your attention !

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