

**El Colegio de Tlaxcala (Coltla), Tlaxcala, México**  
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## **Cambio ambiental global:**

**Retos de la seguridad ecológica y ambiental  
por los cambios de clima y la desertificación**

## **Global Environmental Change:**

**Ecological Security Challenges due to  
Climate Change and Desertification**

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# 1. Global Environmental Change: Concepts & Research Programmes

- During Cold War **ecology was no security concern.**
- **Global (environmental) change (GEC):** changes in nature & society that affected humankind & will affect human beings who are both a cause of this change and often also a victim.
- Those who caused it & are most vulnerable are not identical
- GEC affects & combines the **ecosphere & anthroposphere.**
- Human dimension of GEC covers contribution & adaptation of societies to these changes. These processes pose questions for social, cultural, economic, ethical, & spiritual issues, for saving, but also our responsibility for environm.
- **Ecosphere:** atmosphere (climate syst.), hydrosph. (water), lithosph. (earth crust, fossil fuels), pedosph. (soil), biosph.
- **Anthroposphere:** populations, social organis., knowledge, culture, economy & transport & other human-rel. systems.

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



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

# 1.2. Global Environmental Change: Concepts & Research Programmes

- ❖ Since 1970s, 1980s GEC focused on human-induced perturbations in environment encompassing many globally significant issues on natural & human-induced changes in environment, & socio-econ. drivers
  - IGBP or International Geosphere-Biosphere Programme;
  - IHDP or International Human Dimensions Programme;
  - World Climate Research Program (WCRP), DIVERSITAS
- ❖ IHDP: contribution & adaptation of societies to changes, social, cult., econ., ethical, spiritual issues, our role & responsibility for the environ.
- ❖ GEC deals with **changes in nature & society that affect humankind** as a whole and human beings both a cause and victim, however those who have caused it and are most vulnerable to are often not identical.
- ❖ **GEC affects & combines ecosphere & anthroposphere.**  
*Ecosphere: atmosphere (climate system), hydrosphere (water), litho-sphere (earth crust, fossil fuels), pedosphere (soil), biosphere (life).* *Anthroposphere: populations, social organisations, knowledge, culture, economy & transport*

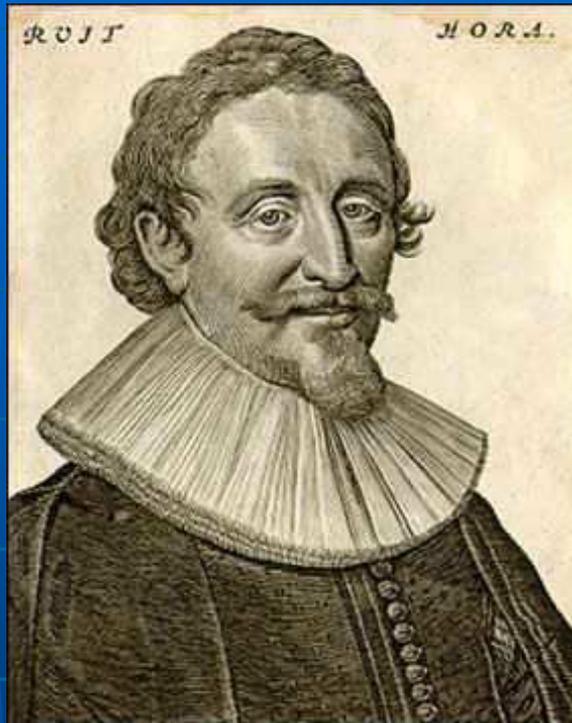
## 2. Global Environmental Change and Security Concepts

- Does GEC pose security dangers, i.e. threats, challenges, vulnerability & risks?
- Which Security Concept are we using?
  - Narrow: national military security?
  - Widened & deepened security concept?
- Hypothesis: Thinking on security changed
  - Global, regional contextual change since when?
  - Scientific revolution or new theoretical approaches?
- Book Project: Global mental mapping of reconceptualization of security
  - Widening, deepening, shrinking, sectorialisation?

## 2.1. A Classical Definition in Political Science & International Relations

- Arnold Wolfers (1962), US of Swiss origin, realist 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”.
- Absence of “**threats**”: interest of policy-makers
- Absence of “**fears**”: interest of social scientists, especially of **constructivists**: “**Reality is socially constructed**”
- Iraq case: WMD: “**subject. fear**” vs. “**lack of obj. threat**”

## 2.2. English School: Hobbes, Grotius & Kant



Hobbes (1588-1679)

Grotius (1583-1645)

Kant (1724-1804)

Security perceptions depend on worldviews or traditions

- ❖ Hobbessian pessimist: *power* is the key category (narrow concept)
- ❖ Grotian pragmatist: *cooperation* is vital (wide security concept)
- ❖ Kantian optimist: *international law* and *human rights* are crucial



## 2.3. Why do we Observe & Analyse a Reconceptualisation of Security?

### Political context: Cold War and since 1990

#### Which change is crucial and long-lasting?

- **9 November 1989:** unification of Germany & Europe: triggered integration
- **11 September 2001:** vulnerability of US to terrorism USA: triggered revival of Cold War mindset, military build-up, and constraints on civil liberty: impact of laws on homeland security
- **Latin America:** Third wave of democratisation, economic crisis?

Did the contextual change of 1989 or the impact of 11 September trigger a global “reconceptualisation” of security?

### Political science context: realism → constructivism

- **Kuhn:** Scientific revolutions lead to paradigm shifts
- **Ideas matter:** emergence of constructivist approaches, security is socially constructed (speech acts), constructivism shift, but no scientific revolution.
- **Threats matter:** evolution of the new worldview of the neo-conservative ideologues in the US & impact on IR.

## 2.4. Global Contextual Change: 9 November 1989 or 11 September 2001:

- **End of the Cold War?**



**Berlin**

- **New threats, challenges,**



**New York**

- **Reunification of Germany**
- **Enlargement of the EU**

## 2.5. Widening of Security Concepts: Towards Environmental 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	Military	Political	Economic	Environmental ↓	Societal
Human individual ⇒			Food/health & water sec.	Cause & Victim	Food/health & water sec.
Societal/Community				↓↑	
National	In Cold War, US since 2001: Shrinking		Energy security	↓↑	
Internat./Regional				↓↑	
Global/Planetary ⇒				GEC	

## 2.6. 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)	<ul style="list-style-type: none"> <li>- Human health</li> <li>- agriculture (yield decline)</li> <li>- biodiversity</li> <li>- desertification</li> </ul>	<ul style="list-style-type: none"> <li>- tourism</li> <li>- food security</li> <li>- fisheries</li> <li>- government action</li> <li>- econ. action</li> </ul>	<ul style="list-style-type: none"> <li>- infect. disease</li> <li>- damage to crops</li> <li>- natural systems</li> <li>- water scarcity</li> <li>- forest fire</li> </ul>	<ul style="list-style-type: none"> <li>- human populations</li> <li>- the poor, old people and children due to heat waves</li> </ul>
Climate change - sea level rise (creeping, long-term)	<ul style="list-style-type: none"> <li>- Small island states</li> <li>- marine ecosystem,</li> <li>- indigenous communities,</li> <li>- industry, energy</li> </ul>	<ul style="list-style-type: none"> <li>- deltas</li> <li>- coastal zones</li> <li>- marine, freshwater ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>- coastal cities, habitats, infrastructure, jobs</li> <li>- cities, homes, jobs</li> </ul>	<ul style="list-style-type: none"> <li>- livelihood</li> <li>- poor people,</li> <li>- insurance,</li> <li>- financial services</li> </ul>

# 3. Climate Change as a New Security Challenge:

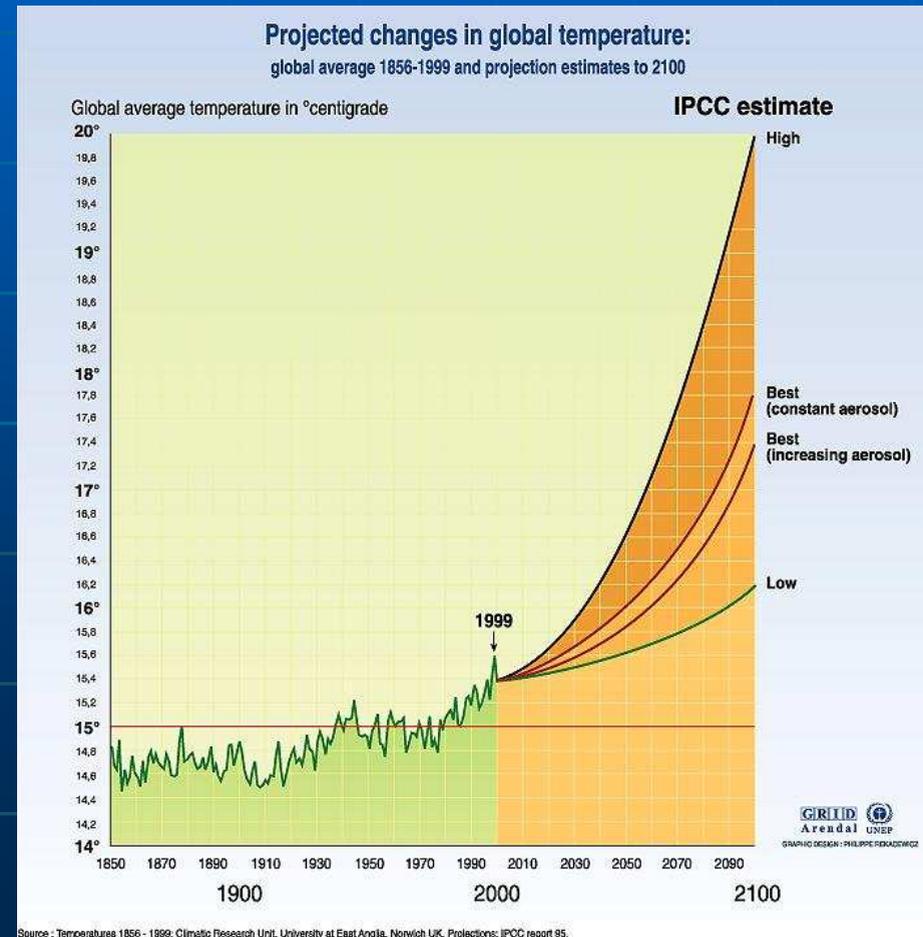
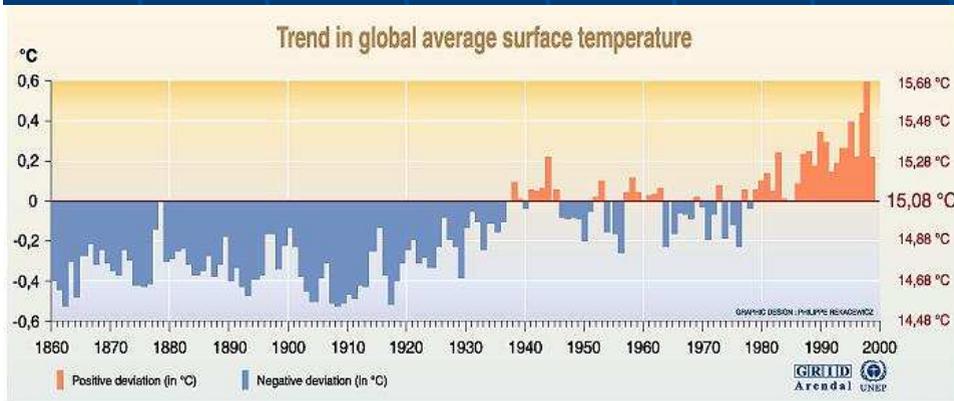
## Water Wars: Climate change may spark conflict

- Britain's Defence Secretary, John Reid, pointed to violent collision between a rising world population & shrinking world water resource: global warming. **Climate change may spark conflict between nations** and British armed forces must be ready to tackle violence.
- He forecast that violence and political conflict would become more likely in the next 20 to 30 years as **climate change turned land into desert, melted ice fields and poisoned water supplies.**
- He ... listed **climate change alongside the major threats ..** in future decades, incl. terrorism, demographic changes, global energy dem.
- Military planners have already started considering **potential impact of global warming for Britain's forces** over next 20 -30 years.
- He warned of increasing uncertainty about the future of the countries least well equipped to deal with **flooding, water shortages and valuable agricultural land turning to desert.**
- „We see uncertainty growing ... about the geopolitical and human consequences of climate change. **Impacts such as flooding, melting permafrost & desertification could lead to loss of agricultural land, poisoning of water supplies & destruction of economic infrastructure.**
- **More than 300 million people in Africa currently lack access to safe water; climate change will worsen this dire situation.**„

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

## 2 Climate Change Impacts: Temperature & Sea level Rise

- ❖ Global average temperature rise in 20<sup>th</sup> century: **+ 0.6°C**
  - ❖ Proj. temperature rise: 1990-2100: **+1.4 – 5. 8°C**
- Sources: IPCC 1990, 1995, 2001



# 3.2. Climate Change Impacts on Precipitation

## Precipitation changes: trend over land from 1900 to 1994



# 3.3. Climate Change Impacts on Agriculture

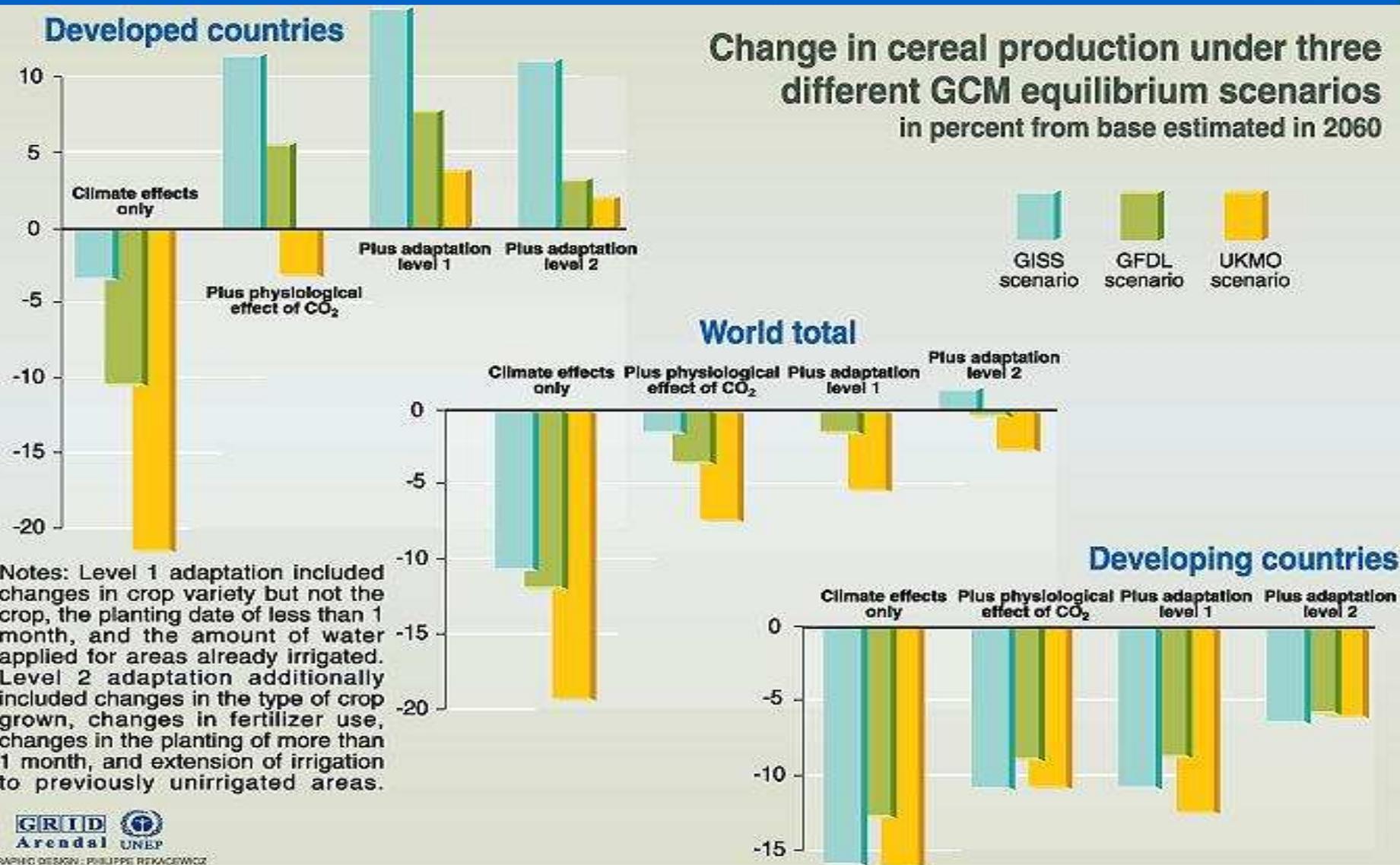




Figure 4. High Potential for Food Crisis 1901-1995.

**← High Potential for Food Crisis (1901-1995)**

Alcamo/Endejan 2002: 143

### 3.4. Food Crises

## High Potential for Food Crisis (2001-2050) with GDP and Climate Change →

Alcamo/Endejan 2002-143

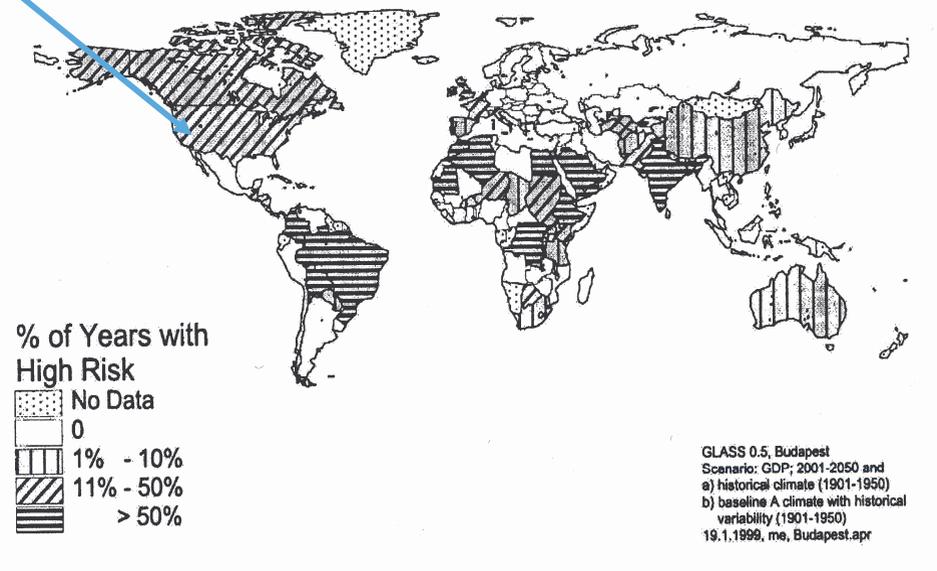
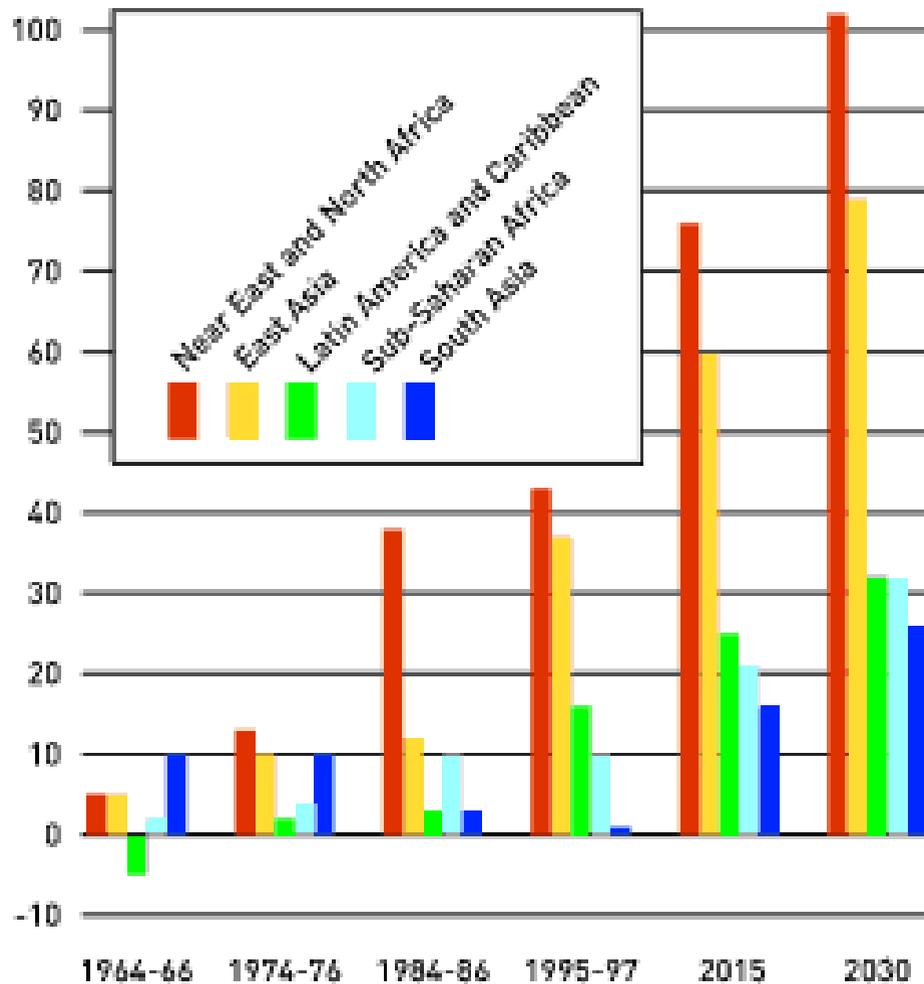


Figure 6. High Potential for Food Crisis 2001-2050 – with GDP Increase and Climate Change.

## 3.5. FAO (2000) Increase in Cereal Imports

### Net cereal imports in developing countries

millions of tonnes



- **FAO: 4 March 2003, Rome** World's population will be better fed by 2030, but hundreds of millions of people in developing 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.



## 4. Desertification as a New Security Challenge

**Amb. Hama Arba Diallo, SG UNCCD:**

The potential of including desertification within the security debate does not lie in merely identifying how desertification acts as a cause for instability and conflicts. Rather, focus on desertification brings forward a new type of confidence-building measures that can effectively reduce the risks to security.

### International Year of Deserts & Desertification (2006):

- Desertification and Migration (Almeria, Spain)
- Civil Society and Desertification (Montpellier, France)
- Science and Desertification (Tunis and Nairobi)
- Poverty, Hunger and Desertification (Geneva, Switzerland)
- Forward-looking strategy for effective implementation of UNCCD (Argent.)
- Summit of Heads of State on: Desertification, Migration and Security.

# 4.1. Desertification as a Security Issue

## 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 livelihoods, homes, villages, provinces, in search for indiv. & group survival
- ❖ Major actors & concept users: in South Asia, UK, US: disaster managers, OCHA, ECHO, humanit. NGOs
- ❖ Solution: enhancement of resilience & sustainable development

# 5. Models on Linkage of Cause & Impact: From the PSR to PEISOR Model

„Pressure-State-Response“  
(PSR) of OECD (93, 97, 99):

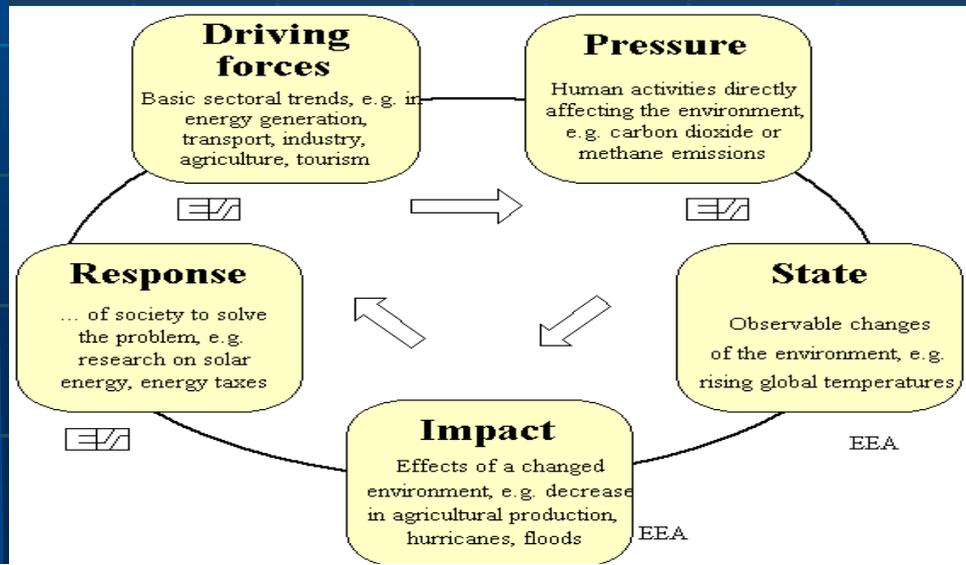
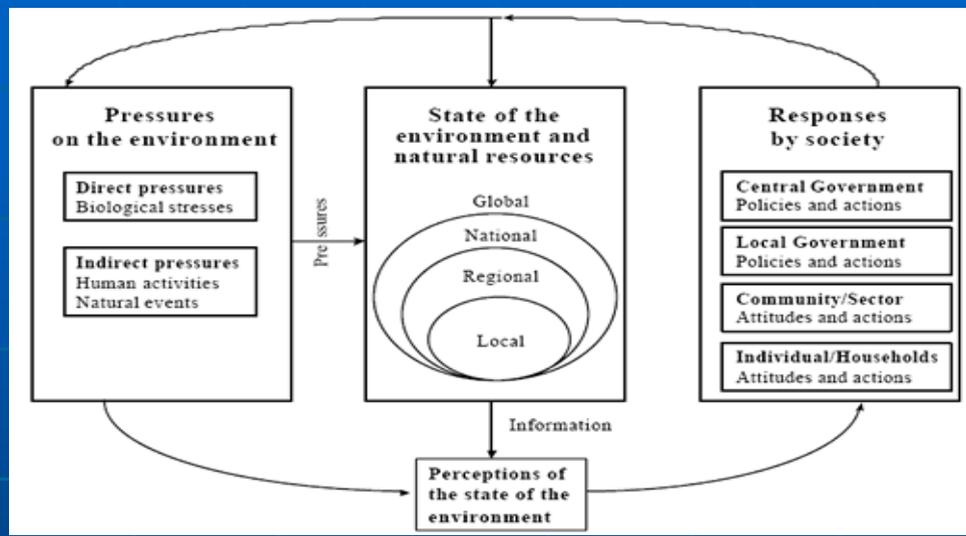
- P: pressure;
- S. state of env.,
- R: policy response:

UN-CSD. Driving Force-State-Response (DSR)

- D: Determinants of human activ;;
- S: State of sustainable developm;;
- R: Responses;

EU-EAA: DPSIR-Model

- D: Driver, P: Pressure, S: State;
- I: Impact; R: Response

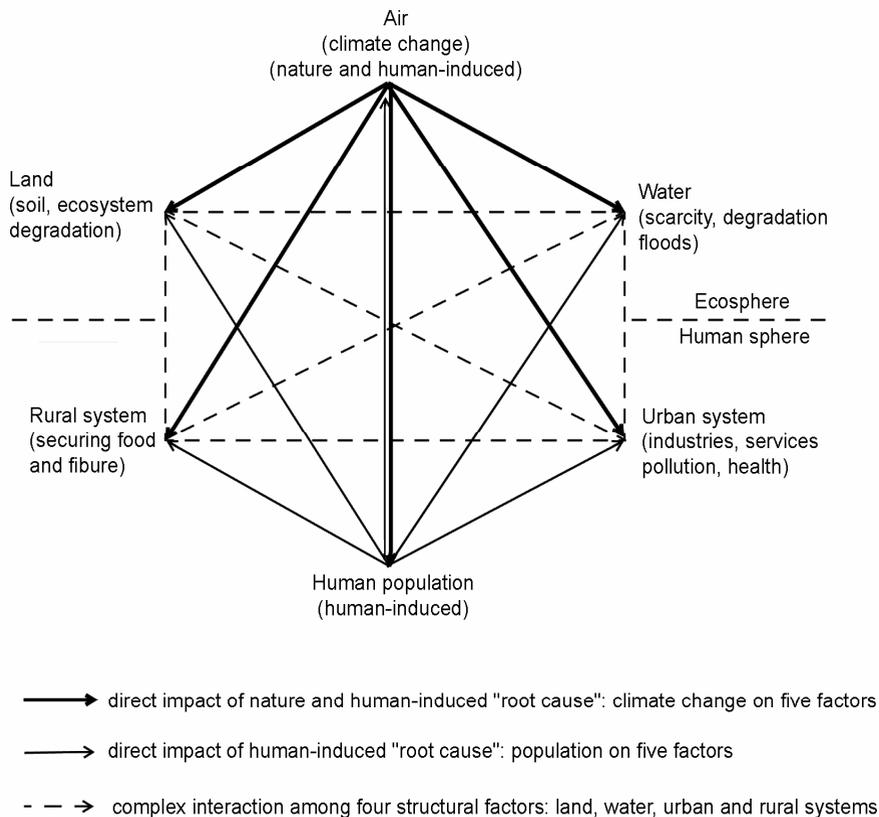




## 5.2. Securitisation of Causes, Impacts and Socio-economic Impacts of GEC:

- **The model distinguished 5 stages:**
  - **P: Causes** of GEC („pressure“): Survival hexagon
    - **Effects:** environmental scarcity, degradation and stress, influenced by national and global context
  - **E: Effect:** environm. scarcity, degradation & stress
  - **I: Extreme or fatal outcome („impact“): hazards**
  - **S: Societal Outcomes:** disaster, migration, crisis, conflict, state failure etc.
  - **R: Response** by the state, society, the economic sector and by using traditional and modern knowledge to enhance coping capacity & resilience

# 5.3. Pressure: Six Causal 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**
- **Exponential**
- **Chaotic, abrupt**

# 5.4. Effects: Environmental Scarcity, Degradation & Stress

## Four Phases of Env. Sec, Research since 1983 - 2003

First Phase: Conceptual Phase: Concept Environmental Security

Second Phase: Empirical Phase: Case studies: Scarcity - Conflict

- Toronto: Homer-Dixon: since 1991: 3 Projects (figure © Homer-Dixon 1998)
- Zürich/Bern: Günther Bächler, K.Spillmann

Third Phase: Manifold Research without Integration (1995 - pres.)

*Sources of environmental scarcity*

*Social Effects*

Decrease in quality and quantity of renewable resources

Population growth

Unequal resource access

Increased environmental scarcity

Migration, expulsion

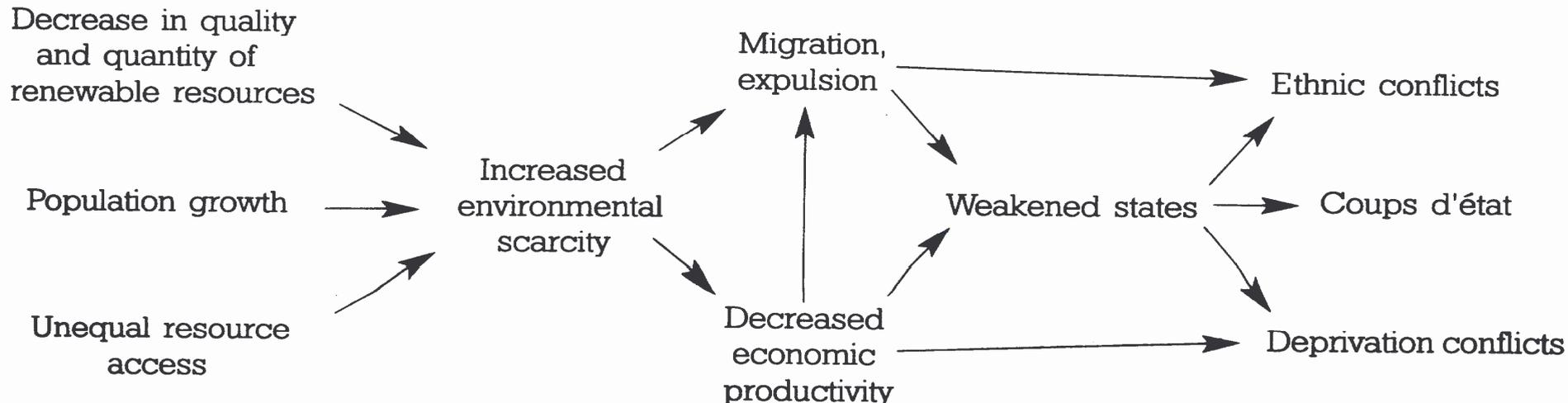
Decreased economic productivity

Weakened states

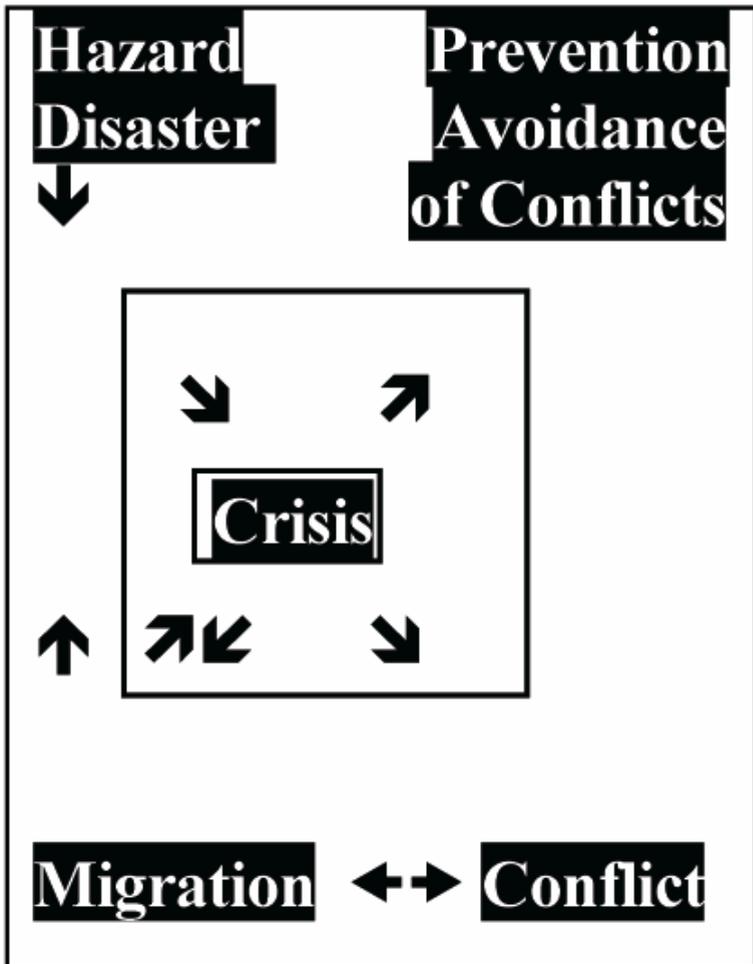
Ethnic conflicts

Coups d'état

Deprivation conflicts



# 5.5. Impact: Human-Induced Natural Hazards Drought, Famine and Societal Consequences



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

## 5.6. Societal Outcomes: Knowledge on Linkages of Outcomes

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

## 5.7. Response: Policy Goal: Early Warning & Reducing Social Vulnerability & Resilience Building

- **To environmental scarcity, degradation & stress:**
  - **Proactive climate policy:** reduce greenhouse gases by shifting to nonfossil energy resources, especially renewables
  - **Combat desertification and soil erosion:**
  - Cope with water scarcity & degradation by demand-side management and alternative supply (desalination with renewables)
  - Cope with population growth, rural emigration and urbanisation
- **To extreme outcomes of GEC, hydro-meteorological hazards & severe societal consequences:**
  - **Reducing the hazard impact by enhanced early warning against multiple hazards and reducing social vulnerability by improved resilience**
  - **Improved policy of conflict resolution, prevention and adaptation and mitigation against challenges of GEC that may lead to conflicts (anticipatory learning & conflict avoidance)**

## **6. Implications of Climate Change for Security and Conflicts**

- Climate Change poses threats, challenges, vulnerabilities and risks for:**
  - Environmental dimension of security (Cause)
  - Human Security: freedom from hazard impact
- Climate Change poses a survival dilemma**
  - for victims of human-induced hydro-meteo-rological hazards: droughts, storms, floods & landslides
  - 3 unfavorable options: stay & die (old/weak); leave and fight (strong) or to emigrate (USA)
- Climate Change poses no military threat and cannot be solved with military means**

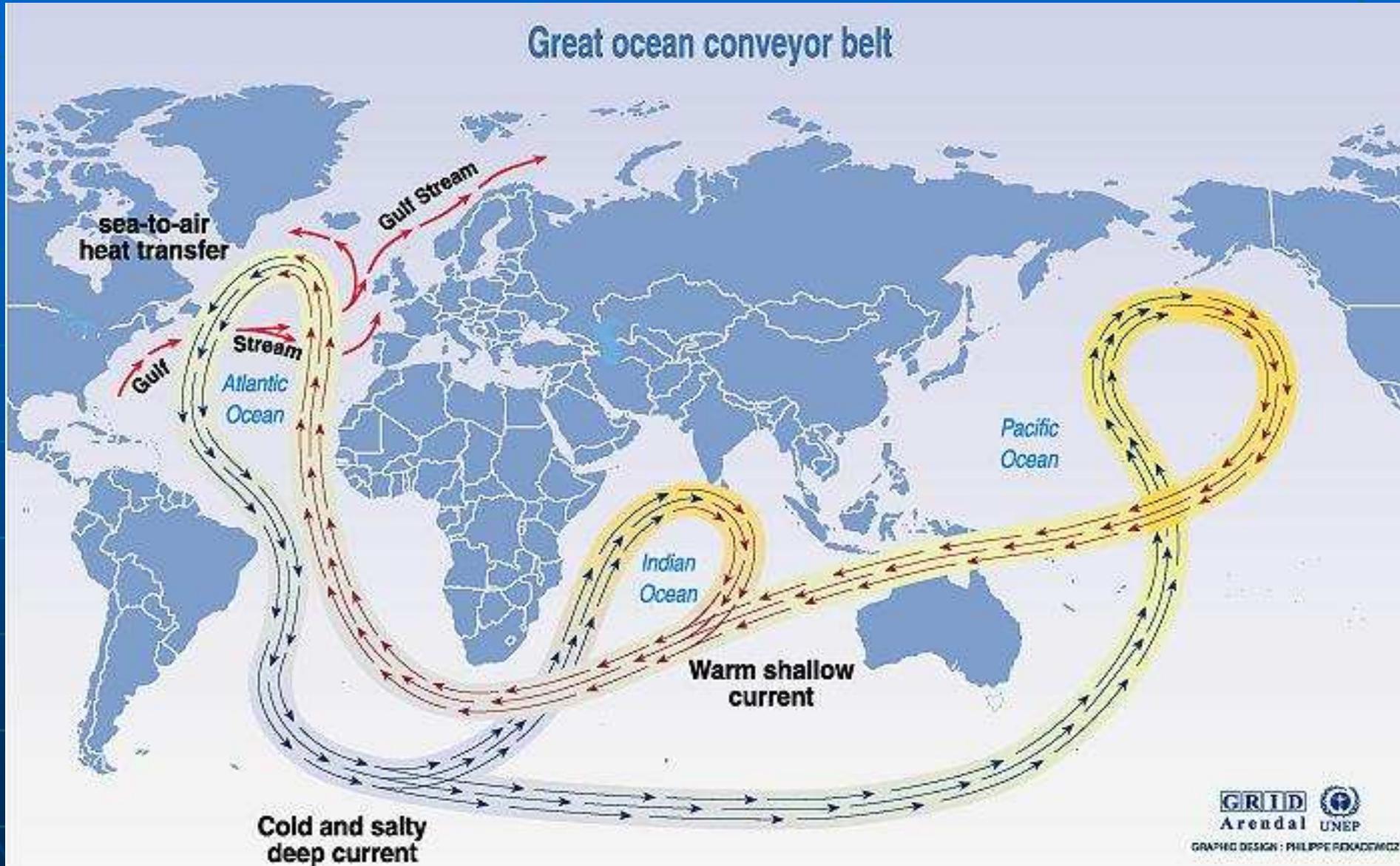
# 6.1. Climate Change and Conflicts

**Hobbesian:** <http://halfgeek.net/weblog/special/gwreport/Pentagon.html>

**Grotian:** <http://www.bmu.de/files/climges.pdf>

- **Peter Schwartz/Doug Randall**
  - Contract Study for DoD, Net Assessment, Oct. 2003
  - *The purpose of this report is to imagine the unthinkable – to push the boundaries of current research on climate change so we may better understand the potential implications on United States national security.*
  - Vantage point: Hobbesian
  - Neo-Malthusian pessimist & Cornucopian optimist
  - Pentagon, US national security
- **Hans G. Brauch (AFES-PRESS)**
  - Contract Study for German Environment Ministry, Nov. 2002
  - *The purpose is to provide empirical evidence on climate change and conflicts and to contribute to the national and international debate on climate protection.*
  - **Contribute to crisis prevention & crisis management & provide additional supportive arguments for precautionary & ambitious climate protection policy.“**

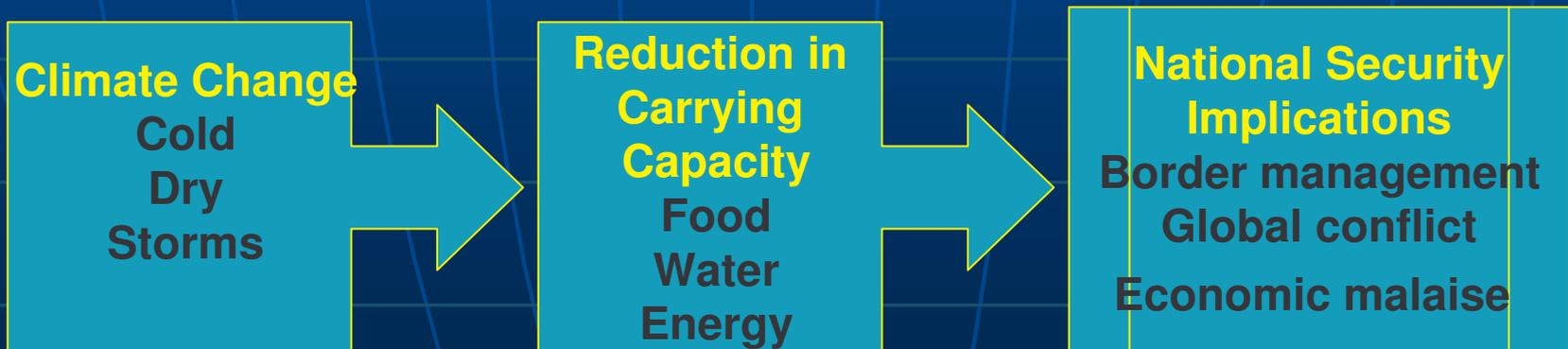
# 6.2. Change in Conveyer Belt & Gulf Stream



## 6.3. Peter Schwartz and Doug Randall: Climate Change as a U.S. Security Concern

- Indications today that global warming has reached the threshold where the thermohaline circulation could start to be significantly impacted.
- These indications include observations documenting that North Atlantic is increasingly being freshened by melting glaciers, increased precipitation, & fresh water runoff making it substantially less salty over the past 40 years.
- **Report suggests that, due to pot. dire consequences, the risk of abrupt climate change, although uncertain & quite possibly small, should be elevated beyond a scientific debate to a U.S. national security concern**

■



## 6.4. Worst Case Conflict Scenario due to Climate Change (2010-2020)

Europe	Asia	United States
<p><b>2012:</b> Severe drought and cold push Scandinavian populations southward, push back from EU</p> <p><b>2015:</b> Conflict within the EU over food and water supply leads to skirmishes and strained diplomatic relations</p> <p><b>2018:</b> Russia joins EU, providing energy resources</p> <p><b>2020:</b> Migration from northern countries such as Holland and Germany toward Spain and Italy</p>	<p><b>2010:</b> Border skirmishes &amp; conflict in Bangladesh, India, and China, as mass migration occurs toward Burma</p> <p><b>2012:</b> Regional instability leads Japan to develop force projection capability</p> <p><b>2015:</b> Strategic agreement between Japan &amp; Russia for Siberia &amp; Sakhalin energy resources</p> <p><b>2018:</b> China intervenes in Kazakhstan to protect pipelines regularly disrupted by rebels &amp; criminals</p>	<p><b>2010:</b> Disagreements with Canada &amp; Mexico over water increase tension</p> <p><b>2012:</b> Flood of refugees to southeast U.S. &amp; Mexico from Caribbean islands</p> <p><b>2015:</b> European migration to United States (mostly wealthy)</p> <p><b>2016:</b> Conflict with Europeans over fish-ing rights</p> <p><b>2018:</b> Securing North America, U.S. forms integrated security alliance with Canada &amp; Mexico</p> <p><b>2020:</b> DoD manages borders &amp; refugees from Caribbean &amp; Europe.</p>

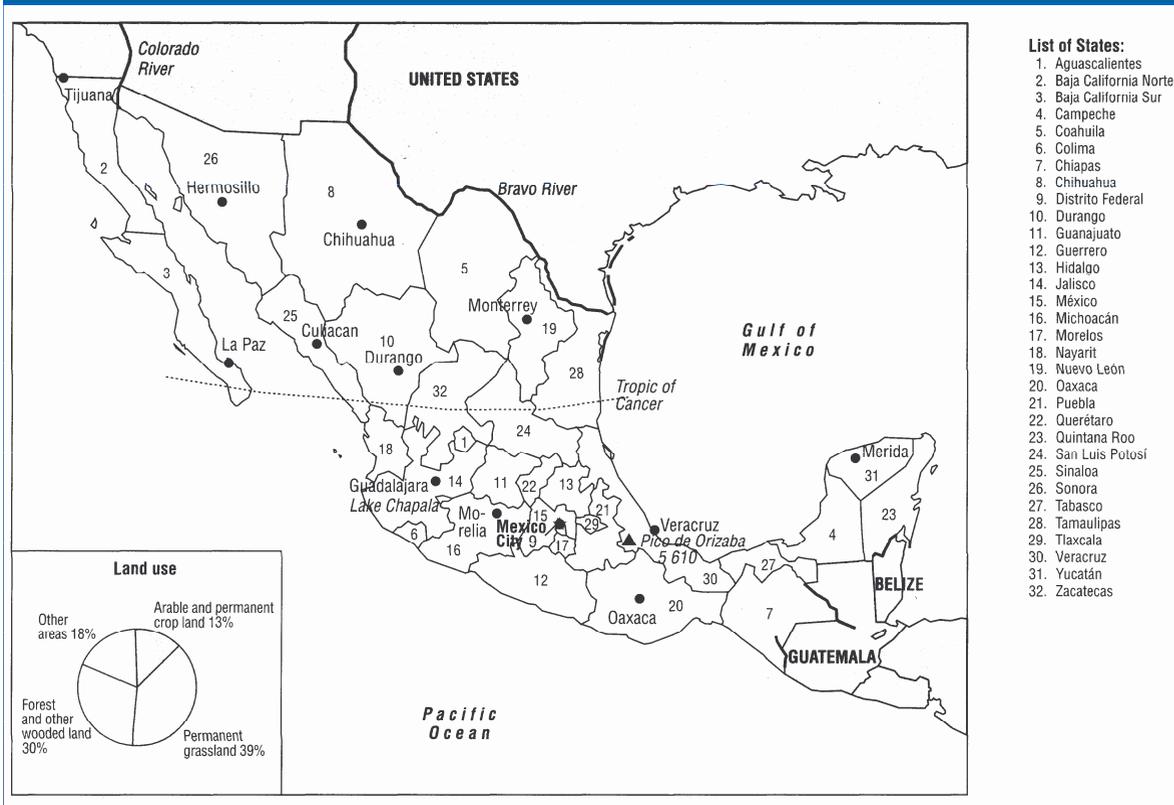
## 6.5. BMU Study Design

- **Case studies on Mexico, Bangladesh and Egypt and the regional study on the Mediterranean focus on different climate zones, eco-regions (tropical, subtropical, semi-arid & arid).**
- **They are affected by different impacts of sea-level rise, temperature increases & extreme weather events, storms, flooding, forest fires & drought.**
- **The probable consequences of the environmental impacts on the conflict dimension may affect different levels from the global, international, and regional to national, societal and to the human level (*human security*).**
- **The five case studies apply the same criteria & include the most recent UN data of projections of population growth until 2050, urbanisation until 2030 and cities until 2015.**

## 6.6. Case Study on Mexico

- ❖ **Case study on Mexico distinguishes the impacts for the northern, the central and the southern region of Mexico on**
  - **desertification, on**
  - **declining precipitation and the**
  - **increasing demand for water (population growth & urbanisation).**
- ❖ **Included is the projected decline in the areas suitable for the production of maize without irrigation and on the decline in the yield of some agricultural products.**
- ❖ **Due to projected trends and impact of severe weather events that have caused severe damages in Central America during 1990s,**
  - **the pressure for (trans)migration from Central America to Mexico & from there to the United States & Canada will increase in the decades to come.**

# 6.7. Case Study on Mexico



- **Climate change & populations growth matter**
- **First Nat. Comm. (97): 59.6% - 75% of land would become unsuitable for maize production due to climate change**
- **Climate change directly affects mortality rate through heat-waves or floods or indirectly through infectious illnesses (malaria, dengue, cholera, typhus).**
- **The growing urban centres imply a growth in demand for water, and those in arid & semi-arid areas will be affected by water shortage**

## 6.8. Prospective Climate Change Impact on Central Mexico (Semarnap, 1997: 32)

- **Conseq. of climate change would be extremely negative.**
- **Drought would increase in severity, affecting mainly the states of Tlaxcala, Puebla, Veracruz and Michoacán** (high vulnerability to desertification over 50% of its surface, with Jalisco. Colima, Nayarit, Queretaro, Hidalgo and Guanajuato Severe water supply problems, and this would **worsen under climate change.**
- Industrial corridors of Iapuateo-Celaya-Salamanca-León (Guanajuato) 6 of Tula-Vito-Apso (Hidalgo) would be severely affected. Lands for non-irrigated maize in Jalisco, Nayarit, Guanajuato, Aguascalientes, Mexico, Colima and northern Michoacán would change from moderately suitable and suitable to unsuitable, reducing the agricultural potential of these states.
- The forest ecosystems most affected in this central region would be the temperate forests in eastern Michoacán, the northern Morelos and wet, temperate forests of the Zongolica sierra in Veracruz. The coasts of Veracruz (Alvaredo Lagoon), are vulnerable to the rise in sea level.

## 6.9. Norman Myers: Ultimate Security (1996)

- **Norman Myers** sceptical on Mexico's future pointing at the vicious circle of environmental degradation, soil erosion and dropping agricultural yields.
- Global warming takes hold, whereupon Mexico becomes warmer and drier, a situation made worse through reduced rainfall. The result is that non-irrigated croplands produce less than half, sometimes one fifth, of what they had before.
- By 1997 the outlook looks beyond remedy, and the migratory surge across the Rio Grande swells several times beyond earlier levels, reaching 5 million in 1998. In reaction, the American government tries to close most of the border. This 'cactus curtain' simply triggered fresh desperation in Mexico, and still large multitudes seek sanctuary in the United States with enraged throngs storming border posts (Myers 1996: 147).

## 6.10. Survival Dilemma for Campesinos BMU-Study (2002)

- Many Mexican campesinos and workers went to the US to work on farms to sustain the survival of their families back home.
- The projected impacts of climate change on water and agriculture will increase the pressure of the rural population to move to the next major urban centre or to the US in search for jobs.
- The search for individual jobs and for the survival of the family has been and will increasingly become a root cause for urbanisation and migration.

## 6.11. Impact of Climate Change on Security of Mexico in 21st Century?

- The consequences [for Mexico] of not creating nearly 15 million jobs in next fifteen years are unthinkable. The youths who can not find them will only have 3 options: the United States, the streets, or revolution.  
J.G. Castañeda, UNAM, 1985 [Myers 1996: 139]
- How may climate change affect the national security of Mexico in the 21st century? While specific predictions are hardly possible, nevertheless it may be foreseen that **climate change as one of several factors contributing to environmental stress in the past and even more so in the future may contribute to domestic societal and political instability.**
- Much will depend on the performance of Mexico's economy in the decades to come. But this require an additional price: **growing agricultural output and industrial production will increase the global warming gas emissions.** Thus, the **development and implementation for national strategies of sustainable development** becomes a major task to mitigate against the climate change impacts and to reduce the environmental stress.

## 6.12. My conclusion in BMU-Study of 2002

- Climate change has already been in the 20th century a factor contribution to environmental stress, during the 21st century the impacts of climate change will become more severe and among the countries that will be significantly affected will be Mexico.
- With high population growth climate change impacts will become more severe due to the increasing demand for water and agricultural land.
- A bilateral migration regime between the US and Mexico could become the easiest and most effective solution that would counter the graying of America.
- There is no traditional security-related military solution to these new challenges for environmental stress. Higher walls, better border detection devices & more police will not be able to contain the socio-economic consequences of climate change, rather, in the long-run effective and stringent climate policies with higher and legally binding QELROs may be the most cost-effective solution.

## 6.13. Grotian Policy Recommendations

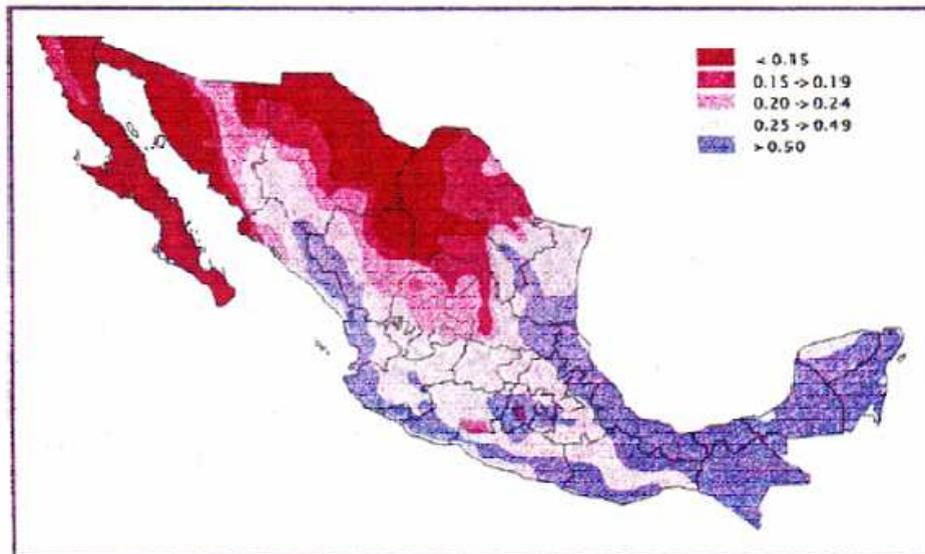
- The main thesis of this study is that cooperative climate *mitigation* strategies are needed that must be linked with policies to assist most affected countries.
- This requires policies that contain the manifold causes of insecurity & instability & that aim at a regional peace based on equity and strategies of sustainable development that may also be associated with the concept of a “sustainable peace”.
- These policies should assist these countries to *adapt to* and to *cope with* these projected effects of extreme weather events and long-term climate change impacts

# 7. Implications of Desertification for Security: Migration and Conflicts

- Desertification is a slow-onset environmental challenge to security and survival, especially for the poor.
  - Affects the individual, family, village, region and their security
  - Affects survival of rural population: contributes to rapid urbanis.
  - Vicious circle: Poverty contributes to desertification & desertification often intensifies poverty. (dual cause and effect relationship)
- Drought, migration and famine are situational challenges to security and survival, especially for the poor.
  - Drought as a hydro-meteorological hazard (partly caused by Climate change and its interaction with desertification) has forced people to leave their home and livelihood
  - Drought has often resulted in famine and/or food price increases that often led to strikes, hunger revolts, domestic crises and conflicts.

# 7.1. Desertification, Migration and Conflict – Case of Mexico: Annual Aridity & Precipitation

Index of Aridity

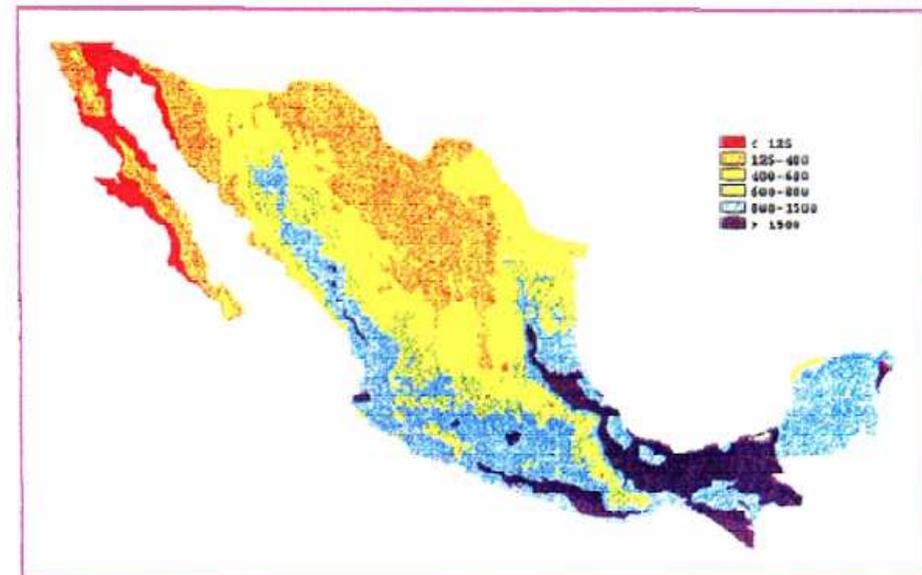


Ratio between annual precipitation and average evaporation

< 0.15	very arid area (desert)
0.15 - 0.20	arid area
0.20 - 0.25	semi arid area
0.25 - 0.50	dry and subhumid area
> 0.50	humid area

Source:  
Atlas Nacional del Medio Físico de México de INEGI  
Mapas Temáticos de INEGI  
Atlas Nacional de México de UNAM

Annual Precipitation

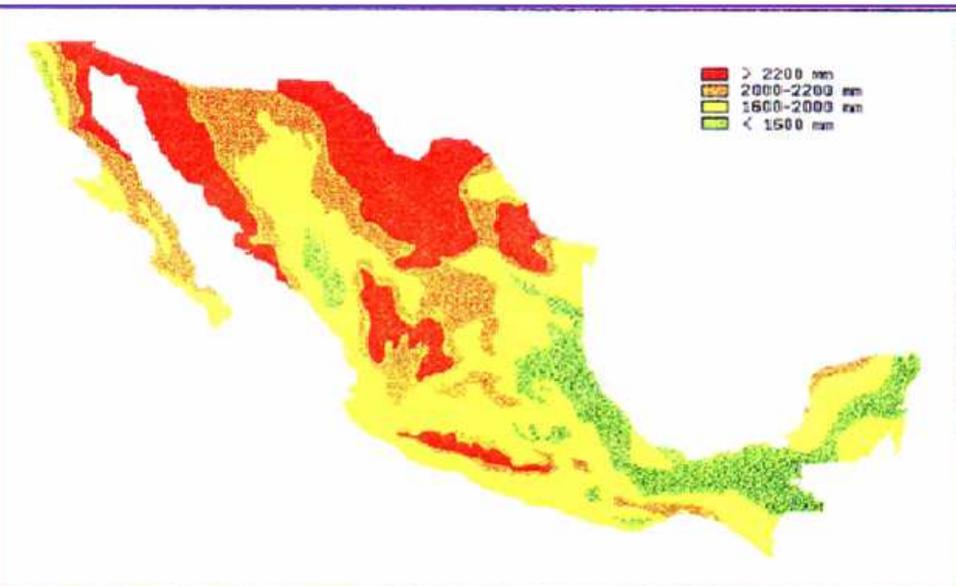


0 - 125 mm	0 - 5 inches
125 - 400 mm	5 - 16 inches
400 - 600 mm	16 - 24 inches
600 - 800 mm	24 - 31 inches
800 - 1500 mm	31 - 59 inches
> 1500 mm	> 59 inches

Source:  
Atlas Nacional del Medio Físico de México de INEGI  
Mapas Temáticos de INEGI  
Atlas Nacional de México de UNAM

# 7.2. Dryness and Desertification in Mexico: Annual Evaporation & Dry months per year

**Average Annual Evaporation**

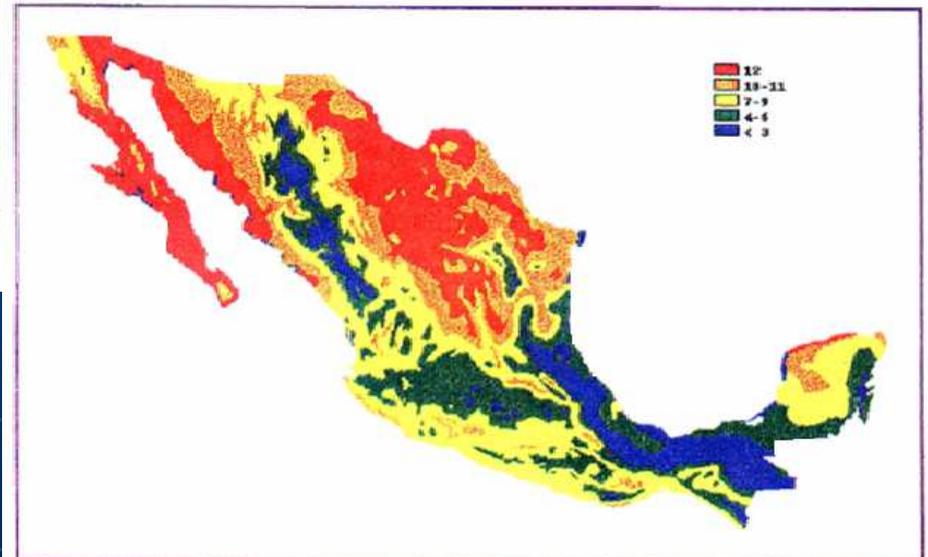


■ > 2200 mm  
■ 2000-2200 mm  
■ 1600-2000 mm  
■ < 1600 mm

> 2200 mm      > 83.6 inches  
 2200 - 2000 mm      78.7 - 86.5 inches  
 2000 - 1600 mm      62.9 - 78.6 inches  
 < 1600 mm      < 62.8 inches

Sources:  
 Atlas Nacional del Medio Físico de México de INEGI  
 Mapas temáticos de INEGI  
 Atlas Nacional de México de UNAM

**Average Number of Dry Months Per Year**

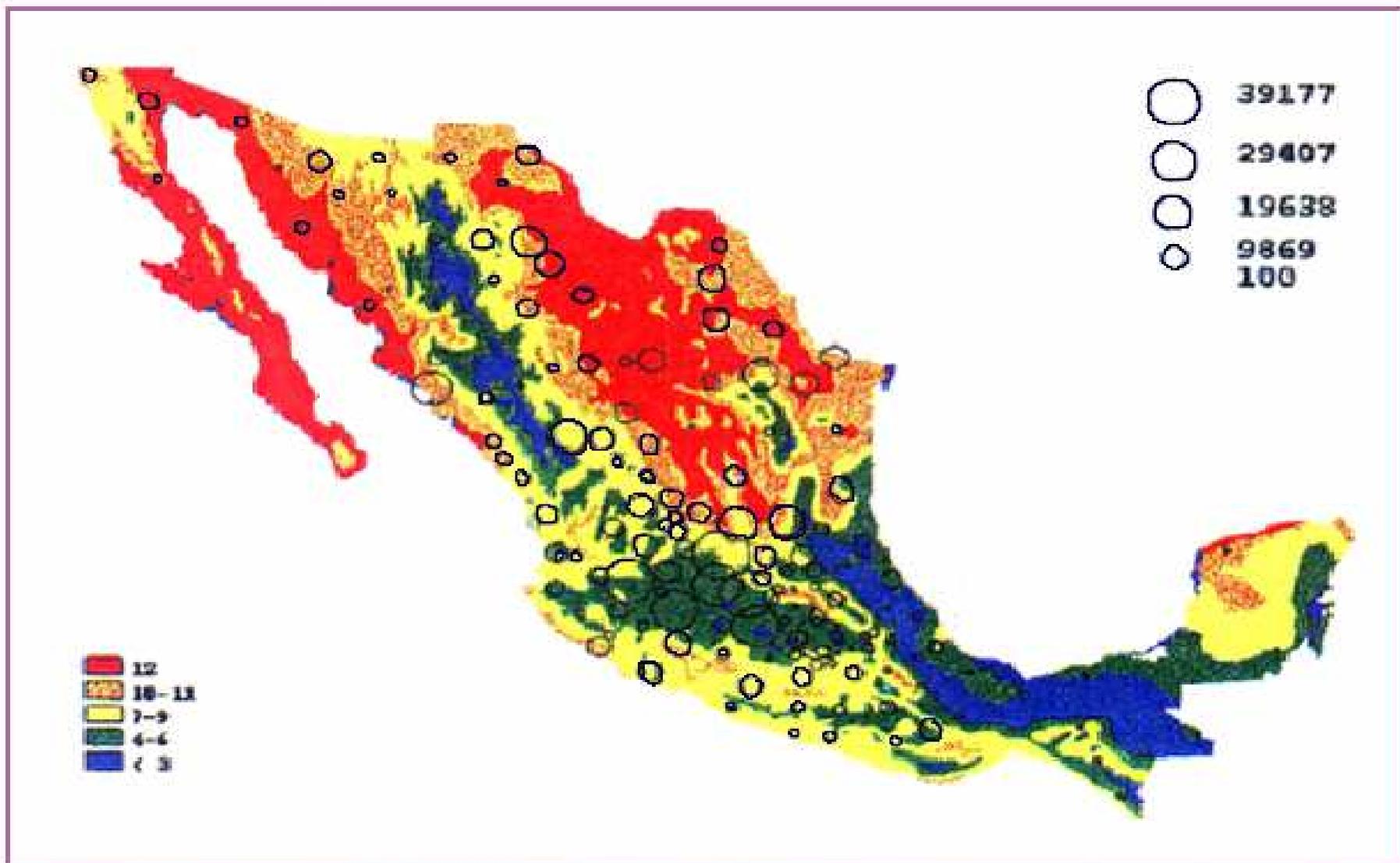


■ 12  
■ 10-11  
■ 7-9  
■ 4-6  
■ < 3

Months:  
 12      arid area  
 10 - 11      semi-arid area  
 7 - 9      dry and subhumid areas  
 4 - 6      humid area  
 < 3      very humid area

Sources:  
 Atlas Nacional del Medio Físico de México de INEGI  
 Mapas temáticos de INEGI  
 Atlas Nacional de México de UNAM

# Number of Dry Months and Migration

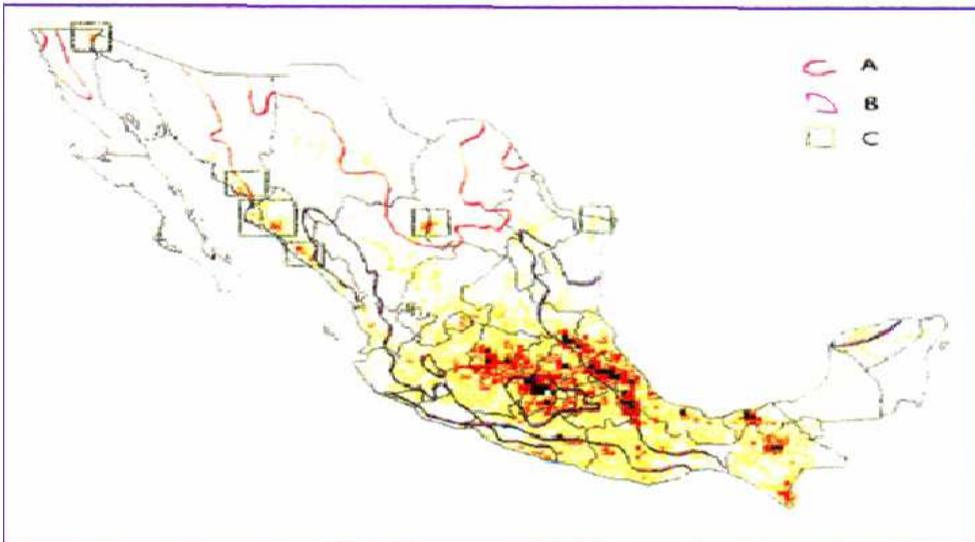


Number of dry months and flow (estimation for 1993) of Mexican migrants living and working in the US, surveyed on the border on their return to Mexico (spatial distribution according to their region of birth in Mexico, rural and urban localities).

Sources:  
 Survey on Mexican-US migratory flow (COLEF)  
 Atlas Nacional de México de INEGI  
 Sistema de Información Geográfica y Estadística de la  
 Frontera Norte (COLEF-DES-FON)

# 7.4. Dryness and Desertification in Mexico: Aridity and Rural Migration

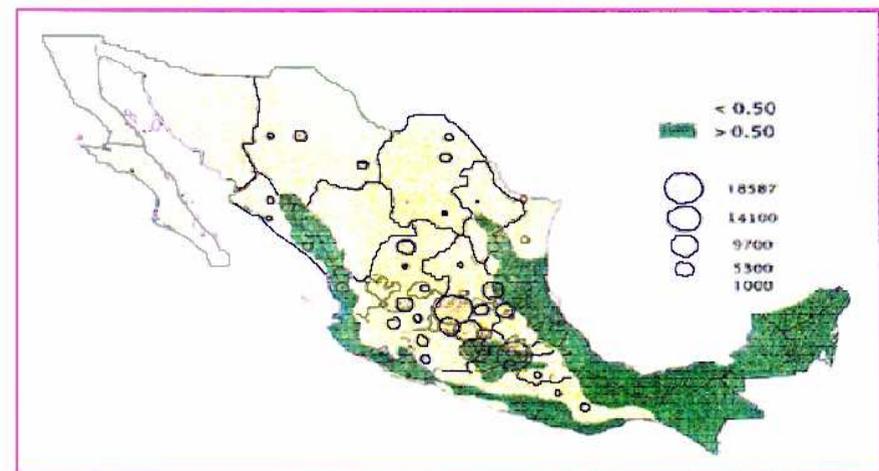
**Aridity and Density of Rural Population**



A- Transition from arid to dry area  
 B- Transition from dry to humid area  
 C- Arid area with irrigation  
 Density of rural population (living in localities of less than 2500 inhabitants) in 1990 (X Mexican Census).

Sources:  
 X Censo de Población y Vivienda, 1990  
 INEGI  
 Atlas Nacional de México de INEGI  
 Sistema de Información Geográfica y Estadística de la Fecundación y Fecundación (SIEF) (INEGI)

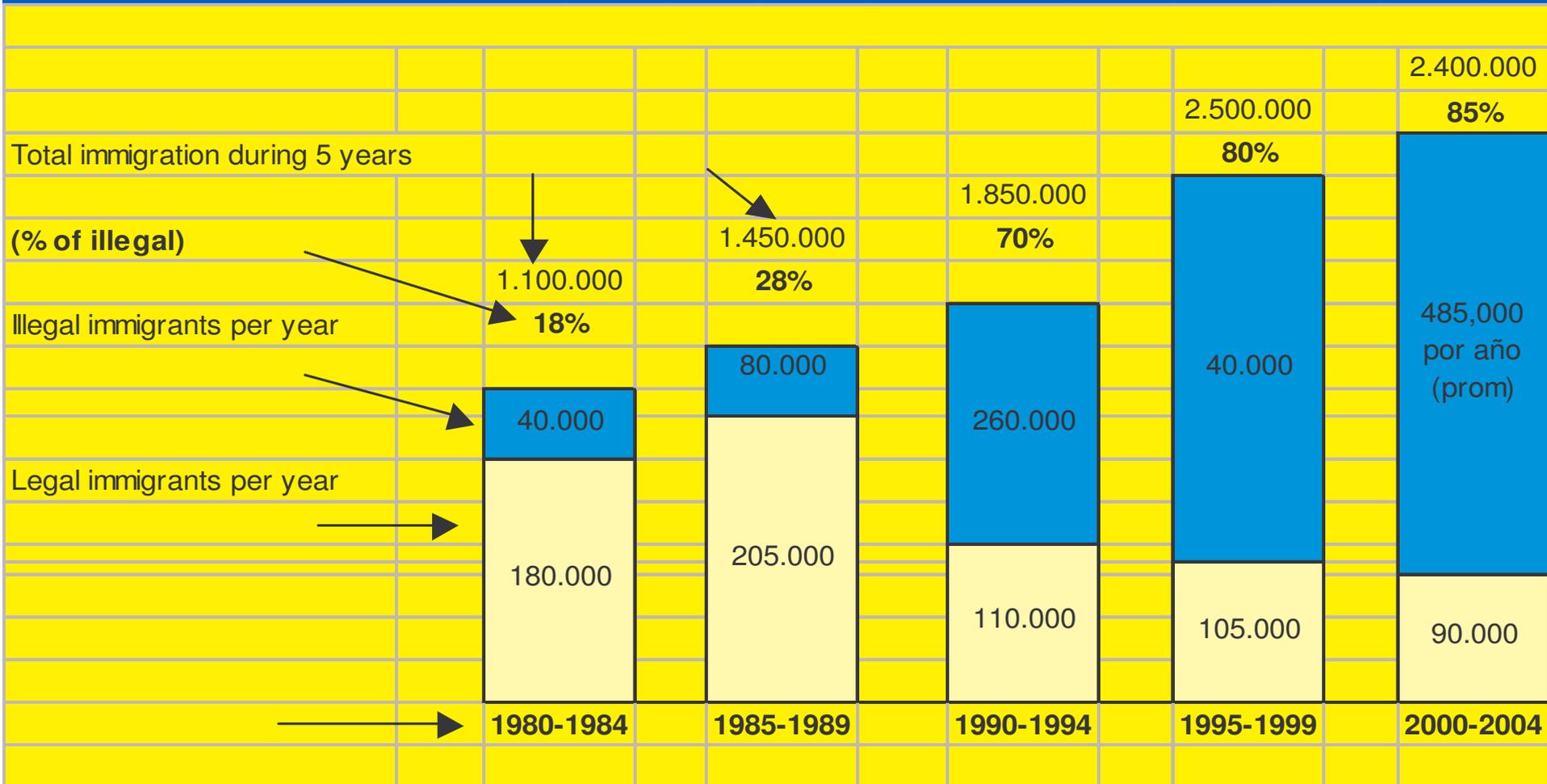
**Rural Migration and Aridity**



- Arid and dry areas (< 0.50)  
 - Humid area (> 0.50)  
 - Flow of Mexican migrants in 1995, living and working in the US, surveyed on the border on their return to Mexico (spatial distribution according to the region of last residence in rural localities of Mexico).

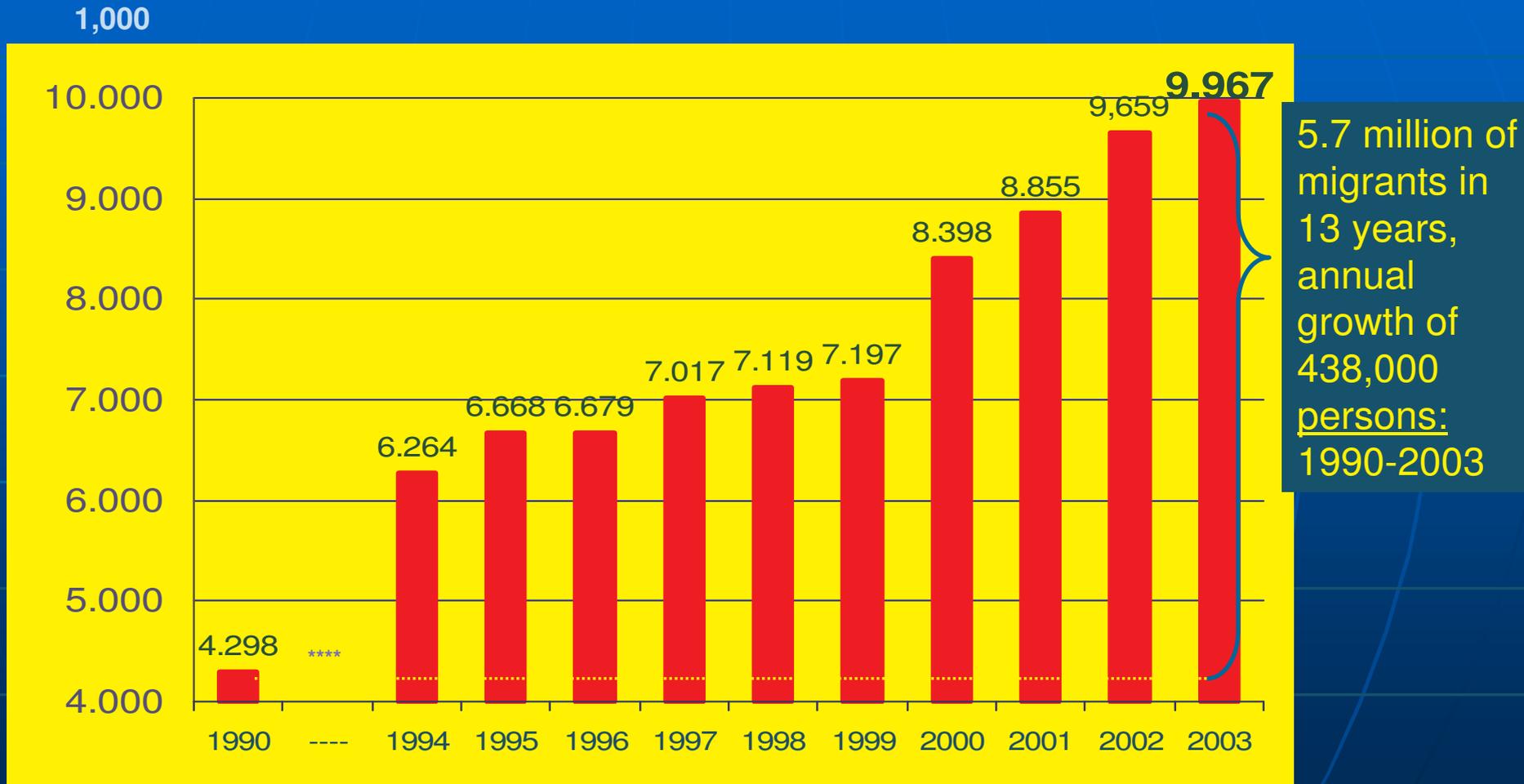
Sources:  
 Sistema de Información Geográfica y Estadística de la Fecundación y Fecundación (SIEF) (INEGI)  
 Atlas Nacional de México de INEGI  
 Sistema de Información Geográfica y Estadística de la Fecundación y Fecundación (SIEF) (INEGI)

# 7.5. Migrants to USA from Mexico by Legal Status



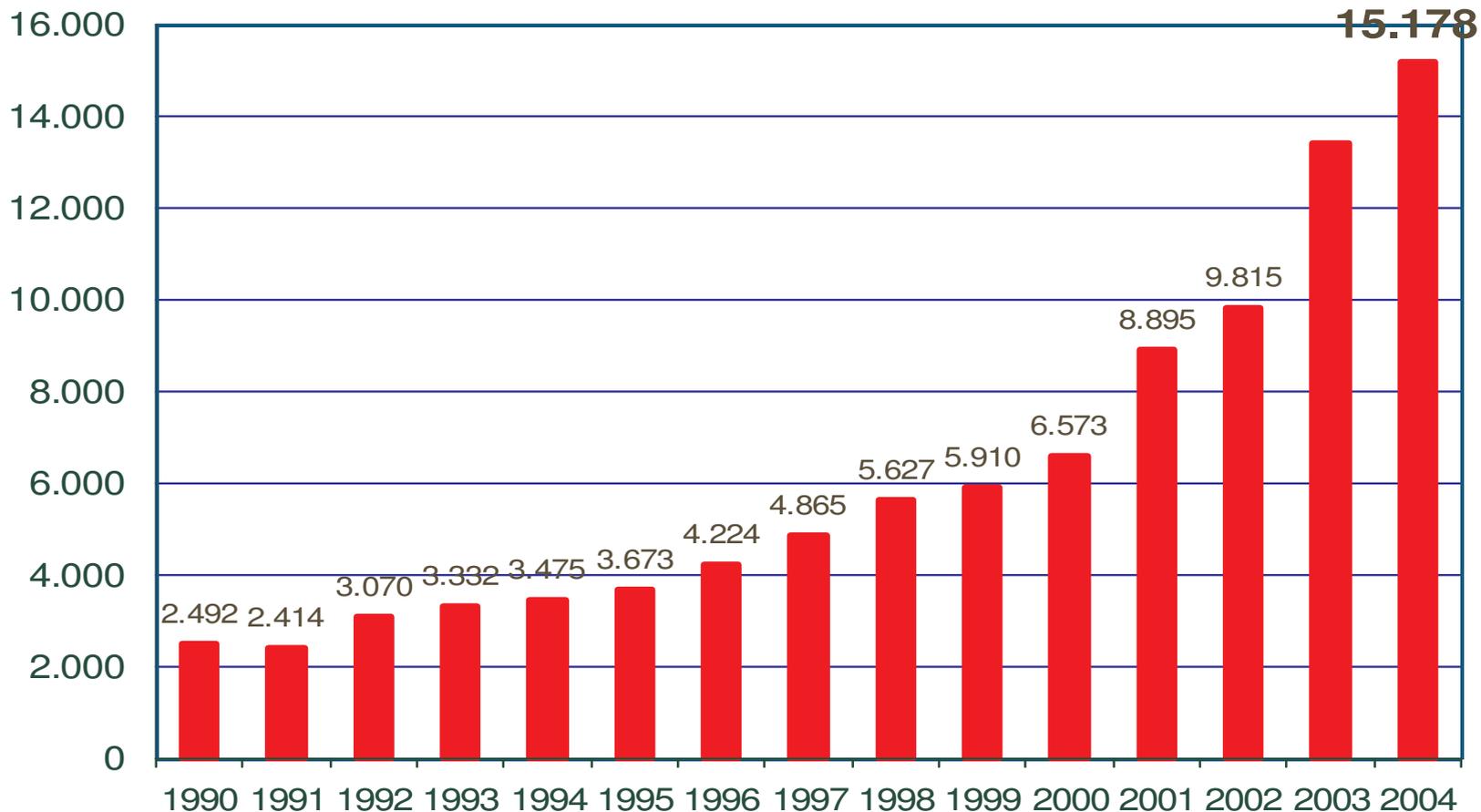
Source: Pew Hispanic Center, Estimation of the Amount and Characteristics of Undocumented Population Living in USA

# 7.6. Mexican Migrants to USA 1990- 2003 (1000 Persons)



SOURCE: Public-use files from the US Census Bureau, Current Population Survey, March Supplement, elaborated by Fernando Lozano, 2005

# 7.7. Remittance From Migrants Sent to Mexico, 1990-2004 (1'000,000 US \$)



January-  
Nov.,  
2004

Average  
2004:  
**1.380**  
billion  
dollars

SOURCE: Informes Anuales Banco de México, varios años. [www.banxico.org.mx](http://www.banxico.org.mx), elaborated by Fernando Lozano, CRIM, 2005

# 8. Climate Change & Desertification: Human & Environmental Security

- **Both climate change and desertification** pose „soft security“ threats, challenges, vulnerabilities and risks not only for **environmental and human security** & for **national security** (see: Debate on immigration in US from Mexico; in European Union from Africa & Asia, but also in India on immigration from Bangladesh).
- **New environmental threats, challenges, vulnerabilities & risks** require non-military coping strategies:
  - Effective policies & implementation to cope with **climate change**: by reducing greenhouse gas emissions in all countries;
  - A shift from fossil energy fuels to **renewable energy sources**;
  - Development & implementation of strategies of **reforestation & combatting soil erosion & desertification**;
  - Effective strategies of **integrated water management** (demand and supply)

# 8.1. Increase in Human Disasters & Conflicts

Will these fatal outcomes of global environmental change (GEC) and climate change (CC) lead to conflicts?

## Hypotheses

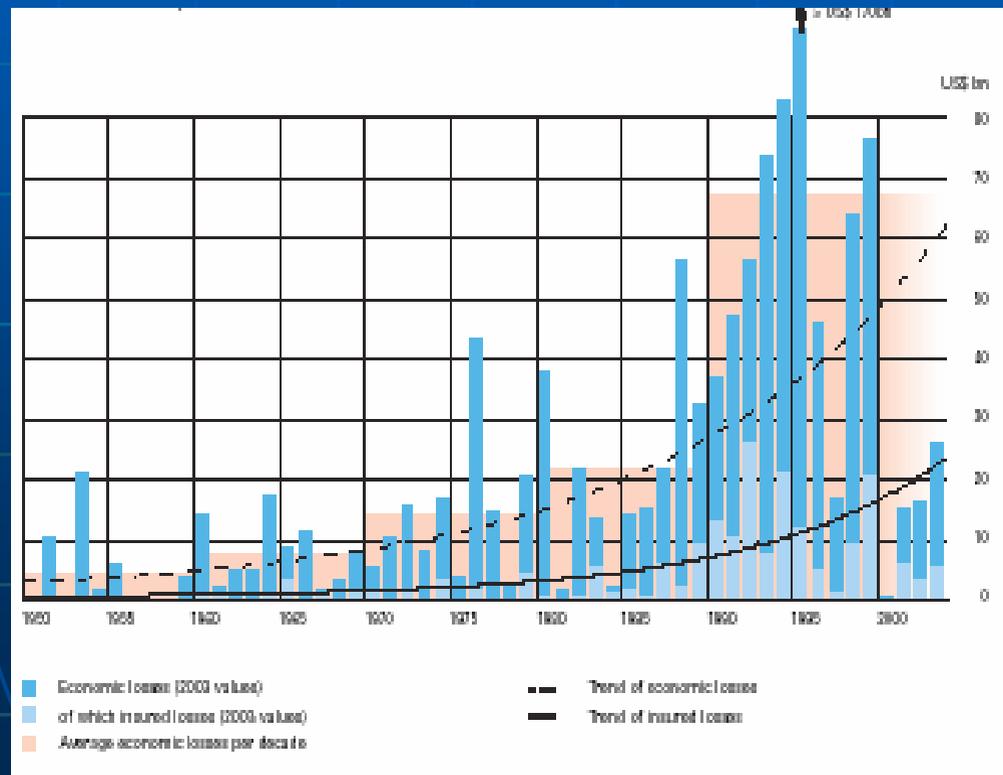
- **Thesis 1:** Population growth, urbanisation & persistent high poverty will increase the societal vulnerability to hazards and disasters.
- **Thesis 2:** Extreme weather events will very likely increase hydro-meteorological hazards (droughts, flash floods and storms).
- **Thesis 3:** Environmental stress and hazards may trigger distress migration and low level conflict potentials within societies and among states.

## Distribution of natural disasters: by origin (1900-2003, by decades\*)

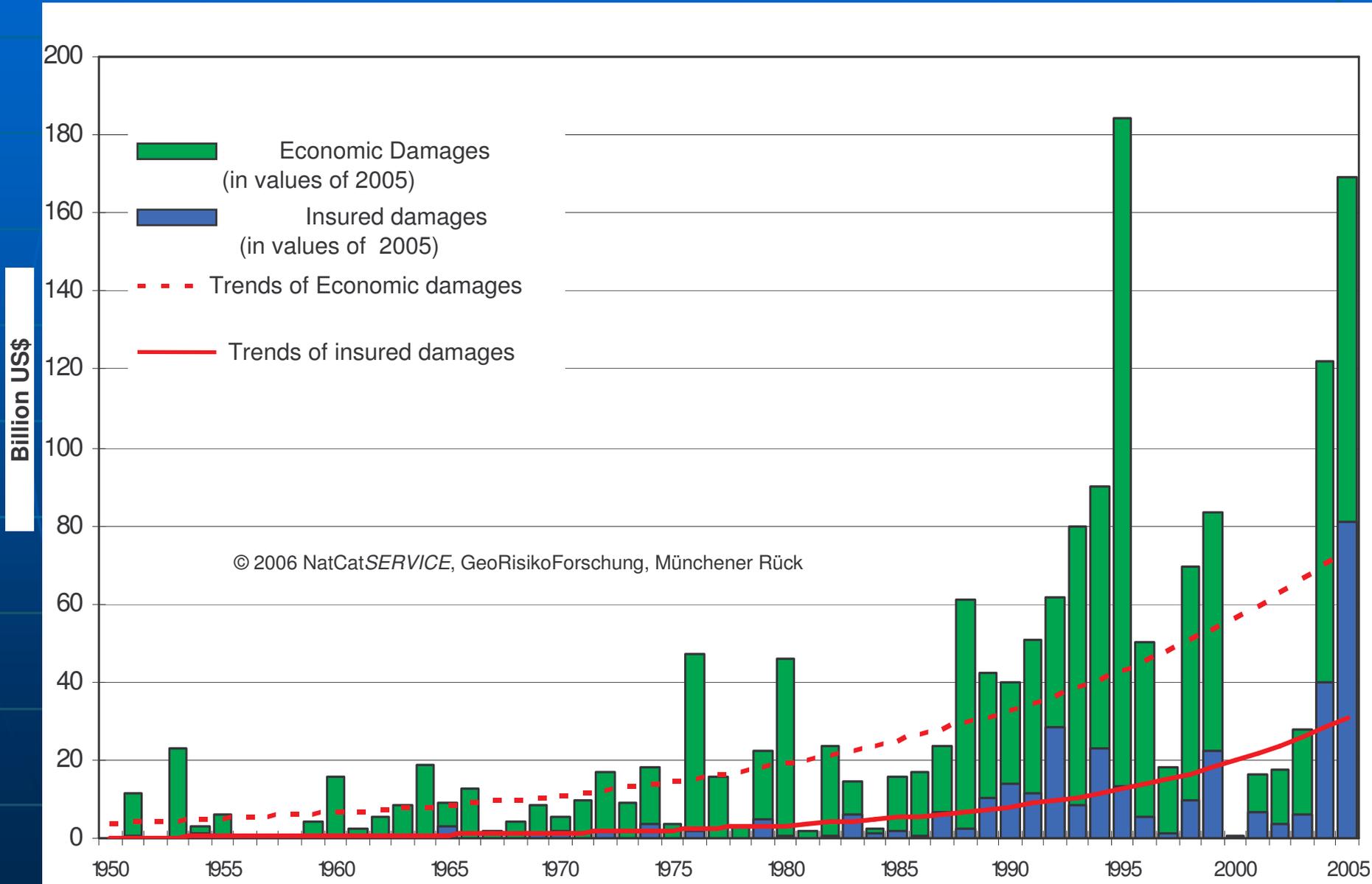
	1900-1909	1910-1919	1920-1929	1930-1939	1940-1949	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2003	Total
Hydro-meteorological	28	75	56	74	128	280	511	795	1575	2139	1444	7105
Geological	36	26	32	38	53	58	94	128	234	283	152	1134
Biological	5	12	10	3	3	3	40	65	167	351	297	956
<b>Total</b>	<b>69</b>	<b>113</b>	<b>98</b>	<b>115</b>	<b>184</b>	<b>341</b>	<b>645</b>	<b>988</b>	<b>1976</b>	<b>2773</b>	<b>1893</b>	<b>9195</b>

650 990 2000 2800 4700

## 8.2. Global Impacts of Natural Hazards

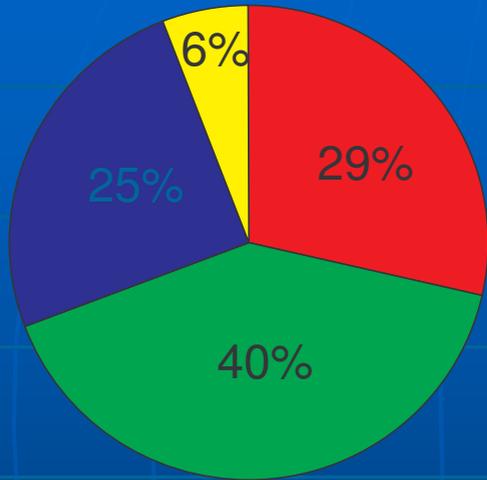


# 8.3. Major Natural Hazards (1950-2005), Economic and Insured Losses



# 8.4. Major Natural Hazards (1950-2005)

267 Events



Geological events

Earthquake/Tsunami, Volcano

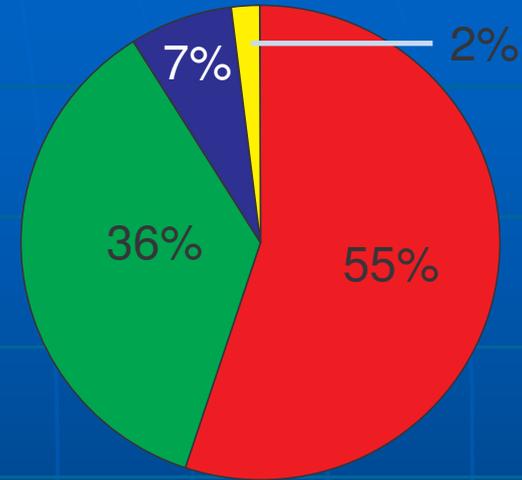
Weather-related events

Storm

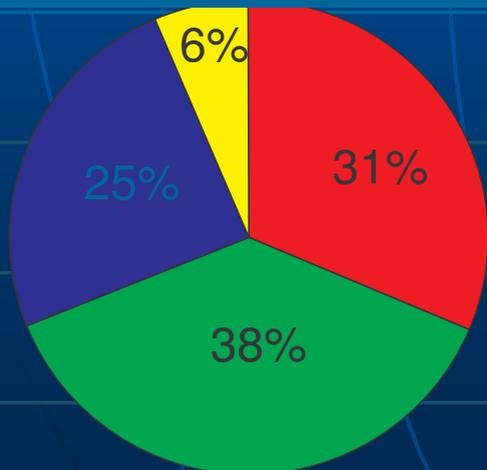
Floods

Extreme temperatures

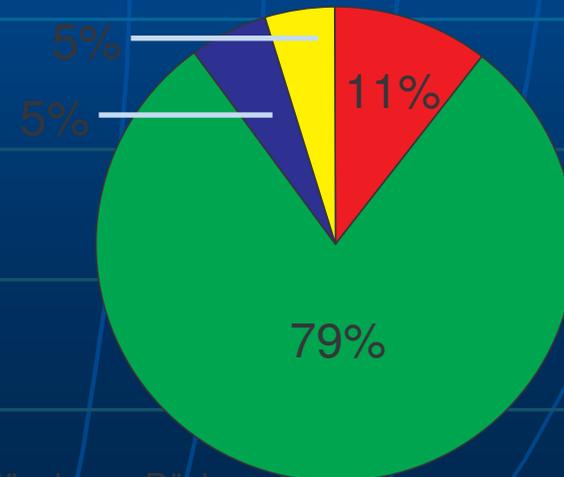
1,75 Million Dead



Economic damage: 1.400 billion US\$

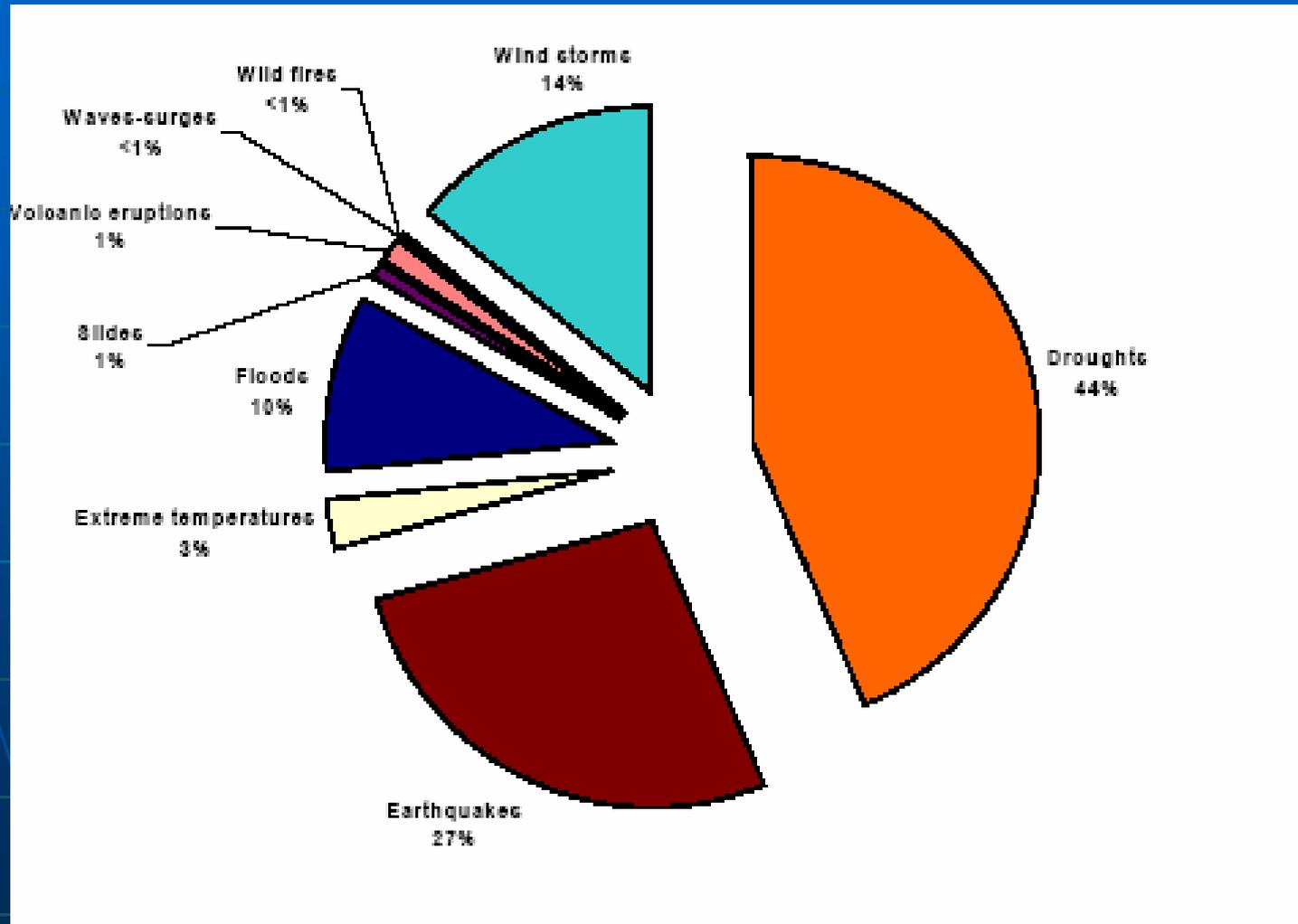


Insured damage: 340 billion US\$



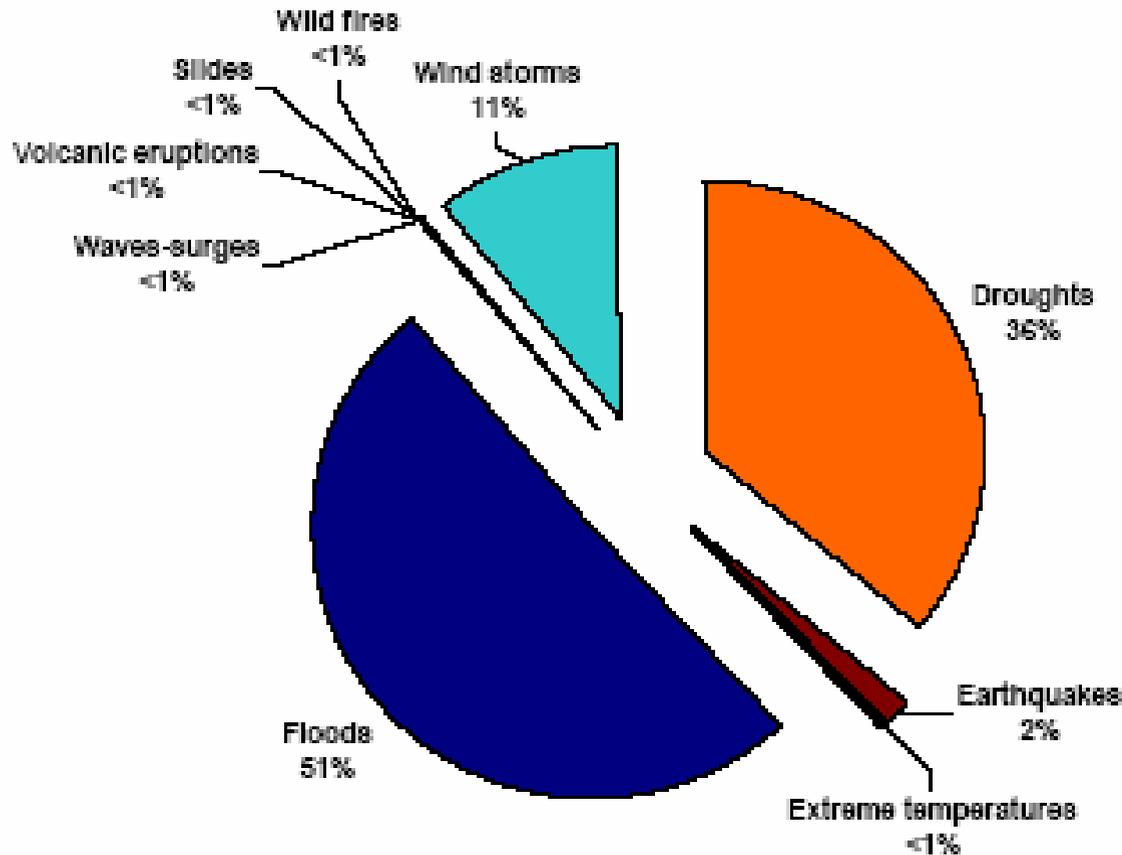
\*in Werten von 2005

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



Source: Hoyois und Guha-Sapir (2004)

# 8.6. Affected persons of Natural Hazards globally (1974-2003): 5 076 494 541 persons



(1) injured + homeless + affected

Source: Hoyois und Guha-Sapir (2004)



## 8.7. Natural Hazards in Mexico

(Source: CRED: number of people killed)

<b>Disaster</b>	<b>Date</b>	<b>Killed</b>
Earthquake	19-Sep-1985	9,500
Flood	1959	2,000
Volcano	1949	1,000
Wind Storm	27-Oct-1959	960
Flood	12-Sep-1999	636
Wind Storm	1-Oct-1976	600
Wind Storm	28-Sep-1955	500
Earthquake	28-Aug-1973	500
Wind Storm	12-Nov-1961	436
Extreme Temperature	30-Apr-1990	380



# 8.8. Natural Hazards in Mexico

(Source CRED: number of people affected)

<b>Disaster</b>	<b>Date</b>	<b>Total Affected</b>
Earthquake	19-Sep-1985	2,130,204
Wind Storm: Rita	1-Oct-2005	1,954,571
Wind Storm: Wilma	19-Oct-2005	1,000,000
Wind Storm	8-Oct-1997	800,200
Flood	12-Sep-1999	616,060
Wind Storm	15-Jul-1976	300,000
Wind Storm	1-Oct-1976	276,400
Wind Storm	Aug-1967	271,000
Wind Storm	Dec-1983	257,500
Flood	16-Sep-1993	231,290



## 8.9. Natural Hazards in Mexico

(Source CRED: economic damage costs)

Disaster	Date	Damage US\$ (000's)
Earthquake	19-Sep-1985	4,104,000
Wind Storm	22-Jun-1993	1,670,000
Drought	May-1996	1,200,000
Flood	3-Sep-1998	602,700
Flood	12-Sep-1999	451,300
Wind Storm	8-Oct-1997	447,800
Wind Storm	24-Sep-2001	400,000
Wind Storm	17-Jan-1988	250,000
Wind Storm	10-Oct-1995	241,000
Earthquake	15-Jun-1999	226,800

## 8.10. Summarized Table of Natural Disasters in Mexico (1929-2005)

	# of Events	Killed	Injured	Homeless	Affected	Total Affected	DamageUS (000's)
<b>Drought</b>	8	0	0	0	65,000	65,000	1,729,500
ave. per event		0	0	0	8,125	8,125	216,188
<b>Earthquake</b>	27	10,677	33,287	112,275	2,411,015	2,556,577	4,691,000
ave. per event		395	1,233	4,158	89,297	94,688	173,741
<b>Epidemic</b>	2	68	0	0	11,525	11,525	0
ave. per event		34	0	0	5,763	5,763	0
<b>Extreme Temperature</b>	16	1,207	0	16,000	0	16,000	82,600
ave. per event		75	0	1,000	0	1,000	5,163
<b>Flood</b>	45	4,083	659	165,990	1,336,695	1,503,344	1,491,900
ave. per event		91	15	3,689	29,704	33,408	33,153
<b>Slides</b>	6	202	0	120	200	320	0
ave. per event		34	0	20	33	53	0
<b>Volcano</b>	10	1,120	500	15,000	146,408	161,908	117,000
ave. per event		112	50	1,500	14,641	16,191	11,700
<b>Wild Fires</b>	3	83	0	0	0	0	83,200
ave. per event		28	0	0	0	0	27,733
<b>Wind Storm</b>	61	4,972	1,803	616,250	4,927,386	5,545,439	3,943,345
ave. per event		82	30	10,103	80,777	90,909	64,645

## 8.11. Desertification & Drought: A Security Issue?

- **Desertification & drought pose environmental security challenges, vulnerabilities and risks.**
- **Desertification & drought are human security challenges.**
  - **Referent: individual, family, village, province**
  - **Value at risk: human survival & livelihood of the poor with low resilience**
  - **Cause of the challenge: nature (GEC), nation states & globalisation processes**
- **Desertification & drought is a food security challenge.**
- **Drought & famine poses a health security challenge.**
- **Drought, famine and drought & famine-induced migration: poses livelihood security challenges, vulnerabilities & risks**
- **Drought, famine & migration: may trigger violent social consequences and thus become: social, national & international security challenges, risks and only in very extreme cases military threats.**

# 8.11. Policy Implications for Human & Environmental Security

## ■ **Conclusion:**

- Environmental Security: Widening of scope & actors
- Human Security: shifting from state to humankind

## ■ **Task for Research:**

- Development the environmental dimension of human security
- Introduce human security concerns into environmental security
- Develop the fourth phase of research on HESP

## ■ **Task for Policy:**

- Mainstream early warning of hazards & conflicts
- Develop anticipatory learning and proactive policies to mitigate against impacts of GEC (climate change)
- Empower people by building resilience and reducing social vulnerability by poverty eradication policies

# 9. Policy Response to Weather Hazards

## Early Warning & Reducing Social Vulnerability

### By Empowerment & Resilience Building

- **To environmental scarcity, degradation & stress:**
  - **Proactive climate policy:** reduce greenhouse gases by shifting to nonfossil energy resources, especially renewables
  - **Combat desertification and soil erosion:**
  - Cope with water scarcity & degradation by demand-side management and alternative supply (desalination with renewables)
  - Cope with population growth, rural emigration and urbanisation
- **To extreme outcomes of GEC, hydro-meteorological hazards & severe societal consequences:**
  - **Reducing the hazard impact by enhanced early warning against multiple hazards and reducing social vulnerability by improved resilience**
  - **Improved policy of conflict resolution, prevention and adaptation and mitigation against challenges of GEC that may lead to conflicts (anticipatory learning & conflict avoidance)**

# 9.1. From Research to Action: Enhancing Environmental & Human Security

- **Primary Goal:** address fatal outcomes of GEC: hazards and disasters, migration, crises & conflicts that may have been caused, triggered, induced, influenced by: a) environmental stress and b) extreme weather events,
- **Enhance Environmental Security:** Address human behaviour that contributes to GEC via climate change, soil degradation, water pollution & scarcity: sustainable strategies
- **Enhance Human Security:** address factors of GEC that challenge survival of individuals, families, villages, ethnic groups
- **Avoid Environmentally-induced Conflicts:** address structural or causal factors (of Survival Hexagon), e.g. climate policy, combat desertification, cope with water stress.

## 9.2. Environmental Conflict Avoidance: Addressing Causes & Fatal Outcomes

- Environmental and human security strategies: address the two values at risk a) **sustainability** (environmental security); and b) **survival** (human security);
- Deal with the different referent objects of security: a) **ecosystem** (environmental security); and b) individual & mankind (human security);
- Address the different causes of threat, challenge, vulnerability and risk: a) **humankind** (environmental security); and b) **nature, state, globalisation** (human security);
- We need **sustainable development strategies** (development, environment policies addressing 6 GWC-factors).
- We need **survival strategies** (protection & empowerment).

## **9.3. Broaden Policy Constituency:**

### **Climate Change, Disaster & Early Warning (disaster & conflict) & Conflict Prevention Community)**

#### **Four constituencies without scientific & policy interaction**

- ❖ **Early Warning communities (global, regional)**
  - of natural hazards and disasters (UNISDR, EWC)
  - of crises and conflicts
- ❖ **Adaptation and Mitigation efforts**
  - Against climate change (IPCC community)
  - Against natural hazards and disasters (UNISDR, GDIN, etc.)
  - 2 conferences in June 2002: by Dutch (Actor specific) & German (research specific) Foreign Ministries
- ❖ **Mainstreaming of these efforts is needed**
  - early warning of hazards, crises & conflicts (IPCC community)
  - Against natural hazards and disasters (UNISDR, GDIN, etc.)
- ❖ **Major Clients: EU-ECHO: funder & UN-OCHA: coordination**

# 10. Policy Responses to Climate Change: Sustainable Renewable Energy Policy

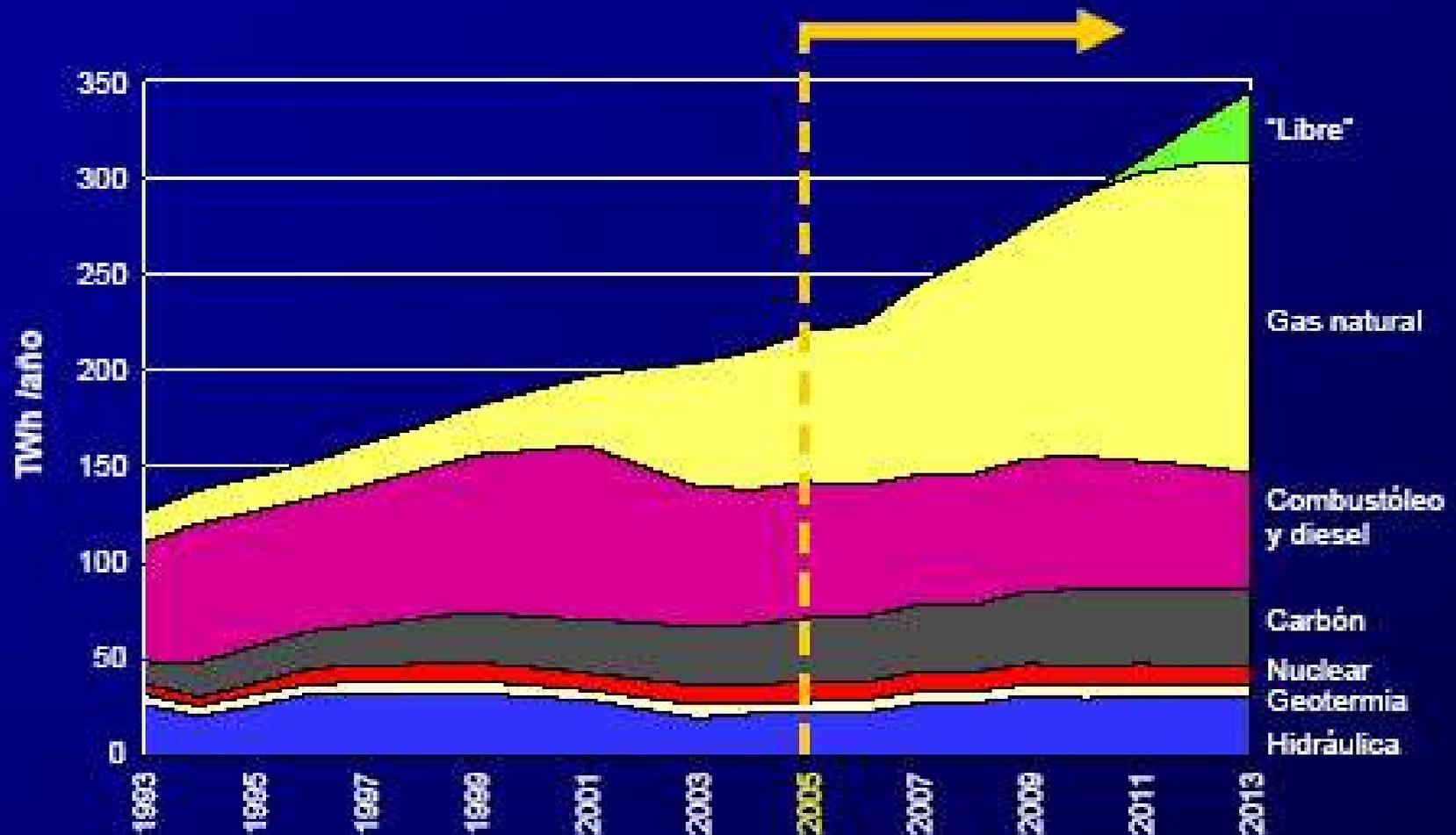
## **Climate Change Report of Mexican governm. (1997):**

- Mexico's natural resources and environment suffer from chronic degradation, its high rates of loss of biodiversity, deforestation, soil erosion, desertification, severe pollution of the country's major water resources, not to mention the air of its principal cities.
- The afore-mentioned problems are further exacerbated by the fact that the countries population and economic activities are not distributed in accordance with the availability of water, which is more plentiful in the south-eastern region of Mexico. Mexico's population, on the other hand, is concentrated in the central, northern and north-eastern region of the country, where water is scarce (MÉXICO 1997: 14).

# 10.1. Gradual Shift to Renewable Energy

- **IEA: World Energy Outlook (2005):** Mexico increase in the oil production from 3,8 (2004) to 3,9 million barrels per day (210) and then a decline to 3,4 (2030).
- Juan Mata (DG Research, Sec de Energia, Feb. 2006): projection for power sector in Mexico: 2005-2013: diesel: decline; minor increase in coal, hydrop., doubling of natural gas, new renewables
- US\$ Mio 25-46 large scale wind energy project
- Projects (GEF, GTZ, USAID, REEEP: public-priv. partnership, launched by UK in Johannesburg, HQ in Vienna) of Gov. of Mexico:
  - Methodology for assess value of risk reduction be RE
  - Contribution of itnermittent sources to grid capacity
  - Small-scale self-supply (PV)
  - Dispatch & planning models to incorporate wind in elect. Sector
  - Long-term prospective study of RE
  - **REEEP: Latin American Regional Sustainable Energy Policy Development Forum**

- Power sector: A growing dependence on natural gas...



## 10.3. For Cooperative Strategies in Dealing with Environmental and Human Security Challenges

- Climate change, desertification & water scarcity & degradation are real: will have global impacts & for Mexico in 21st century,
- Environmental & human security challenges have affected and will affect Mexico even more during the 21st century;
- As a multi-hazard country: Mexico has increasingly been affected by water-related hazards (hurricanes, floods, droughts, land-slides). She has increased & economic damage (e.g. in 2005)
- Energy sector: is cause and one of long-term solutions to global warming:
- Mexico has large potential of geothermal, solar (thermal & PV), wind power, biomass, rural & urban waste: electricity, hydrogen
- Declining reserves of oil & gas and rising demand (population & economic growth): two key drivers for renewables
- Cooperation: UN, UNESCO, OAS, NAFTA, HSN (Canada, Chile, Costa Rica)
- Cooperation with Germany & other EU countries on electricity feed-in law & new energy law, wind power, solar power (huge unused potential of deserts)

**Thank you**

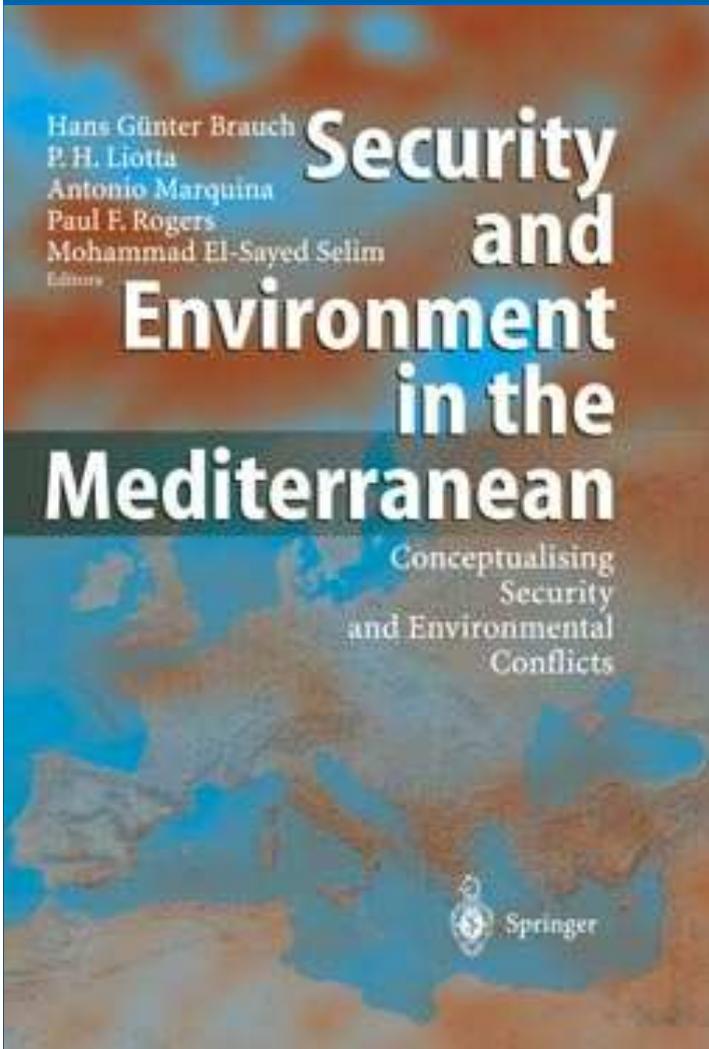
**for inviting me and giving me  
an opportunity to share with  
you my conceptual ideas.**

**Thank you for your attention  
and patience.**

**Send your comments to:  
[brauch@onlinehome.de](mailto:brauch@onlinehome.de)**

# Sources:

[http://www.afespress.de/html/download\\_hgb.html](http://www.afespress.de/html/download_hgb.html)



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- ❖ Brauch-Liotta-Marquina-Rogers-Selim (Eds.): *Security and Environment in the Mediterranean* (Berlin – New York – Paris – London -Milan: Springer 2003) ([http://www.afes-press.de/html/bk\\_book\\_of\\_year.html](http://www.afes-press.de/html/bk_book_of_year.html))
- ❖ Brauch: *Environment and Human Security. Towards Freedom from Hazard Impacts*. UNU-EHS: Intersections 2/2005
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