



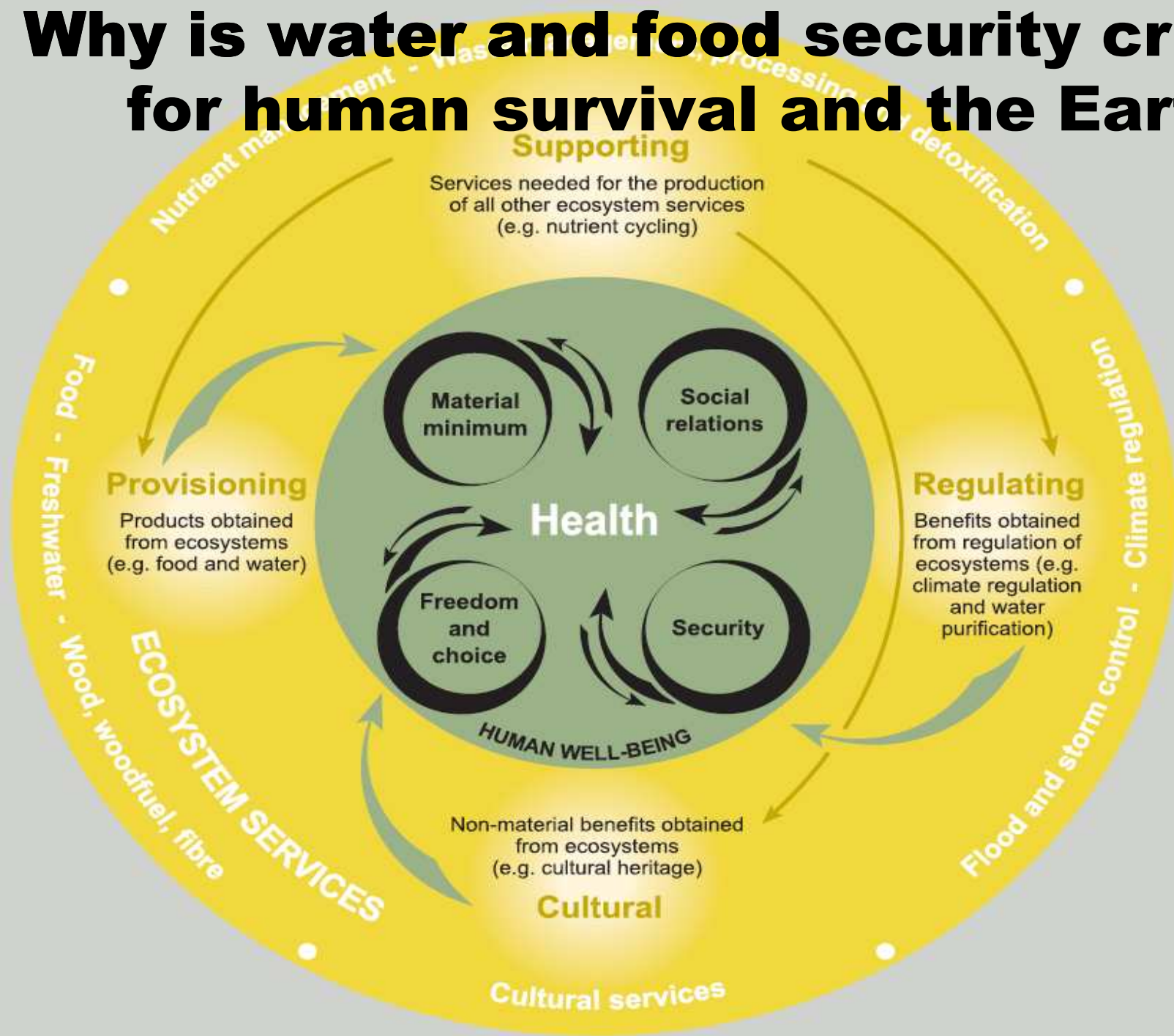
Water and Food Security in the Anthropocene

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United Nation's University: EHS
National Coordinator on Water Research Networks**

Index

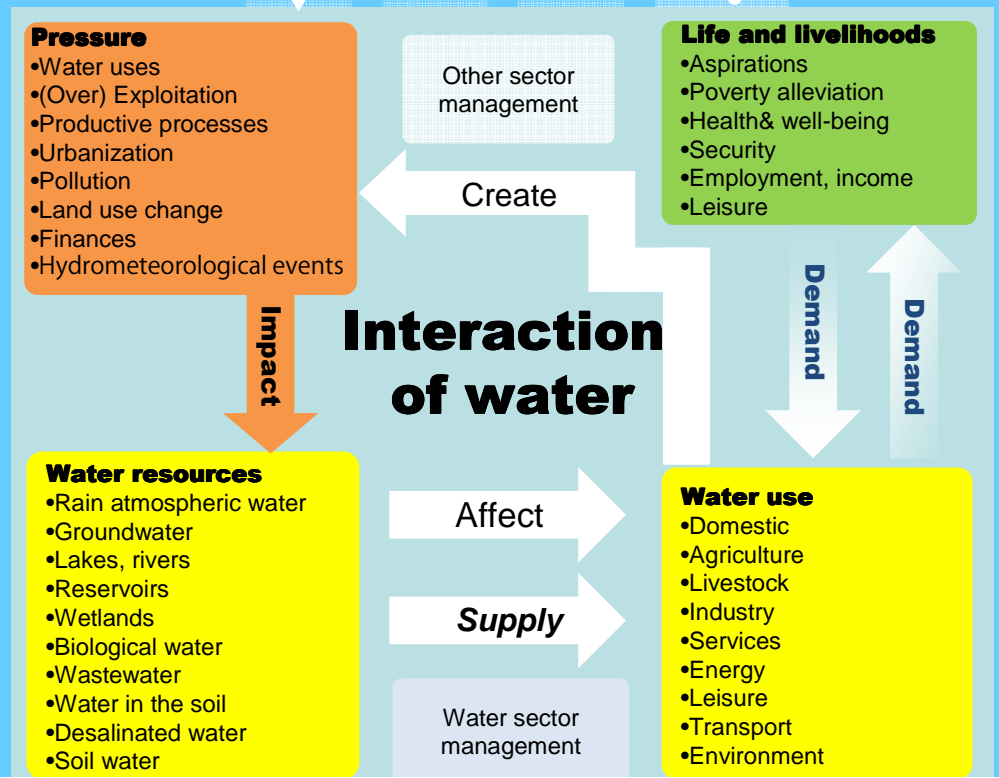
- 1. Why is water and food security crucial for the survival of humans and the Earth?**
- 2. Why is water security crucial for life?**
- 3. Threats to water security**
- 4. Definitions on food security and food sovereignty**
- 5. World's food situation**
- 6. Challenges for food sovereignty: three models of food production**
- 7. Conclusions: water and food sovereignty with resilience-building from top-down and bottom-up for improving human, gender and environmental security. A HUGE Security**

1. Why is water and food security crucial for human survival and the Earth?



CEG: Global Environmental Change:

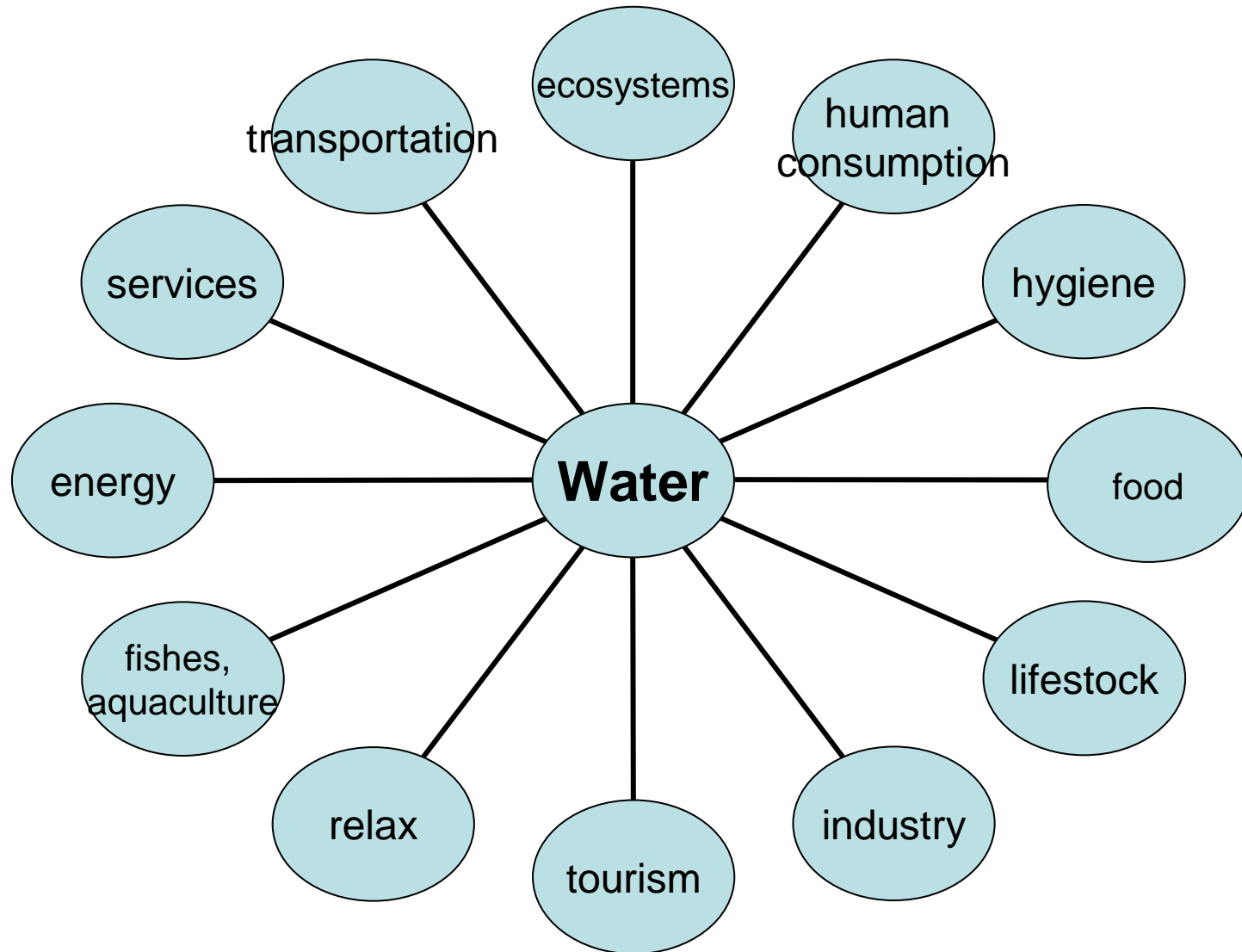
- Demographic
- Urbanization
- Food
- Social organization
- Economy and finance
- Policy & law
- Technology
- Environment
- Hydrometeorological events
- Culture



2. Why is water security crucial for life?

Source: based on Global Water News, #9, p. 4

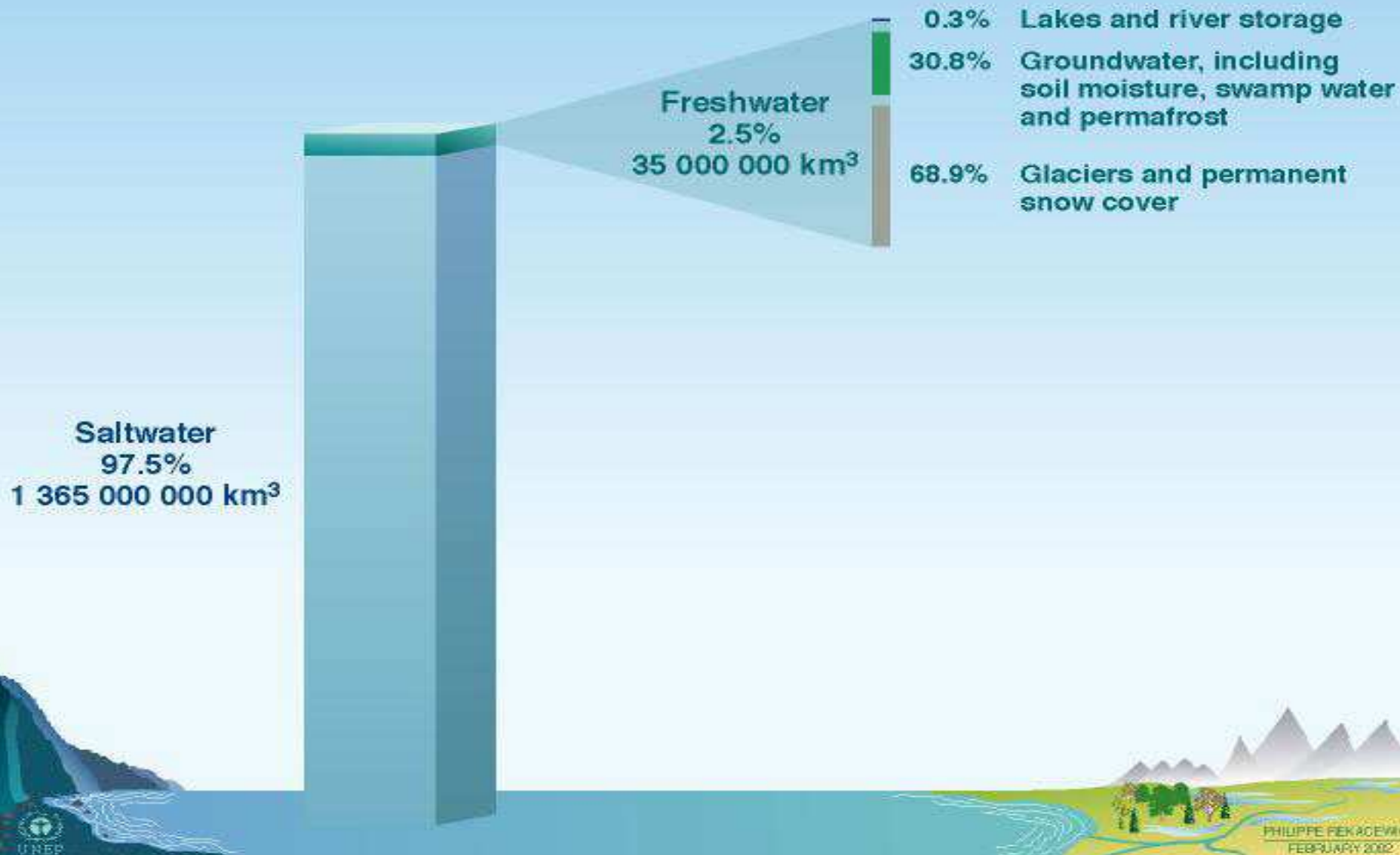
3 Water security is transversal



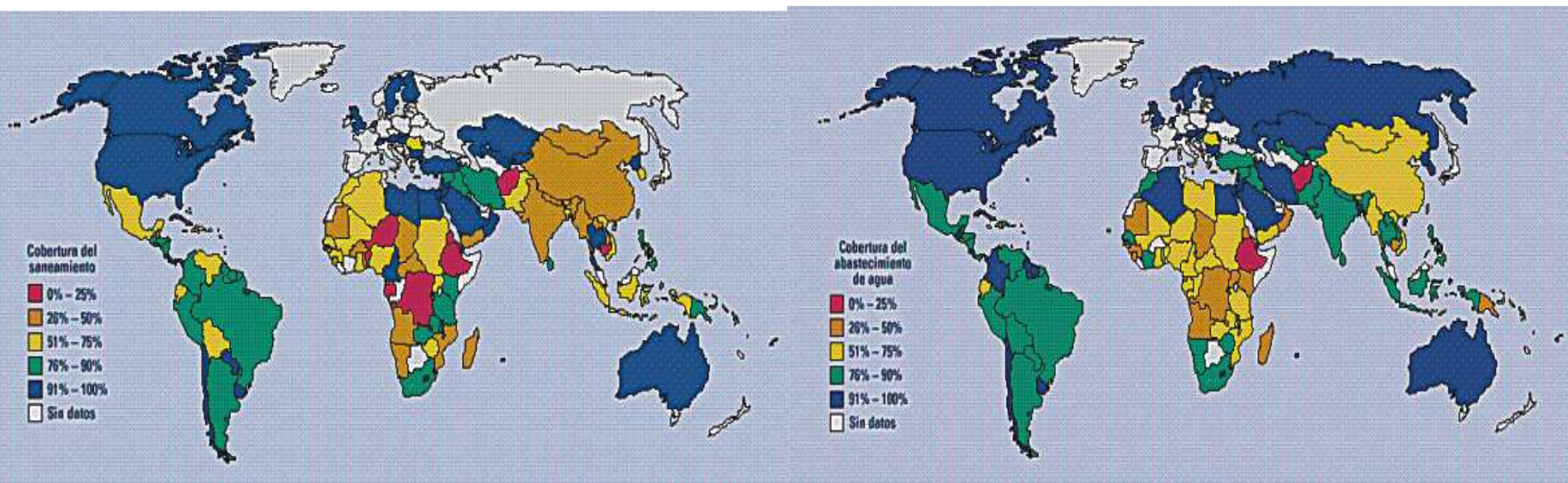
Source: Oswald 2007

A World of Salt

Total Global Saltwater and Freshwater Estimates



Safe water and sanitation



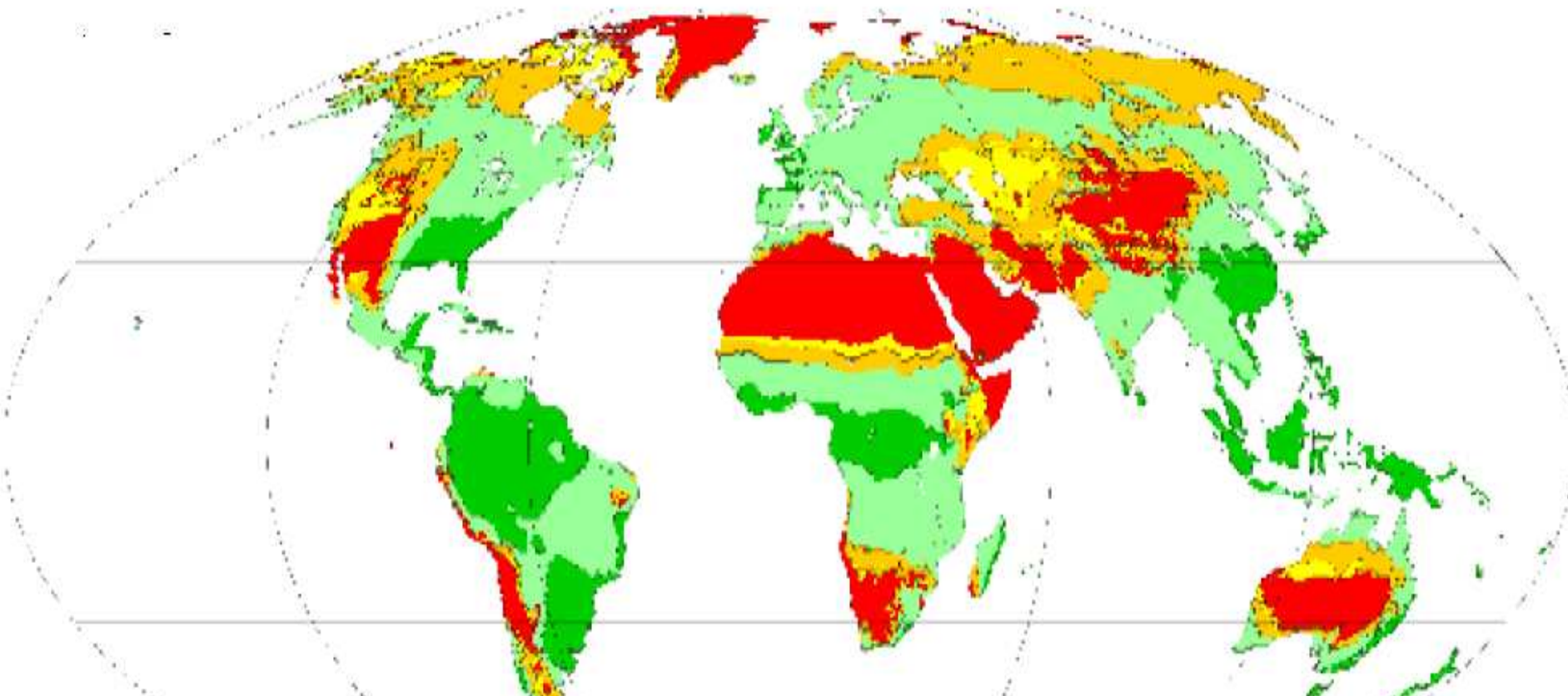
Source: WHO, 2007

3. Threats to Water Security



- Water is vital for **life and health** of people and ecosystems
- **15 out of 24 ecosystem services** are degraded or used unsustainably
- **Soil nutrient** depletion, erosion, desertification
- Depletion of **freshwater reserves** and pollution of groundwater
- **Overfishing** is pressuring fragile soils
- **Loss of tropical forest** and of biodiversity reduces food availability
- **Urbanization** is diminishing the availability of land for food production.

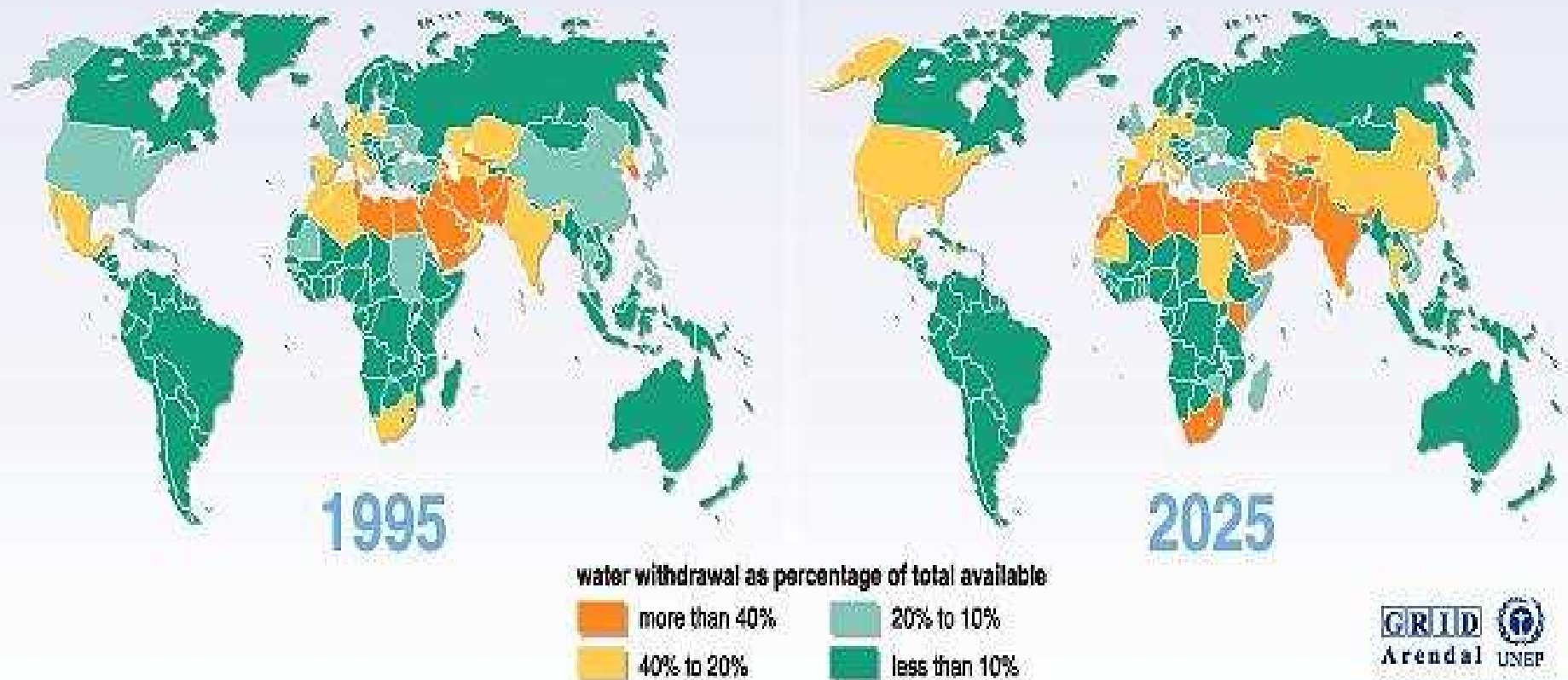
Water stress



Kofi Annan: “Drought and desertification are threatening the well-being and livelihood of more than one billion people in 110 country of the world“.

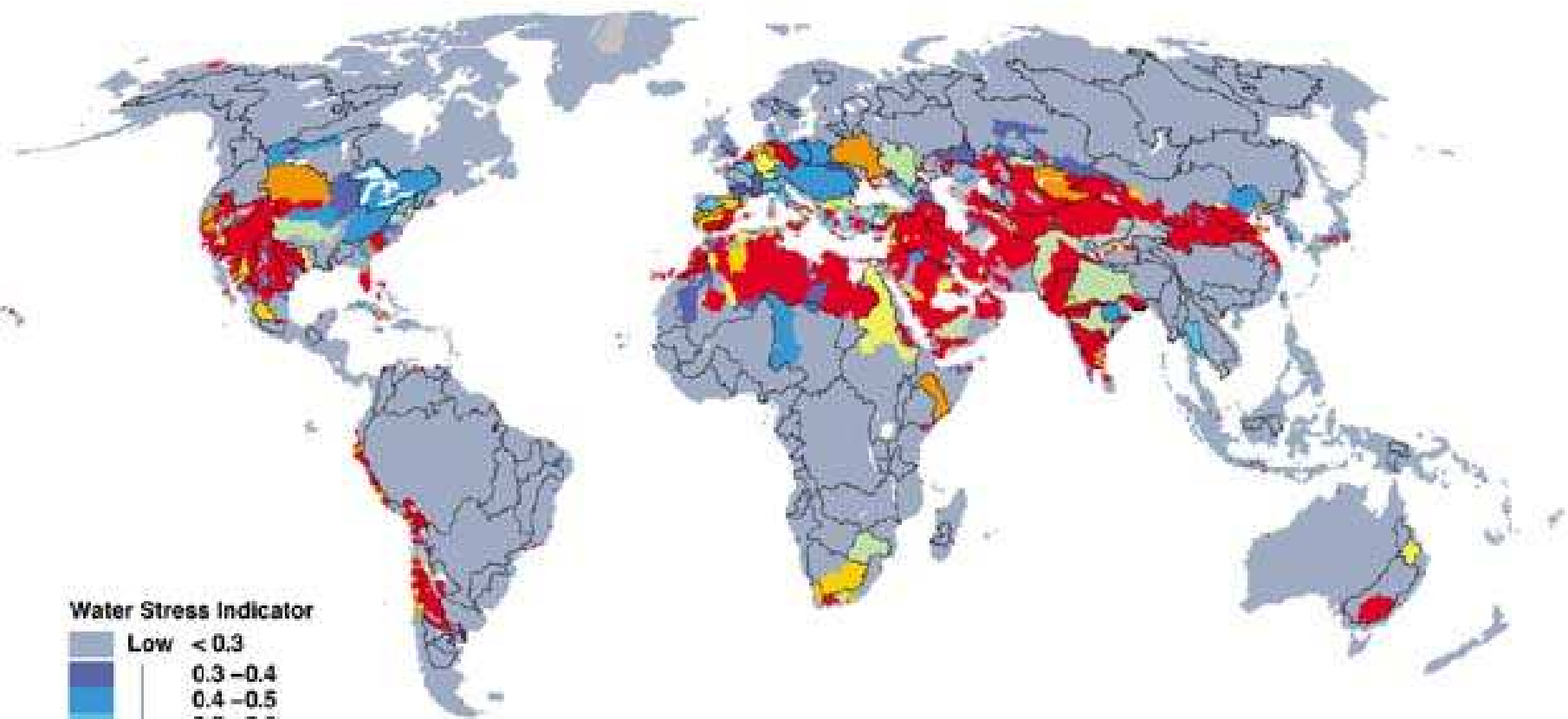
■ hyperarid ■ arid ■ semi-arid ■ dry subhumid ■ non-dryland

Freshwater stress

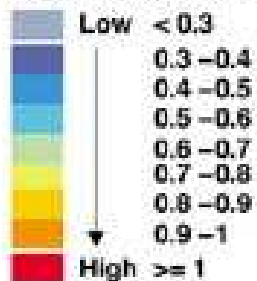


North Africa, Middle East, South Africa, India and Mexico are seriously affected by water stress from 1995 on. Climate change will increase water stress in Sudan, Kenya, Mauritania, China, Pakistan, Australia, Peru, Chile and some European countries.

Zones with Highest Water Stress

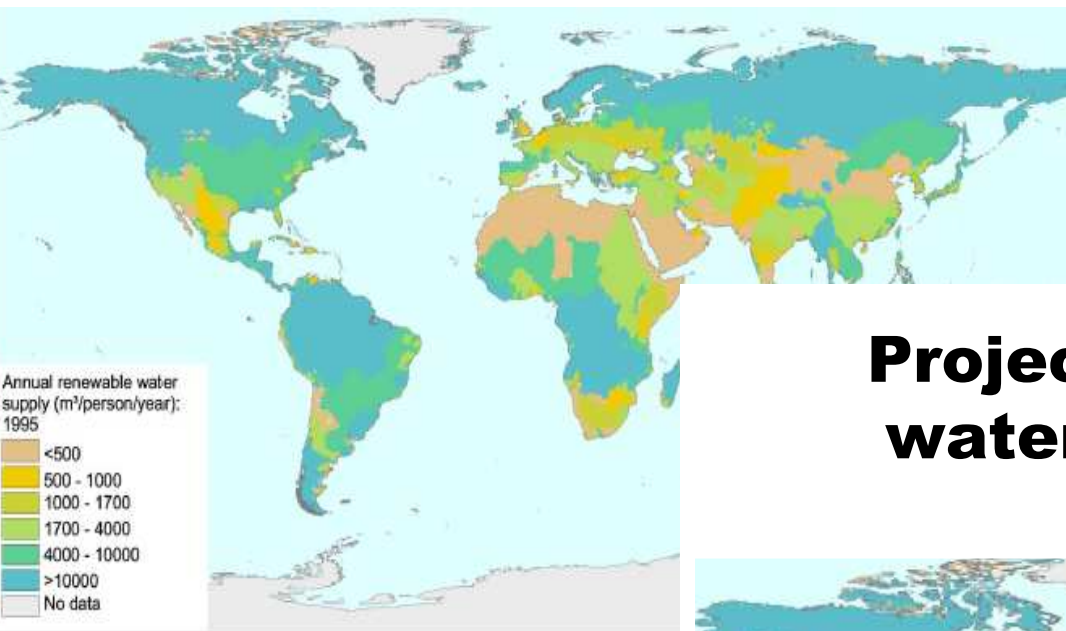


Water Stress Indicator

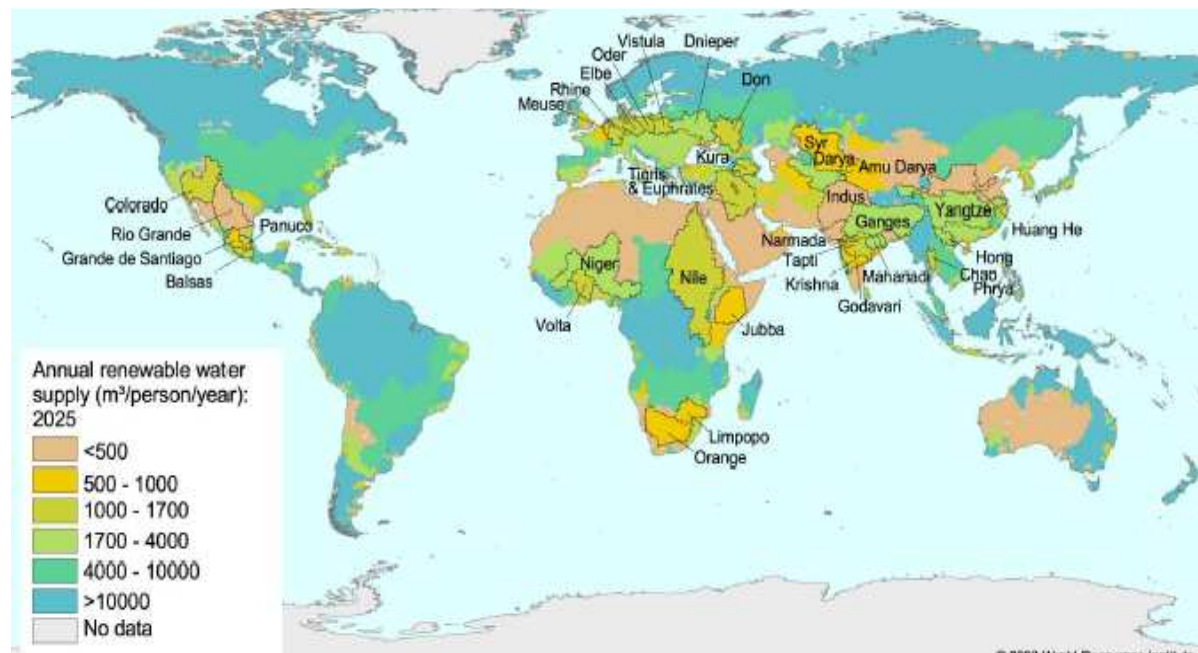


Grey No discharge
Black Major River Basins

Reserves of renewable water year/person/basin: 1995

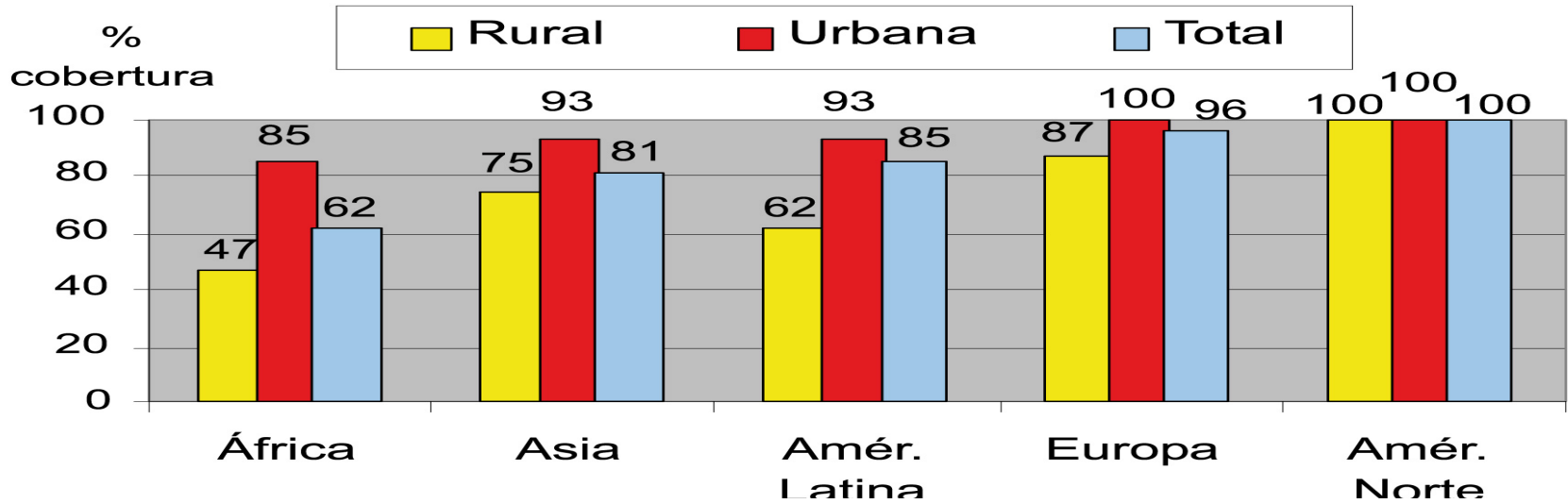


Projections of renewable water year/person/basin: 2025

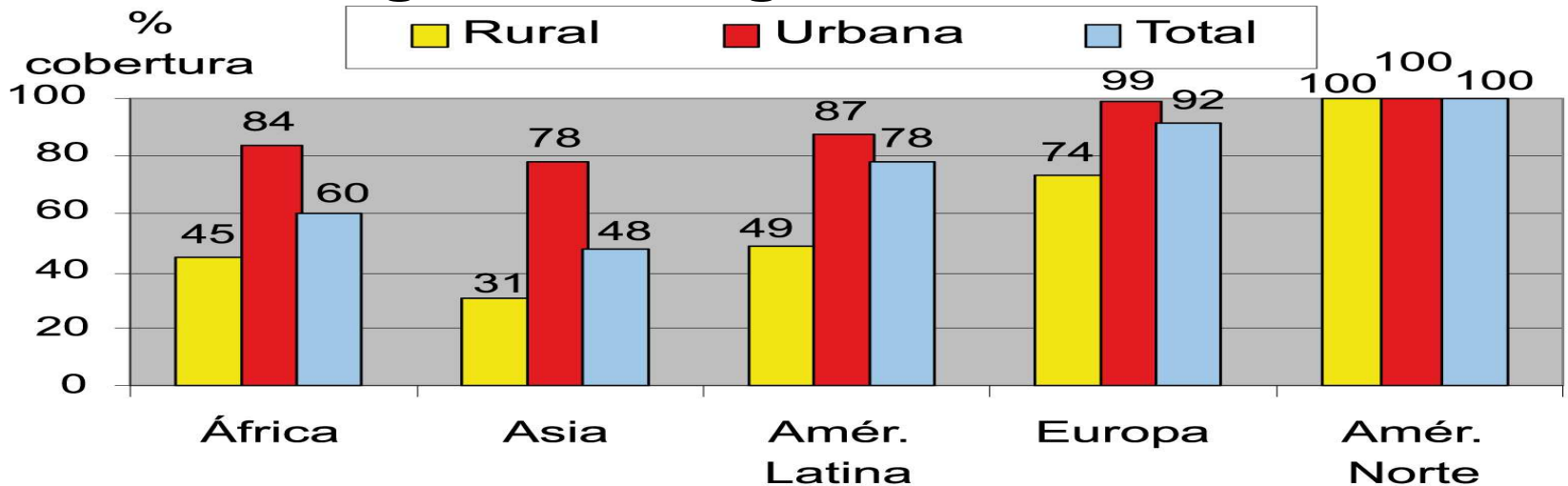


Inequality in water and sanitation

Coverage of tap water in 2000



Coverage of sewage facilities in 2000



- **One common goal:** *to provide water security in the 21st Century:*
 - 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 are hit first and hardest (slum dwellers without basic services).
- One simple conclusion: **business as usual is not an option.**

Human and Social Right of Water

1. Water is life: basic human right: 40-50l/pers. for survival
2. Water gives services: social right
3. Water is business: economic right: 70% of extracted and river water is used for business
4. Lack of water: affects health, environment, social organization, economic development, psychological factors, violence and conflicts
5. MDG: reduce by half people without safe water: 80% of all illnesses
 - 1.1 billion without water; 2.4 billion without sanitation
 - 4 billion people with diarrhea; 10% of people in the South infected by parasites
 - 6 million blind (trachoma)
 - 200 million esquistosomiasis (20 million severe ill)
 - 10 million with arsenic pollution due to overexploitation of aquifers???
 - 50% of rural areas in poor countries lacking safe water and sanitation
 - Slum dwellers are mostly without safe water and sanitation
6. Obligation of industrialized countries:
 - Investments, transfer of technologies, advice, long term investments
7. Obligation of poor countries:
 - Decentralization of water management, clean hands, hygienic education, medium term plans, efficient administration, clear priorities, just tariff system, adapted technology, development and maintenance of water supply system, gender sensitivity, combating corruption

4. Definitions of food security and food sovereignty



Food security

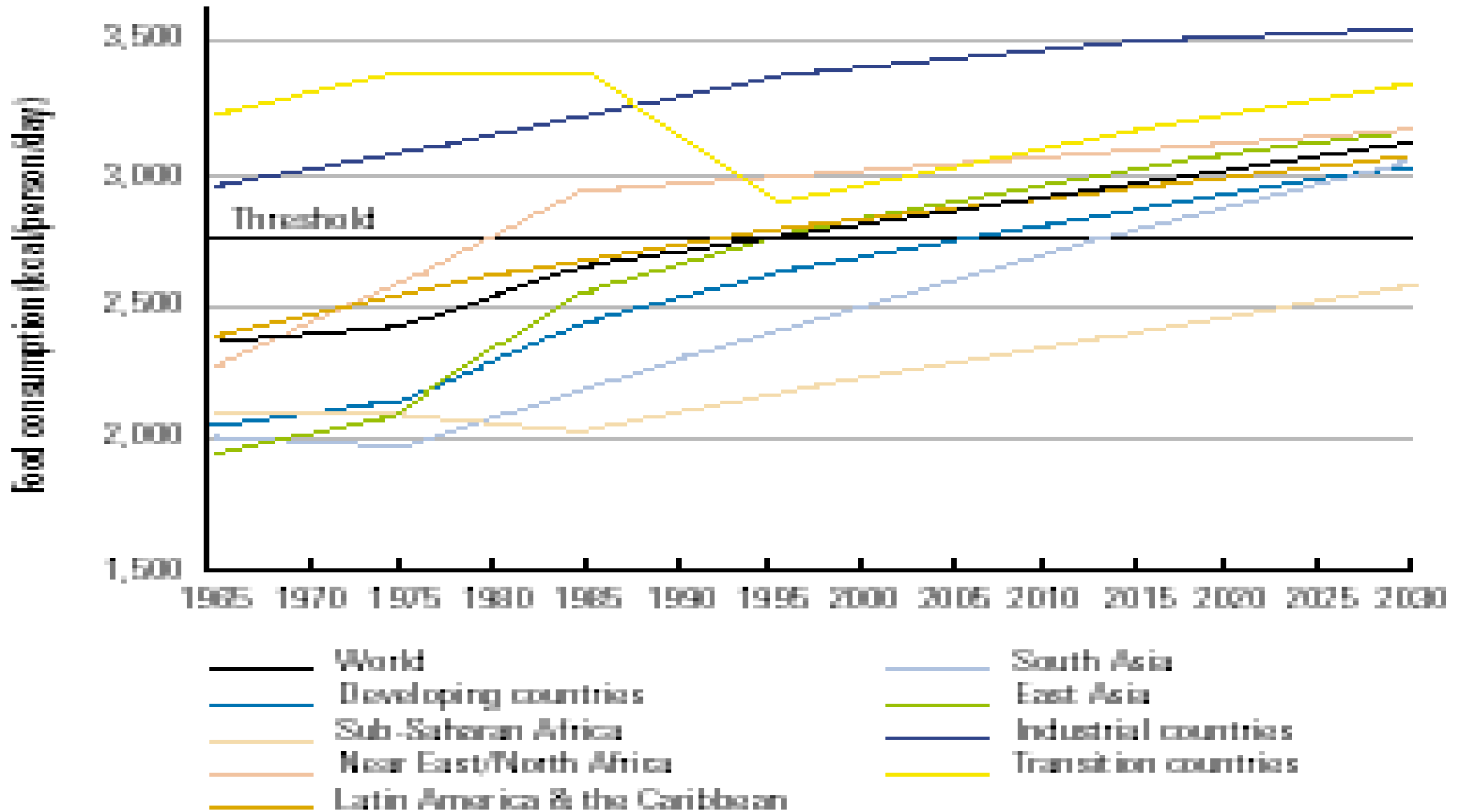
Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life.

Household food security is the application of this concept to the family level, with individuals within households as the focus of concern. Vulnerable people are greatly exposed to famine (FAO, 2003)

***Via Campesina's* food sovereignty**

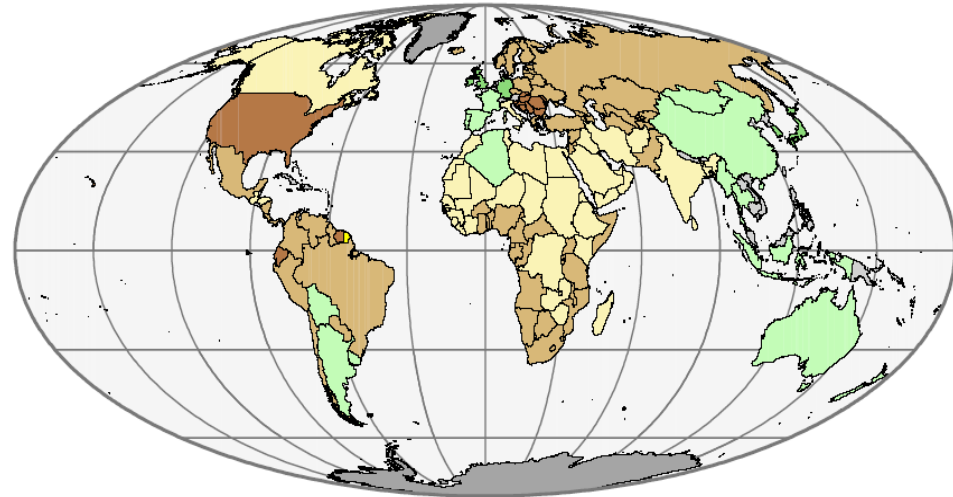
“Food sovereignty is the right of people, communities, and countries to define their **own** agricultural, pastoral, labour, fishing, food and land **policies** which are **ecologically, socially, economically, and culturally** appropriate to their unique circumstances. It includes the **right to food 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” (2004).

5. World's Food Situation



Food Scenarios: 2020, 2050, 2090

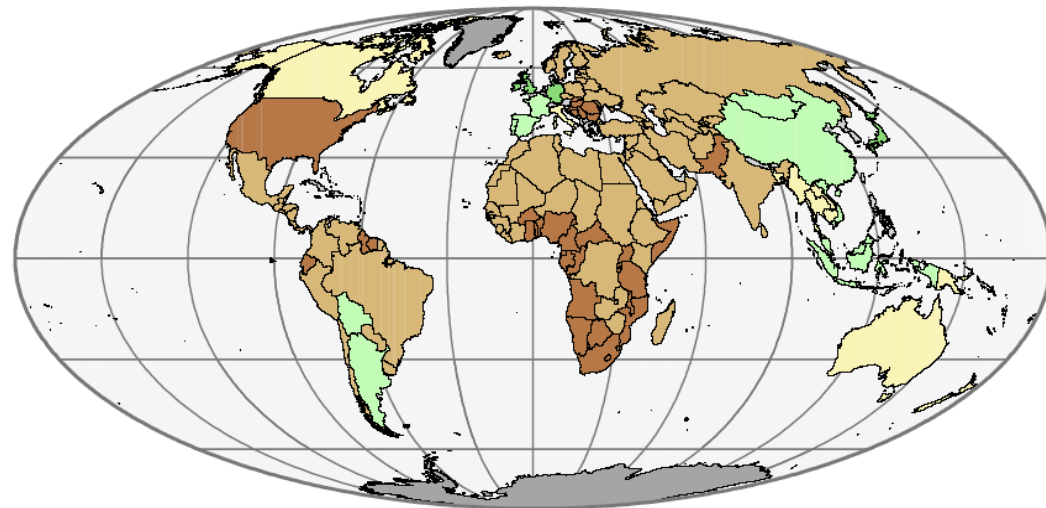
Food security 2040 - 2069 (HADCM3 GGA1)



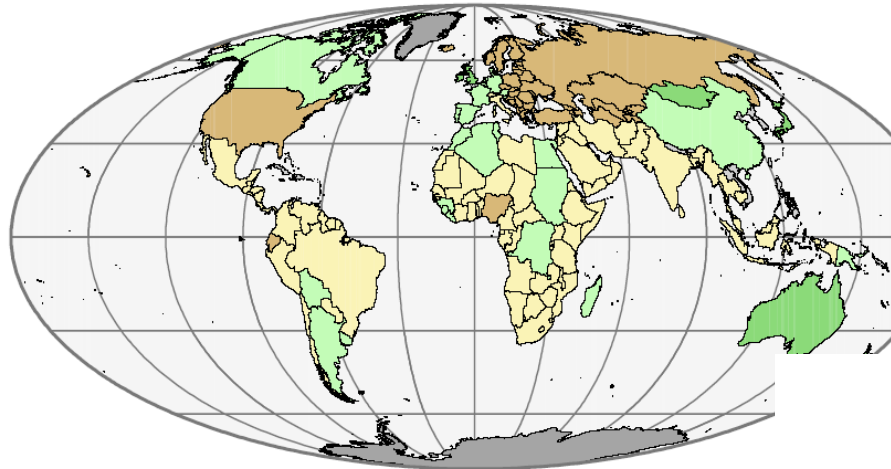
potential yield change [%]



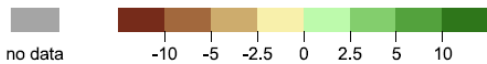
Food security 2070 - 2099 (HADCM3 GGA1)



potential yield change [%]



potential yield change [%]





**6. Challenges for food
sovereignty: three
models of food
production :**

- Productivity paradigm**
- Life science paradigm**
- Green agriculture
paradigm**

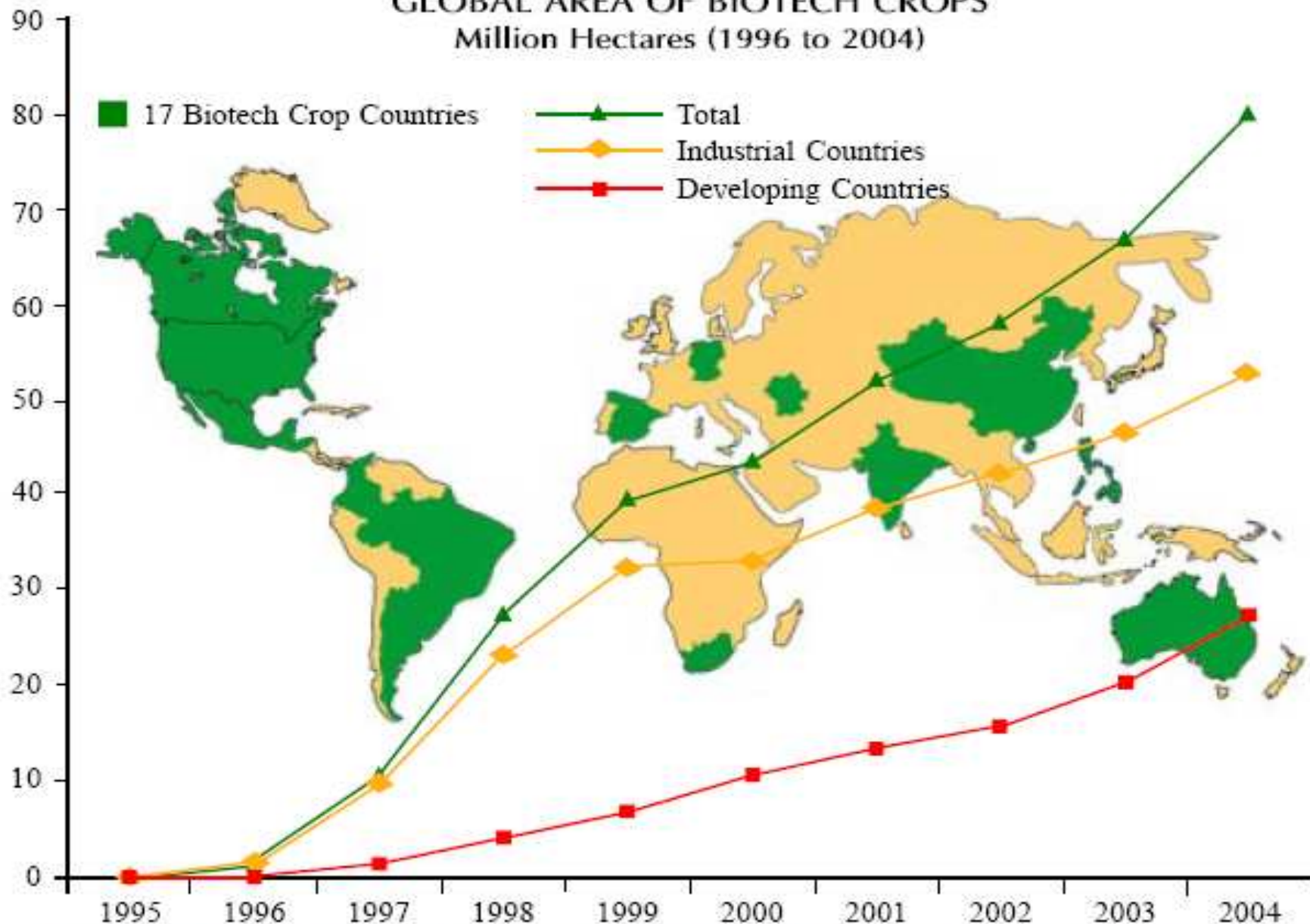
Productivity paradigm

- **Green revolution with intensive use of chemicals, veterinarian drugs, improved seeds, machines, fossil energy, and irrigation systems;**
- **industrialization** of agriculture.
- **cheap and homogenous** food for urban areas with government subsidies,
- **Low food prices** leaving poverty in the countryside.
- Production controlled by **agronomists, veterinarians,** and the chemical industry.
- **Ministry of Agriculture** managed natural resources: soils, water, forests, flora, fauna, and fish. Health and environment concerns were marginal.
- **Limits** of this model: **negative effects** on health, environment (scarcity in water and oil resources) and the destruction of rural livelihood.

Life science paradigm

- ***Life science model*** integrates the food chain in form of **clusters** of production, transformation & trade of food.
- Combines **genetic research** with field experiments, biotechnology, engineering, nutrition, pharmacology, health, and mobile field labs controlled by multinational food chains.
- Offers **clean and homogenous** products that can stay for weeks on the shelves of supermarkets, thanks to ***genetically modified genes and organisms*** with some undesired social, health and environmental effects.
- **Cornucopian vision** of life where MNE resolves environmental, social, and health problems through science and technology.
- **Increases costs of production** and **food prices** due to **TRIPs**, and created monopolies of agro-chemicals and food transformation.
- Food is transformed into **medicine** (Nestlé, 2002)

GLOBAL AREA OF BIOTECH CROPS Million Hectares (1996 to 2004)



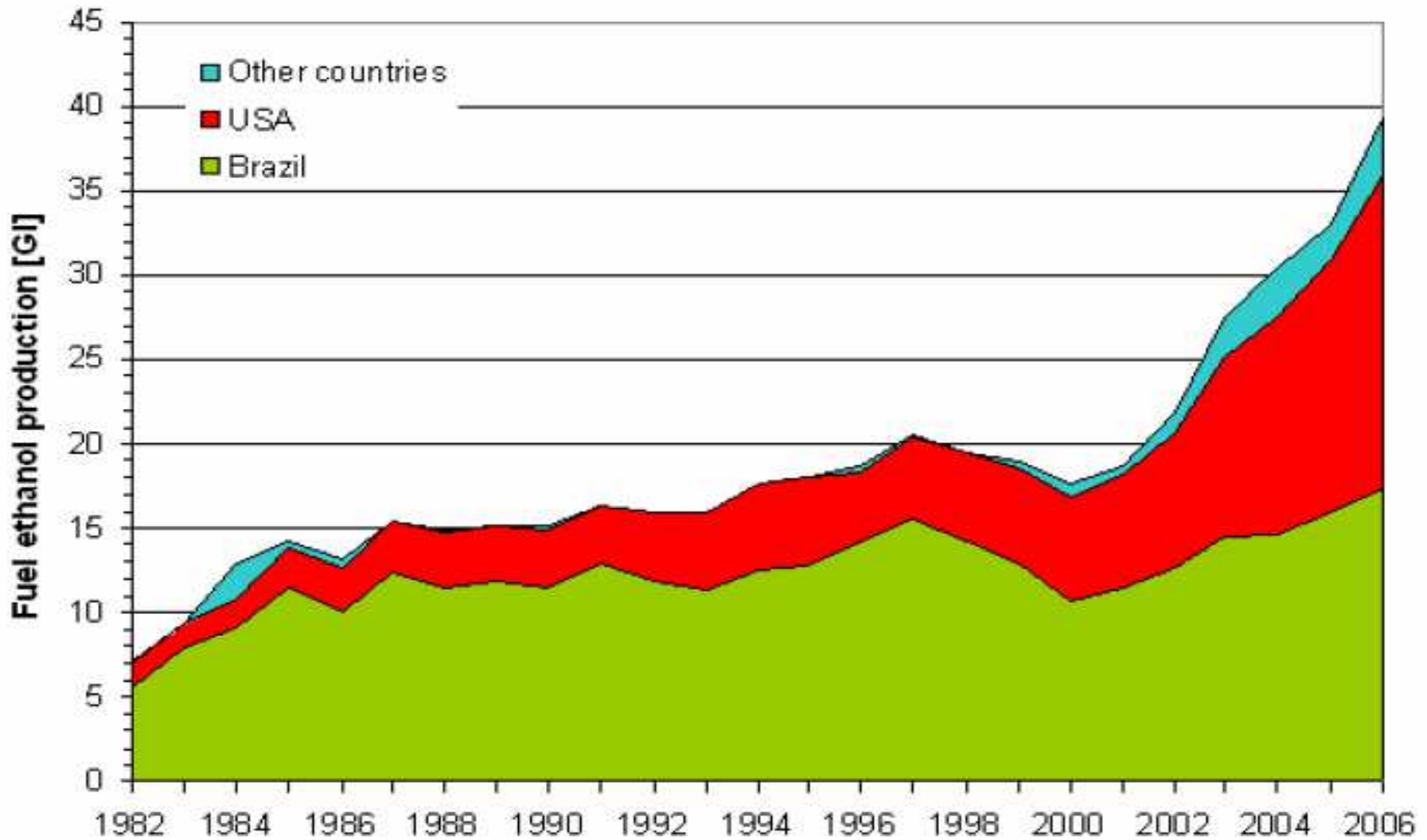
Increase of 20%, 13.3 million hectares or 32.9 million acres between 2003 and 2004.

Source: Clive James, 2004

Accidents with Genetic Modified Organisms: Transgenics



Biofuel: ethanol or food?

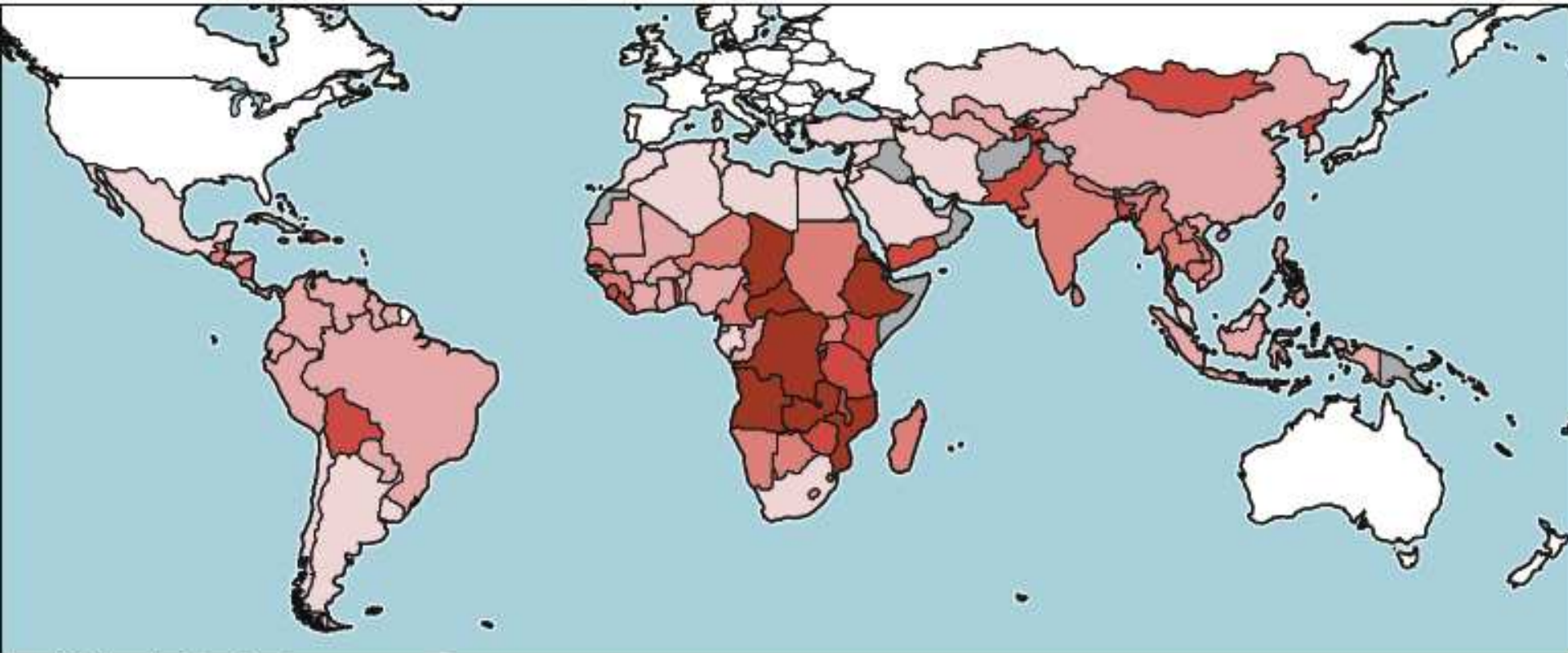


(Walter, A., 2007)

Green agriculture paradigm

- **Green model** generates **symbiotic relations** and mutual dependence between nature and food production, using soft methods of agriculture.
- **Regionally diverse**, utilizes polycultivation, association of crops, rotation, mixed agriculture, bio-fertilizers, fixation of nitrogen from air to soil, bio-pesticides, traditional methods of soil conservation and food, integral management of water, plagues, and environmental services.
- **Local agricultural production**, transformation and trade, with access for peasants to water, seeds, credits
- **Women as key producers** for food issues, care about vulnerable and consolidate livelihood,
- When livelihood in villages and countries is guaranteed public resources for **poverty and hunger alleviation** can be reduced and reallocated for other development purposes, creating stable social relations synergies and cooperation.

Undernourishment in the world

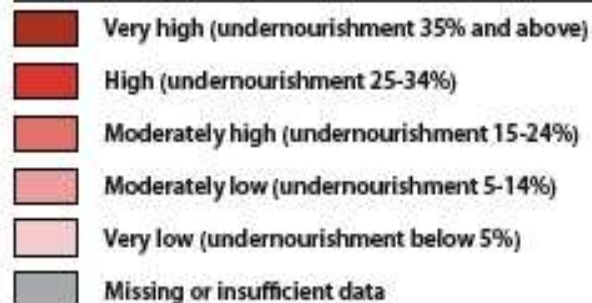


Source: FAOSTAT 2010 (www.fao.org/hunger)

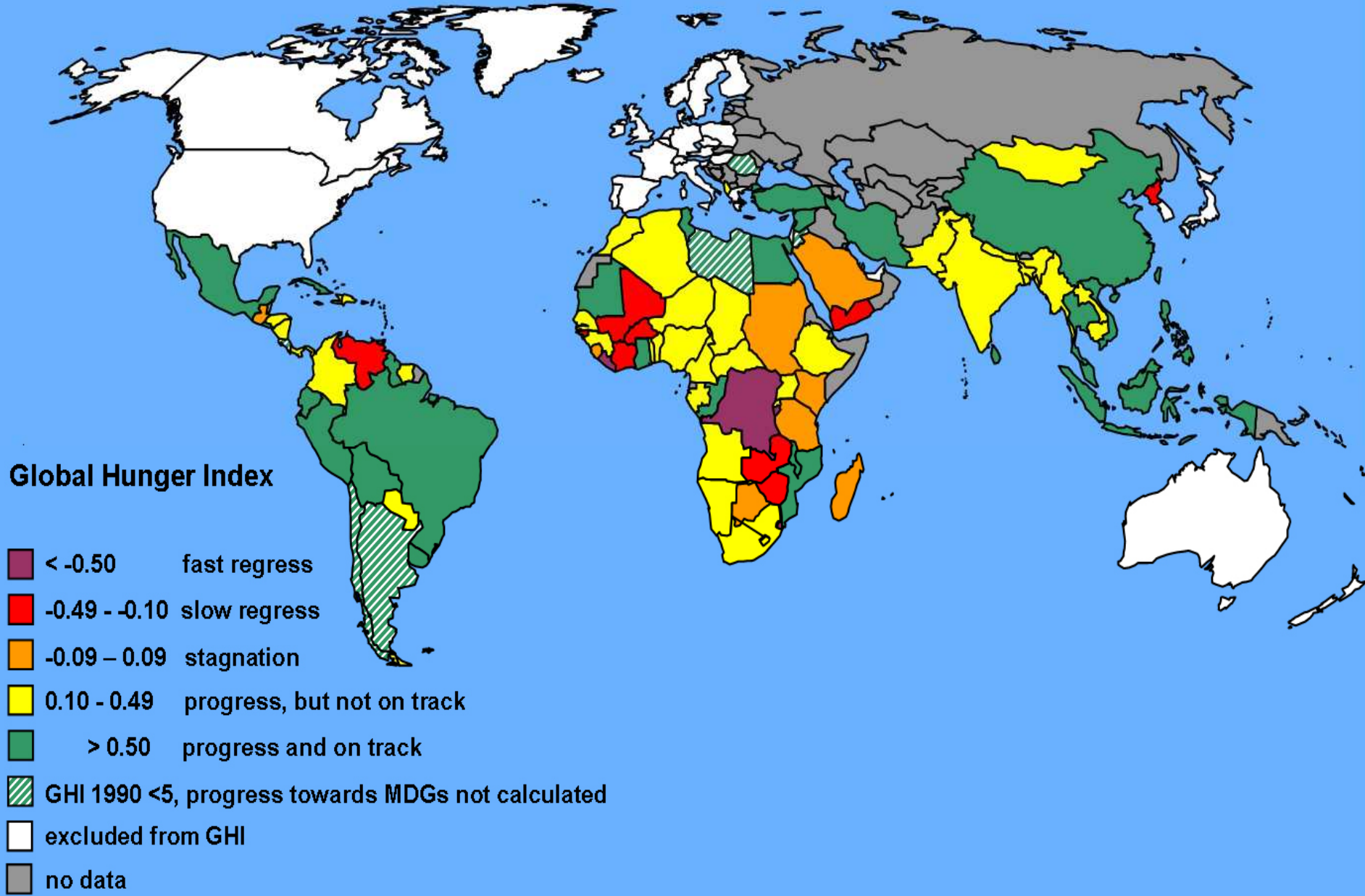
Note: The map shows the prevalence of undernourishment in the total population of developing countries as of 2005-7 – the most recent period for which complete data are available. Undernourishment exists when caloric intake is below the minimum dietary energy requirement (MDER). The MDER is the amount of energy needed for light activity and a minimum acceptable weight for attained height, and it varies by country and from year to year depending on the gender and age structure of the population.

The designations employed and the presentation of material in the map do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal or constitutional status of any country, territory or sea area, or concerning the delimitation of its boundaries.

Prevalence of undernourishment in developing countries (2005-07)



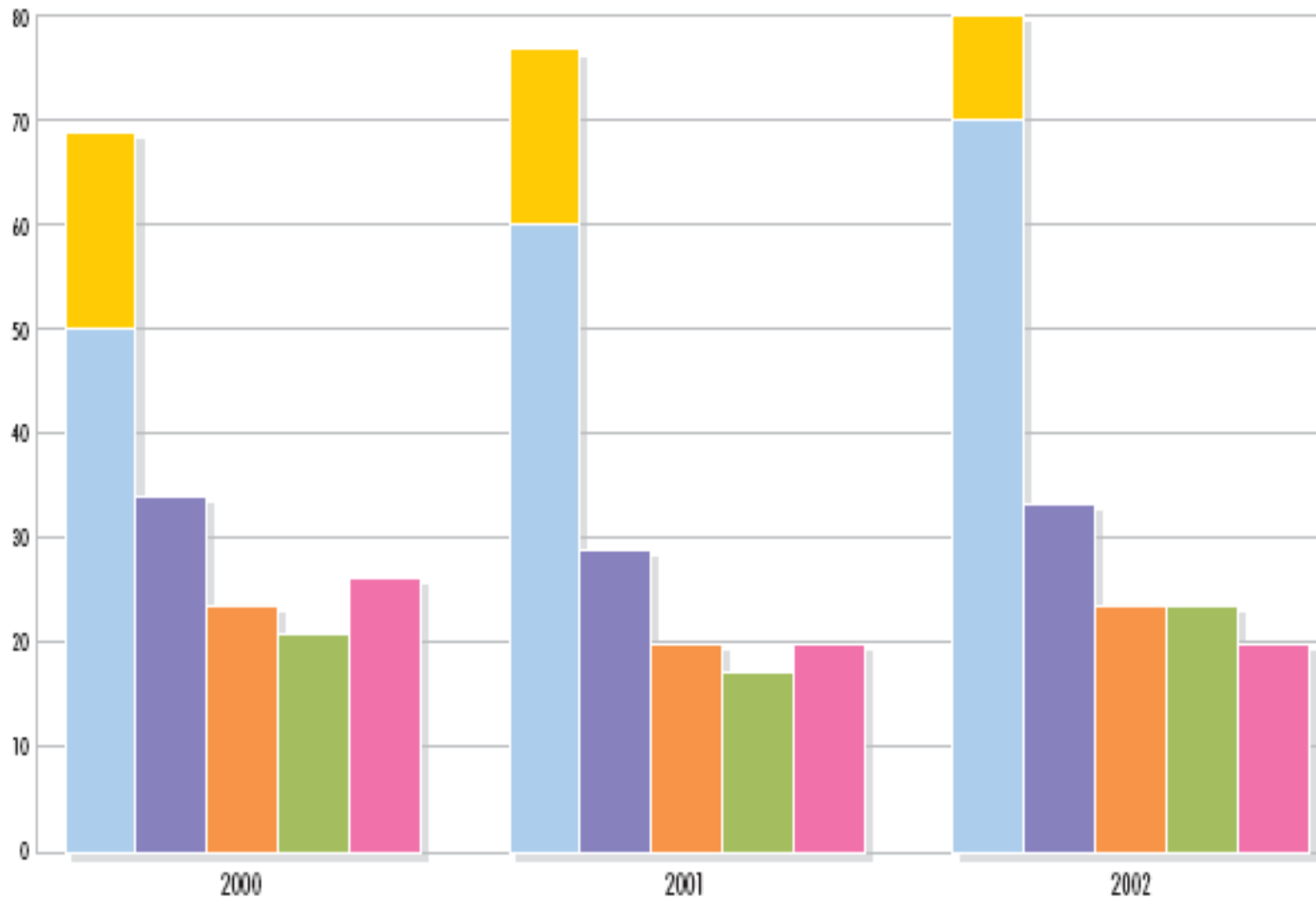
Results: MDG and Hunger Index



Food production emergencies

Per cent of food emergencies*

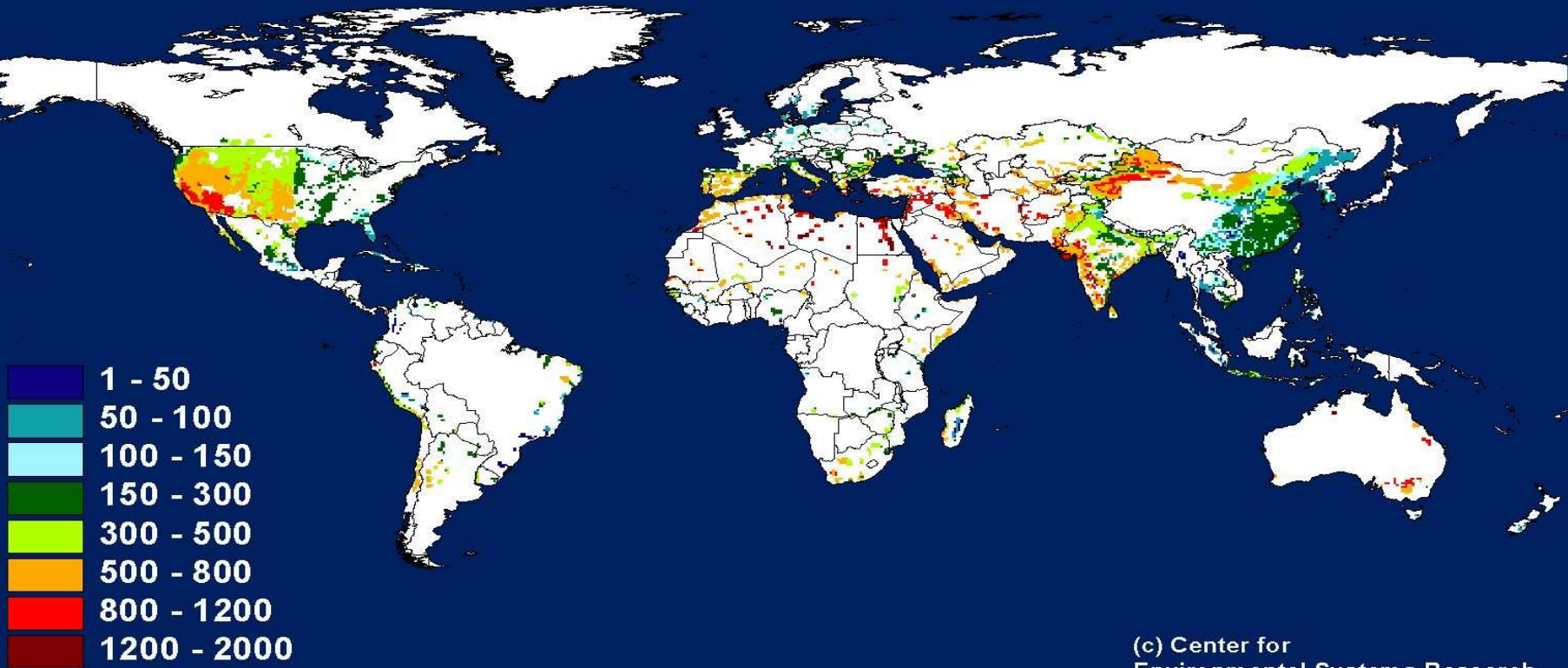
- Flood
- Drought
- Conflict
- Refugees**
- Economic problems
- Other



* Total exceeds 100% because of multiple causes and cited for many emergencies.

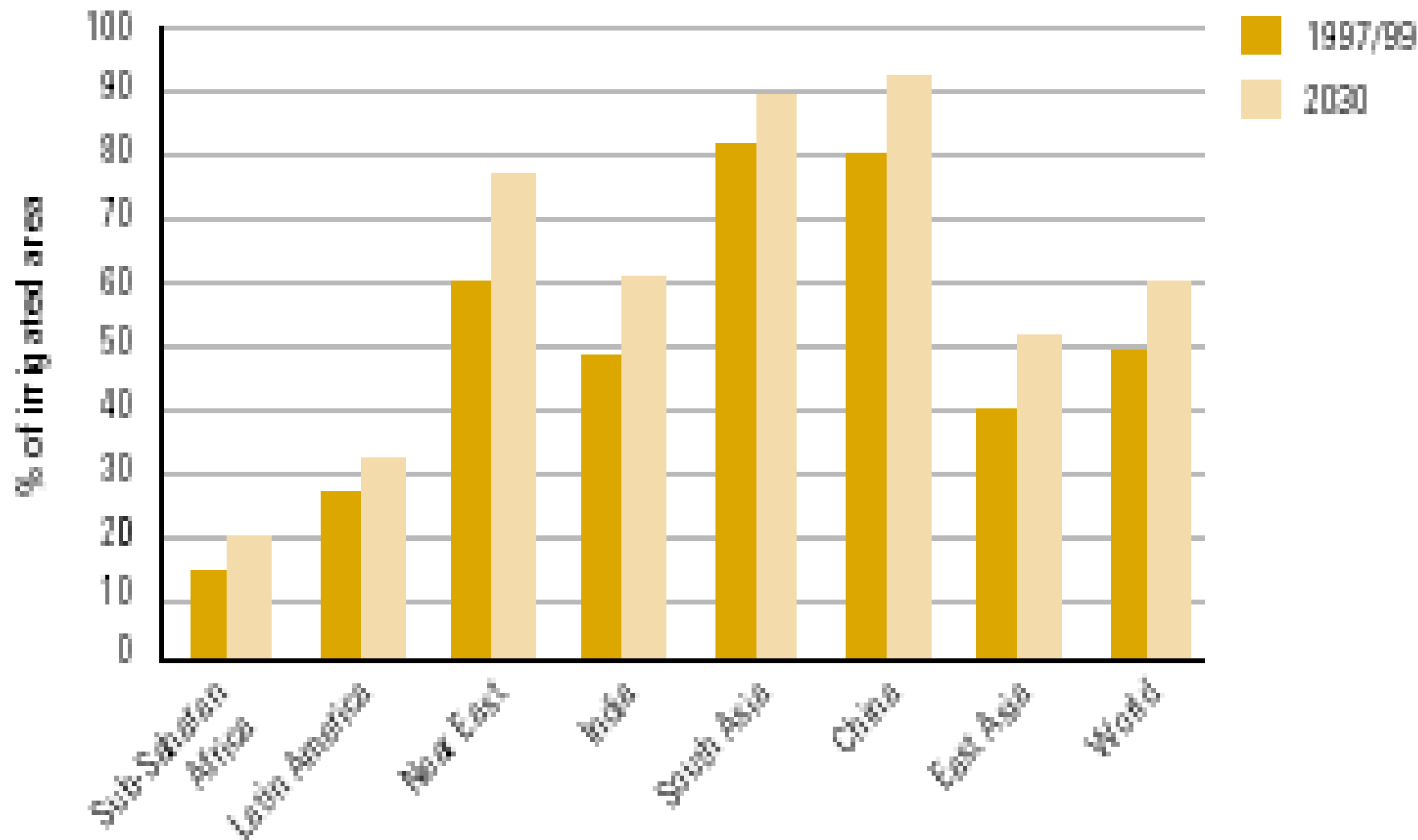
** Includes internally displaced people.

Water Use in Agriculture Irrigated Areas

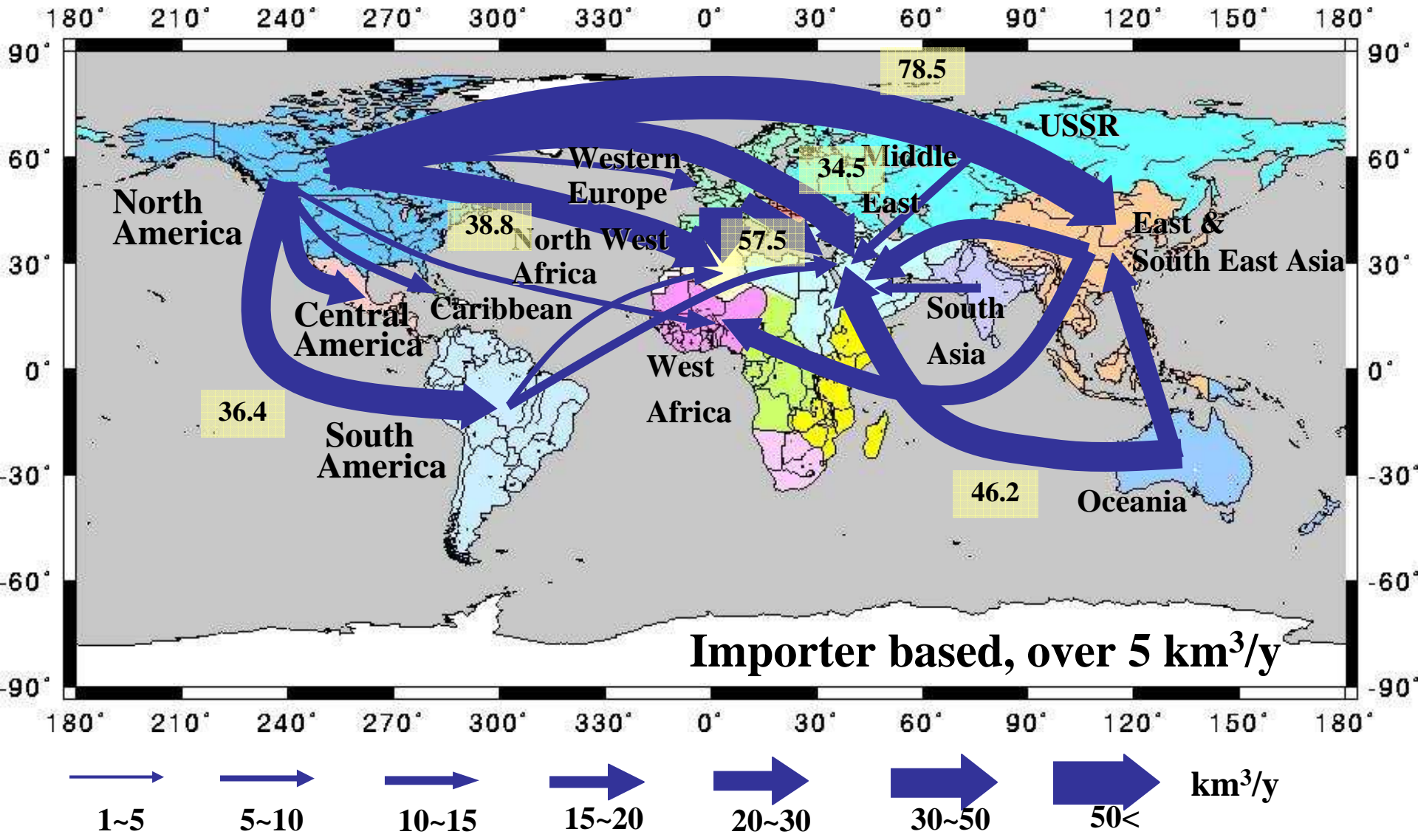


(c) Center for
Environmental Systems Research,
University of Kassel, Nov 2000

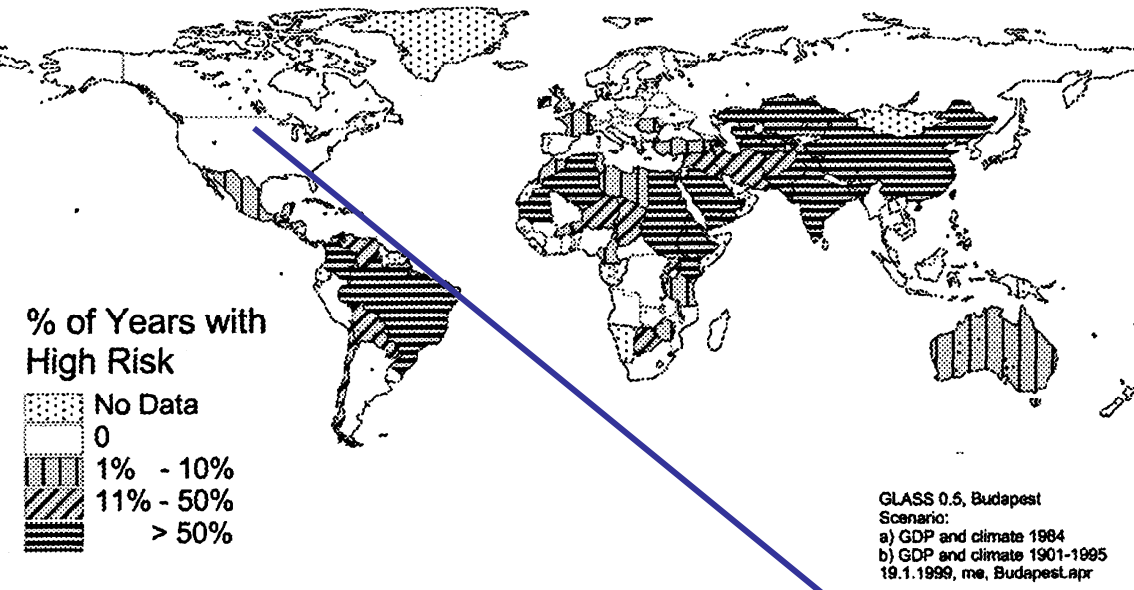
Potential of irrigation in the world



Virtual Water and Food (only grains)



(Oki, et. al, 2002, IHE-UNESCO) (Based on Statistics from FAO etc., for 2000)



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

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

Higher Potential of Food Crisis with Climate Change (Medium GDP Development (2001-2050) Alcamo/Endejan 2002:143

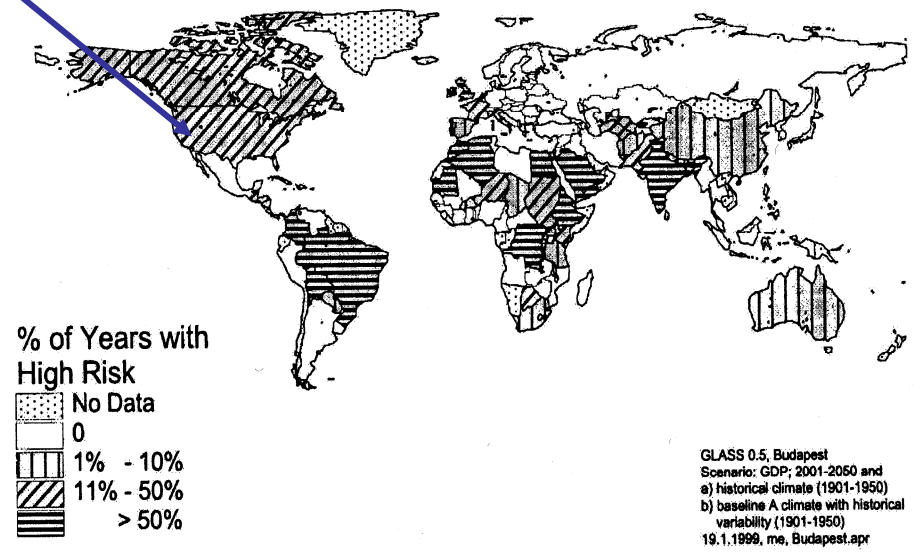
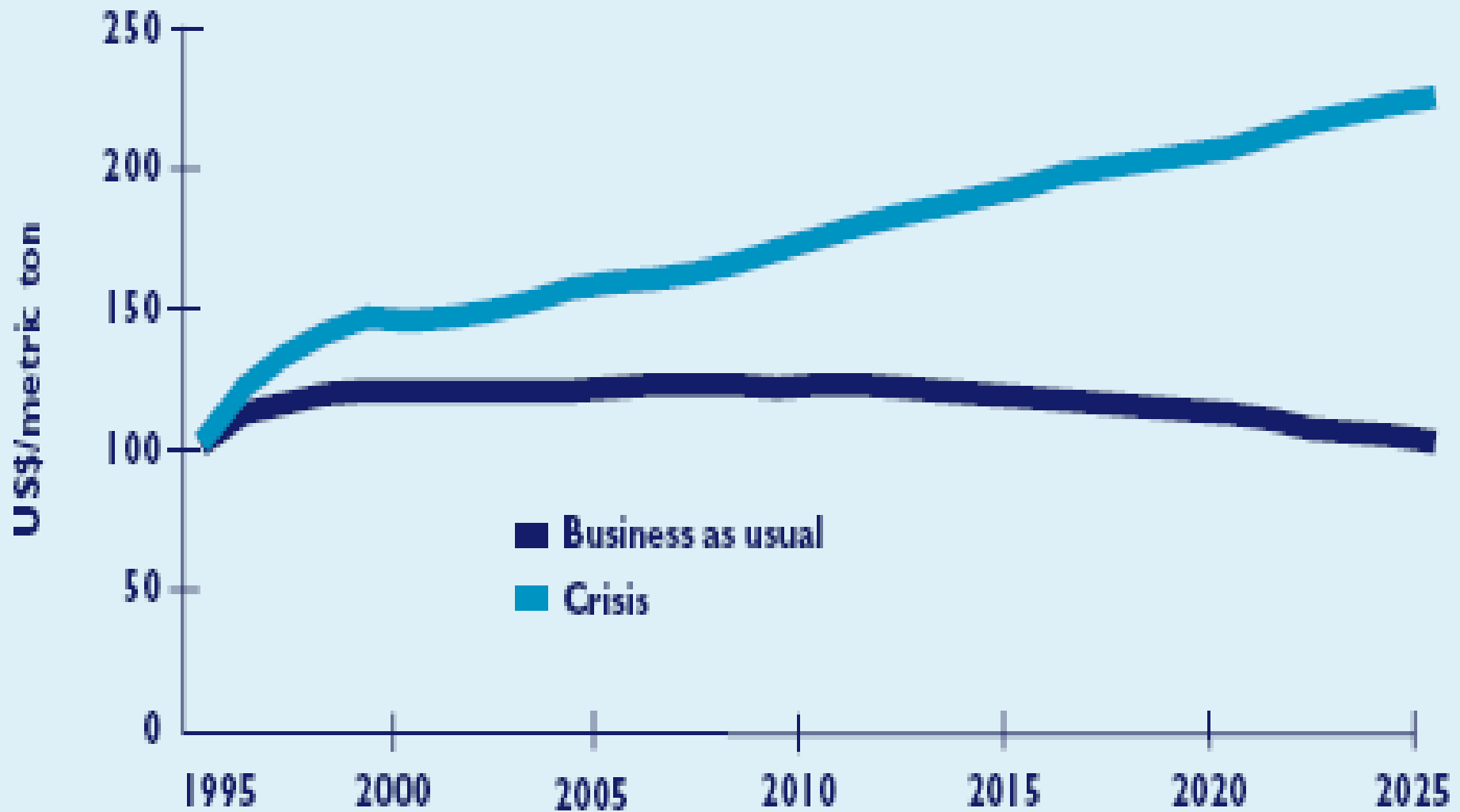


Figure 6. High Potential for Food Crisis 2001-2050 – with GDP Increase and Climate Change.

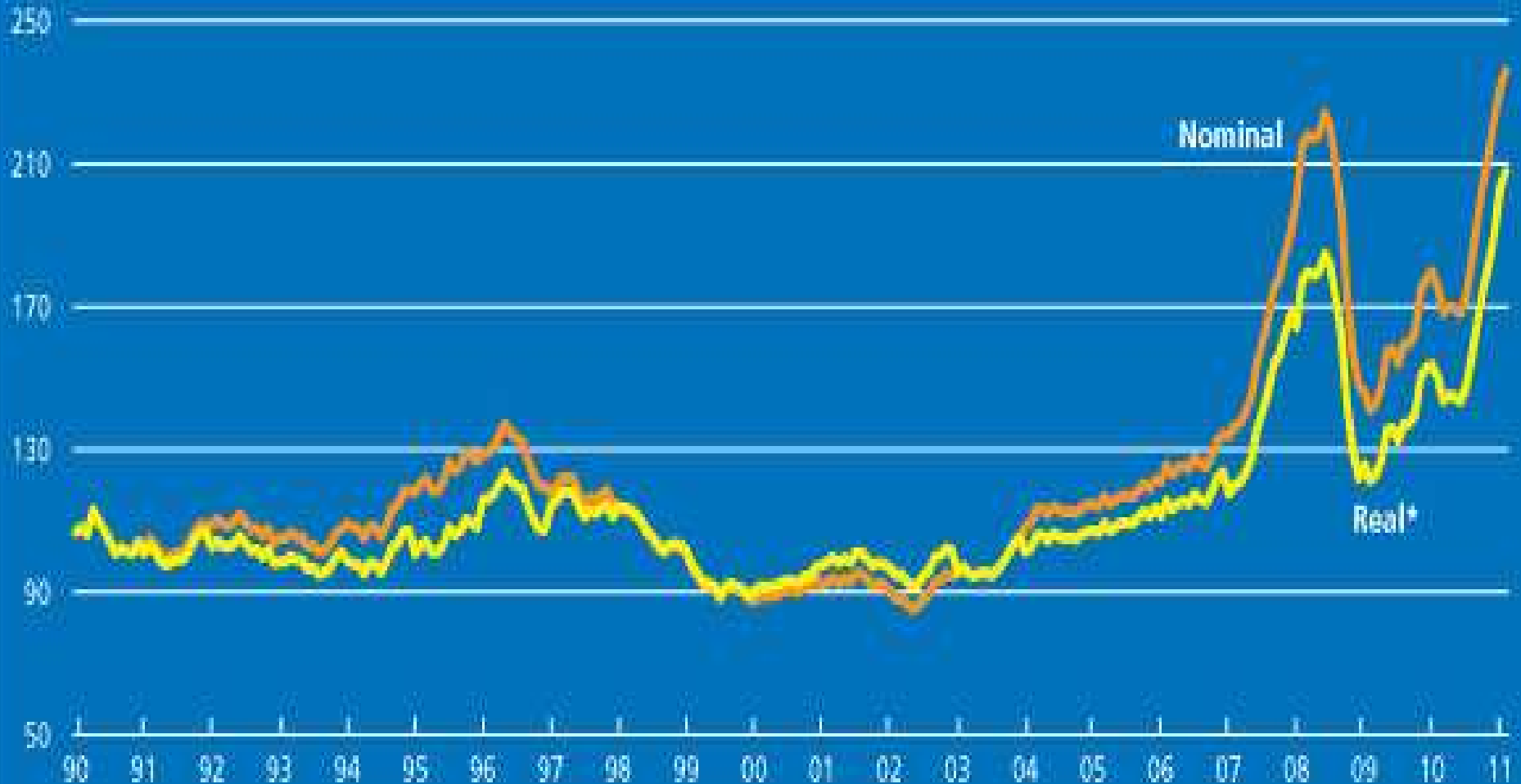
International Corn Prices



(3/3/2011)

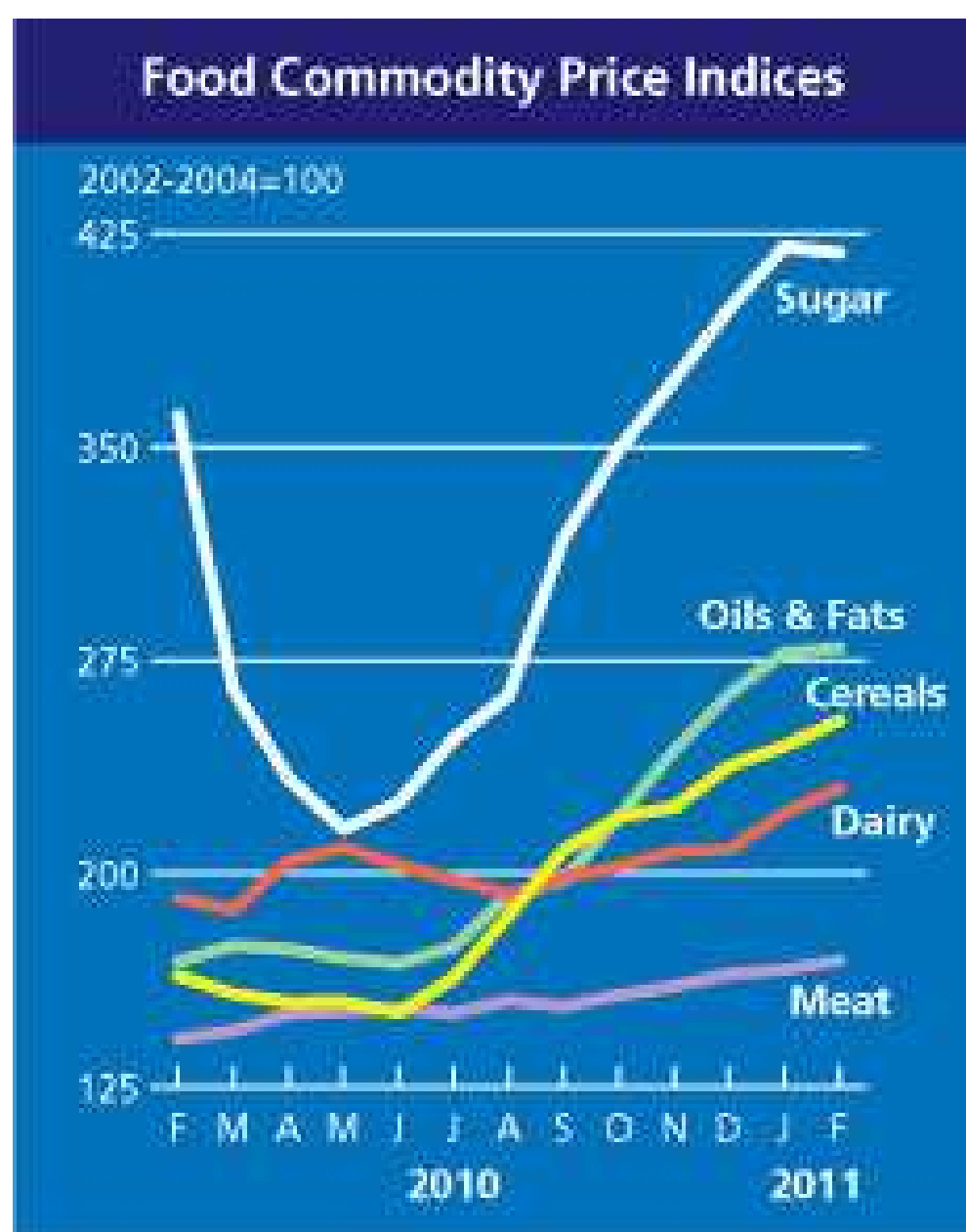
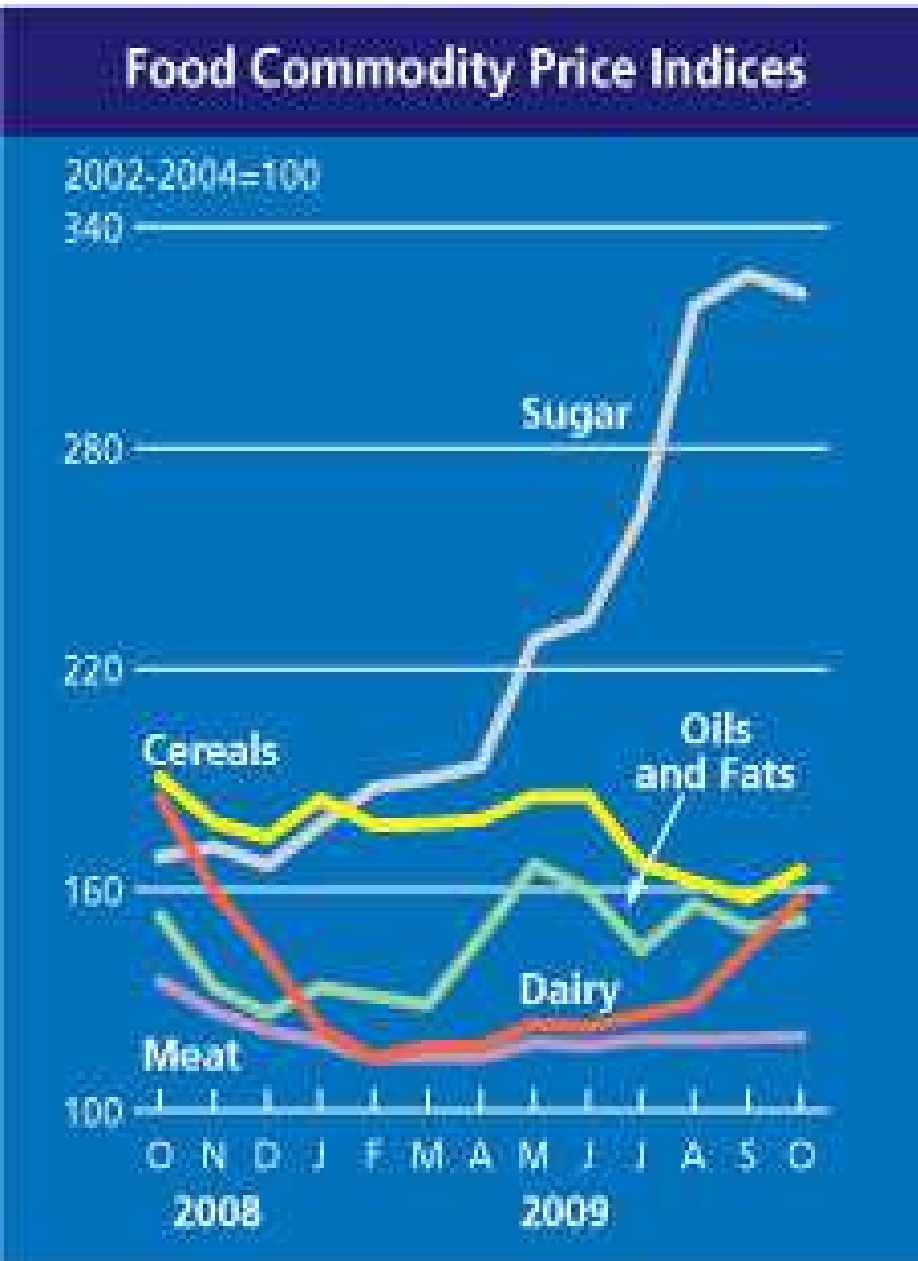
FAO Food Price Index

2002-2004=100



* The real price index is the nominal price index deflated by the World Bank Manufactures Unit Value Index (MUV)

Price Indexes of food (Nov. 2009 & March 2011)



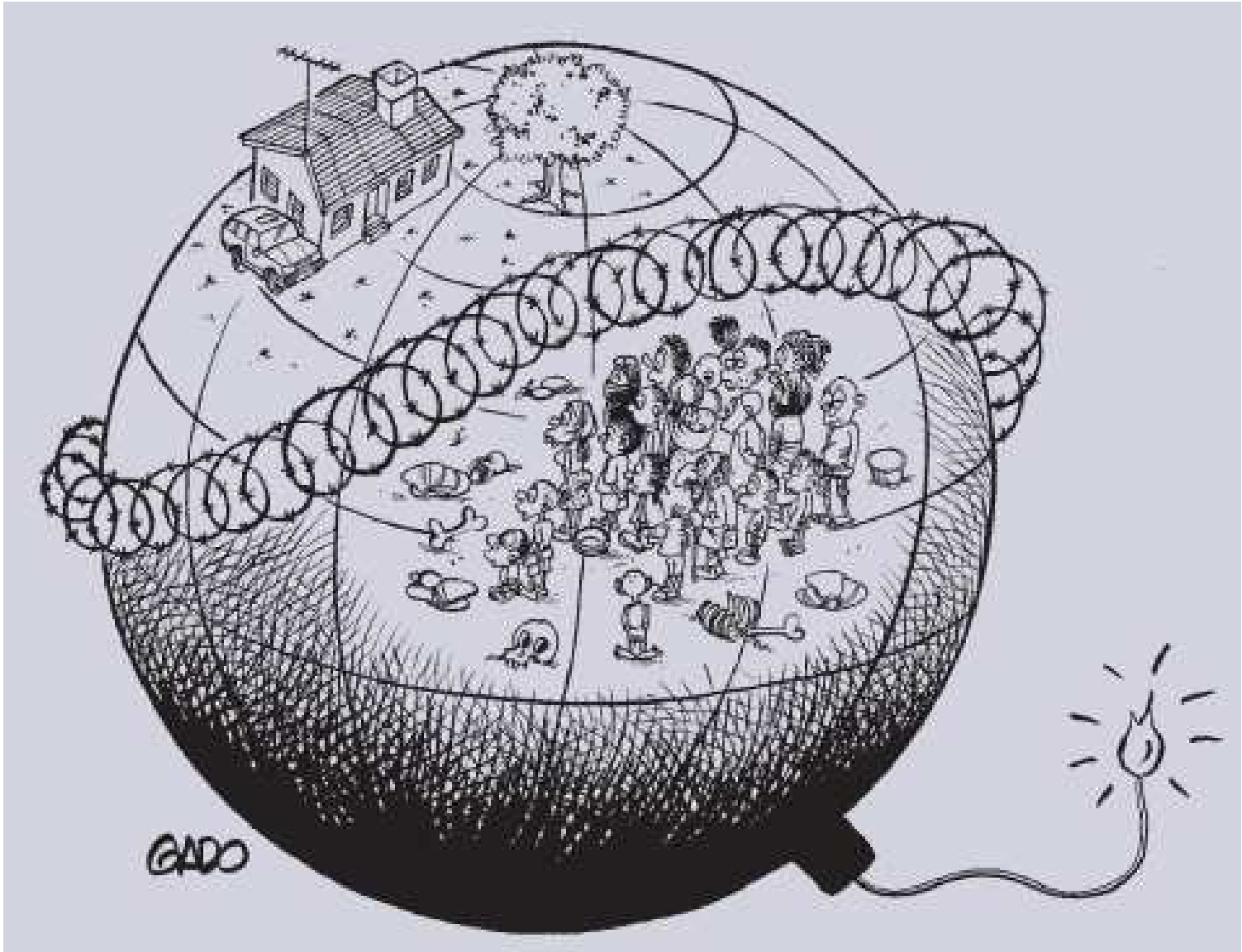
FAO Program after Food Summit

- To **eradicate hunger** from the earth.
- To **feed the world population by 2050** (reach 9-10 billion) & food must grow by 50 %
- **More coherent and effective system of governance** of food security at national and international levels.
- **Developing countries get a fair chance** in world commodity markets (no unfair international trade).
- **Ensure farmers incomes** comparable to other sector workers.
- **Mobilize additional public and private sector investments in agriculture** and rural infrastructure to boost food production and productivity.
- More than **30 countries** have food emergencies: **effective mechanisms for early reaction to food crises.**

A Problem of Equity

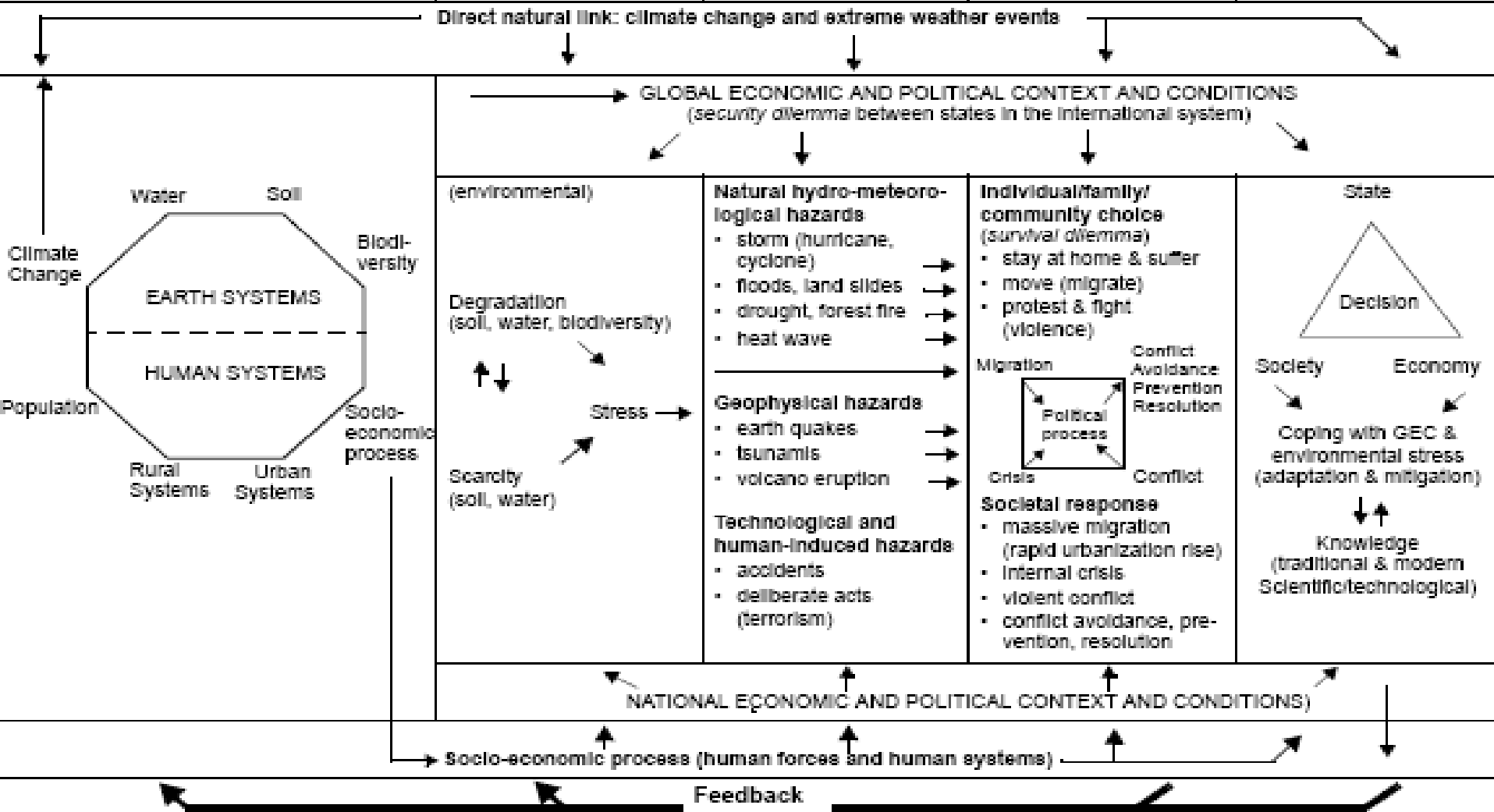
- Each **sixth person** on the globe is hungry: **1.06 billion** are undernourished, have not enough food or money to pay for it. Food price rise **provoked 107 million more hungry people** in 2008. MDG can not be reached and affects above all rural and urban poor.
- Land degradation and desertification affect **one third of the world land surface** and affects around **485 million** people; 46% of people are affected in Africa with 43% of the deserts.
- In Africa the **productivity loss/year** is estimated in 0.5-1%
- **Desertification and land degradation** pose multiple global, regional and national security issues: **food, water, climate, livelihood, health, urban, rural and transportation security.**
- Desertification and land degradation aggravated by drought may induce **large-scale forced migration movements, hunger riots** and emerging **conflicts** on scarce resources.

What kind of future do we want?



The PEISOR Model

Pressure	Effect	Impact	Societal Outcome	(Policy) Response
Causes of Global Environmental Change (GEC)	Socio-economic Interaction Environmental scarcity, degradation and stress	Natural and human-Induced hazards	Individual choice (survival dilemma) Societal response	National and international political process, state, societal and economic actors and knowledge



7. Conclusions: Food sovereignty with resilience

- Dissemination of information on food and water security issues based on the scientization, through cooperation with leading universities and research institutes globally.

Policy Advocacy

- Epistemic community to foster cooperation & bring together science and policy making on water security issues (FAO, WHO, WMO, UNDP, UNEP, UNESCO); international workshops for systematic interchange of practical experiences for territorial governance with social cohesiveness. Pro-active strategies for adjustment and mitigation to water threats.

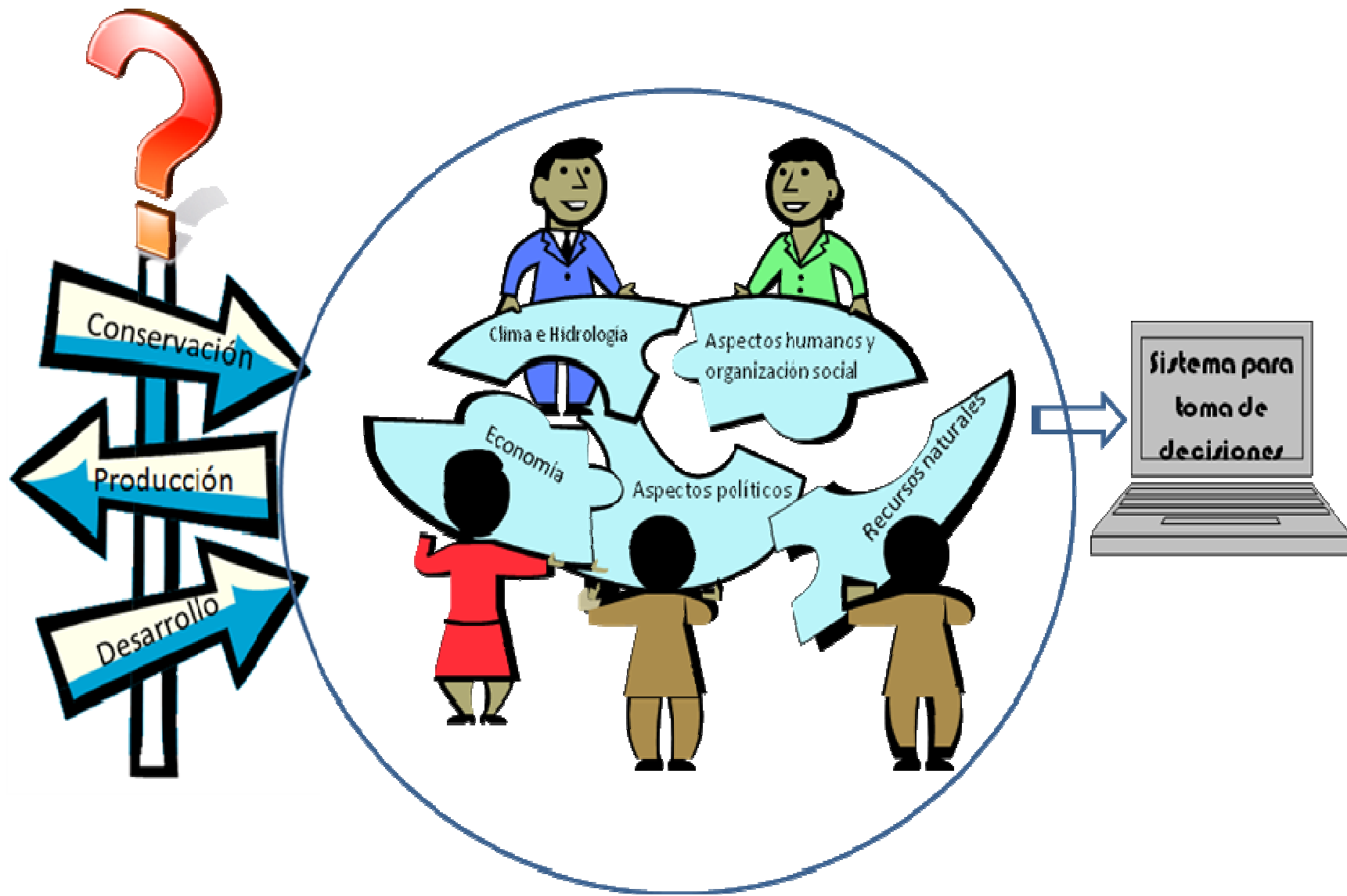
Capacity Building

- **Strengthening traditional and innovative knowledge for embedding the assessment of levels of water security into the environmental impact and risks assessment, land use planning and environmental auditing.**
- **Training on best practices for conflict settlement mechanisms at the sub regional and national levels.**

Financing: Channelling Resources

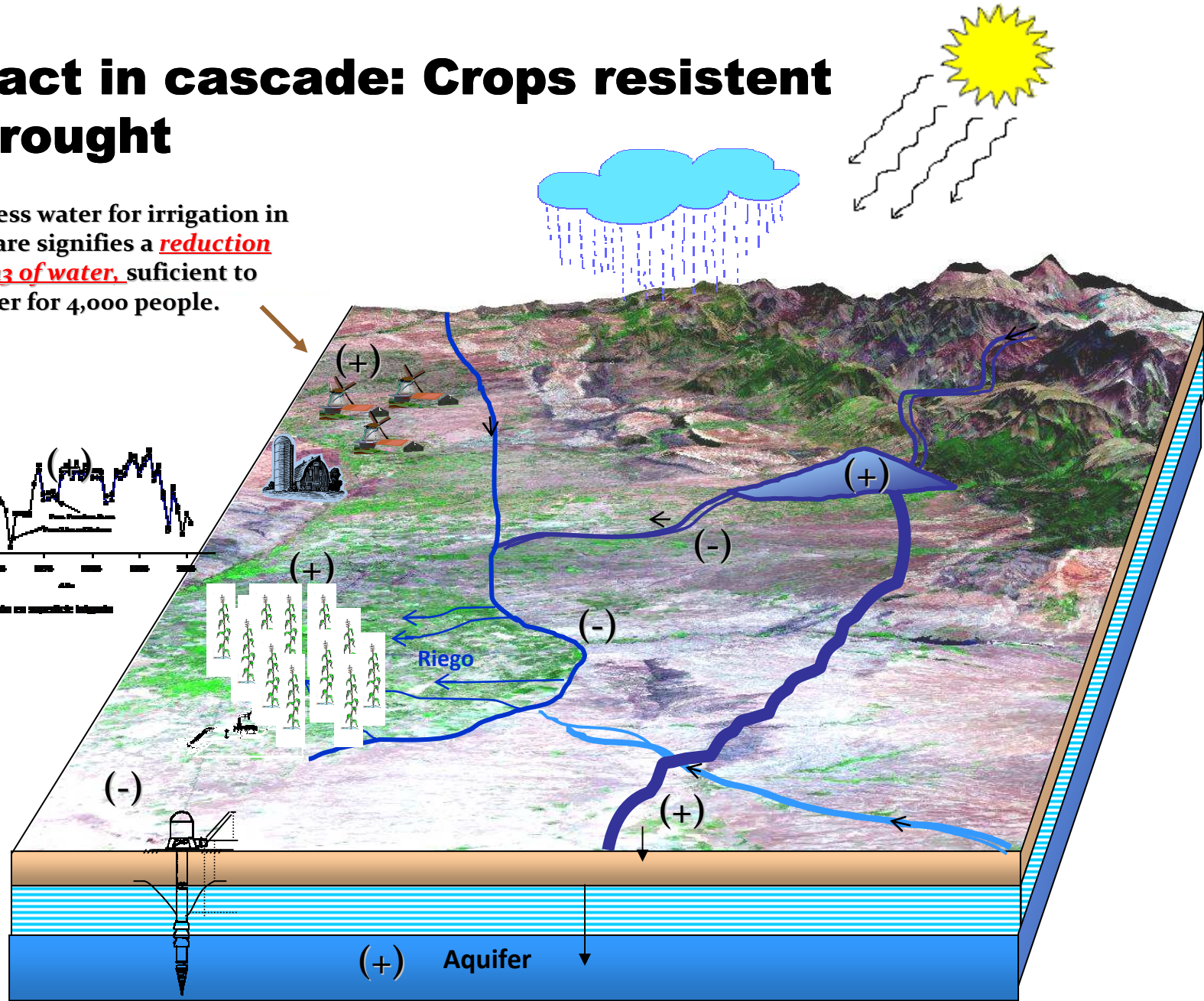
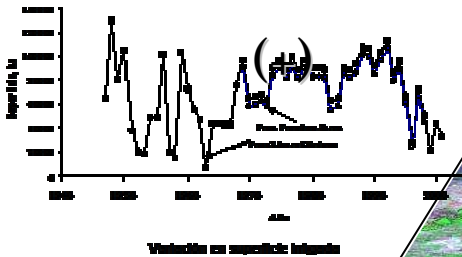
International, climate related financial institutions (IFAD, GEF), micro credit, insurance and land use micro investments for local development programmes and, regional organizations and national donors (ministries of development cooperation and environment) to improve policies for water security.

Multidisciplinary, multi-sectorial and multi-institutional research



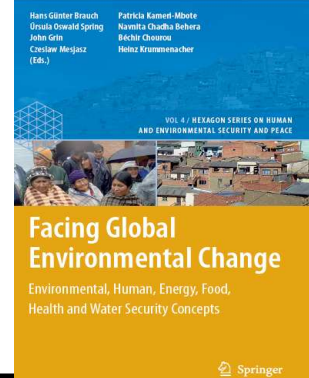
Impact in cascade: Crops resistant to drought

10cm of less water for irrigation in one hectare signifies a **reduction of 1000 m³ of water**, sufficient to offer water for 4,000 people.



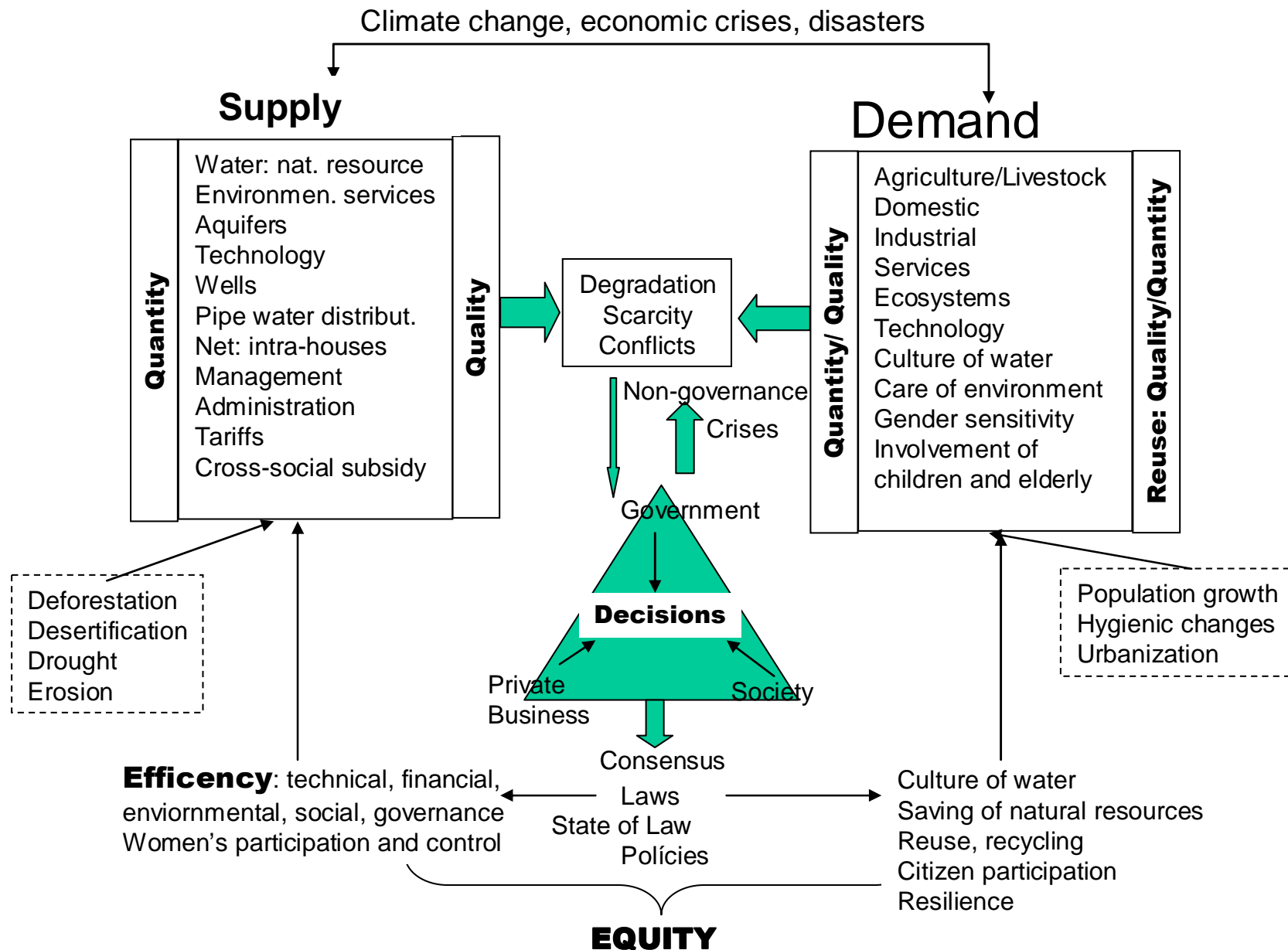
Relation: biotechnology, genetic, hydrology, agriculture sociology, economy, health, livelihood, poverty alleviation, etc.

Widening, Deepening and Sectorialization of Security Threats and Risks



Security dimension ⇒ ↓	Military	Political	Economic	Environmental ↓	Societal
Level of interaction					
Human individual Human security ⇒	Land mines	Failed state	Food & Health security	Cause & victim	Food & Health security
Societal, community security	Border control	Public security	Water, Food & Health sec.	↓↑	↓↑
National security	During Cold War shrinking (in USA since 2001 ↑ & since 2009 ↓)		Energy security	↓↑	Energy Food, Water & Health security
International and Regional security			Water security	↓↑	Water security
Global and planetary security ⇒	Terrorism	Intern. migration	Financial crisis	CC; GEC; biodiversity loss	Health security

Efficiency and Equity with Natural Resources

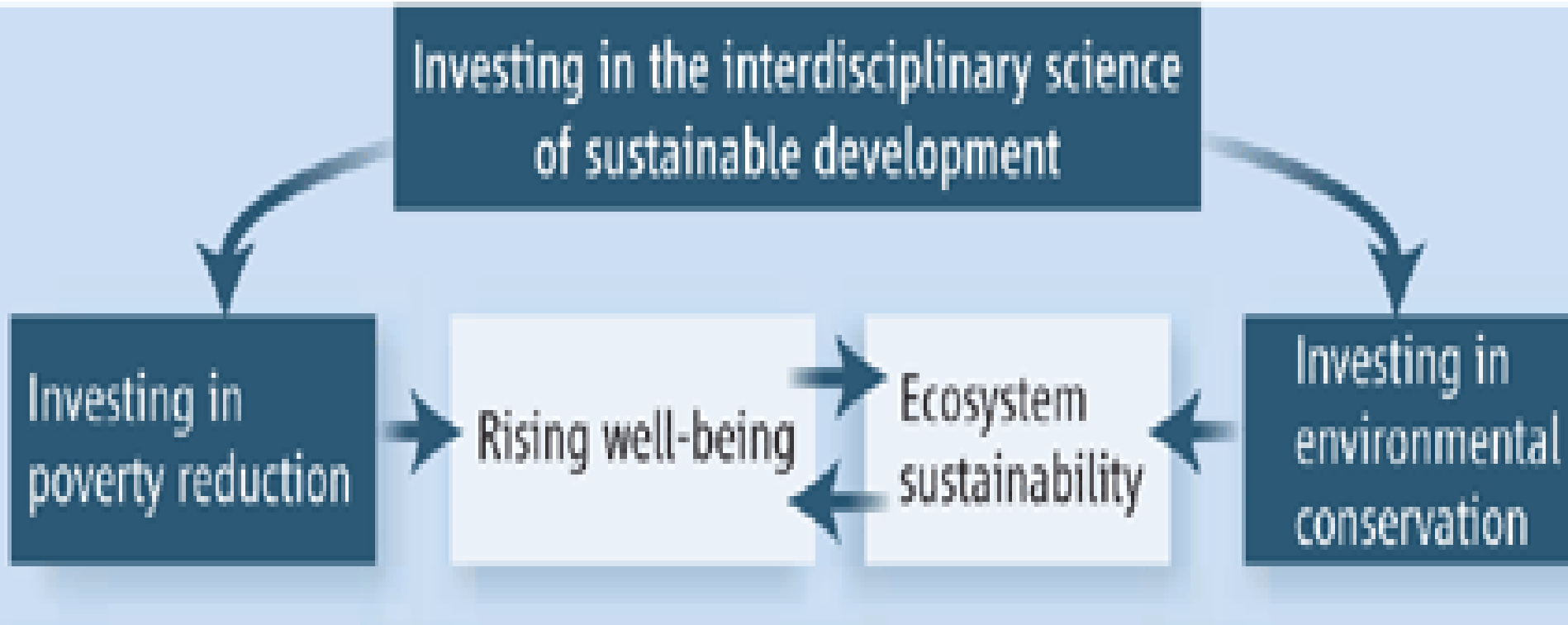


A photograph of a waterfall cascading over dark, mossy rocks in a lush, green forest. The water is white and frothy as it falls, creating a misty spray at the bottom. The surrounding vegetation is dense and vibrant green.

Thank you for your attention

http://www.afes-press.de/html/download_oswald.html

Integral proposal of poverty alleviation and environmental recovery to reduce migration



8. Water research in Mexico

Elaboration of a national of the scientific and technological state of art of water research, institution, business and urgent research themes

Mexican state of art in water research

National and international sources of financing

Objetivos específicos

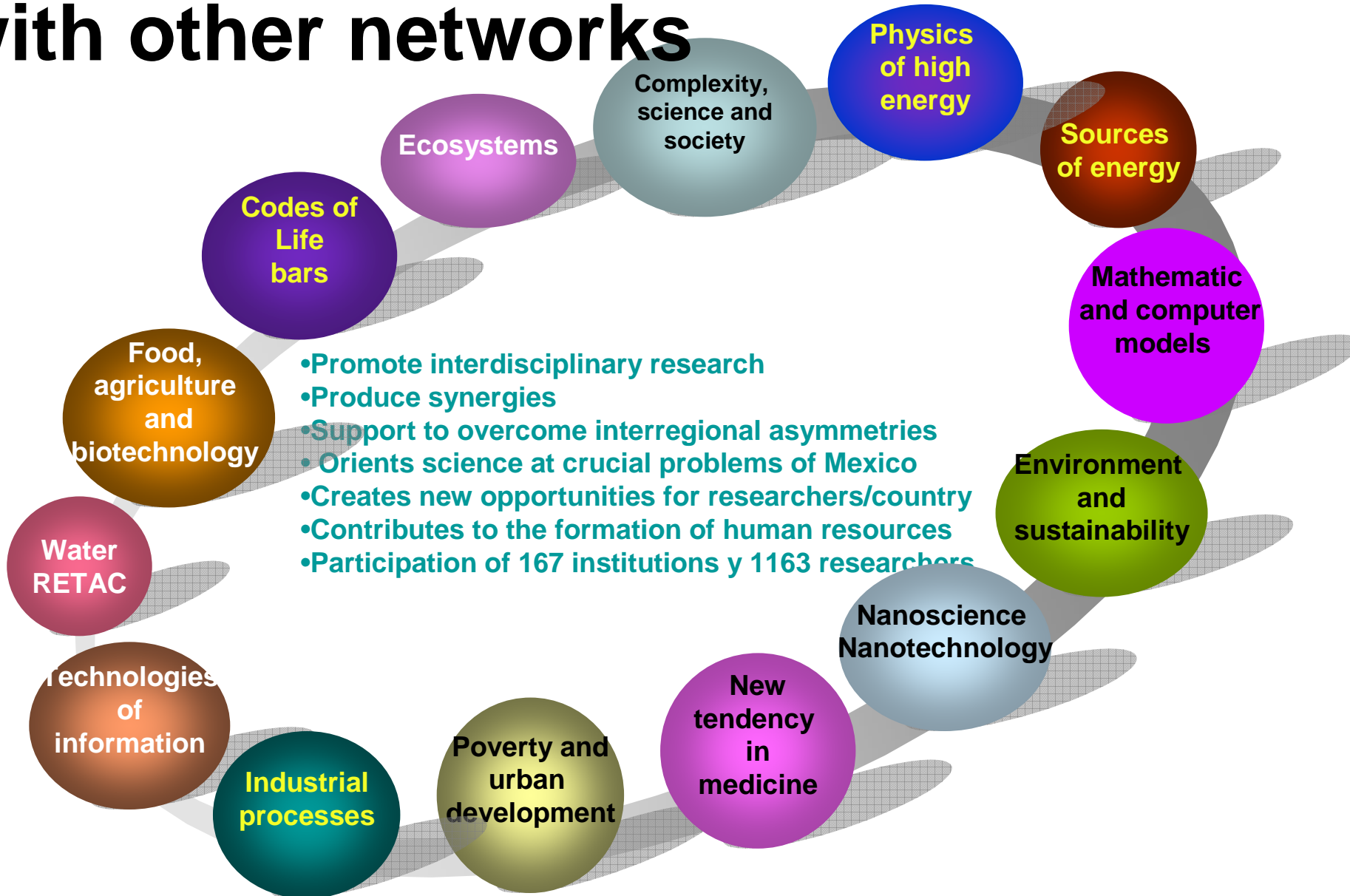
Potential projects feasible to link up with public and private sector (business with environmental ethic)

Catalogue of:
- Human resources
- Capacity for formation of new resources
- Infrastructure in collaboration with business an government

Projects oriented to resolve or create conditions to tackle strategic problems of Mexican society in cooperation with government and business in water management

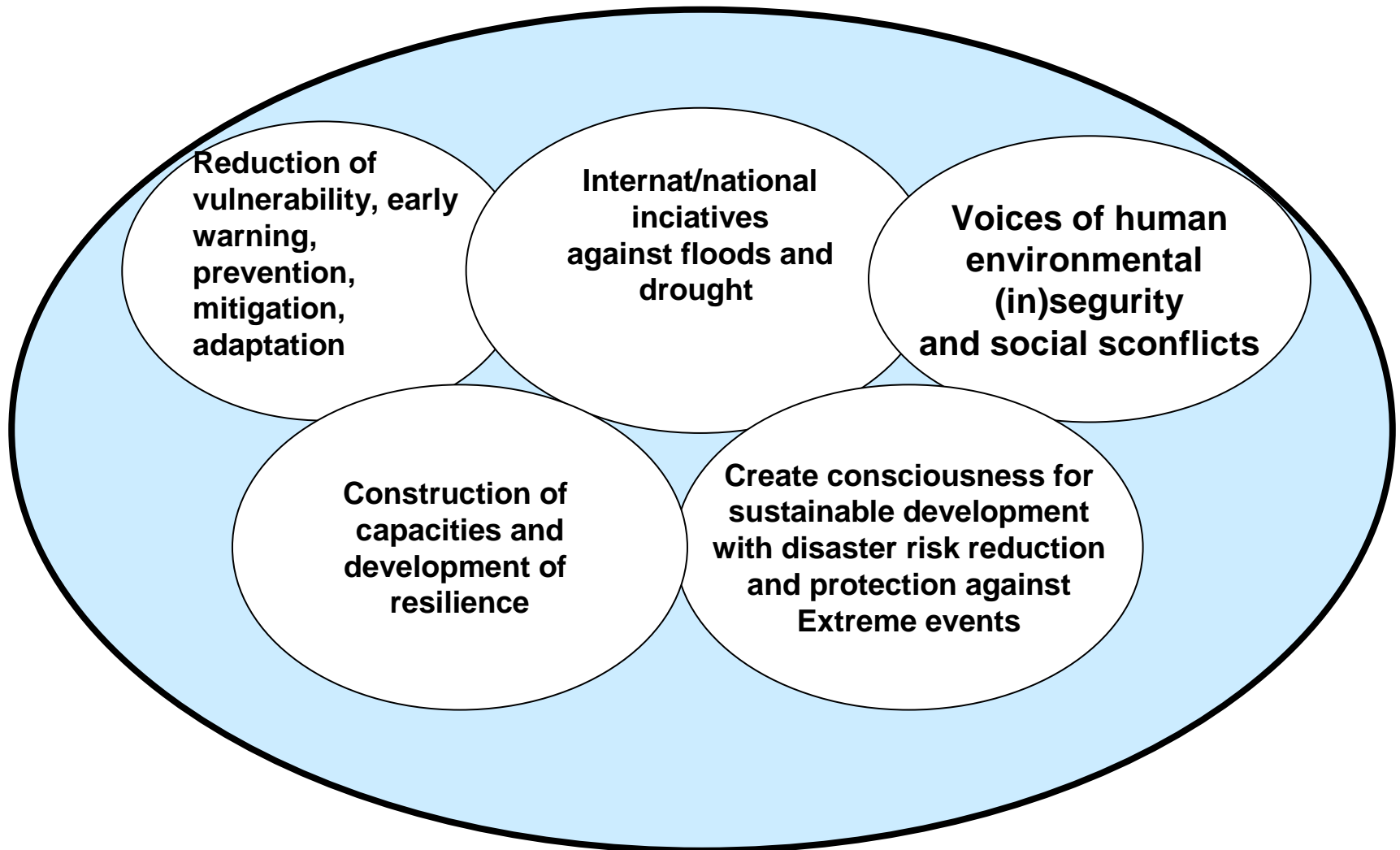
Multi-institutional and interdisciplinary projects relating problems from basic science, engineering, integral basin management, ecosystem services and water culture

Transversal interrelation of RETAC with other networks

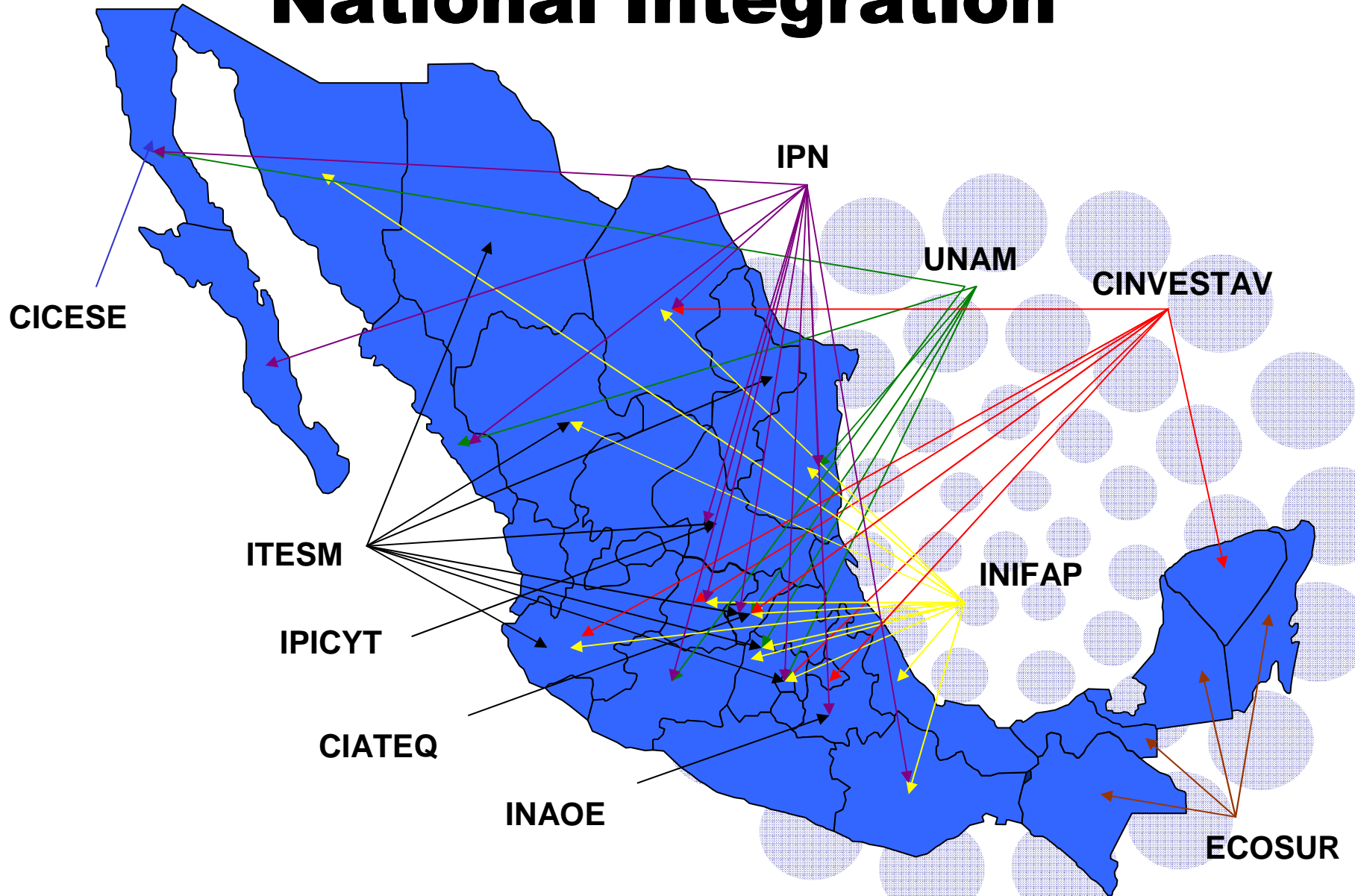


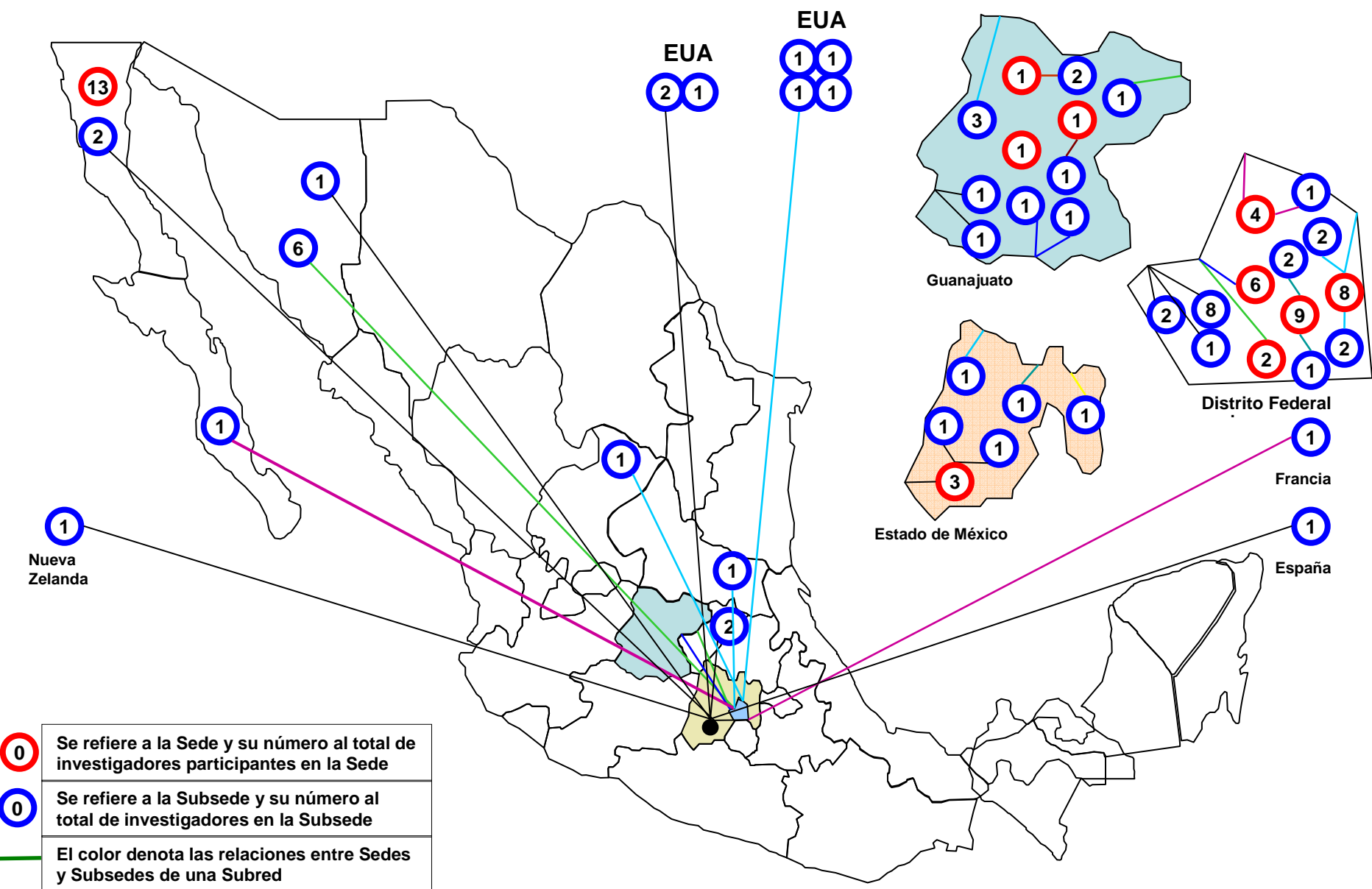
Central objectives of the research of RETAC in Mexico

The basin as a hydrological unit for planning and development of a multisectorial, multi-institutional and multidisciplinary research and actions



National Integration





Nueva Zelanda

EUA

EUA

Guanajuato

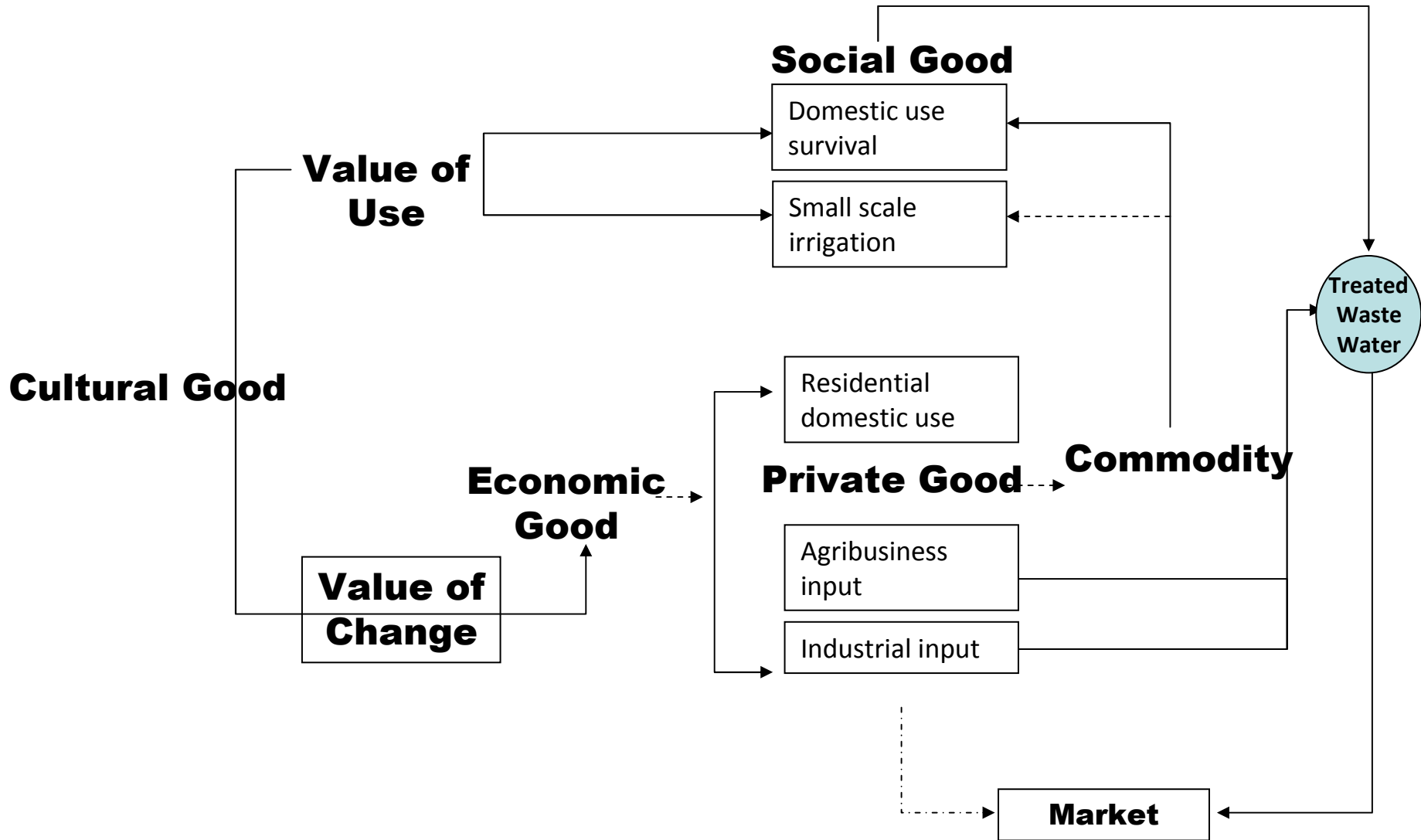
Estado de México

Distrito Federal

Francia

España

Logics of Value of Water



Economy of Water

Objectives of plans, economic sustainability and legislation

