



Koninklijk Hoger Instituut voor Defensie

# Water en Veiligheid: Een Europees Perspectief



**Hans Günter Brauch,**  
Privatdozent,  
(Freie Universität Berlin)

**24 maart 2010**

**KHID Avondconferentie**

Conferentiecentrum  
Campus Renaissance  
Hobbenstraat 8  
1000 Brussel

Ontvangst vanaf 16 u 30

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Institut Royal Supérieur de Défense

# L'eau et la Sécurité : Une Perspective Européenne



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**24 mars 2010**

**IRSD Conférence du soir**

Centre de conférence  
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**24 March 2010, 17.00-18.30**  
**Water and Security**  
**A European Perspective**  
**Brussels, Campus Renaissance**  
**Av. De la Renaissance 30, 1000 Brussels**

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Adj. Professor, Free University of Berlin, Otto-Suhr Institute, Berlin  
Chairman, Peace Research and European Security Studies  
Editor, Hexagon Series on Human, Environmental Security & Peace  
Senior Fellow, Institute on Environment and Human Security of United Nations University (UNU-EHS), Bonn



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# **1. Introduction: Key Questions**

- Does reconceptualization of security matter & what does water security & securitization of water mean?**
- What is the global water stress & scarcity by 2025 and how will it affect Africa & the Mediterranean region?**
- How does water interact with other global environmental factors & how will population growth & climate change affect water demand & supply in both hotspots relevant for European security?**
- Which proactive mitigation policies are needed for cooperation to avoid international water conflicts?**
- How may the military adapt to water stress, scarcity & water-induced hazards to avoid conflicts?**

## 2. Reconceptualizing of Security since 1990

### Objective, subjective and intersubjective security

- **Wolfers (1962)** pointed to two sides of the security concept: "Security, in an **objective sense**, measures the **absence of threats to acquired values**, in a **subjective sense**, the **absence of fear that such values will be attacked**".
- From a constructivist approach in international relations 'security' is the outcome of a process of social & political interaction where social values & norms, collective identities & cultural traditions are essential. Security: **intersubjective** or "what actors make of it".



# 2.1 Reasons for Reconceptualizing of Security since 1990

- **3 Reasons for a Reconceptualization of Security**
  - **End of the Cold War:** Fall of Berlin Wall (9 Nov. 1989)
  - **Globalization: Non-state Actors and Processes**
    - **Terrorism and organized crime:** weapons, drugs, human trafficking (children, women, organs etc.)
    - **Uncontrolled financial transfer and speculation: worst global economic crisis since 1929**
  - **Global Anthropogenic Environmental Change**
    - **Nobel Laureate Paul Crutzen (MPI for Chemistry in Mainz): Anthropocene:** phase of Earth history since industrial revolution
    - **Goal: Conceptual Foundation and Long-term Thinking on a new Security and Peace Policy for the Phase of the Anthropocene,** that combines **sustainable development with sustainable peace.**

## 2.2. Theory of Securitization

### Ole Wæver's Securitization Theory (1995)

- Copenhagen school security as a **“speech act”**, “where a securitizing actor designates a threat to a specified reference object and declares an existential threat implying a right to use extraordinary means to fend it off”.
- Such a process of **“securitization”** is successful when the construction of an “existential threat” by a policy maker is socially accepted and where “survival” against existential threats is crucial.
- Major contribution to a conceptual emancipation and vitality of European scholarship from US conceptual dominance during Cold War period



## 2.3. Buzan: Widening, Deepening and Sectorialization of Security Threats, Challenges, Vulnerabilities & Risks

Security dimension ▶ Level of interaction ▼	Military	Political	Economic	Environmental ▼	Societal
Human ▶			Securing soil, water, food, health, livelihood and energy for human beings combining all levels of analysis & interaction		
Village/Community/Society			▼▲		
National	Security dilemma of states	Social, energy, food, health, livelihood and soil threats may pose a survival dilemma in areas with high vulnerability			
	Security of the territory				
International/Regional/Global			▼▲		

## 2.4. Climate Change, Water, Food & Security as International, National & Human Security

- Since 1970/80s: '*global environmental change*' (GEC) became a new topic in natural and social sciences
- Since late 1980s and 1990s policy efforts on:
  - Climate Change: 1988: issue of G7; 1990: UN GA mandate; 1992: Rio summit: UNFCCC (1992) and Kyoto Protocol (1997)
  - Desertification: UNCCD (1994)
  - **Water (since 1997, World Water Fora, GWP, WWW)**
- Since 2000: all 3 are considered as security issues
  - **Since 2000: Ministerial Water Declaration (The Hague)**
  - Since 2002: climate change is seen as a security threat/risk
  - Valencia: 2003: NATO: Desertification as a security issue
- Since 2007: two debates on climate change & security
  - **UN & EU Debates: climate change and international security**
  - **US debate on climate change as threat for US national security**



# 3. Water and other Security Concepts

The links between 'water' & 'security' issues are complex and directly linked with many other security concepts:

- Water is a major object of analysis in ***environmental security*** to maintain ecosystem services, and to protect the biological and hydrological cycles and the ecosphere.
- As a key problem of ***social and societal security*** permits livelihood, recreation, and joy of life. It requires policy initiatives to avoid hydrological disasters and illnesses through protection, prevention, resilience-building, early warning, and evacuation to safe places in case of extreme weather events.
- Water as an issue of ***economic security*** creates development opportunities.
- Water is a **precondition for *food security*** that requires permanent, sufficient, accessible, safe, and nutritional food that is also culturally accepted.
- Water is essential for ***health and livelihood security*** to protect people from thirst, waterborne illnesses, vector diseases, but also from floods, drought, and plagues.

# 3.1. Definition of Water Security

- When and how has water been securitized by governments and how has “water security” been used in the scientific literature?
- Which role has been given to water in the 5 ‘dimensions’ of security for different reference objects (national, international, and human security) and in other sectoral security concepts (food)?
- The concept of ‘water security’ was introduced in the Ministerial Declarations of the Second *World Water Forum* (WWF) in The Hague (2000) and developed further at the 3rd WWF in Kyoto (2003), 4th in Mexico City (2006) and 5th in Istanbul (2009).
- The Ministerial Declaration of The Hague (2000) pointed to these challenges for achieving water security that refer to several other security concepts:
  - a) *meeting basic needs* (societal security);
  - b) *securing food supply* (food security);
  - c) *protecting ecosystems* (environmental security);
  - d) *sharing water resources* (political security);
  - e) *managing risks* (environmental, human and gender security);
  - f) *valuing water* (economic security);
  - g) *governing water security* (political security).



## 3.2. Ministerial Declaration of The Hague on Water Security in 21st Century, 22.3.2000

- Water is vital for the life and health of people and ecosystems and a basic requirement for the development of countries, but around the world women, men and children lack access to adequate and safe water to meet their most basic needs.
- Water resources and the related ecosystems that provide and sustain them, are under threat from pollution, unsustainable use, land-use changes, climate change and many other forces.
- The link between these threats and poverty is clear, for it is the poor who are hit first and hardest. This leads to one simple conclusion: business as usual is not an option.
- There is, of course, a huge diversity of needs and situations around the globe, but together we have one common goal: *to provide water security in the 21st Century.*
- This means ensuring that freshwater, coastal and related ecosystems are protected and improved; that sustainable development and political stability are promoted, that every person has access to enough safe water at an affordable cost to lead a healthy and productive life and that the vulnerable are protected from the risks of water-related hazards....

## 3.3. Water Vision: Water Goals for 2025

This 'water vision' suggested many changes in water management, with three key objectives for 2025:

- Empowering women, men, and communities to decide on levels of access to safe water and hygienic living conditions, and on the types of water-using economic activities that they desire – and to organize to obtain them.
- Producing more food and creating more sustainable livelihoods per unit of water applied and ensuring access for all to the food required for healthy and productive lives.
- Managing water use to conserve the quantity and quality of freshwater and terrestrial ecosystems that provide services to humans and all living things.

From the pledges and commitments made by governments in The Hague six main themes emerged:

- **Integrated water resources management: river basins.**
- Water policies and laws.
- Institutional capacities and development.
- Participation, empowerment, and gender.
- International collaboration and assistance.
- Education, awareness, and training.



# 3.4. Water Security and 5 Dimensions

- **Water as an issue of environmental sec.**
  - Reduction of water supply due to climate change
- **Water as an issue of societal security**
  - to secure, avoid & to foresee (scarcity, degradation)
- **Water as an issue of economic security**
  - Essential public good vs. commodity of the market
- **Water as an issue of political/military sec.**
  - Poison, attack dams & flood, divert & interrupt flow
- **Water as object of conflicts/cause of wars**
  - A. Wolf: There have been no water wars in history
  - P. Gleick: Water chronology: 200 water conflicts

# 3.5. Deepening & Sectorializing of Water Security

## Deepening

- **Human security approach on water issues**
  - Falkenmark/Rockström: secure, avoid, foresee
- **National security approach on water issues**
  - US EPA: protect water quality against terrorist attacks
- **International security approach on water issues**
  - Hydrodiplomacy (US/Mexico, Turkey/Syria, Israel/Jordan)
  - International Water Resource management: NBI (Nile)

## Sectorializing

- **Water and soil security:** condition for food security
- **Water as food security** ('virtual water')
- **Water as health security:** water-related diseases



# 4. Global & Regional Water Scarcity, Degradation and Stress

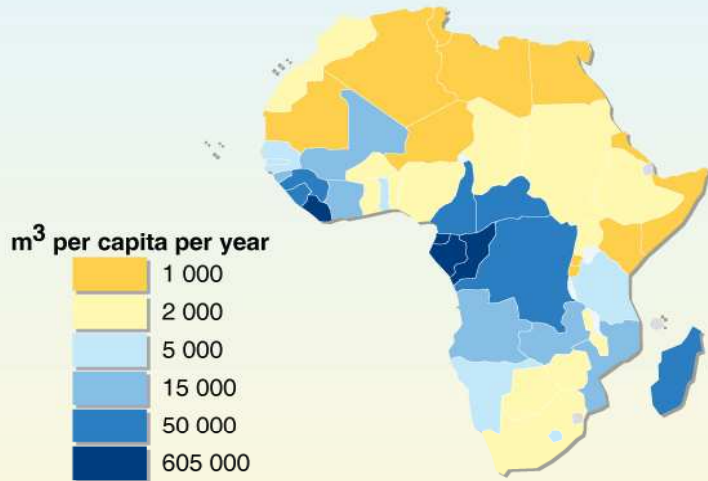


PHILIPPE BEKAERWAZ  
FEBRUARY 2006

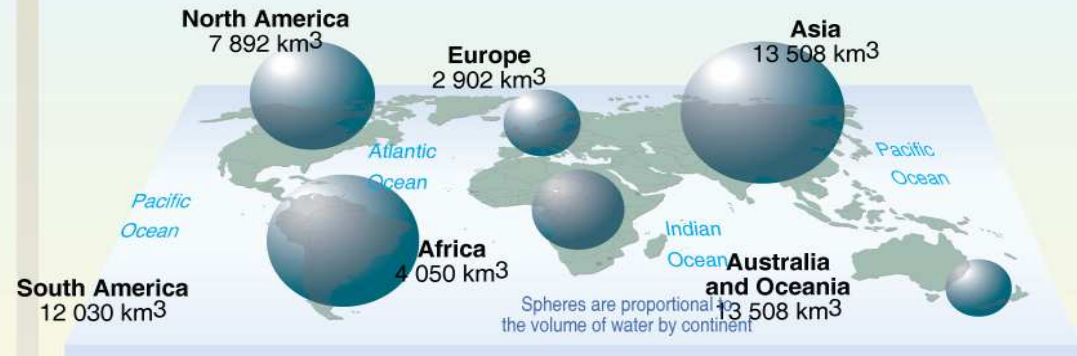
# 4.1. Fresh water resources by continent

## Freshwater Resources

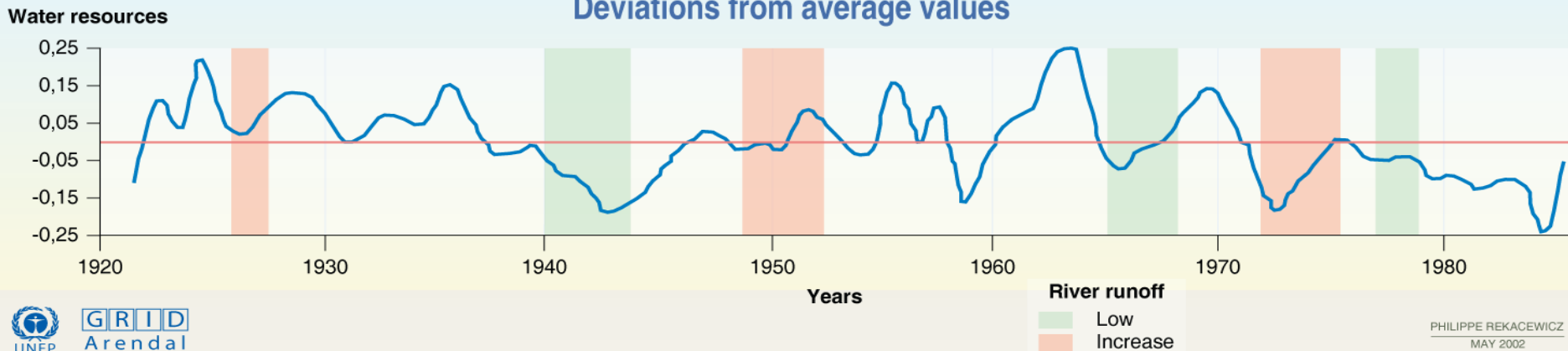
### Freshwater Withdrawal Average Annual



### Water Resources by Continent Annual Volume, Average 1921-1985



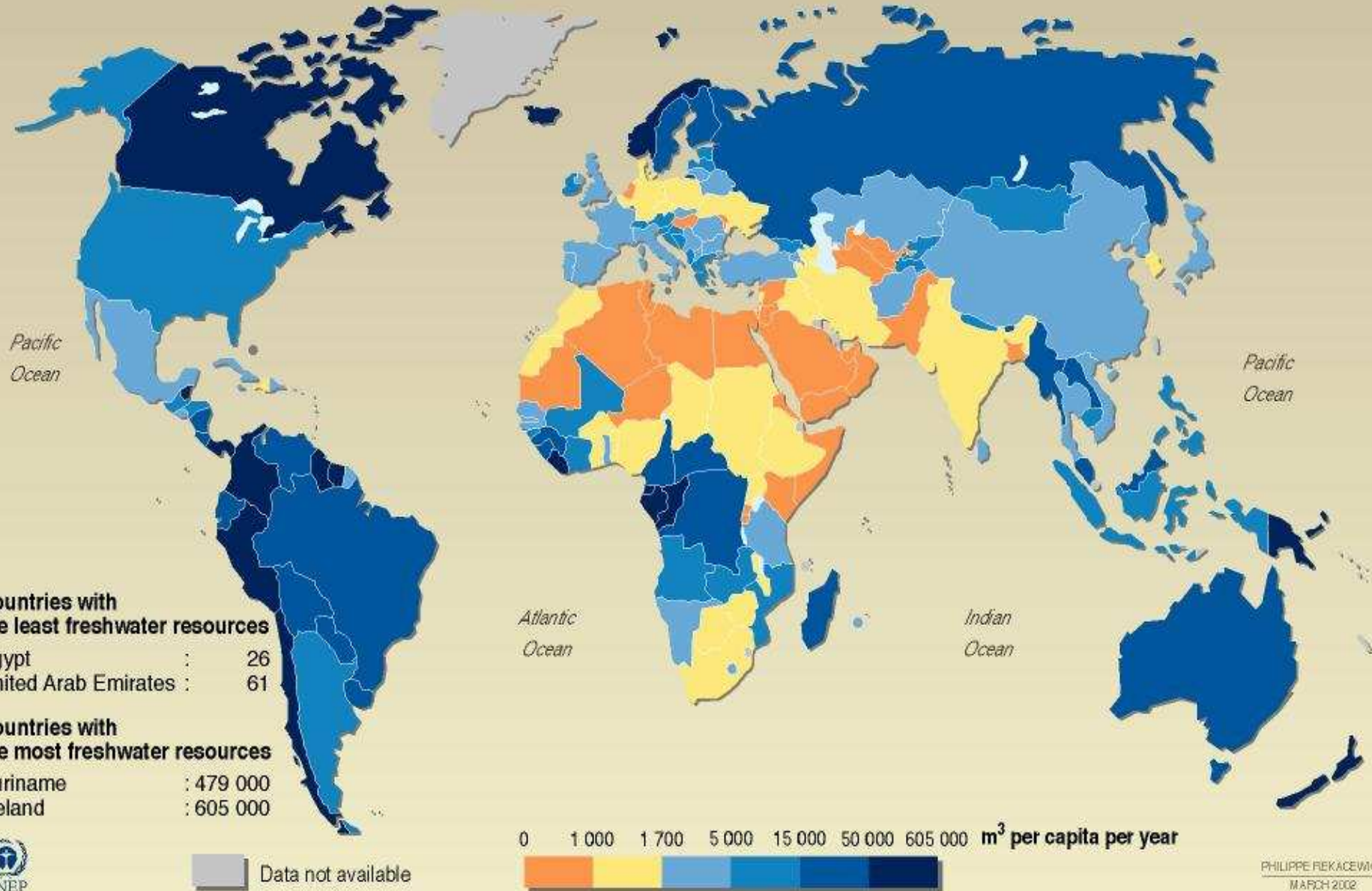
### Water Resources over the 20th Century Deviations from average values



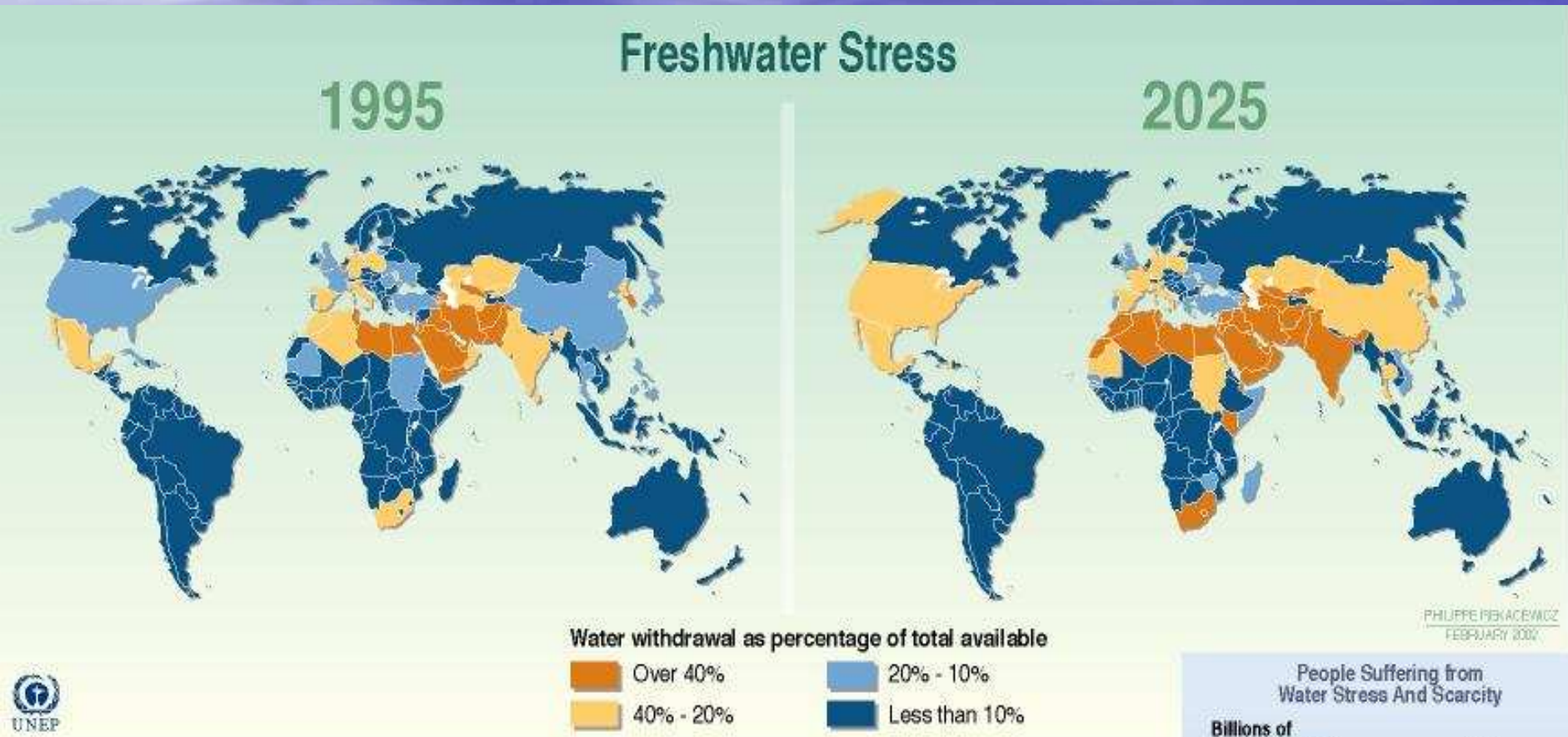


# Availability of Freshwater in 2000

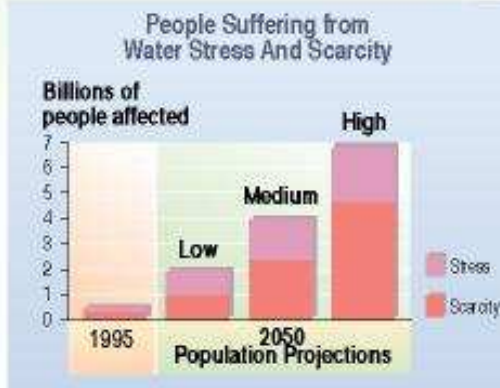
## Average River Flows and Groundwater Recharge



# 4.3. Freshwater Stress: 1995 to 2025



Source: World Meteorological Organisation (WMO), Geneva, 1996; Global Environment Outlook 2000 (GEO), UNEP, Earthscan, London, 1999.



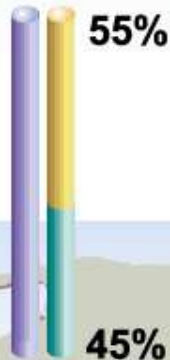


# The World's Surface Water

## Precipitation, Evaporation and Runoff by Region



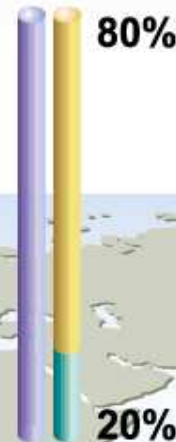
**North America**  
18 300 km<sup>3</sup>



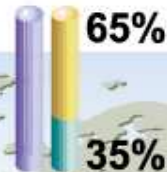
**South America**  
28 400 km<sup>3</sup>



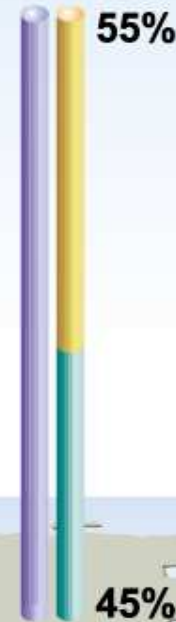
**Africa**  
22 300 km<sup>3</sup>



**Europe**  
8 290 km<sup>3</sup>



**Asia**  
32 200 km<sup>3</sup>



**Australia and Oceania**  
7 080 km<sup>3</sup>



Pacific Ocean

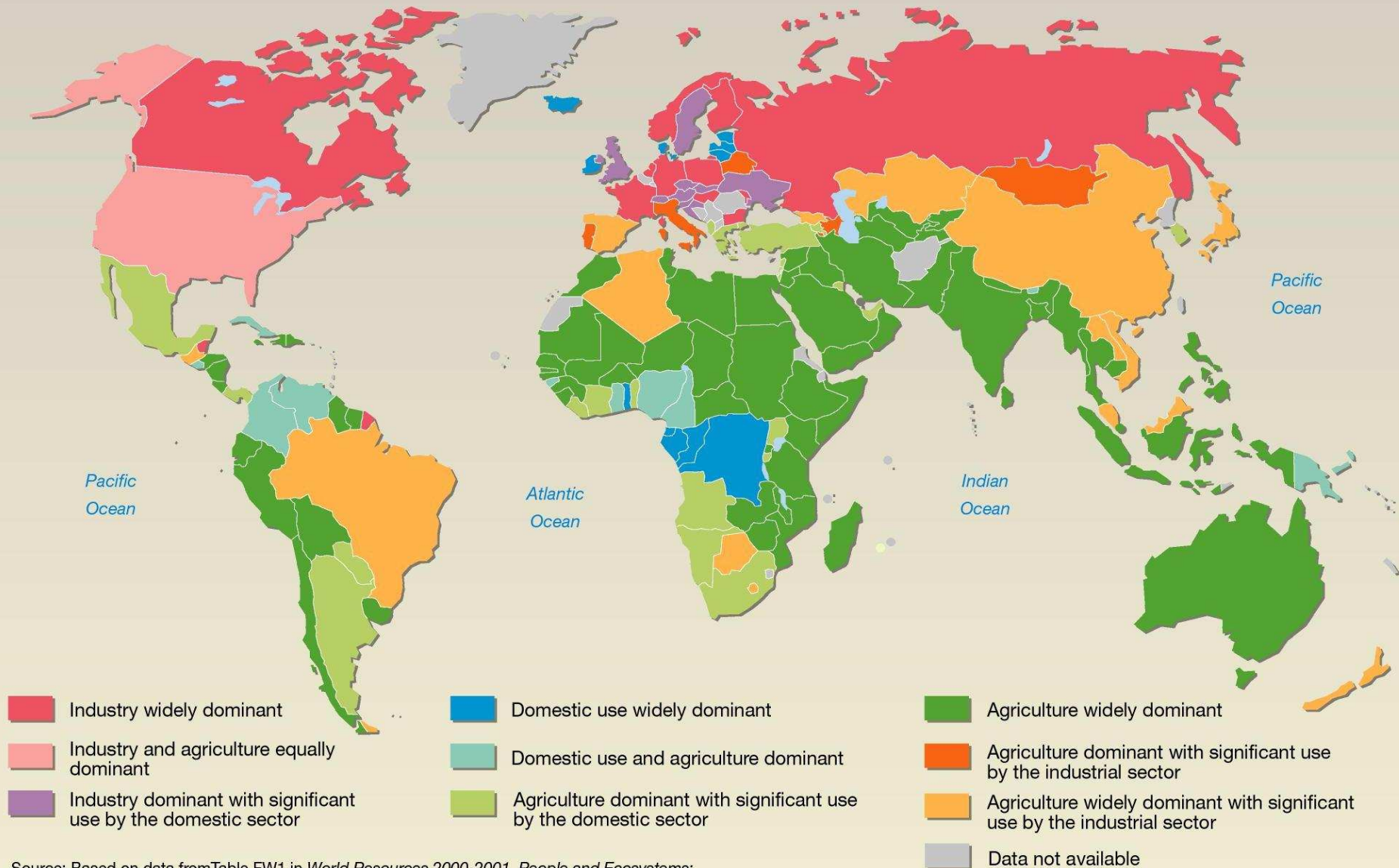
Pacific Ocean

Atlantic Ocean

Indian Ocean



# 4.5. Use of Freshwater by Sector

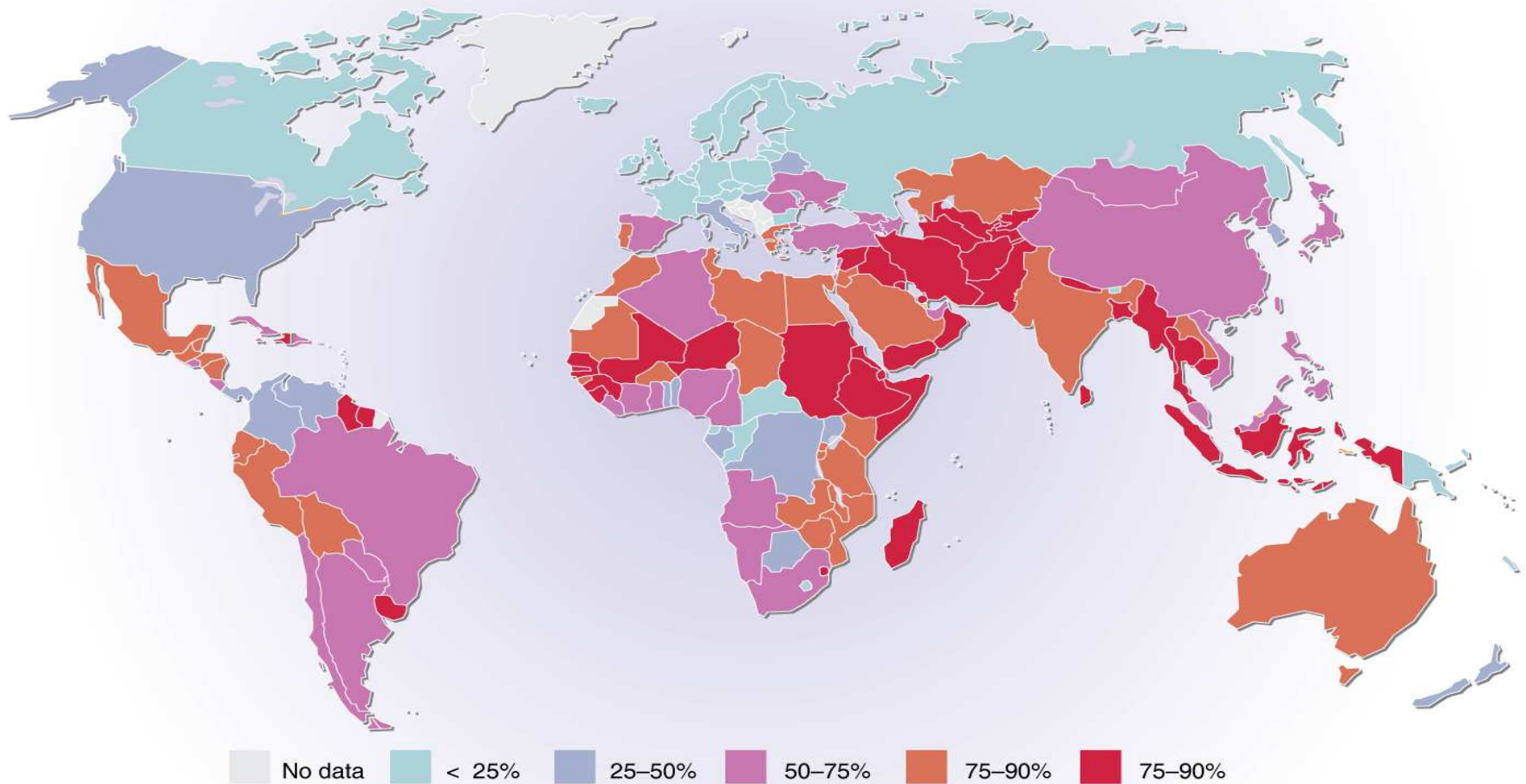


Source: Based on data from Table FW1 in *World Resources 2000-2001, People and Ecosystems: The Fraying Web of Life*, World Resources Institute (WRI), Washington DC, 2000.

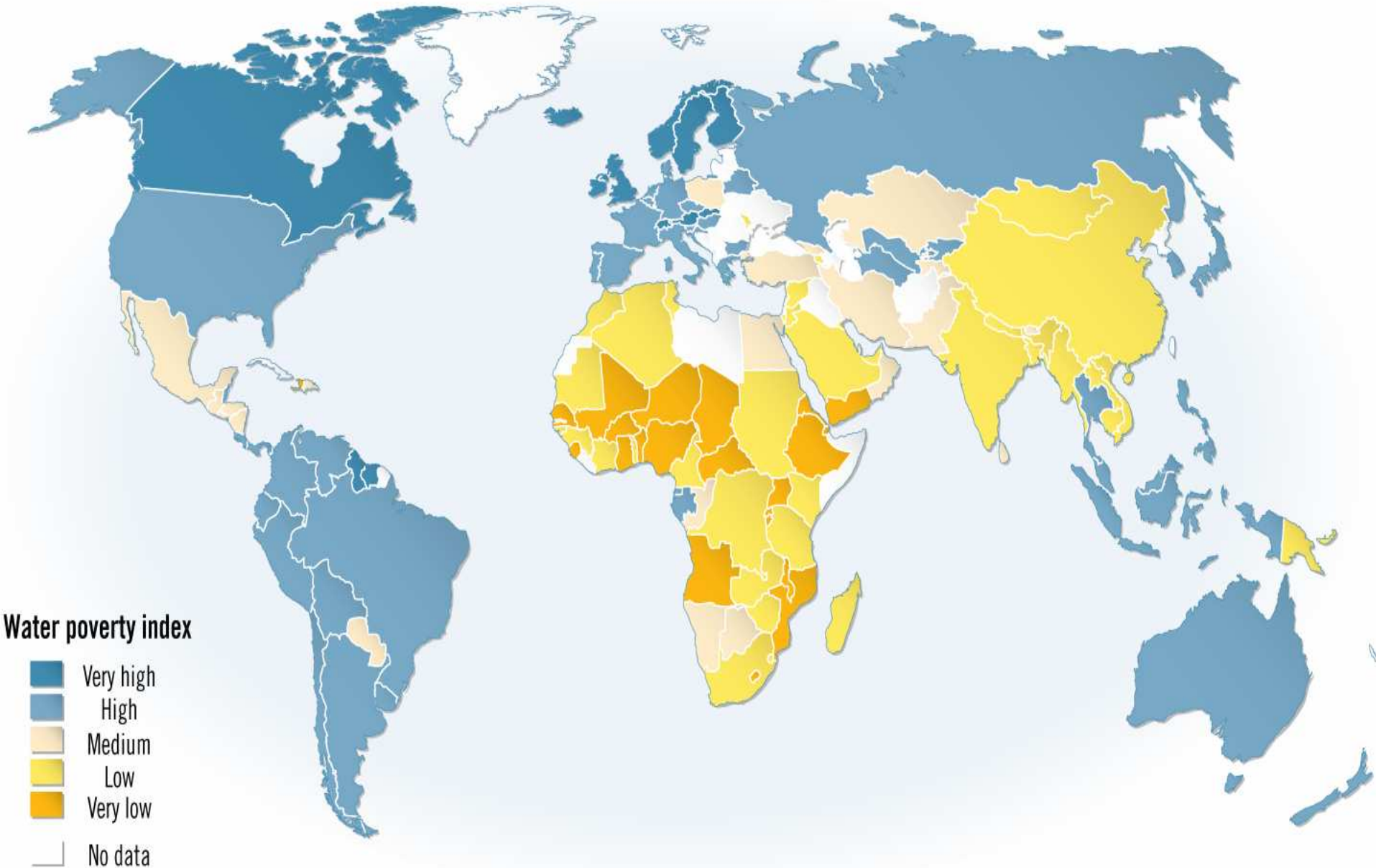


# 4.6. Water withdrawal for Agriculture, 2001

## Proportion of water withdrawal for agriculture, 2001

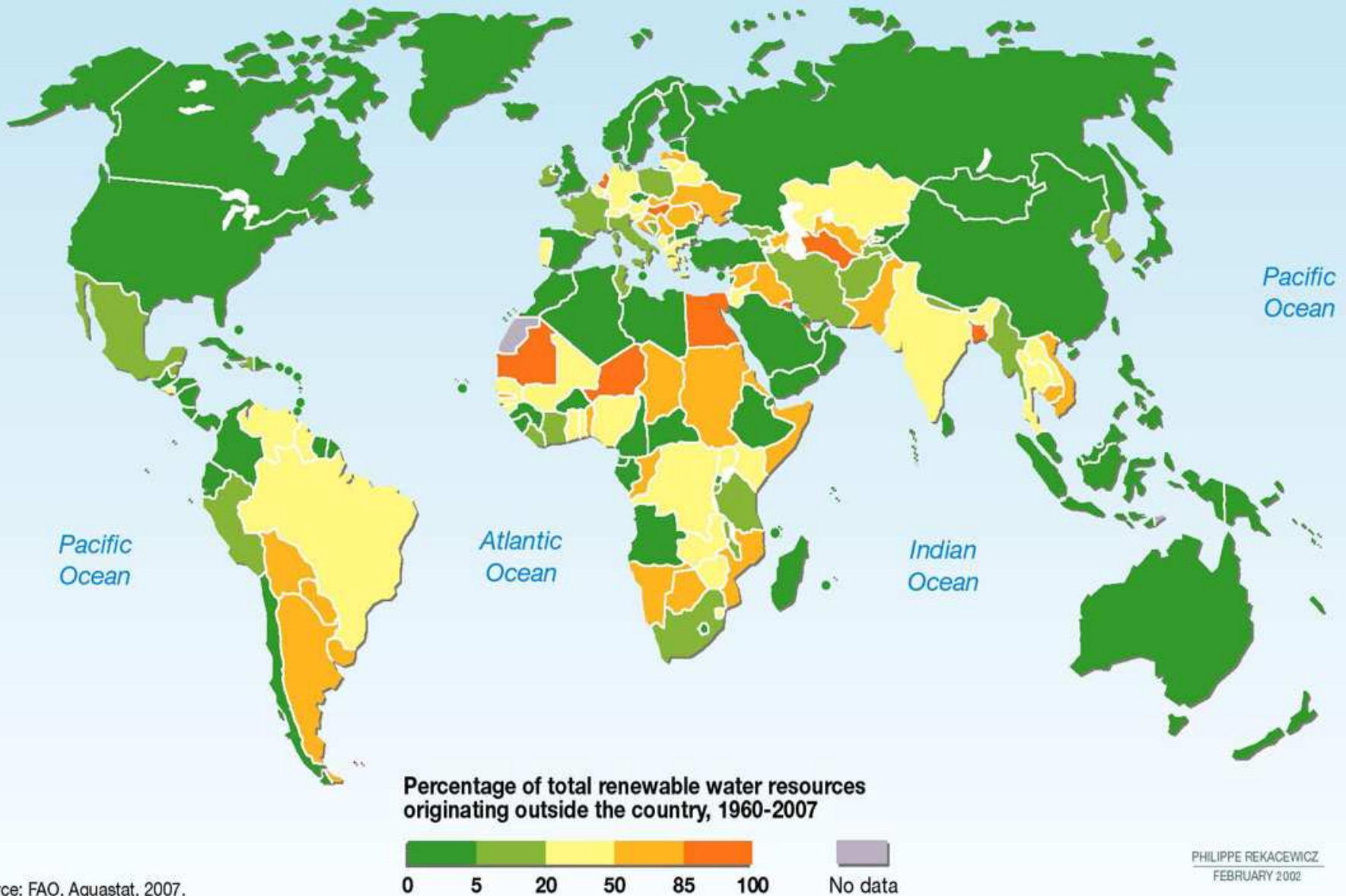


# 4.7. Water Poverty



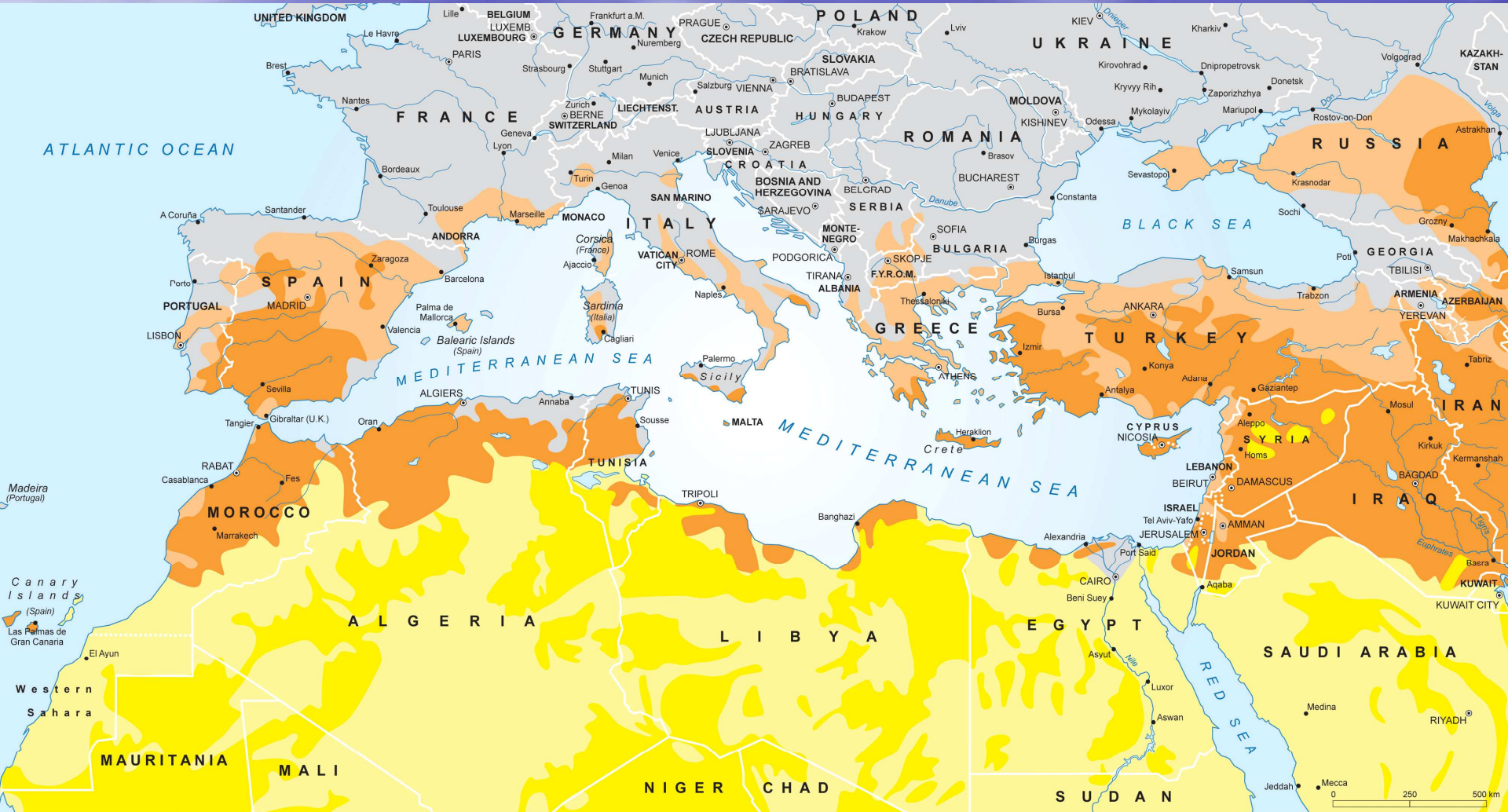


# 4.8. Dependency on water from outside



# 5. Water stress and scarcity in Africa

## Desertification in the Mediterranean



Environment and Security in the Mediterranean: **Desertification**

- Desert
- Desertification vulnerability, serious
- Semi-desert
- Desertification vulnerability, moderate

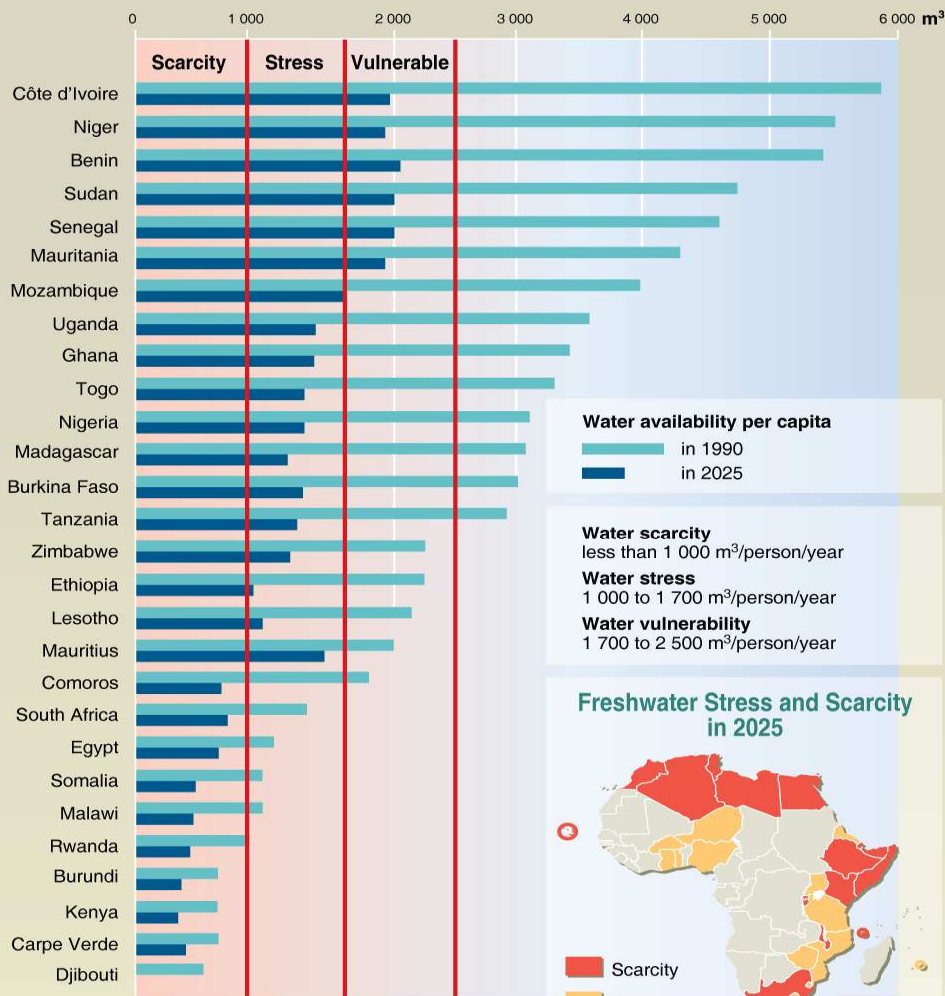
Sources: Natural Resources Conservation Service, Plan Bleu, Times Atlas of the World



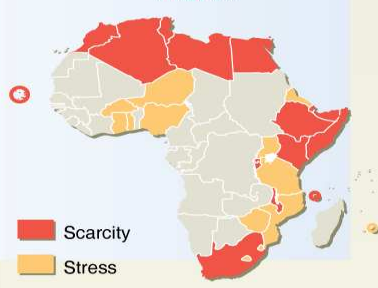


# 5.1. River basins & Freshwater stress, scarcity in Africa by 2025

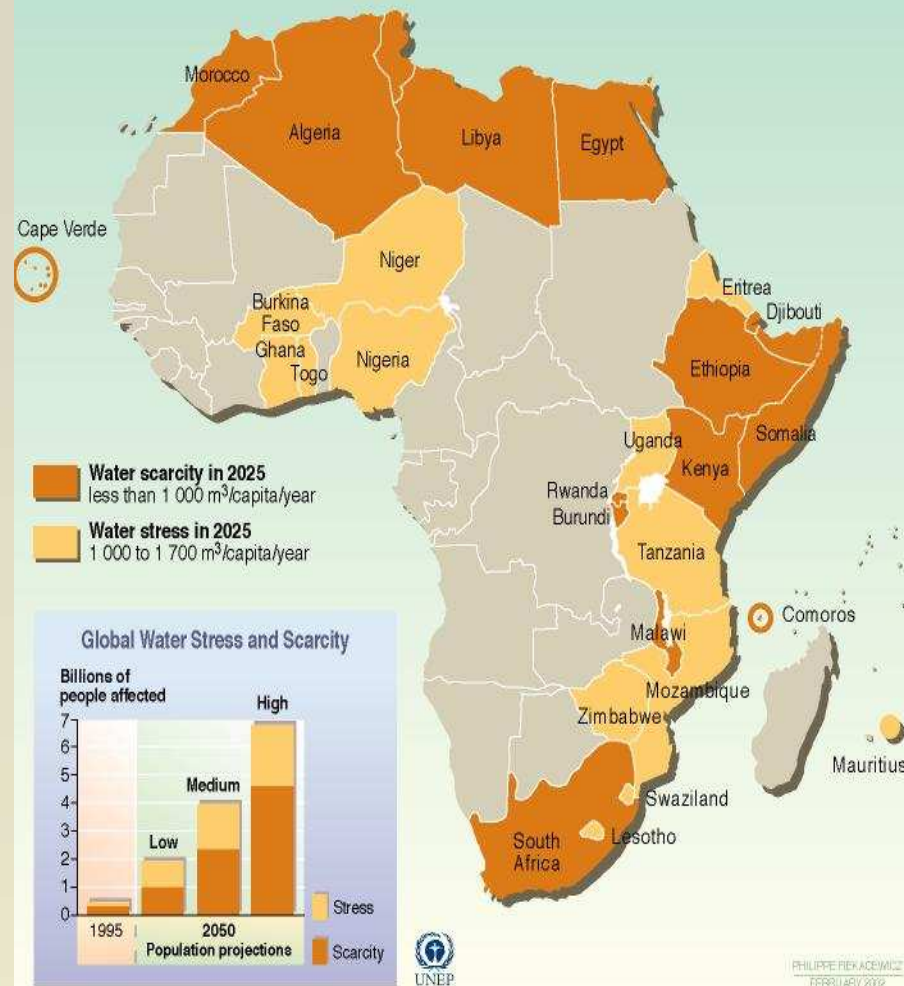
## Water Availability



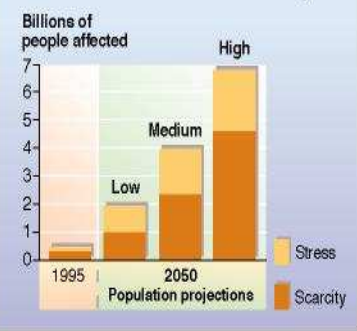
## Freshwater Stress and Scarcity in 2025



## Freshwater Stress and Scarcity in Africa by 2025



## Global Water Stress and Scarcity



# 5.2. Climate change vulnerability, hunger, conflicts

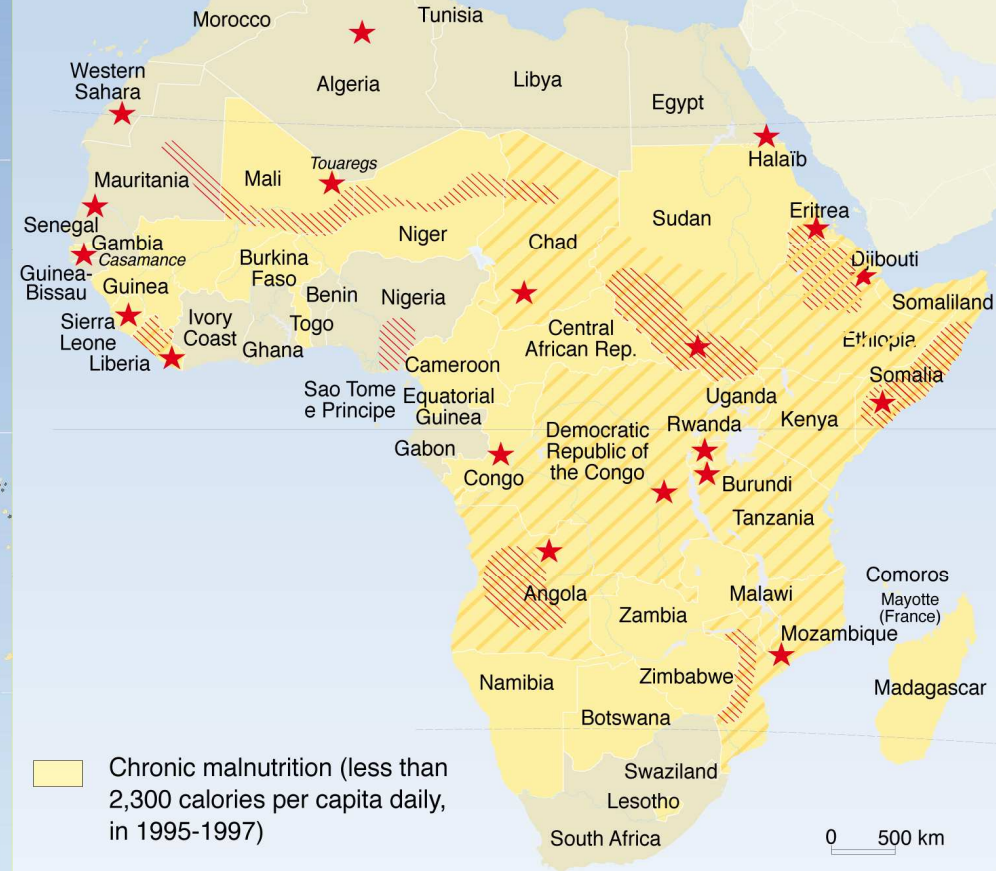
## Climate Change Vulnerability in Africa



### The vulnerabilities



## HUNGER AND CONFLICTS IN AFRICA



Chronic malnutrition (less than 2,300 calories per capita daily, in 1995-1997)

Food shortages

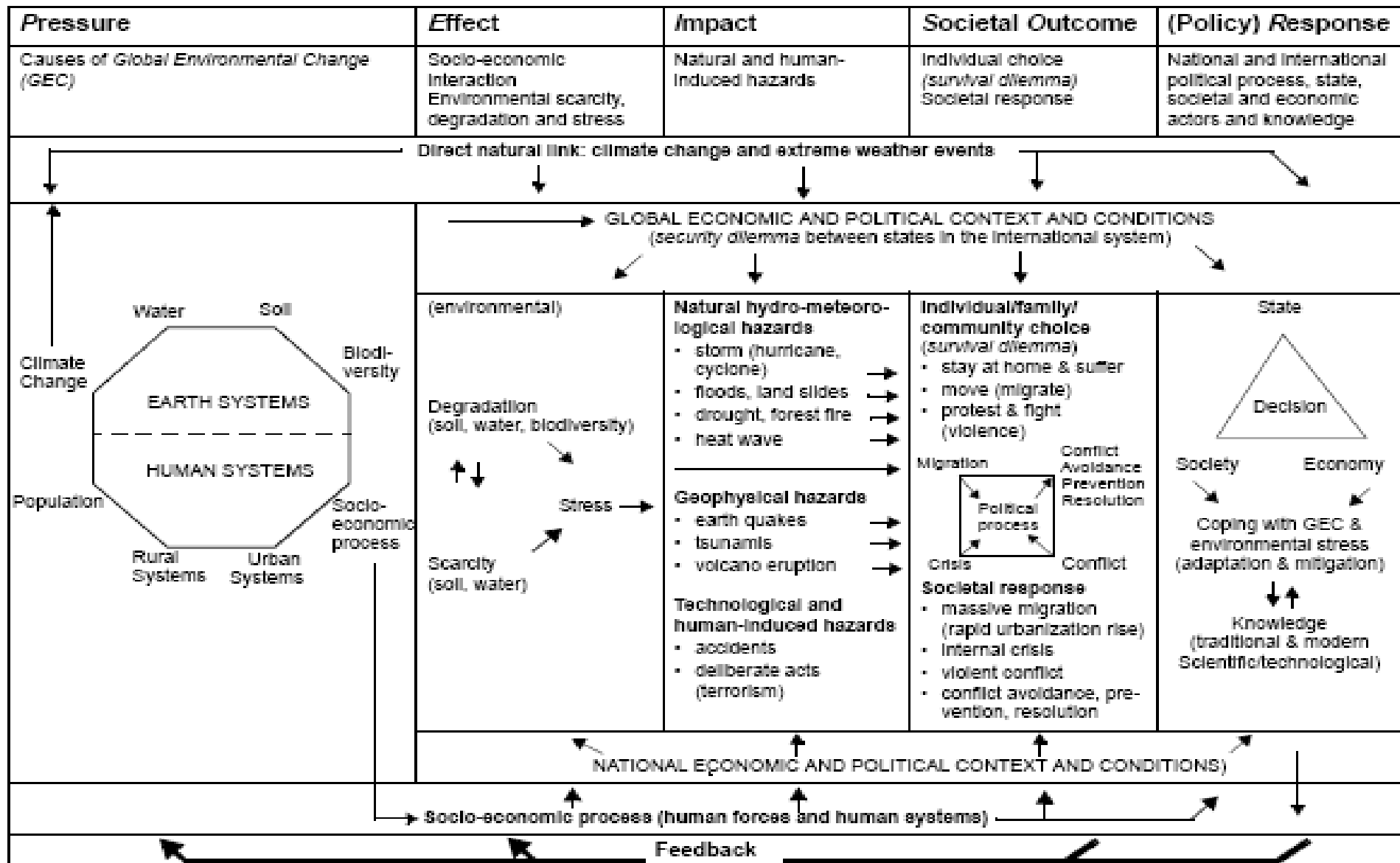
Main areas of famines during the last thirty years

Main conflicts in the 1990s

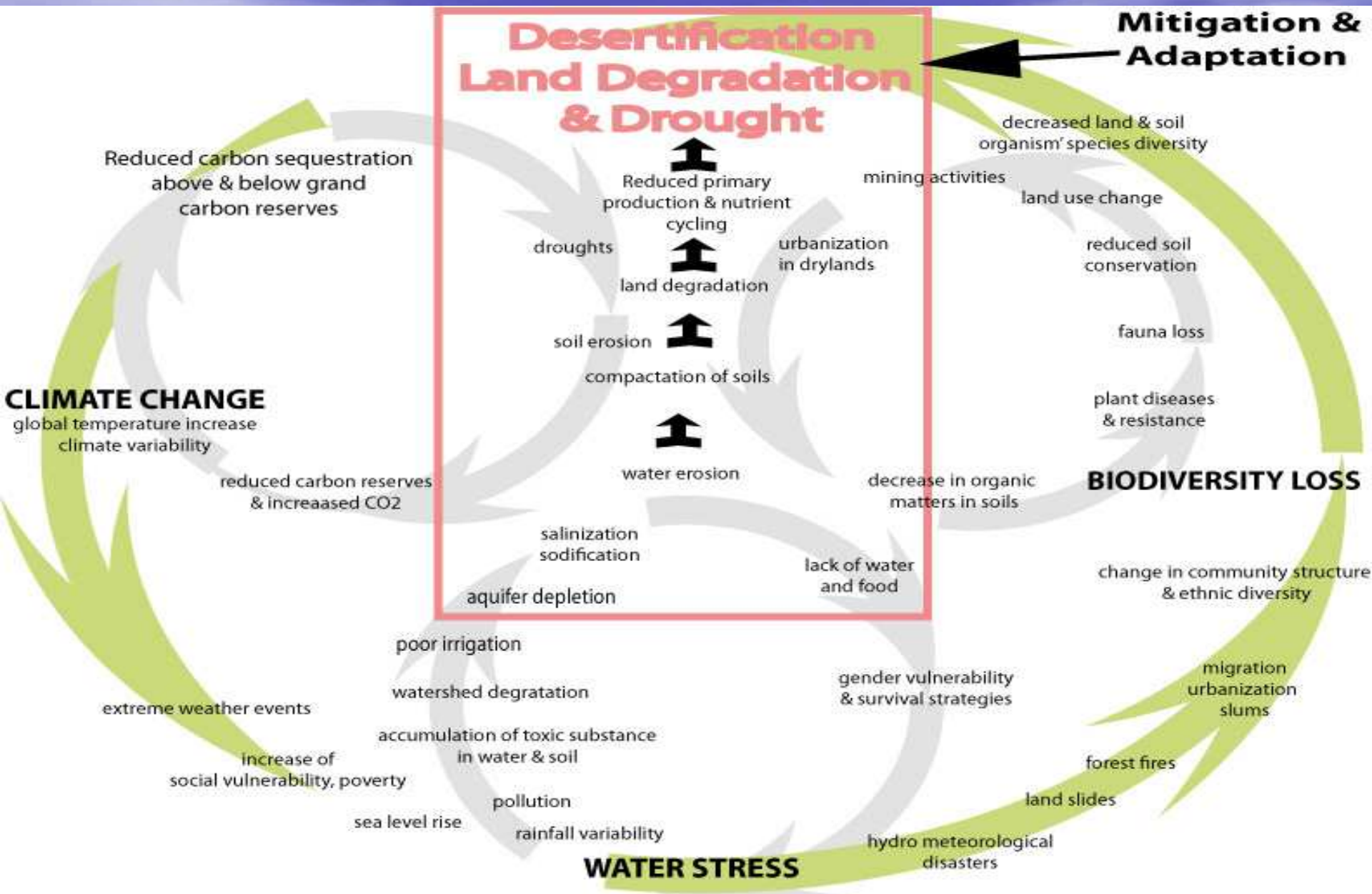
Sources: Map originally created by Sylvie Brunel and Cécile Marin. *Human Development Report*, UNDP, 1996; Ramsès 1994, Dunod; *Total Call of the HCR Examination of the Programs*, HCR, 2001; *The State of Food Insecurity in the World*, FAO, Rome, 1999; *Populations en danger*, Médecins sans frontières - 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 no.1, Croissance, Paris, 1998.



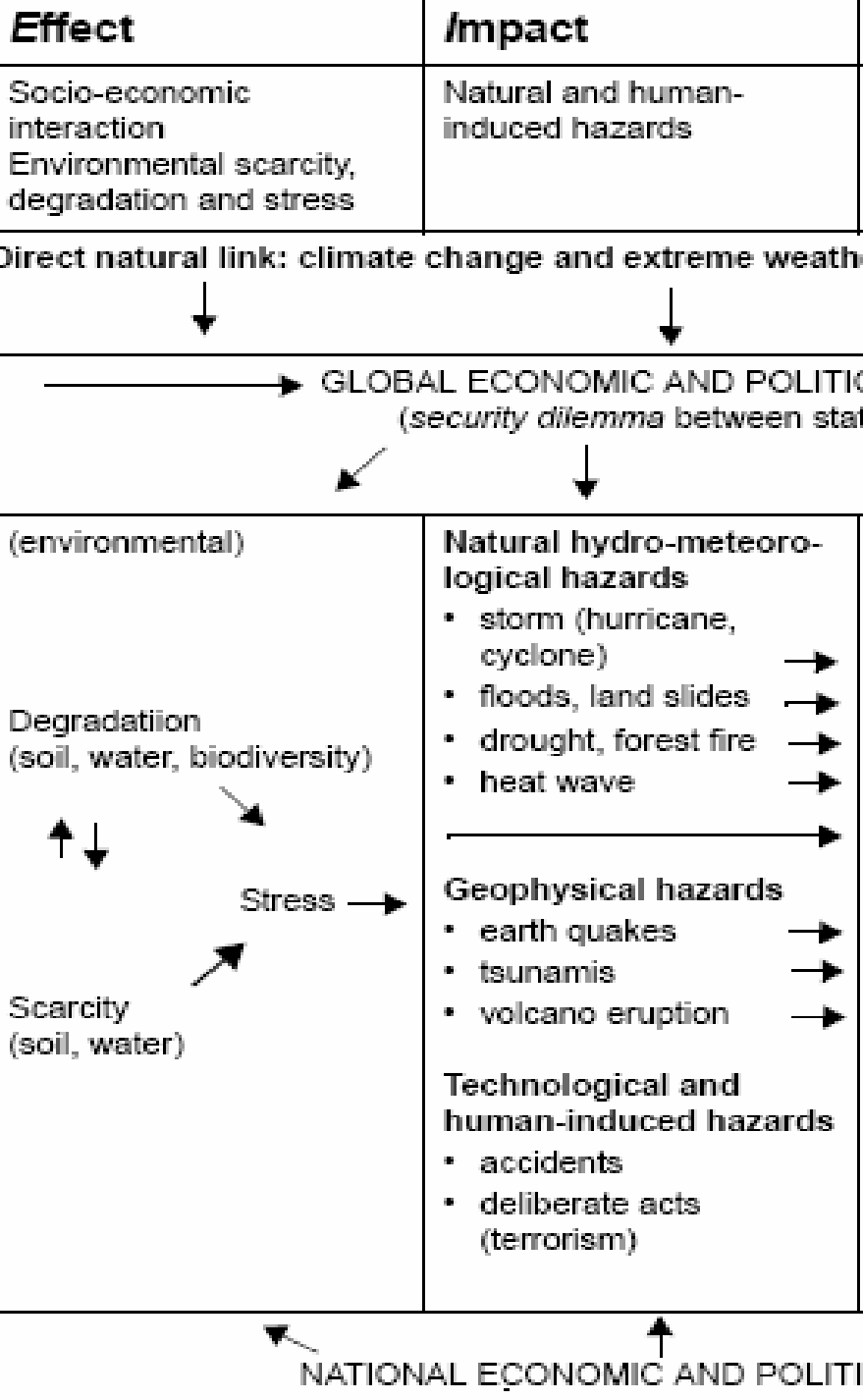
# 6. Global Environmental Change & Impacts: PEISOR Model



# 6.1 P: Pressure: Interactions of GEC



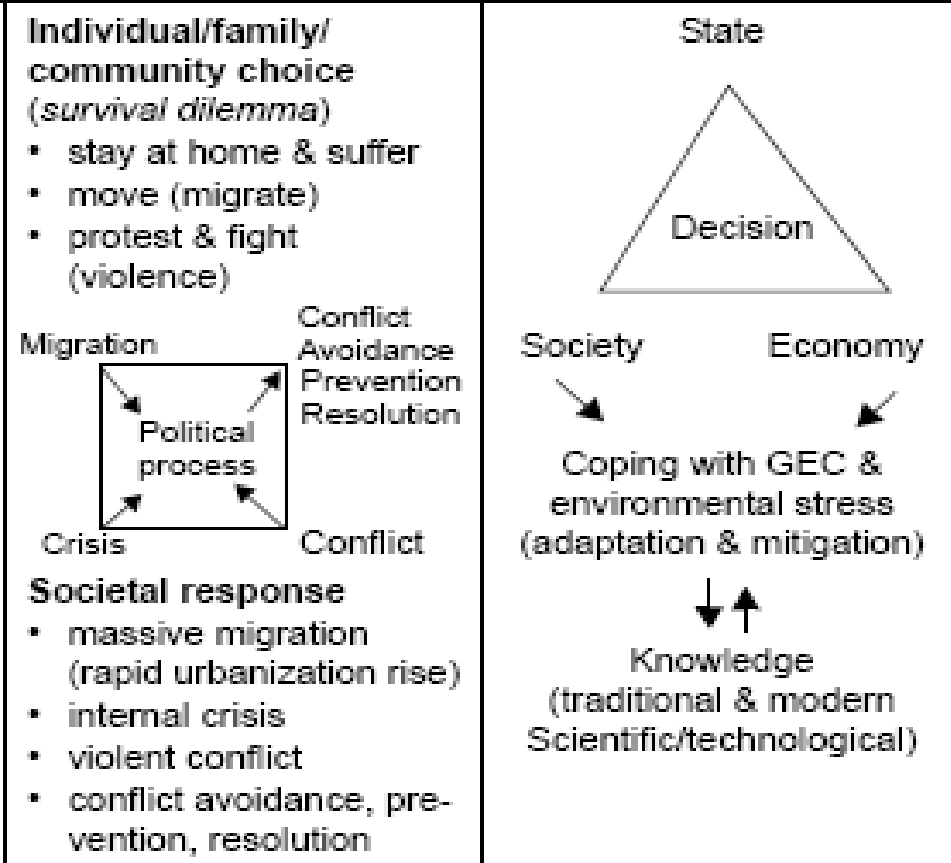
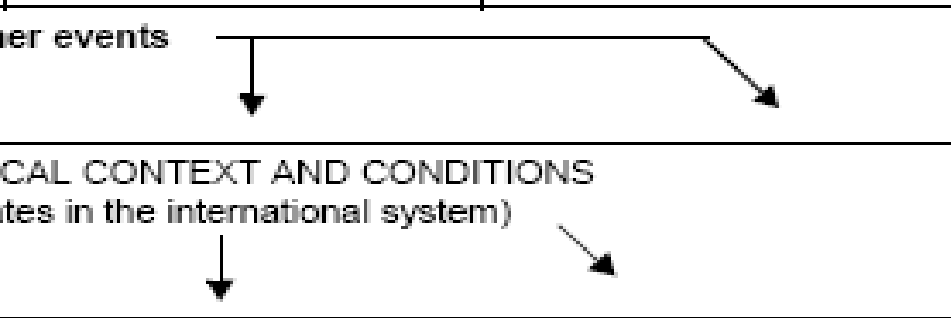




## 6.2 E: Effect, I: Impact

- **E: Environmental security debate of 1990s**
  - Toronto school
  - Swiss school (ENCOP):
  - **Water & Soil scarcity > degradation > environmental stress**
- **I: climate change-> extreme weather events**
  - Hydrometeorological hazards
    - **Drought (wind erosion)**
    - Heatwaves
    - Forest fires
    - Storms (hurricanes)
    - **Flash floods & landslides (wind & water erosion)**

Societal Outcome	(Policy) Response
Individual choice ( <i>survival dilemma</i> ) Societal response	National and international political process, state, societal and economic actors and knowledge



## 6.3 SO: Societal Outcomes

- Individual level (choice)
  - Human security perspective
  - **Survival dilemma of humans**
- State/society level
  - **Hunger**, famine
  - **Migration** to urban slums
  - Rural-rural migration
  - **Transborder migration**
    - Seasonal (labour, nomads)
    - Permanent
  - **Crises**: domestic
  - **Conflicts**:
    - Peaceful protests
    - Violent clashes
  - **Complex emergencies**



## 6.4 R Policy Response to Security Dangers posed by Global Change

- **How? Responsive vs. proactive action**
  - **Reponse**: cost of non-action (Stern Report)
  - **Proactive**: anticipatory knowledge, learning, action
- **What? Addressing causes (**Pressure**)**
  - **Earth system**: environmental quartett
  - **Human**: productive/consumptive behaviour
- **Responding to **Effects & Impacts****
  - **Environmental stress**
  - **Climate-related natural hazards**
- **Addressing **Societal Outcomes**:**  
Migration/Conflicts

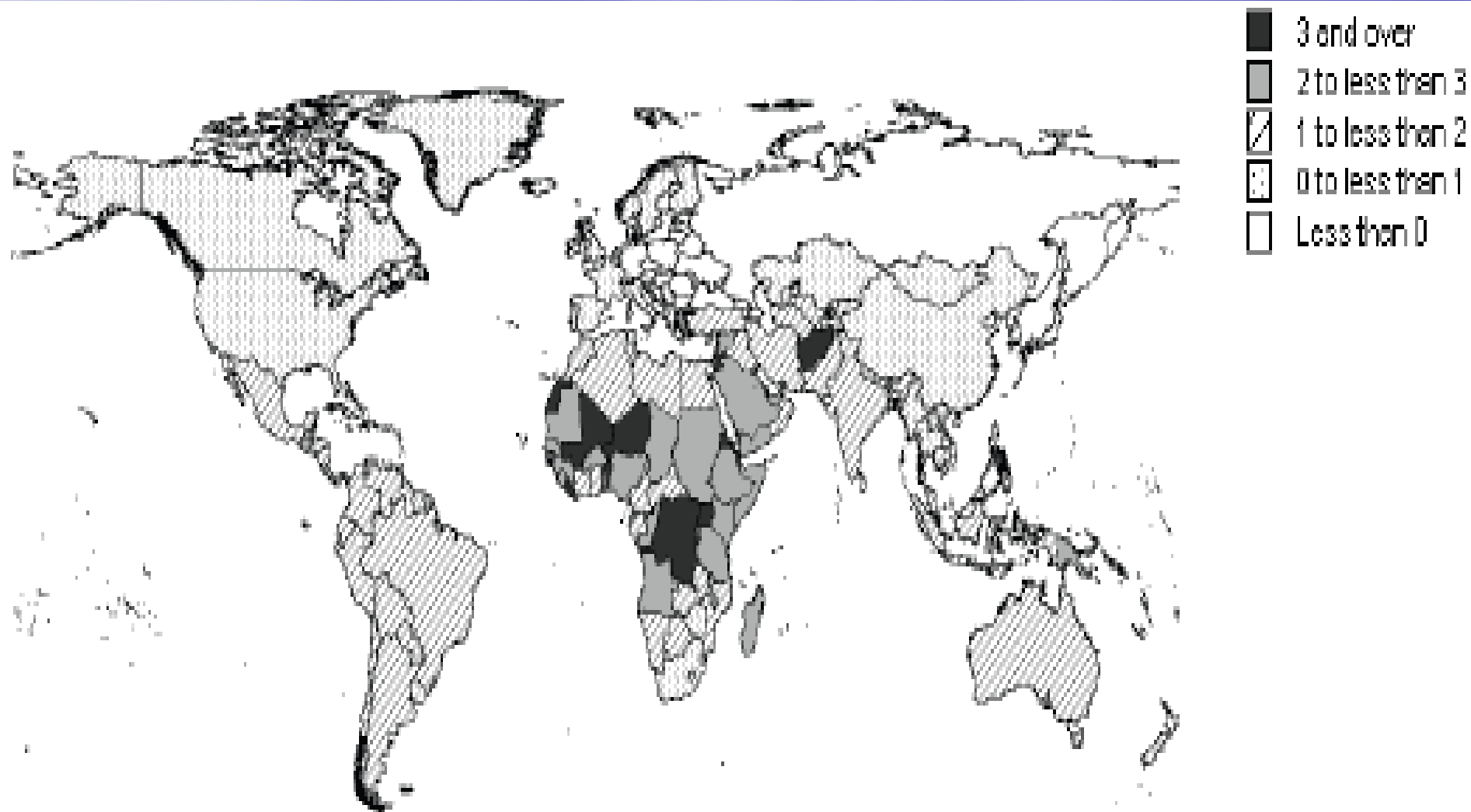
# 7.0. Population Growth, UN-PD, 2008 Rev.

<i>Major area</i>	<i>Population (millions)</i>			<i>Population in 2050 (millions)</i>			
	<i>1950</i>	<i>1975</i>	<i>2009</i>	<i>Low</i>	<i>Medium</i>	<i>High</i>	<i>Constant</i>
World.....	2 529	4 061	6 829	7 959	9 150	10 461	11 030
More developed regions.....	812	1 047	1 233	1 126	1 275	1 439	1 256
Less developed regions.....	1 717	3 014	5 596	6 833	7 875	9 022	9 774
Least developed countries .....	200	357	835	1 463	1 672	1 898	2 475
Other less developed countries .....	1 517	2 657	4 761	5 369	6 202	7 123	7 299
Africa.....	227	419	1 010	1 748	1 998	2 267	2 999
Asia.....	1 403	2 379	4 121	4 533	5 231	6 003	6 010
Europe .....	547	676	732	609	691	782	657
Latin America and the Caribbean .....	167	323	582	626	729	845	839
Northern America.....	172	242	348	397	448	505	468
Oceania.....	13	21	35	45	51	58	58

*Source:* Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat (2009). *World Population Prospects: The 2008 Revision. Highlights*. New York: United Nations.



## 7.1 Average annual rate of populations change (2005-2010), med. variant (%). UN PD (2007)



# 7.2. Global Climate Change: Temperature Increases & Sea Level Rise

## Climate Change Impacts: Temperature & Sea level Rise

- ❖ Global average temperature rise in 20<sup>th</sup> century: **+ 0.6°C**

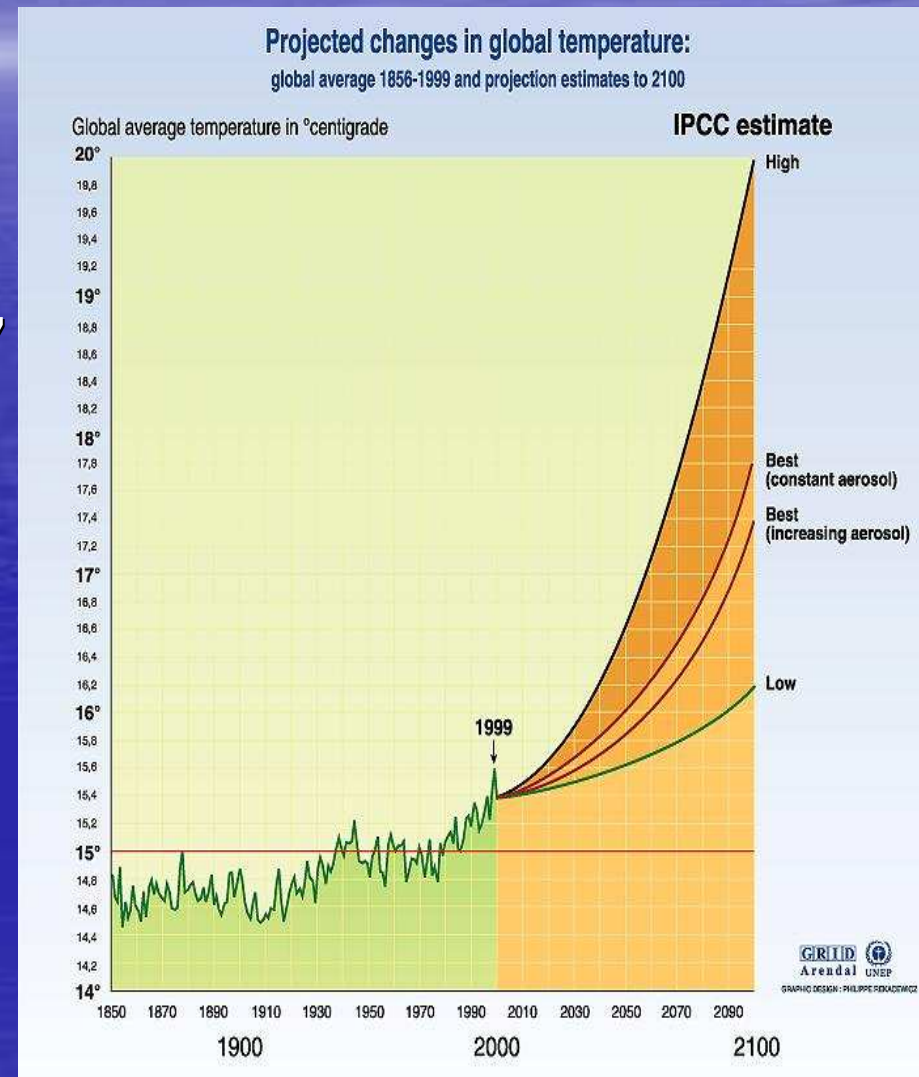
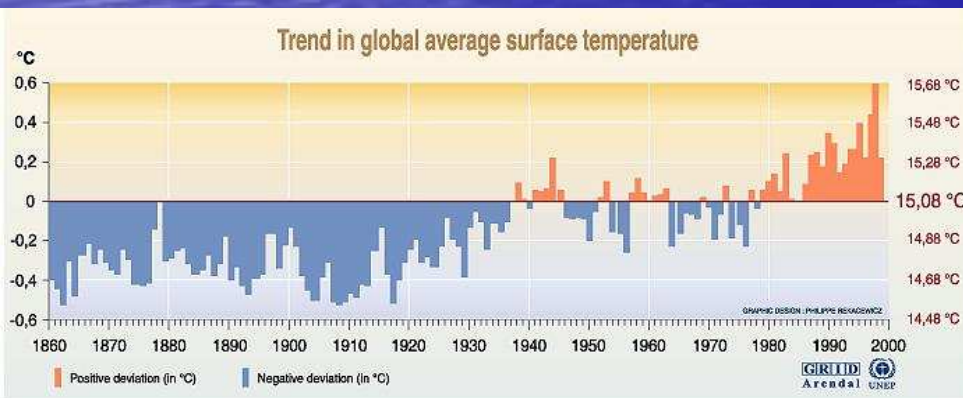
### Projected temperature rise:

- ❖ TAR (1990-2100): **+1.4-5.8°C**
- ❖ AR4 (07): **+1.1-6.4 (1.8-4)°C**

Sources: IPCC 1990,1995,2001,'07

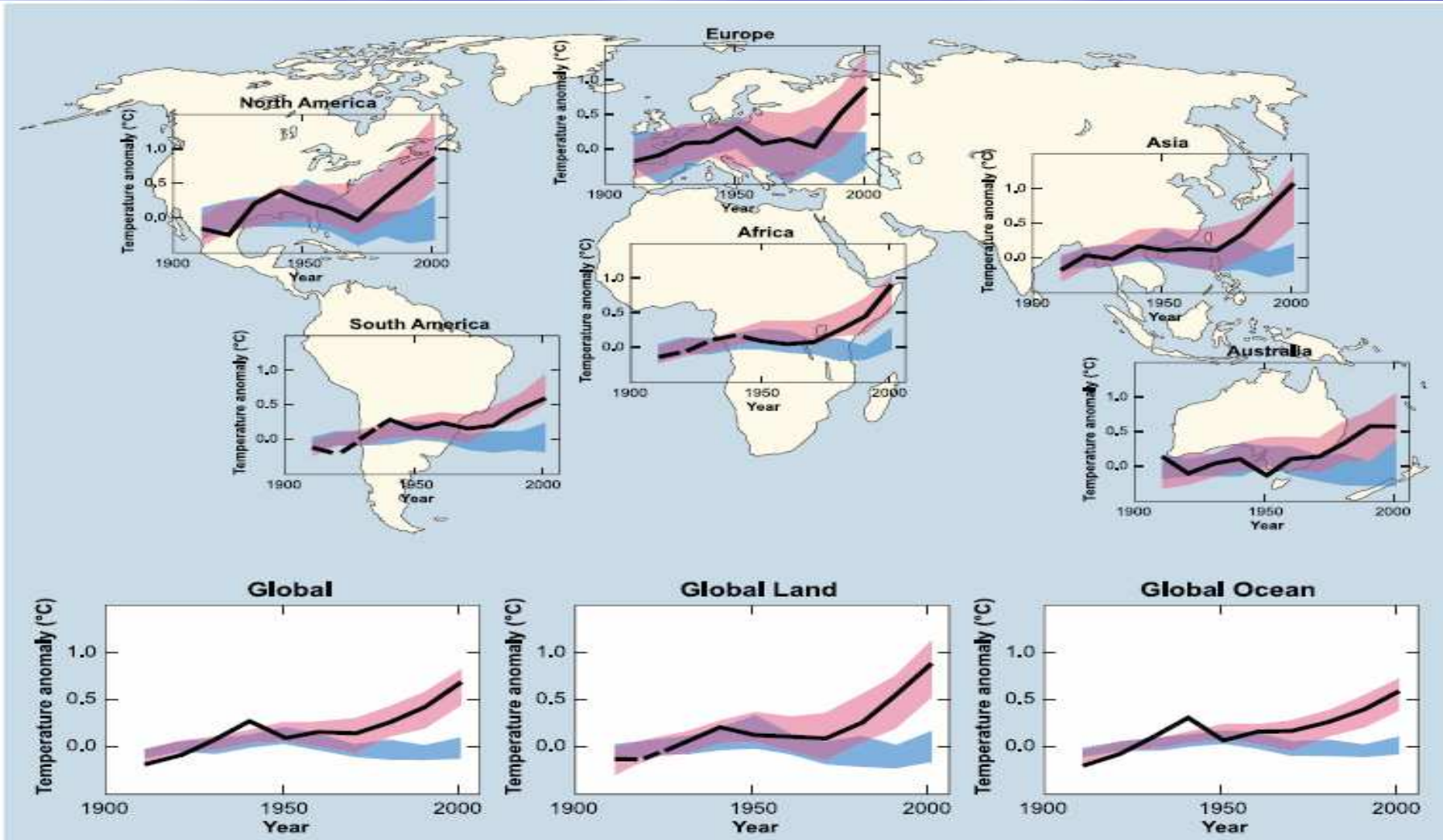
### Sea level Rise:

- ❖ 20<sup>th</sup> cent.: **+0,1-0,2 metres**
- ❖ TAR: 21st century: **9-88 cm**
- ❖ AR4 (2000-2100): **18-59 cm**





# 7.3. Global & Regional Change in Temperature (IPCC 2007, WG 1, AR4, 11)

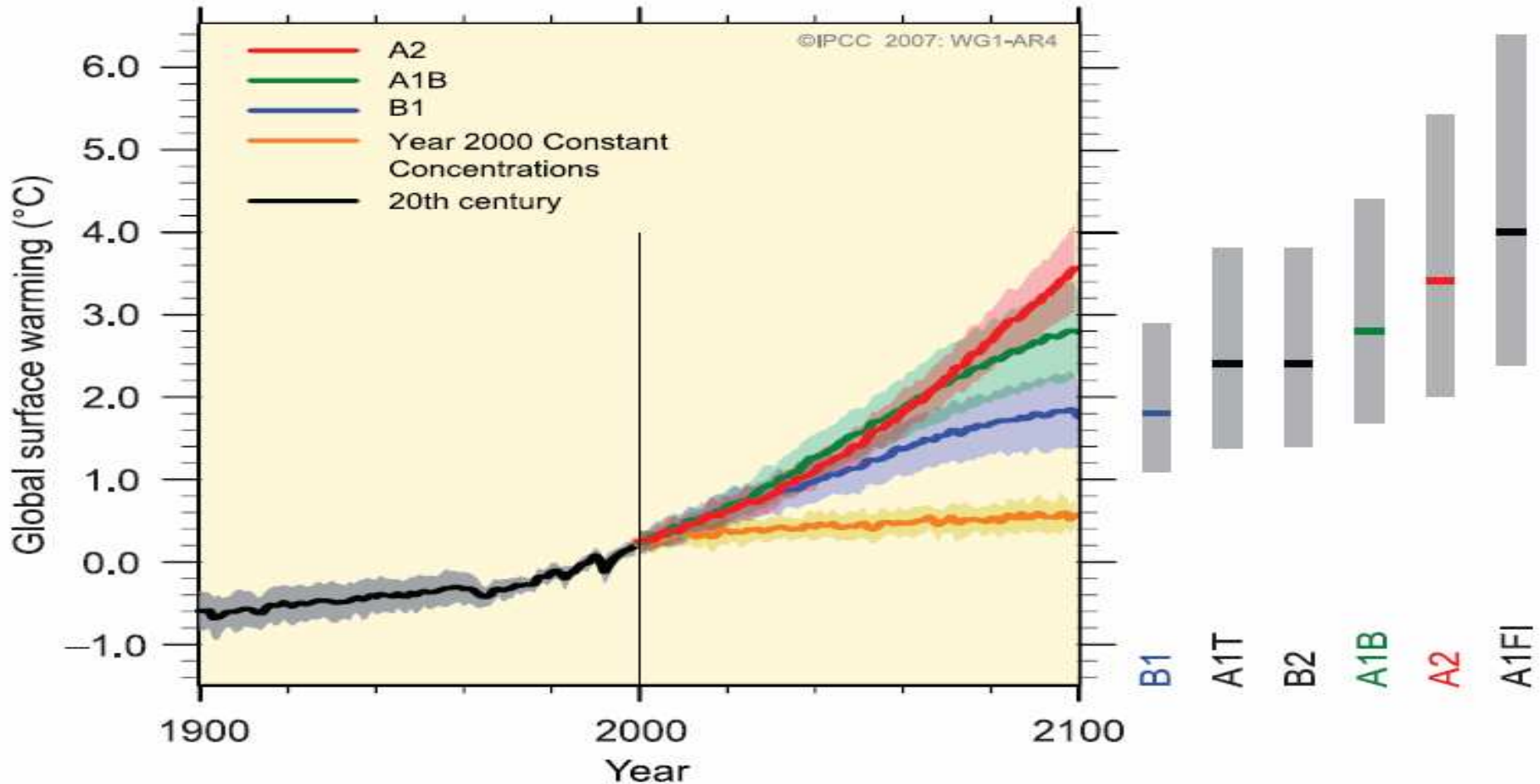


models using only natural forcings  
models using both natural and anthropogenic forcings

observations

# 7.4. Average Value of Surface Temperature (IPCC 2007, WG 1, AR4, p. 14)

MULTI-MODEL AVERAGES AND ASSESSED RANGES FOR SURFACE WARMING



**Figure SPM.5.** Solid lines are multi-model global averages of surface warming (relative to 1980–1999) for the scenarios A2, A1B and B1, shown as continuations of the 20th century simulations. Shading denotes the  $\pm 1$  standard deviation range of individual model annual averages. The orange line is for the experiment where concentrations were held constant at year 2000 values. The grey bars at right indicate the best estimate (solid line within each bar) and the likely range assessed for the six SRES marker scenarios. The assessment of the best estimate and likely ranges in the grey bars includes the AOGCMs in the left part of the figure, as well as results from a hierarchy of independent models and observational constraints. [Figures 10.4 and 10.29]



# 7.5. Projected Impacts of Climate Change

## Projected Impacts of Climate Change

Global temperature change (relative to pre-industrial)

0°C

1°C

2°C

3°C

4°C

5°C

### Food

Falling crop yields in many areas, particularly developing regions

Possible rising yields in some high latitude regions

Falling yields in many developed regions

### Water

Small mountain glaciers disappear – water supplies threatened in several areas

Significant decreases in water availability in many areas, including Mediterranean and Southern Africa

Sea level rise threatens major cities

### Ecosystems

Extensive Damage to Coral Reefs

Rising number of species face extinction

### Extreme Weather Events

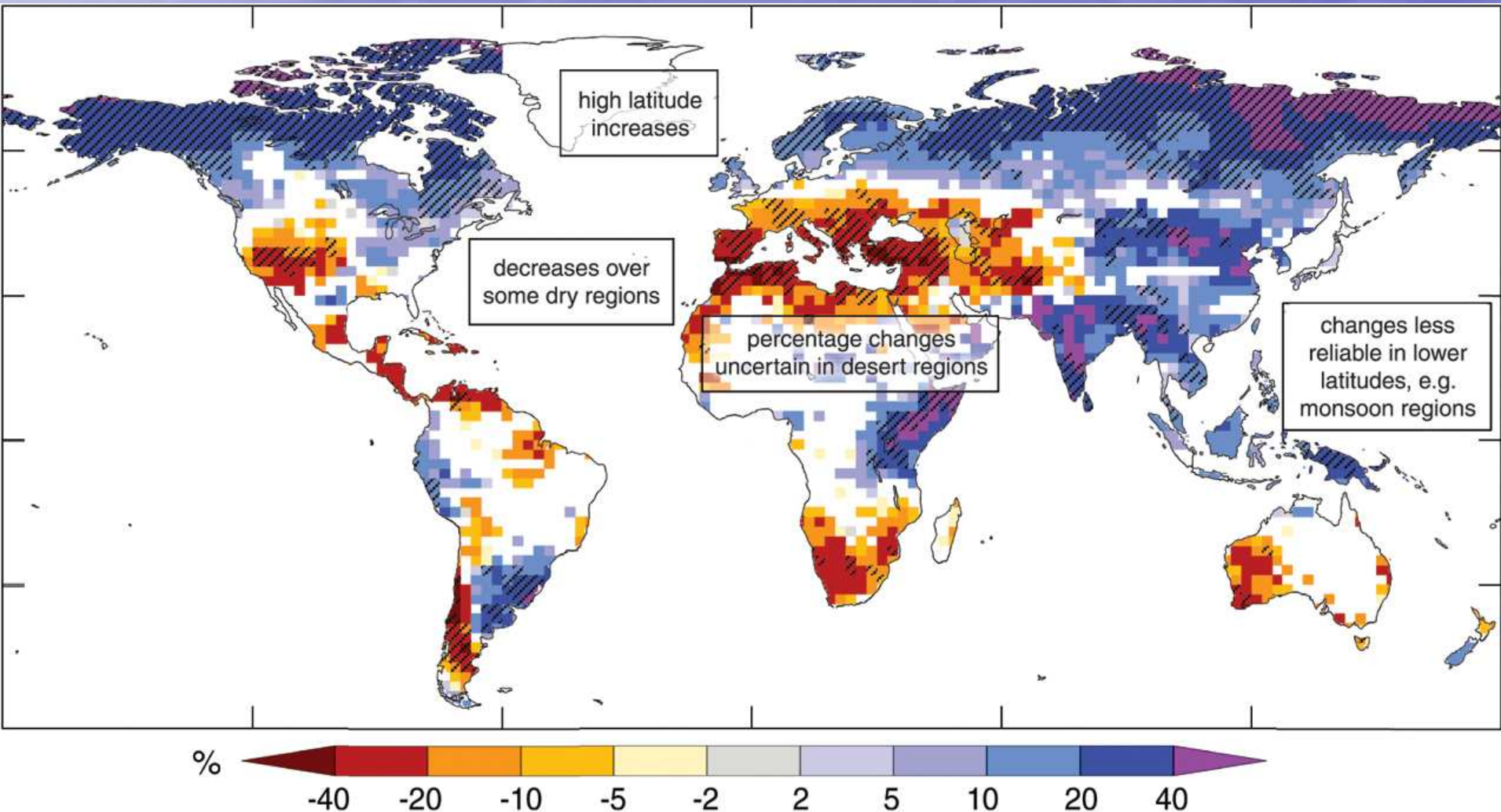
Rising intensity of storms, forest fires, droughts, flooding and heat waves

### Risk of Abrupt and Major Irreversible Changes

Increasing risk of dangerous feedbacks and abrupt, large-scale shifts in the climate system

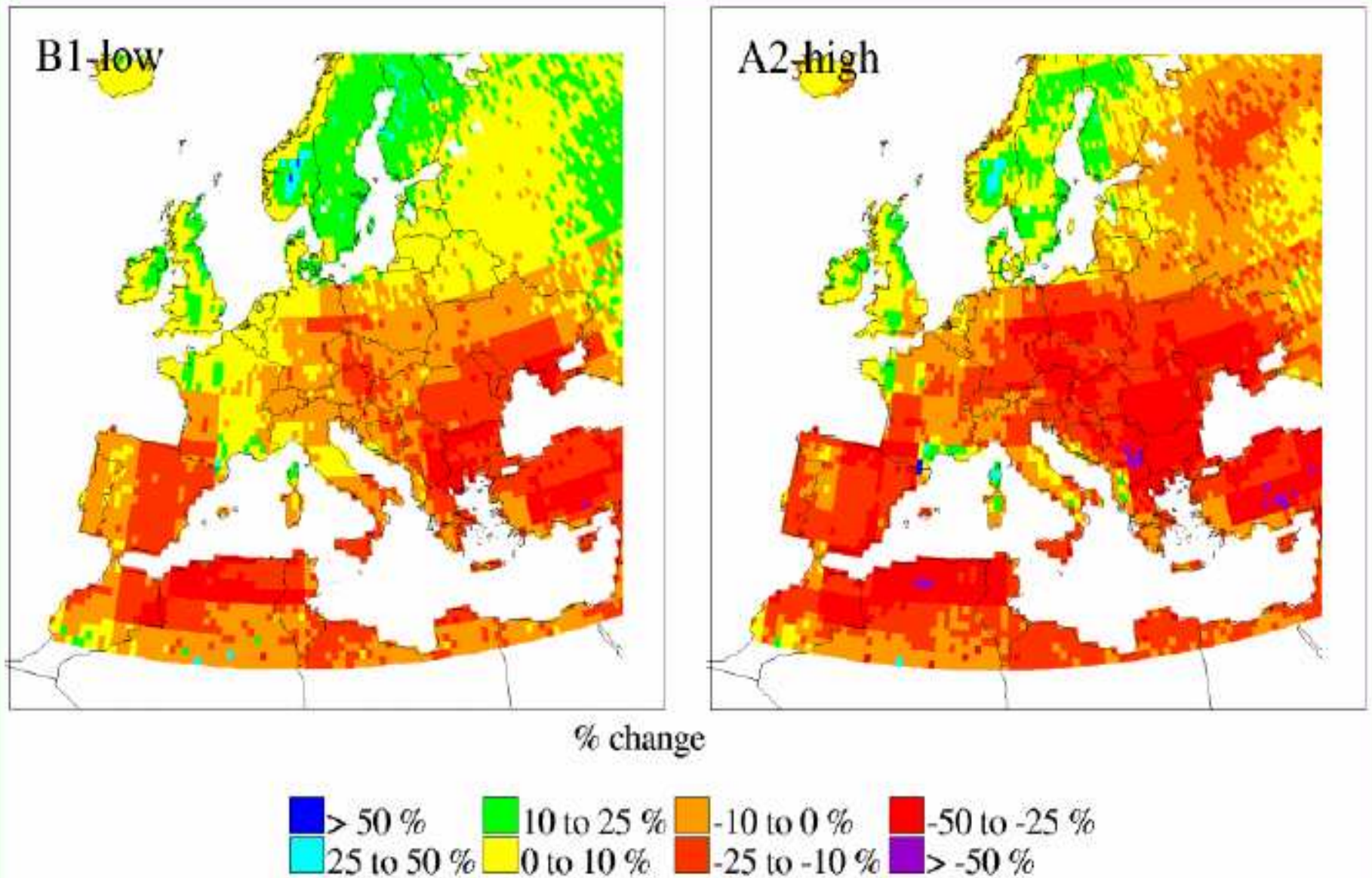
# 7.6. Precipitation Change by 2100:

Projections and model consistency of relative changes in runoff by the end of the 21st century





# 7.7. Water Availability 2050 (Parry, IPCC, 2005)



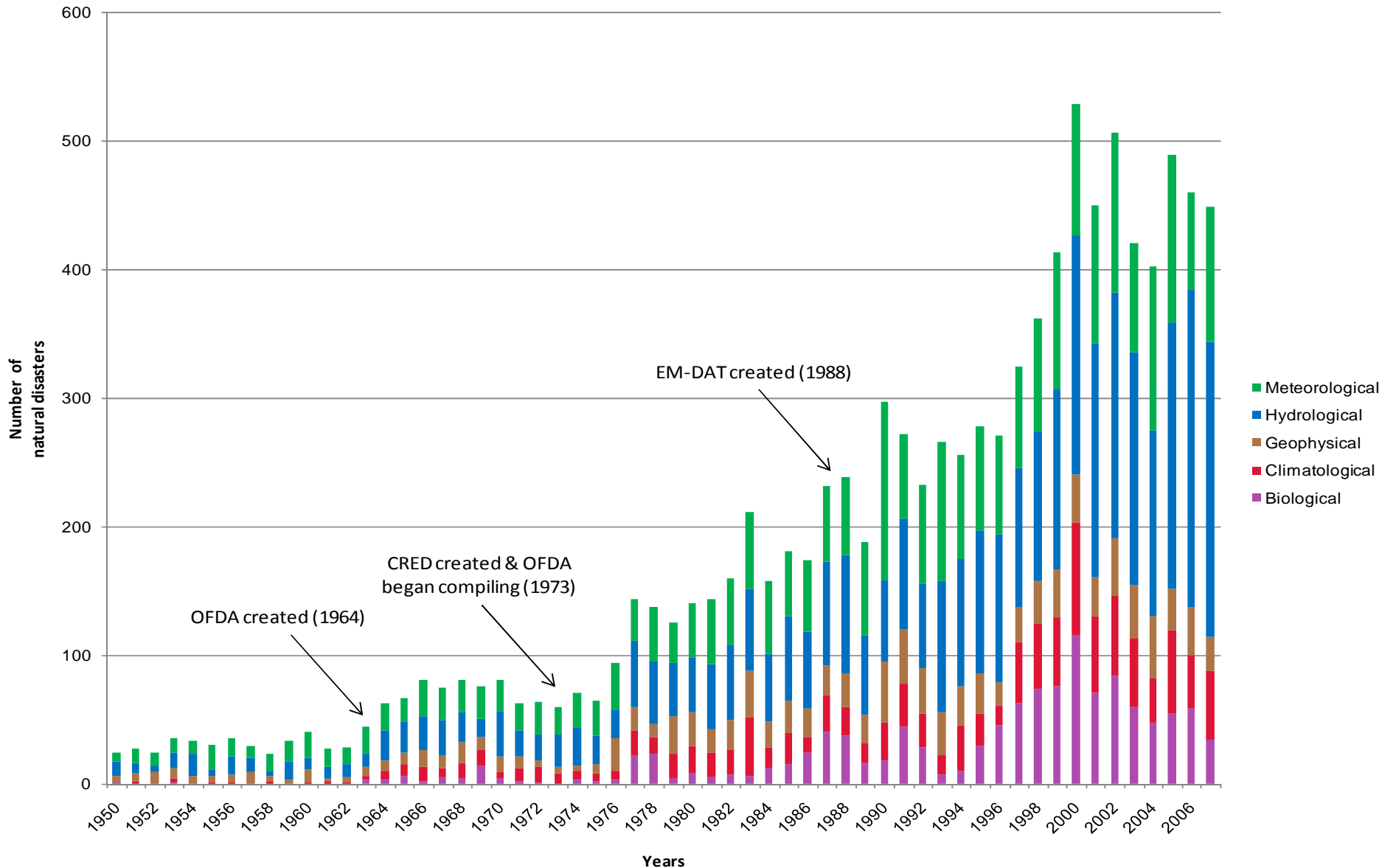


## 7.8. Projected Sealevel Rise (Pachauri, 2008)

Stabilization level (ppm CO <sub>2</sub> -eq)	Global mean temp. increase (°C)	Year CO <sub>2</sub> needs to peak	Global sea level rise above pre-industrial from thermal expansion (m)
445 – 490	2.0 – 2.4	2000 – 2015	0.4 – 1.4
490 – 535	2.4 – 2.8	2000 – 2020	0.5 – 1.7
535 – 590	2.8 – 3.2	2010 – 2030	0.6 – 1.9
590 – 710	3.2 – 4.0	2020 – 2060	0.6 – 2.4

# 7.9. Change in hydro-meteorological hazards.

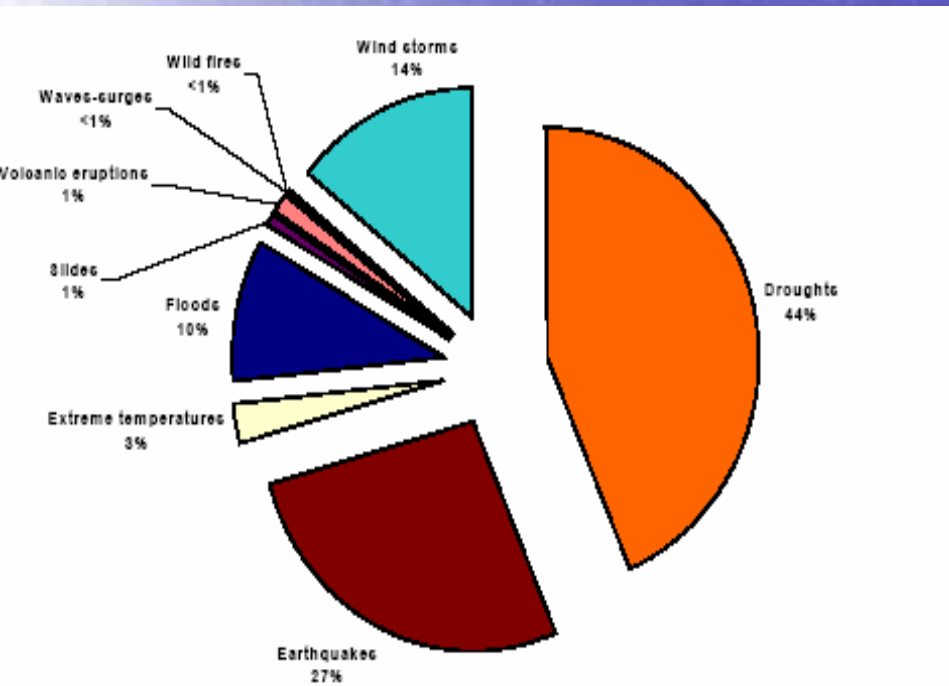
Source: Guha-Sapir (2010)



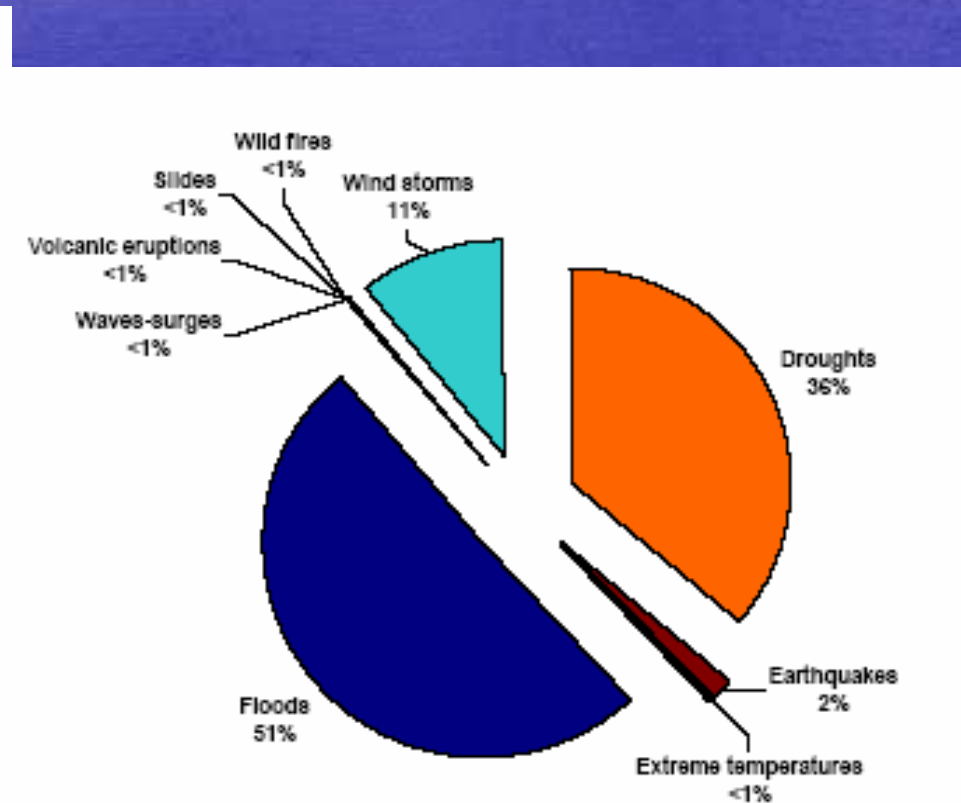
# 7.10. Impacts of Hazards (1974-2003)

Reported death of natural hazards globally:  
2.066.273 persons

- Affected persons of natural hazards:  
5 076 494 541 persons



Source: Hoyois/Guha-Sapir (2004)



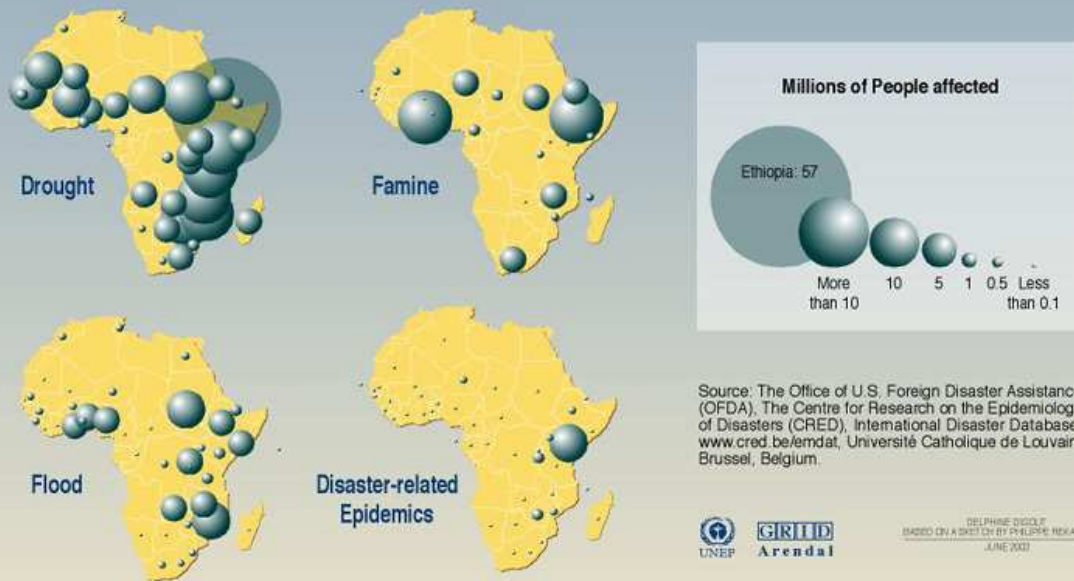
(†) injured + homeless + affected



# 7.11. 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 and crops in 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

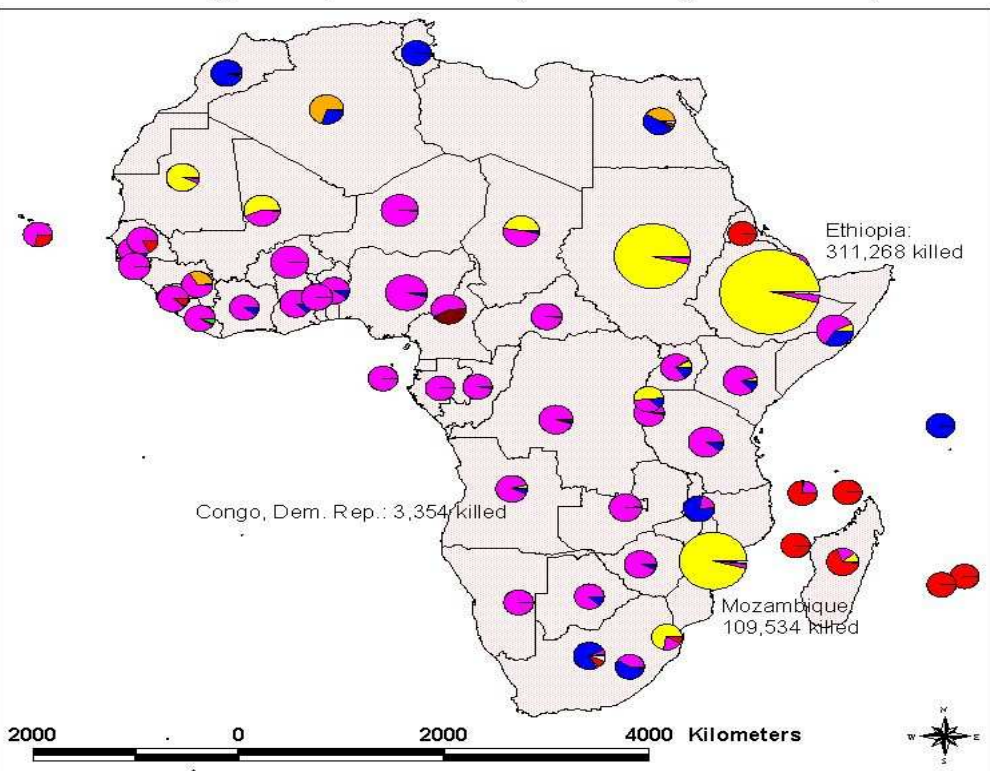
People Affected by Natural Disasters between 1971-2000



- 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)

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

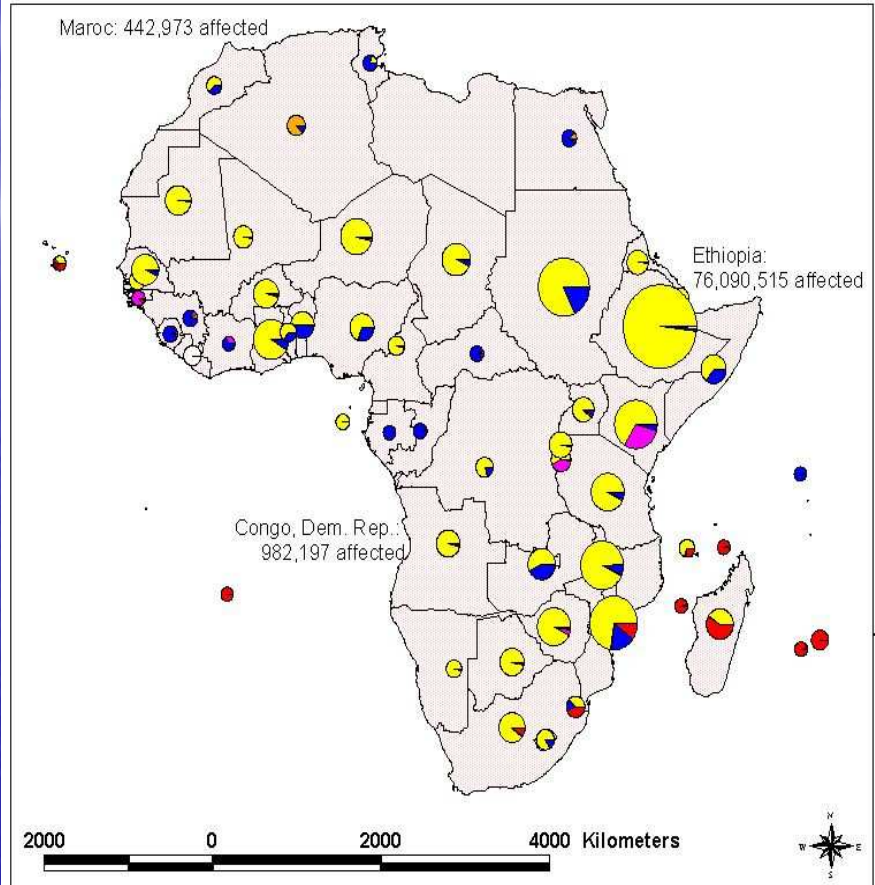
Distribution of natural disasters fatalities, by country and type of phenomena, in Africa (1975-2001)



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



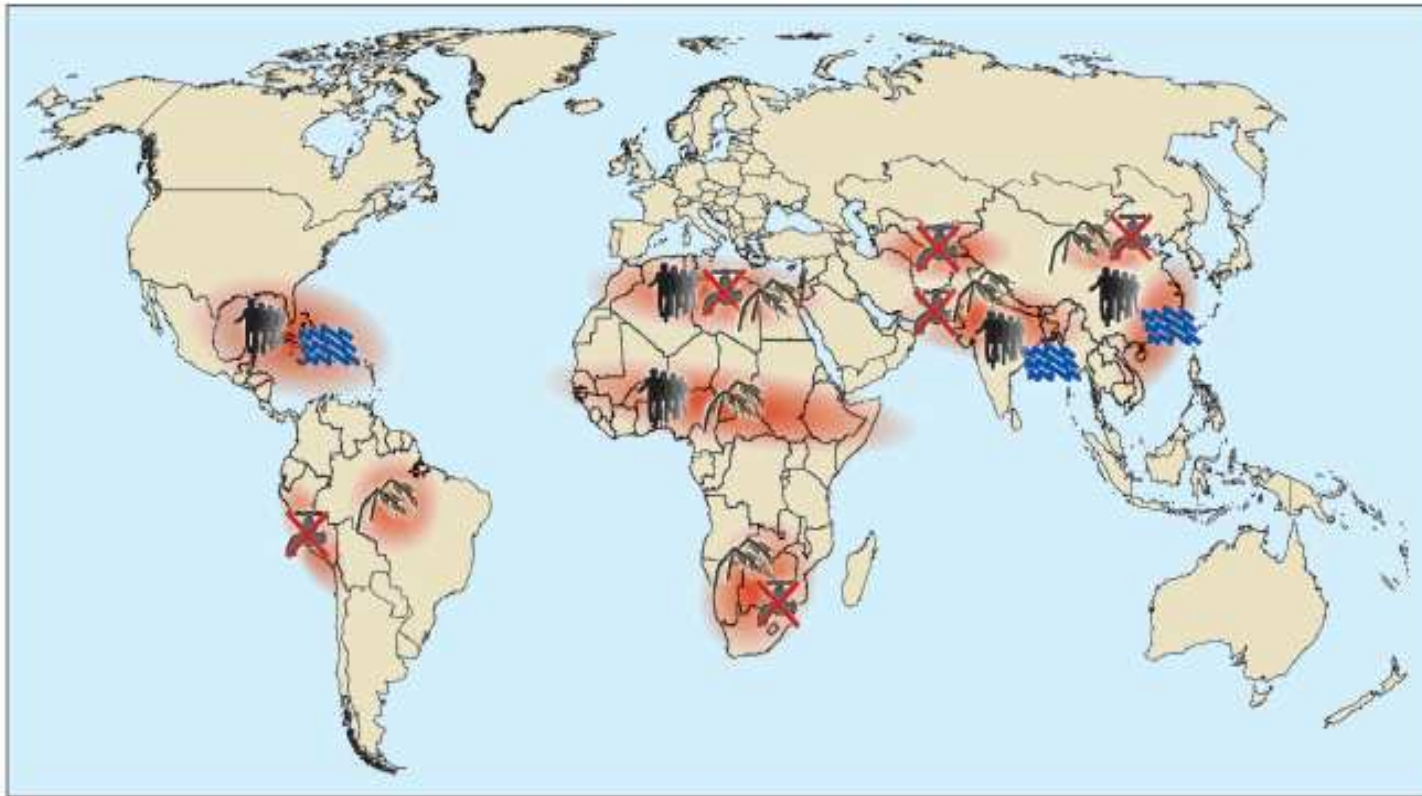
EM-DAT: The OFDA/CRED International Disaster Database  
 (<http://www.cred.be> ; email: [cred@epid.ucl.ac.be](mailto:cred@epid.ucl.ac.be))

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



# 8. Environmental and Water Hotspots special focus on MENA and Africa

Figure 4.7: Regional hotspots and security risks associated with climate change. Source: WBGU (2008: 4). Reprinted with permission.



## Conflict constellations in selected hotspots



Climate-induced degradation of freshwater resources



Climate-induced decline in food production



Hotspot



Climate-induced increase in storm and flood disasters



Environmentally-induced migration

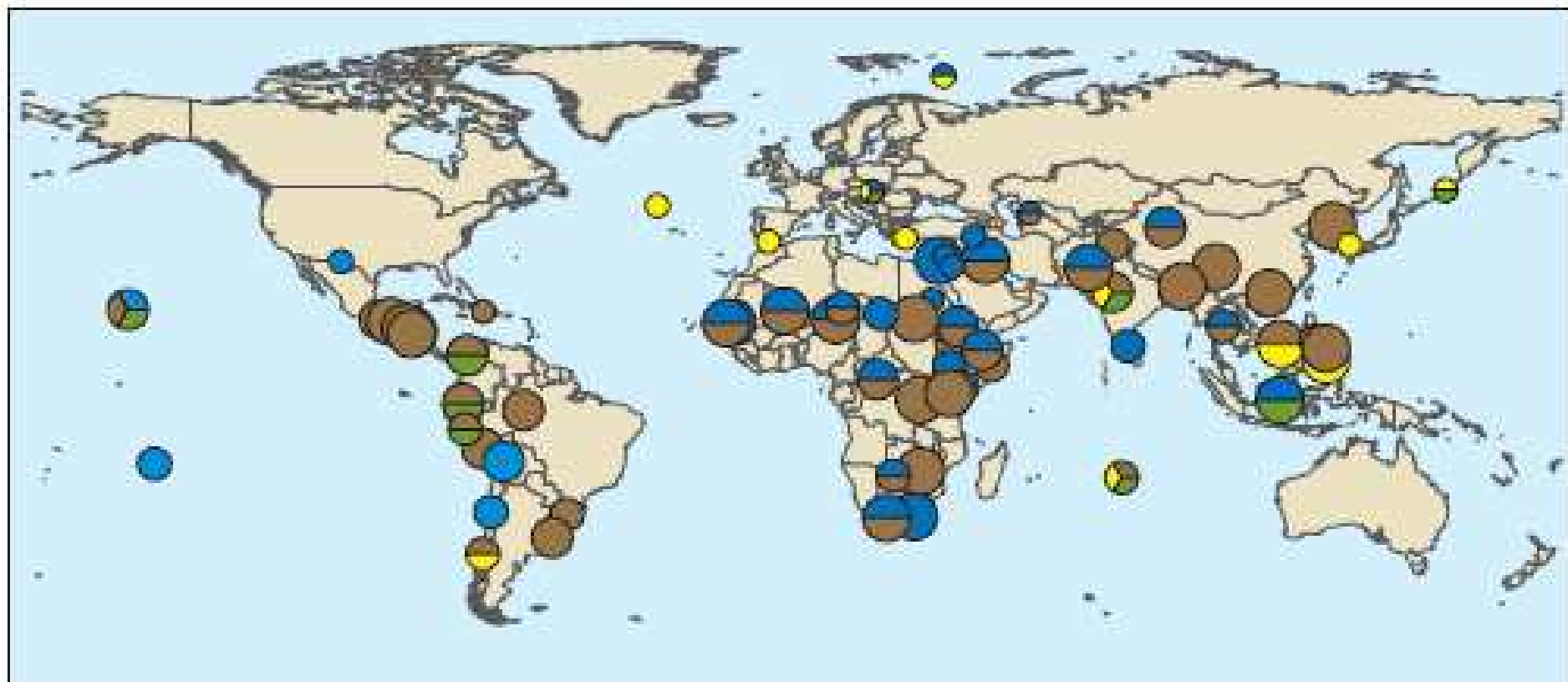
**Security-related challenges in MENA region: Water scarcity to rise due to demand increase and supply decline**

**Rising food deficits**

**Rising environmentally induced migration**



# 8.1. Environmental Conflicts: Water and Soil (1980-2006)



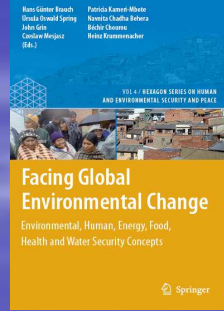
## Conflict intensity

- Diplomatic crisis
- Protests (partly violent)
- Use of violence (national scope)
- Systematic/collective violence

## Conflict cause

- Water
- Land/soil
- Fish
- Biodiversity

# 8.2. Cases of Water Conflicts and Cooperation in Africa: 19 chapters →



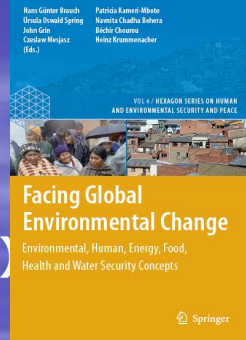
- **Water Wars vs. Water Cooperation:**
  - Whether there have been water wars is disputed among leading authors, e.g. the controversy Aaron Wolf and P. Gleick (USA).
- **Water Cooperation and Water Conflict in Senegal River**
  - Intensified cooperation in times of water scarcity (**M. Kipping**)
    - Infrastructure projects (Org. for the Dev. of Senegal River, OMVS)
    - Cooperation during intensive drought, building of dams
    - Dispute over new farmland between: Moorish and Senegalese
  - Intra-state violent conflict in times of growing water availability
    - Violent conflict: Mauritania vs. Senegal (1989/1990)
- **International Water Resource Management (IWRM)**
  - Nile Basin Initiative (Kampala): 10 riparian countries
    - Downstream: Emad Adly, Tarek Ahmed (Egypt)
    - Upstream: Patricia Kameri-Mbote, Kithure Kindiki (Kenya)
  - Volta Water Regime Formation (Maelis Borghese)
  - Permanent Water Commission for the Okavango River Basin
  - Zambezi River Authority (Stefan Lindemann)

# 8.3. 19 Chapters on Water Security

**11 Úrsula Oswald Spring & Hans Günter Brauch** *Securitizing Water (175-202)*

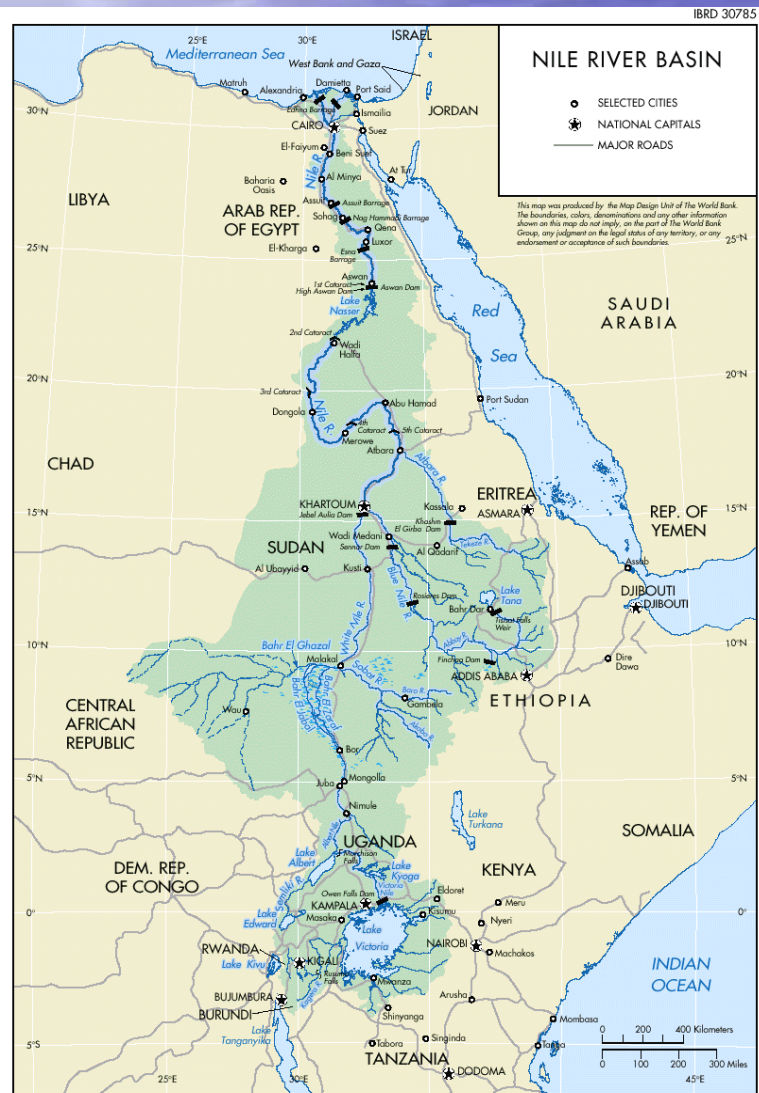
**Part VII Water Security for the 21st Century: pp. 573-778**

- 41 T. Allan** : Global Trade: Balancing Existing & Future Regional Water Resource Deficits
- 42 Vandana Shiva** : Water Wars in India
- 43 B. Affeltranger** : Sustainability of Environmental Regimes: Mekong River Commission
- 44 M. Aydin & F. Ereker** : Water Scarcity & Political Wrangling: Security in Euphrates and Tigris Basin
- 45 Bassam Ossama Hayek** : Water Resources in Arab World: A Case Study on Jordan
- 46 Jan Selby** : 'New Security Thinking' in Israeli-Palestinian Water Relations
- 47 A. Jägerskog** : Functional Water Cooperation in Jordan River Basin: Spillover or Spillback for Political Security?
- 48 Emad Adly & Tarek Ahmed** : Water and Food Security in the River Nile Basin: Perspectives of the Government and NGOs in Egypt
- 49 Patricia Kameri-Mbote and Kithure Kindiki** : Water and Food Security in the Nile River Basin:
- 50 P. Ashton & A. Turton** : Water & Security in Sub-Saharan Africa: Emerging Concepts Implications for Effective Water Resource Management in the Southern African Region
- 51 Martin Kipping** : Water Security in the Senegal River Basin: Water Cooperation and Water Conflicts
- 52 Maëlis Borghese** : The Centrality of Water Regime Formation for Water Security in West Africa: An Analysis of the Volta Basin
- 53 Stefan Lindemann** : Success & Failure in International River Basin Management –Case of Southern Africa
- 54 Martin Kipping** : Can 'Integrated Water Resources Management' Silence Malthusian Concerns? Case of Central Asia
- 55 Eva Rakel** : Environmental Security in Central Asia and the Caspian Region: Aral and Caspian Seas
- 56 Julia Wunderer** : The Central Asian Water Regime as an Instrument for Crisis Prevention
- 57 Christopher Martius, Jochen Froebrich and Ernst-August Nuppenau** : Water Resource Management for Improving Environmental Security & Rural Livelihoods in the Irrigated Amu Darya Lowlands
- 58 Mara Tignino** : Water Security in Times of Armed Conflicts



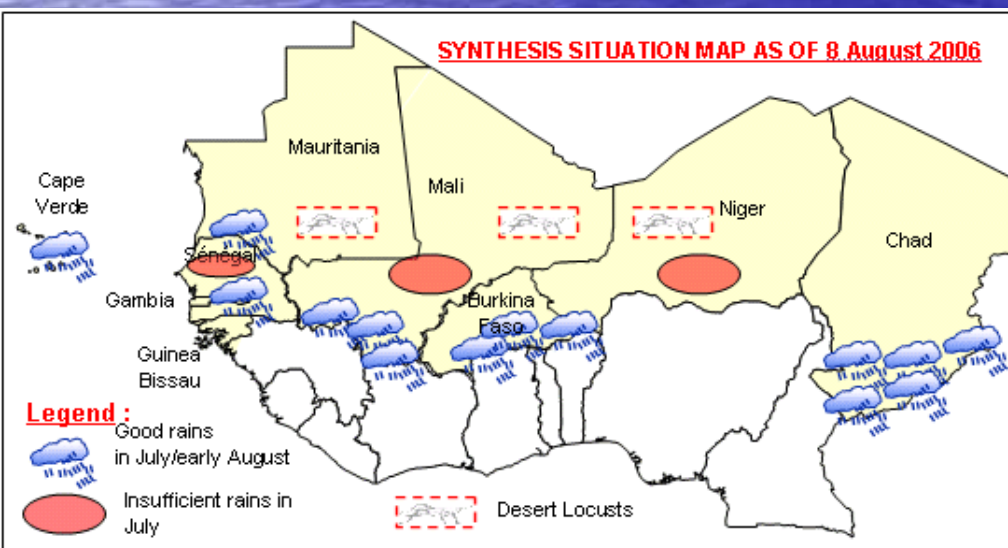
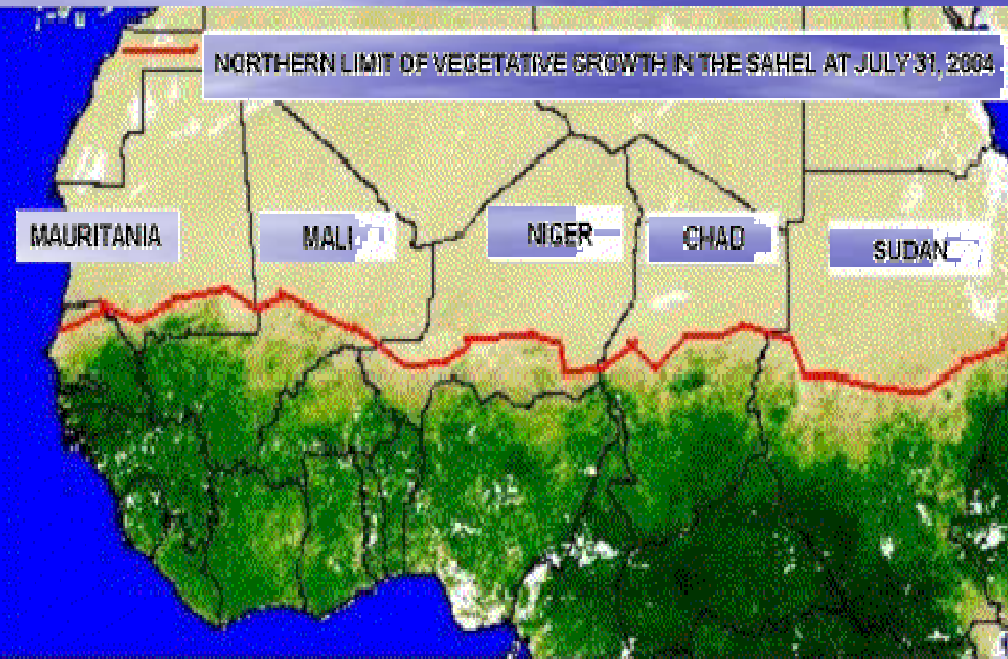


# 8.3. Nile Basin countries: population growth of riparian countries: +300 m. (2025) & 500 m.(2050)



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
<b>Total</b>	<b>86,7</b>	<b>280,8</b>	<b>580,6</b>	<b>881,1</b>	<b>510,3</b>

# 8.4. 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
<b>Total</b>	<b>18,5</b>	<b>75,4</b>	<b>128,0</b>	<b>220,5</b>	<b>145,2</b>
Nigeria	29,8	131,5	190,3	258,1	126,6

# 8.5. Horn of Africa

## East Africa: Horn of Africa

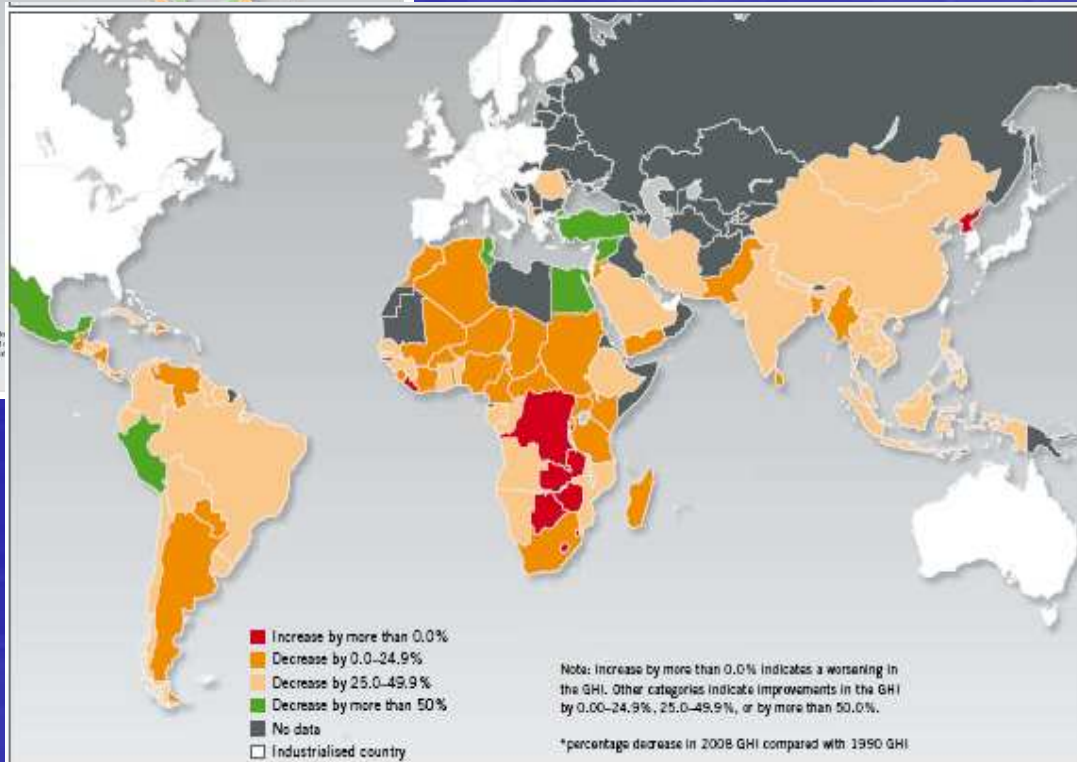
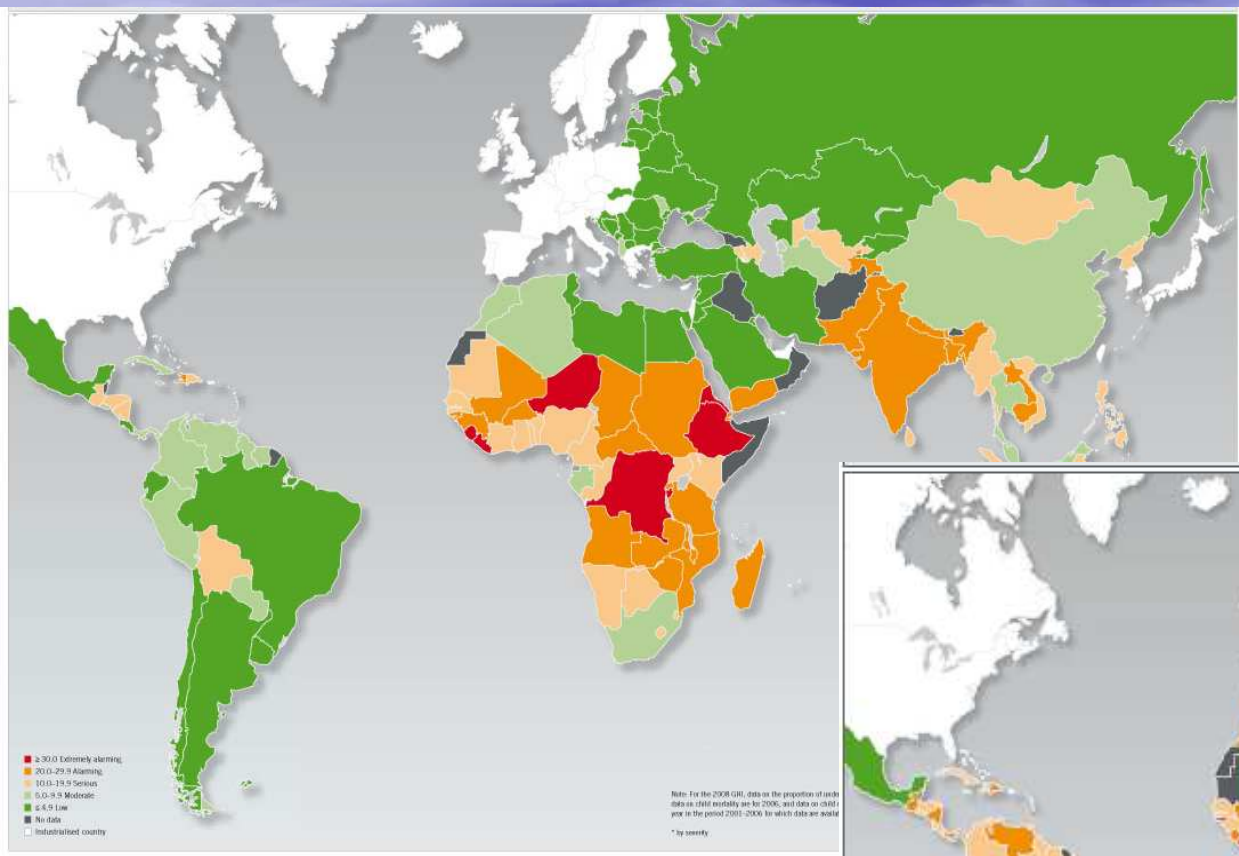


Horn of Africa.	1950	2005	2025	2050	2005-2050
Eritrea	1.1	4.7	7.2	10.2	5.5
Ethiopia	18.4	77.4	118.4	170.2	92.8
Kenya	6.3	33.8	49.4	64.8	31.0
Sudan	9.2	40.2	61.3	84.2	44.0
Uganda	5.2	26.9	55.8	130.9	104.0
Djibouti		0.8	1.1	1.5	0.7
Somalia		8.6	14.9	25.5	16.9
<b>Total</b>	<b>86.7</b>	<b>192.9</b>	<b>308.1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



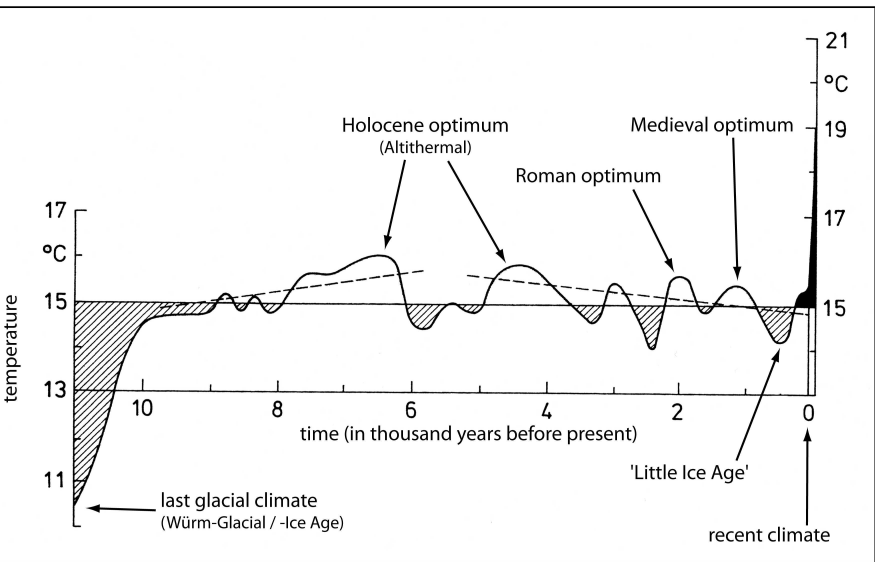
# 8.6. Global Hunger Index 1990-2008

← 2008 Global Hunger Index  
 Country progress in reducing the Global Hunger Index between 1990 and 2008 ↓



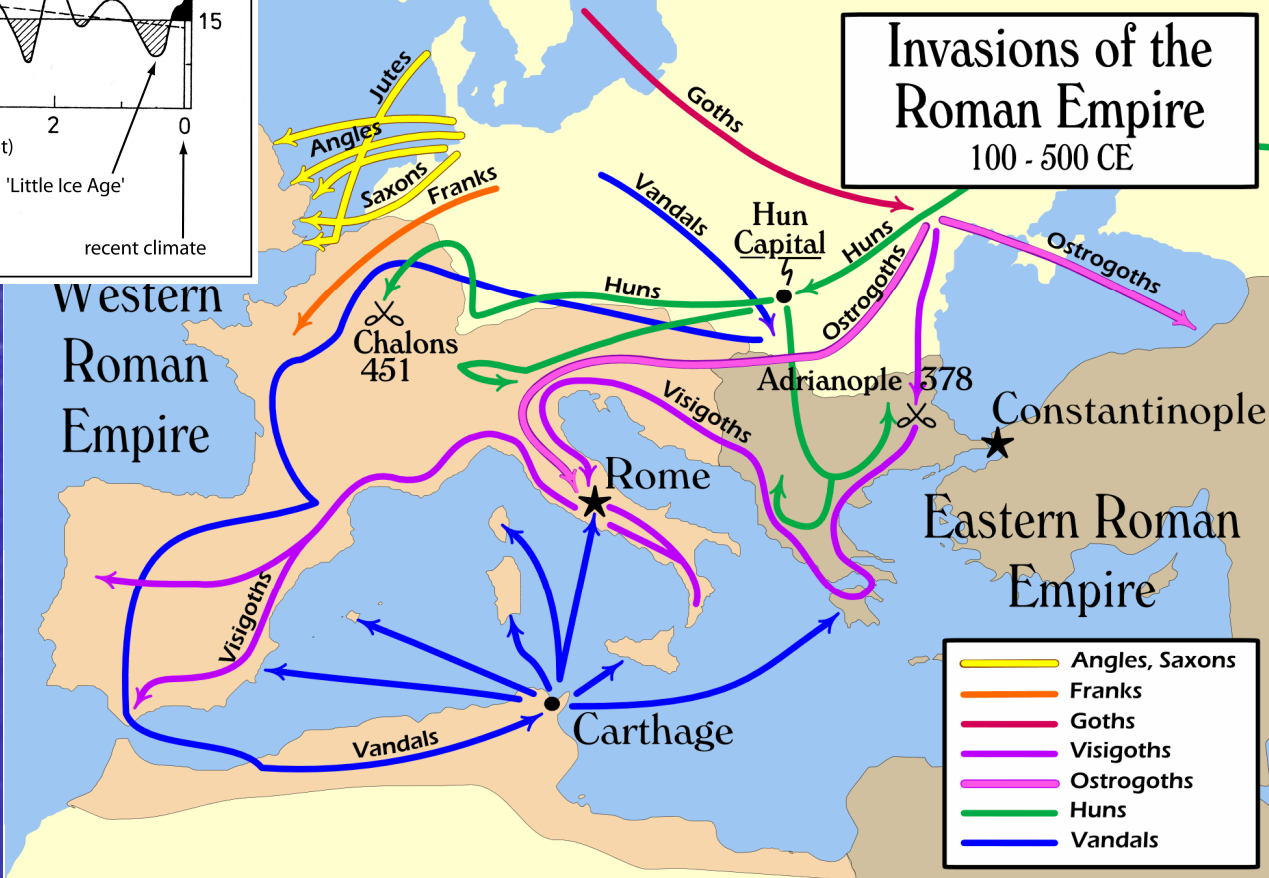
Source: IFPRI, 2008

# 8.7. Impacts of Climate Variability in the Holocene to the Anthropocene (since 1750)



End of Roman Empire: massive people's movements: 300-500 AD, Germanic, Turkish & other peoples.

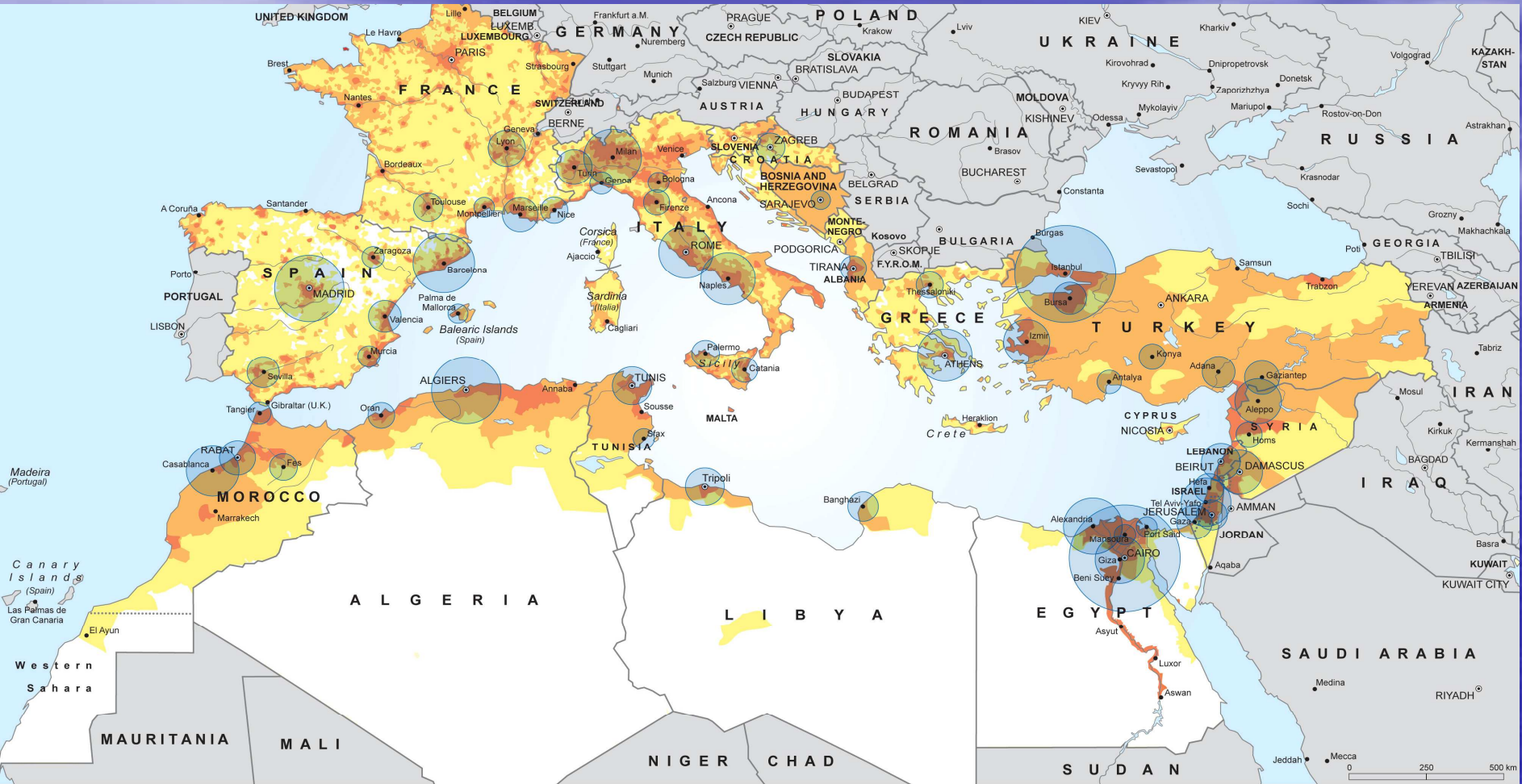
During **Holocene** era both **climate pessima** (cold periods) and **changes in precipitation patterns** and long periods of **drought** were major triggers for several phases of massive people's movements:



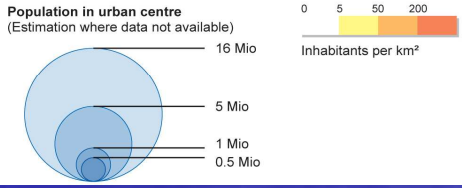
- Angles, Saxons
- Franks
- Goths
- Visigoths
- Ostrogoths
- Huns
- Vandals



# 8.8. Population in the Mediterranean



## Environment and Security in the Mediterranean: Population



Sources: Center for International Earth Science Information Network (CIESIN),  
Columbia University; World Gazetteer

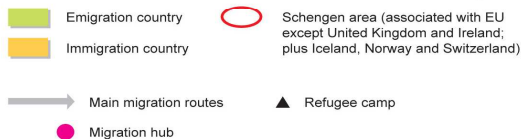




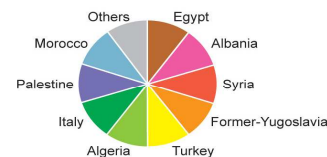
# 8.9. Migration in the Mediterranean



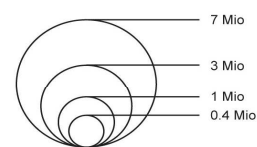
## Environment and Security in the Mediterranean: Migration



Citizenship of foreign population (> 10%)



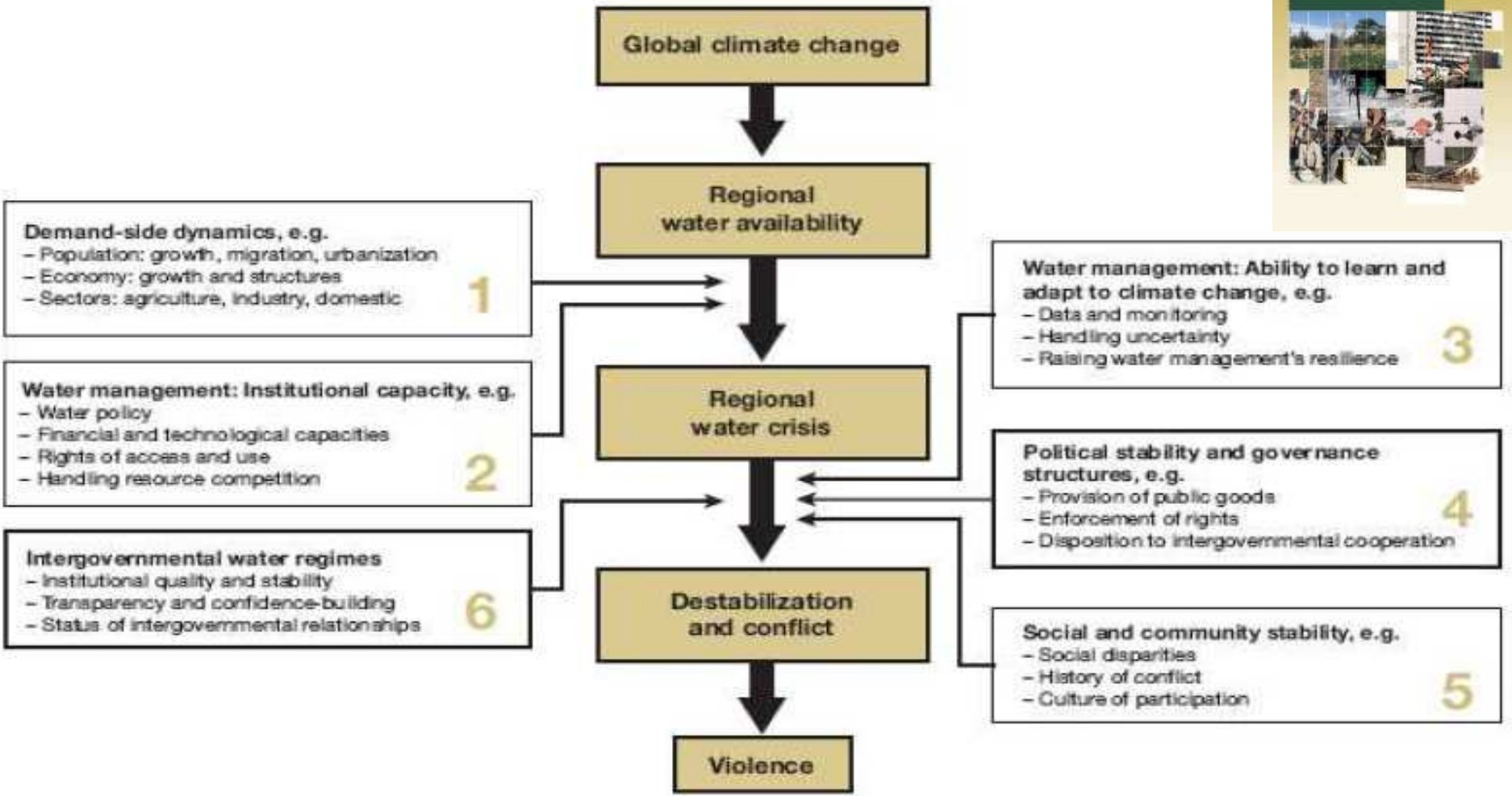
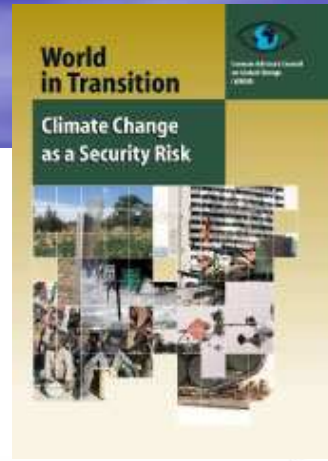
Total of foreign population



## **8.10. Water, Climate Change & Conflicts**

- **Africa and Mediterranean experienced and will experience water stress & scarcity**
- **There was a water-induced war in Senegal but not due to water scarcity but to sufficient new water,**
- **There have been many donor support efforts to establish river basin commissions in Africa**
- **Which impact will the increase in water & food demand due to population growth and supply decline due to climate change have on water security issues in the 21st century?**

# 8.11. Climate-induced degradation of fresh-water resources: conflict constellation



Boxes 1 – 6: Dimensions of influence with key factors



Central causal chain



Influence of key factors on the central causal chain



# 9. Mitigation: Euro-Mediterranean Survival Pact

## Proactive Policies for Coping with Climate-Induced Migration in the MENA

- Trans-Mediterranean migration has been securitized by EU decision-makers: motivation for Barcelona process (1995) & Mediterranean Union (13 July 2008).
- Two EU policy strategies on migration overlap:
  - **short-term policy response** (FRONTEX, tightening of asylum laws, justice & home affairs [Tampere, Dublin, The Hague])
  - **longer-term proactive development & environmental security strategies** that aim at containing and overcoming causes for future climate-induced migration aiming at a 2°C world by 2100 what requires a major decarbonisation of the European and the world economy by 2050 in the post-2012 regime.
- **Strategy for development of drylands: Mediterranean Union Solar Initiative & Desertec Industrial Initiative**

# 9.1. Avoiding Environmentally-Induced Conflicts

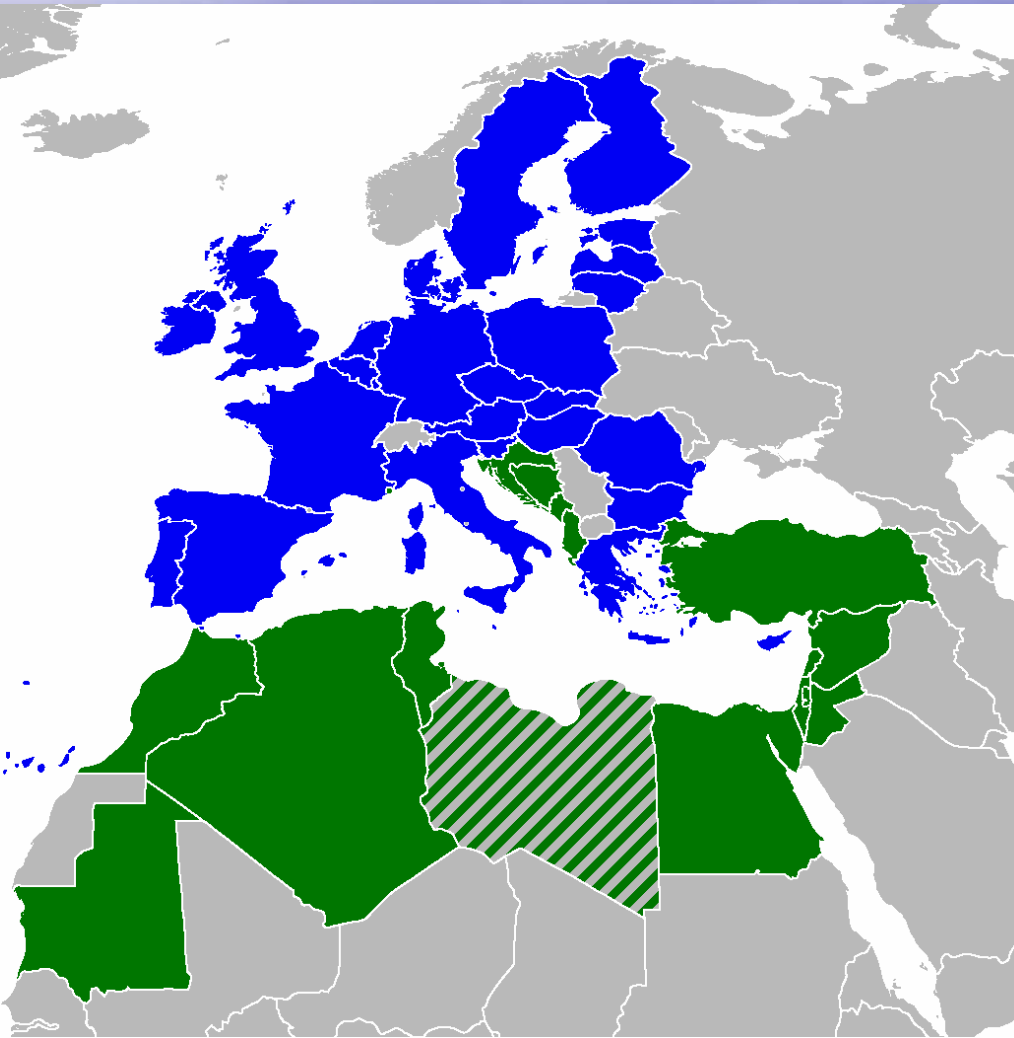
- **Joint North-South anticipatory learning**, peace building, search for action-oriented strategies to cope with root causes & socio-econ. implications.
- **Survival pact**: linking the *virtual water* through food imports with the *virtual sun* or renewable energy exports through partnership building.->**TREC**
- **Functional cooperation against soil erosion**, water scarcity & pollution, employment in rural areas and in intermediary urban networks.
- **Empowerment of grassroots stakeholders** enhance human and societal security, expand adaptation measures and soil security & reduce costs of coping with consequences.

# 9.2. Proposed MEH-SEC Initiative within Union for Mediterranean

**Model: ENVSEC Init.**  
(Central Asia, Caucasus, Balkans)

## **Mediterran. Environmental & Human Security Initiative**

- Address longer-term environmental dimension of human security posed by GEC: water, soil & climate change
- Address causes & regional impacts of GEC
- **Framework of the Union for Mediterranean (UfM)**
- Partners: MU (leader),
- EU, UN, UNEP, UNDP, OSCE, NATO, Arab League, WMO, IPCC





# 9.3. Tasks of MEH-SEC

- **MEH-SEC** should address soft non-military, environmentally-induced security threats, challenges vulnerabilities and risks for the Mediterranean that are projected to evolve by 2025, 2050 and 2100 and that cannot be solved with military means.
- They can only be overcome by **forward-looking, proactive, functional cooperation that requires knowledge** (regional climate change scenarios for the Mediterranean: Mediterranean climate impact assessment).
- **Initiative should coordinate global & regional organizations:**
  - to analyse, assess available research and develop joint cooperative adaptation and mitigation measures
  - to develop cooperative measures dealing with societal consequences, including environmentally-induced forced migration that may lead to hunger & food riots, domestic conflicts & only in the worst case in violent conflicts.
- **Goal: preventive diplomacy and conflict avoidance by addressing root causes of conflicts**



# 9.4. Solar Electricity Generating System - SEGS, California, USA (354 MW, since 1985) ANDASOL 1, Spain (50 MW, 7 h storage, 2009)

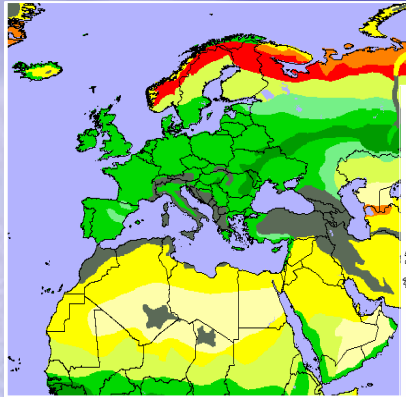




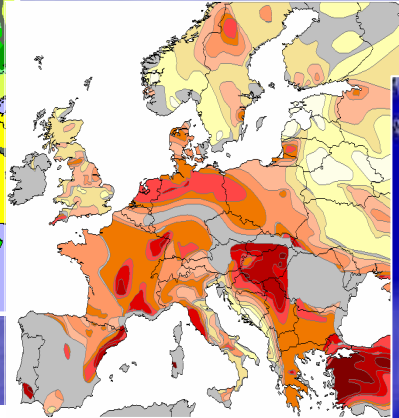
# 9.5. Renewable Energy Potentials in EU-MENA

Source: Trieb, Krewitt, May, in: Brauch et al. (2009)

Biomass (0-1)

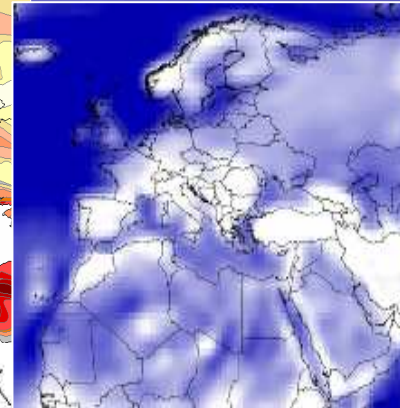


Geothermal (0-1)

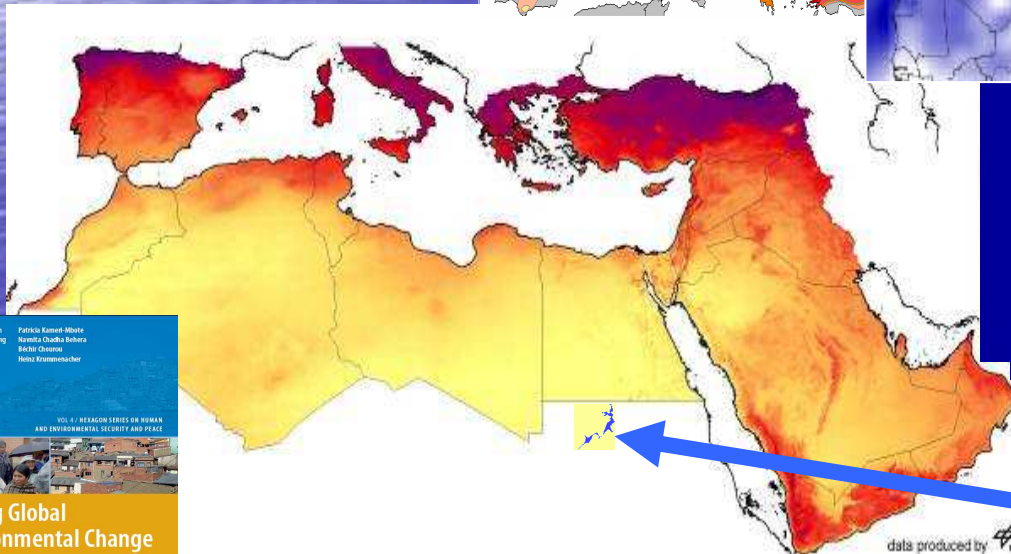
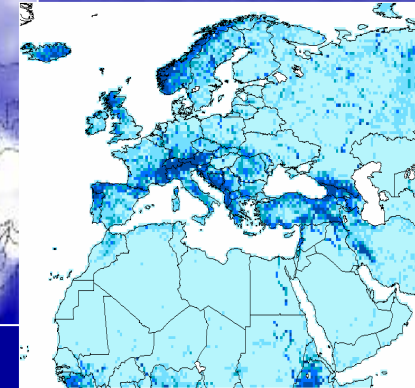


in brackets (Electricity in GWh/km<sup>2</sup>/a)

Wind Energy (5-50)



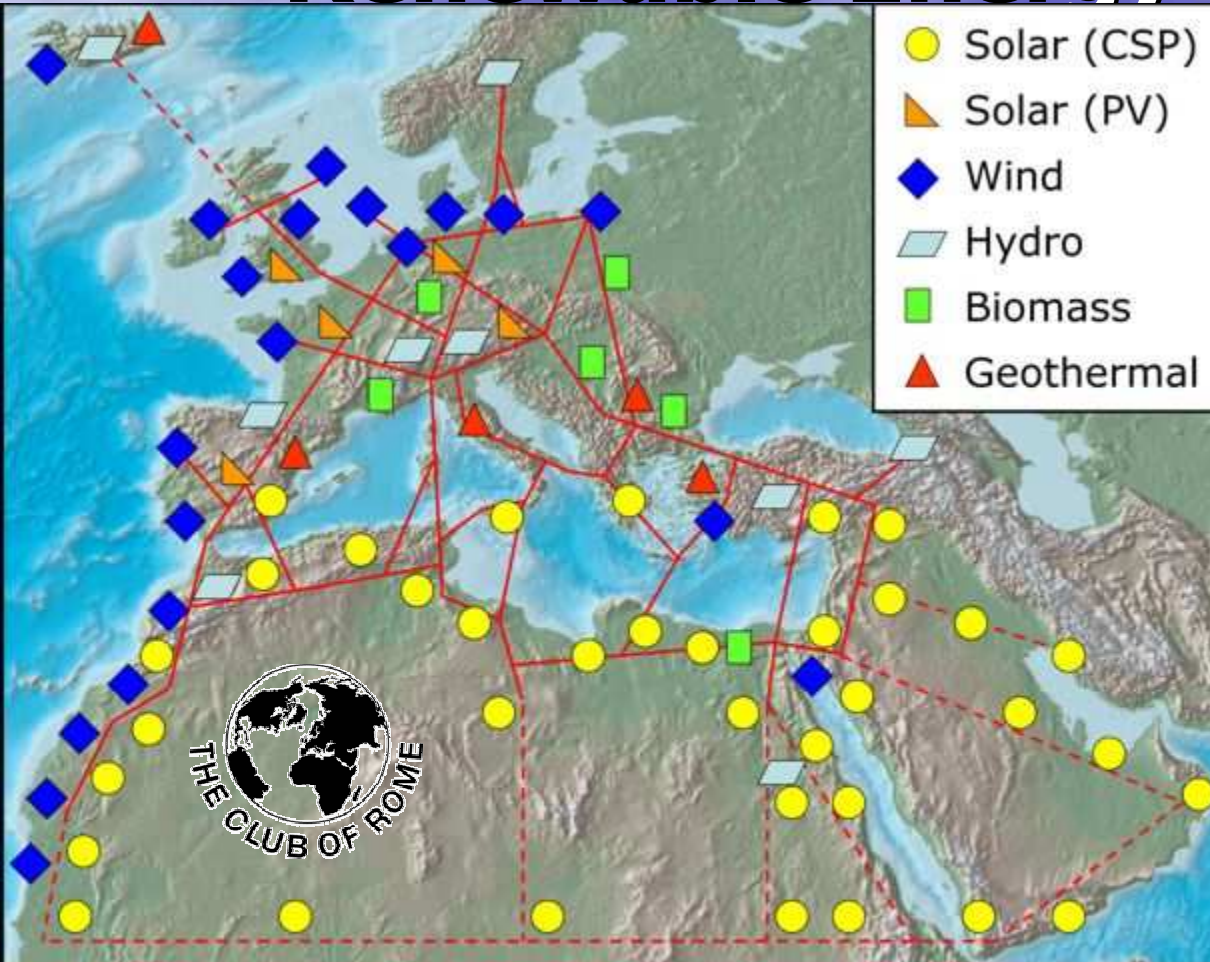
Hydropower (0-50)



A solar thermal power plant of the size of the Assuan Dam would produce 120 times as much energy, i.e. about 30% of the total European energy demand.



# 9.6. Mediterranean Renewable Energy Potential



Trans-Mediterranean Renewable Energy Cooperation (TREC) is an initiative that campaigns for the transmission of clean power from deserts to Europe.

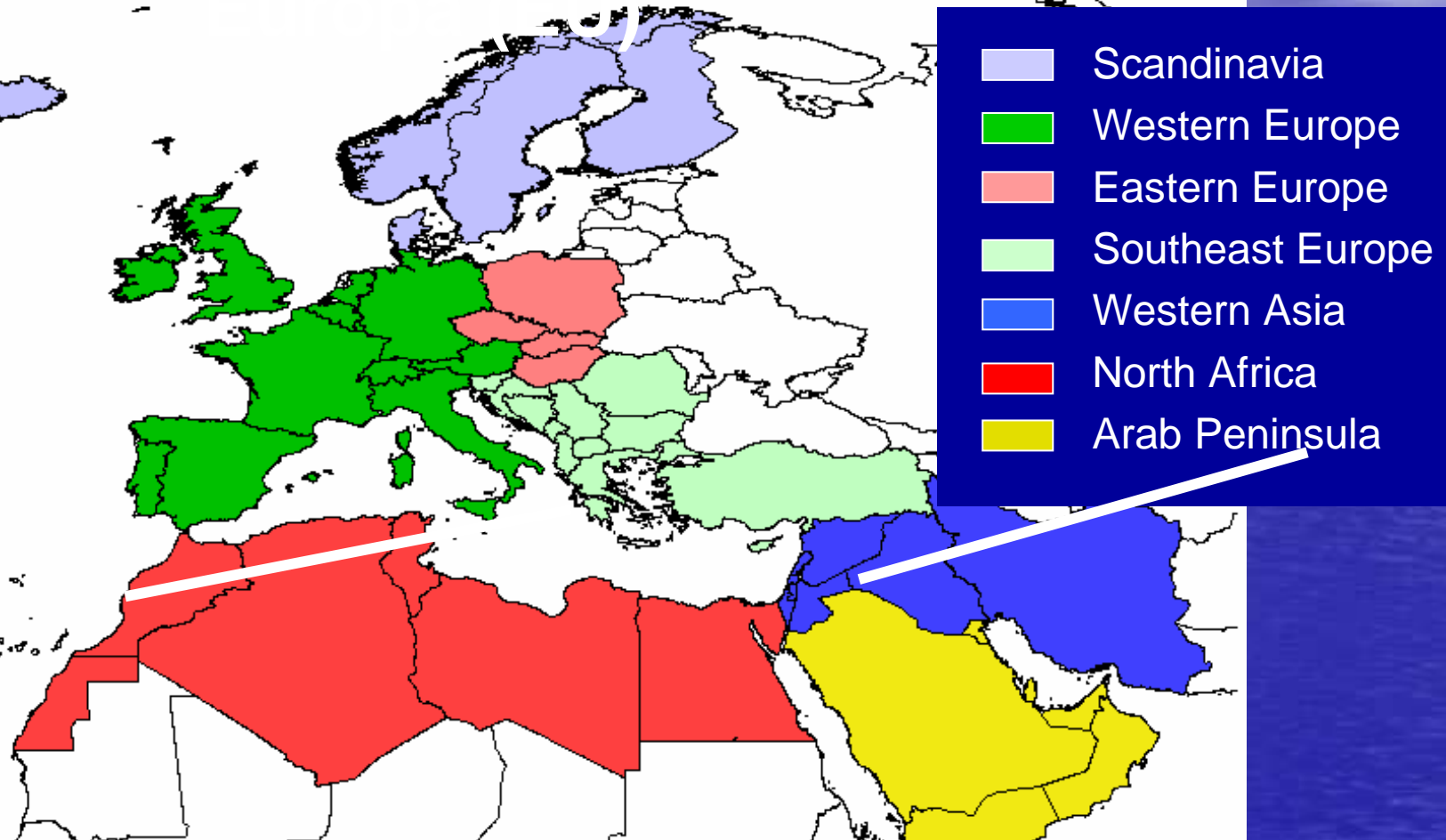
Since 2003 TREC has developed the **DESERTEC Concept**.

#### Concentrating Solar Thermal Power (CSP):

- Solar heat storage for day/night operation
- Hybrid operation for secured power
- Power & desalination in cogeneration

Sketch of High-Voltage Direct Current (HVDC) grid: Power transmission losses from the Middle East and North Africa (MENA) to Europe less than 15%.

## 9.7. TREC studied over 50 countries



### Middle East & North Africa (MENA)

Three studies were commissioned by BMU. 'MED-CSP' and 'TRANS-CSP' studies (2004-2006). 'AQUA-CSP' study: solar desalination was completed by end of 2007.



# 9.8. DESERTEC Concept & Technology

- **DESERTEC concept: less than 0.3% of desert of MENA region, solar thermal power plants can generate enough electricity and desalinated seawater for current & future demands in EU-MENA.**
- **High solar radiation outweighs transmission losses from MENA to Europe. Solar thermal power plants in MENA are more economic than in South Europe.**
- **Solar & wind power can be distributed in MENA and transmitted via High Voltage Direct Current (**HVDC**) transmission lines to Europe with transmission losses of 10-15%. **Loss of power during transmission can be limited to 3% per 1000 km.****
- **Solar thermal power plants (Concentrating Solar Thermal Power, CSP).**
- **Use mirrors to concentrate sunlight and create heat to drive steam turbines and electricity generators. Excess heat from additional collectors can be stored in tanks of molten salt & used to power steam turbines during the night or when there is a peak in demand.**



## 9.9. Desertec Vision: An Intercontinental Mega Project



## 9.10. Survival Pact for the Mediterranean: linking food and renewable energy

Need of political framework for trust & cooperation

Political thinking on co-development based on partnership beyond the fear of a "*food*" and "*energy*" *weapon*.

Financial incentives for linking food and energy.

Renewable energies have a threefold potential:

- for a long-term *sustainable energy policy* in line with climate obligations for both South and North;
- for creating *sufficient revenue* for other sustainable development projects & imports of *virtual water*;
- for reducing the competition over scarce oil and gas resources (avoid: *resource control conflicts*).



# 9.11. "Virtual Water" & "Virtual Sun"

- Tony Allan: *Virtual water* is water embedded in water intensive commodities (e.g. grain).
- MENA region imported 20% as virtual water by 2000. Proportion will rise to 50% by 2050.
  - Virtual water reduces local water deficits. Problem can be solved by exporting virtual water (cereals, food from Europe to MENA region)
  - MENA countries need foreign income and must overcome the fear that *food as a weapon*.
- "*Virtual sun*" is the sun embedded in forms of renewable energy that can both solve energy demand (including for desalination of drinking water) & can be exported as electricity to the North via long-distance cables and as hydrogen (alternative fuels for transport system of the 21st century with low CO2 emission).
- Constraint: Thinking in terms of energy security (supply security) due to the oil shocks of the 1970s, 1980s that energy can be used as a weapon to "strangulate" economies of the North.



# 9.12. Survival Pact: Component of a Global Partnership for Sustainable Development

- Pragmatic perspective: multilateral cooperation can solve security challenges posed by GEC impacts.
- A Euro-Mediterranean Survival Pact to address the long-term challenges of GEC: develop cooperative strategies combining goals for a sustainable development via
  - a sustainable energy policy that contributes to *su-stainable economic development* in South & North
  - a sustainable agricultural policy that counters the *poverty* and market *driven* processes of desertification
- Euro-Mediterranean Survival Pact requires:
  - *Science and knowledge transfer* on renewable energy technologies (e.g. technical training in MENA area)
  - Market incentives (Kyoto mechanisms, CDM)
  - Financial framework: Desertec Industrial Initiative
- Survival Pact: Regional Partnership for Sustainable Development Strategies based on comparative advantages, by linking 2 essential commodities: food (virtual water) and solar energy (virtual sun).

## 9.13. Achieving Environmental, Human, National International, **Water**, Food and Energy Security

- Long-term proactive policy responses to climate change impacts are possible and needed.
- Vision of Survival Pact for sustainable codevelopment
- UfM & Solar Plan offer policy framework for developing renewable energy potential in the MENA region.
  - Desertec Industrial Initiative offers a financial, technological and economic framework.
- Linking virtual water & virtual sun achieve these goals:
  - reduce GHG emissions (environmental security)
  - satisfy food import needs (human and food security)
  - Reduce the resource competition over control and access to oil and gas (economic, national & international security).
- Realize a policy of sustainable peace with sustainable development

# **10. Adaptation: Policy Suggestions for Future Humanitarian Missions in Natural Hazards**

- Water stress and scarcity will rise in Mediterranean, MENA and in Africa and other hotspots**
- Hydro-meteorological hazards (drought, forest fires, heat waves, cold spills, storms, floods) will rise**
- International water resource management (cooperative frameworks are needed, for Nile River Basin: area of drought, famines, many conflicts in past and present!**
- Early warning, rescue and humanitarian aid missions (drought & flood),**
- Navies and air force (transport capabilities)**
- Civil Protection: CBMs & PBMs, Union for Mediterranean**
- UfM Solar Plan, Desertec Industrial Initiative require: Policy Framework to act boldly: e.g. bailout of banks**
- MEHSEC: Survival Pact (linking renewable energy & food) confidence building project requires trust**

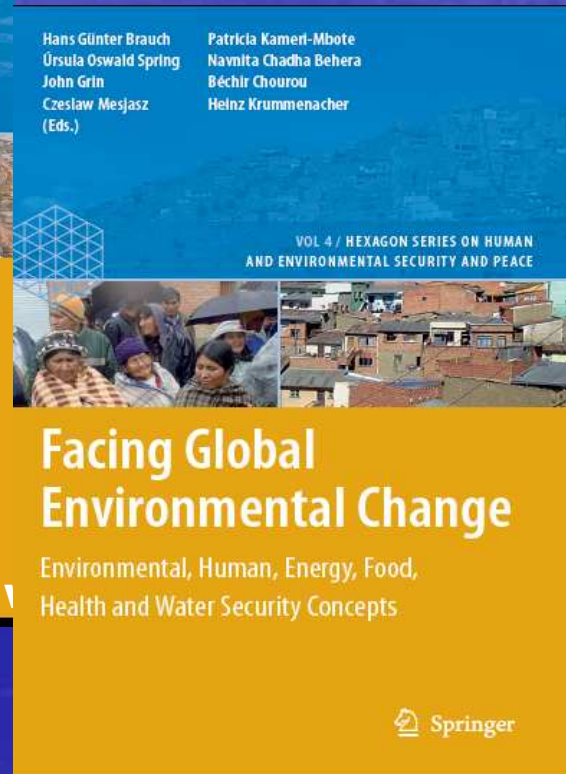
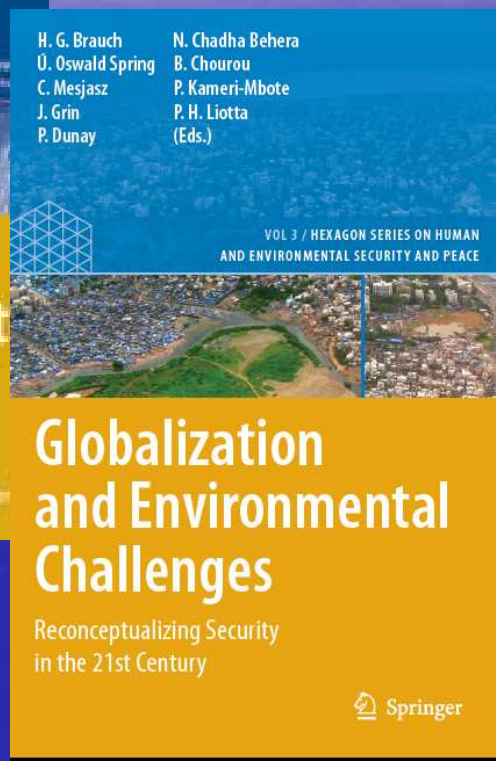
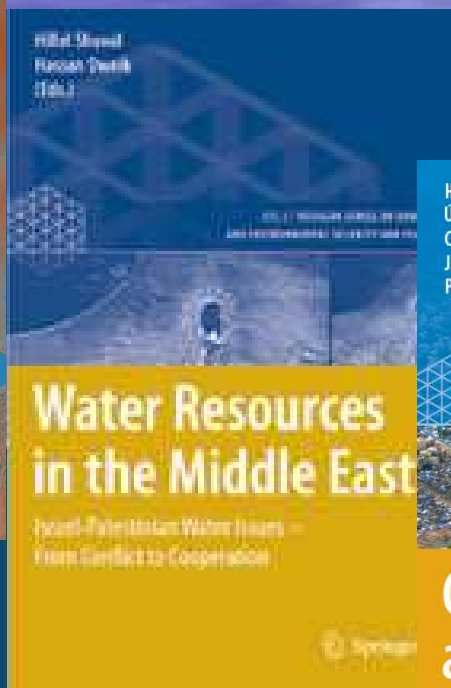
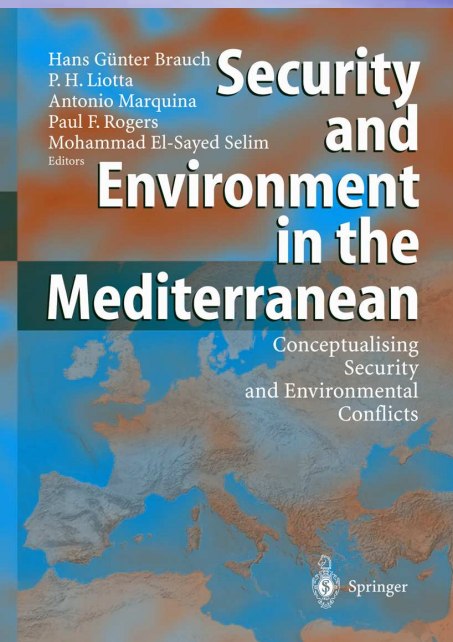


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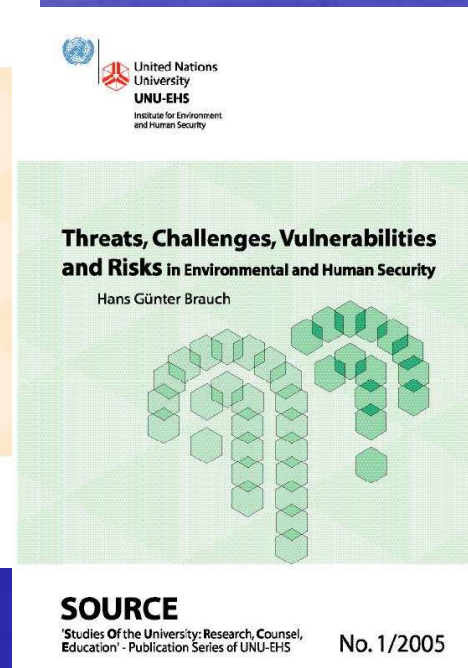
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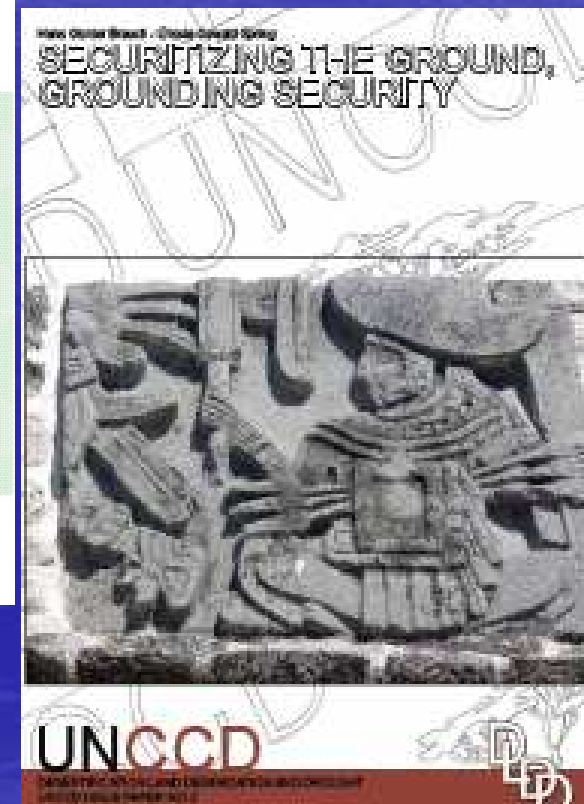


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