



**25. GENERAL  
CONFERENCE OF  
INTERNATIONAL PEACE  
RESEARCH ASSOCIATION  
IPRA ON UNITING FOR  
PEACE: BUILDING  
SUSTAINABLE PEACE  
THROUGH UNIVERSAL  
VALUES**



**Systemic model of water management for conflict resolution with people and nature**

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- 5. Water management of Mexico: regional, social and temporal inequality**
- 6. Water security and food security: NAFTA and virtual water**
- 7. Overcoming food and water insecurity with social and gender justice**

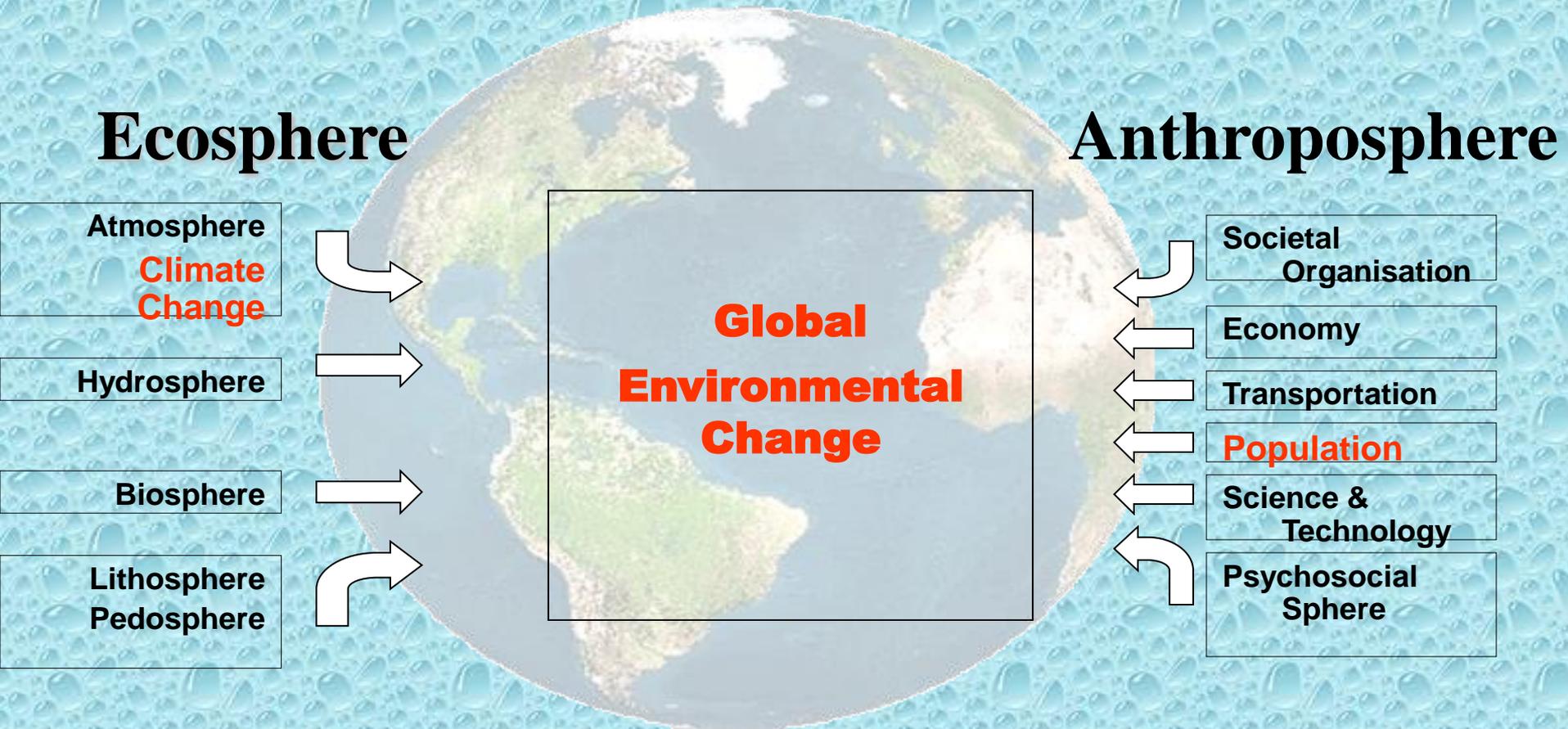
## **Research questions**

**How can developing countries and especially Mexico overcome the present unequal access of water without further destroying the precarious water and food security, and how could small-scale farmers and especially women, depending on rain-fed agriculture, support the recovery of the food sovereignty in the country?**



**2. Global environmental change (GEC) and climate change (CC)**

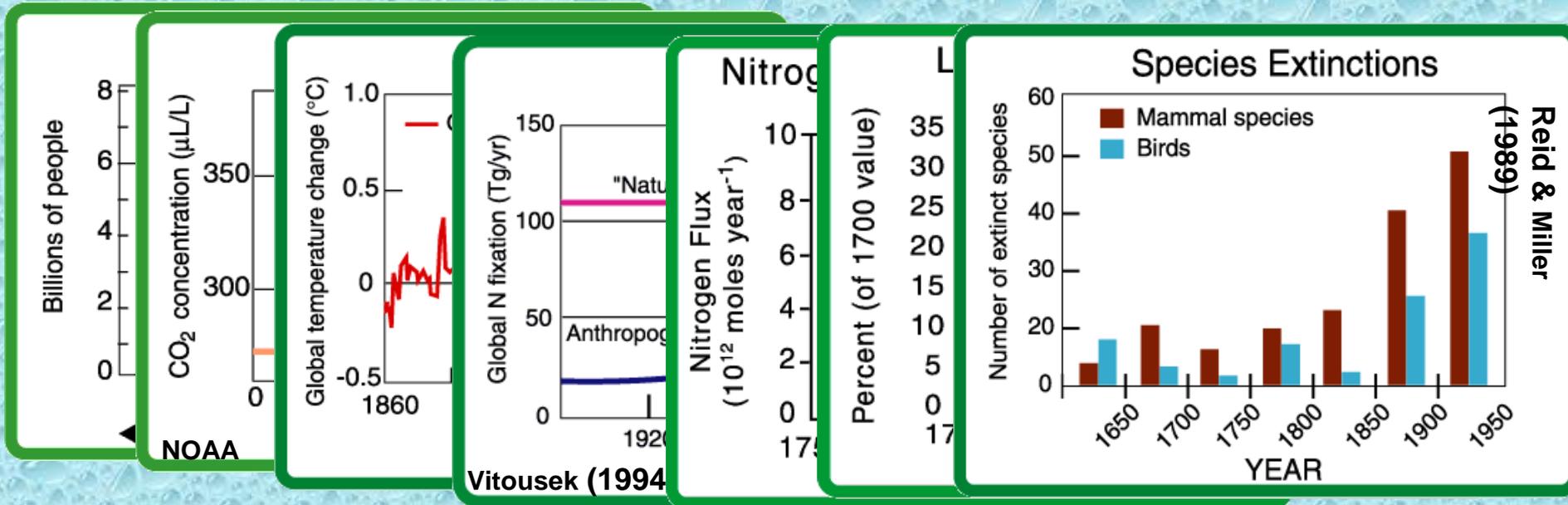
# Global Environmental Change (GEC)



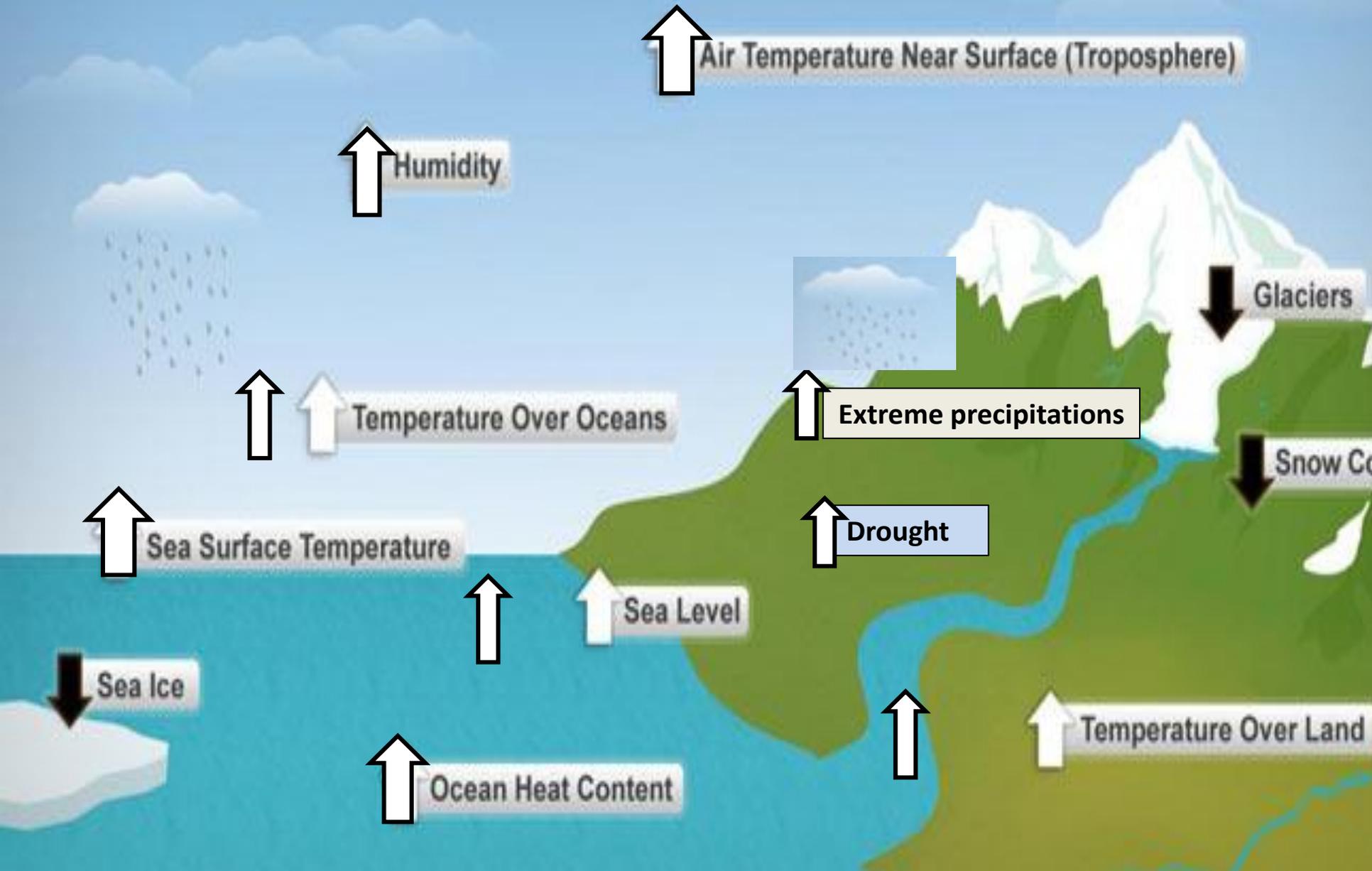
**GEC poses a threat, challenge, vulnerabilities and risks for human security and survival.**

# What is global environmental change (GEC)?

- GEC is more than climate change
- It includes the natural **plus** the human factors
- It is a constellation of changes in different domains such as:



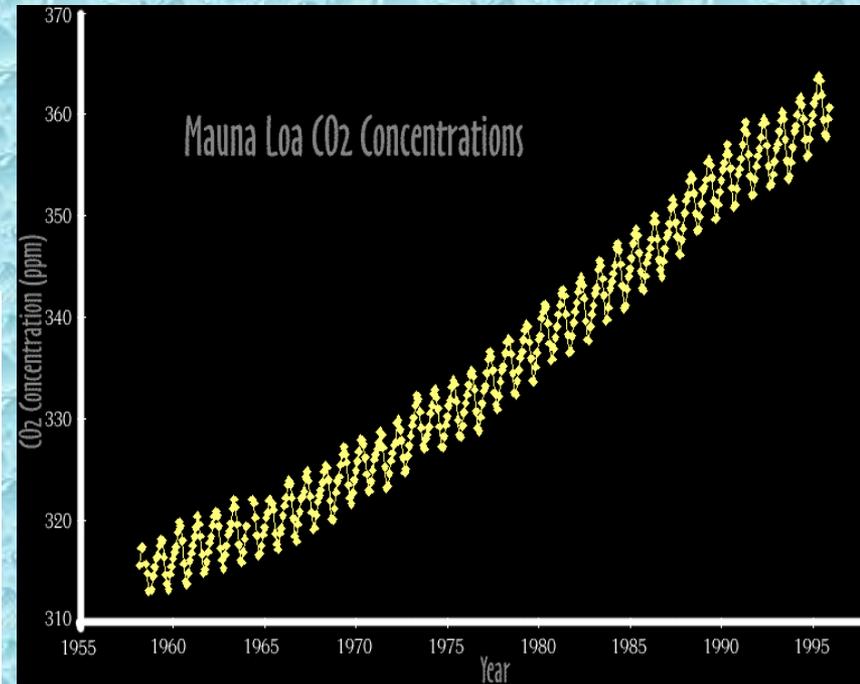
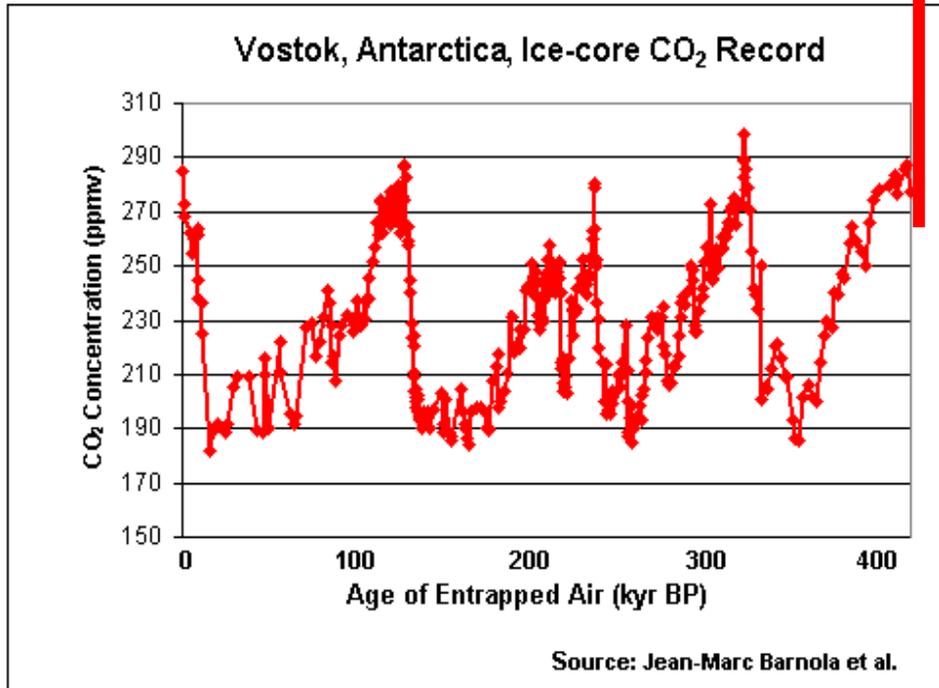
# Climate Change (CC)



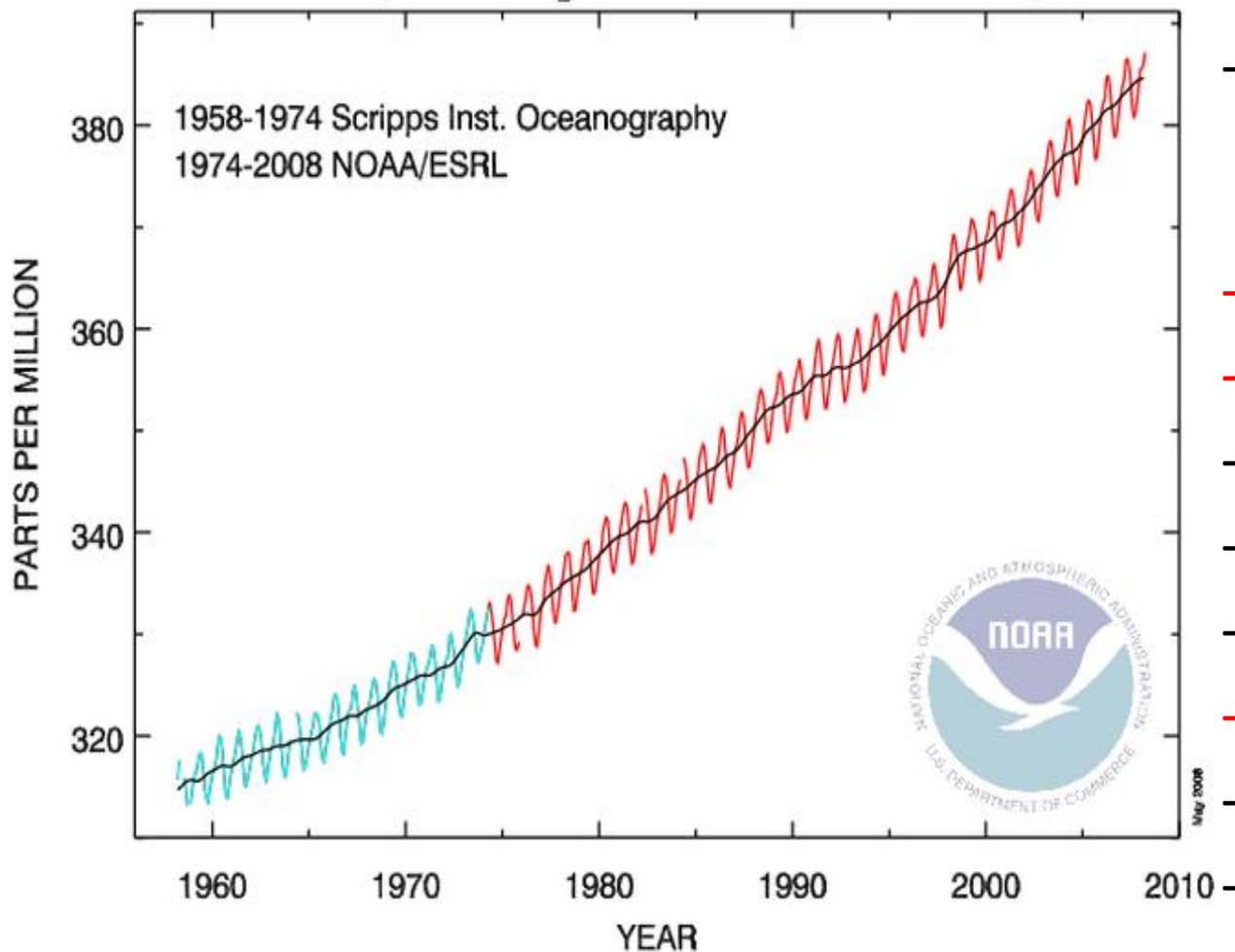
# Atmospheric concentration of CO<sub>2</sub>

With 99% of confidence global warming in the 20 century is related to greenhouse gases (IPCC 2013)

← 2014=407 ppm

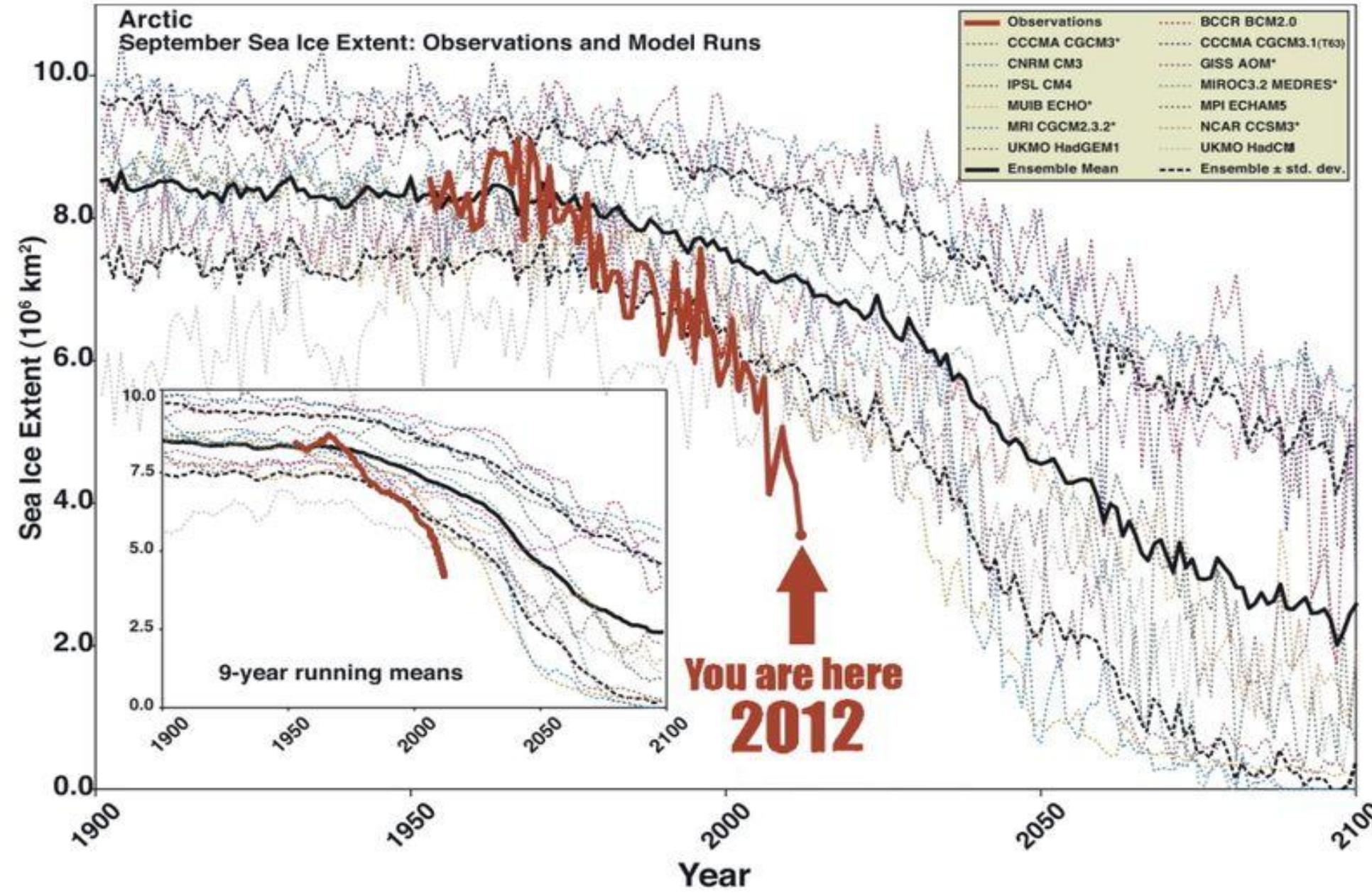


# Anthropogenic Climate Change in the Anthropocene

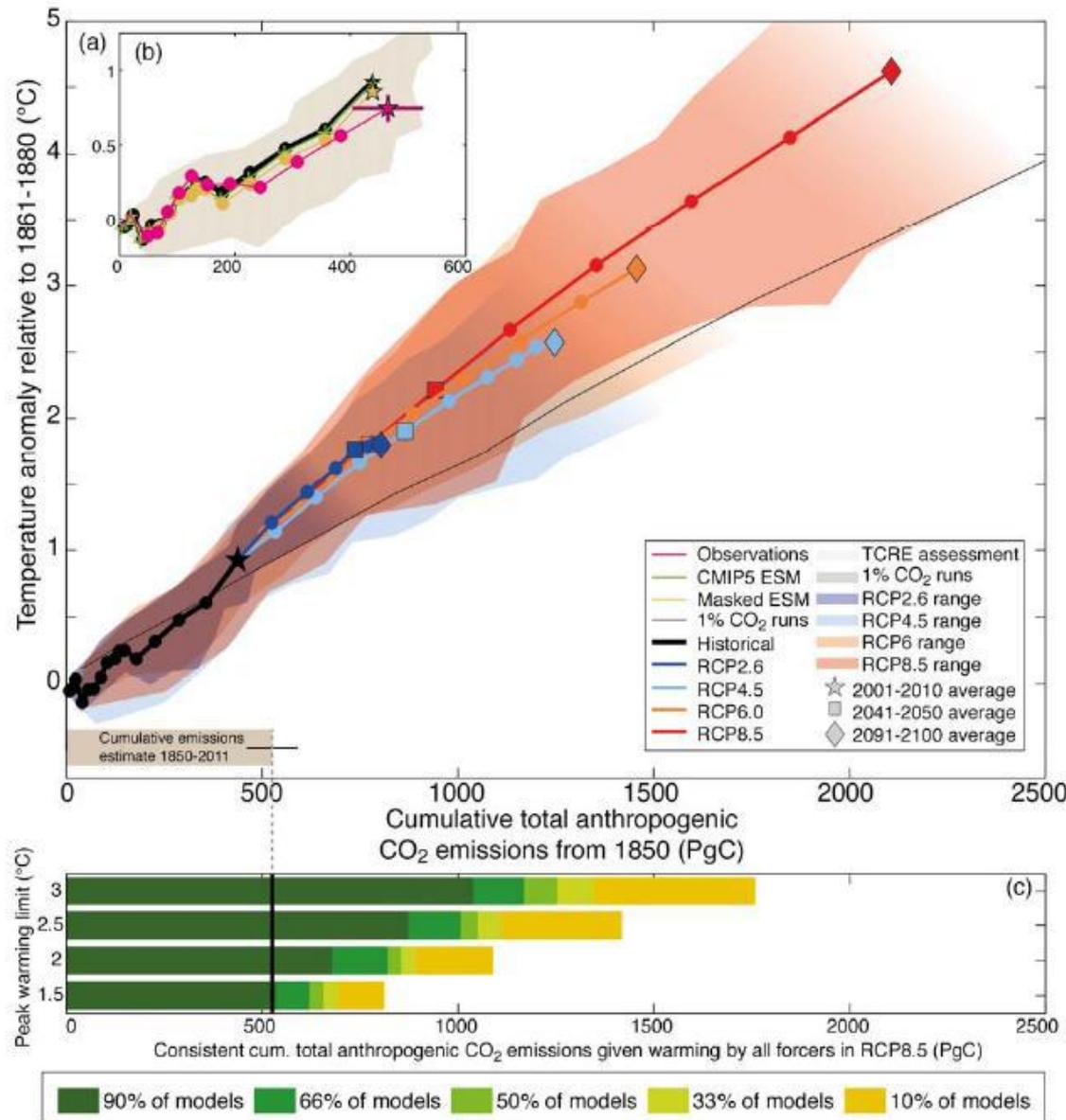


- GHG concentration in the atmosphere
- 1750: 279 ppm
- 1958: 315 ppm
- 1987: 387 ppm
- 2011: 393 ppm
- 2012: 396 ppm
- 2013: 400 ppm
- 1/3: 1750-1958:
- 2/3: 1958-2014:
- 3/3: 1750-2014: 315 to 412 ppm

# Loss of arctic ice (NOAA, 2014)



# CC: IPCC, 5th Assessment Report, 2013



## Physical effects:

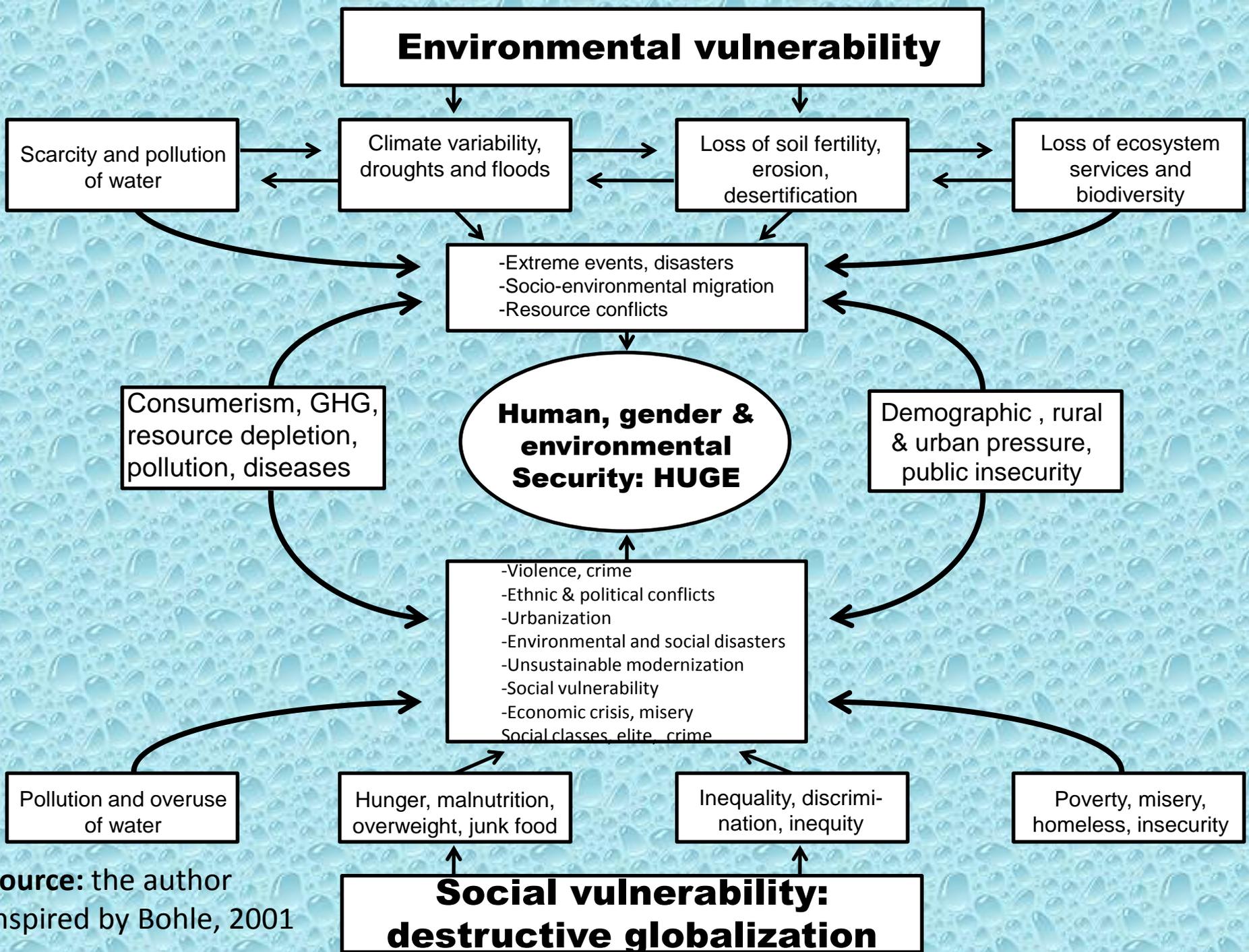
- Temperature increase (cumulative anthropogenic CO<sub>2</sub> emissions since 1870)
- Precipitation change
- Sea level rise: to up to 1 meter is possible 2100
- Extreme events
  - Tropical storms (typhoons, cyclones, hurricanes)
  - Winter Storms
  - Floods, flash floods
  - Land slides
  - Droughts
  - Glacier melting

## Societal effects

- Migration
- Conflicts
- Adaptation
- Resilience
- Loss of culture and livelihood



**3. Concepts: dual vulnerability, systemic water management, water security, food security and food sovereignty**



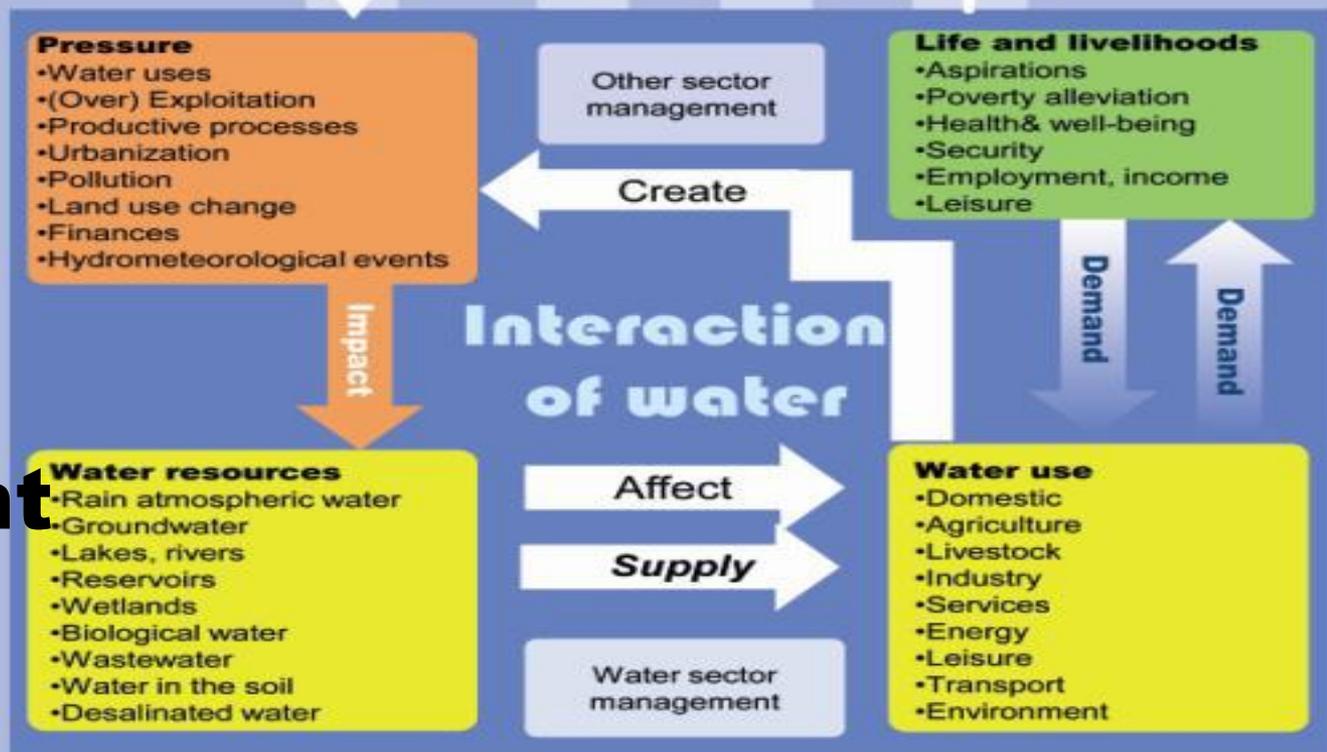
Source: the author  
Inspired by Bohle, 2001

### CEG: Global Environmental Change:

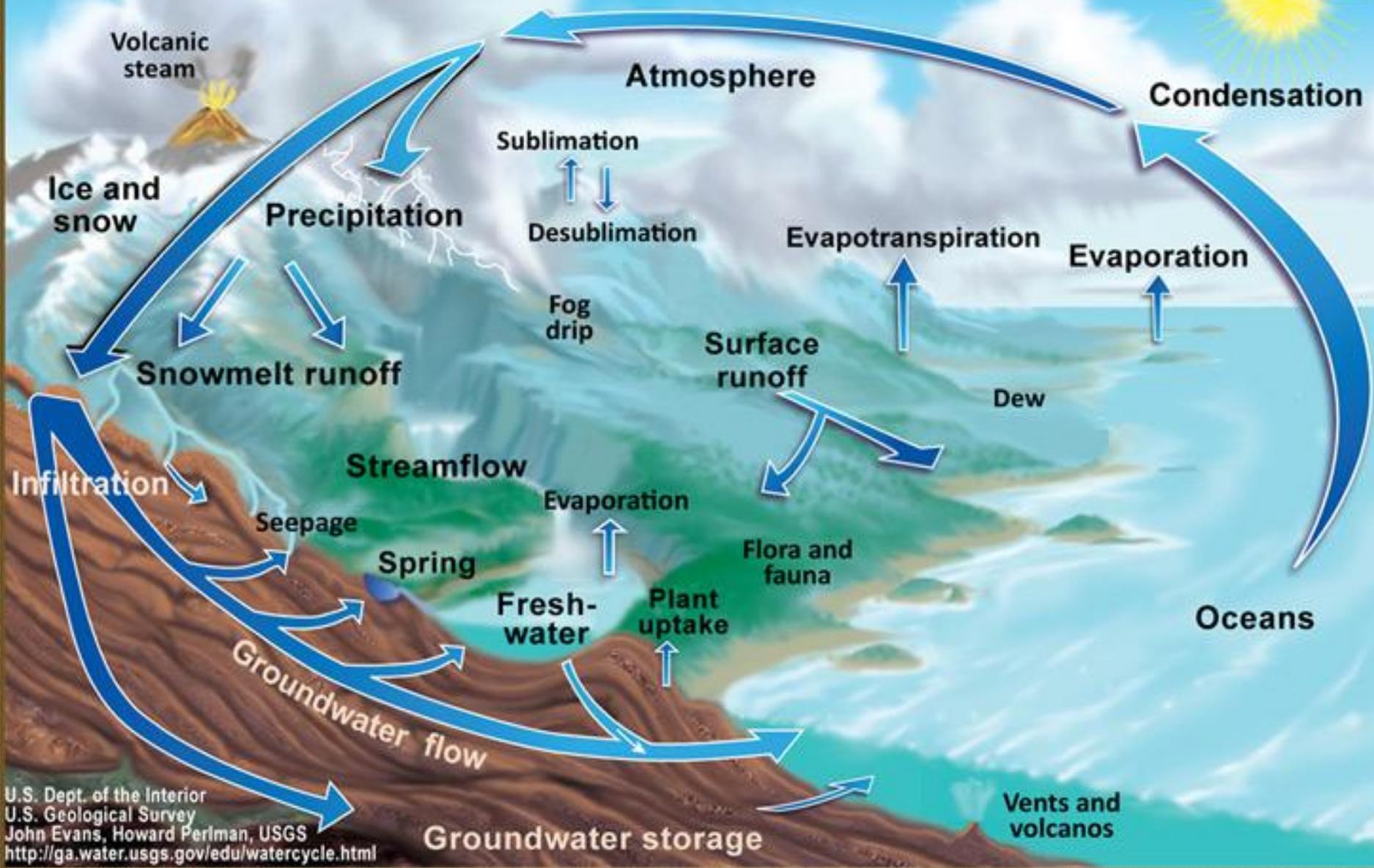
- Demographic
- Urbanization
- Food
- Social organization
- Economy and finance
- Policy & law
- Technology
- Environment
- Hydrometeorological events



# Systemic water management



# The Water Cycle

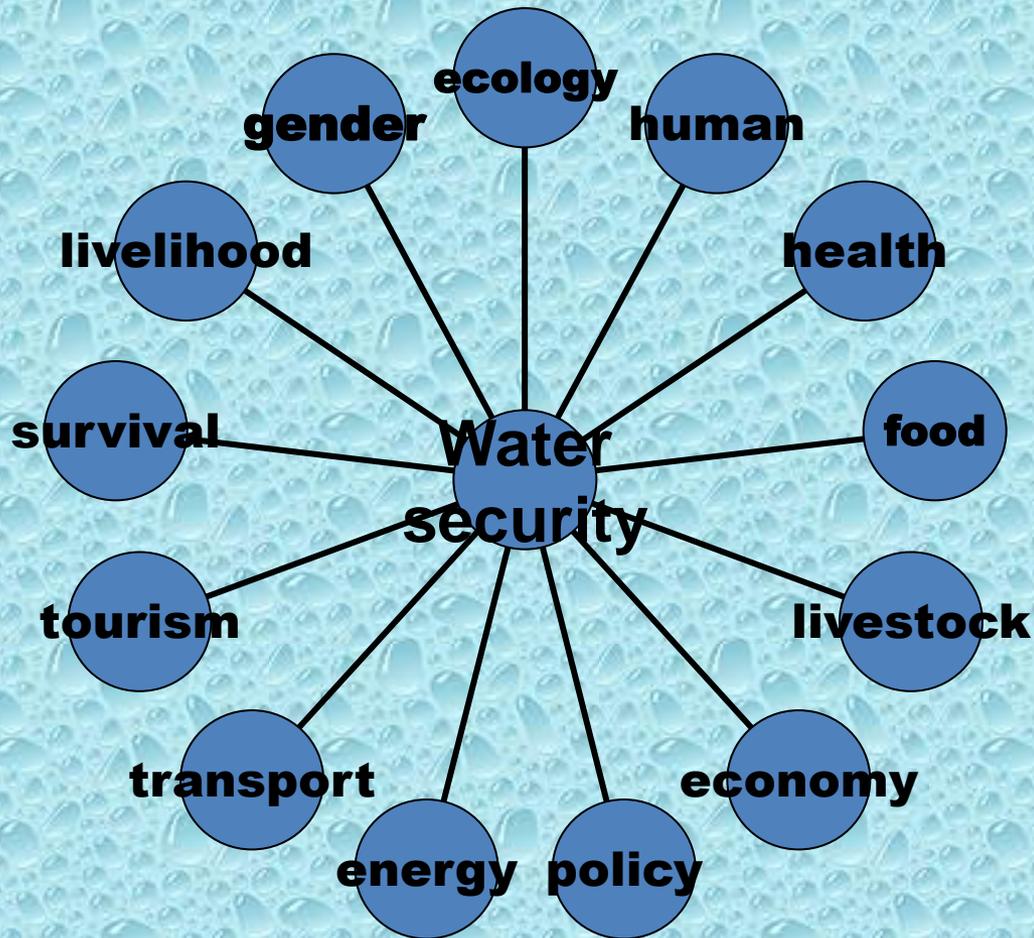


# Water security

- Water is vital for the life and health of people and ecosystems
- **One common goal:** *to provide water security in the 21st Century (Ministerial Declaration The Hague:*
  - This means ensuring that freshwater, coastal and related ecosystems are protected and improved;
  - sustainable development and political stability are promoted;
  - every person has access to enough safe water at an affordable cost to lead a healthy and productive life
  - the vulnerable are protected from the risks of water-related hazard
- Water resources are under **threat** from pollution, overexploitation, land-use changes, unsustainable use, climate change and other anthropogenic forces.
- Links between threats and poverty: the poor who are hit first and hardest (slum dwellers without basic services).
- One simple conclusion: **business as usual is not an option.**

# What is water security?

Freedom from threats (objective) and from fear (subjective)



- Ensuring survival (**societal** security)
- Ensuring human rights (**human** security)
- Ensuring food (**food** security)
- Protecting ecosystems (**environmental** security)
- Sharing water resources (**political** security)
- Risk management (**human and gender** security)
- Valuating water (**economic** security)
- Water governance (**political** security)
- Protect health (**health** security)

# Obstacles to water security

**Integrated  
water  
management**

**Governance**

- **Policy**
- **Planning and projects**
- **Transparency**

**Finances  
S&T**

- **Financing**
- **Investment**
- **Technology**

**Management**

- **Information**
- **Administration**
- **Tariffs**

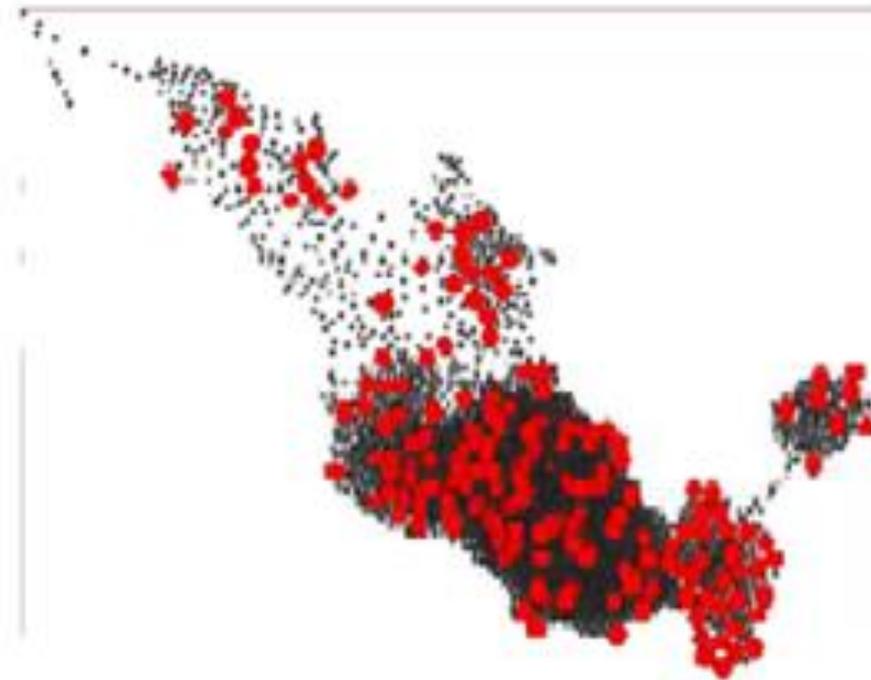
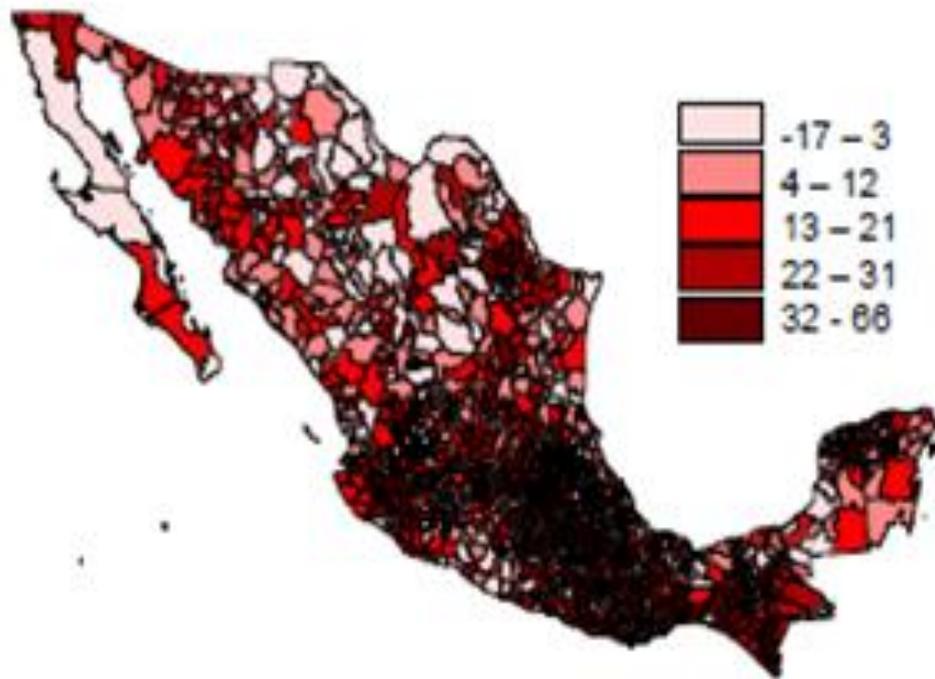
# Food security and food sovereignty

**“Food security** exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food, which meets their dietary needs and food preferences for an active and healthy life” (FAO, 2008).

**“Food sovereignty** is the right of people, communities, and countries to define their **own** agricultural, pastoral, labour, fishing, food and land **policies** which are **ecologically, socially, economically, and culturally** appropriate to their unique circumstances. It includes the **right to food and to produce food**, which means that all people have the right to safe, nutritious and culturally appropriate food and to food-producing resources and the ability to sustain themselves and their societies” (Via Campesina, 2004).

# 4. Mexico threatened by GEC and CC impacts: dual vulnerability

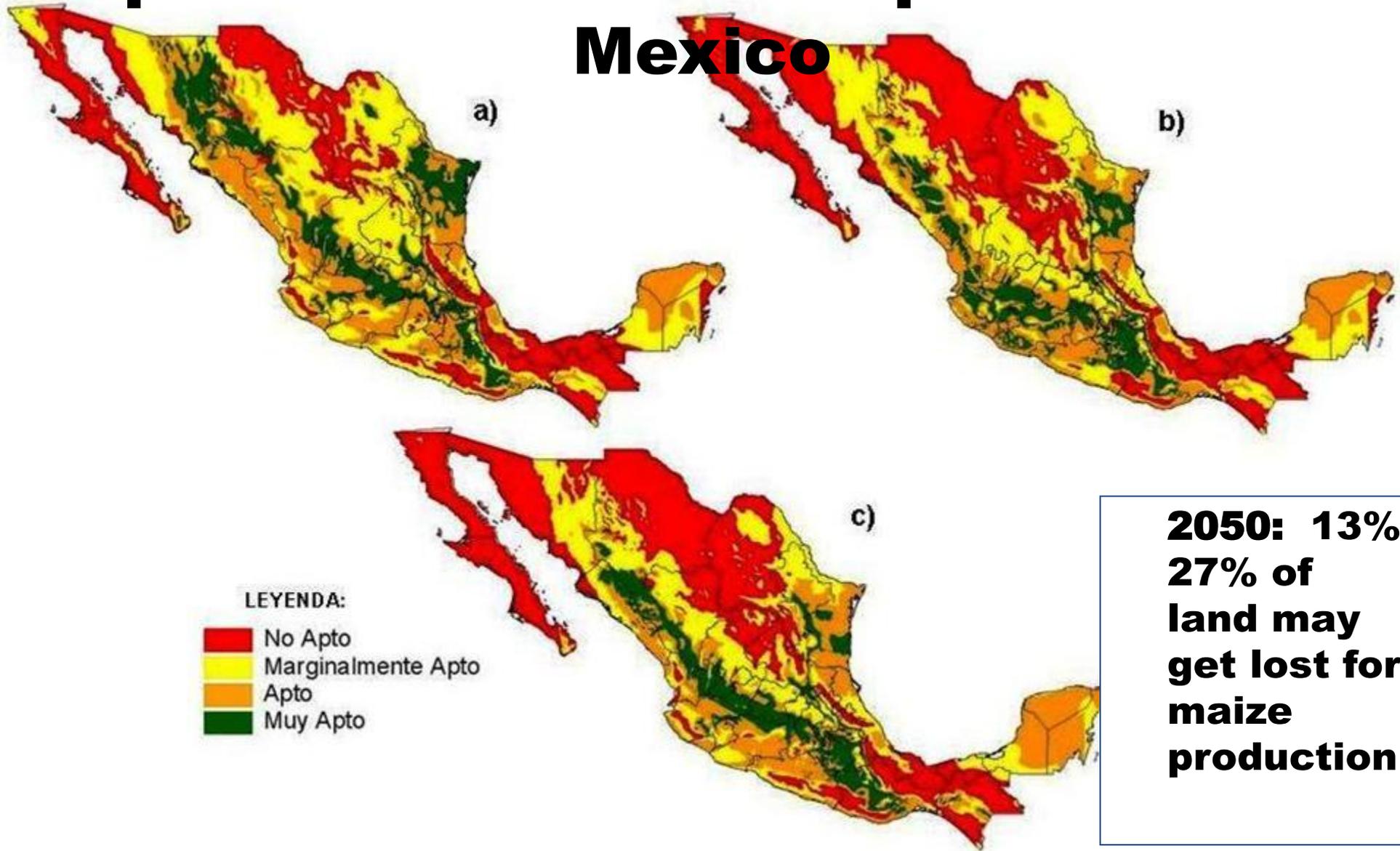
left: extreme poverty; right: disaster impacts over 500,000 USD



# Complex interactions

1. More **extreme temperatures**: extreme hot and cold, but days with more temperature
2. **Desertification** and erosion of soils
3. **Sea level rise**, coastal salinization and intrusion of sea water into aquifers and soils
4. Extreme and more frequent **hydrometeorological events**
5. Variability in **precipitation**
6. Loss of **biodiversity** and ecosystem services
7. Chaotic **urbanization** and population growth
8. Massive **migration** due to survival dilemma
9. Rise of **poverty** and inequality
10. **New diseases**, plagues and invasion of alien species affecting differently social class and gender
11. Socio-environmental **disasters** and **conflicts** in different regions
12. Rise of **organized crime** and **public insecurity**, tendency to a failed state

# Impacts of CC in maize production in Mexico



Monterroso, A. G, Rosales, 2006.



## **5. Water management of Mexico: regional, social and temporal inequality**

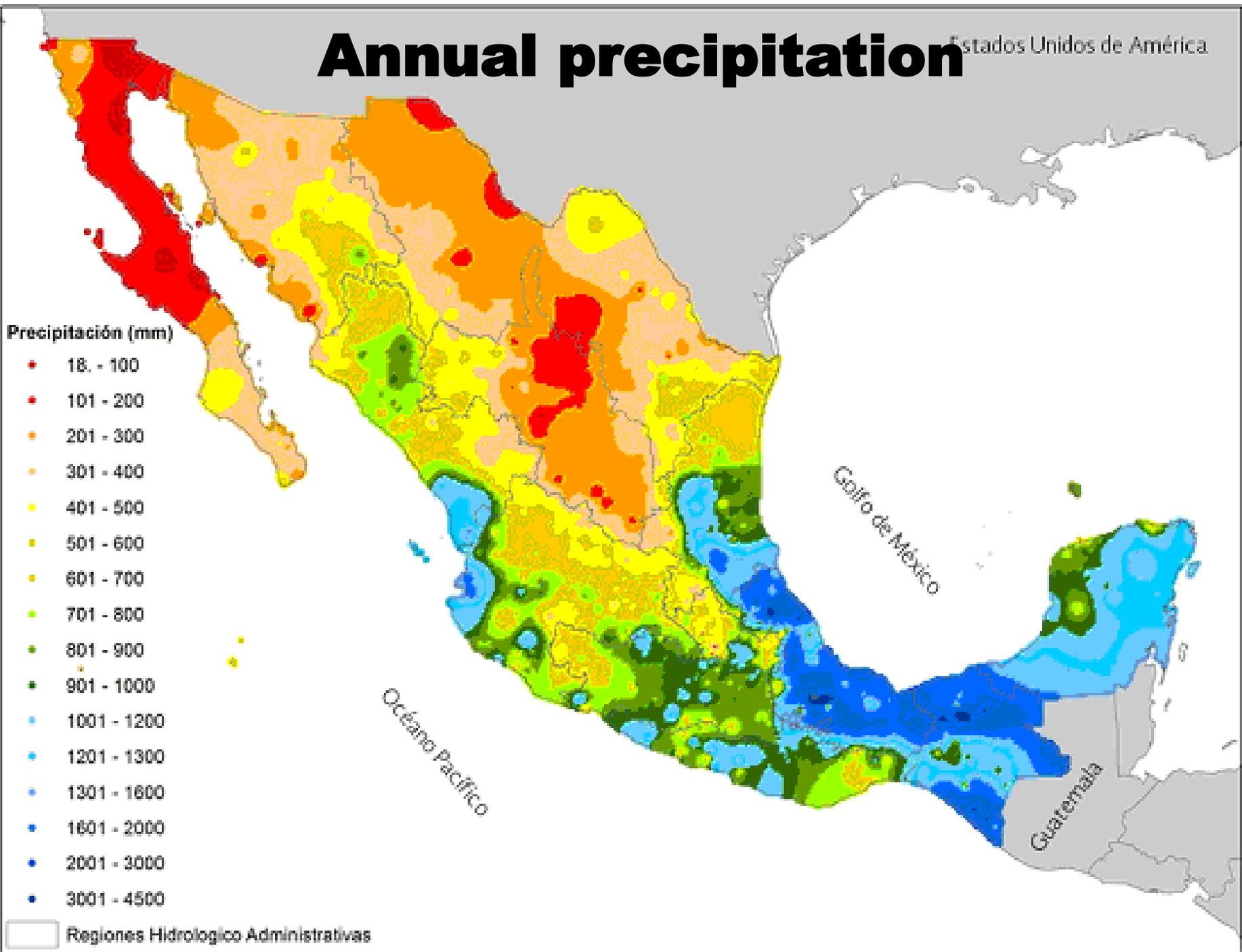
# Annual precipitation

Estados Unidos de América

## Precipitación (mm)

- 18 - 100
- 101 - 200
- 201 - 300
- 301 - 400
- 401 - 500
- 501 - 600
- 601 - 700
- 701 - 800
- 801 - 900
- 901 - 1000
- 1001 - 1200
- 1201 - 1300
- 1301 - 1600
- 1601 - 2000
- 2001 - 3000
- 3001 - 4500

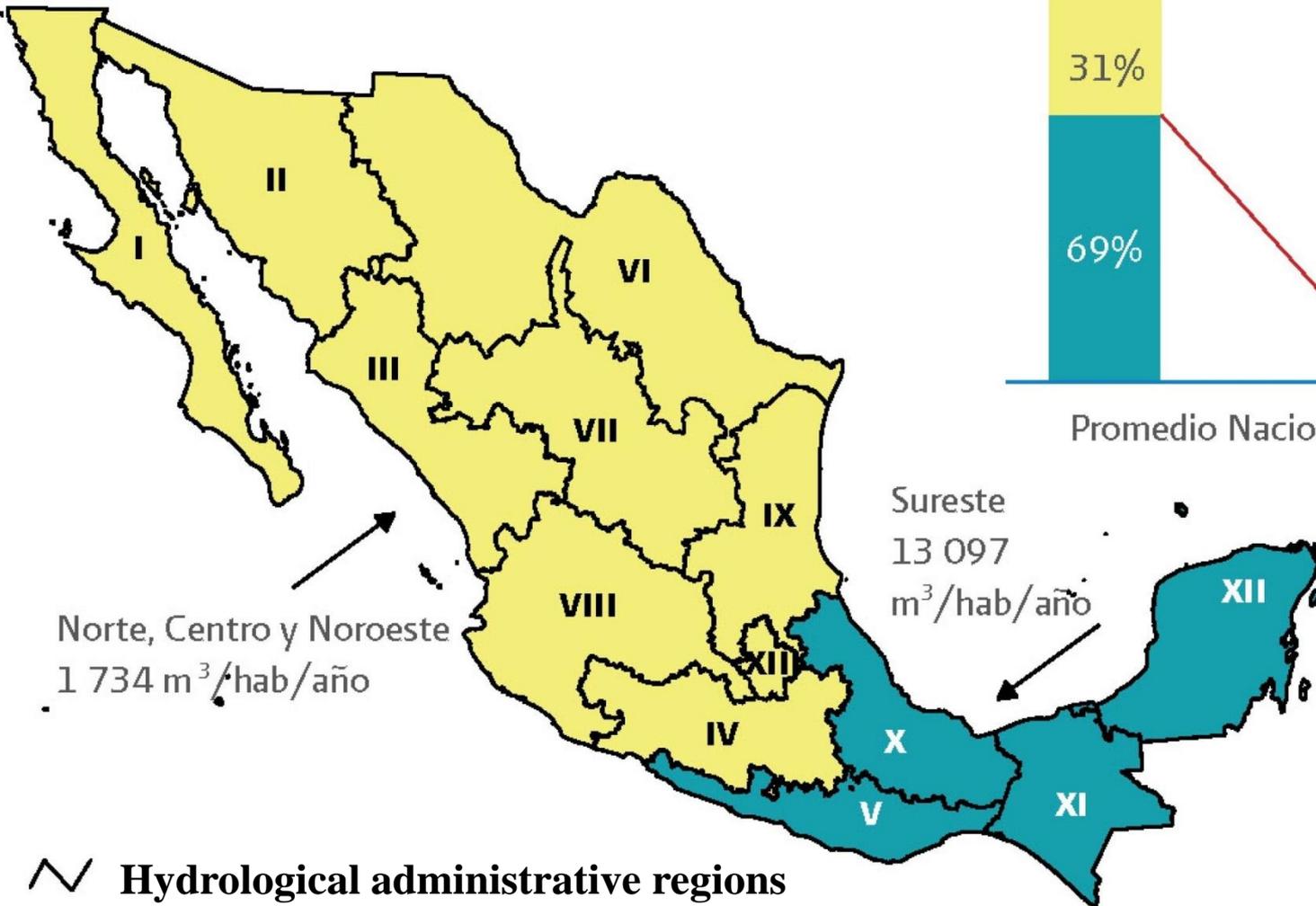
Regiones Hidrológico Administrativas



# Unequal regional and social distribution

42 big rivers

653 aquifers; 105 overexploited in 2013



Natural availability

Population

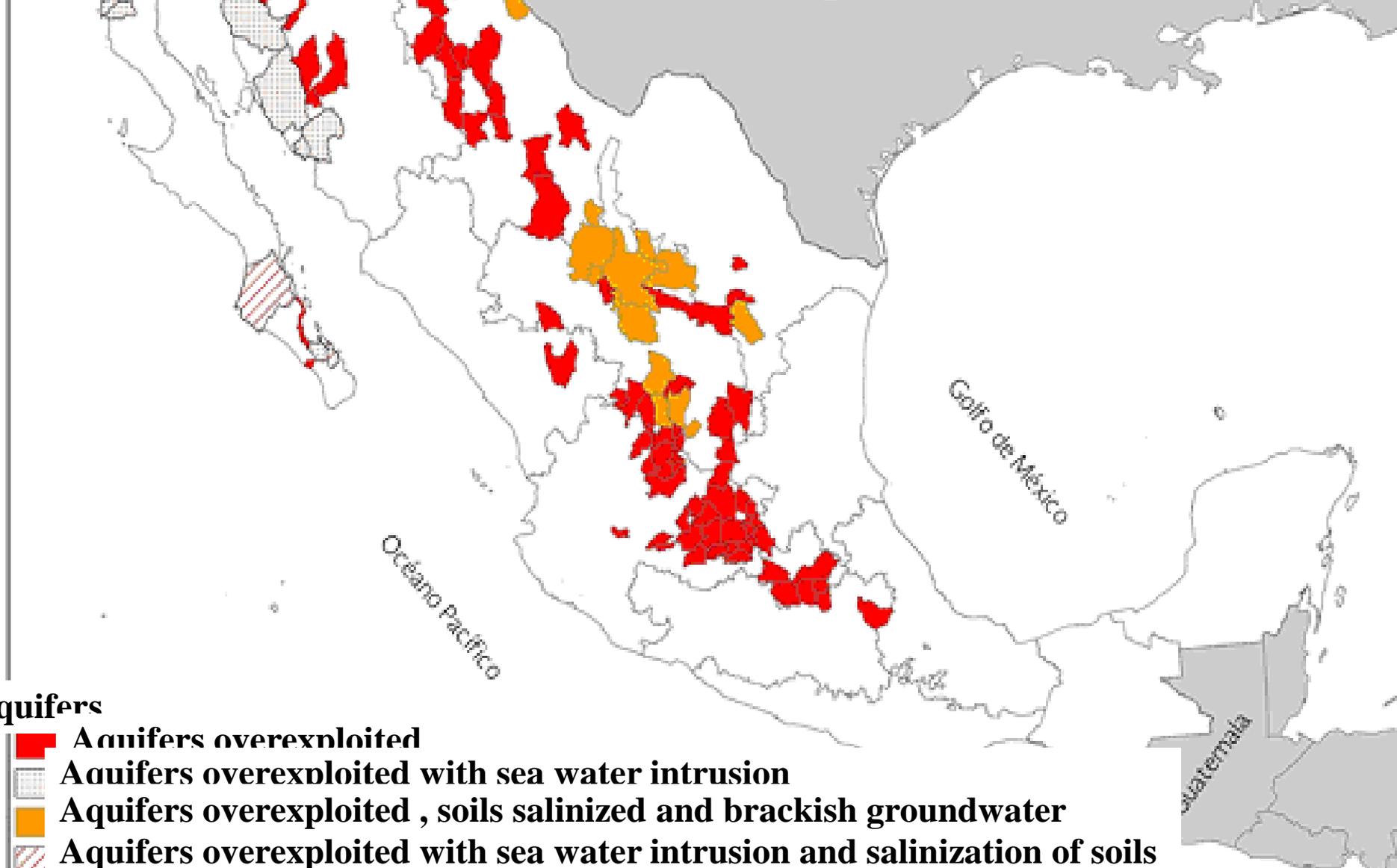
GDP



Promedio Nacional 4 312 m<sup>3</sup>/hab/año

# Salinization of soils and intrusion of sea water into aquifers

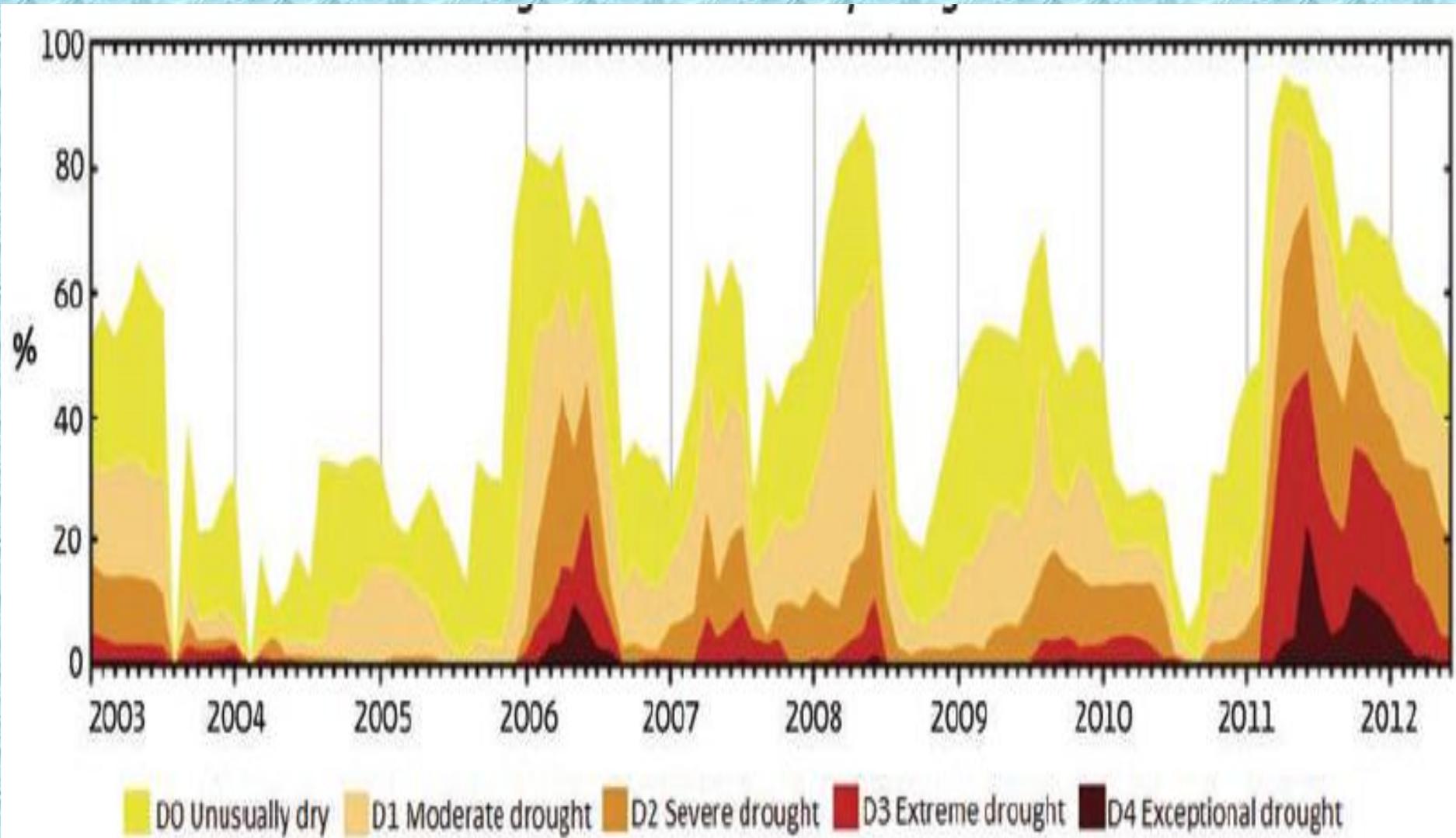
Estados Unidos de America



## Acuíferos

- Acuíferos sobreexplotados
- ▨ Acuíferos sobreexplotados con intrusión de agua de mar
- Acuíferos sobreexplotados, suelos salinizados y agua subterránea salina
- ▨ Acuíferos sobreexplotados con intrusión de agua de mar y salinización de suelos
- Regiones administrativas hidrográficas

# Droughts in Mexico

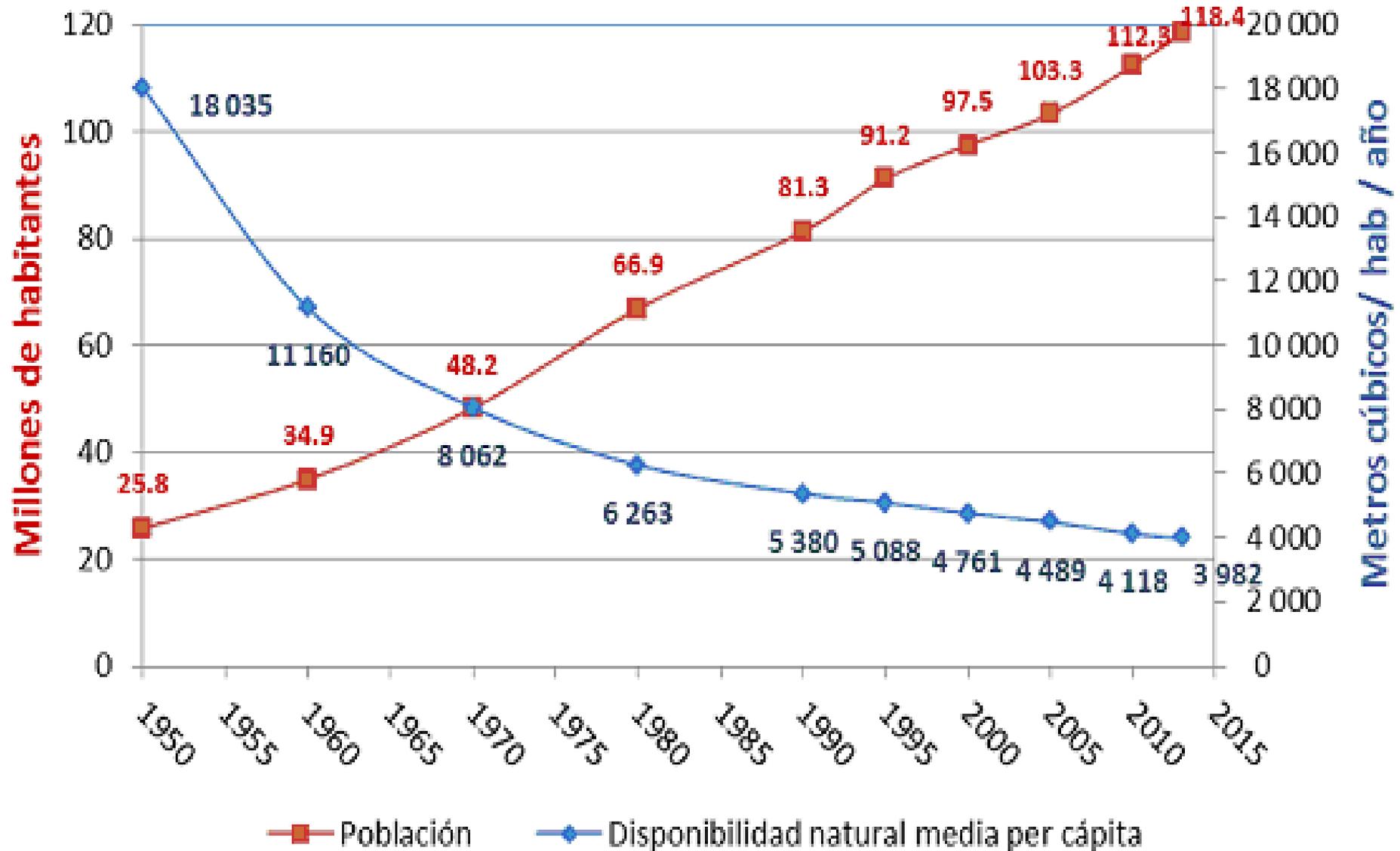


*Affected surface (%) in Mexico due to the drought from 2003 to 2012*

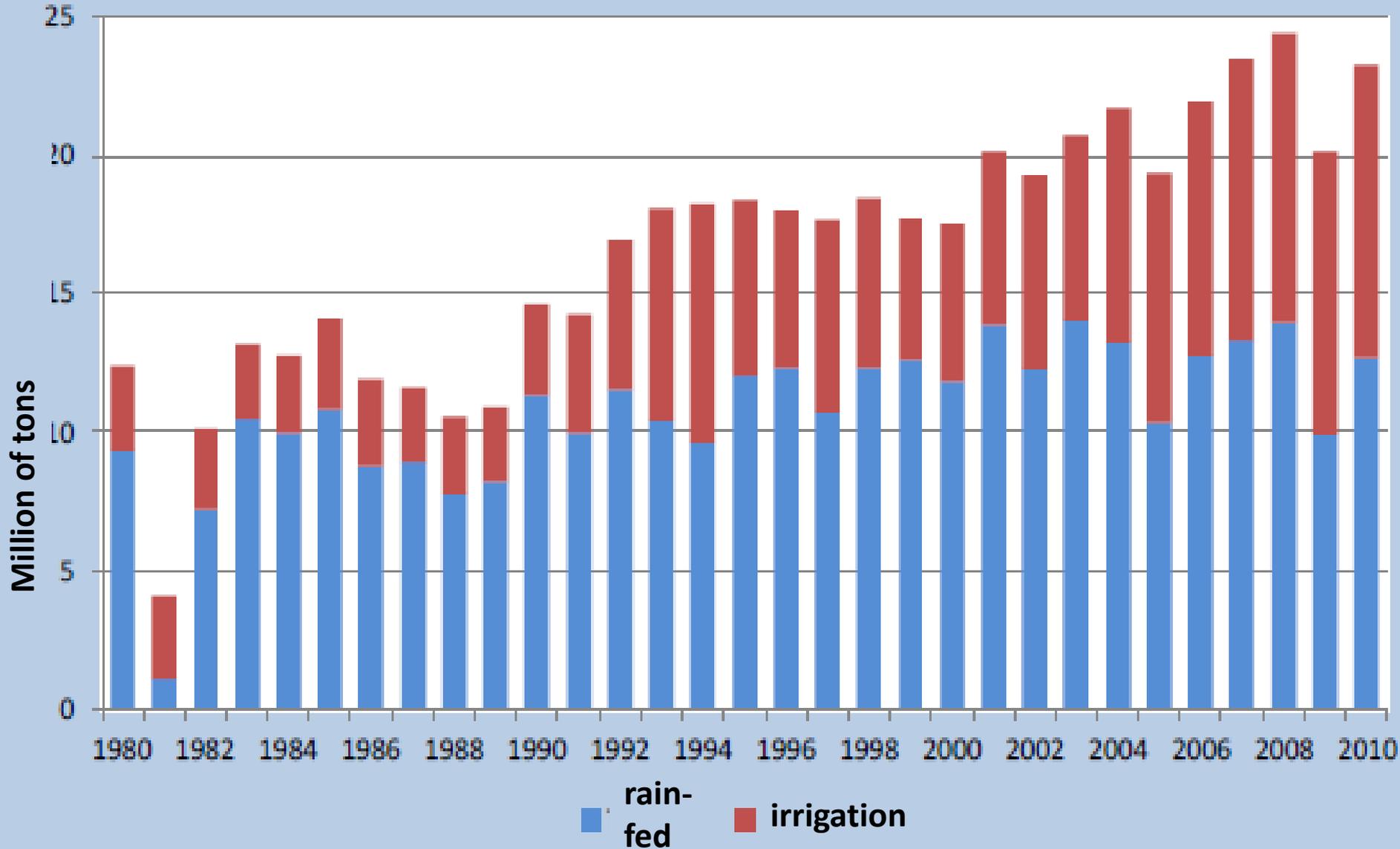
A collage of several hands holding different types of grains and seeds, such as wheat, corn, and lentils, arranged in a circular pattern. The background is a dark, textured surface. The text is overlaid on the center of the image.

**6. Water security and food security: NAFTA and virtual water**

# Average availability of water/cap

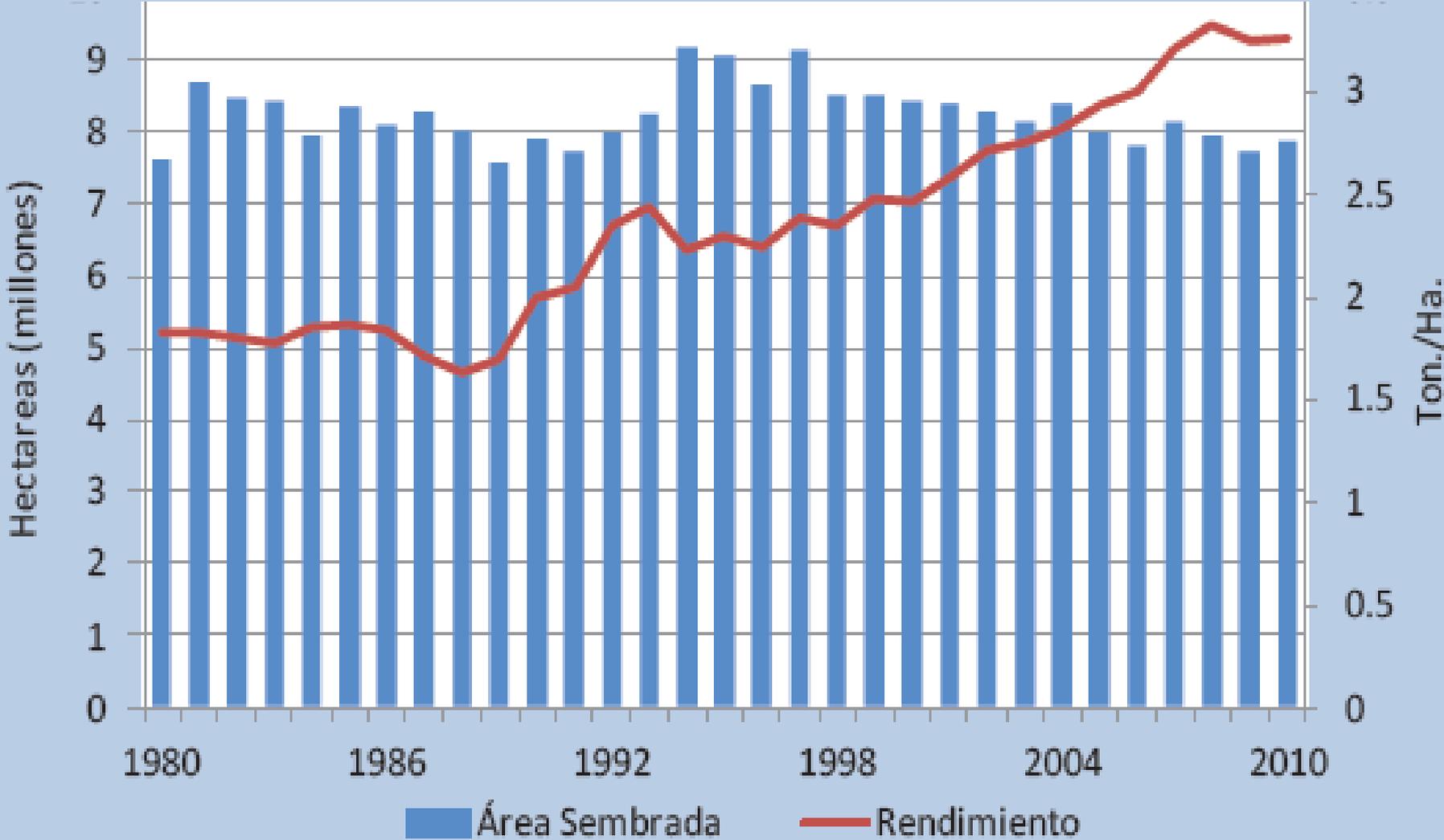


# Production of maize: irrigation and rain-fed: 1980-2010



**Source: SICON, SIAP, May 2012**

# Cultivated area and yields of maize: 1980-2010

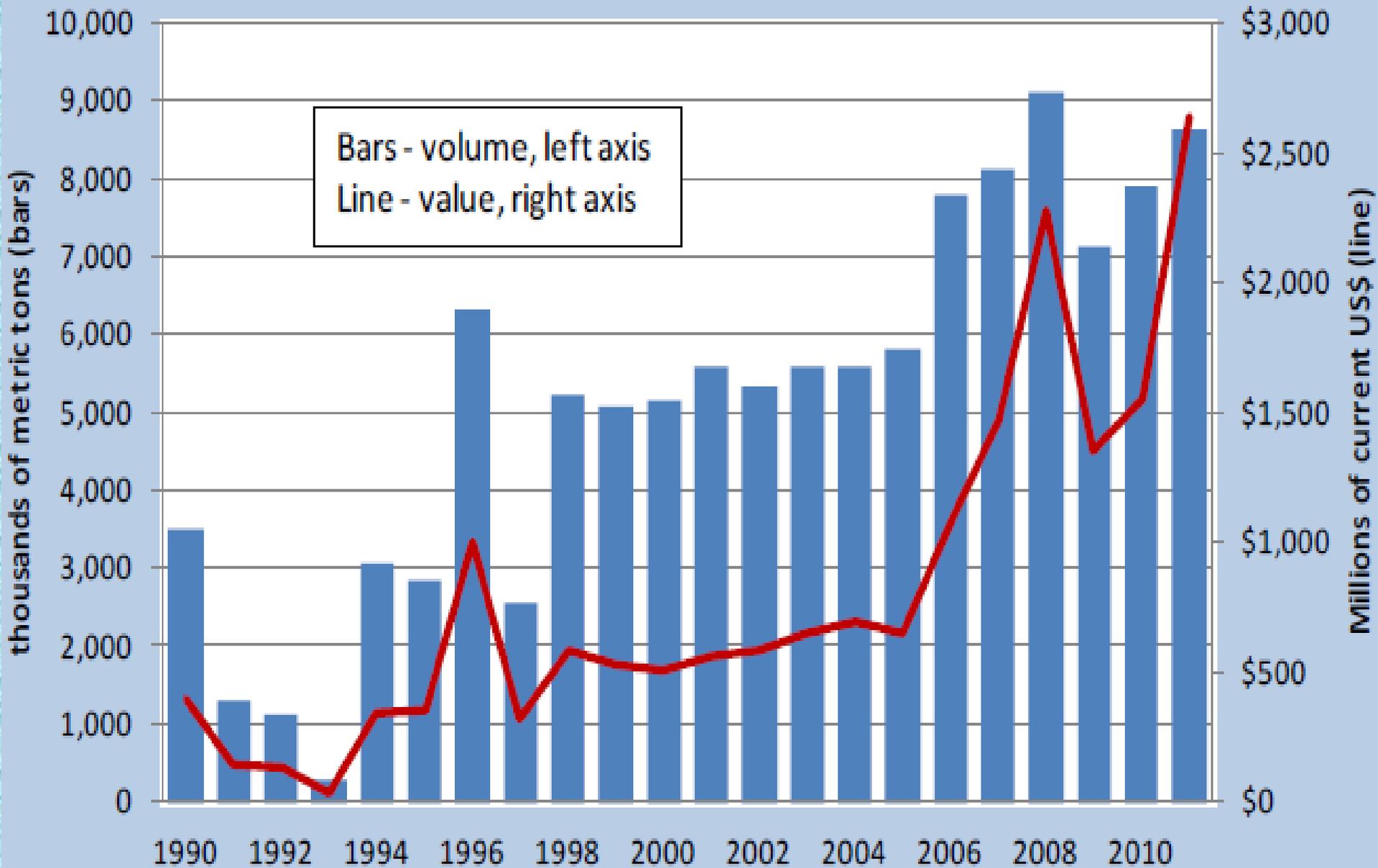


Source: SICON, SIAP,  
May 2012

# Mexico: Rising Maize Import Volume and Cost

1990-2011

Source: SICON, SIAP, May 2012



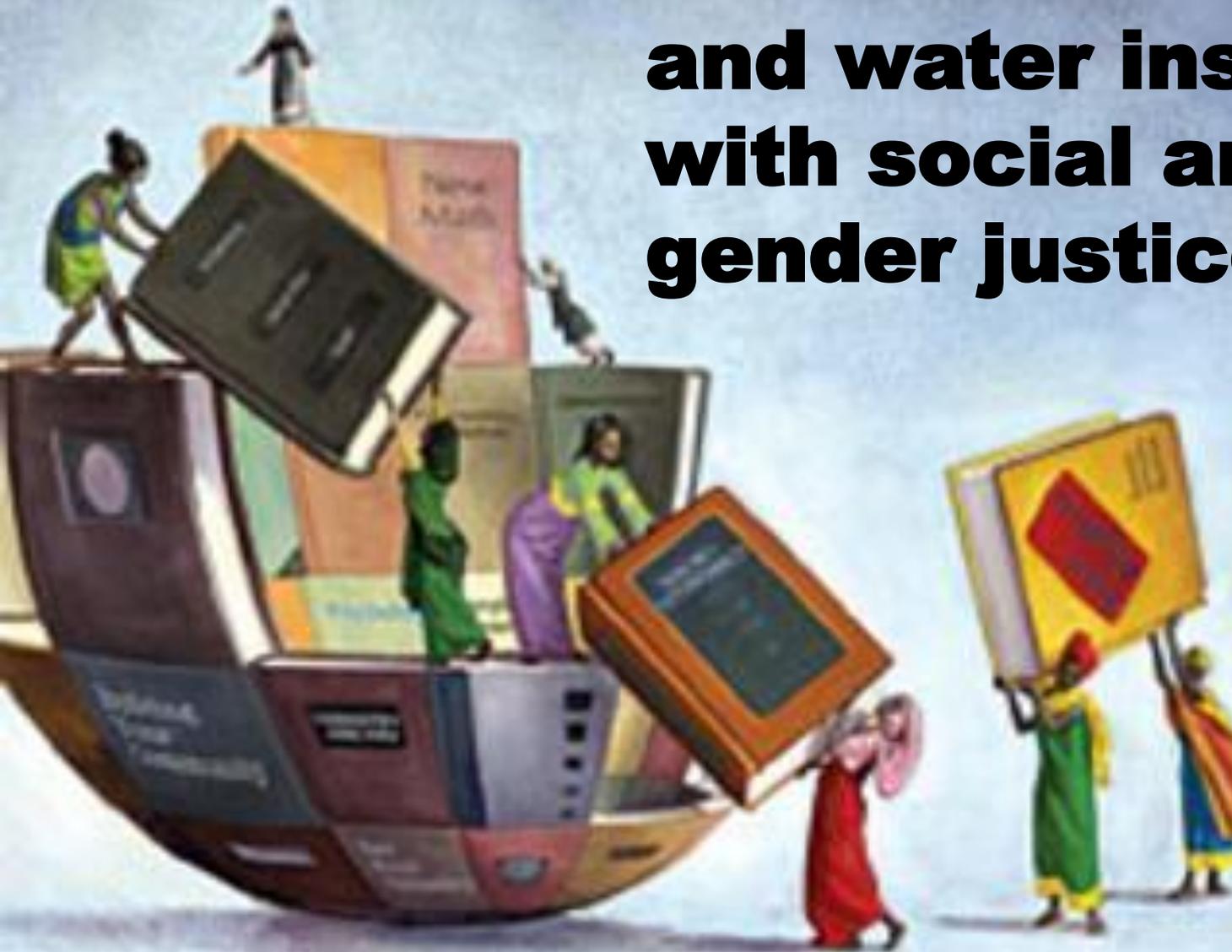
# International prices of maize

## 2000-2012



**Source: International prices, represented January each year data July, 2012; <http://www.indexmundi.com>**

# 7. Overcoming food and water insecurity with social and gender justice



# Model inputs and scenario definitions

Urban growth & changes in food habits (demand elasticities)

Income growth projections

Population growth projections

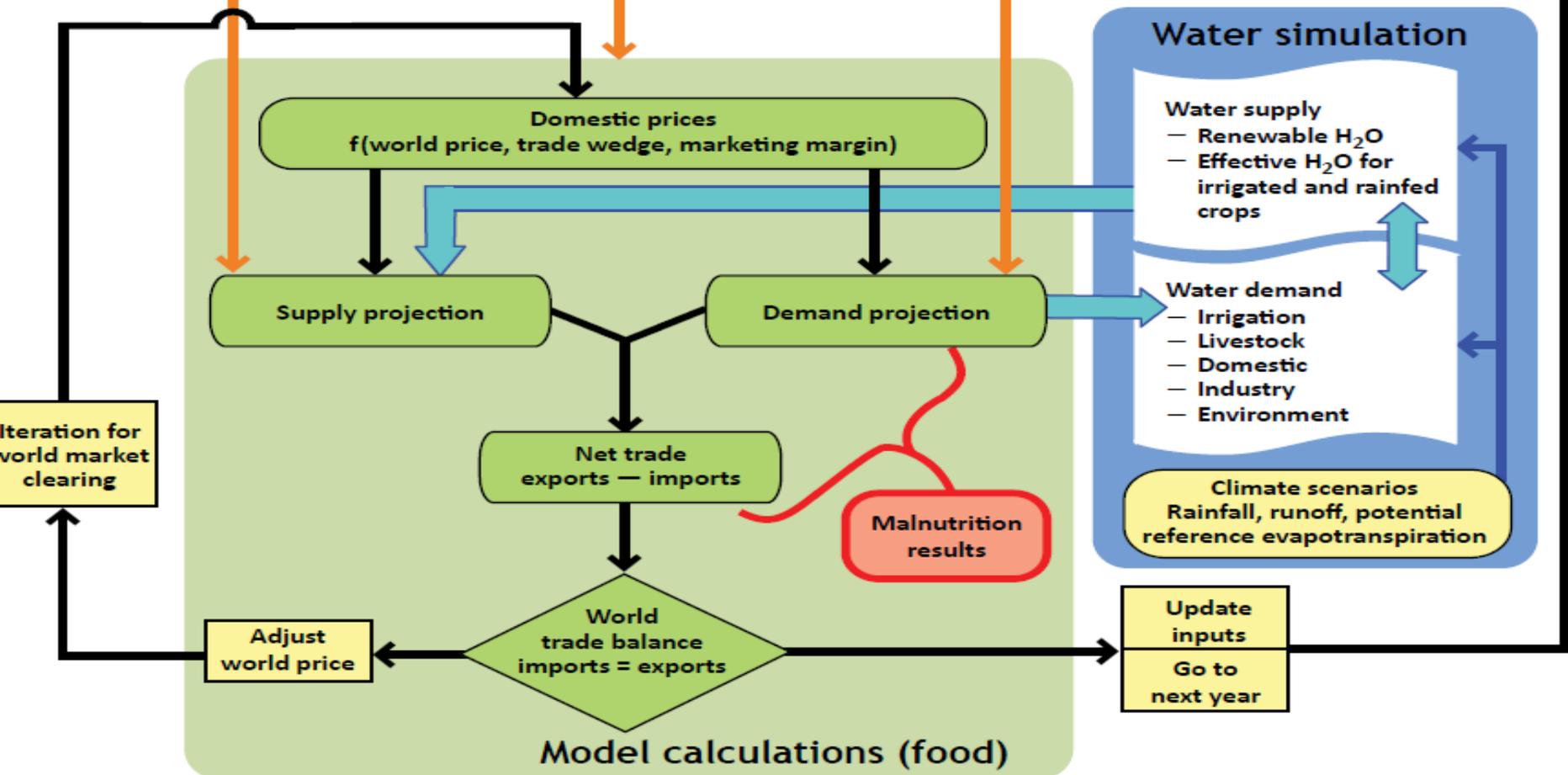
Supply, demand, and trade data from FAOSTAT, IFPRI, UN, World Bank, and others

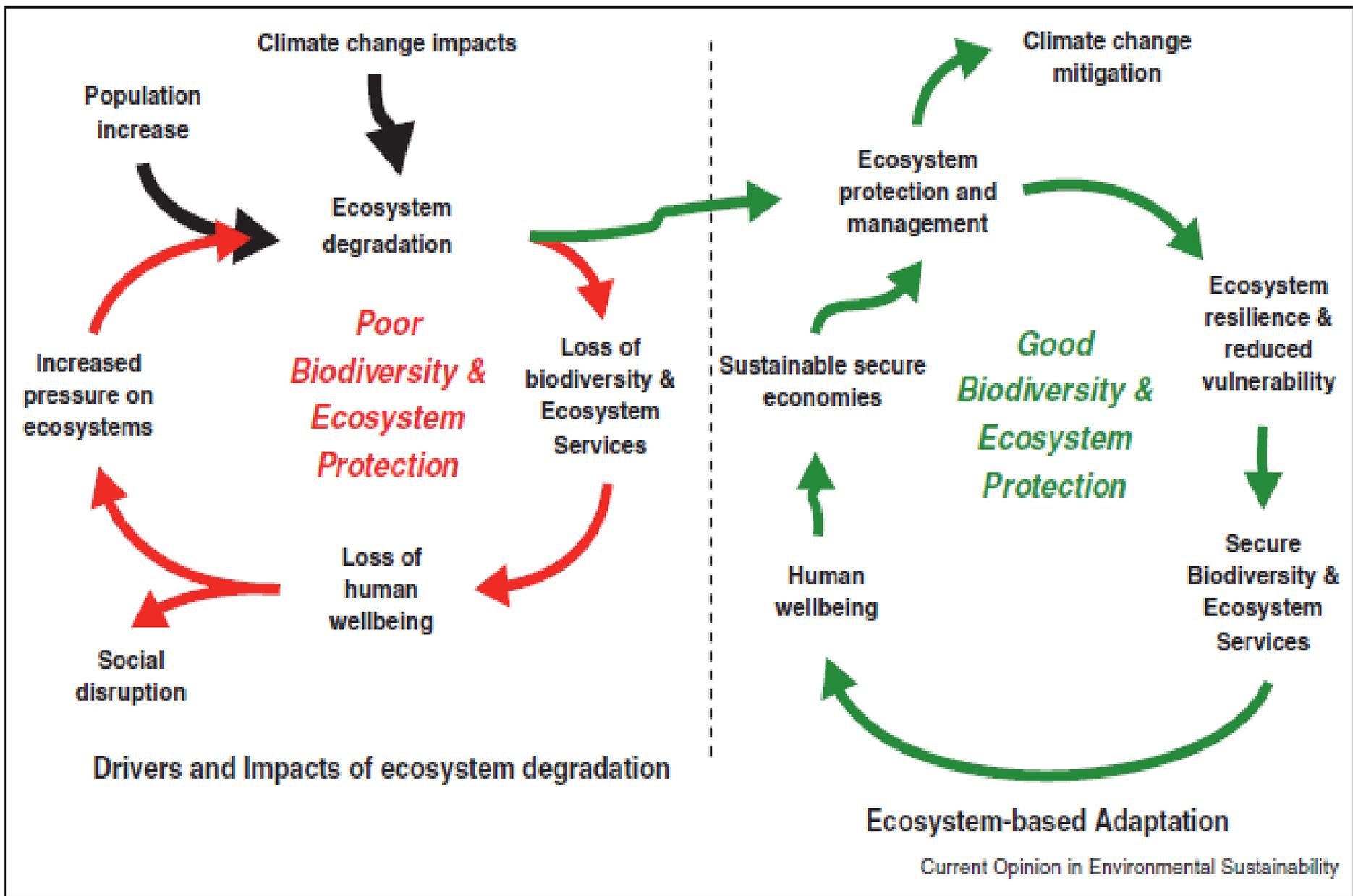
Area elasticities with respect to crop prices

Yield elasticities with respect to crop, labor, and capital prices

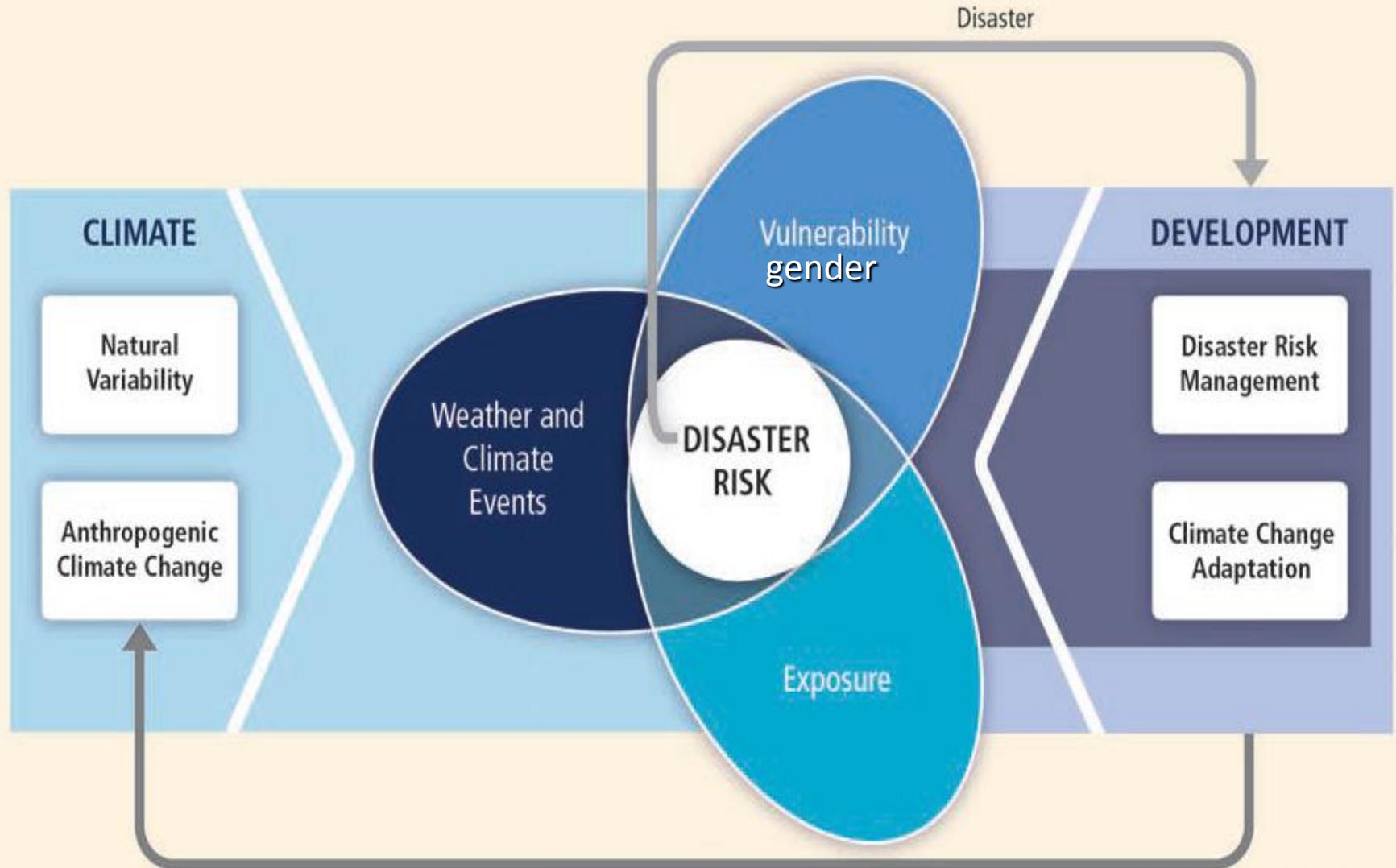
Area and yield annual growth rates

Source: Intern. Model for Policy Analysis, of Agricultural Commodities and Trade (IMPACT)





# Integration of 3 epistemic communities: DRR, CC & development with a gender perspective



Greenhouse Gas Emissions

IPCC-SREX, 2012

**Thank you very much  
for your attention**

Úrsula Oswald Spring  
*Editor*



# Water Resources in Mexico

Scarcity, Degradation, Stress, Conflicts,  
Management, and Policy

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Los retos de la investigación  
del agua en México

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