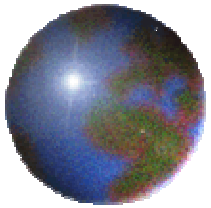
Training Course on
The Role of Genebanks in Promoting the Use of Agricultural Biodiversity to Combat Desertification
from 27 November – 7 December 2006



Desert Research Centre, El Arish, Sinai, Egypt

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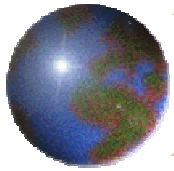
Desertification and Climate Change:
Challenges, Impacts and Policy Responses in the 21st Century for North African, Sahelian, Horn and Nile Basin Countries

For download at: **<http://www.afes-press.de/html/download_hgb.html>**



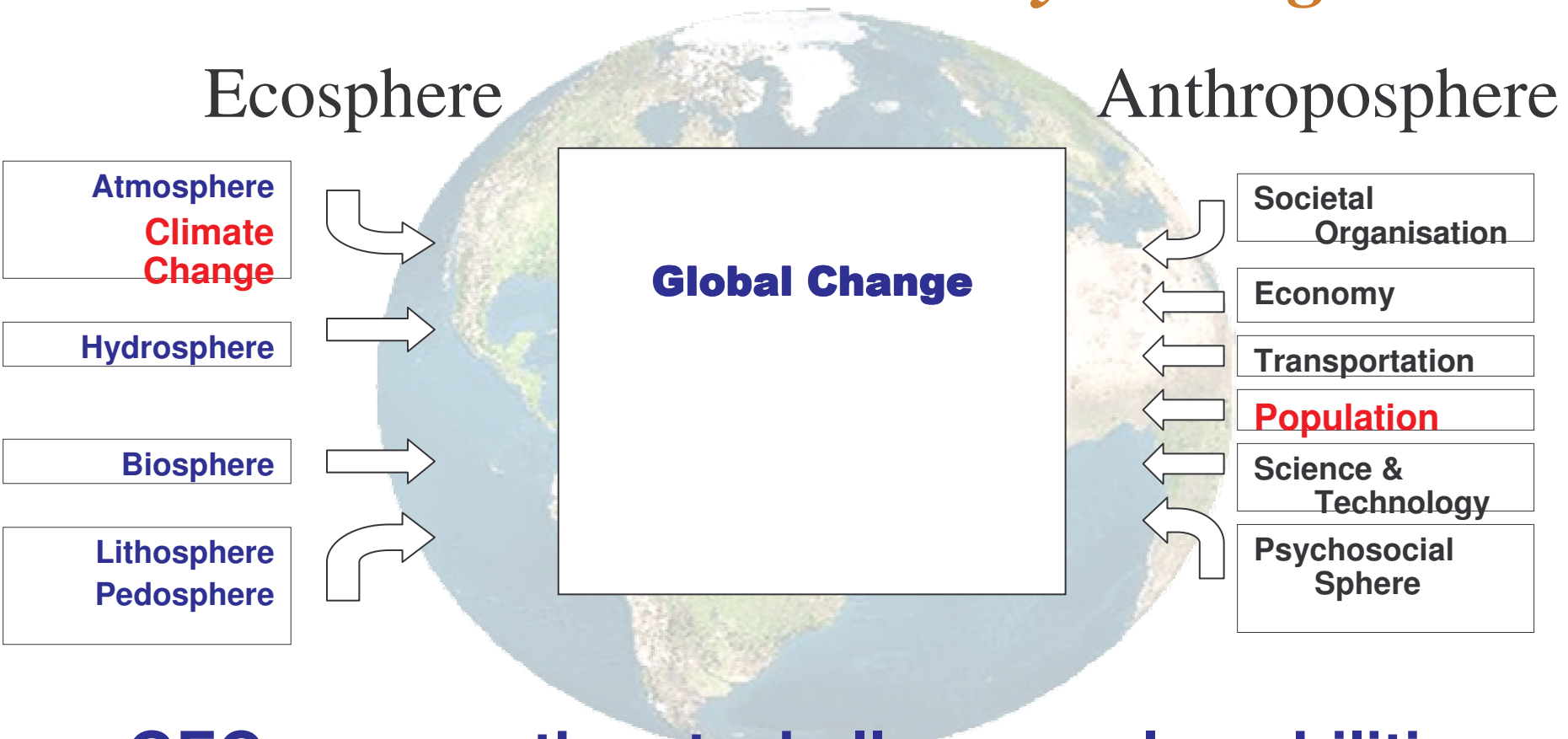
Outline of this Presentation

1. **Introduction:** Global Environmental Change: Challenge for security, development and survival of Africa
2. **From a narrow national security to wider environmental and human security concepts**
3. **Global Environmental Change: Challenges of Desertification and Climate Change for Security, Development and Survival**
4. **PEISOR Model: GEC, Environm. Stress & Societal Outcomes**
5. **Challenges for 4 African Sub-regions until 2050 & 2100**
6. **Environmental Stress & Impact: Hazards and Migration**
7. **Societal Outcome: Crises and Conflicts**
8. **Policy Responses: Reactive vs. Proactive Strategies**
9. **Need for Global Proactive Strategies and Proposals**
10. **Regional Cooperative Reactive and Proactive Mitigation Strategies and Proposals: MENA & Nile Basin Initiative**

1. Introduction: Global Environmental Change: Challenge for Security, Development and Survival of Africa

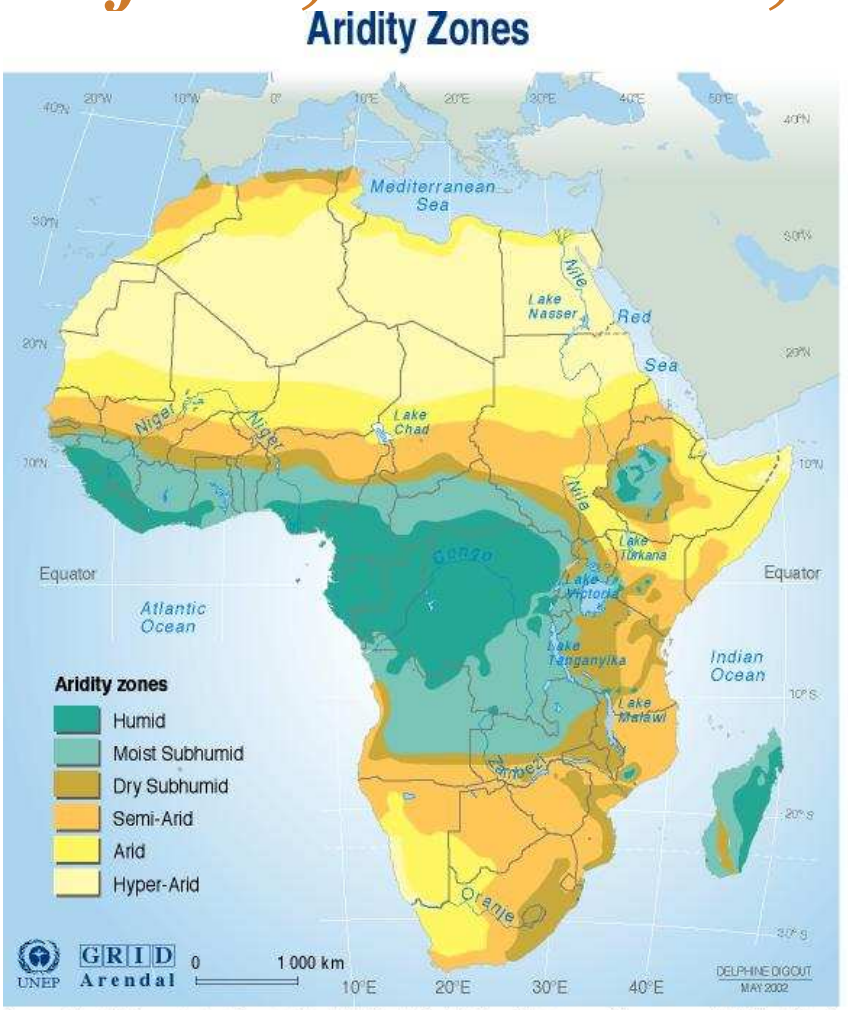
- **Geopolitical & Geoecological Context of the workshop**
  - **Focus: Global Processes of Global Environmental Change**
    - **Global Climate Change, Desertitication Affecting Biodiversity**
    - **Genebanks:** Tool for Agricultural Biodiversity in Combating Disertification
  - **Regional Impacts for the Mediterranean & Africa**
    - Mediterranean, North Africa, Nile Basin Countries, Horn & Sahel Countries
  - **Effects: Environmental Scarcity, Degradation & Stress**
  - **Impacts: Increase in Hazards: Drought & Flash Floods**
  - **Societal Outcomes:**
  - **Policy Responses**
- **Political Strategies: Reactive vs. proactive coping with GEC**
  - **Need of Better Knowledge on Regional Impacts**
  - **Cooperative Strategies, Policies and Measures for Reactive & Proactive Adaptation and Mitigation**

1.1. Global Environmental Change (GEC): Environment & Security Linkages



GEC poses a threat, challenge, vulnerabilities and risks for human security and survival.

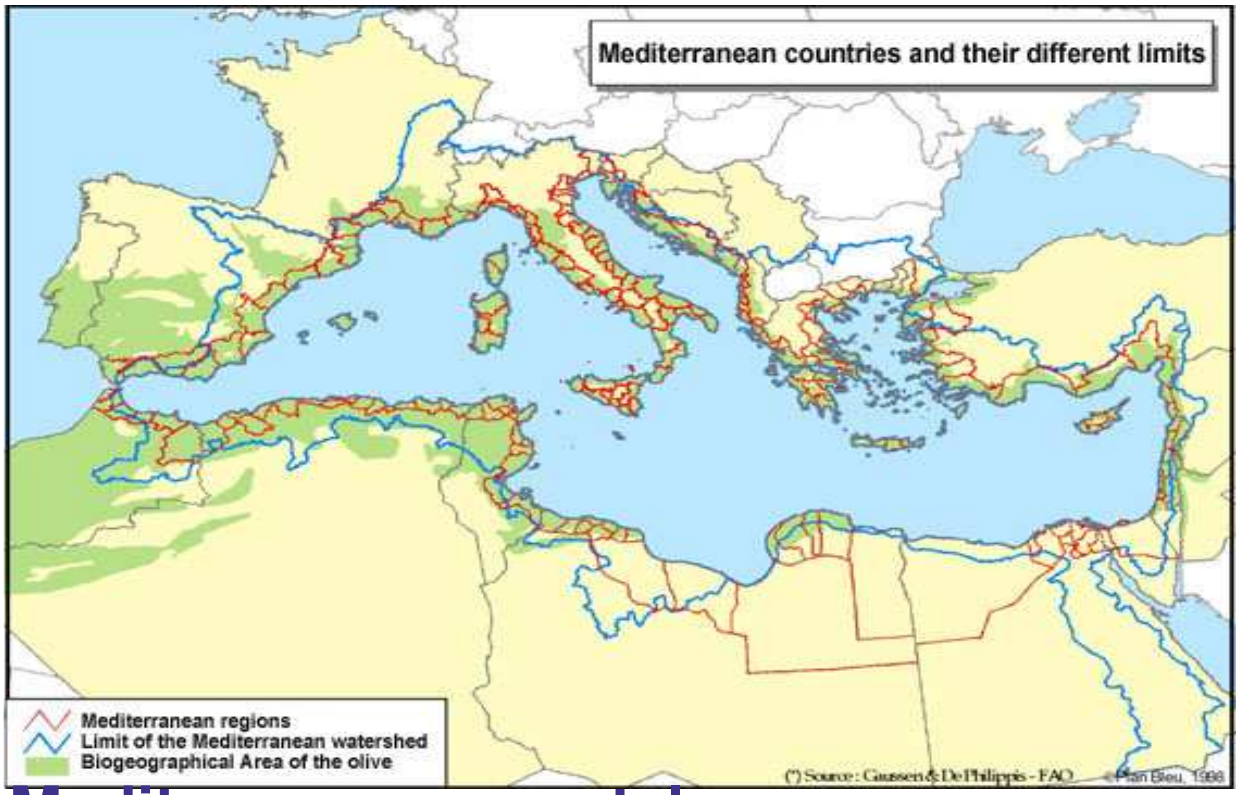
1.2. Regional Impacts: Mediterranean, North Africa, Nile Basin, Horn and Sahel Countries



Source: World Meteorological Organization (WMO), United Nations Environment Programme (UNEP), *Climate Change 2001: Impacts, Adaptation, and Vulnerability*, Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

- **Euro-Mediterranean Region**
  - Middle East & North Africa
    - WBGU: GEC & Security (2007)
    - AFES-Study for German Advis. Council on Glob. Env. Change
      - **Southern Europe**
      - **North Africa**
- **Focus of this talk:**
  - **North Africa (5)**
  - **Nile Basin Countries (10)**
  - **Horn of Africa & IGAD**
  - **Sahel Countries (10)**
- **Common features: drylands**

1.3. Common Environmental Challenges until 2100



Mediterranean coastal zone

- vulnerable to rapid onset hazards: drought & forest fires, storms, flash floods, mudflows;
- vulnerable to slow onset hazards: sea-level rise and temperature increase (climate change)

- **Geoecological commonalities**
  - Climate change (extreme weather events: hazards) ↓
- **Soil erosion & ↑ desertification ↓**
  - Water: precipitat.↑ (scarcity, degradation, drought, forest fire)
- **Socio-economic differences**
  - Population growth
  - Urbanisation
  - Food needs

North/South difference:

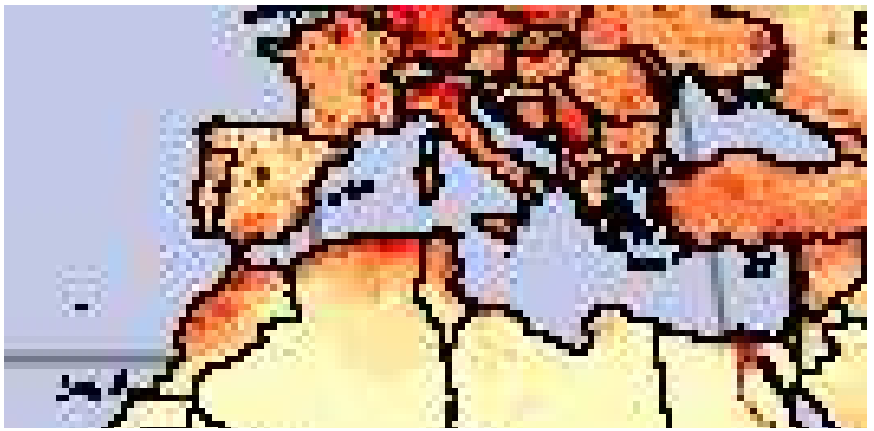
- Social vulnerability
- Resources and
- Coping capacity

Common tasks

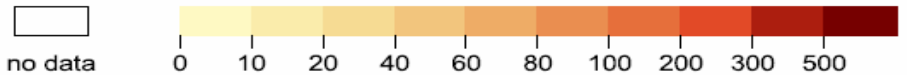
1.4. North Africa

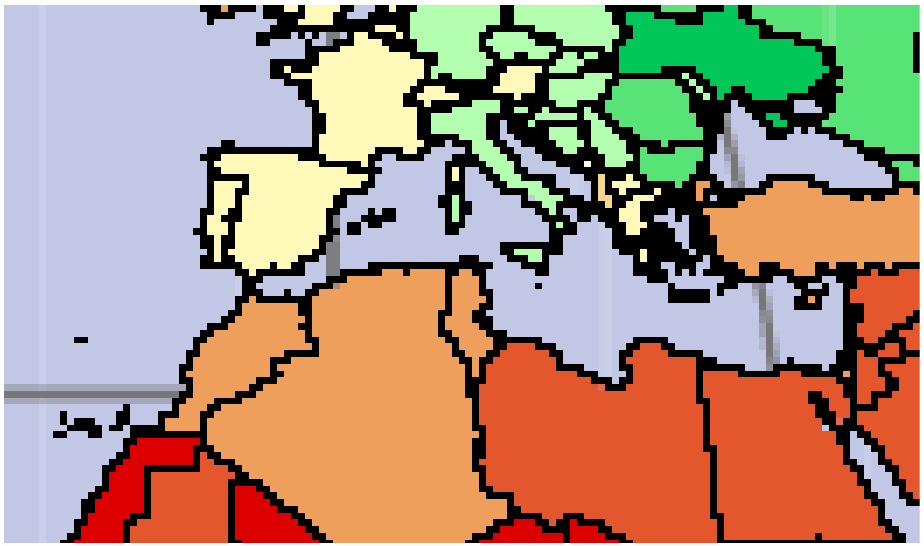
- 5 countries in North Africa
- Dramatic population growth
  - 1950: 42 mio.; 2000: 142 mio.
  - 2020: 193 mio. 2050: 244 mio.
- Rapid urbanization (in %)
  - 1950: 25; 2000: 48; 2030: 63
- High population density in cities: increase:2005 to 2025

High population density in cities in 2005



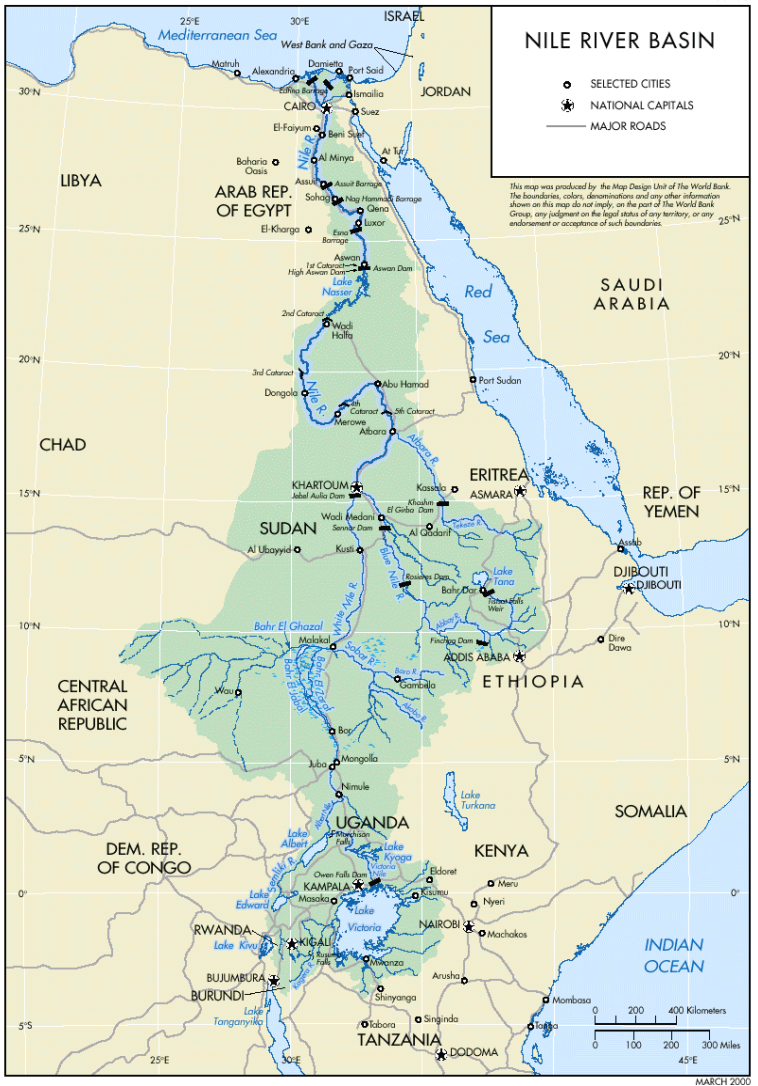
density [persons per km²]





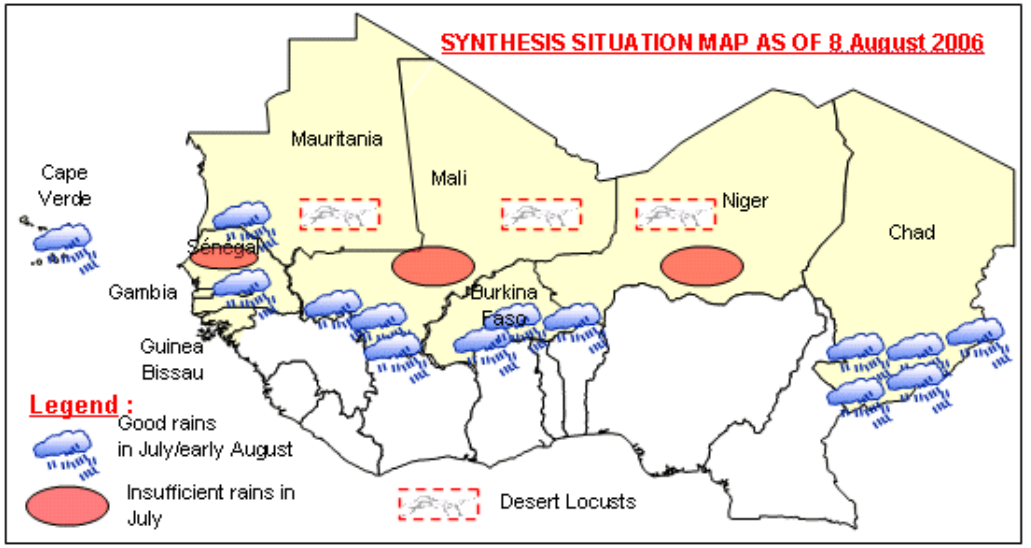
change [%]

1.5. Nile Basin countries: population growth



NB countr.	1950	2000	2025	2050	2005-2050
Burundi	2,5	6,4	13,9	22,9	15,1
D.R.Congo	12,2	51,0	108,0	183,2	122,4
Egypt	21,8	67,9	101,1	125,9	51,9
Eritrea	1,1	3,7	7,2	10,2	5,5
Ethiopia	18,4	62,9	118,4	170,2	92,8
Kenya	6,3	30,7	49,4	64,8	31,0
Rwanda	2,1	7,6	12,9	17,4	8,7
Sudan	9,2	31,1	61,3	84,2	44,0
Tanzania	7,9	35,1	52,6	71,4	34,9
Uganda	5,2	23,3	55,8	130,9	104,0
Total	**86,7**	**280,8**	**580,6**	**881,1**	**510,3**

1.6. Sahel Countries



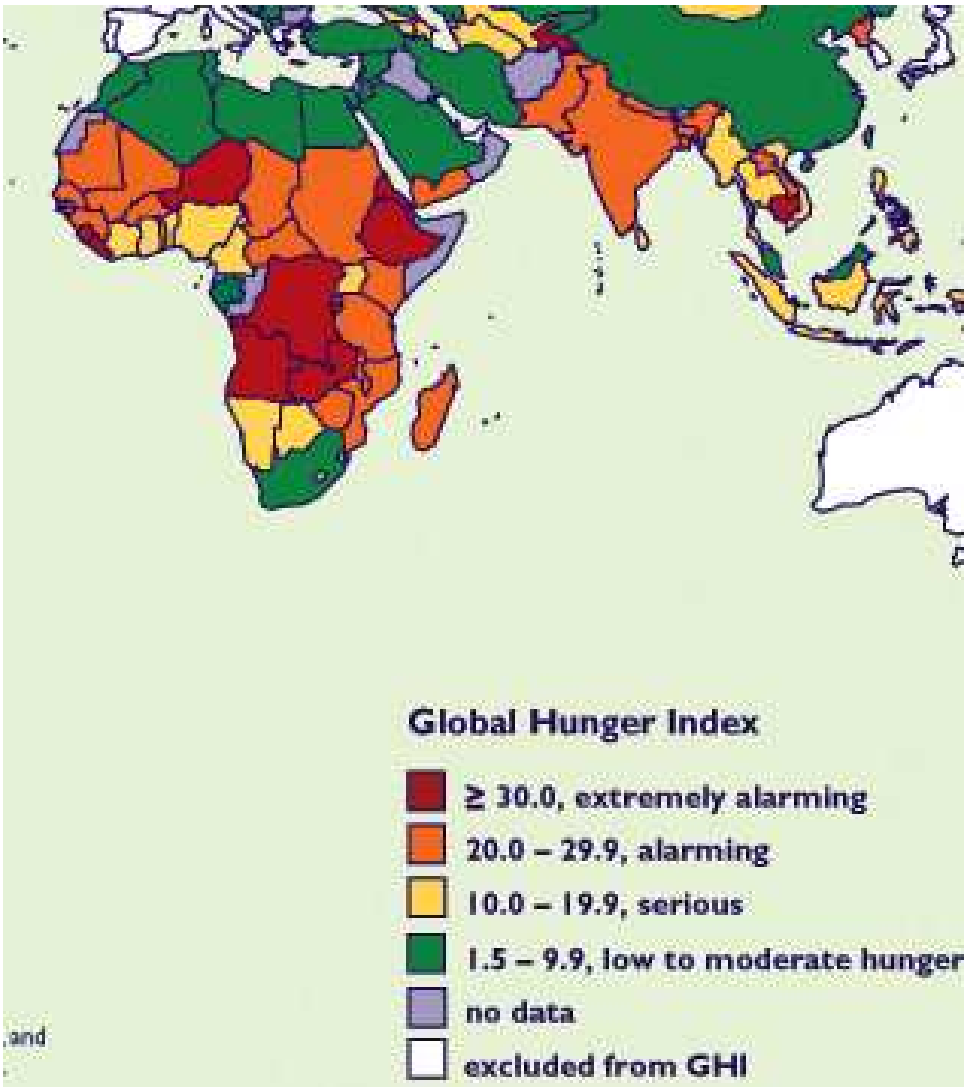
Sahel	1950	2005	2025	2050	2005-2050
Mauretania	0,8	3,1	5,0	7,5	4,5
Mali	3,5	13,5	24,0	42,0	28,5
Niger	2,5	14,0	26,4	50,2	36,2
Chad	2,7	9,7	17,0	29,5	19,8
Senegal	2,5	11,7	17,3	23,1	11,4
Guinea	2,5	9,5	15,8	28,7	19,2
Burkina Faso	4,0	13,9	22,5	39,5	25,6
Total	**18,5**	**75.4**	**128,0**	**220.5**	**145,2**
Nigeria	29,8	131,5	190,3	258,1	126,6

1.7. Horn of Africa

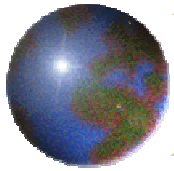
Eastern Africa: IGAD, Horn

Horn of Africa.	1950	2005	2025	2050	2005-2050
Eritrea	1.1	4.7	7.2	10.2	5.5
Ethiopia	18.4	77.4	118.4	170.2	92.8
Kenya	6.3	33.8	49.4	64.8	31.0
Sudan	9.2	40.2	61.3	84.2	44.0
Uganda	5.2	26.9	55.8	130.9	104.0
Djibouti		0.8	1.1	1.5	0.7
Somalia		8.6	14.9	25.5	16.9
Total	86.7	192.9	308.1	487.3	294.9

1.8. IFRI: Global Hunger Index: Oct. 2006



- **Global Hunger Index** of Internat. Food Policy Research Institute
- **Of 12 countries** with highest hunger levels, **nine** were affected by **civil wars or violent conflicts**.
- **The 10 worst cases are all in Sub-Saharan Africa**.
- Among **most affected** are countries in Nile Basin (**Eritrea, Ethiopia**), in Sahel (**Niger**)
- In all other countries: **alarming**.
- **Situation may get worse:**
  - **demand increase** and
  - **supply decline** due to impects of **Global environmental change**.



1.9. Global Environmental Change and Security

- Does GEC pose security dangers, i.e. threats, challenges, vulnerability & risks?
- Which Security Concept are we using?
  - Narrow: national military security?
  - Widened & deepended security concept?
- Hypothesis: Thinking on security changed
  - **Past:** Global, regional contextual change since when?
  - Future: Shift in earth history from Holocene to Anthropocene
- Hexagon Series Book Project: Global mental mapping of reconceptualization of security
  - Widening, deepening, shrinking, sectorialisation?

2. From a narrow national security to wider environmental and human security concepts

- **Thinking on security changed since 1990:**
  - **Contextual change since end of the cold war (1990)**
    - **9.11. 1989: End of bipolar nuclear arms race (deterrence theory)**
    - **11.9.2001: Emergence of new non-state actors (terrorism)**
  - **Widening, deepening and sectorialisation of security globally**
    - **UN Sec. General's High Level Panel on Threats (Egypt: A.Moussa)**
    - **Kofi Annan: In larger Freedom: March 2005**
- **Security thinking must adapt to new future challenges**
  - **UK: D. King: Climate change more serious threat than terrorism**
  - **UK: N. Stern: Costs of not acting are higher than WW I & WWII**
  - **Crutzen/Schellnhuber: Shift from Holocene to Anthropocene**
- **This requires a rethinking of security: from the *security dilemma* of states to the *survival dilemma* of people.**

2.1. Widening of Security Concepts: From National to Environmental and Human Security

4 trends in reconceptualisation of security since 1990:

- **Widening** (dimensions, sectors), **Deepening** (levels, actors)
- **Sectorialisation** (energy,food,health), **Shrinking** (WMD, terrorists)

Dimensions & Levels of a Wide Security Concept

Security dimension⇒ ⇓ Level of interaction	Mili-tary	Politi-cal	Economic	Environ-mental ⇓	Societal
Human individual ⇒			Food, health water security	Cause & Victim	Food/ health
Societal/Community				⇓⇑	
National	shrinking		Energy security	⇓⇑	
International & Regional				⇓⇑	
Global/Planetary ⇒				GEC	

2.2. Environmental & Human Security

Table: Expanded Concepts of Security (© Bjørn Møller, 2003)

Label	Reference object	Value at risk	Source(s) of threat
National security	The State	Territorial integrity	State, substate actors (e.g. terrorists)
Societal security	Societal groups	Nation. identity	Nations, migrants
Human security	Individ., humankind	Survival	Nature, state, globaliz.
Environmental sec.	Ecosystem	Sustainability	Humankind

Environmental Security: Referent: Ecosystem; Value at risk is *sustainability*.

- Major challenges: *global environmental change & humankind*,
- Focus: Interactions between ecosystem & humankind,
- Impact of global environmental change on environm. degradation, of increasing demand on environmental scarcity & environmental stress.

Human security: Referent: individuals and humankind.

- Values at risk: survival of human beings and their quality of life.
- Major source of threat: nature (*global environm. change*), globalisation, nation state with its ability to cope with dual challenge.

2.3. Four Pillars of Human Security

- **Origin: UNDP Report 1994:** M. ul Haq (Pakistan)
- **Human security**: "safety from the threat of disease, hunger, unemployment, crime, social conflict, ... environmental hazards"
- **Ogata/Sen**: Human Security Now: protection & empowerment
- **Four major pillars of the human security concept:**
  - "**Freedom from fear:** small arms, human rights (UNESCO, HSN), **Canadian approach:** Human Security Report
  - "**Freedom from want**". **Human development** (UNDP 1994; CHS 2003: Ogata/Sen: Human Security Now), **Japanese approach;**
  - "**Freedom to live in dignity**" (**Kofi Annan** in his report: *In Larger Freedom* (March 2005)
  - "**Freedom from hazard impact**" by reducing vulnerability & enhancing coping capabilities of societies confronted with natural & human-induced hazards (Bogardi/Brauch 2005; Brauch 2005a, 2005b).

3. Global Environmental Change: Challenges of Climate Change and Desertification for Security, Development and Survival

- **UK Def. Min. Reid (2006)**: **Climate Change: threat to UK security**
- **D. King, Science Adviser, UK PM, 9.1.2004: „Climate change is a far greater threat to the world than international terrorism. … Without immediate action flooding, drought, hunger & debilitating diseases would hit millions of people.**
- US DoD Study: **Randall/Schwartz (2003)**: Impact of Abrupt Climate Change: Cooling in NC.Europe‘ on U.S. national security
- **Brauch Study (2002):** for German Environment Ministry: Impact on Bangladesh, Mexico, Engypt and Mediterranean: Climate Change as a challenge for environment & human security
- **AFES-PRESS** Study for WBGU (2006): Impact of Global Chan-ge on National & Human Security in South. Europe & N. Africa
- **My own thesis**: Climate change does not pose *security dilemma* for states but a *survival dilemma* for affected people who are forced to leave their home and livelihood (migration).

3.1. Compilation of Environmental 'Threats', 'Challenges', 'Vulnerabilities' and 'Risks'

Environmental causes, stressors, effects & natural hazards pose	Natural and economic factors		Societal impact factors (exposure)	
	Substantial threats for	Challenges affecting	Vulnerabilities for	Risks for
	Security objects (for what or whom?)			
Climate change - temperature increase (creeping, long-term)	- Human health - agriculture (yield decline) - biodiversity -desertification	- tourism - food security - fisheries - government action - econ. action	- infect. disease - damage to crops - natural systems - water scarcity - forest fire	- human populations - the poor, old people and children due to heat waves
Climate change - sea level rise (creeping, long-term)	- Small island states - marine eco-system, - indigenous communities, - industry, energy	- deltas - coastal zones - marine, freshwater ecosystems	- coastal cities, habitats, infrastructure, jobs - cities, homes, jobs	- livelihood - poor people, - insurance, - financial services

4. PEISOR Model: Global Change, Envi-ronmental Stress & Extreme Outcomes

- **PEISOR model: Environmental stress and extreme and sometimes fatal outcomes**
  - Hazards: Nature impacting on humans: victims: poor & highly vulnerable people
  - Hazard impact depends on degree of social vulnerability
  - Human security: Freedom from hazard impact
- **PEISOR model distinguished 5 stages:**

P: Pressure: Causes of GEC : Survival hexagon

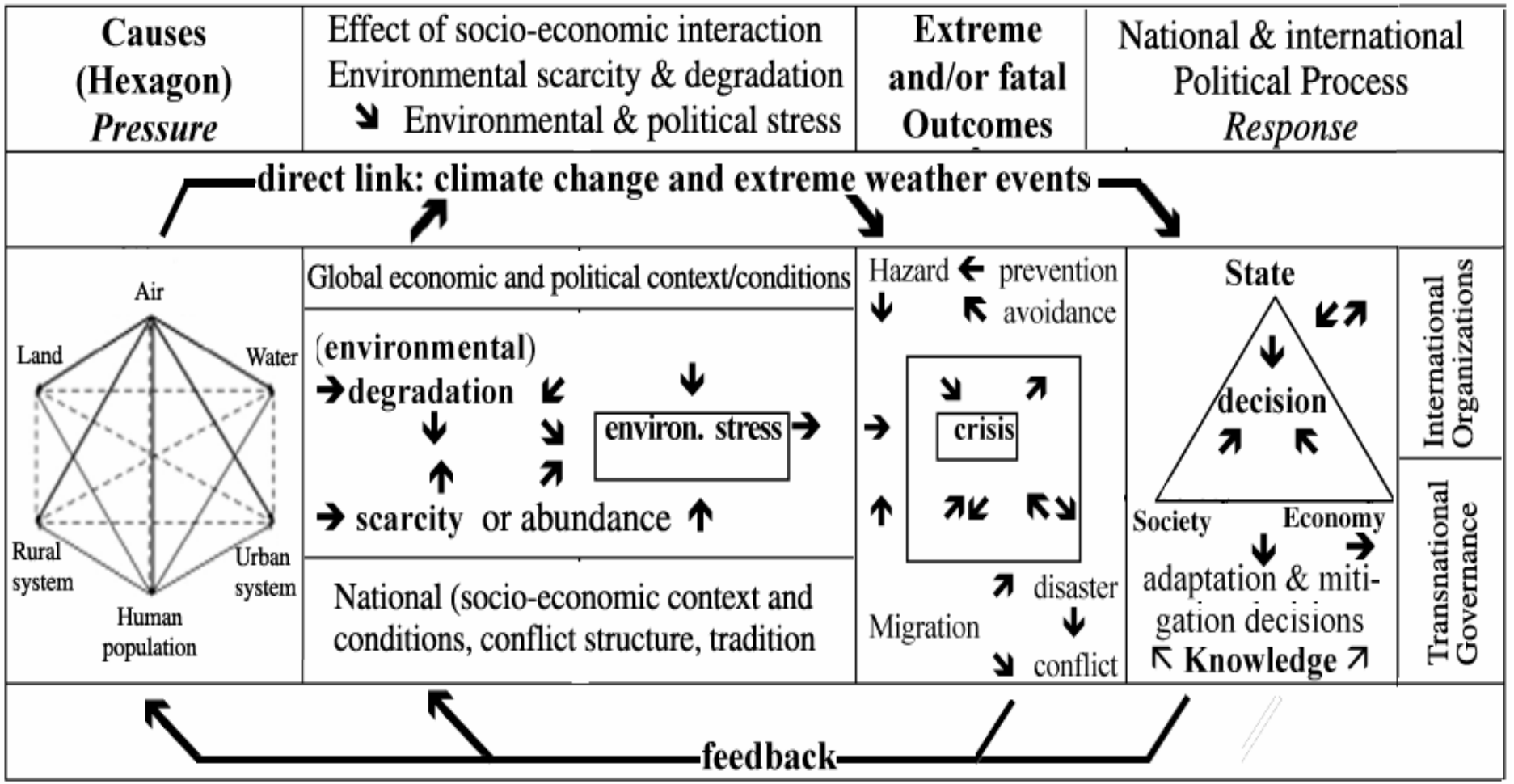
E: Effect: environm. scarcity, degradation & stress

I: Impact: Extreme or fatal outcome: hazards

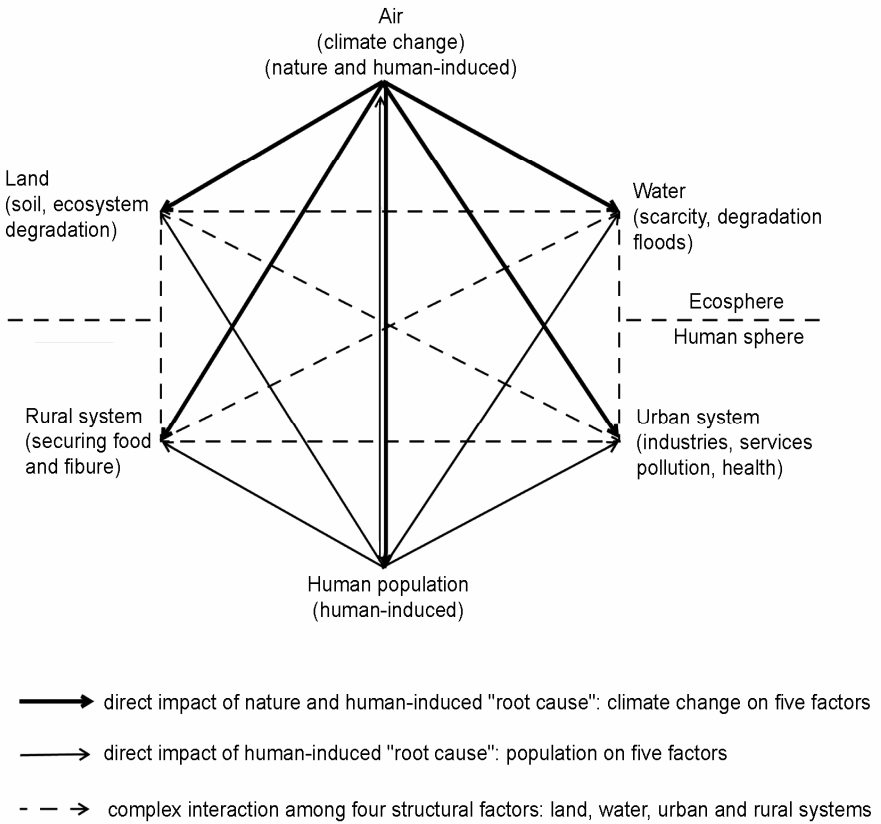
SO: Societal Outcomes: disaster, migration, crisis, conflict, state failure etc.

R: Response by the state, society, the economic sector and by using traditional and modern know-ledge to enhance coping capacity and resilience

4.1. PEISOR Model: Global Change, Environmental Stress & Extreme Outcomes



4.2. Cause: Pressure of Global Environmental Change: Six Determinants: Survival Hexagon



Ecosphere:

- Air: Climate Change
- Soil: Degradation, Desertification
- Water: degradat./scarcity

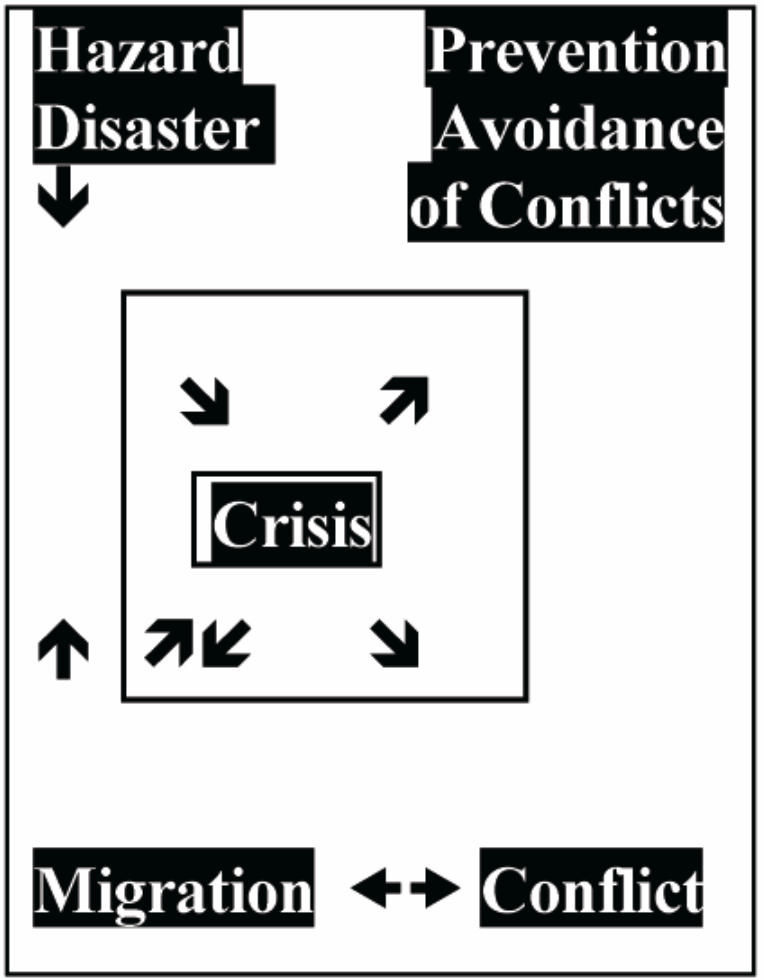
Anthroposphere:

- Population growth/decline
- Rural system: agriculture
- Urban system: pollution etc.

Mode of Interaction

- Linear, Nonlinear
- Exponential
- Chaotic, abrupt

4.3. Impact: Human-Induced Natural Hazards Drought, Famine and Societal Outcomes



Much knowledge on these factors:

- ✓ **Drought, migration, crises, conflicts**

Lack of knowledge on linkages among fatal outcomes

- ➢ **Drought & drought-ind. migration**
- ➢ **Famine & environm.-ind. migration**
- ➢ **Conflicts & conflict-induced migration**

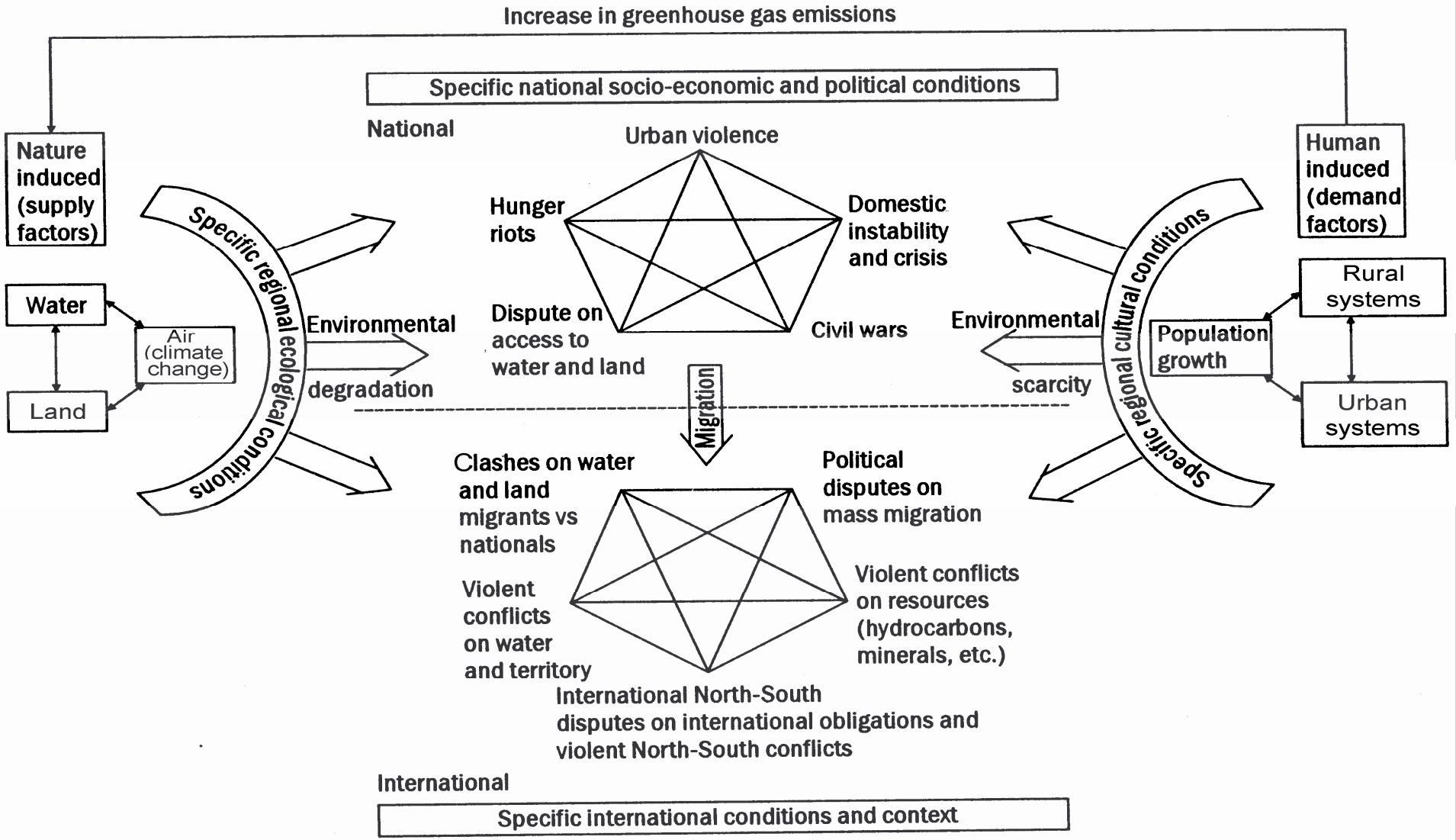
Lack of knowledge on societal consequences: crises/conflicts

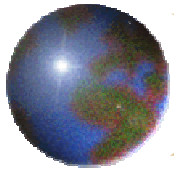
- ➢ **Domestic/international crises/conflicts**
- ➢ **Environmentally or war-induced migration as a cause or consequence of crises and conflicts**

4.4. Societal Outcomes: Knowledge on Linkages of Outcomes

- **What are consequences of climate change, desertification and water scarcity for:**
  - Environmental scarcity
  - Envivironmental degradation
  - Environmental stress?
- **What are indirect Societal Outcomes of:**
  - Human-induced hydro-meteorological natural water-related hazards (Storms, floods, landslides, drought) due to natural variability & increase due to climate change?
  - For migration, societal crises and domestic and international conflicts?
  - What role does social vulnerability of victims play?

4.5. Pentagon of Extreme Outcomes





5. Climate Change, Desertificastion Natural Hazards and Disasters

- **Climate Change**: Natural variability during past millenia & anthropogenic change since Industrial Revolution (1750).
- **During 21st Century**: Climate change may have manifold impacts on security & survival of people & states.
- Climate & Weather-related **natural hazards** have increased during 20th century and will increase during 21st century.
- This will have **serious impacts** on international relations **pose manifold security dangers.**

5.1. Global Climate Change: Temperature Increases & Sea Level Rise

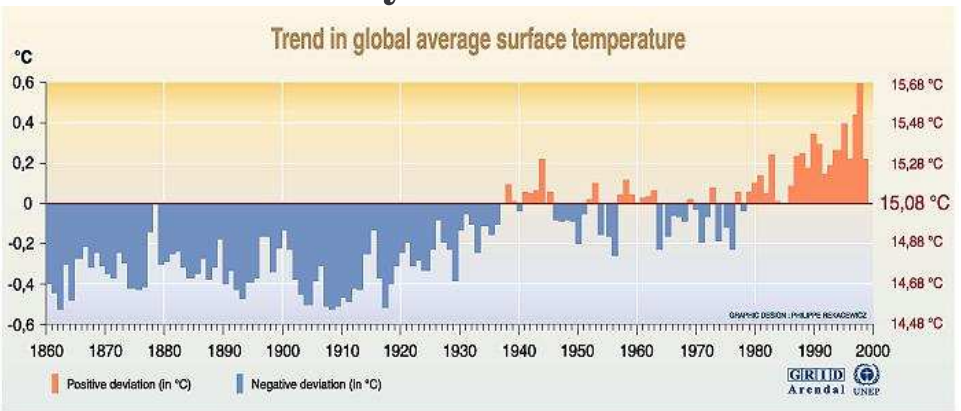
2 Climate Change Impacts: Temperature & Sea level Rise

- Global average temperature rise in 20th century: + 0.6°C
- Proj. temperature rise: 1990-2100: +1.4 – 5. 8°C

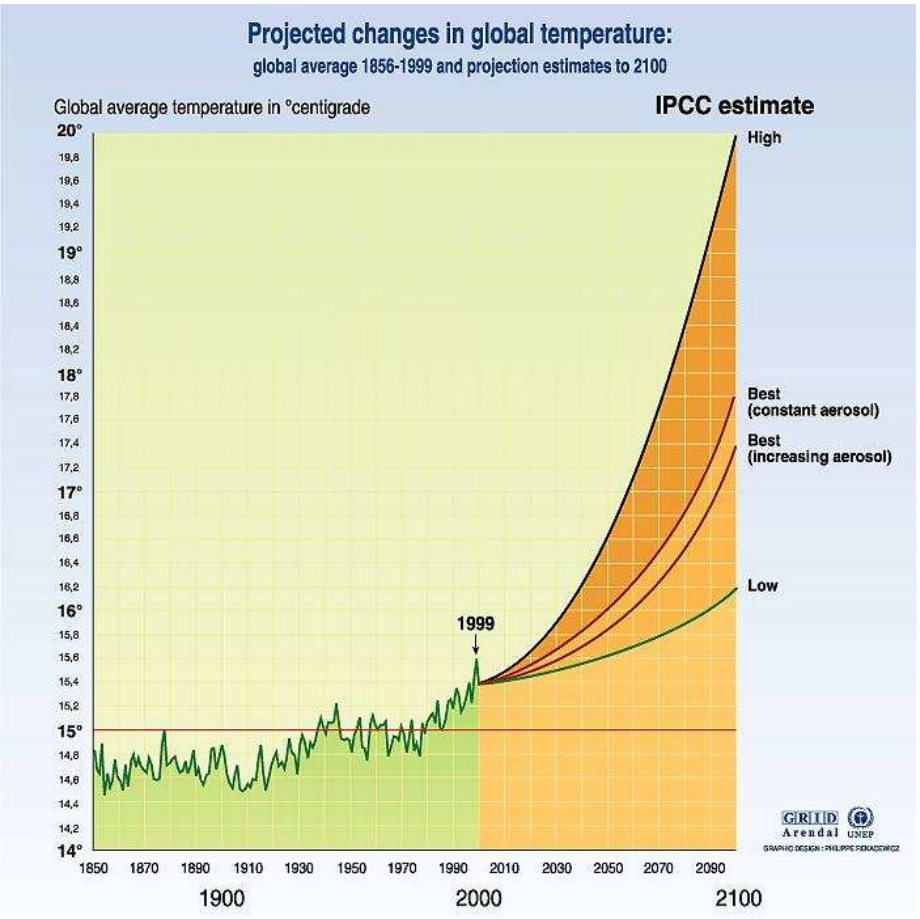
Sources: IPCC 1990, 1995, 2001

Sea level Rise:

- 20th cent.: +0,1-0,2 m
- 21st century: 9-88 cm

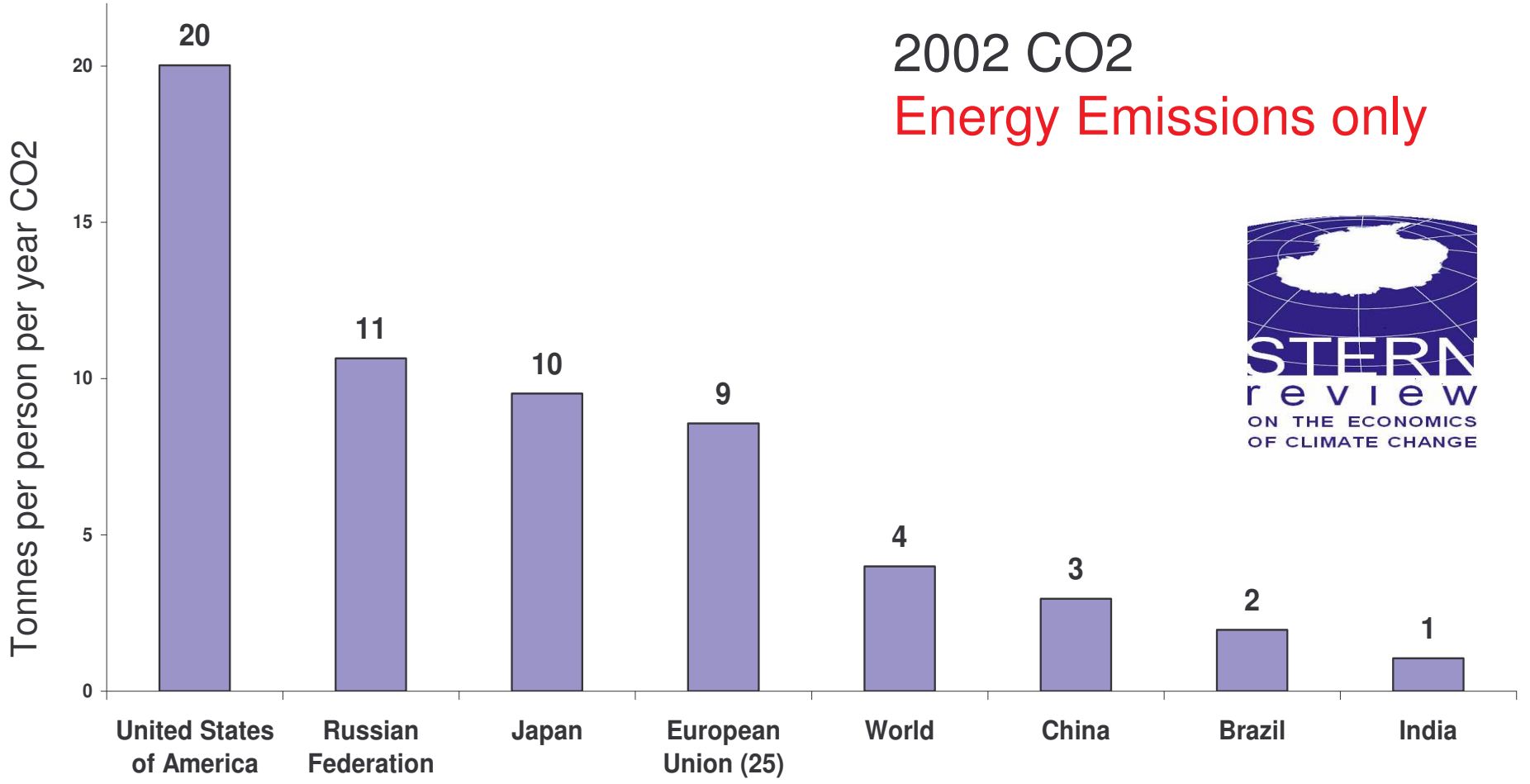


Source: School of environmental sciences, climatic research unit, university of East Anglia, Norwich, United Kingdom, 1999.



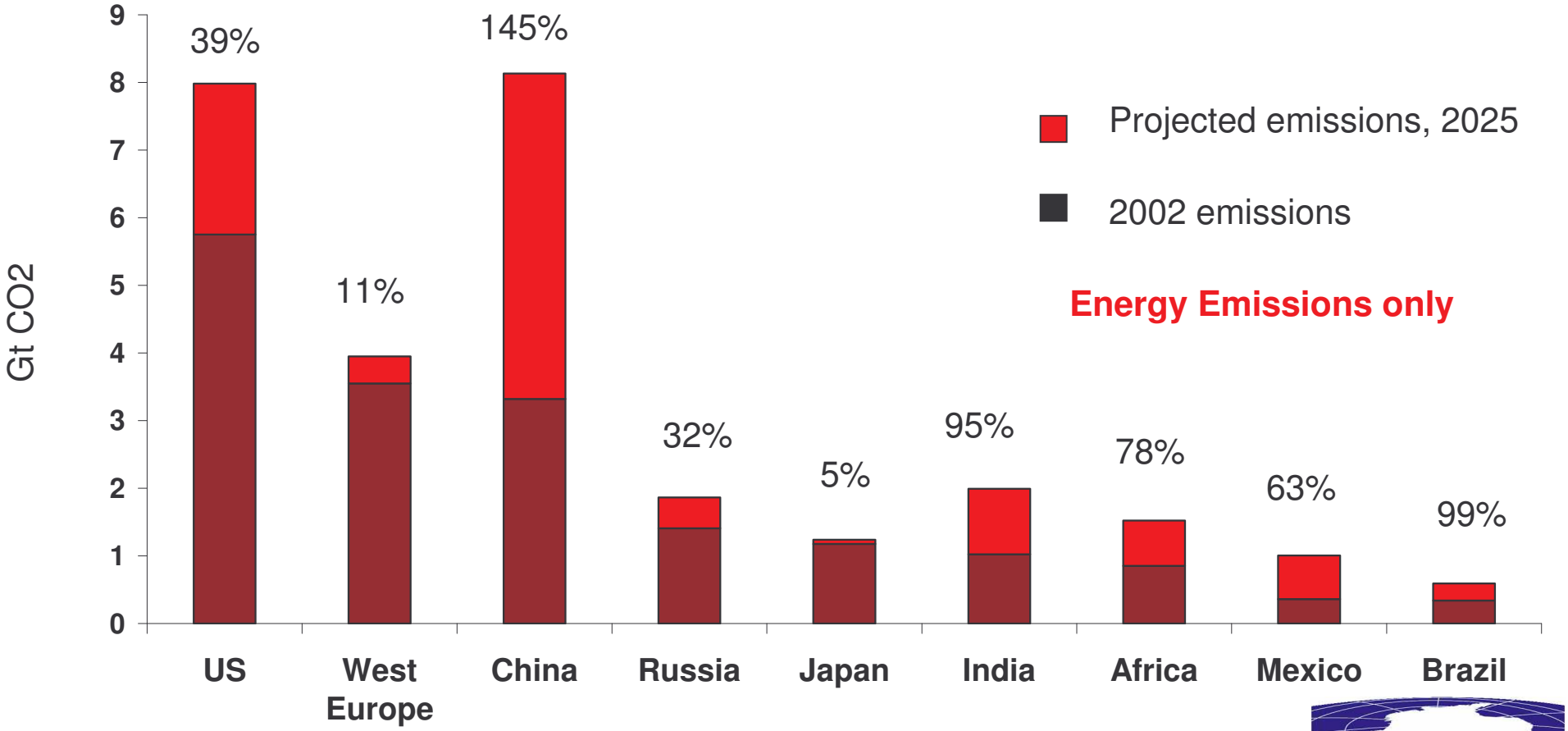
Source : Temperatures 1856 - 1999: Climatic Research Unit, University at East Anglia, Norwich UK. Projections: IPCC report 95.

5.2. Current emissions per capita are higher in developed countries



Source: World Resources Institute, CAIT

5.3. Larger developing countries account for much of the forecast rise in emissions

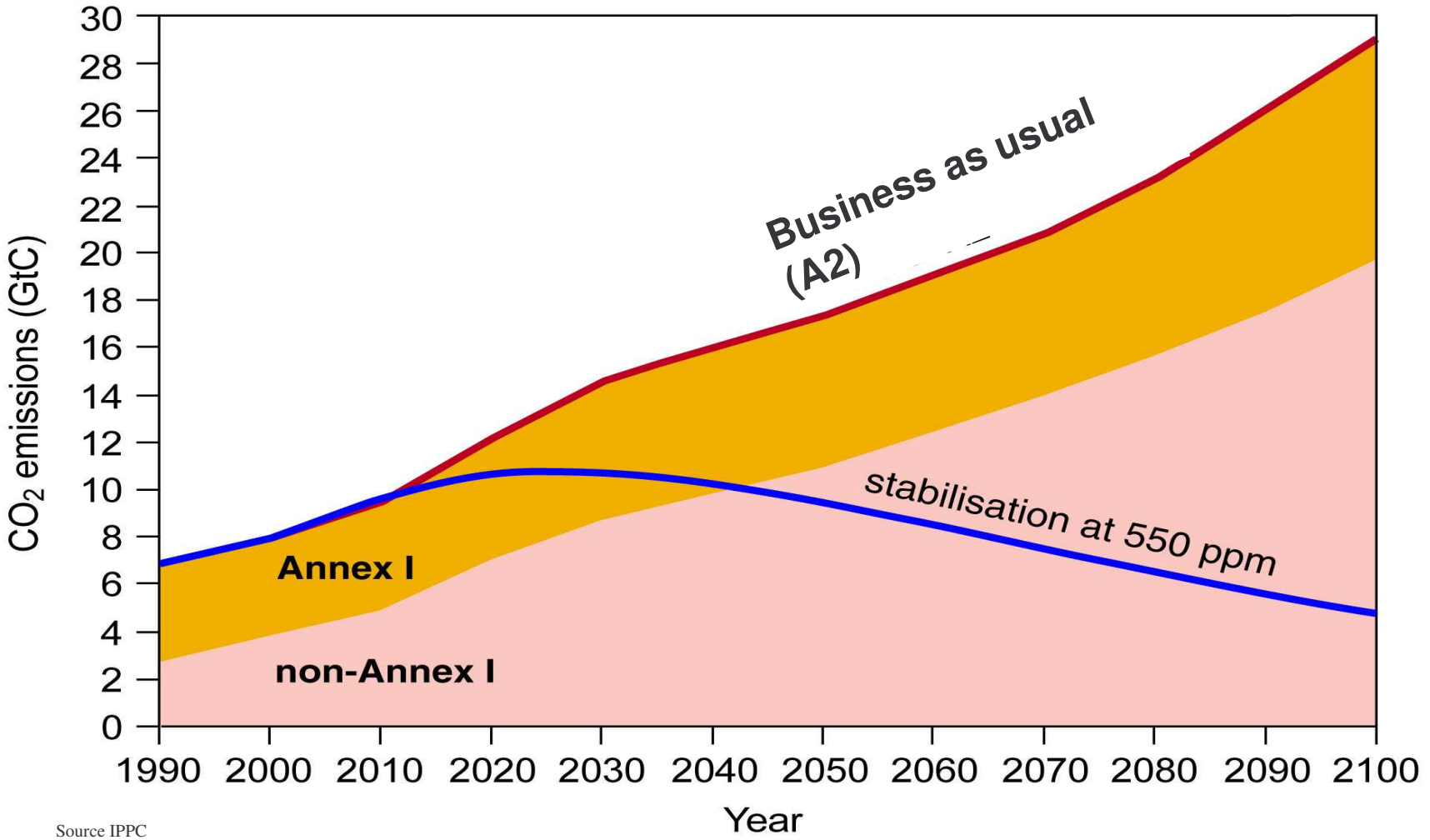


Source: World Resources Institute, CAIT Energy Information Administration Reference Scenario, Energy emissions only

STERN review ON THE ECONOMICS OF CLIMATE CHANGE

5.4. Stabilisation below 550 ppm, emissions must fall & developing countries must be part of the solution

STERN review ON THE ECONOMICS OF CLIMATE CHANGE

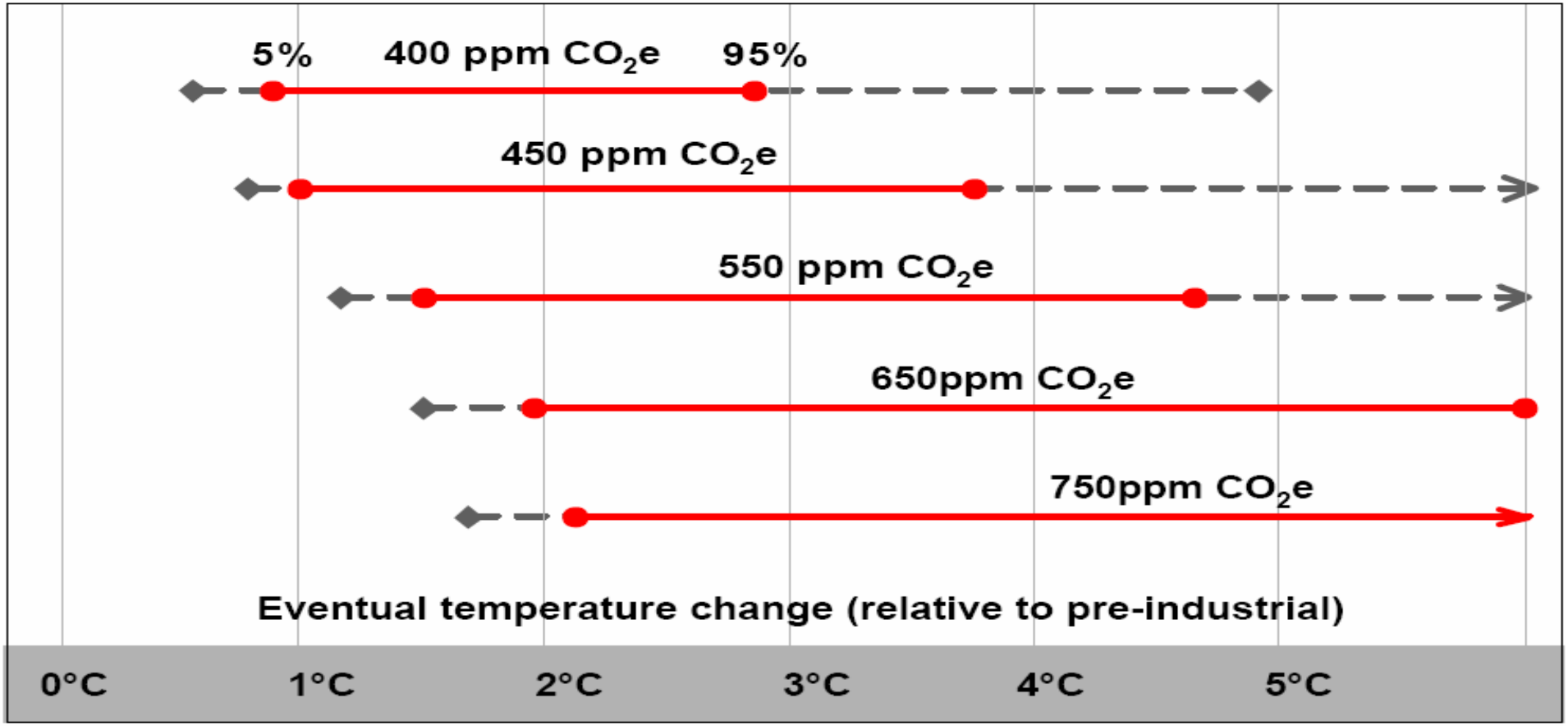


Source IPPC

5.5. Stern Report (UK), 30 Oct. 2006

STERN review
ON THE ECONOMICS OF CLIMATE CHANGE

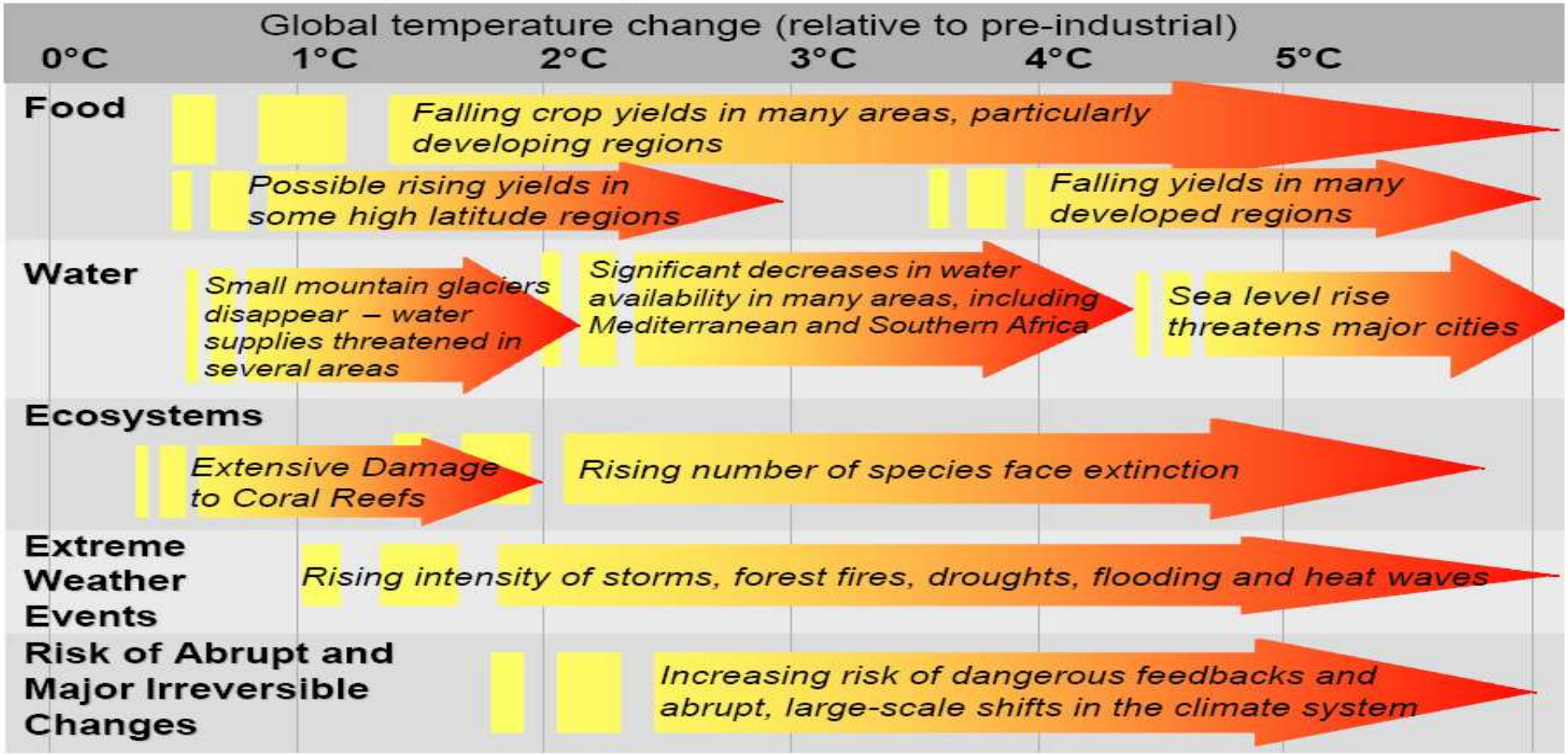
Stabilisation and Commitment to Warming



5.6.Nich. Stern Report, Oct. 2006

STERN review
ON THE ECONOMICS OF CLIMATE CHANGE

Projected Impacts of Climate Change

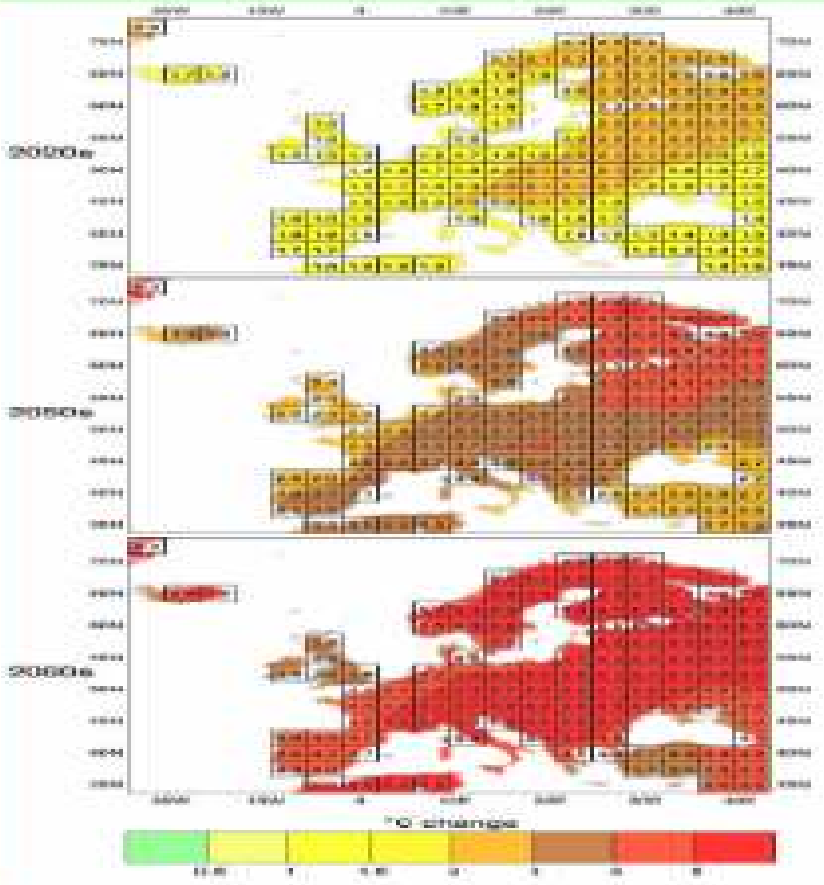


5.7. Projected Changes for Winter Temperatures & Summer Precipitation in Europe (2020/2050/2080)

©M. Parry, Meeting of EU Agriculture/ Environment Ministers, 11.9.2005, London

Winter Temperatures

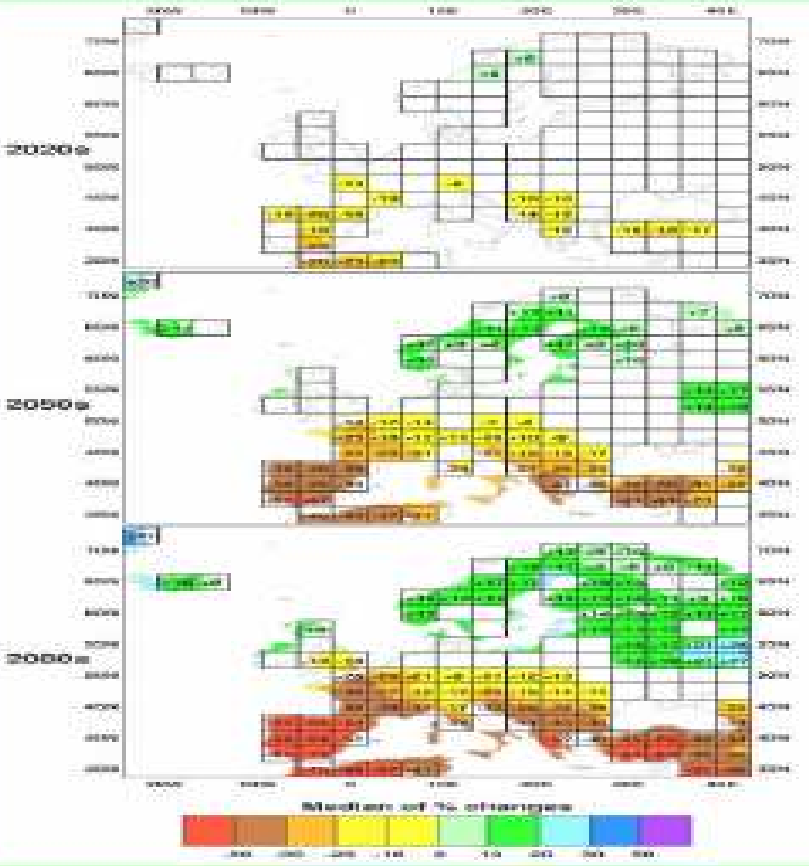
A2



Summer Precipitation

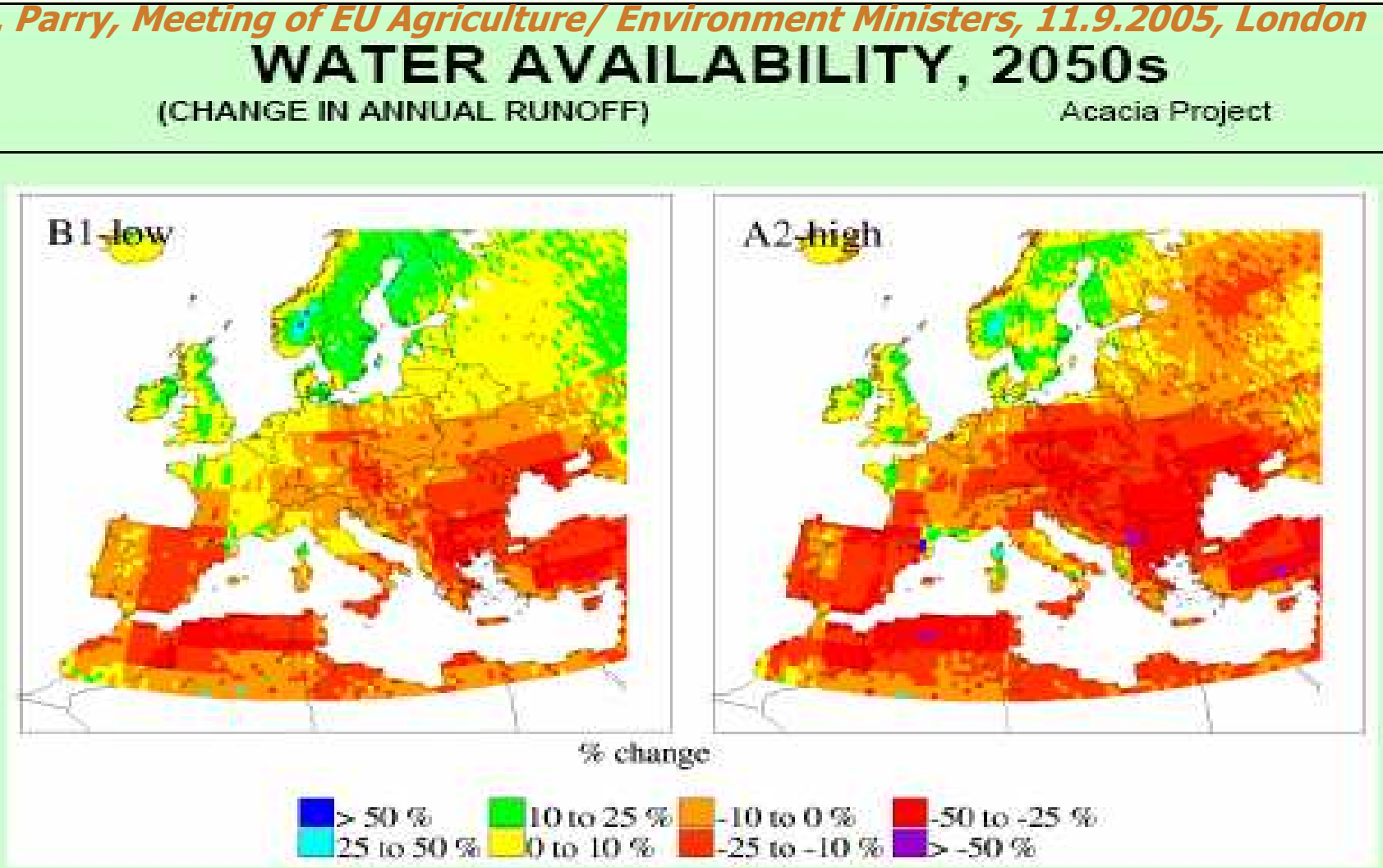
(only significant changes shown)

A2



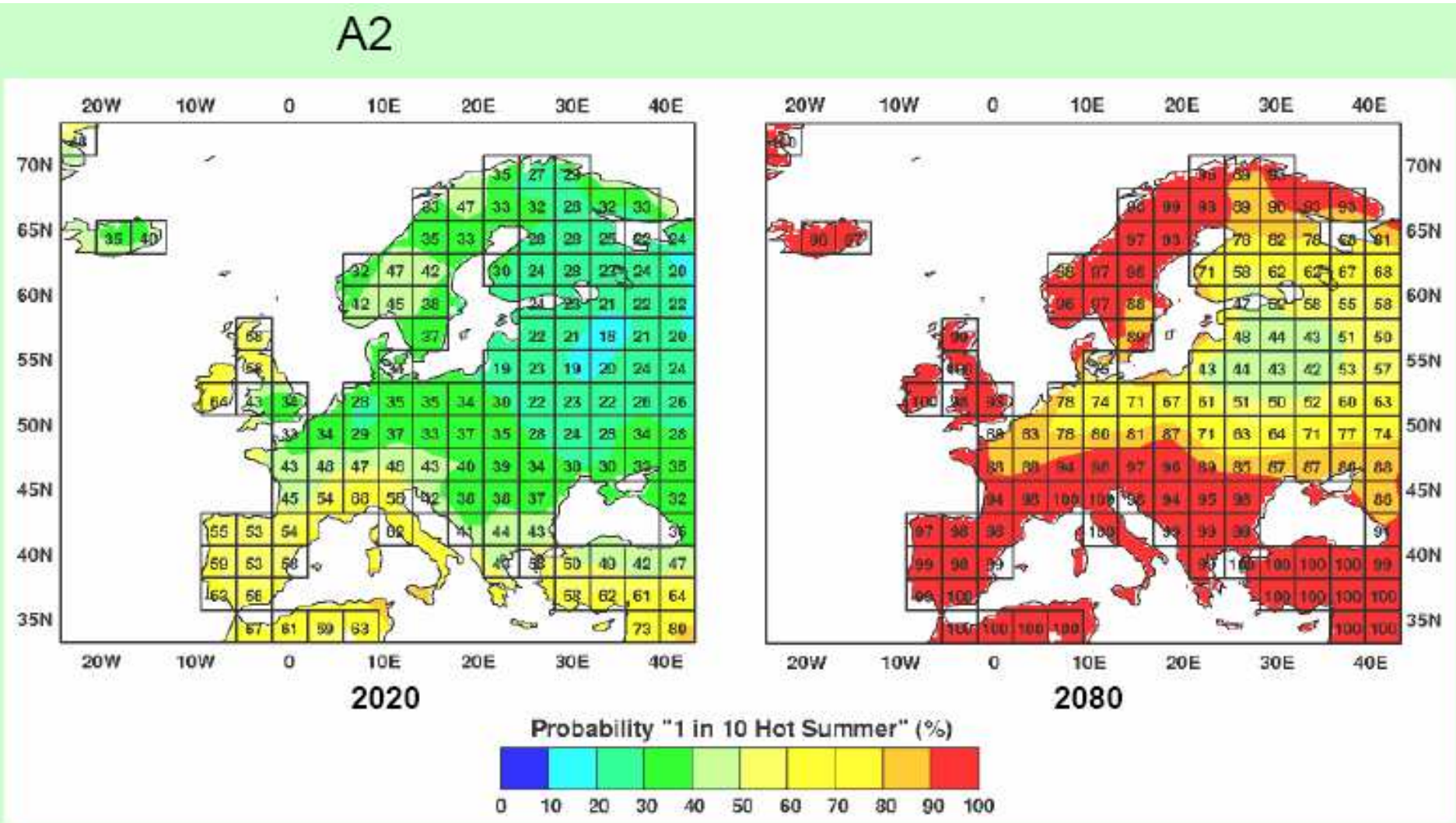
5.8. Water Availability in Europe, 2050‘s

© M. Parry, Meeting of EU Agriculture/ Environment Ministers, 11.9.2005, London



5.9. Probability of 1 in 10 Hot Summers (%) by 2020/2080

©M. Parry, Meeting of EU Agriculture/ Environment Ministers, 11.9.2005, London

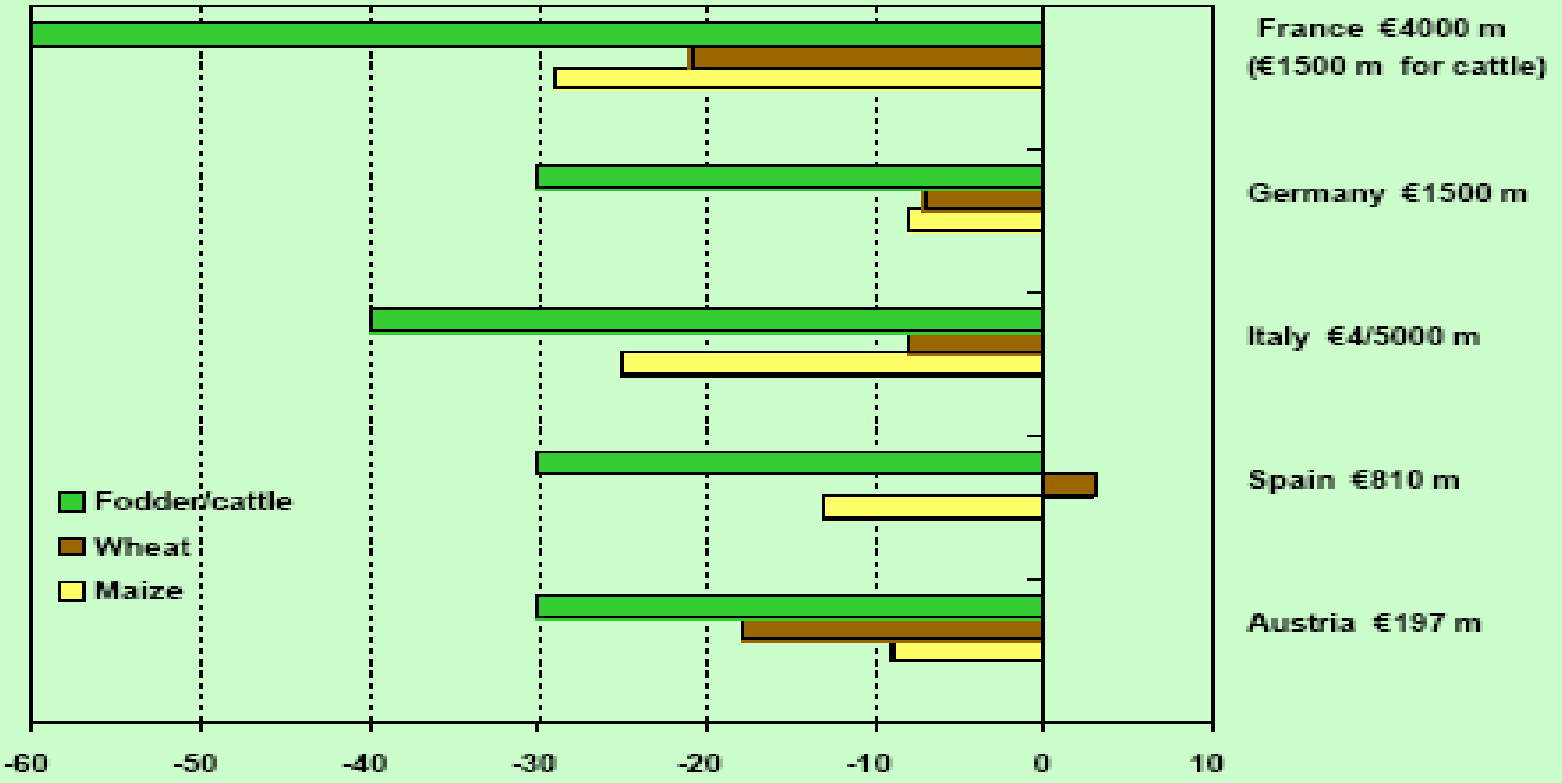


5.10. Effects of 2003 summer heat wave on agricultural yield in five EU countries

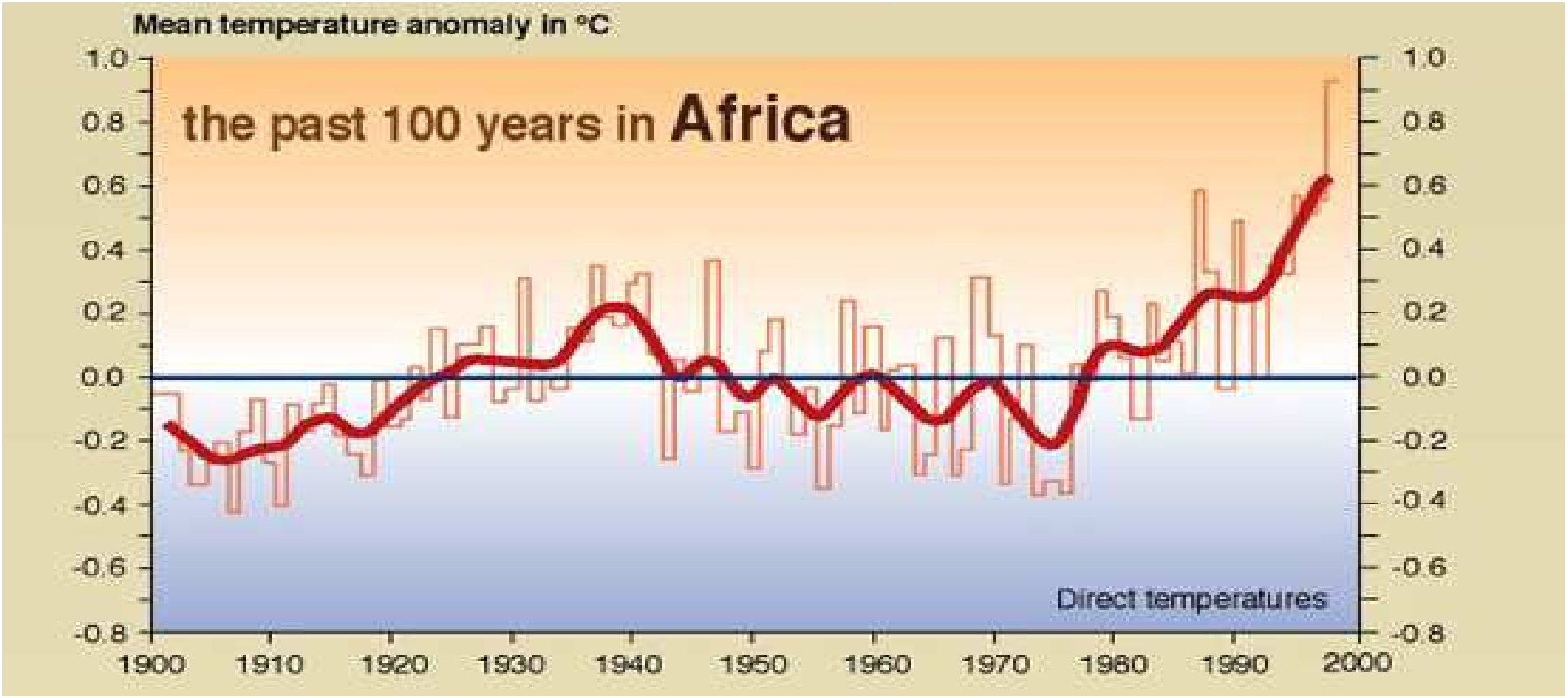
©M. Parry, Meeting of EU Agriculture/ Environment Ministers, 11.9.2005, London

COPA

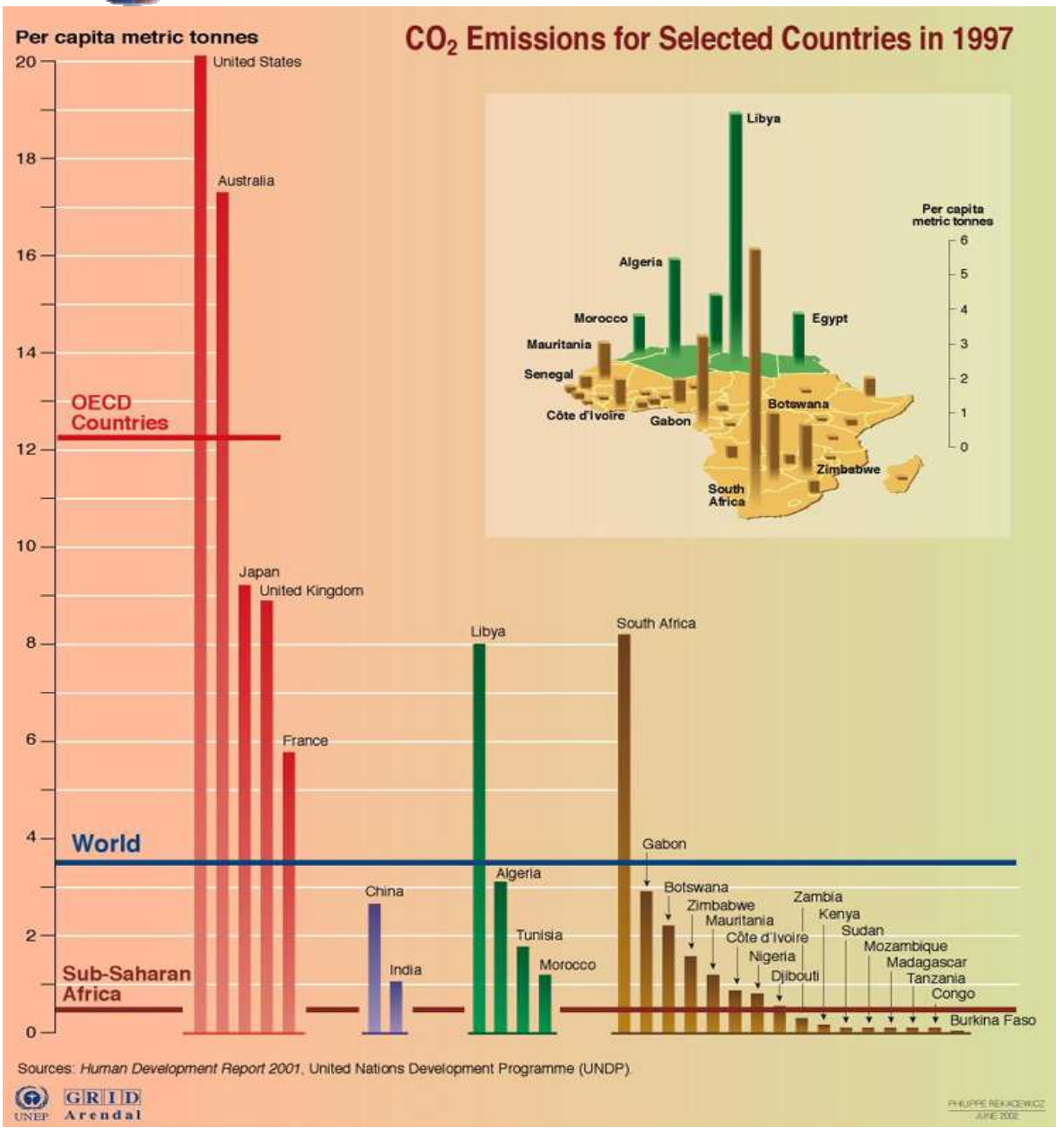
Effects of 2003 summer heat wave on EU agriculture



5.11. Climate Change in Africa: Temperature Rise



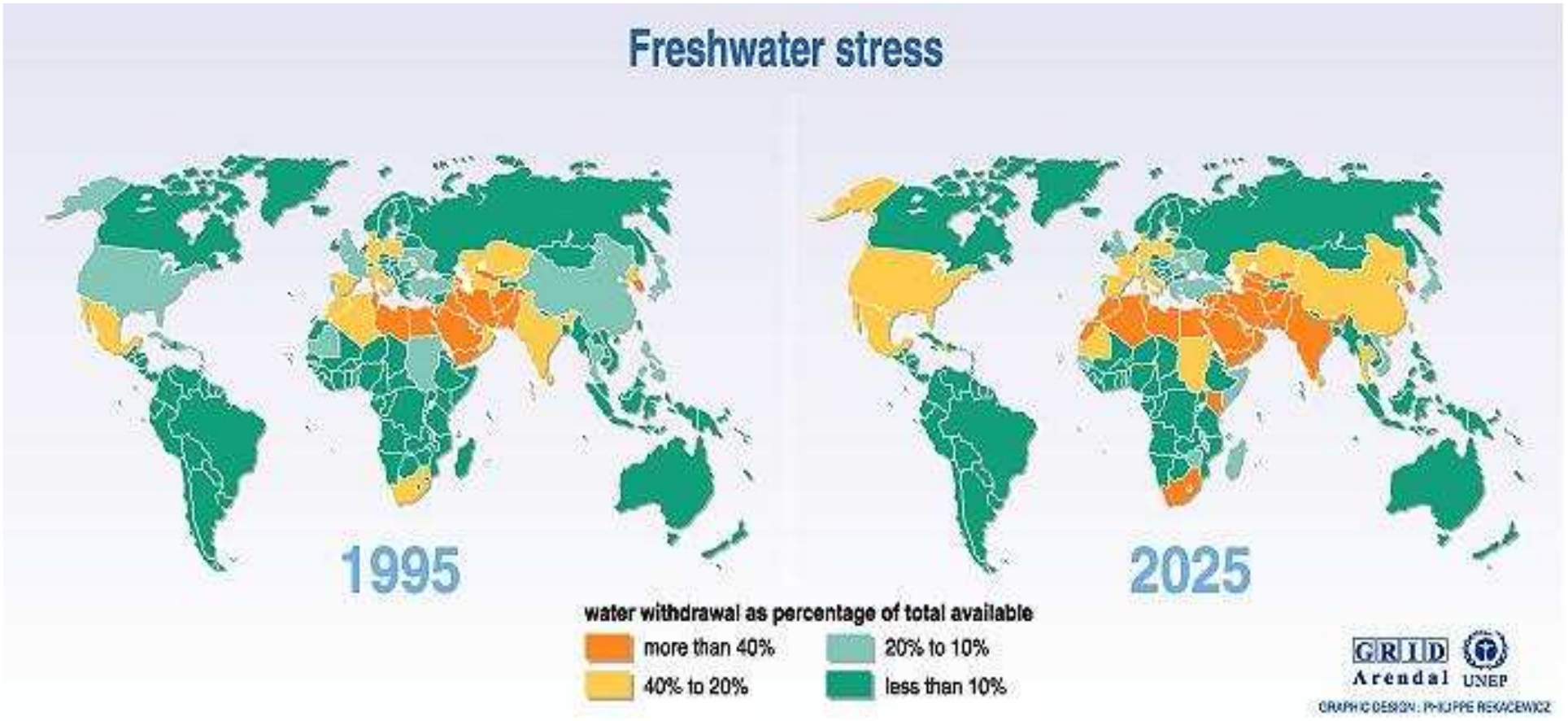
Africa has been warming in the 20th century at 0.05°C per decade. By 2000, the 5 warmest years in Africa occurred since 1988, 1988 & 1995 being the two warmest years. (Source: UNEP-GRID)



5.12. Limited Emissions & high impact

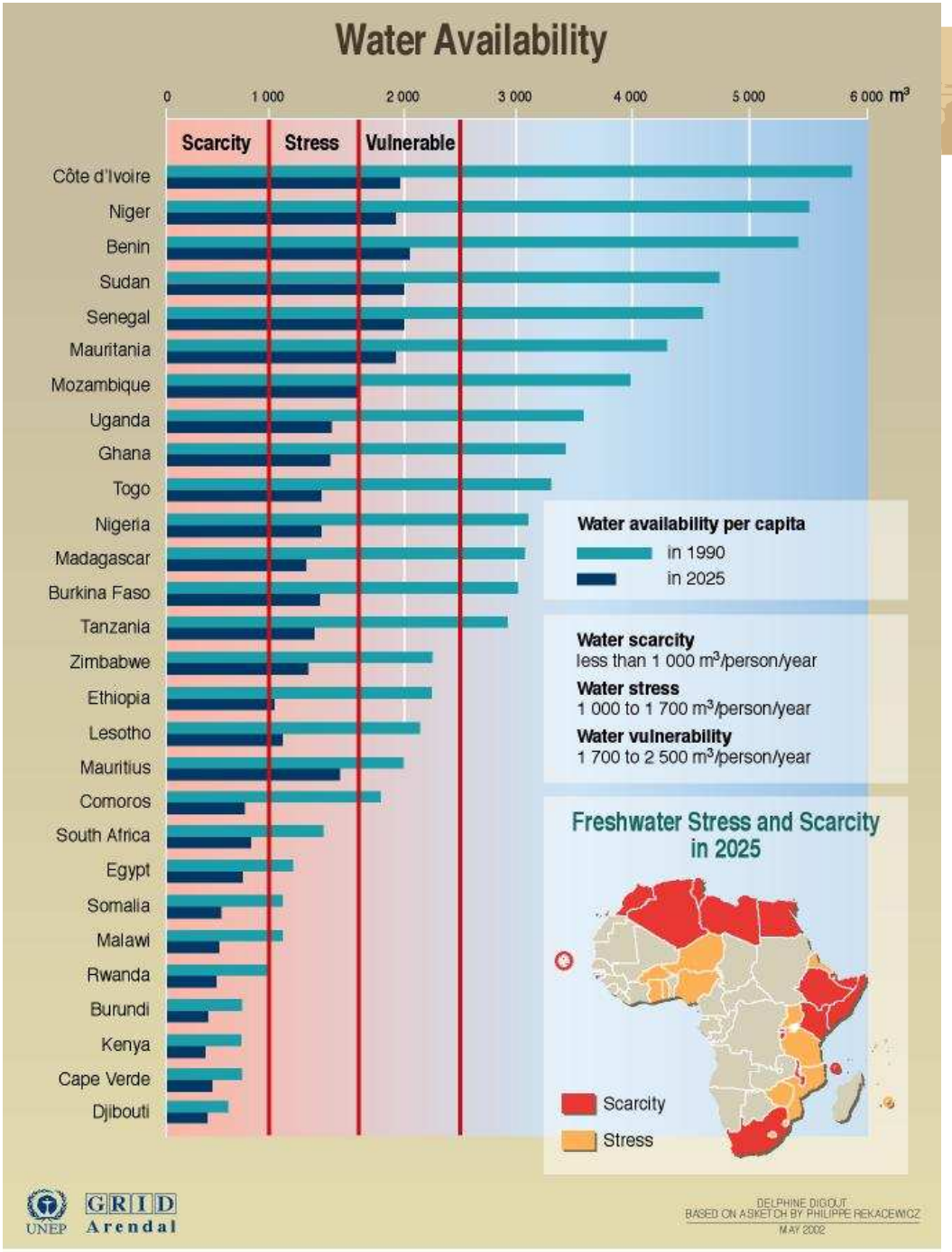
- Africa is very vulnerable to climate change given its low capacity to respond and adapt.
- Africa's contribution through greenhouse gas emissions is insignificant.
- Greenhouse gas emissions per capita in Africa are low
- Europe emit 50-100 times, U.S. 100-200 times more.
- Africa Regional Workshop in Accra, 21.-23.9.2006:
- CC affects Sustainable Development;
- CC jeopardizes MDG 1 (poverty & hunger eradication), 6 (AIDS), 7 (environm. sutain.)

5.13. Freshwater stress, 1995 and 2005



Source: Global environment outlook 2000 (GEO), UNEP, Earthscan, London, 1999.

North Africa was already seriously affected by fresh water stress in 1995 and this stress will intensify by 2025 affecting also Sudan, Kenya and Mauritania.

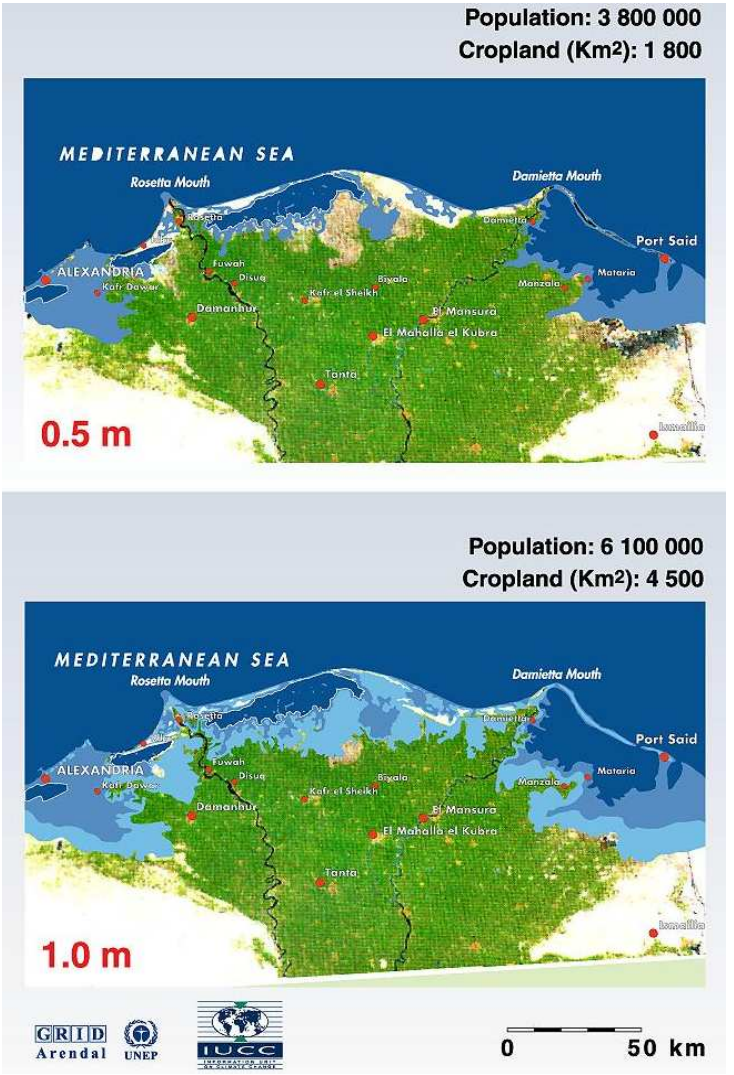


Source: United Nations Economic Commission for Africa (UNECA), Addis Ababa ; Global Environment Outlook 2000 (GEO), UNEP, Earthscan, London, 1999.

• *5.14. Impact of Climate Change on Precipitation*

- **Sahel:** precipitation decline: -25%
- **Zambezi runoff** under CC is projected to drop by 40%.
- **By 2000, 300 million** Africans risk living in a water-scarce environment.
- **By 2025**, the number of countries experiencing water stress will rise to 18 affecting **600 million people**
- Population growth & climate change cause economically significant constraints in parts of Africa.
- Water scarcity, increasing population, degradation of shared freshwater ecosystems, & competing demands for water have potential to create bilateral& multilateral conflicts

5.15. Climate Change Impacts for Nile Delta



Global Climate Change:

Sea level rise: IPCC, TAR, WG 2 (2001)

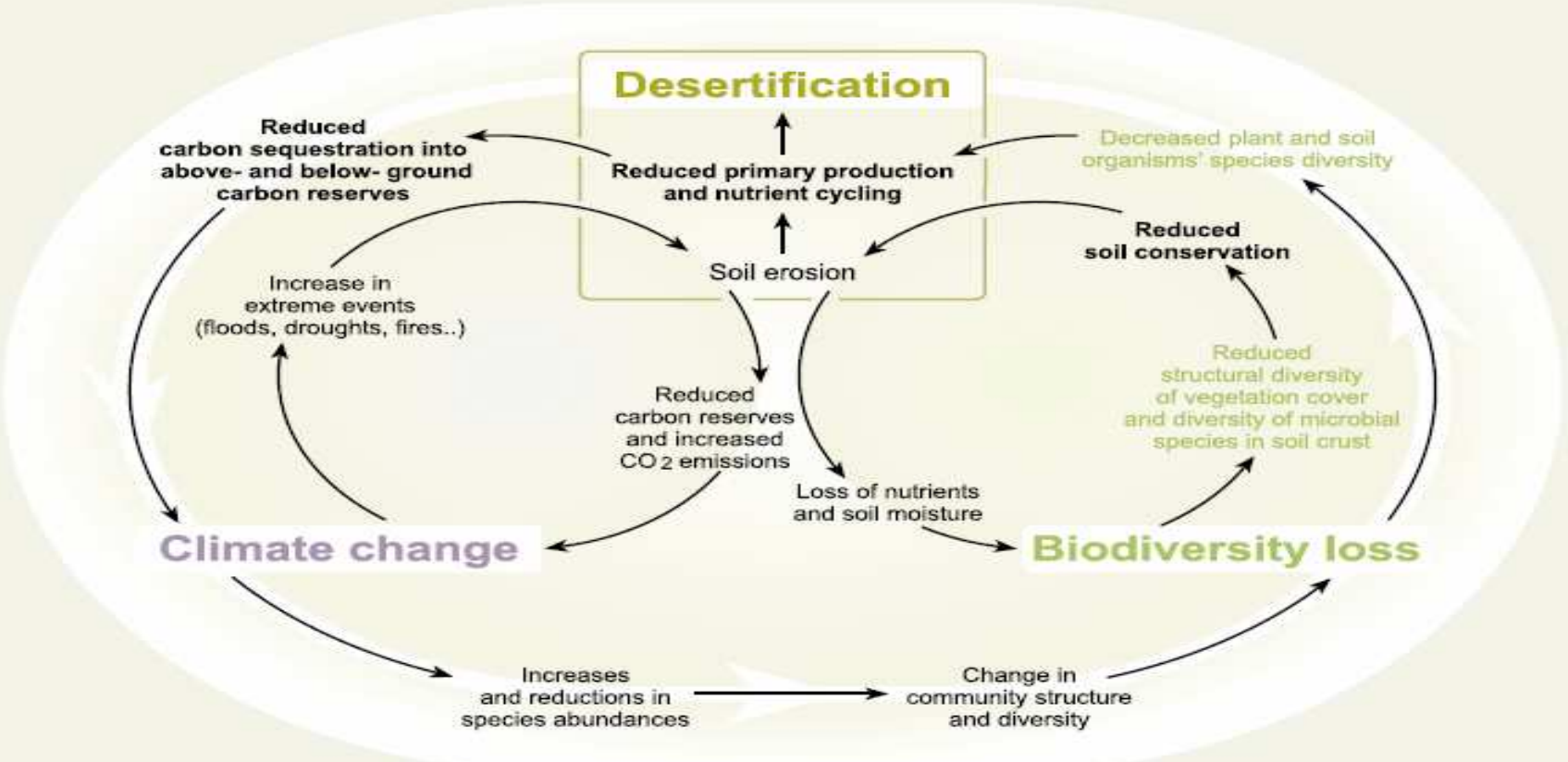
- **1860-2000: 0.1 – 0.2 m;**
- **1990-2100: 0.09-0,88 m**

Climate Change Impacts: Egypt:

- **Nil Delta: 50cm, 2 mio. pers., 214.000 jobs**
- **Temperature Cairo 2000-2060: + 4°C**
- **Self-sufficiency rate (SSR) for cereals: 1990-2060: decline from 60 to 10%**
- **Projected yield decline for wheat due to climate change: 2000 - 2050: -18%.**

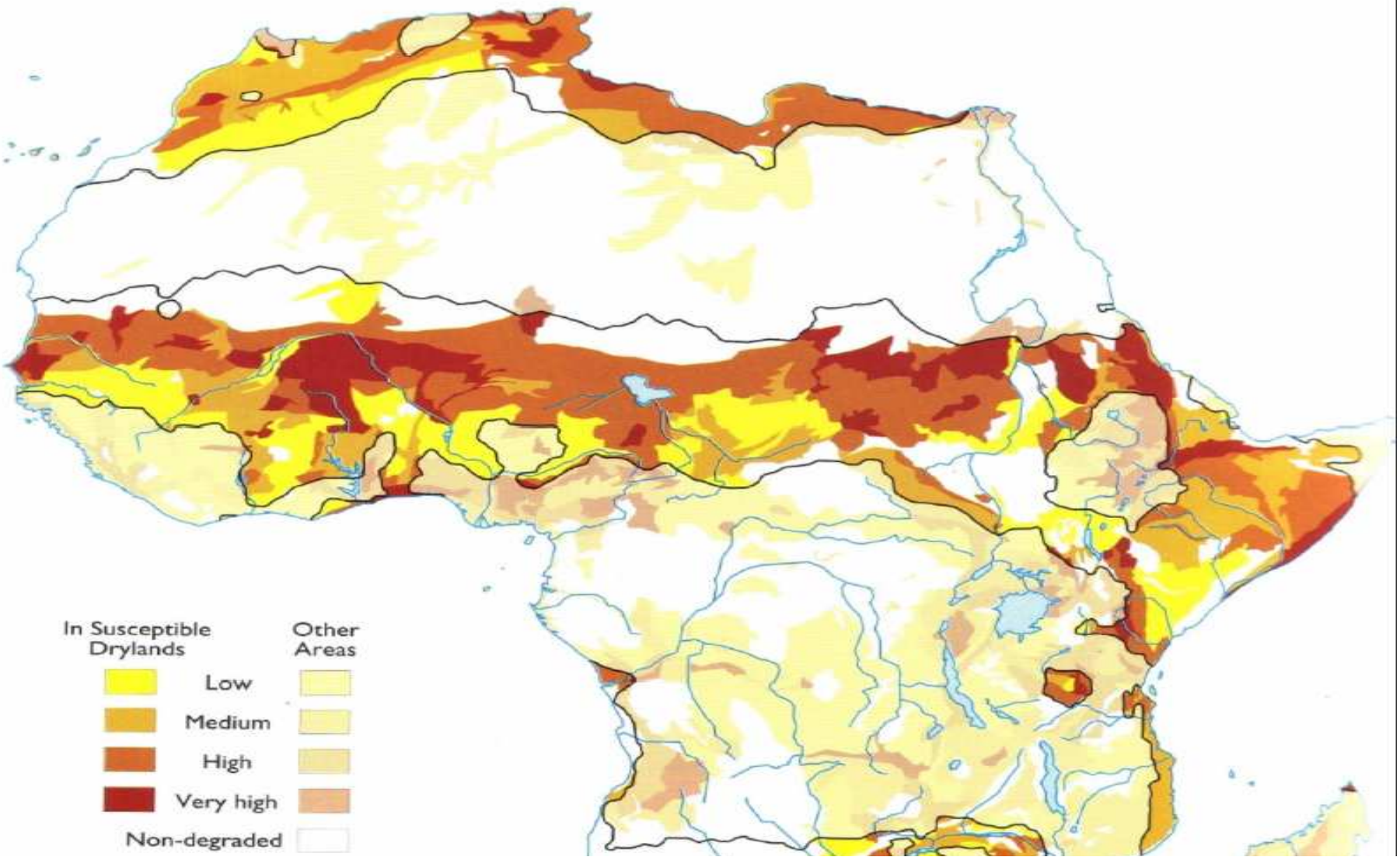
5.16.Linkages and Feedback Loops between Desertification, Climate Change and Biodiversity

The major components of biodiversity loss (in green) directly affect major dryland services (in bold). The inner loops connect desertification to biodiversity loss and climate change through soil erosion. The outer loop interrelates biodiversity loss and climate change. On the top section of the outer loop, reduced primary production and microbial activity reduce carbon sequestration and contribute to global warming. On the bottom section of the outer loop, global warming increases evapotranspiration, thus adversely affecting biodiversity; changes in community structure and diversity are also expected because different species will react differently to the elevated CO_2 concentrations.

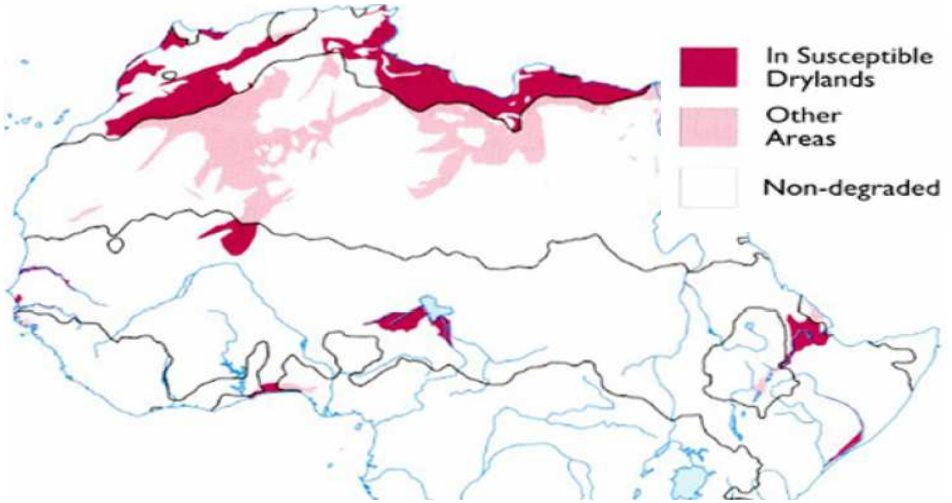


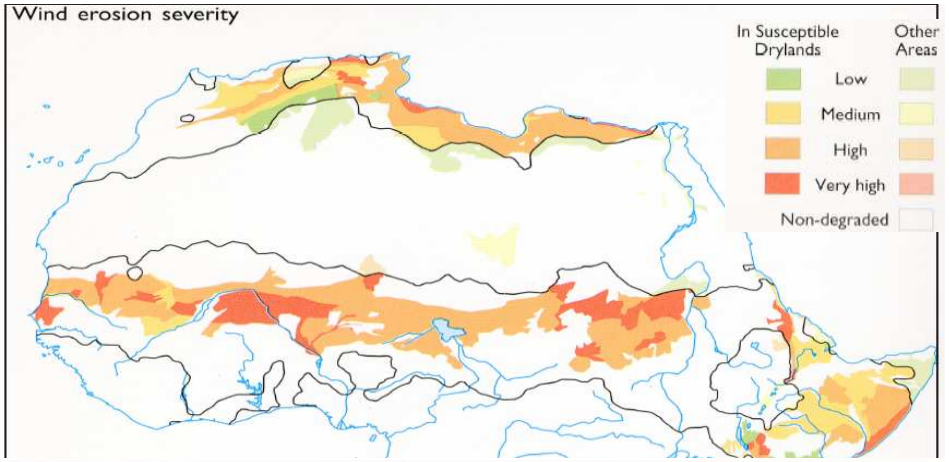
Source: Millennium Ecosystem Assessment

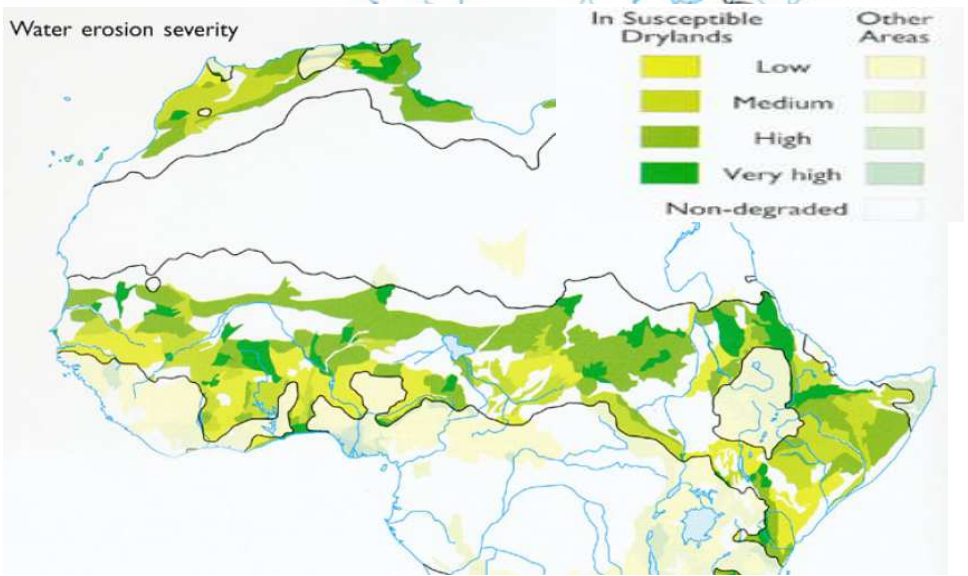
5.17. Degraded Land in Africa. *Source:UNEP/ISRIP,CRU/UEA*

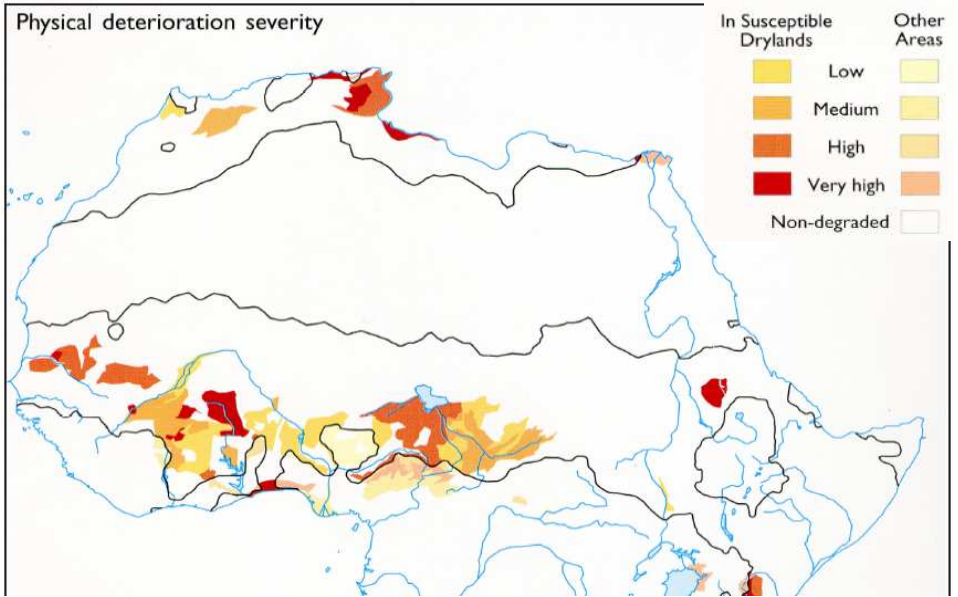


5.18.Forms of Soil Degradation in Africa: a) Saliniza tion; b) water eros.; c) wind eros., d) physcial deteriorat.

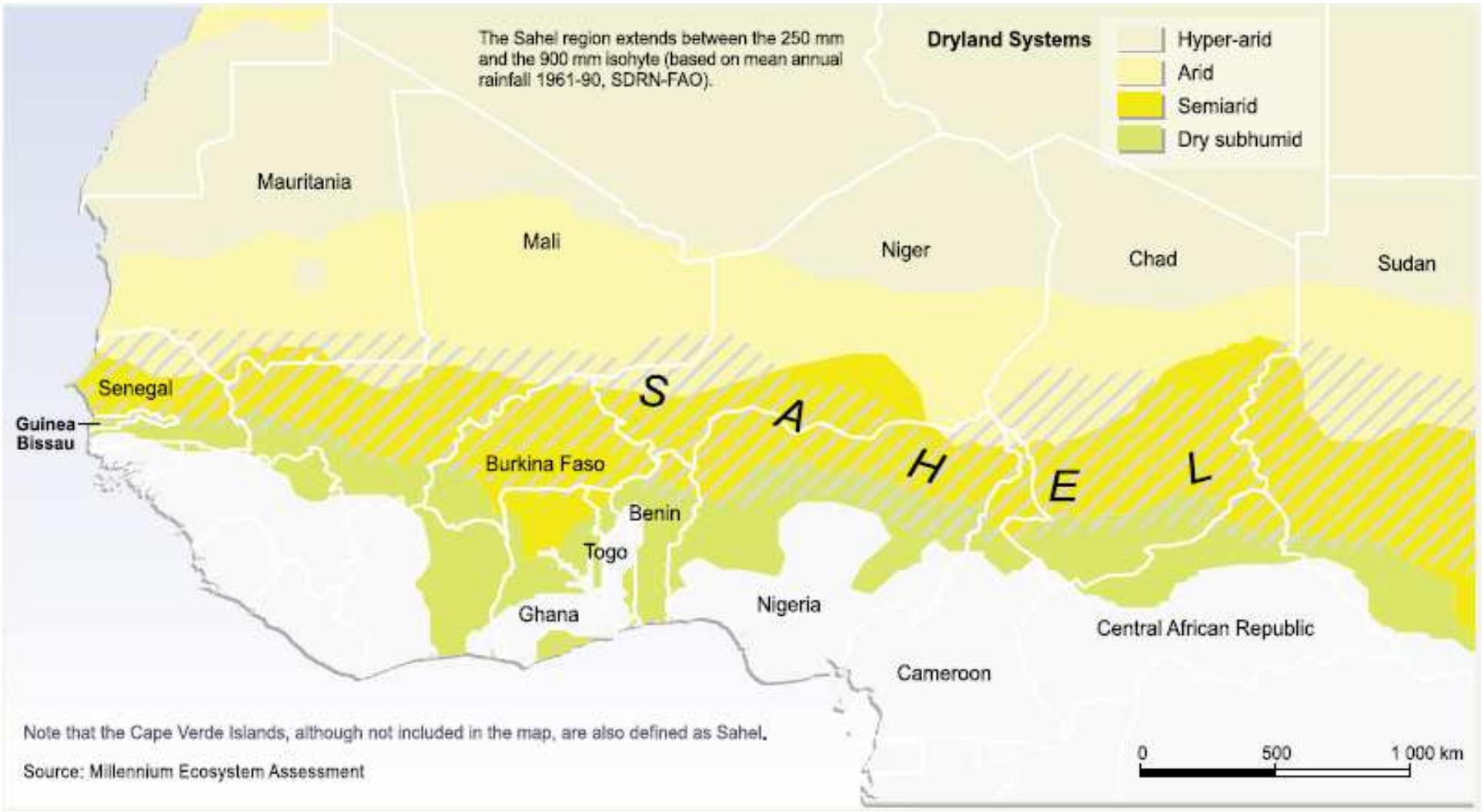








5.19. Drought & Famine in the Sahel in 1970s/1980s



5.20. Desertification as a Security Issue

- **Mr. Hama Arba Diallo**, Executive Secretary of the United Nations Convention to Combat Desertification (**UNCCD**): "It is widely recognized that environmental degradation has a role to play in considerations of national security as well as international stability. Desertification has been seen as a threat to human security," by security experts at a **NATO workshop in Valencia, Spain, on 2-5 December.**

Brauch: Desertification as a Security Issue in the Mediterranean

Desertification as a Food Security Issue

- **Desertification** (**cause**) & **drought** (**impact**: **hydro-meteorologic. hazard**) **> famine > migration: force people to leave their home (livelihood);**
- **Major actors & concept users: FAO, WFP, OCHA, ECHO, human. NGOs**
- **Solution: short-term: food aid & long-term: sustainable agriculture**

Desertification as a Health Security Issue

- **Famine: undernourishment, malnutrition, high vulnerability to disease, higher rate of death among children> becomes as health security issue**
- **Major actors & concept users: WHO, OCHA, ECHO , humanit. NGOs**
- **Solution: short-term: medical aid & long-term: sustainable developm.**

Desertification as a Livelihood Security Issue

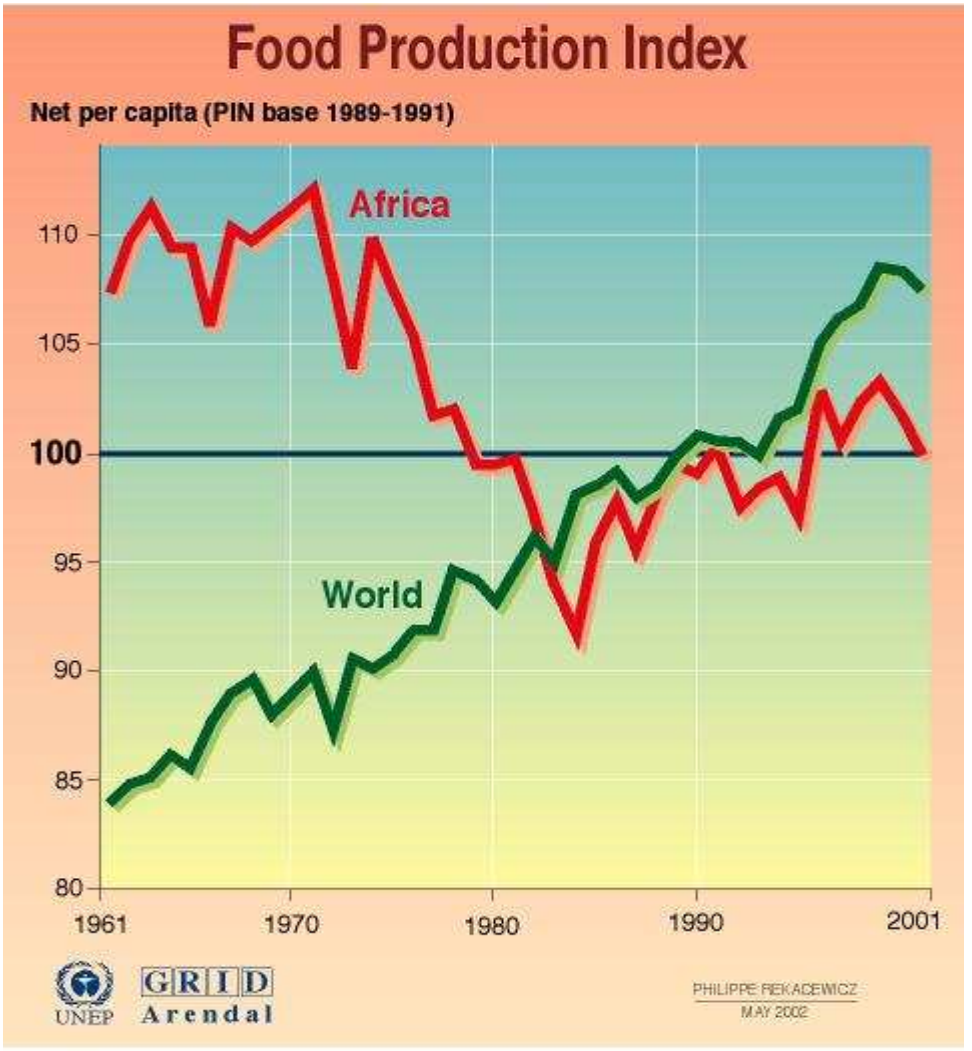
- **Desertification, drought & famine: force people to leave their liveli-hoods, homes, villages, provinces, in search for indiv. & group survival**
- **Major actors & concept users: in South Asia, UK, US, OCHA, ECHO, humanit. NGOs**
- **Solution: enhancement of resilience & sustainable development**

5.21. Desertification as a Survival Issue

Drought and desertification threaten the livelihood of over 1 billion people in more than 110 countries around the world.

Kofi Annan

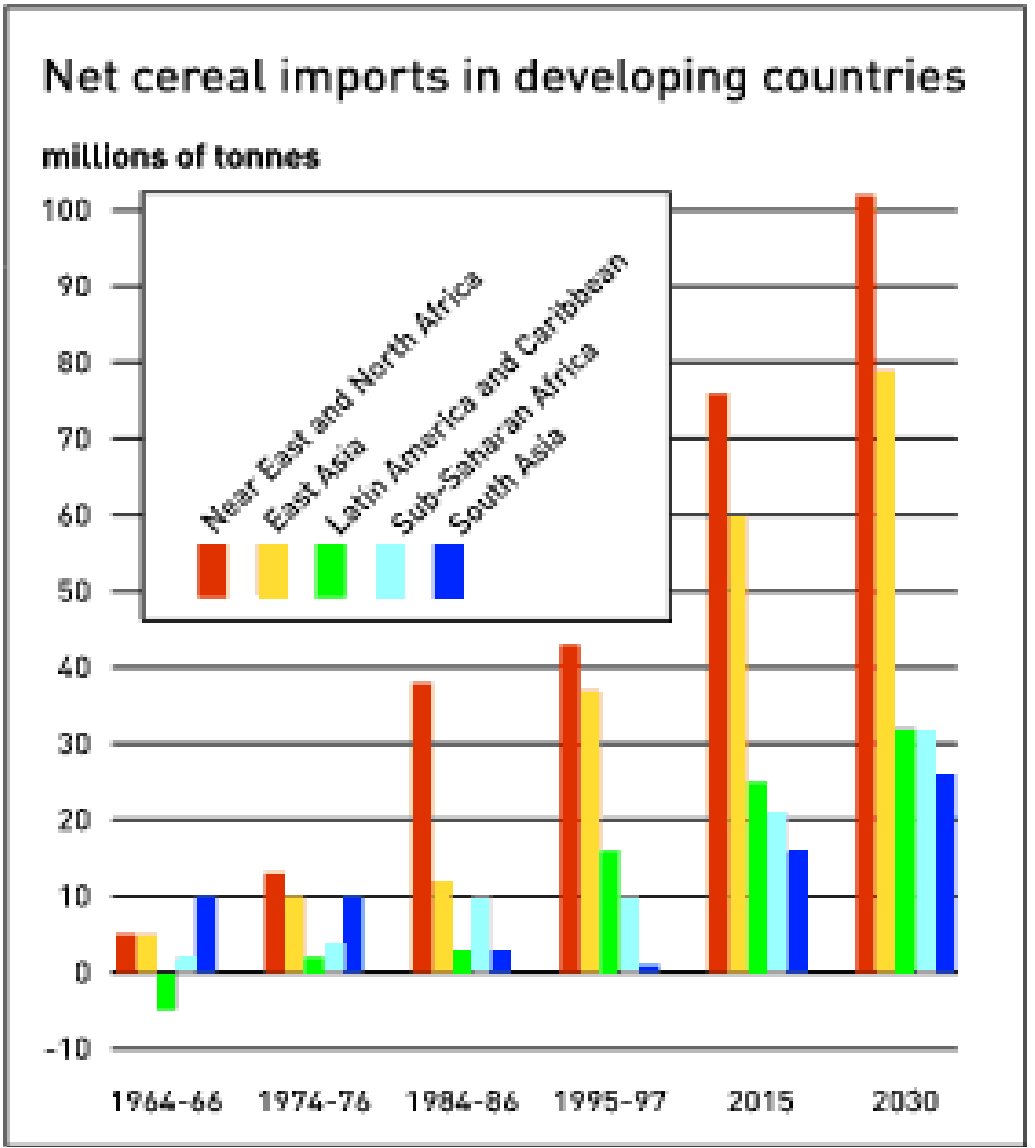
5.22.Climate Change and Food Production in Africa



Source: Food and Agriculture Organization (FAO), Statistical databases (FAOStats), 1995.

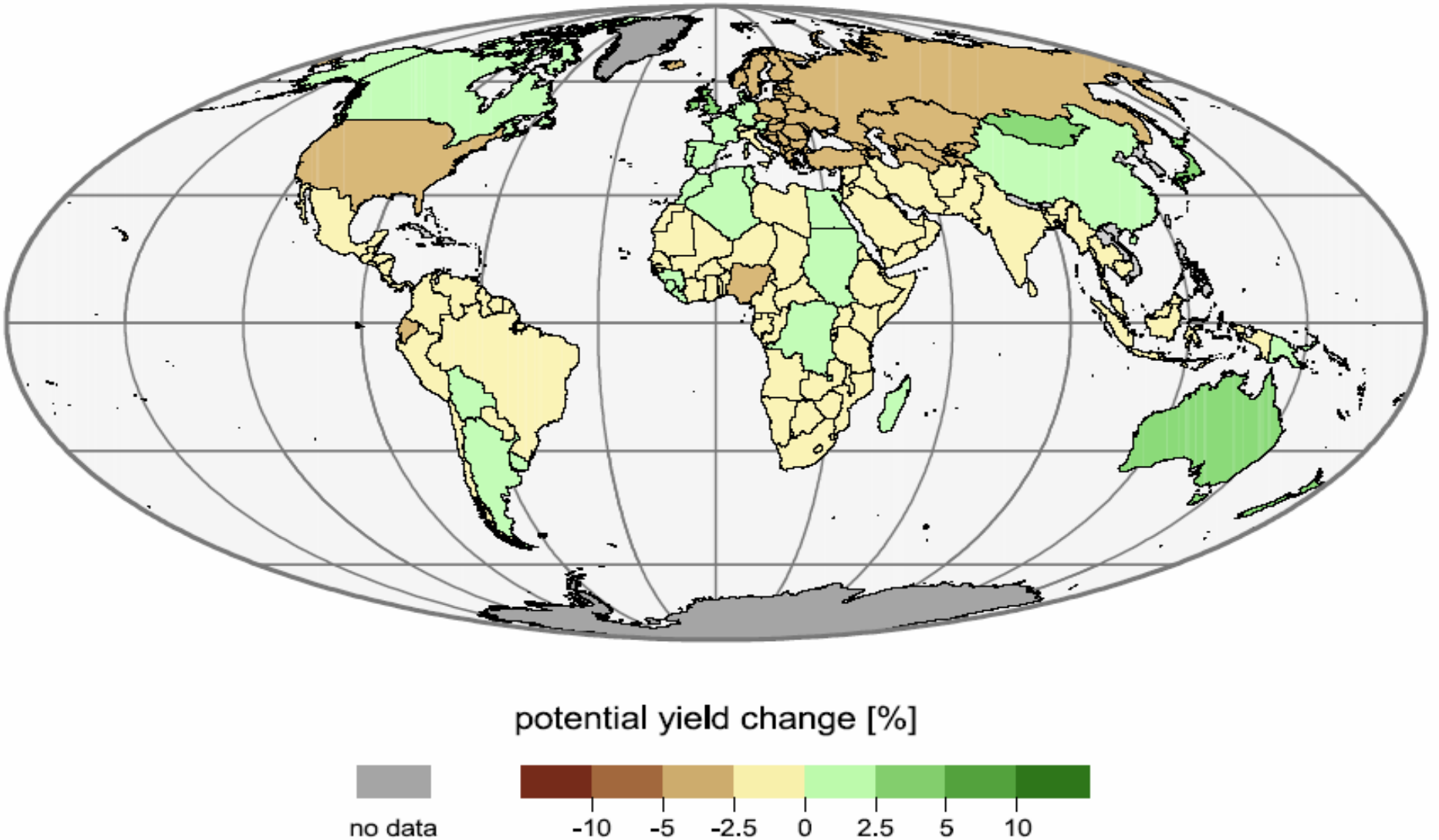
- **Agriculture is vital source of food in Africa; prevailing way of life.**
- 70% of population lives by farming, and 40% of exports are from agricultural products.
- One third of national income in Africa is generated by agriculture.
- Crop production & livestock: half of household income.
- The poorest members of society are most dependent on agriculture for jobs & income.
- The poor in SSA spend 60-80% of their total income on food.
- Food consumption exceeded domestic production by 50% in the drought-prone mid-1980s and more than 30% in the mid-1990s
- A major challenge: increase agricultural production & achieve sustainable econo-mic growth; to improve food security.

5.23. FAO (2000) Increase in Cereal Imports

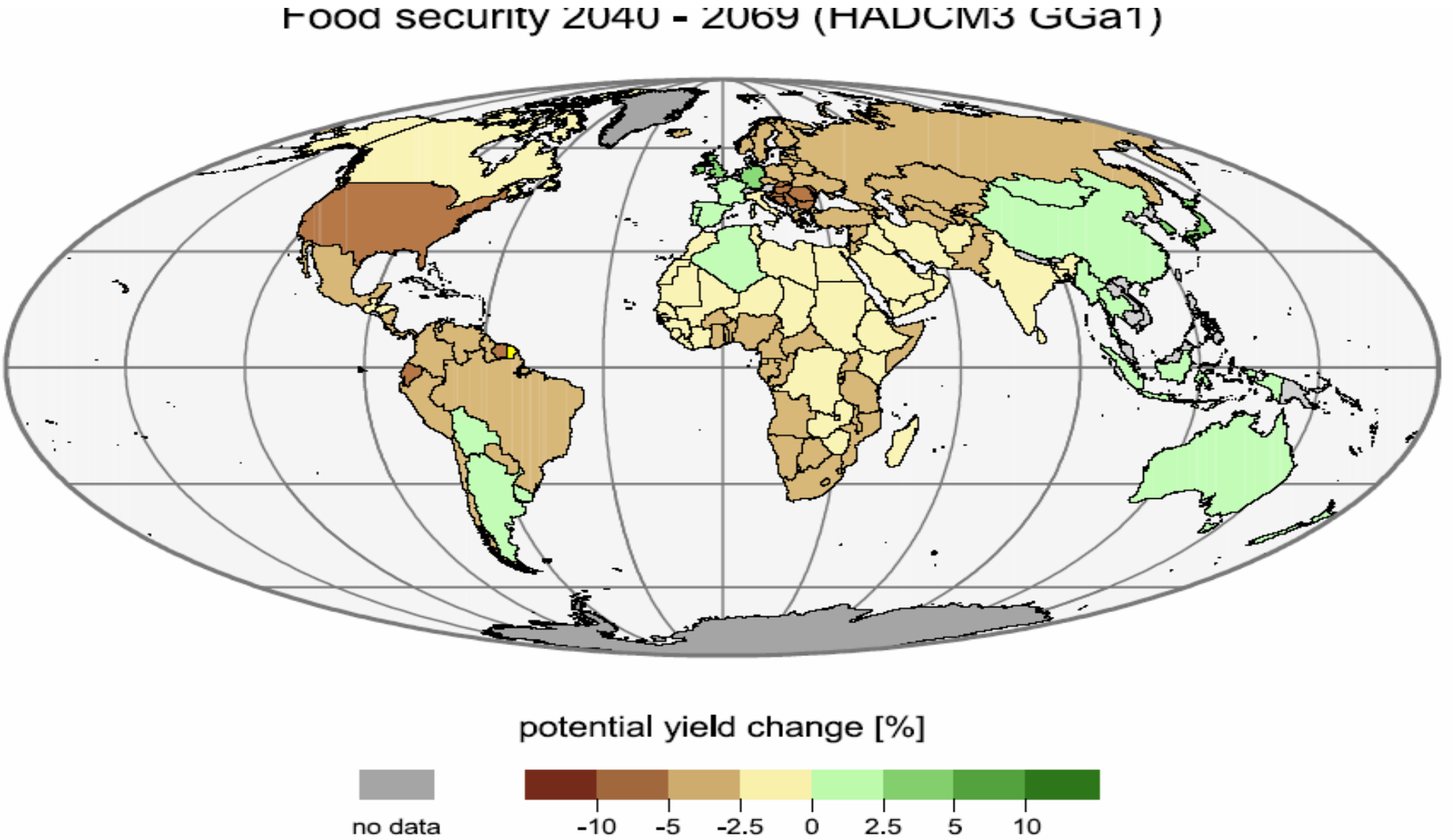


- **FAO: 4 March 2003, Rome** World's population will be better fed by 2030**, but hundreds of millions of people in develo-ping countries will remain chronically hungry**.
- Number of hungry people will decline from 800 million today to 440 million in 2030.
- **The target of the World Food Summit (1996) to reduce the number of hungry by half by 2015, will not be met by 2030.**

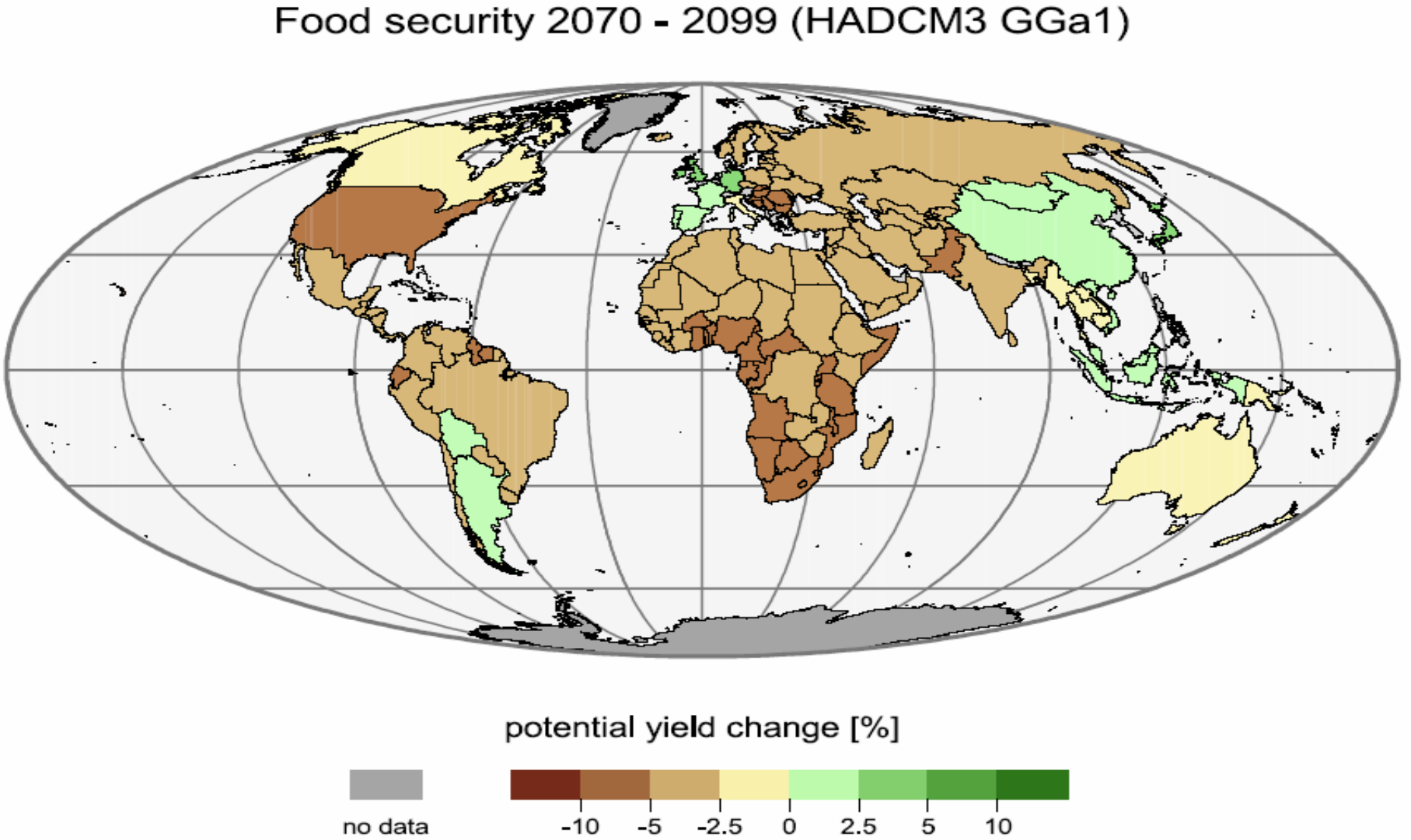
5.24. Food Security by 2020: Changes in Crop Yield



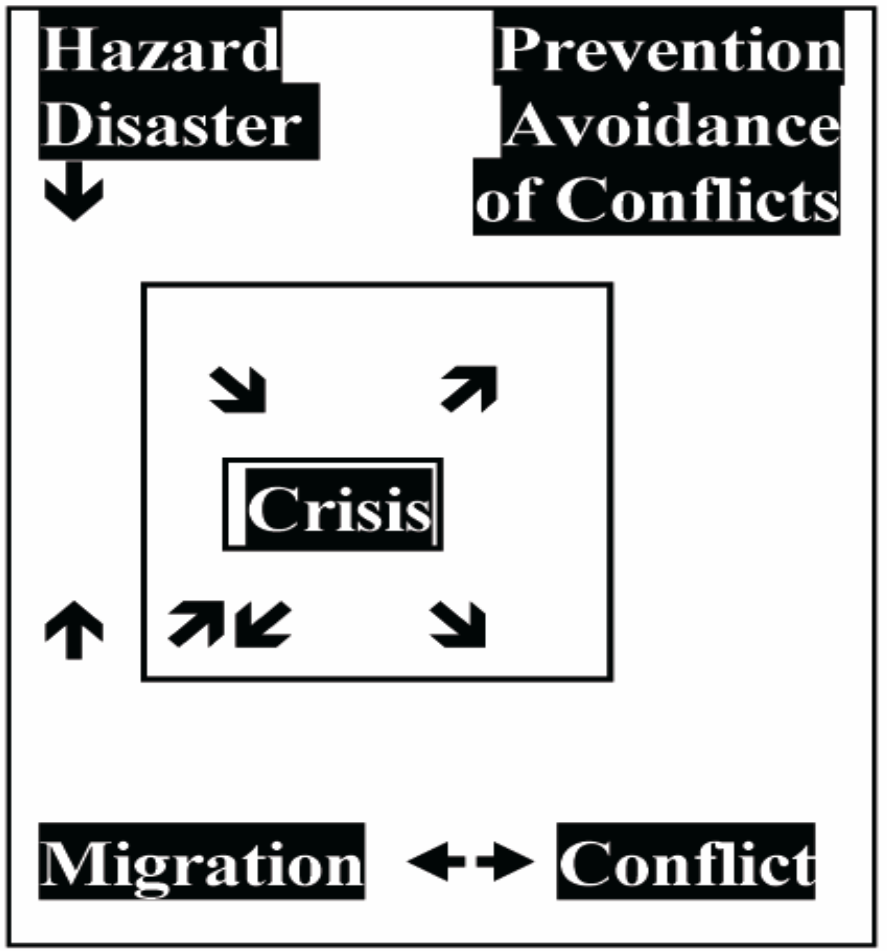
5.25. Food Security by 2050: Changes in Crop Yield



5.26. Food Security by 2080: Changes in Crop Yield

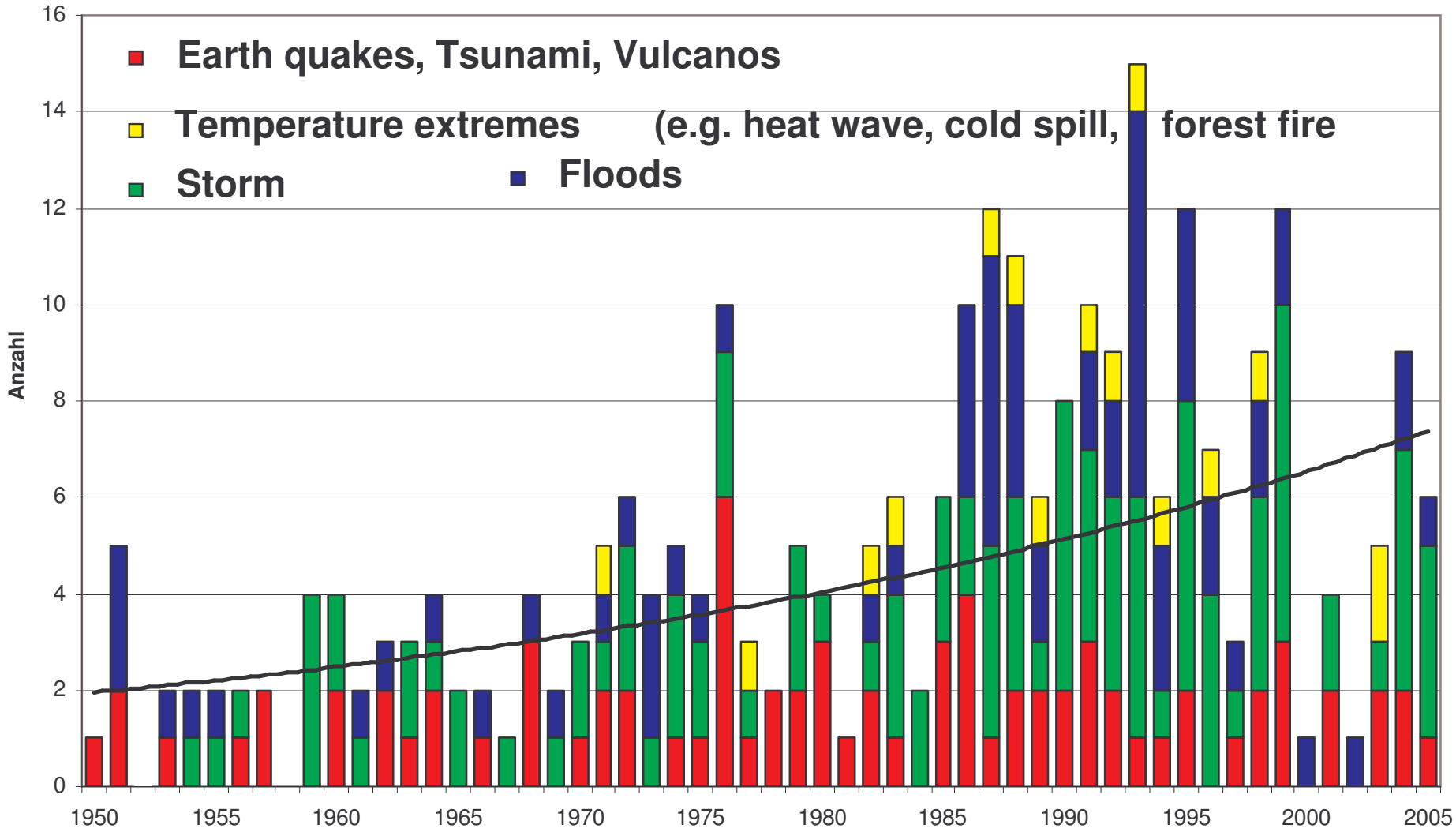


6. Environmental Stress & Impact: Hazards and Migration

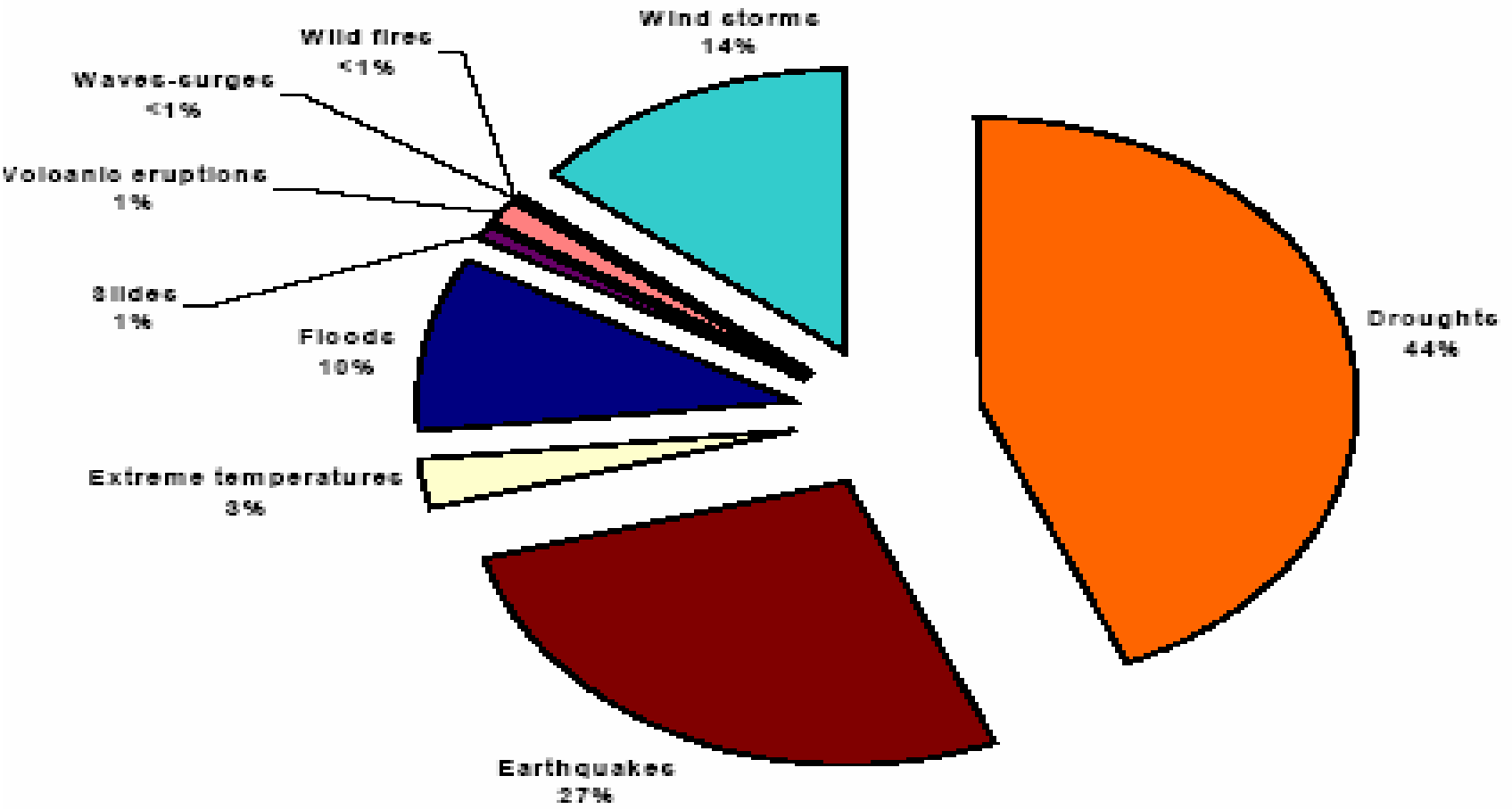


- IPCC TAR (2001): high probability
- Direct link between clima-te change and hydro-meteorological hazards:
  - Drought, forest fires
  - Storms, flash floods
  - Land slides
- Evidence by MunichRe & CRED, EMDAT, Louvain
- This has affected & will affect the region in 21st century.

6.1. Major Natural Hazards (1950 – 2005)

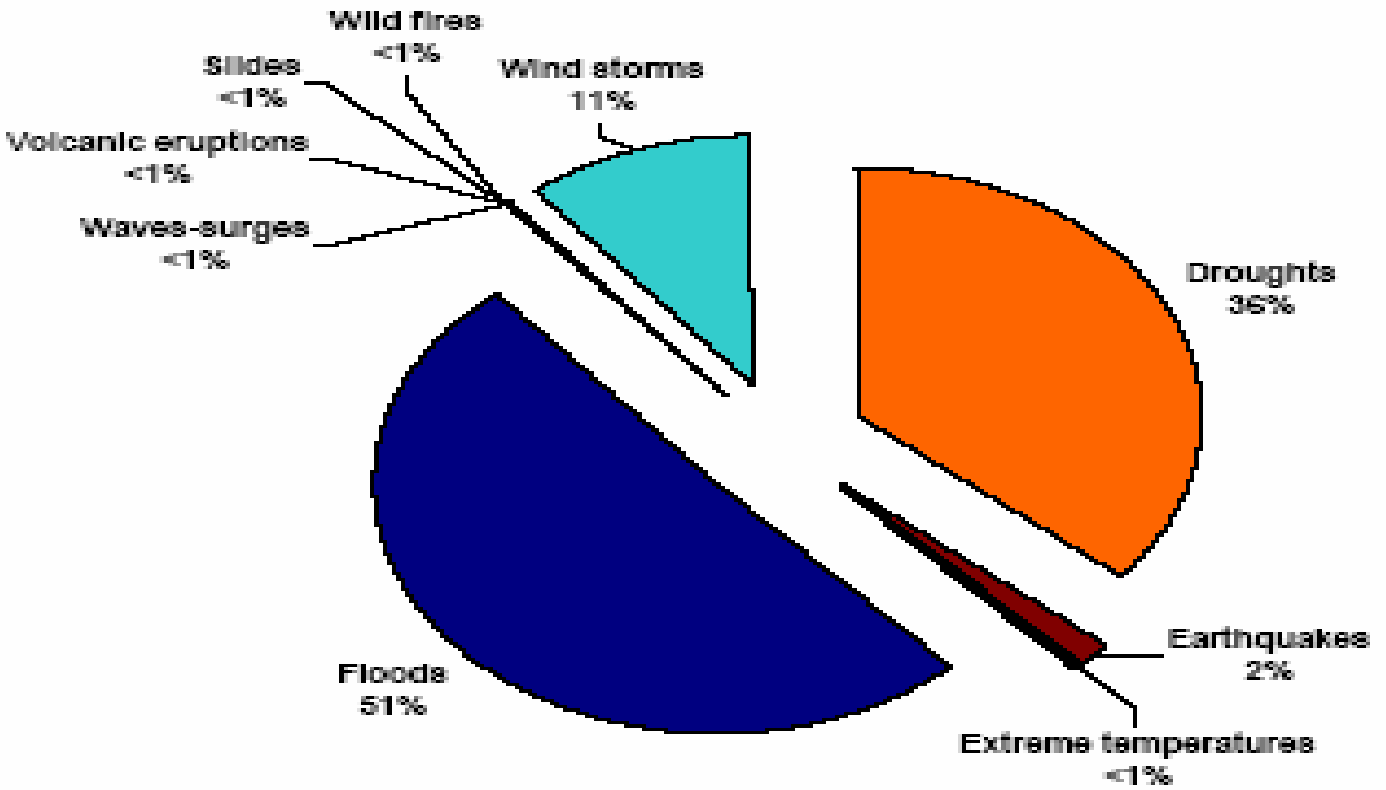


6.4. Reported Death of Natural Hazards globally (1974-2003): 2.066.273 persons



Source: © Hoyois und Guha-Sapir (2004)

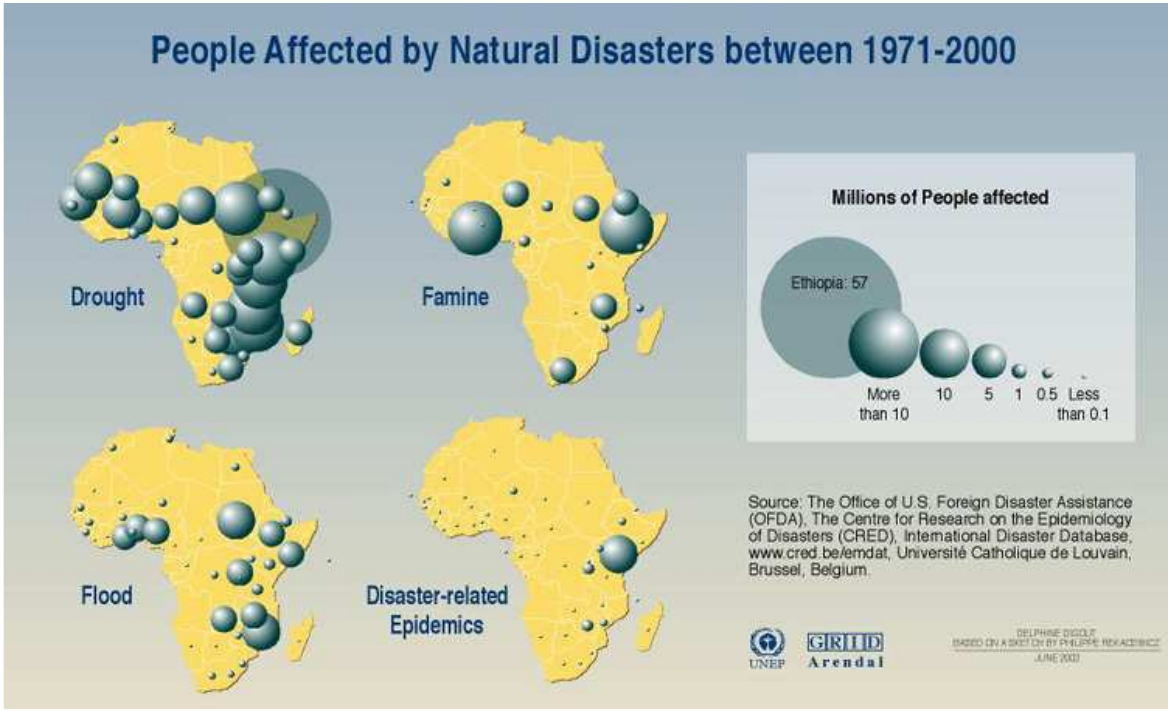
6.5. Affected Persons of Natural Hazards Globally (1974-2003): 5 076 494 541 Persons



(1) injured + homeless + affected

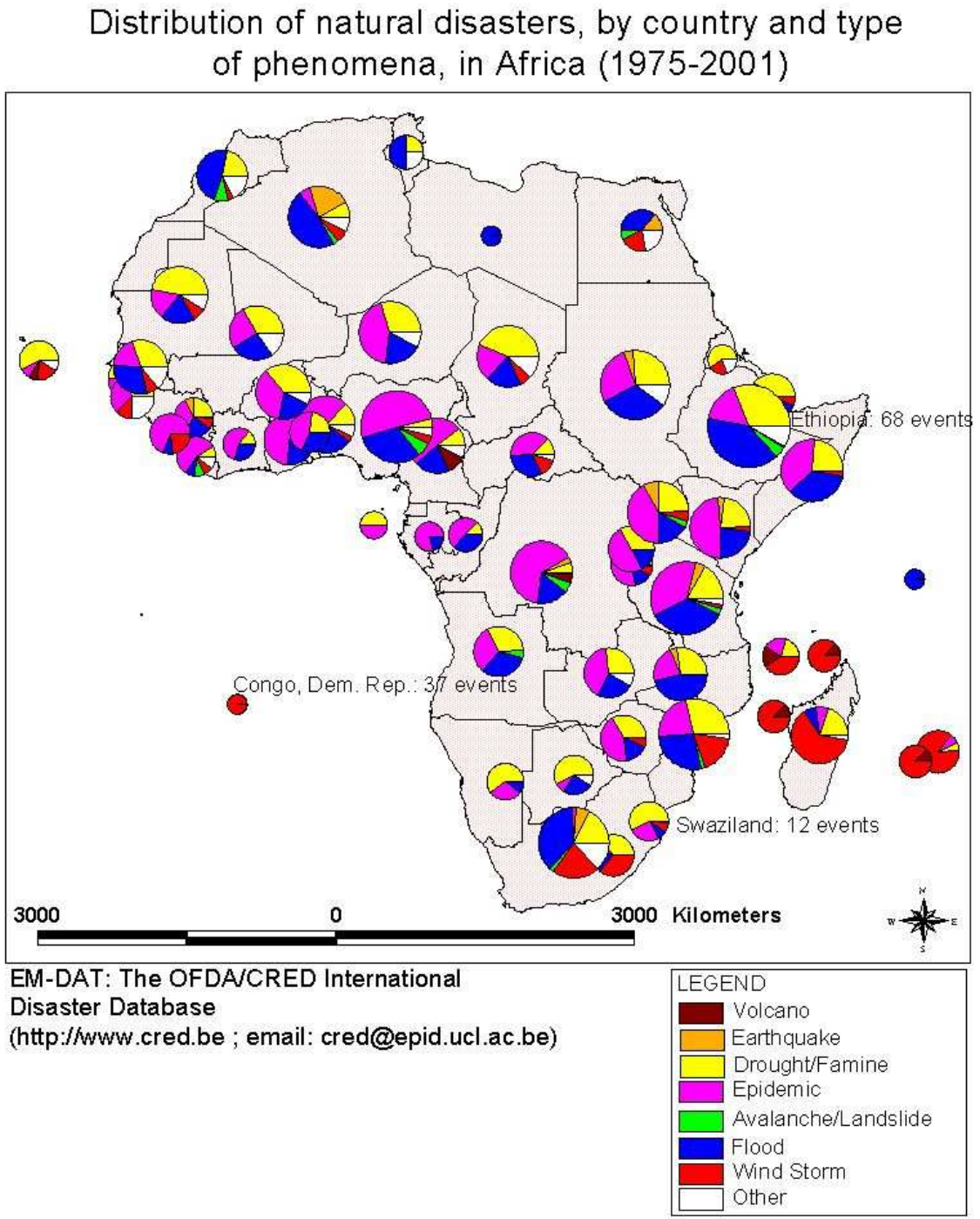
Source: © Hoyois und Guha-Sapir (2004)

6.6. Natural hazards in Africa



- **Droughts & floods** ➡ food & water security in Africa.
- Droughts & floods: major human & econ. costs in Africa.
- Floods (1998) in East Africa: human suffering, deaths,damage: infrastructure,crops Kenya.
- Floods in Mozambique (2000) & in Kenya (1997-1998): 100s of people died & 1000s were displaced from their homes.
- Cost in Kenya:US$1 billion

- The floods in E.African (1998) and Mozambique (2000-2001) caused damage to property and infrastructure (road & rail network damage.
- Communications among human settlements in Kenya, Uganda, Rwanda & Tanzania were seriously disrupted (goods & persons)

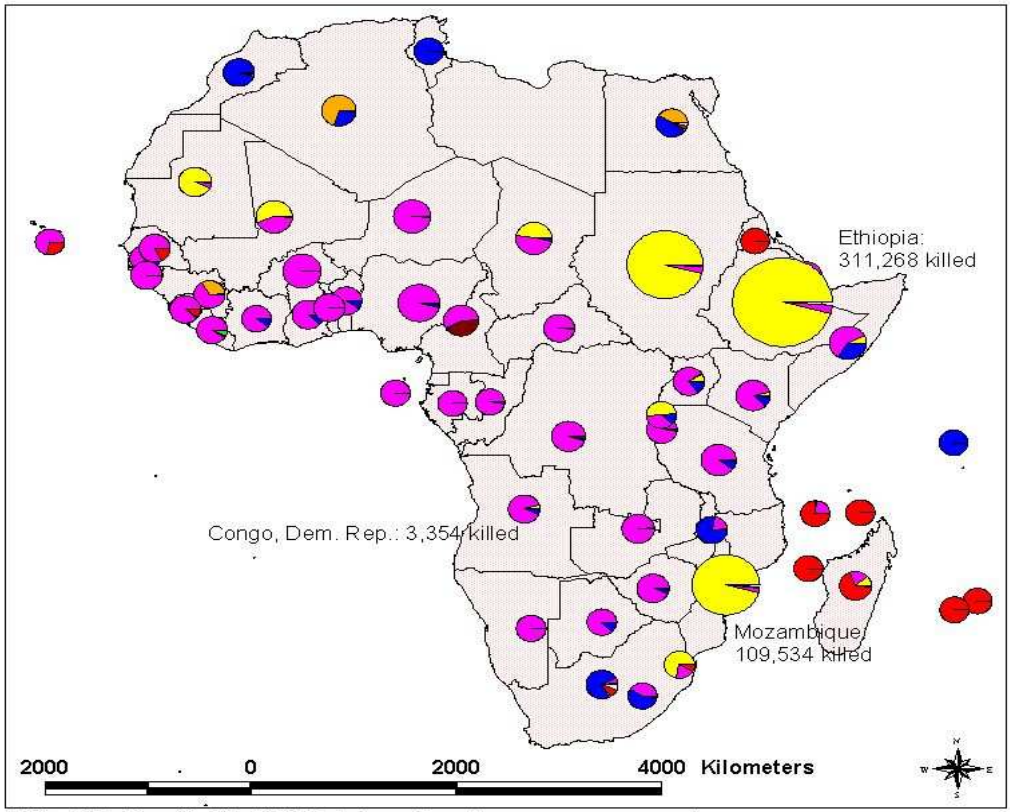


6.7. Types of natural Hazards in Africa (1975-2001)

- This survey of EM-DAT, CRED, Univ. Louvain (Belgium) illustrates the **vulnerability to drought & floods**
- *Mediterranean*: **earthquakes**
- *North Africa*: **floods**
- *Sahel & Horn*: **drought**

6.8. Fatalities & Affected People of Natural Hazards in Africa (1975-2001)

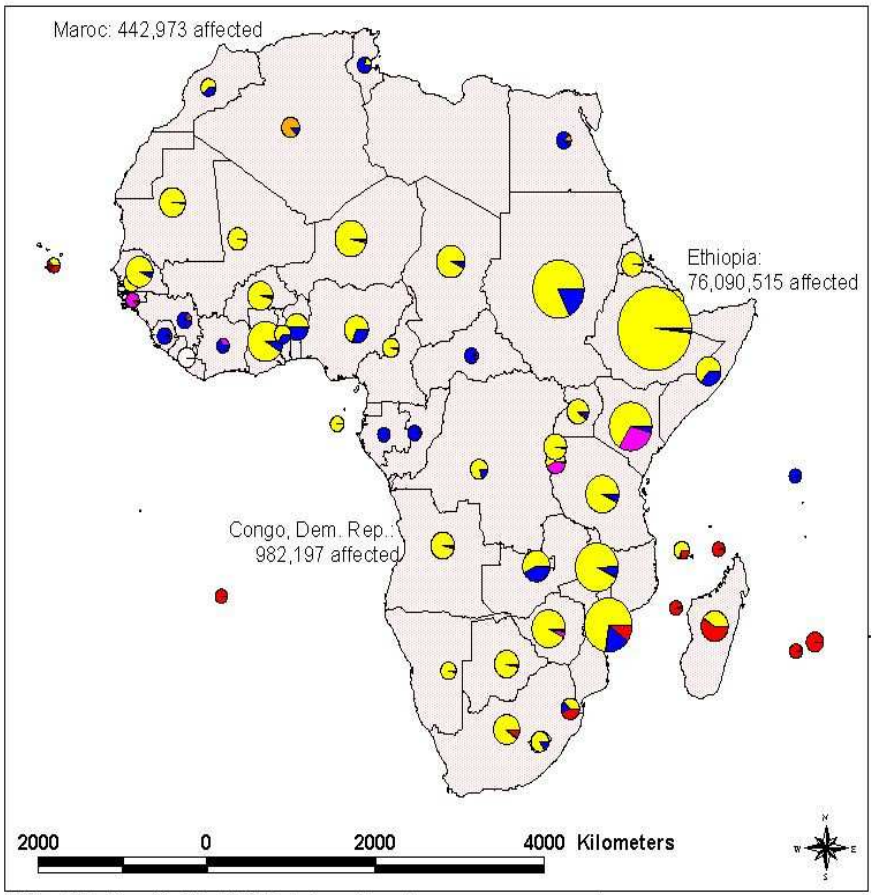
Distribution of natural disasters fatalities, by country and type of phenomena, in Africa (1975-2001)



EM-DAT: The OFDA/CRED International Disaster Database
(http://www.cred.be ; email: cred@epid.ucl.ac.be)

LEGEND
- Volcano
- Earthquake
- Drought/Famine
- Epidemic
- Avalanche/Landslide
- Flood
- Wind Storm
- Other

Distribution of people affected by natural disasters, by country and type of phenomena, in Africa (1975-2001)



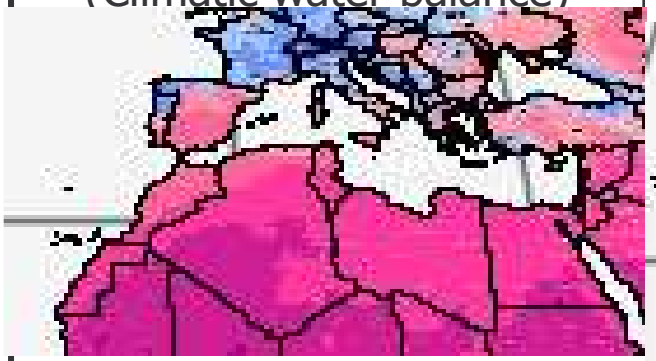
EM-DAT: The OFDA/CRED International Disaster Database
(http://www.cred.be ; email: cred@epid.ucl.ac.be)

LEGEND
- Volcano
- Earthquake
- Drought/Famine
- Epidemic
- Avalanche/Landslide
- Flood
- Wind Storm
- Other

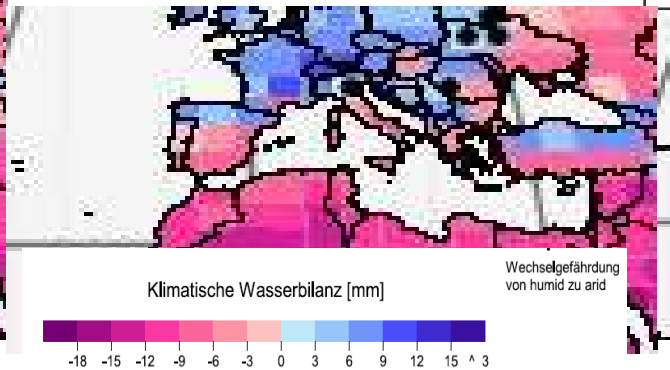
6.9. Potential Dangers of Drought

*Source: **AFES-PRESS for WBGU, 2006, slides by PIK for WBGU***

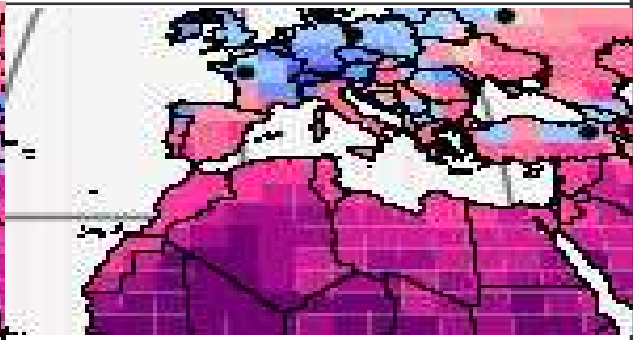
For 1975-2004
(Climatic water balance)



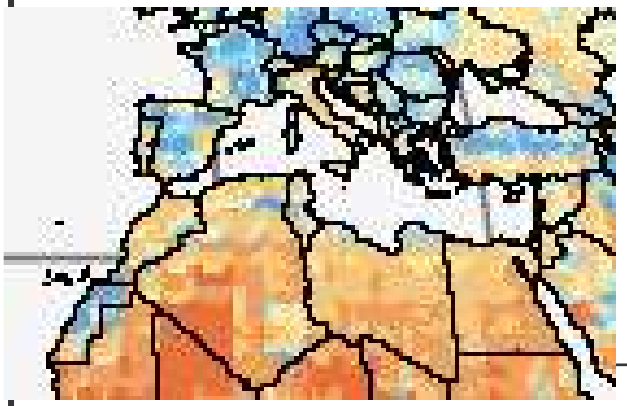
For 2050 (2040-2069)
(Climatic water balance)



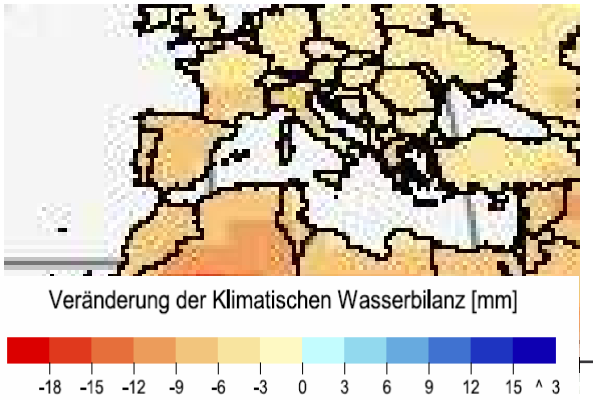
For 2080 (2070-2099)
(Climatic water balance)



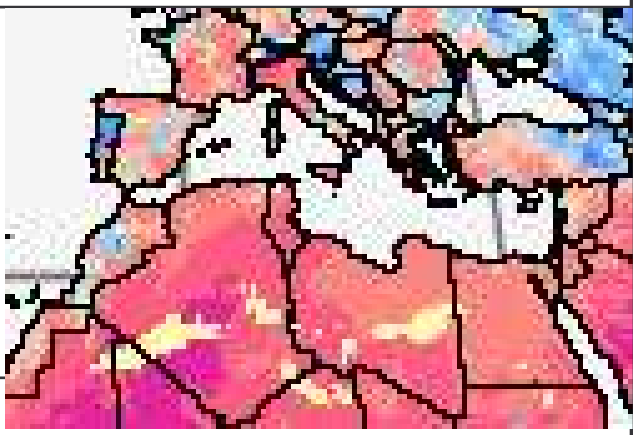
Difference 2040/2069-1975/2004,
change of climatic water balance.



Difference 2070/ 2099-2040/69,
change of climatic water balance.



Trends of climatic water balance.



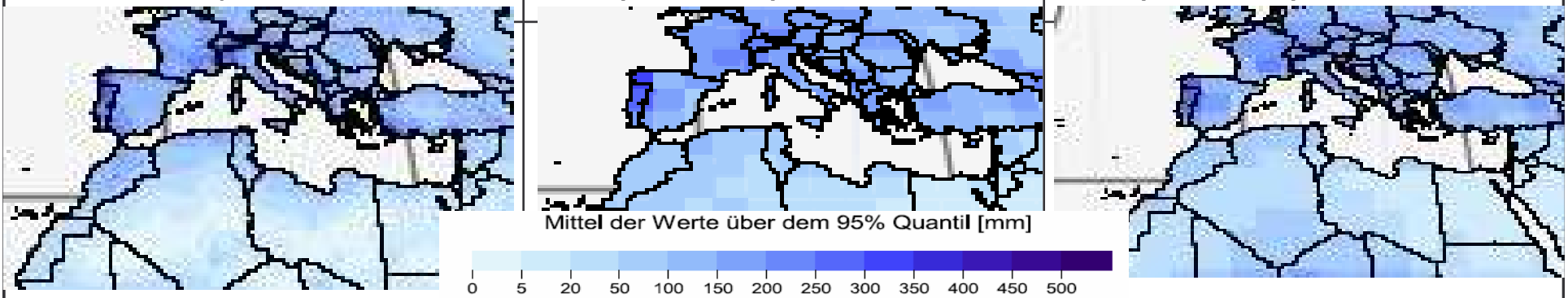
6.10. Potential for Flash Floods

*Source: **AFES-PRESS for WBGU, 2006, slides by PIK for WBGU***

Potential danger of flash floods by country, 1975-2004

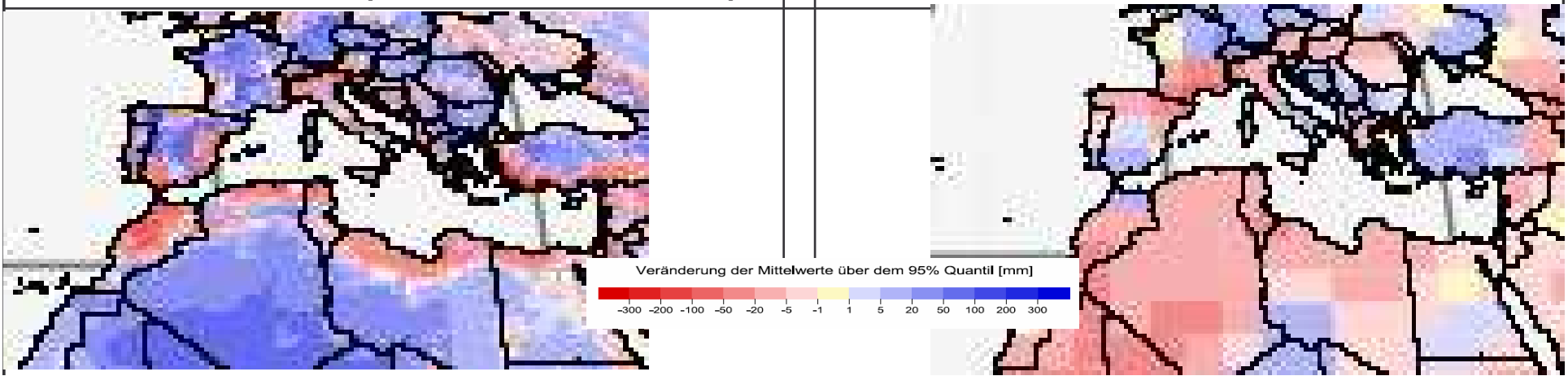
Potential danger of flash floods by 2050 (2040-2069)

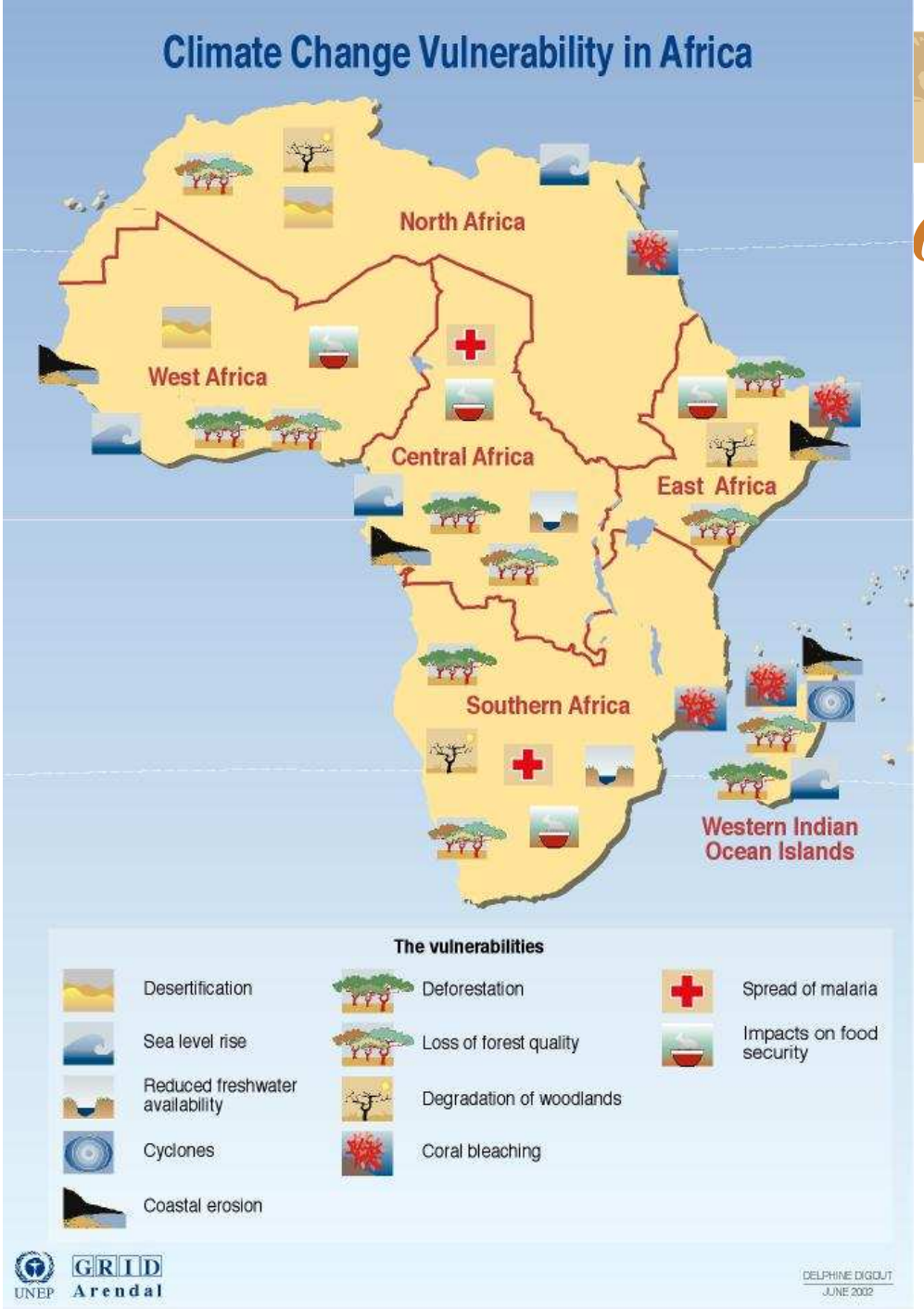
Potential danger of flash floods by 2080 (2070-2099)



Potential danger of flash floods by country Difference 1990-2050 (2040-2069 -1975/2004)

Potential danger of flash floods by country Difference 2050-2080 (2070/2099 -2040/2069)



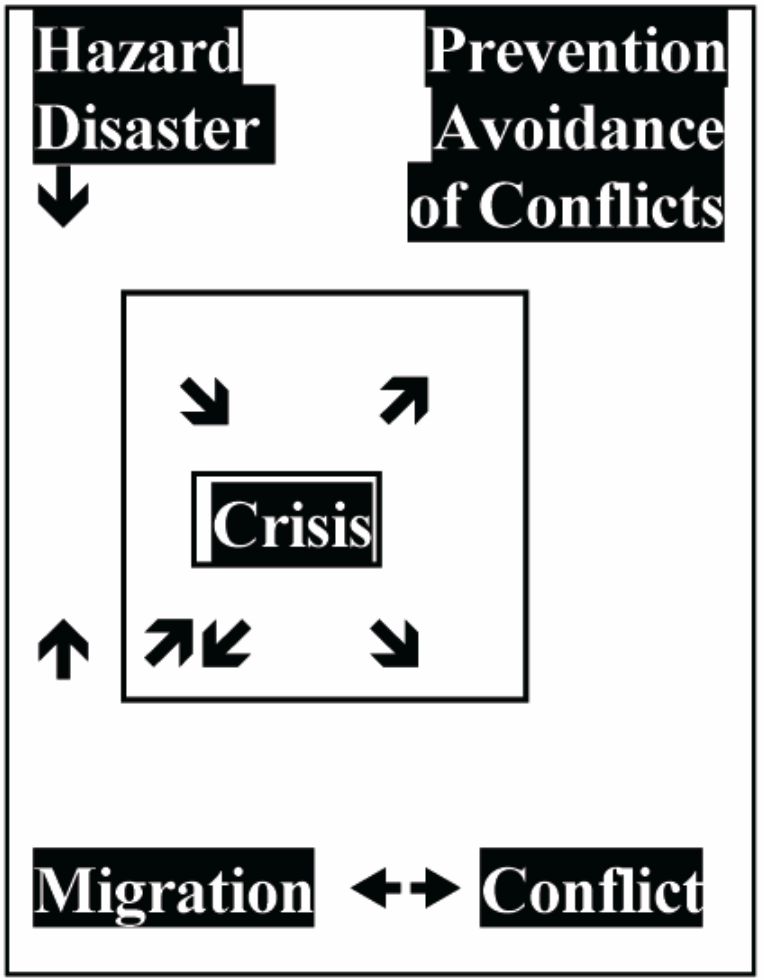


Sources: Anna Ballance, 2002.

6.11. CC Vulnerability

- Multiple stresses make most of Africa highly vulnerable to environmental changes.
- Climate change will increase vulnerability of an already stressed continent.
- This figure highlights findings of published studies; local impacts are even more dramatic and varied.
- As countries continue to submit national communications, there will be more documented cases, as well as proposals for adaptation measures.

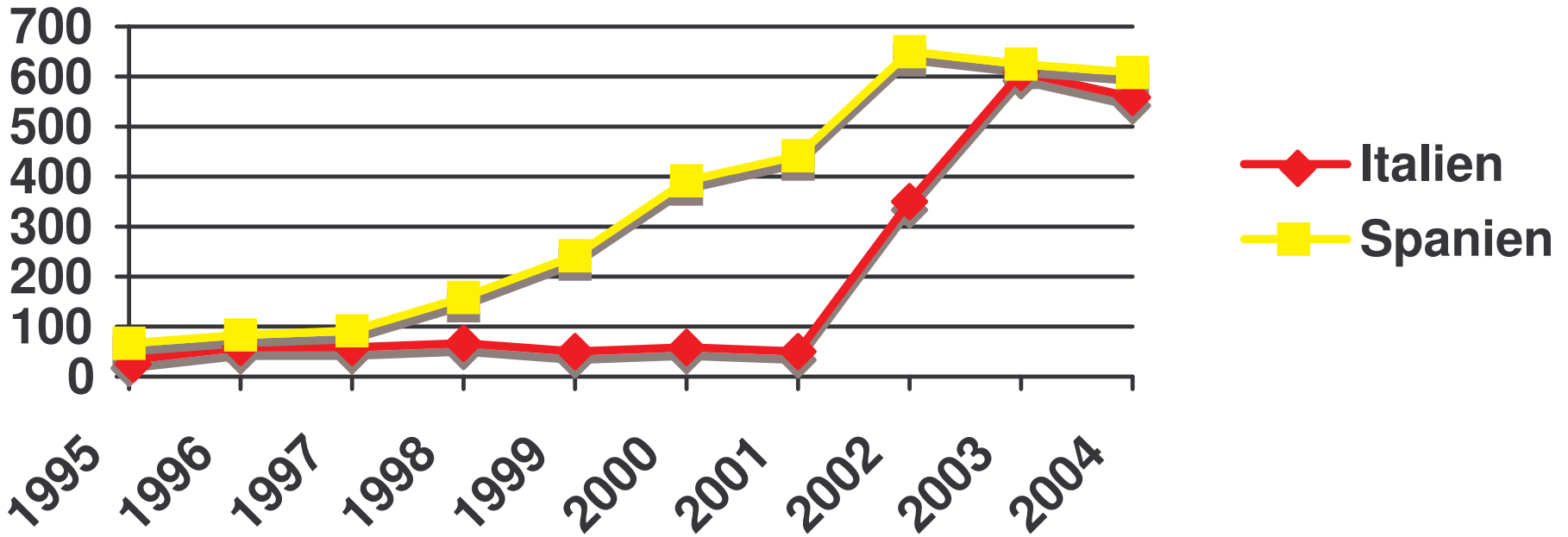
7. Societal Outcome: Crises and Conflicts



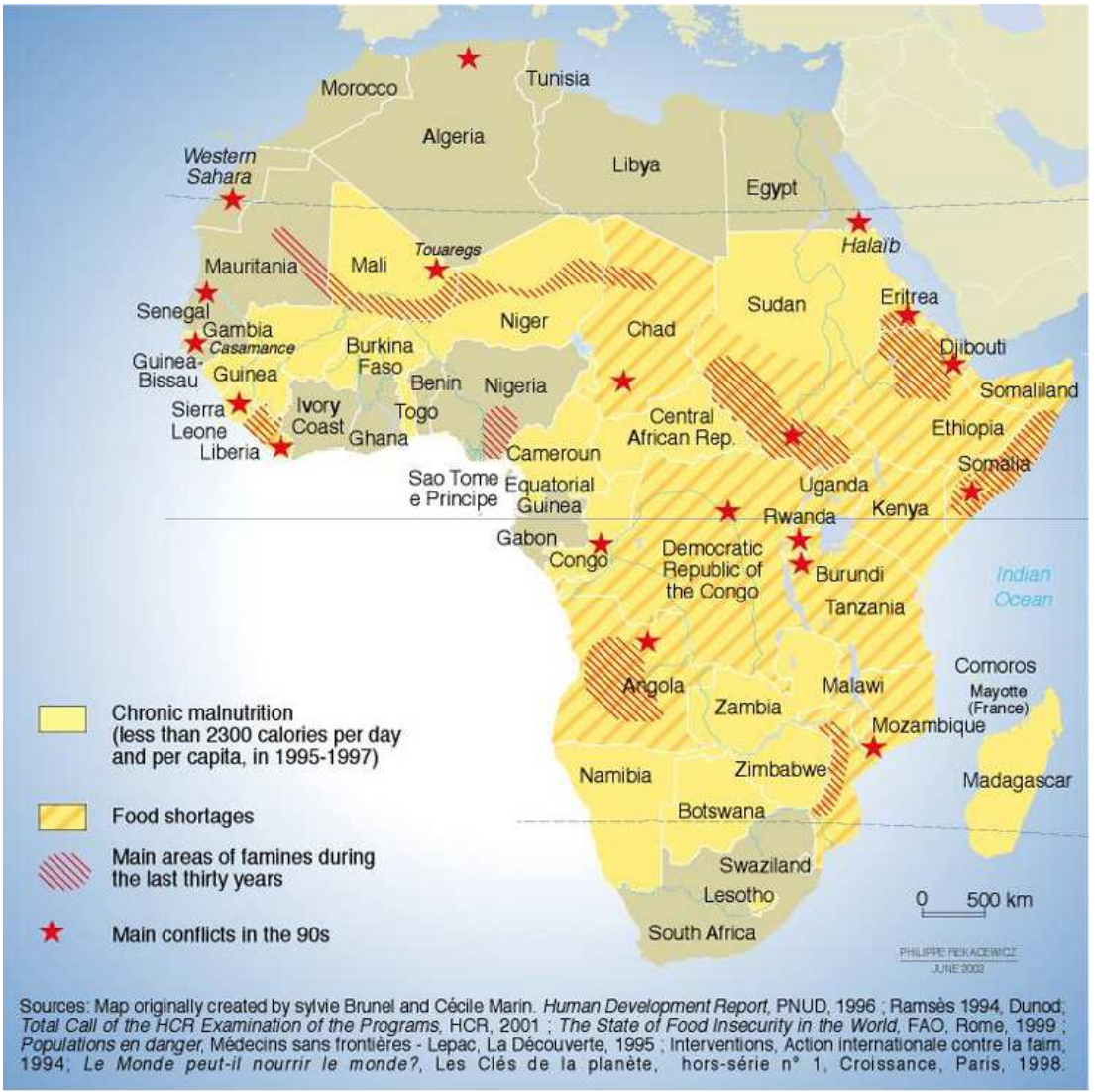
- Do climate change & desertification trigger migration movements?
- Migration is a process that covers different people's movements from:
  - rural to urban livelihoods (*urbanization*),
  - b) temporary '*internal displacements*' due to a natural hazard, conflict or a complex emer-gency or
  - c) permanent internal, regional or international South-North migration.
- Such migration may be *forced* (often due to push factors) or *voluntary* (often due to pull factors).
- Environmental factors due to GEC (water scarcity, soil degradation, climate change) may force people to leave their homes and traditional livelihoods to survive or to have better prospects for life and economic and human well being.

7.1. Migration Saldo in Italy and Spain (1995-2004 (in 1.000)

Diagramm 3: Wanderungssaldo in Italien und Spanien zwischen 1995-2004 (in 1.000)



7.2. Climate Change and Conflicts in Africa



Sources: Map originally created by sylvie Brunel and Cécile Marin. *Human Development Report*, PNUD, 1996 ; Ramsès 1994, Dunod; *Total Call of the HCR Examination of the Programs*, HCR, 2001 ; *The State of Food Insecurity in the World*, FAO, Rome, 1999 ; *Populations en danger*, Médecins sans frontières - Lepac, La Découverte, 1995 ; Interventions, Action internationale contre la faim, 1994; *Le Monde peut-il nourrir le monde?*, Les Clés de la planète, hors-série n° 1, Croissance, Paris, 1998.

- Many countries in sub-Saharan Africa face chronic malnutrition, frequent famine episodes.
- There are still many places in Africa where civil strife is a major constraint to livelihood and food security.
- Achieving food & water security are development priorities for Africa for years to come.
- IFRI World Hunger Index on linkage to conflicts.

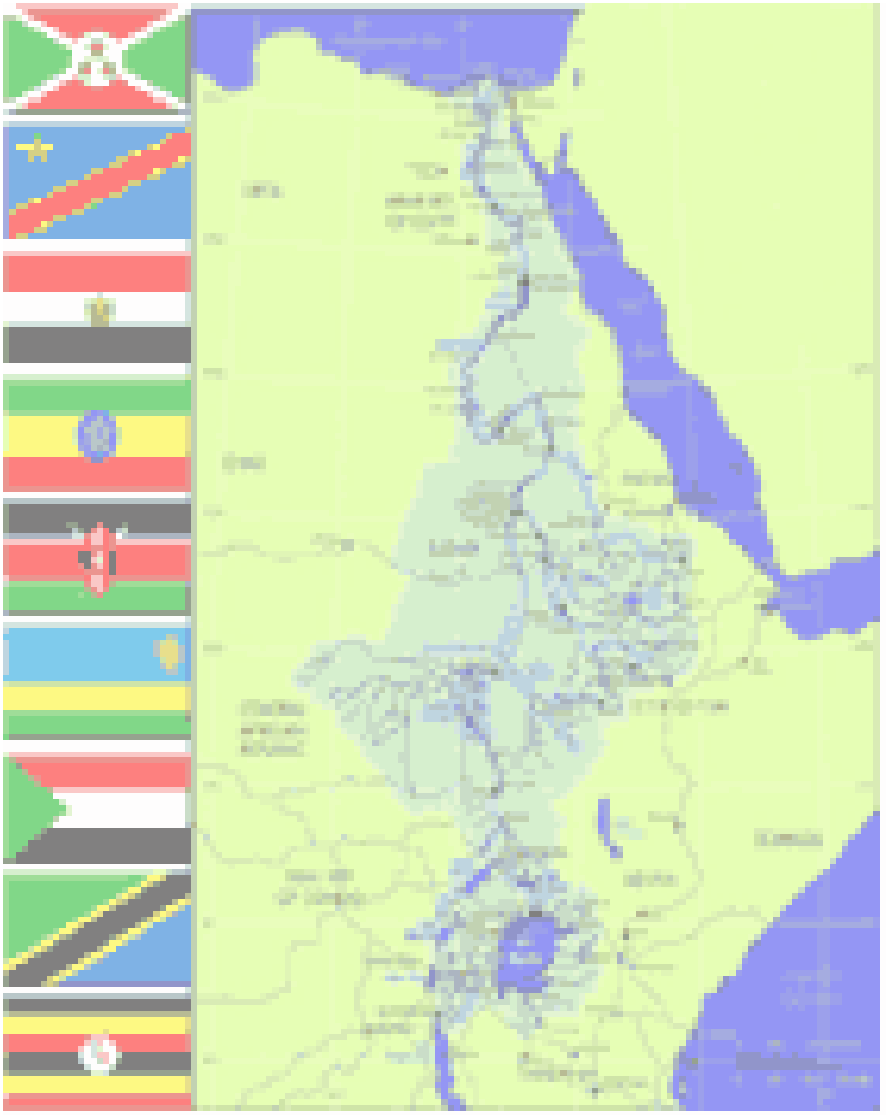
7.3. Environmental Change & Conflict in N. Africa

- For states in North Africa (2005-2020) **it is unlikely** that **GEC** (climate change, soil erosion, water scarcity) and **their impacts** (declining agricultural yields, extreme weather events) will lead to a „**Security Dilemma**" or wars among the states of North Africa or bet-ween these states and those in Southern Europe.
- **Climate change, desertification & water scarcity cannot be contained with military means.**
- However, the **societal impacts of GEC** my pose a **survival dilemma** for **affected people** and force them to leave their homes and livelihoods to the cities or to other countries.

7.4. Most Likely: Migration and Conflicts in the Nile Basin

- **GEC:** Climate change, desertification and water stress will affect: countries of North Africa, Sahel, Horn and in Nile Basin and have negative imapcts on precipitation and food yields.
- **Migration pressure is to rise:** the transmigration pressure from countries of Sub-sahara Africa to North Africa & Europe will rise. This requires a joint migration policy & regime.
- Sadat, Boutros-Ghali, Serageldin warned: **Next war will be fought about water. Cooperative policy measures should reduce the probability of this prophecy to become reality.**
- **Nile Basin Initiative:** should be extended from joint management to joint research and knowledge creation.

7.5. Nile Basin Initiative (NBI)



- **NBI:** transitional **institutional mechanism**, an **agreed vision**; basin framework, & a process to facilitate substantial investment in the Nile basin to **realize regional socio-economic development**.
- Establishment: beginning of the **process of confidence building** and realizing mutual benefits through shared projects.
- **Shared Vision Program (SVP)** creating environment for sustainable development
- **Subsidiary Action Programs (SAPs)**.

7.6. Widening the Scope of Nile Basin Initiative & Nile Transboundary Environment Action Project

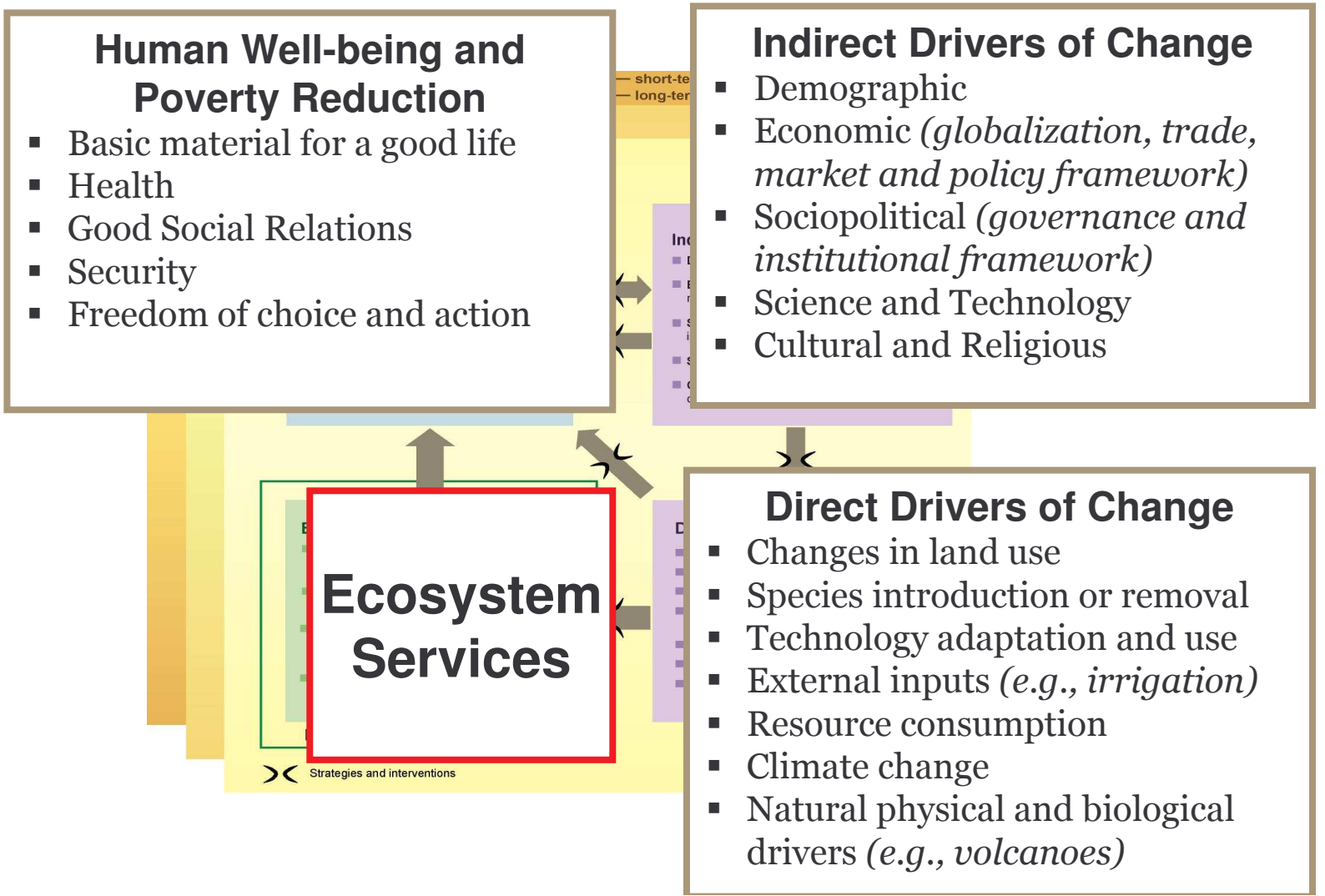
- **NBI & NTEAP does not address:**
  - **Challenges posed by Global Environmental Change**
    - **Climate Change & desertification**
    - **Basic and applied research**
- **NBI should consider to add on to its action plan:**
  - **Linkages of integrarted water management with:**
    - **Enhanced Weather Monitoring (systematic observation)**
    - **Regional Impact and vulnerability assessments**
    - **Adaptation planning and implementation**
    - **Assistance in the preparation of National Action Plans:**
      - **Responding to Climate Change**
      - **Combatting desertification**

8. Policy Responses: Reactive vs. Proactive Strategies

Millenium Ecosystem Assessment: Towards ‚Anthropocene‘

- Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber & fuel
- The changes that have been made to ecosystems have contributed to **substantial net gains in human well-being** and **economic development**, but these gains have been achieved at growing costs in the form of the **degradation** of many ecosystem services, **increased risks of nonlinear changes**, and the **exacerbation of poverty** for some groups of people.
- **The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the Millennium Development Goals**
- The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services can be partially met under some scenarios that the MA has considered but these involve significant changes in policies, institutions and practices, that are not currently under way.

8.1. MA Framework



8.2. Four Working Groups

Condition and Trends	Scenarios	Responses
▪ What is the current condition and historical trends of ecosystems and their services? ▪ What have been the consequences of changes in ecosystems for human well-being?	▪ **Given plausible changes in primary drivers, what will be the consequences for ecosystems, their services, and human well-being?**	▪ What can we do to enhance well-being and conserve ecosystems?
Sub-Global	▪ All of the above, at regional, national, local scales	

8.3. MA Findings - Outline

- 1. Ecosystem Changes in Last 50 Years
- 2. Gains and Losses from Ecosystem Change

Three major problems may decrease long-term benefits

- **Degradation of Ecosystem Services**
- **Increased Likelihood of Nonlinear Changes**
- **Exacerbation of Poverty for Some People**

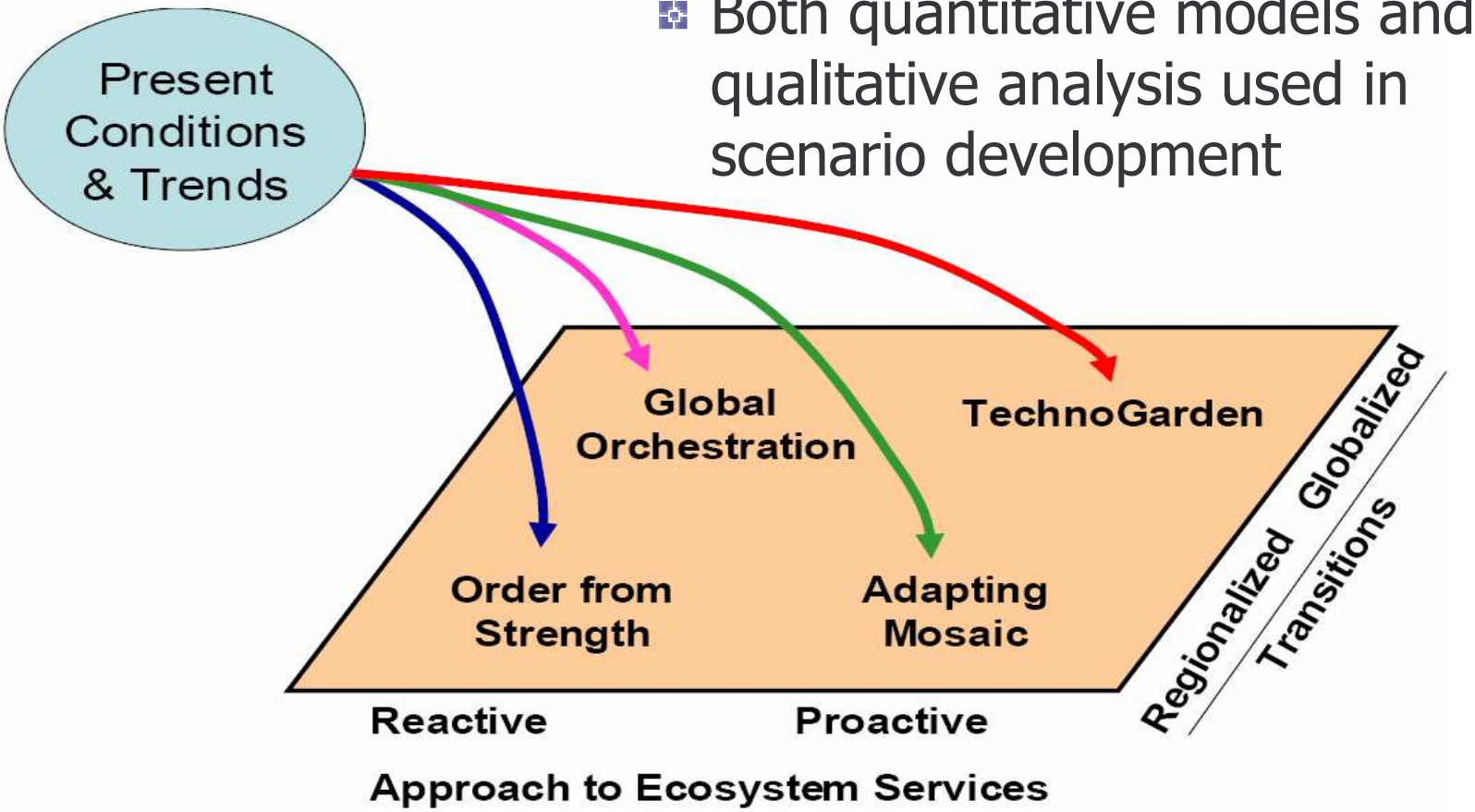
- 3. Ecosystem Prospects for Next 50 Years
- 4. Reversing Ecosystem Degradation

8.4. Changes in direct drivers: Climate Change

- **Potential future impacts**
  - By the end of the century, **climate change and its impacts may be the dominant direct driver of biodiversity loss and changes in ecosystem services globally**
  - **Harm to biodiversity will grow worldwide with increasing rates of change in climate and increasing absolute amounts of change**
  - Some ecosystem services in some regions may initially be enhanced by projected changes in climate. As climate change becomes more severe the **harmful impacts outweigh the benefits** in most world regions.
- **Net harmful impact on ecosystem services**
  - The balance of scientific evidence suggests that there will be a significant net harmful impact on ecosystem services worldwide **if global mean surface temperature increases more than 2° C above preindustrial levels** (*medium certainty).*
  - This would require CO_2 stabilization at less than 450 ppm (**unlikely**).

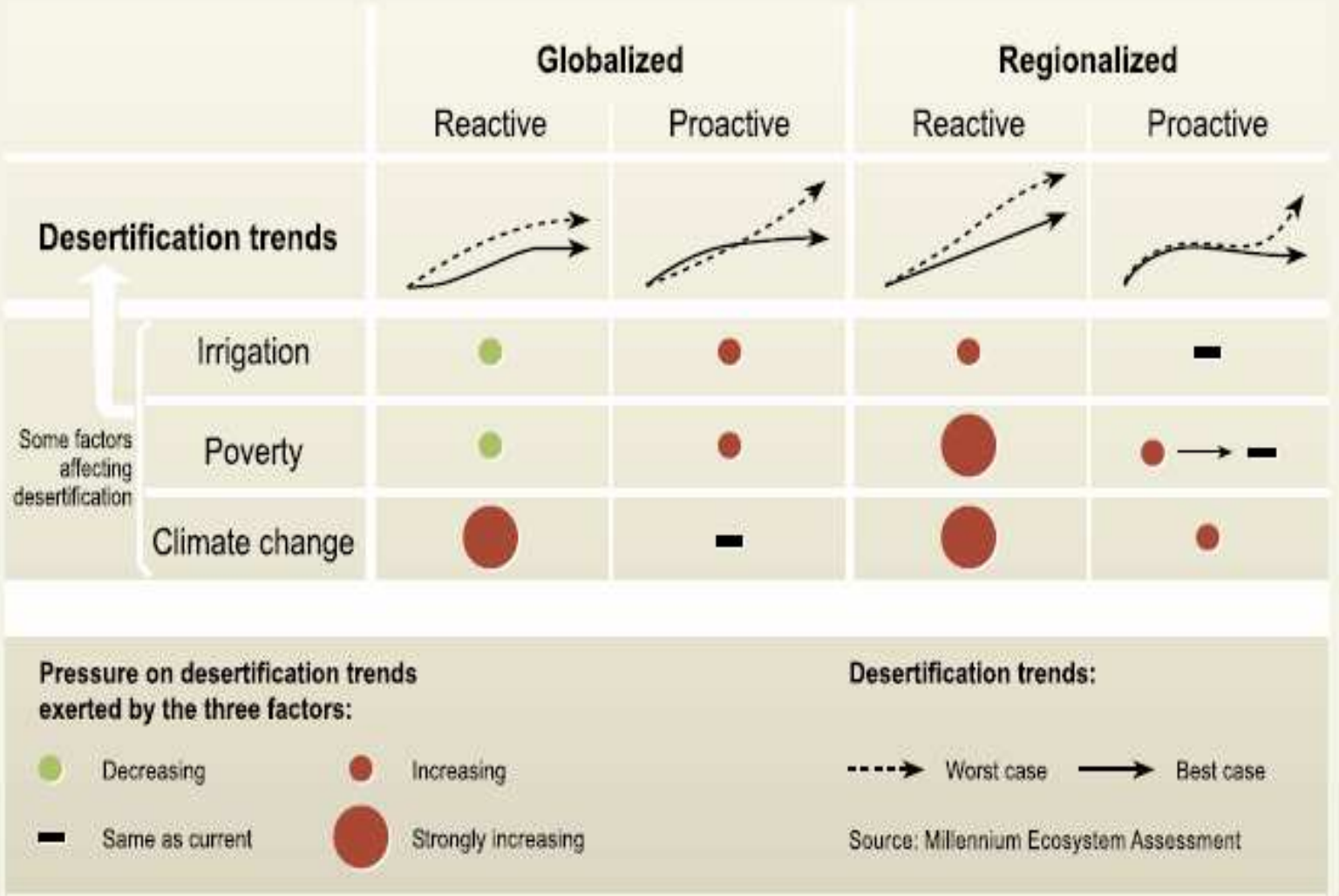
8.5. MA Scenarios

- **Not predictions – scenarios are plausible futures**
- Both quantitative models and qualitative analysis used in scenario development

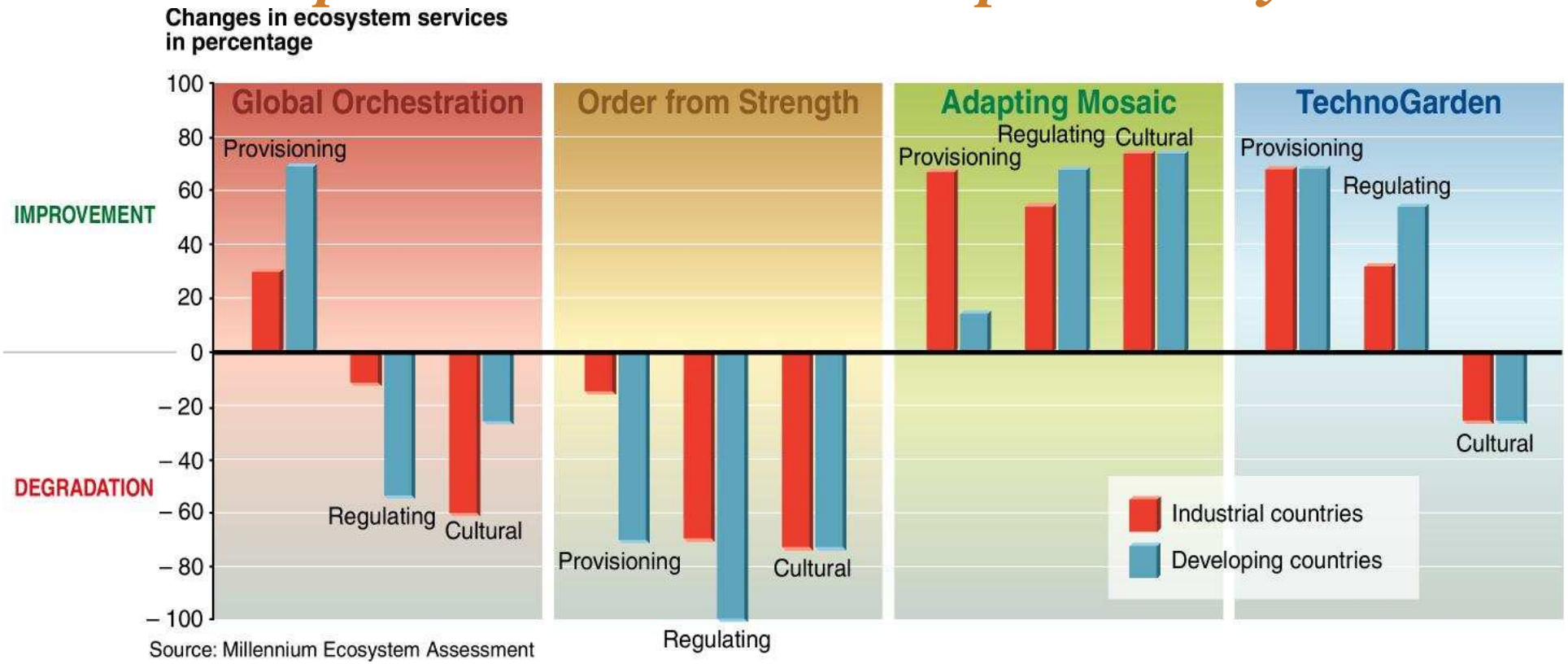


8.6. MEA-Scenarios

Rates of change in the extent of desertified areas in the drylands: Solid lines indicate the best case; dashed lines indicate the worst case for desertification in each of the MA scenarios.



8.7. Improvements in services possible by 2050



- **Three of the four scenarios show that significant changes in policy can partially mitigate the negative consequences of growing pressures on ecosystems, although the changes required are large and not currently under way**

8.8. Examples of changes in policies and practices that yield positive outcomes

- **Global Orchestration**
  - **Major investments in public goods (e.g., education, infrastructure) and poverty reduction**
  - Trade barriers and distorting subsidies eliminated
- **Adapting Mosaic (Regional)**
  - **Widespread use of active adaptive management**
  - **Investment in education** (countries spend 13% of GDP on education, compared to 3.5% today)
- **TechnoGarden(Global)**
  - **Significant investment in development of technologies to increase efficiency of use** of ecosystem services
  - Widespread use of 'payments for ecosystem services' and development of market mechanisms

8.9. Responses – Importance of Indirect Drivers

- **Ecosystem degradation can rarely be reversed without actions that address one or more indirect drivers of change:**
  - **population change** (including growth and migration)
  - **change in economic activity** (including economic growth, disparities in wealth, and trade patterns)
  - **sociopolitical factors** (including factors ranging from the presence of conflict to public participation in decision-making)
  - **cultural factors**
  - **technological change: knowledge & technology**
- **Collectively these factors influence the level of production and consumption of ecosystem services and the sustainability of the production.**

8.10.Responses: Technological

- ***Development and diffusion of technologies designed to increase the efficiency of resource use or reduce the impacts of drivers such as climate change and nutrient loading are essential***
- **Promising Responses**
  - **Promotion of technologies that enable increased crop yields without harmful impacts related to water, nutrient, and pesticide use**
  - Restoration of ecosystem services
  - **Promotion of technologies to increase energy efficiency and reduce greenhouse gas emissions**

8.11. Responses: Knowledge

- ***Effective management of ecosystems is constrained both by the lack of knowledge and information about ecosystems and by the failure to use adequately the information that does exist***
- **Promising Responses**
  - **Incorporation of nonmarket values of ecosystems in resource management decisions**
  - Use of all relevant forms of knowledge and information in assessments and decision-making, including traditional and practitioners' knowledge
  - **Enhancement of human and institutional capacity for assessing consequences of ecosystem change for human well-being & acting on such assessments**

9. Need for Global Proactive Strategies & Proposals

Developing the TechnoGarden by Technology Sharing

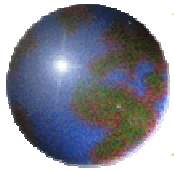
- **Two Centres of Excellence for Advanced Research, Technology Development and Training on Renewable Energy**
  - **Masreq in Cairo (feasibility study, Nov. 2006):**
    - **project development bilateral: Egyptian-German scientific co-operation**
    - **project realization interregional: Euro-Mediterranean Barcelona Process**
    - **project funding**
    - **hosts: Egyptian-German Technical University in Cairo**
  - **Maghreb in Tunis (Italy & Tunisia: MEDREP: Mediterranean Renewable Energy Programme (s. 2004)**

9.1. Bilateral Renewable Energy Programme

- **BMZ/GTZ: Projects (development assistance)**
  - **Programme for the Use of Wind Energy Zafastra (KfW)**
  - **Reduction of Env. Impact in Electricity Generation (KfW)**
  - **Wind park Zafarana III (KfW)**
  - **Wind park Zafarana IV (KfW)**
  - **Wind Energy Use in Africa:** Decentralized Energy Supply **(InWEnt)**
  - **Wind Energy Use in Africa (InWEnt)**
- **BMU (environment cooperation):**
  - **Trans-CSP:** Trans-Med. Interconnection for Concentrating Solar Power
  - **MENAREC Process, MENAREC III in Cairo in 2006.**
  - **Solartherm (EU 6 FP, GTZ Coordinator):** with education component
- **BMFT/DAAD:** German-Egyptian Year of Science & Technology in 2007 (Agent: German Academic Exchange Services)

10. Regional Cooperative Reactive and Proactive Mitigation Strategies and Proposals: MENA & Nile Basin Initiative

- Lack of research in those countries that are affected most by climate change and desertification in the Nile Basin
- No area of activities of NBI and of its present programmes
- Regional Proactive Scenario of Knowledge Creation
- Developing a Regional Adaptation Mosaic & Awareness Raising:
  - Two Centres of Excellence for Research and Training on the Impact of Global Environmental Change: Climate Change – Desertification and Water for the Nile Basin Countries in
    - Kampala or Nairobi: regional integrated climate modelling for NBI
    - Alexandria: on impact of Sea-leavel Rise on Coastal Region and development of adaptation and mitigation plans & strategies
  - Funding: NBI Trust Fund (managed by the World Bank)
    - World Bank
    - EU 7th Frame-work programme
    - Governments contributing to the Trust Fund
  - Partners: 10 Nile Basin Countries plus outside experts from donors



Thank you

for inviting me and giving me an opportunity to share with you these very preliminary and emerging conceptual ideas.

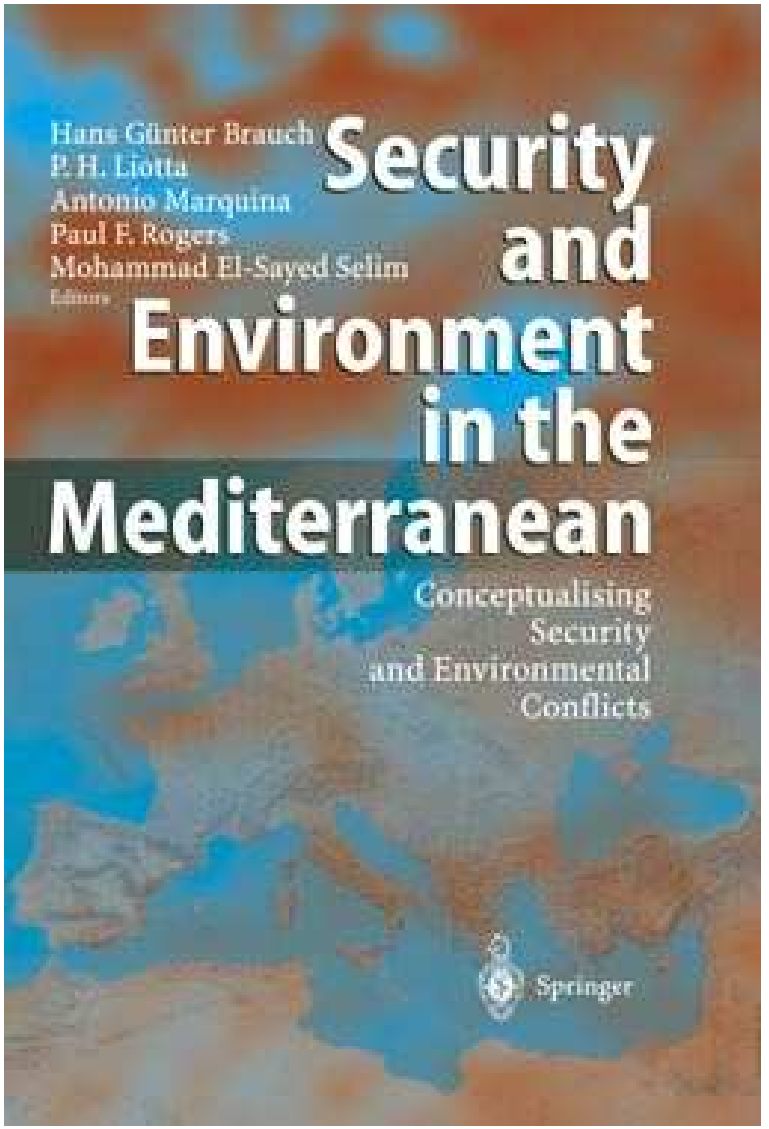
Thank you

for your attention and patience.

Send your comments to:

Brauch@onlinehome.de

Sources



- **BMU: *Climate Change and Conflicts* (2002)**
- **Brauch-Liotta-Marquina-Rogers-Selim (Eds.): *Security and Environment in the Mediterranean* (Springer 2003)** <http://www.afes-press.de/html/bk_book_of_year.html>.
- **UNU-EHS: <Roberts@ehs.unu.edu>**
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