Charakteristik und Design nachhaltiger Entwicklungspfade für Ländergruppen

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Potsdam-Institute for Climate Impact Research

Founded: 1992, annual turnover 16 Mio. €, ~7 Mio. baseline, 9 Mio. third party

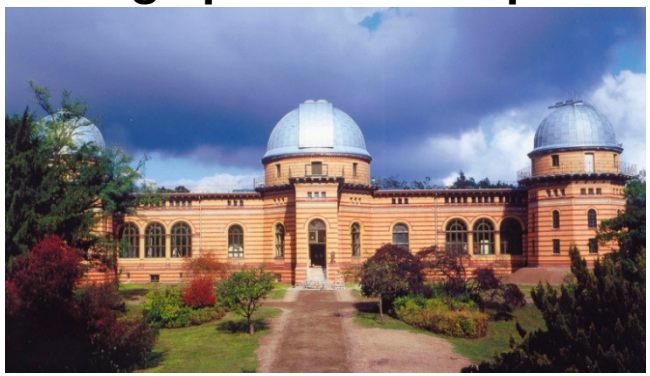
Status: Member of Leibniz Society

Resources: Man power: 290 employees, service: ~25, scientists: 111 PostDocs, 70 PhD students, 13 professors

including: *approx. 45 of the NSP focal point, 3 permanent posts*

"Technological power": One of the worldwide largest meteorological, climate and impact database;

high performance parallel computing and storage system



Michelson Building

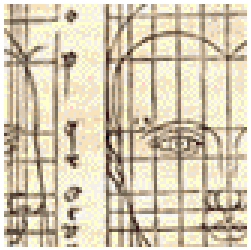
Süring Building

PIK

Research Domain 1:
Earth System Analysis

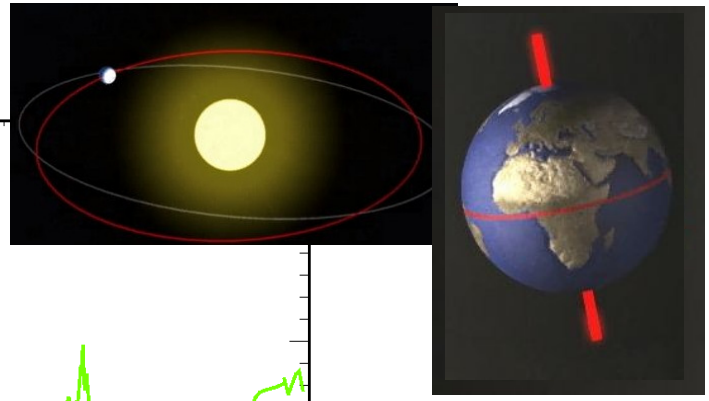
Research Domain 2:
Climate Impacts & Vulnerabilities
T3-NSP unit

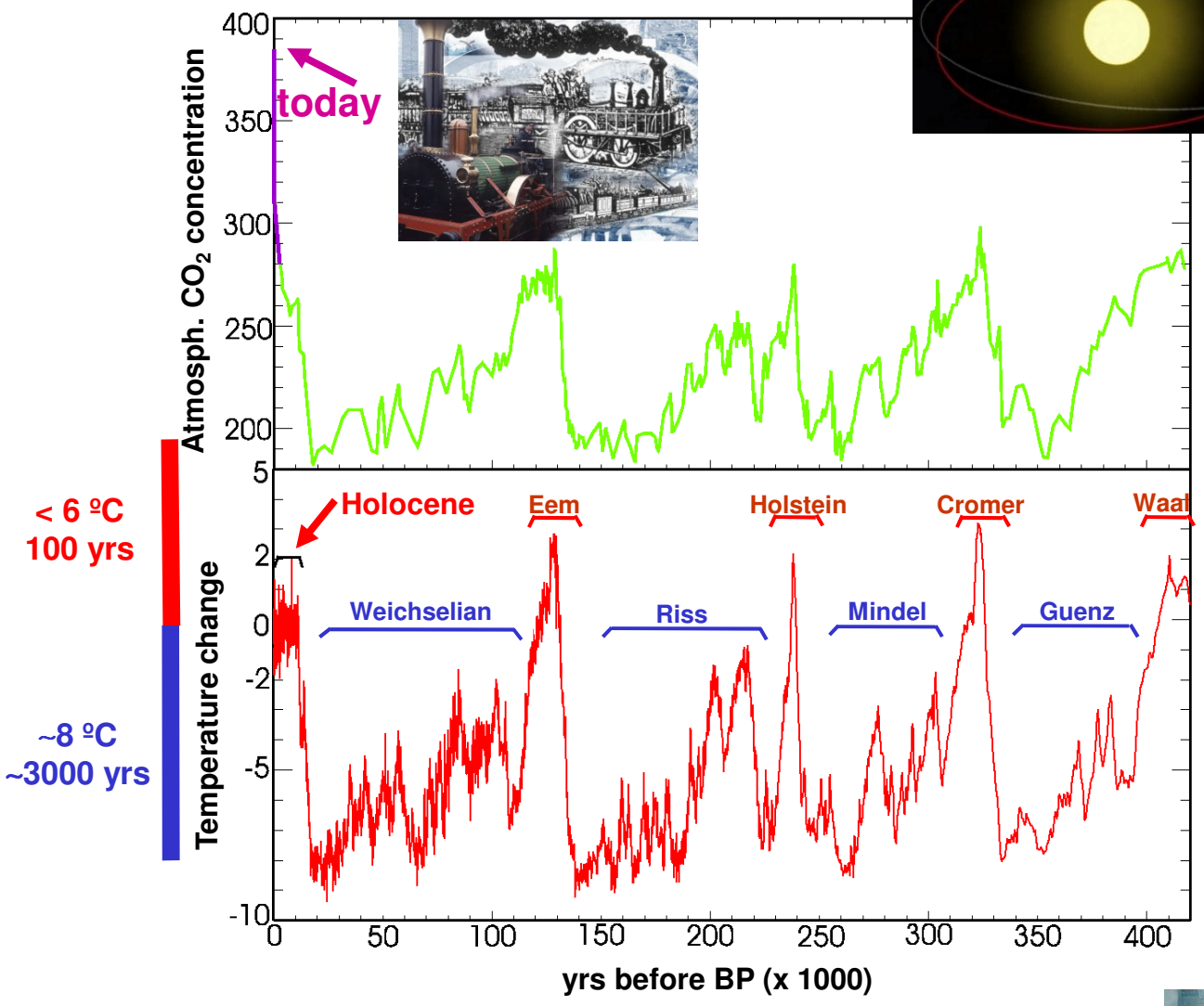
Research Domain 3:
Sustainable Solutions



Research Domain 4:
Transdisziplinary Concepts & Methods

On what we are talking about?





< 6 ºC
100 yrs

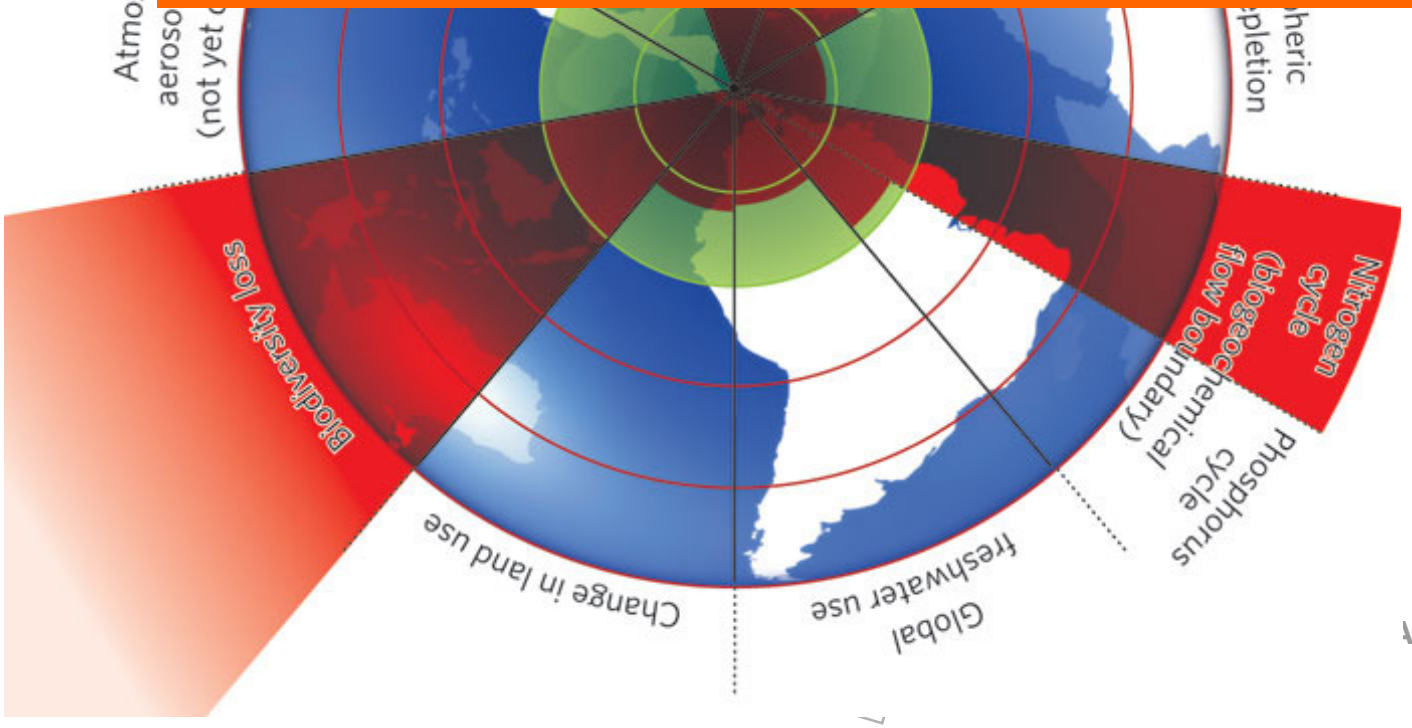
~8 ºC
~3000 yrs

- humankind increases CO_2 concentration ~35% since 1850
- expected change at least 20 times faster

Fourier, Stefan, Boltzmann, Arrhenius: ~1820-1920

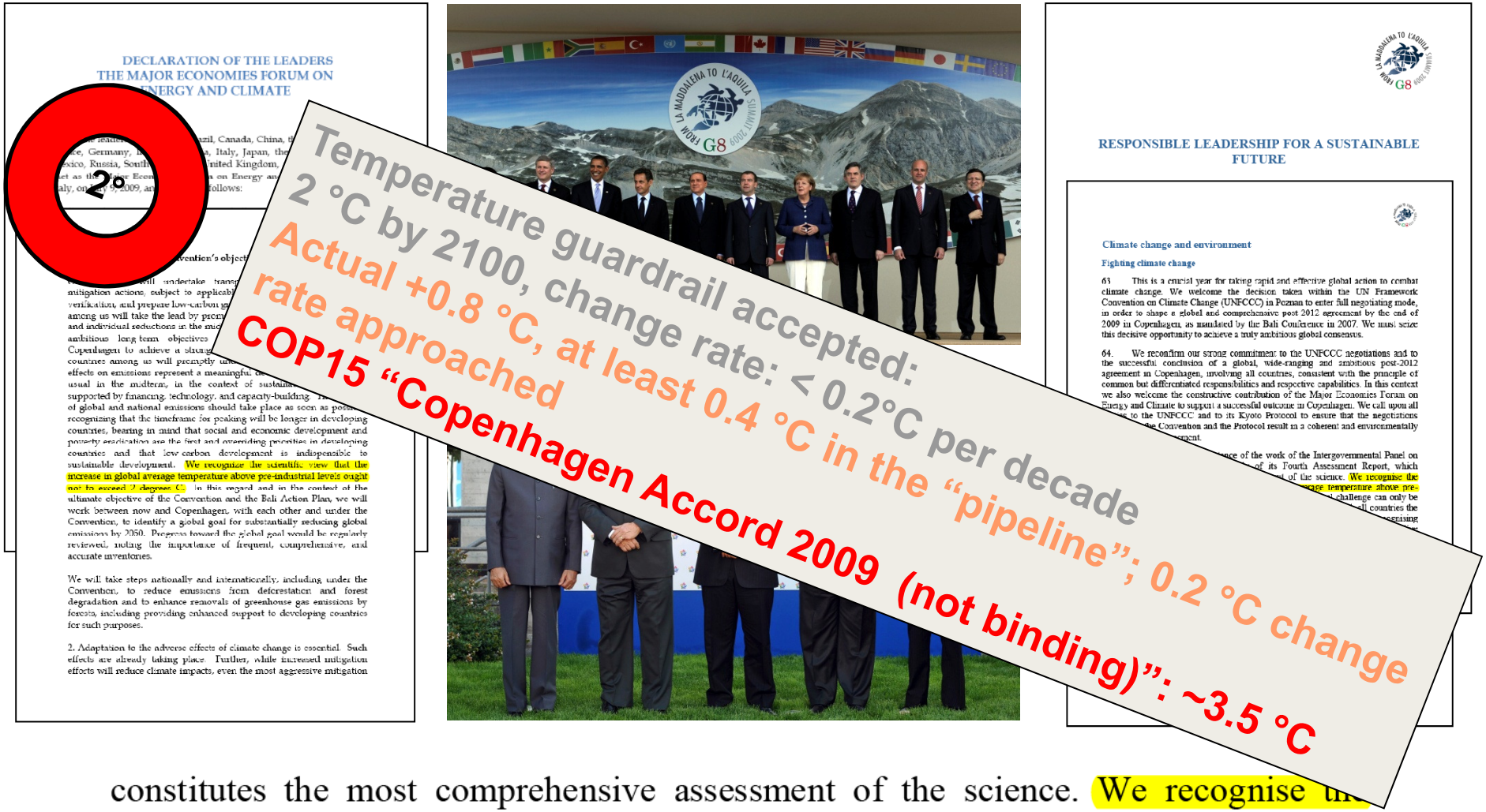
For example:

earth system process	parameter	proposed boundary	current	pre-industrial
climate change:	atmospheric carbon dioxide (ppm vol)	350	387	280
	change in radiative forcing (W/m2)	1	1.5	0
rate of biodiversity loss	extinction (# species per million species per year)	10	>100	0.1-1
nirogen cycle	amount N2 removed from atmosphere for human use (mio. to/yr)	35	121	0



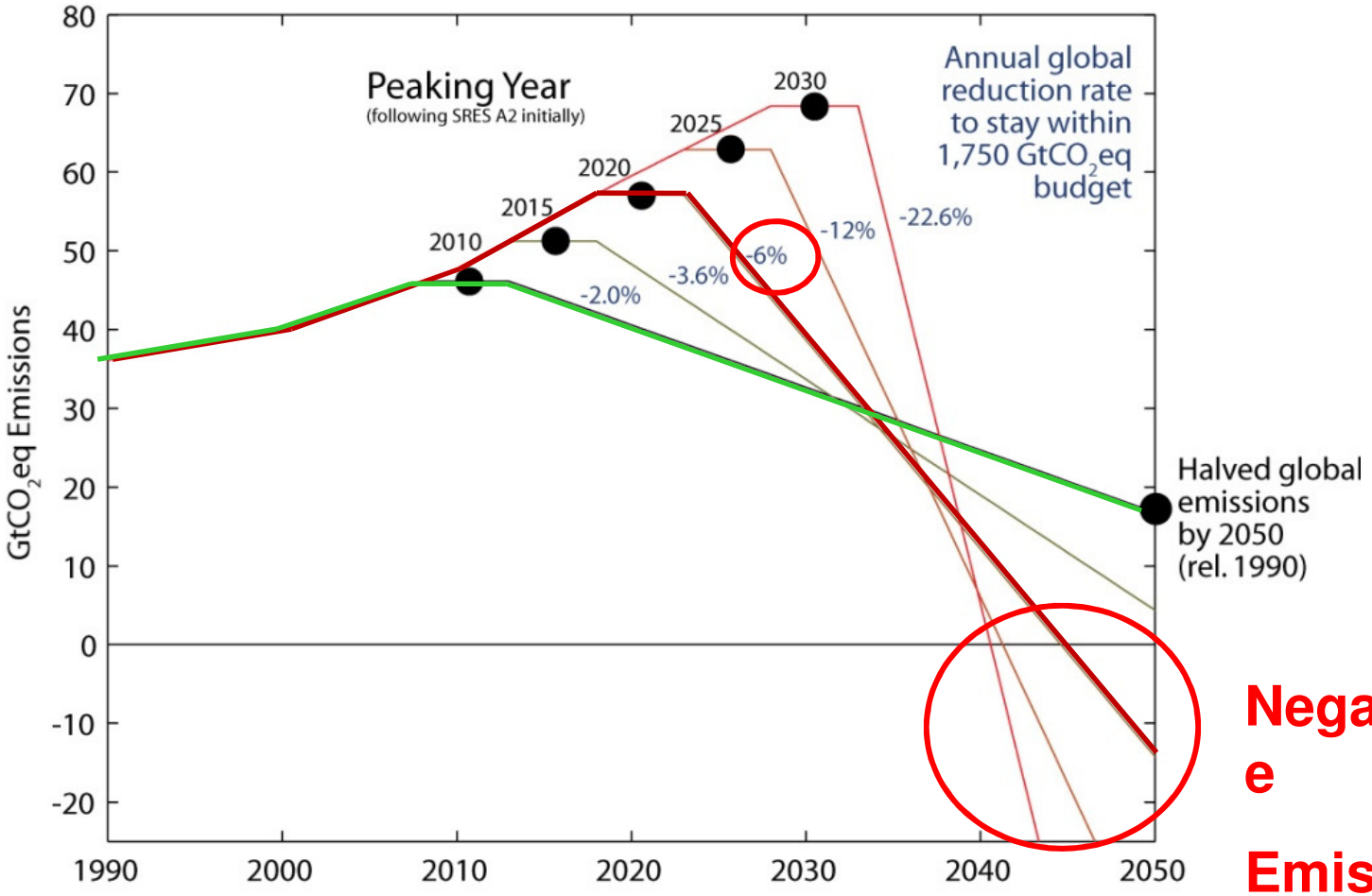
A. Foley

G8 and Emerging Economies Agree on 2° C Long-term Target



constitutes the most comprehensive assessment of the science. We recognise the broad scientific view that the increase in global average temperature above pre-industrial levels ought not to exceed 2°C. Because this global challenge can only be

Emissions Peaking After 2020:
More than 1 Kyoto per Year



Negative Emissions

(Meinshausen et al. 2009b)

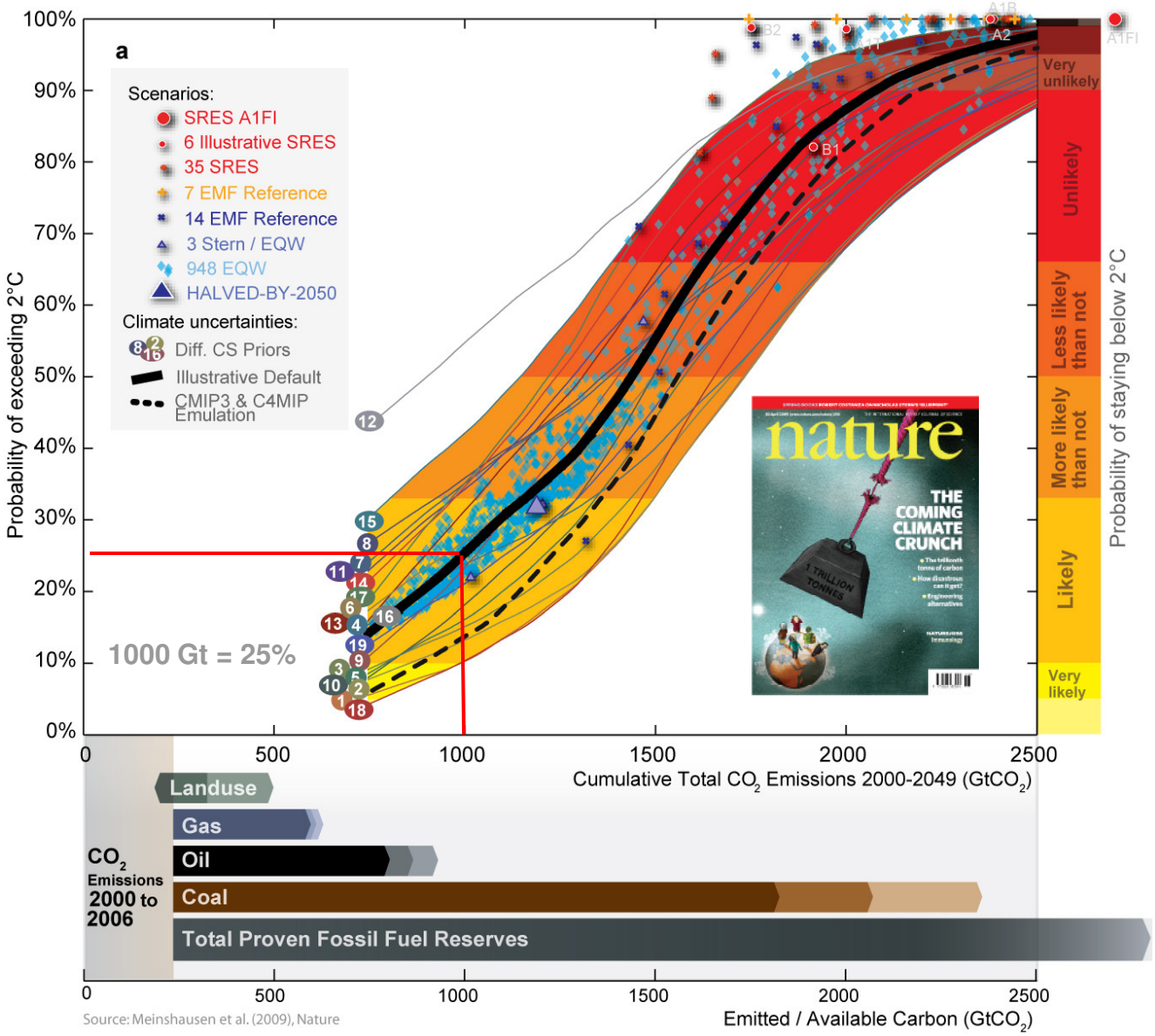
The probability of exceeding 2°C warming vs. CO_2 emissions

Top

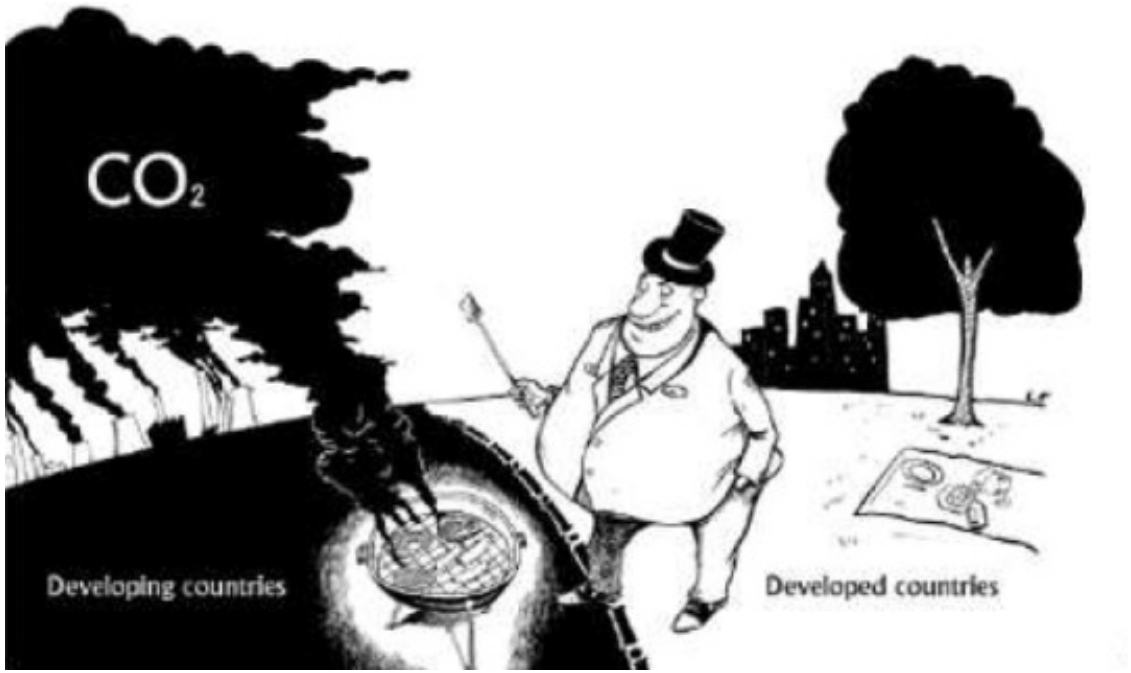
- probabilities of exceeding 2°C of individual scenarios for illustrative default and smoothed probabilities for all climate sensitivity distributions.
- dashed line: proportion of carbon cycle model emulations exceeding 2°C
- coloured areas: ranges of probabilities

Bottom

- total CO_2 emissions emitted 2000 - 2006 (grey area)
- potential emissions (fossil fuel burning available fossil fuel reserves/landuse 2006 – 2049)

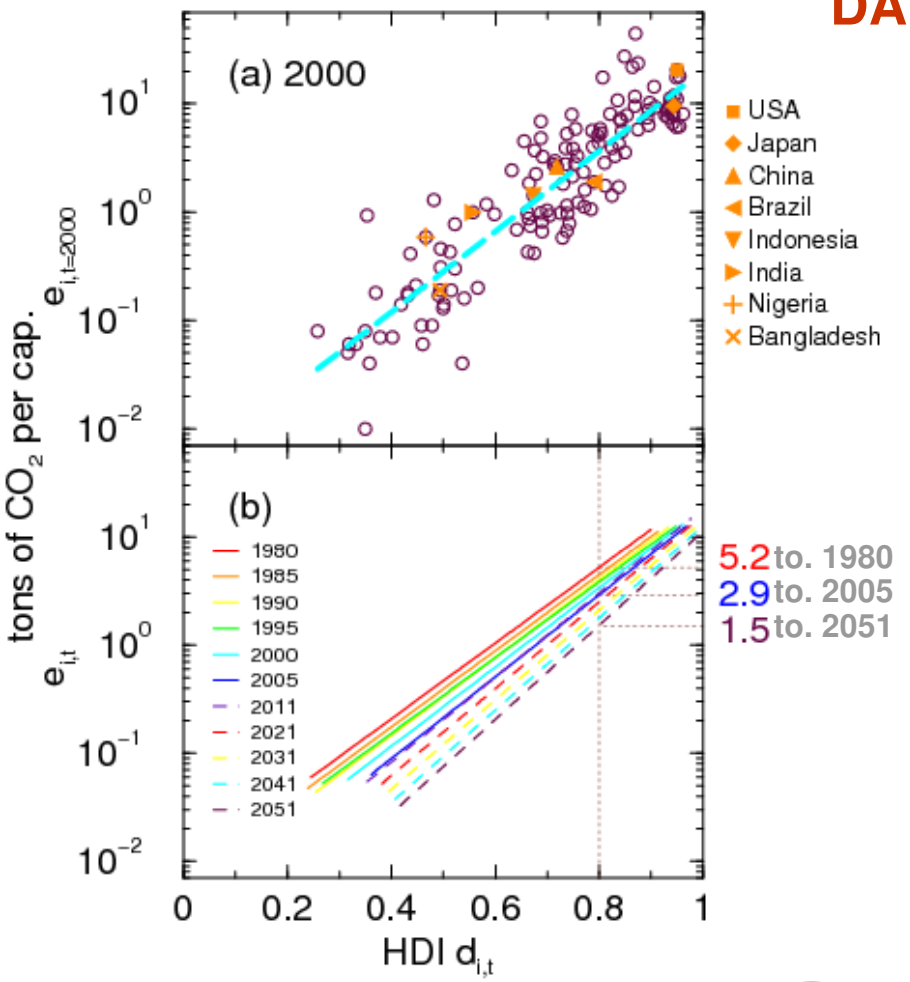


Have developing countries an increasing responsibility for our climate?



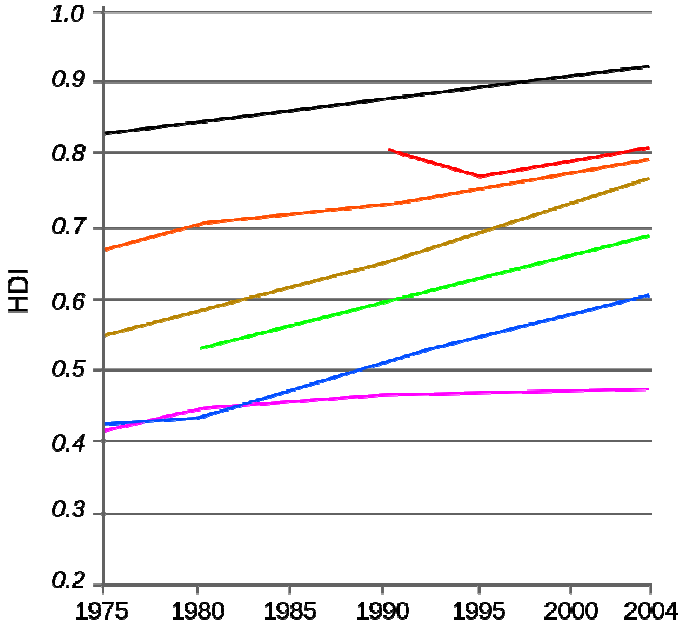
Not yet, but what happens when development proceeds as we have organized it in the last past, and we do not have fair, efficient, and suitable agreements?

Relationship between development & emissions



HDI: GDP per cap (in PPP), life expectancy, literacy rate and enrolment rate

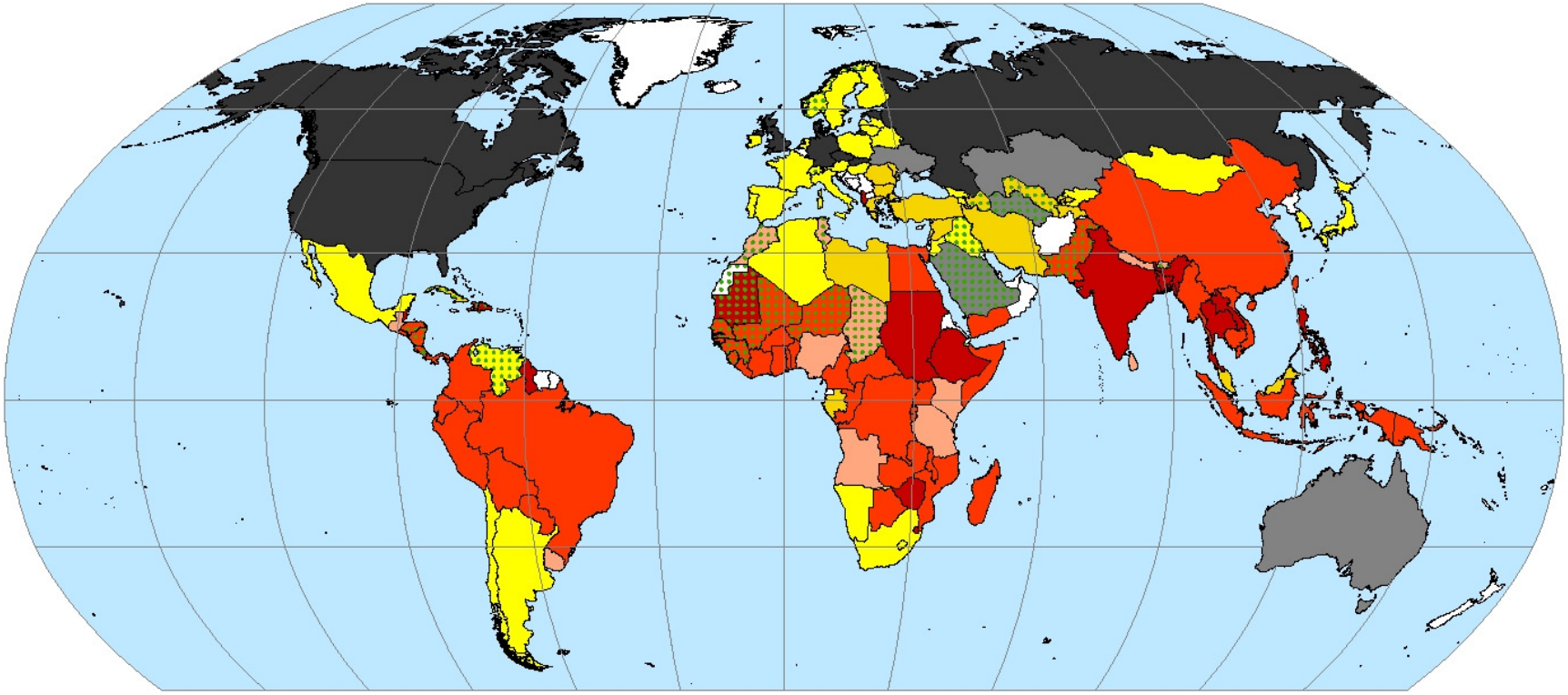
DAU end-up by 2.000 Gt/CO2 by 2050



HDI Trend: OECD
Central & east Europe
South America & Carribean
East Asia
Arabian States
South Asia
Subsaharan Africa

Source: PIK/Costa/Rybski/Kropp (2010)

The most vulnerable and the responsible



Levels of per capita average CO_2 emissions (1950 - 2003) in relation to social, economic, and ecological vulnerability

High emissions

- Social and economic vulnerability low
- Social or economic vulnerability low

Low emissions

- Social and economic vulnerability high
- Social or economic vulnerability high
- Neither social nor economic vulnerability high

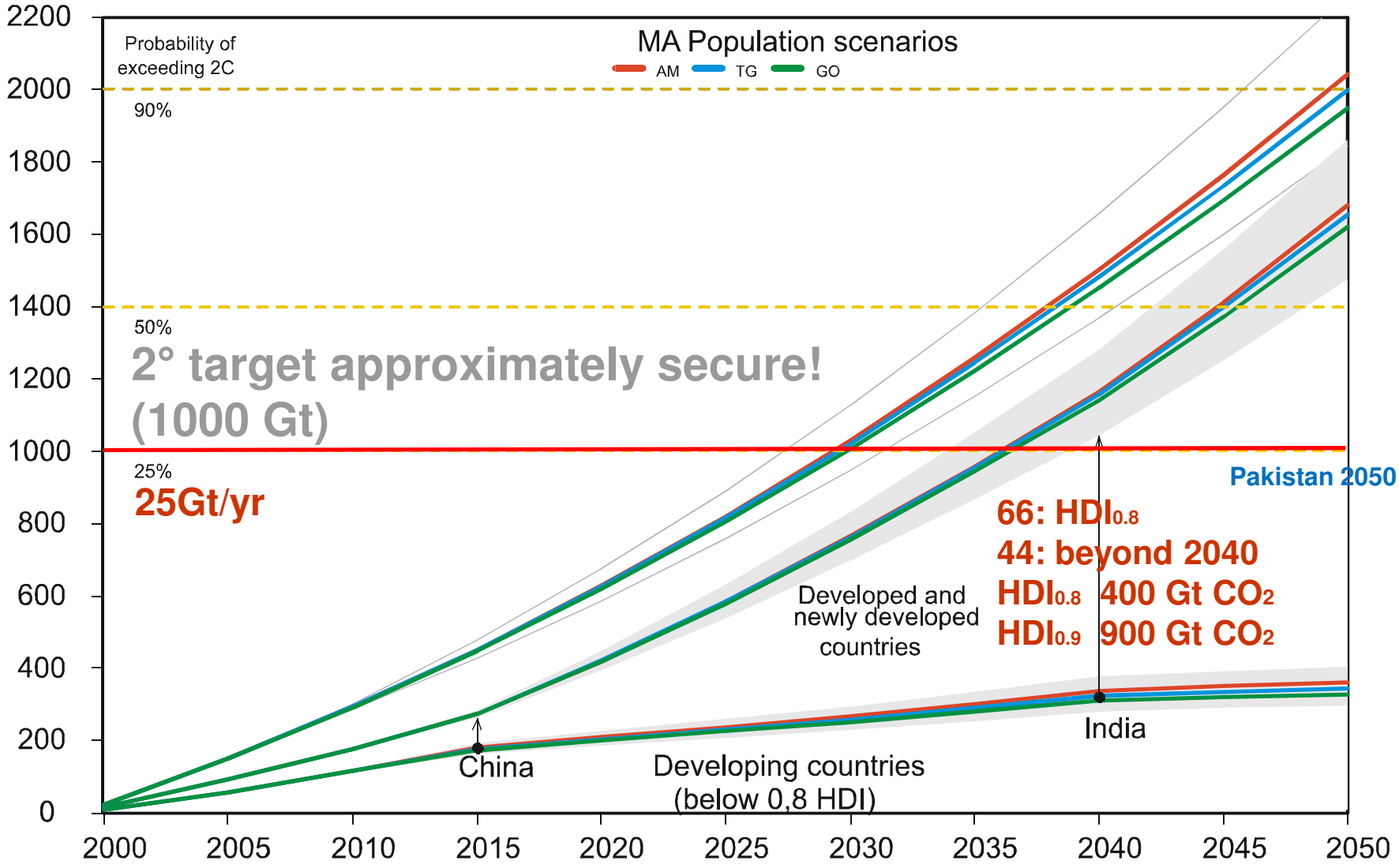
Medium emissions

- Social or economic vulnerability high
- Neither social nor economic vulnerability high

- High ecological vulnerability
- One or more indexes missing

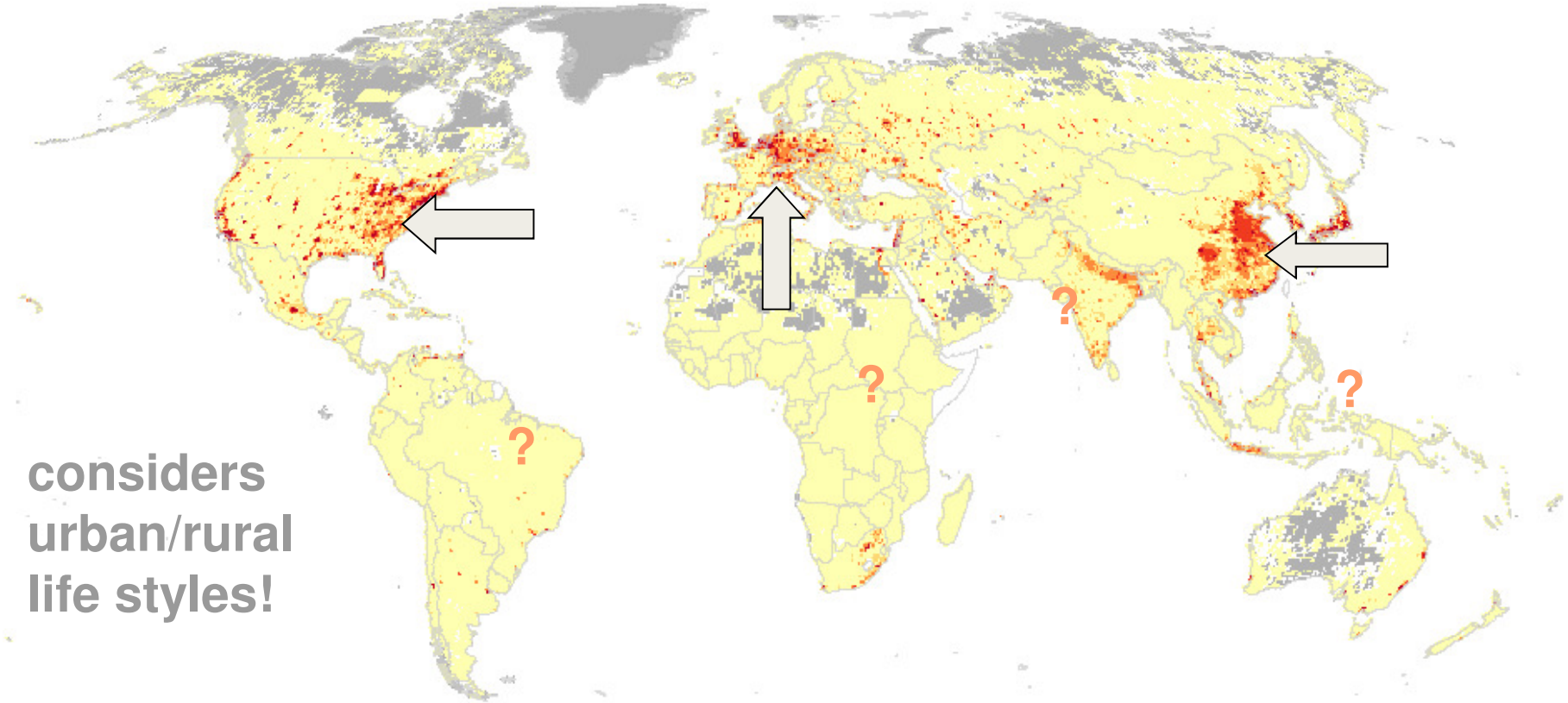
Source: PIK/Prepared for UN Sigma Xi 2006

Development As Usual Szenario
When a country approaches HDI 0.8



Source: PIK/Costa/Rybski/Kropp (2010)

Regional for the year 2003



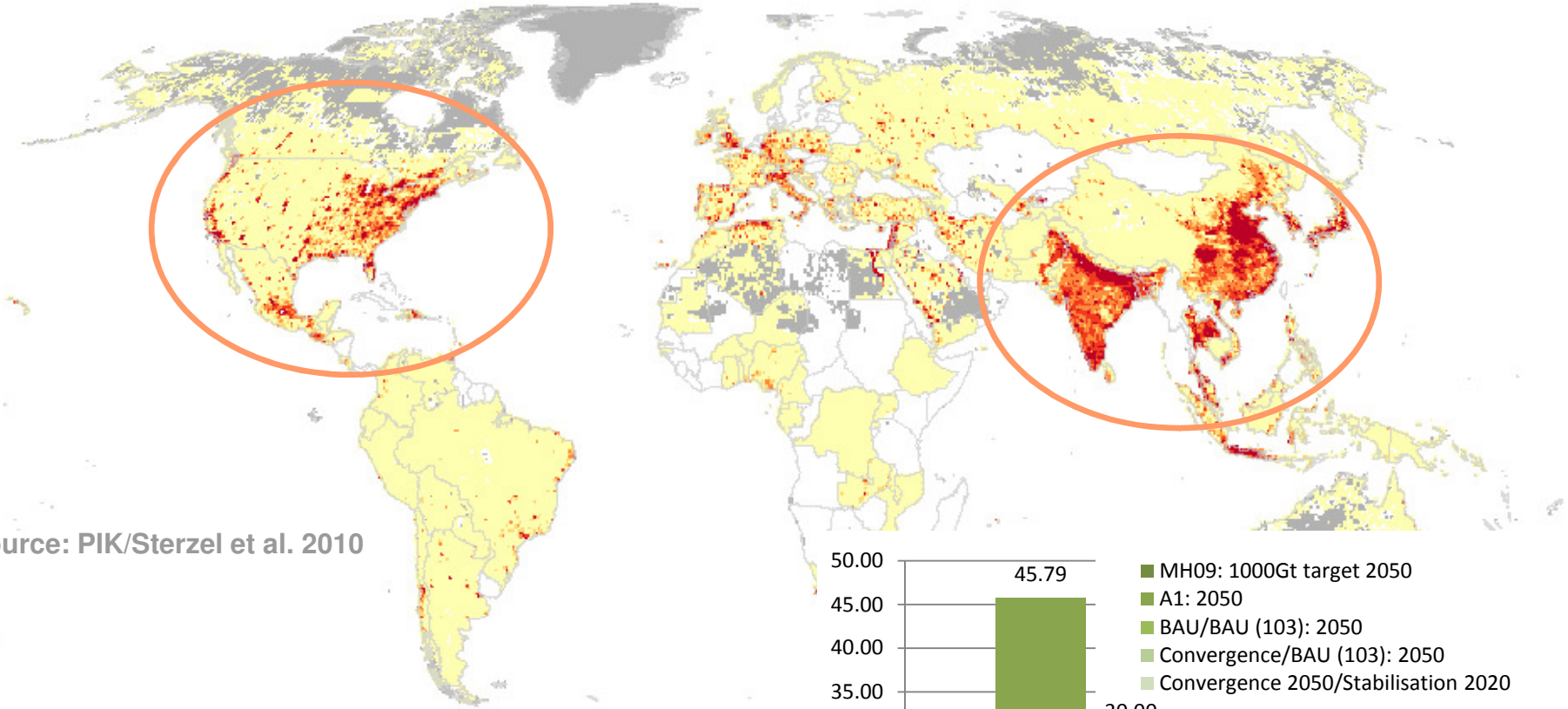
considers urban/rural life styles!

CO_2-Emissionen [Mio t] durch Verbrennung fossiler Energieträger und Zementproduktion per 0.5° x 0.5° lat / lon Gridzelle

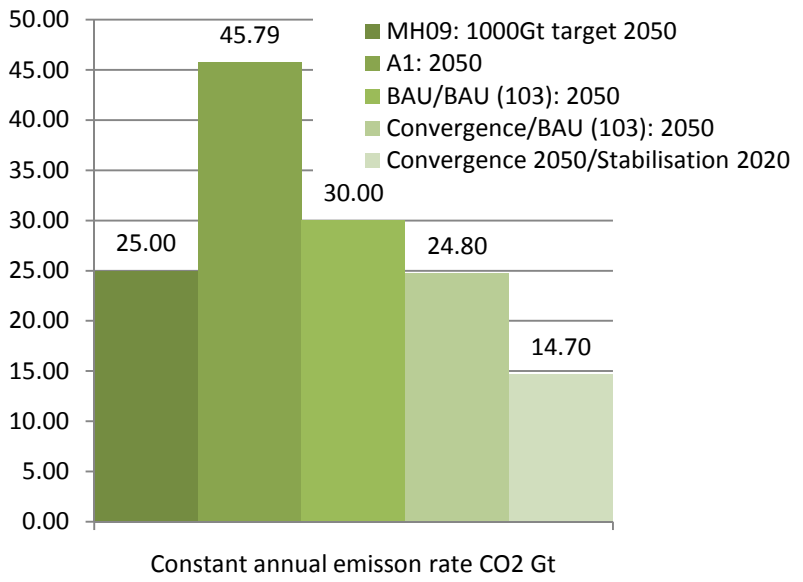
- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 8
- 8 - 250
- Unbewohnt (in 2000, und in Projection)

Source: PIK/Sterzel et al. 2010

Development as Usual 2050

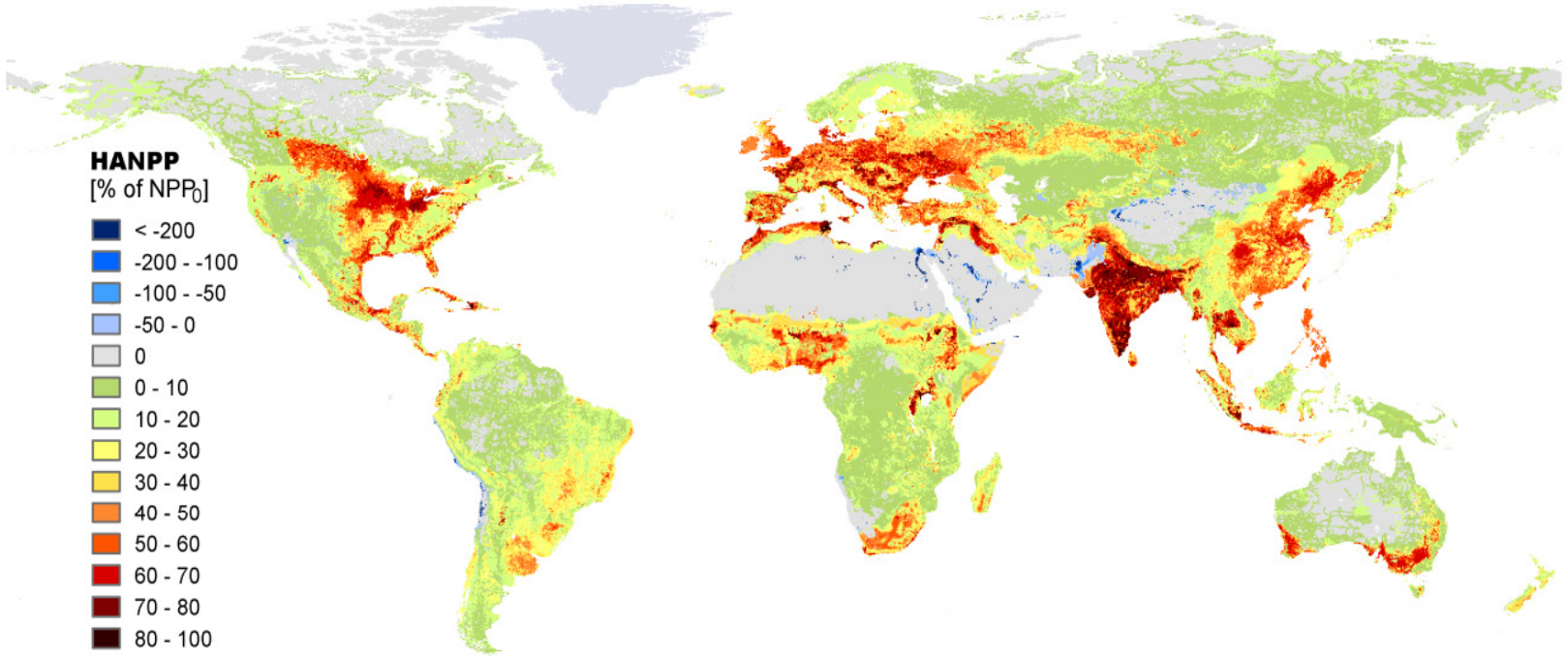


Source: PIK/Sterzel et al. 2010



Hot spots for reconciling adaptation and climate protection

urrent human acquisition of global Net-Primary production (HANPP)



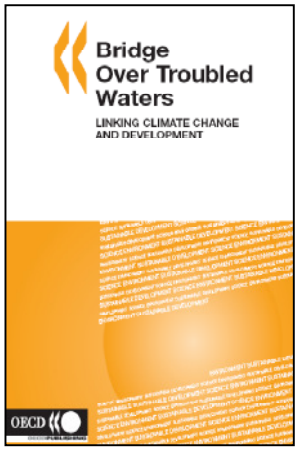
	Natural Veget. (GtC/yr)	65.5	100%
	Actual Vegetation	59.2	90%
Anthrogenic Impacts	Changed Vegetation	6.3	10%
	Yield / Extraction	7.2	11%
	Fire	1.1	2%
	HANPP Total	14.7	23%
	Backflow	1.5	2%

Haberl et al. (2006)

= 270 EJ/yr
(incl. 35-55 EJ/yr Bio-Fuel)

Bio-Fuel Projections until 2100:
200-300 EJ/yr = 4-7 GtC/yr

Worldbank: ¼ of all programms are facing significant climate risks (= 5 bn. US $/a)



First take home messages:

- **Climate change threatens MDGs, but adaptation alone will**
- **not be the solution!**
- **Current development policies will not lead to sustainability!**
- **We need complete different pathways, so-called socio-eco-technological transitions, and**
- **strategies and capacities for change management**

Therefore, national development scenarios, storylines!

Overview IS 1990

Scenario estimates	1990	IS92 scenarios for 2100					
		IS92a	IS92b	IS92c	IS92d	IS92e	IS92f
Population (billion)	5.252	11.3	11.3	6.4	6.4	11.3	17.6
Economic growth rate (annual GNP;% p.a.)	--	2.3	2.3	1.2	2.0	3.0	2.3
CO_2 concentration (ppmv)$_{(1)}$	354	708	685	471	542	954	820
Global mean temp. change (ºC)$_{(2)}$	--	2.18	2.13	1.47	1.75	2.64	2.52
Range (ºC)$_{(3)}$	--	1.5-3.1	1.5-3.1	1.3-2.3	1.2-2.6	1.8-3.7	1.7-3.5
Global mean sea-level rise (cm) $_{(2)}$	--	51	50	40	45	57	56
Range (cm)(3)	--	20-90	20-89	14-76	16-82	24-98	23-96

SRES Scenarios

developed between 1996 and 1999

Storyline: a narrative description of a scenario (or a family of scenarios), highlighting the main scenario characteristics and dynamics, and the relationships between key driving forces.

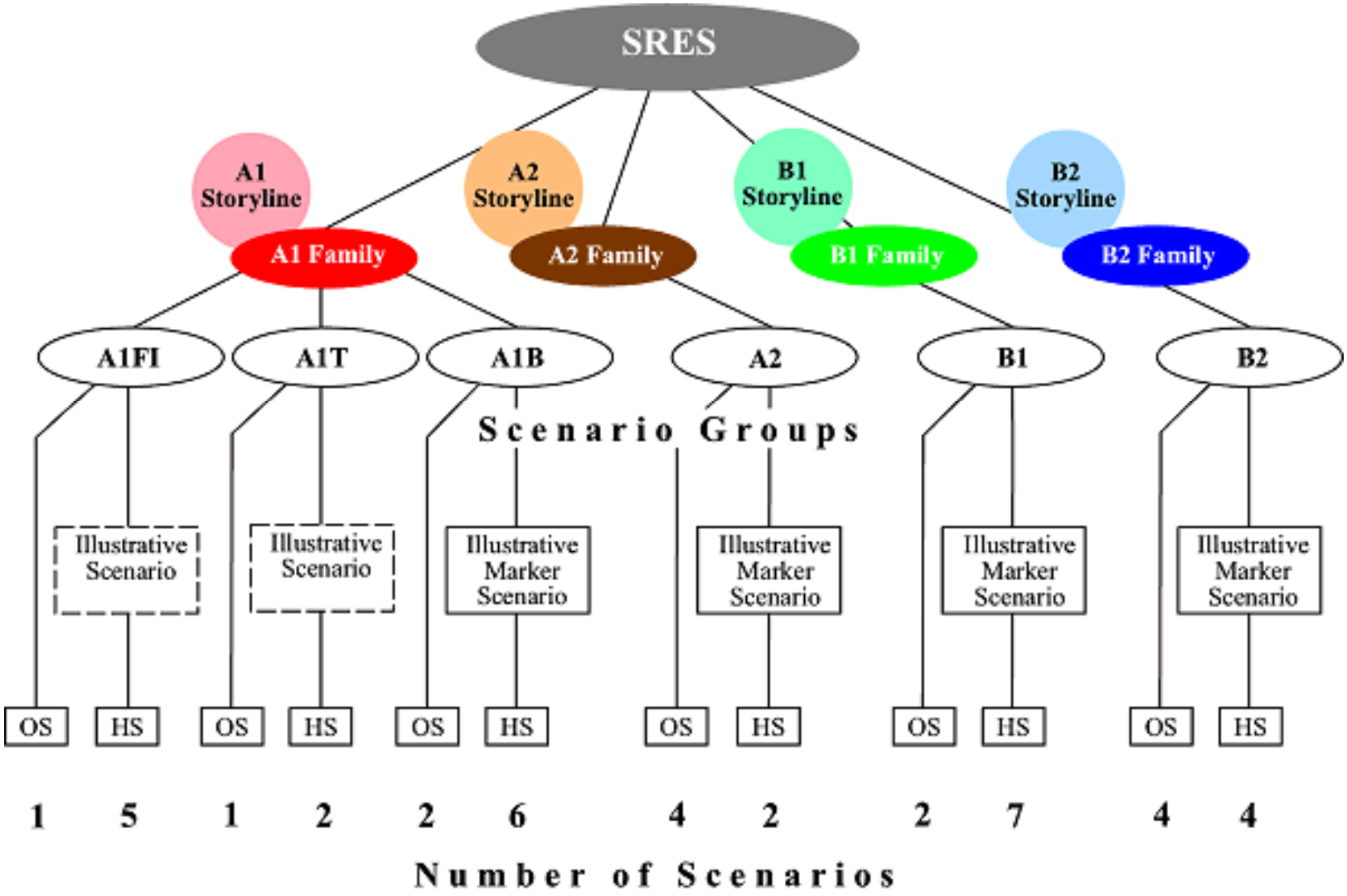
Scenario: projections of a potential future, based on a clear logic and a quantified storyline.

Scenario family: one or more scenarios that have the same demographic, politico-societal, economic and technological storyline.

The SRES team defined four narrative storylines labelled **A1, A2, B1** and **B2** Each storyline represents different demographic, social, economic, technological, and environmental developments that diverge in increasingly irreversible ways.

Projections: calculated time developments of climatic variables

SRES Family

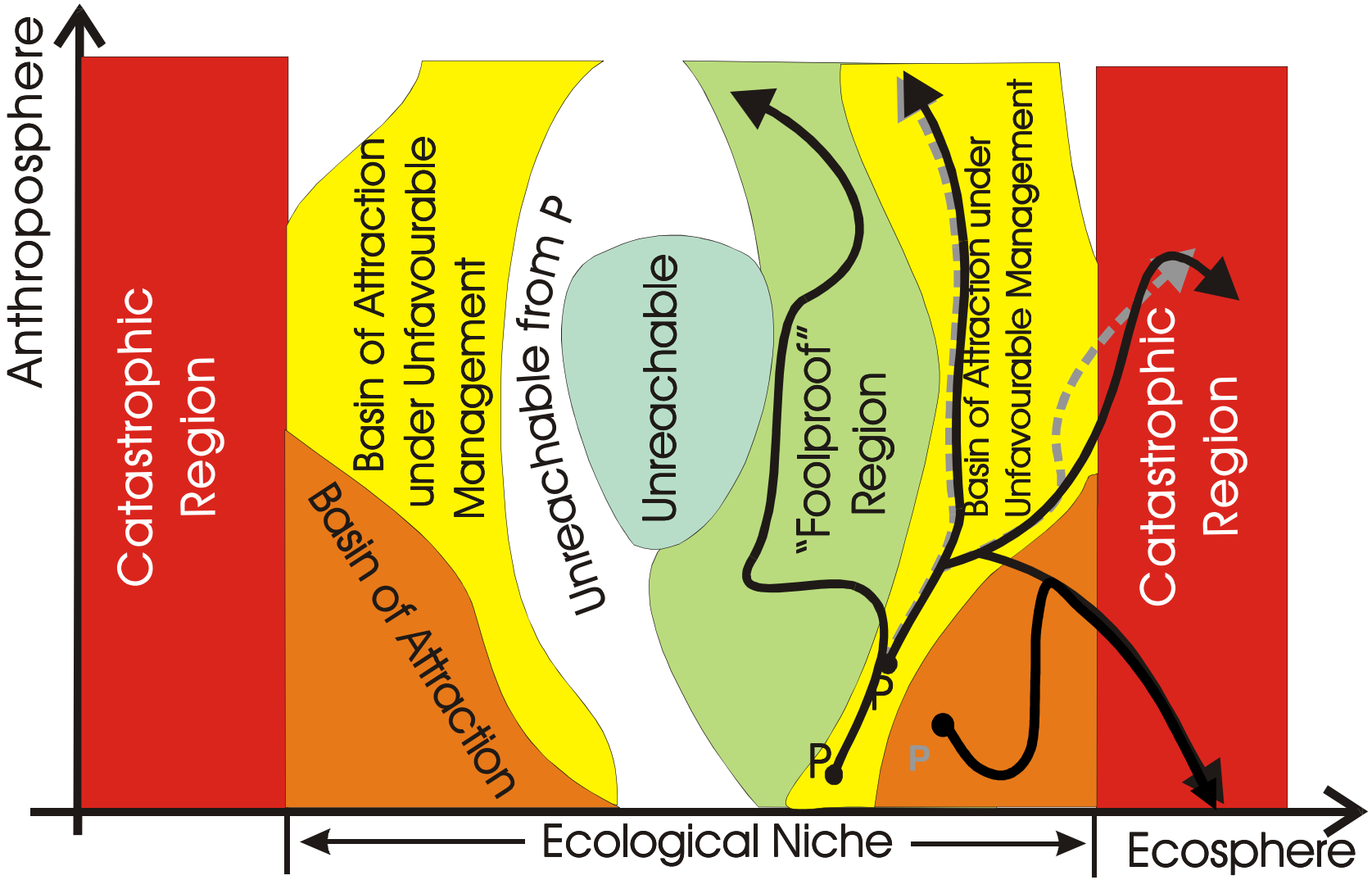

SRES
A1 Storyline
A2 Storyline
B1 Storyline
B2 Storyline
A1 Family
A2 Family
B1 Family
B2 Family
A1FI
A1T
A1B
A2
B1
B2
Scenario Groups
Illustrative Scenario
Illustrative Scenario
Illustrative Marker Scenario
Illustrative Marker Scenario
Illustrative Marker Scenario
Illustrative Marker Scenario
OS
HS
OS
HS
OS
HS
OS
HS
OS
HS
OS
HS
1 5 1 2 2 6 4 2 2 7 4 4
Number of Scenarios

IA Models & Criticism

- **Asian Pacific Integrated Model (AIM) (Morita et al., 1994);**
- **Atmospheric Stabilization Framework Model (ASF) (Lashof and Tirpak, 1990);**
- **Integrated Model to Assess the Greenhouse Effect (IMAGE) (Alcamo et al., 1998)**
- **Multiregional Approach for Resource and Industry Allocation (MARIA) (Mori and Takahashi, 1999);**
- **Model for Energy Supply Strategy Alternatives and their General Environmental Impact (MESSAGE) (Messner and Strubegger, 1995;;**
- **Mini Climate Assessment Model (MiniCAM) (Edmonds et al., 1996a).**

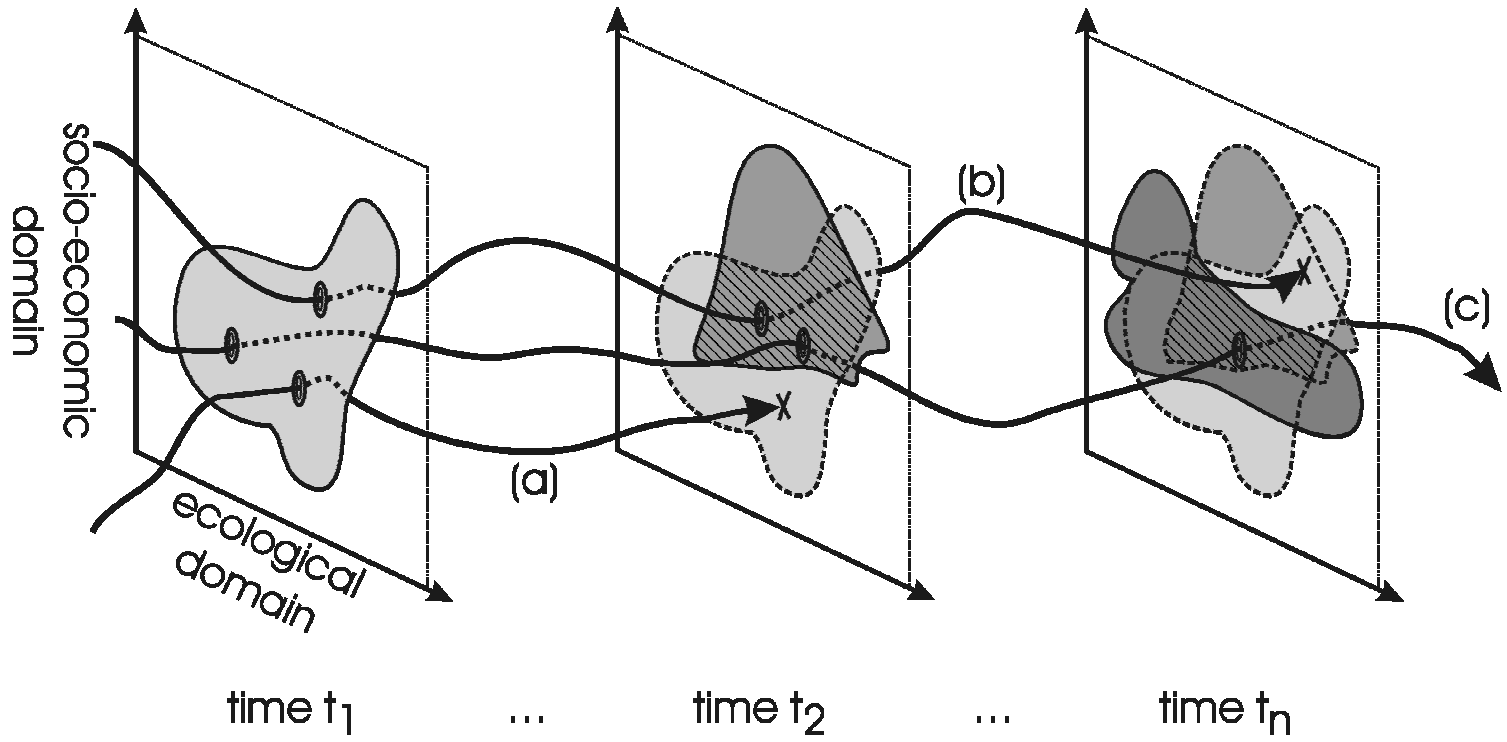
•Forcing Storylines are hypothetical
•Future climate protection efforts are not included
•Several colleagues demand usage of PPP instead of MER (market
•leading to an overestimation of emissions
•Nevertheless current observations are above worst-case storyline

Cartoon of Pessimization



Schellnhuber & Kropp 1998

Schematically: Filtering



Set normative constraints (viability criteria) and examine whether time developments (trajectories) exist, which stay within this viability domain for any time (cf. Aubin 1991)

Scenarios: Narratives and Numbers

From. „Great Transition“, Raskin et al. 2002, Global Scenario Group, SEI

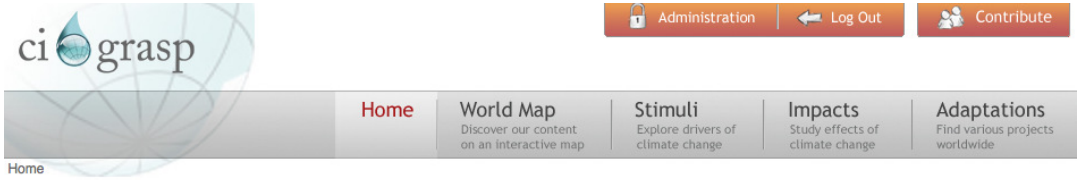
Fortress World: **A Narrative**

By 2002, the market euphoria of the last decade of the twentieth-century seems like a naïve and giddy dream. A global economic recession chastens the irrational exuberance of dot-com investors, and the 9/11 terrorist attack awakens a sleepwalking global elite

deteriorate. Multiple stresses—pollution, climate change, ecosystem degradation—interact and amplify the crisis. Disputes over scarce water resources feed conflict in regions with shared river basins. Environmental degradation, food insecurity and emergent diseases foster a vast health crisis.

institutional frameworks. The affluent live in protected enclaves in rich nations and in strongholds in poor nations—bubbles of privilege amidst oceans of misery. In the police state outside the fortress, the majority is mired in poverty and denied basic freedoms.

- triggering single events
- mechanisms, to make the scenario plausible
- descriptions



Bridging the Information Gap

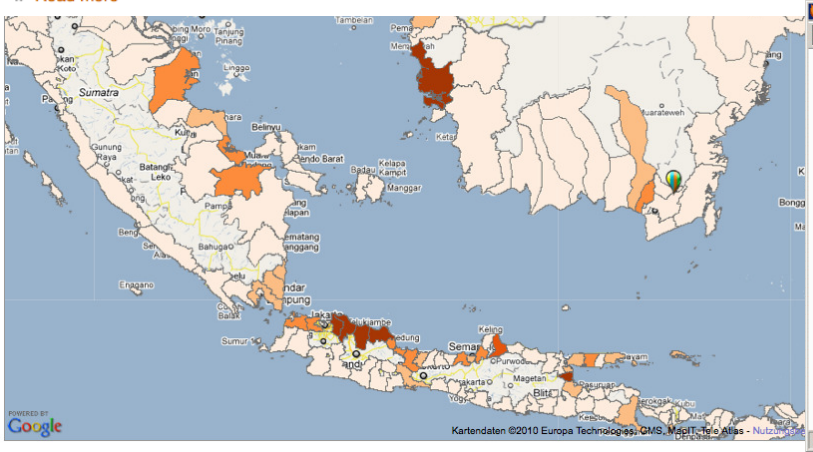
The ci:grasp Transmitter

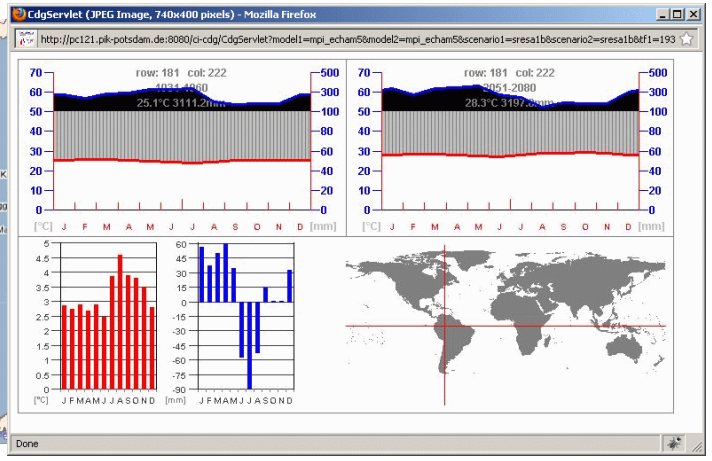
Climate Impacts: global and regional adaptation support Platform

cigrasp.pik-potsdam.de

1000 impact maps

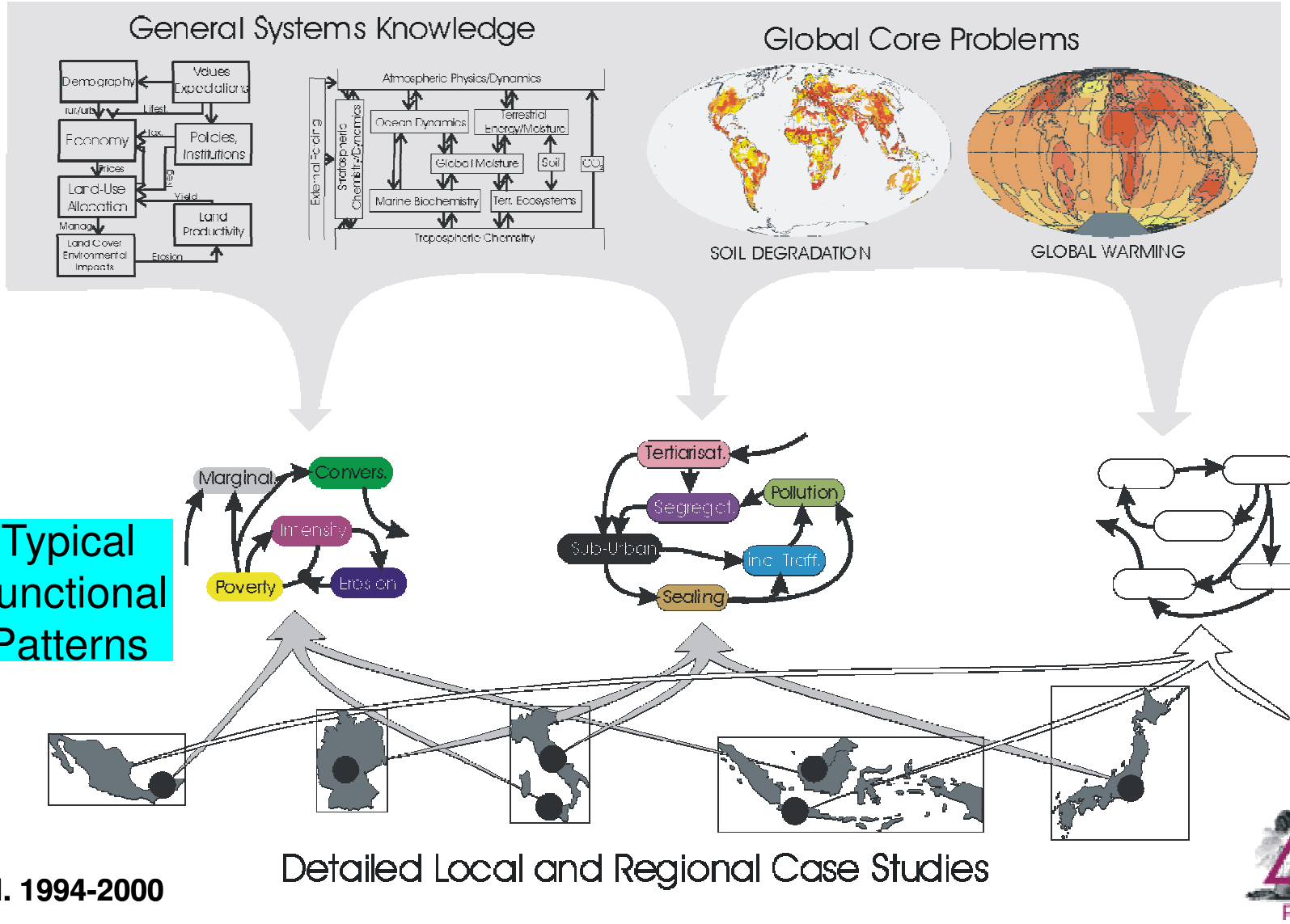
200 adaptation measures





Source:
PIK/Kropp et al., 2010

An Intermediate Complexity Analysis of Global Change



WBGU et al. 1994-2000

PIK

Welche Bedingungen für den Schein?

- Seminarvortrag, ca. 45-60 Minuten
- Hausarbeit

Länder mit spezifischem Input:

Gruppe I: Indien, China, Brasilien, Pakistan, Mexiko, Südafrika

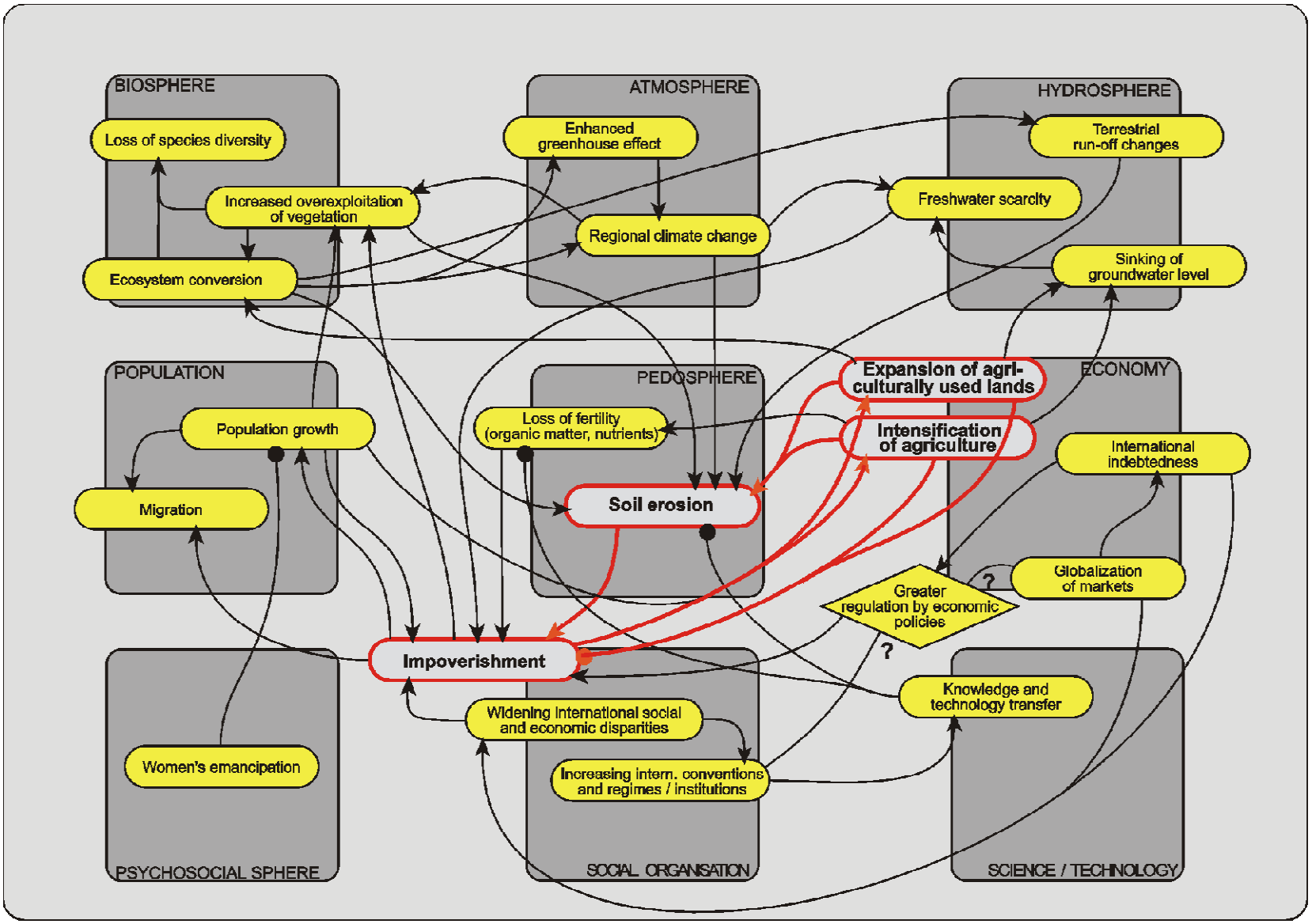
Gruppe II: Pazifikstaaten

Gruppe III: Zentralafrika

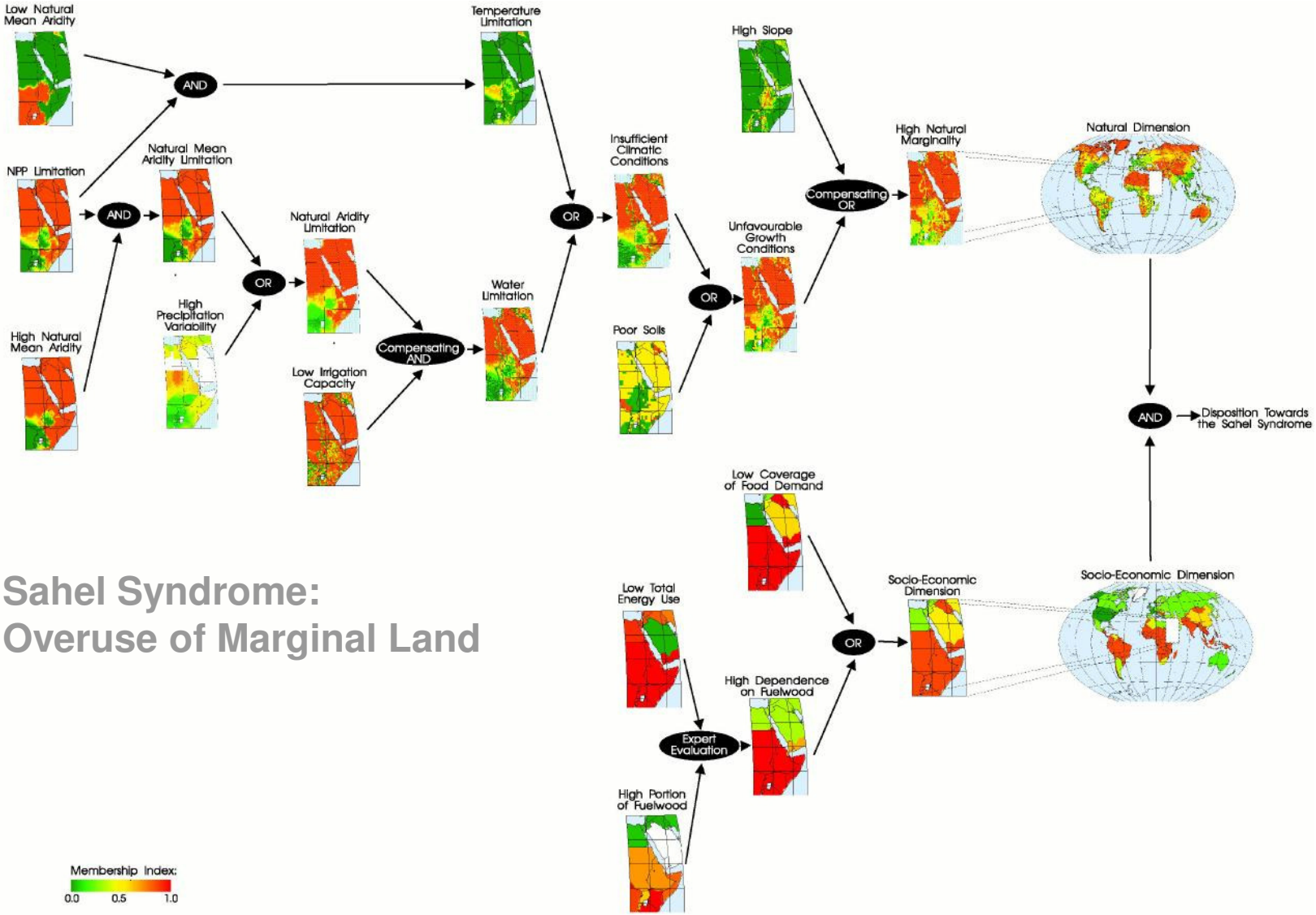
Gruppe IV: Südostasien

Dazwischen Vorlesungen, mit begleitenden Themen

Network of Interrelations: Sahel Syndrome

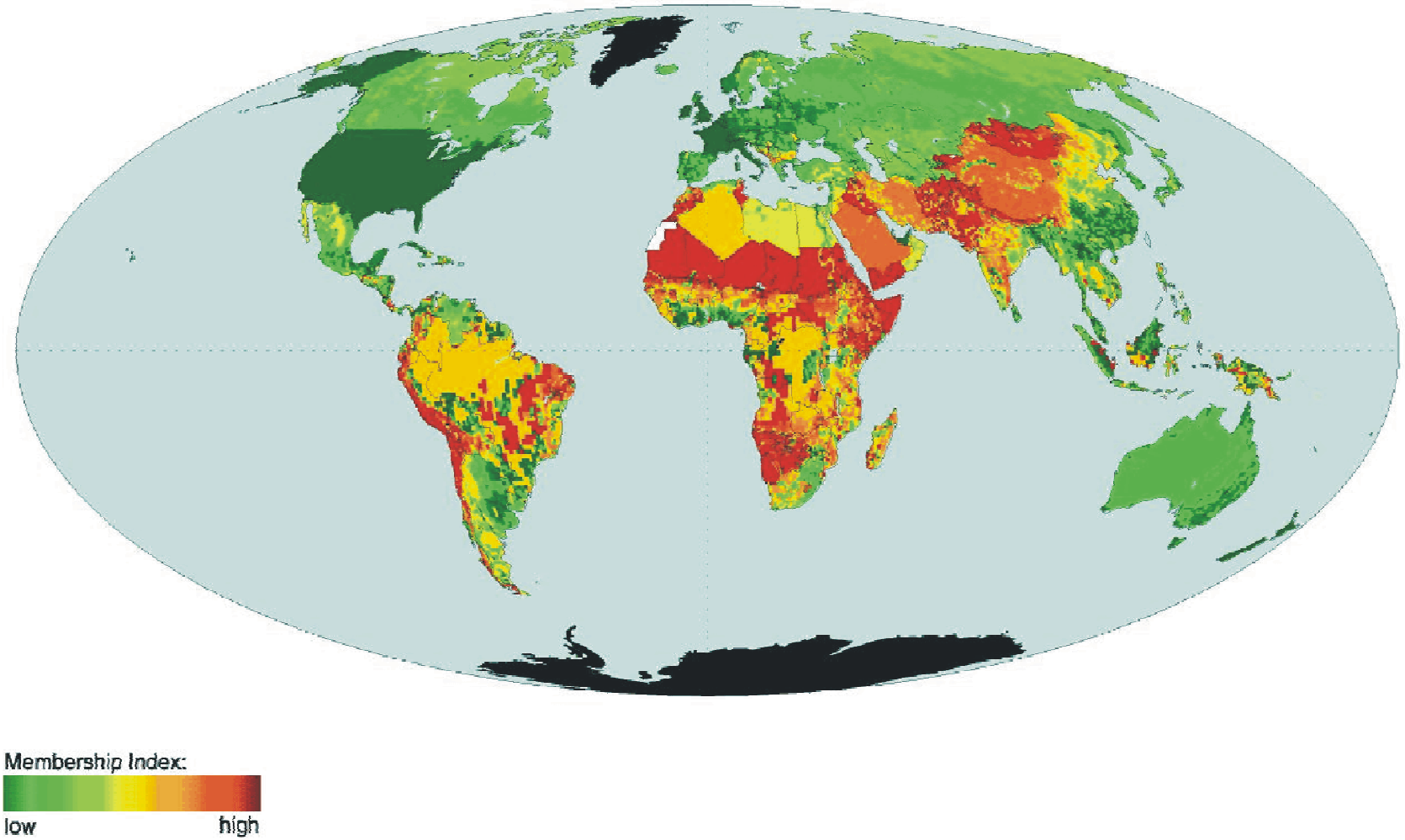


Diagnosis of Hazardous Patterns: Sahel Disposition

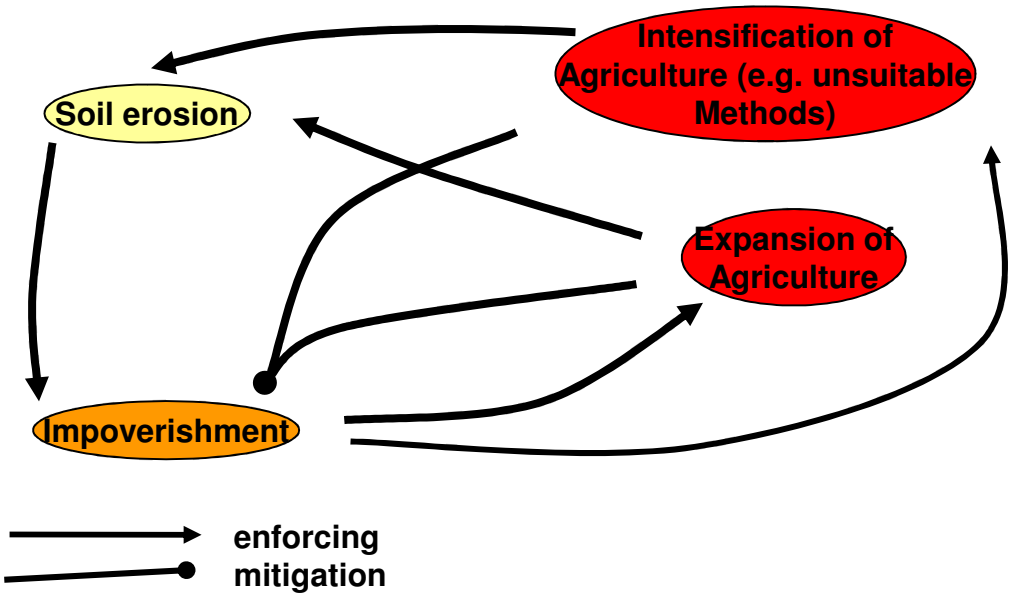


Sahel Syndrome:
Overuse of Marginal Land

Overall Sahel Disposition

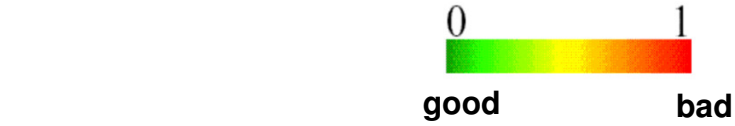


Dynamic Pattern: Poverty – Degradation Spiral (Overuse of marginal land)

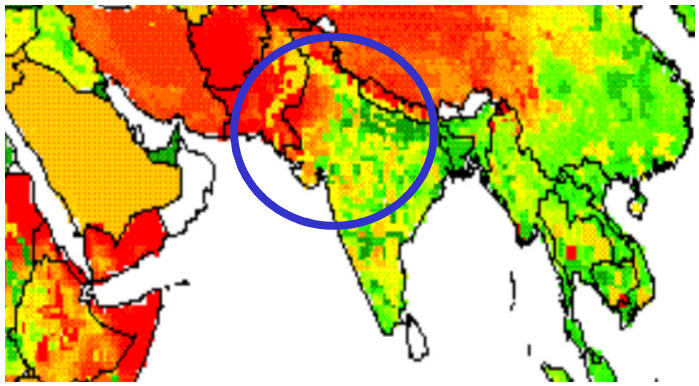


Potential that the „mechanism“ will become active is aggravated under climate change!

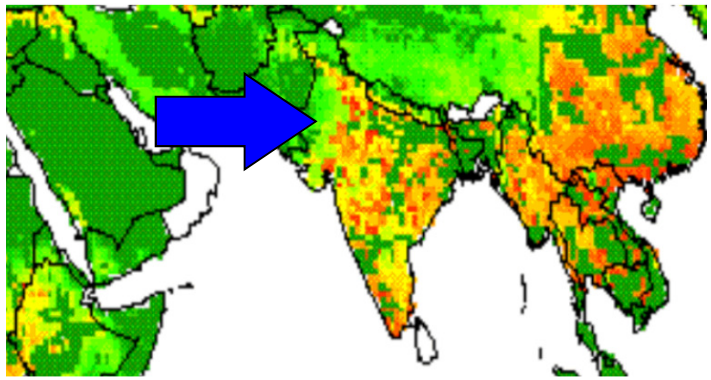
Source: PIK/further examples, e.g. Schellnhuber et al. (1997), Kropp et al. (2001), Lüdeke et al. (2004), Kropp et al. 2002, Kropp et al. 2007, Eisenack et al. (2007), Eisenack/Tekken Kropp (2006), …..

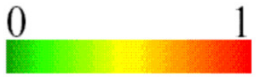


Current disposition (2000)



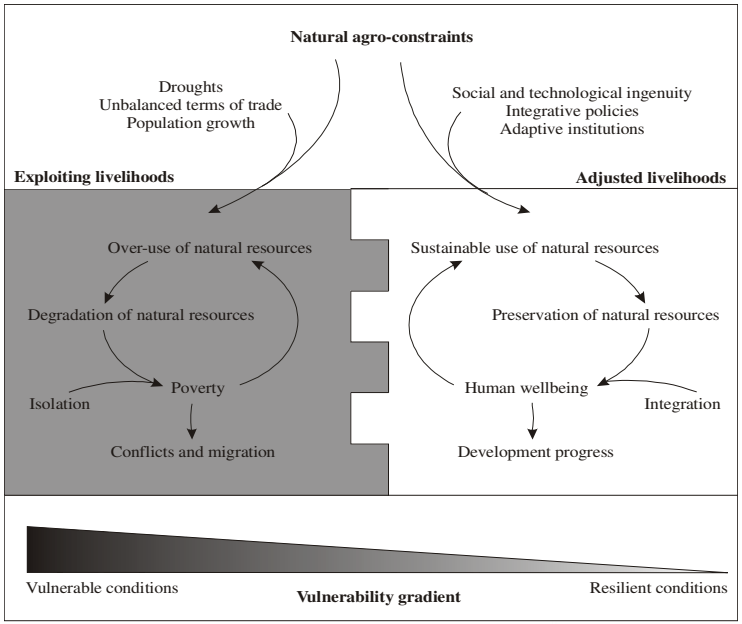
Change of disposition considering Climate Change





unchanged decline

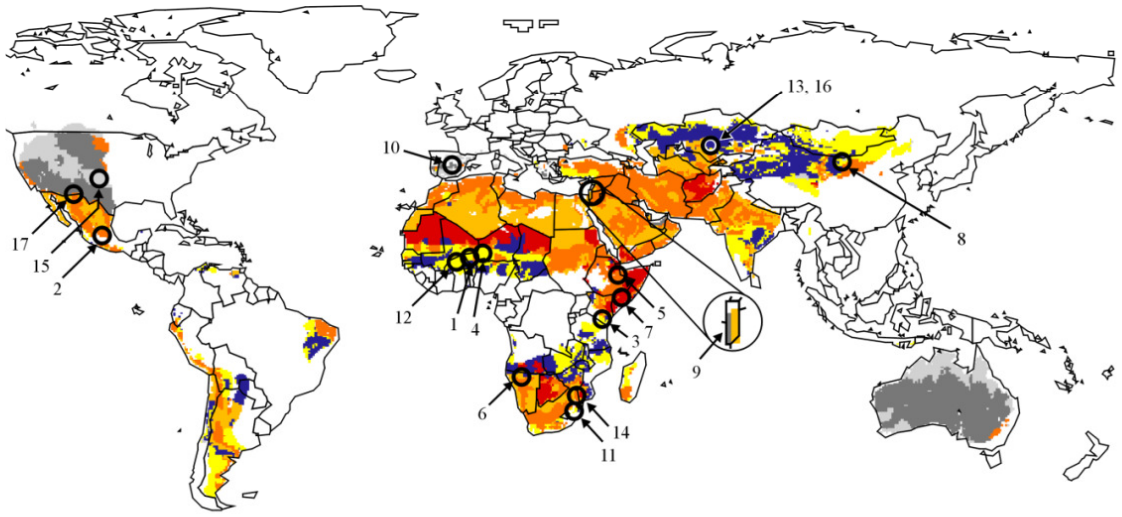
Global drylands: Spatially-specific adaptation strategies based on vulnerability clusters



Examples for adaptation patterns

Cluster 2 (PAK): Alternative, non-agricultural based livelihoods to faciliate independence of heavily degraded natural resources and pronounced agro-constraints?

Cluster analysis



Vulnerability patterns

- Cluster 1
- Cluster 2
- Cluster 3
- Cluster 4
- Cluster 5
- Cluster 6
- Cluster 7

Case studies verifying cluster-specific mechanisms and providing entry points for vulnerability reduction

1 Fatondji et al. (2006)
2 González-Morán et al. (1999)
3 Ifejika Speranza et al. (2008)
4 Kabore & Reij (2004)
5 Kassahun et al. (2008)
6 Kluge et al. (2008)
7 Lesage & Majid (2002)
8 Pei et al. (2008)
9 Portnov & Safriel (2004)
10 Puigdefabregas & Mendizabal (1998)
11 Reid & Vogel (2006)
12 Reij et al. (2005)
13 Robinson et al. (2003)
14 Shakleton et al. (2008)
15 Stewart (2004)
16 UNDP (2002)
17 Vásquez-León et al. (2003)

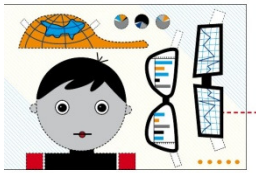
N W E S

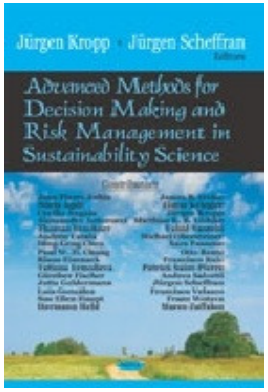
0 5.000km

Source: PIK/Sietz et al., 2010

Scientific Underpinning of Decision Making

access: www.pik-potsdam.de/nsp





G8+5 Environment Ministers at PIK

Climate Change Information for Effective Adaptation
A Practitioner's Manual

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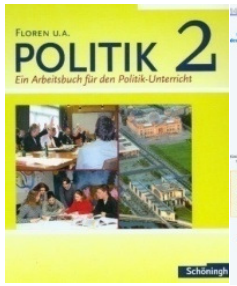

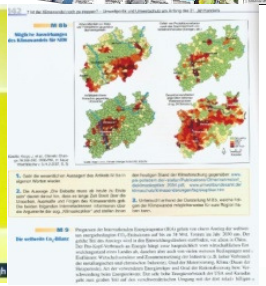

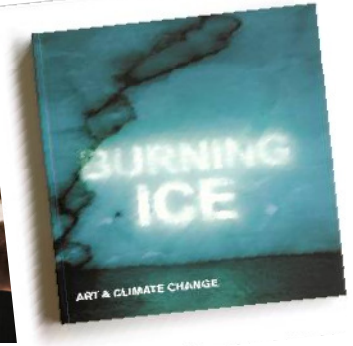

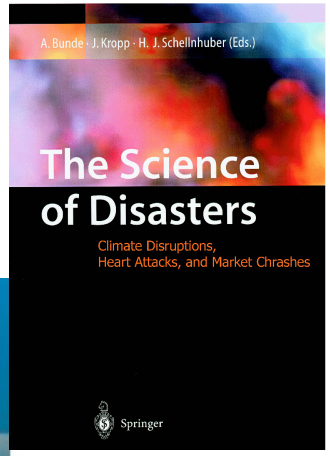

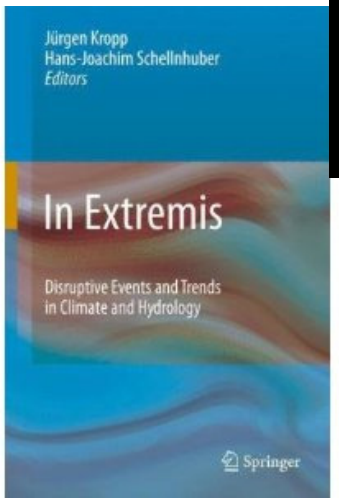

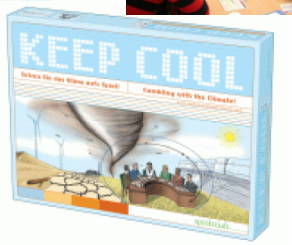

The Council of Europe
Adaptation to climate change:

Building adaptive capacity in local and regional authorities of Local and Regional Authorities

The North-South Team

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Thank you for your attention!