

UNFCCC technical workshop on water and climate change impacts and adaptation strategies under the Nairobi work programme on impacts, vulnerability and adaptation to climate change
18.20 July 2012, Mexico City, Mexico

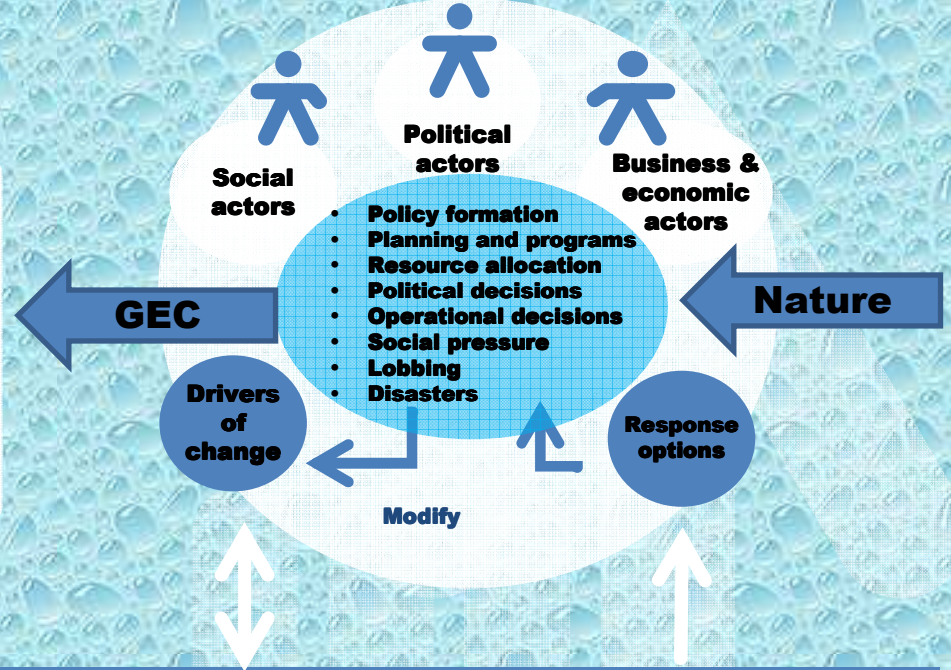
Climate change impacts on water resources, livelihoods, related sectors and ecosystems



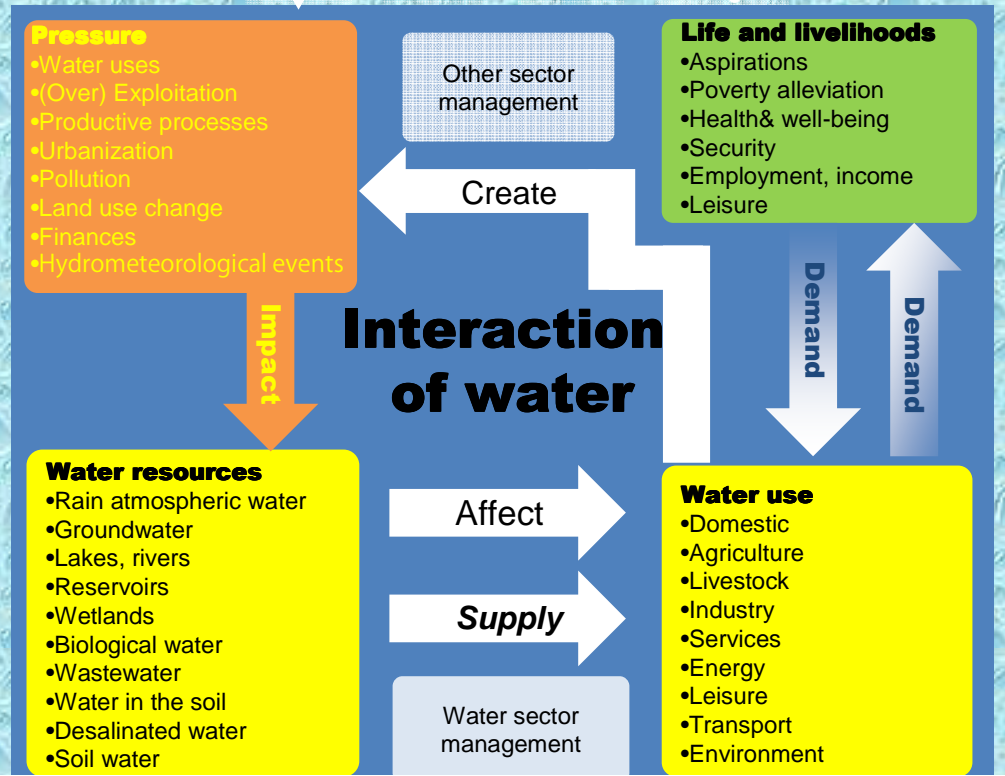
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IPCC Lead Author

CEG: Global Environmental Change:

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



Why water security is crucial for humans and nature?



Source: transformed from Global Water News, #9, 2010, p. 4

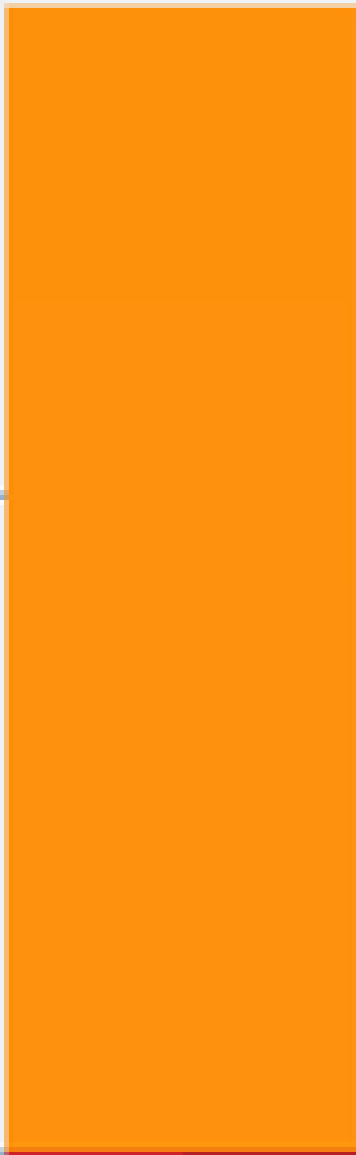
Water: Daily Requirements

2000 -
4000 litres

TO PRODUCE
DAILY FOOD
REQUIREMENTS

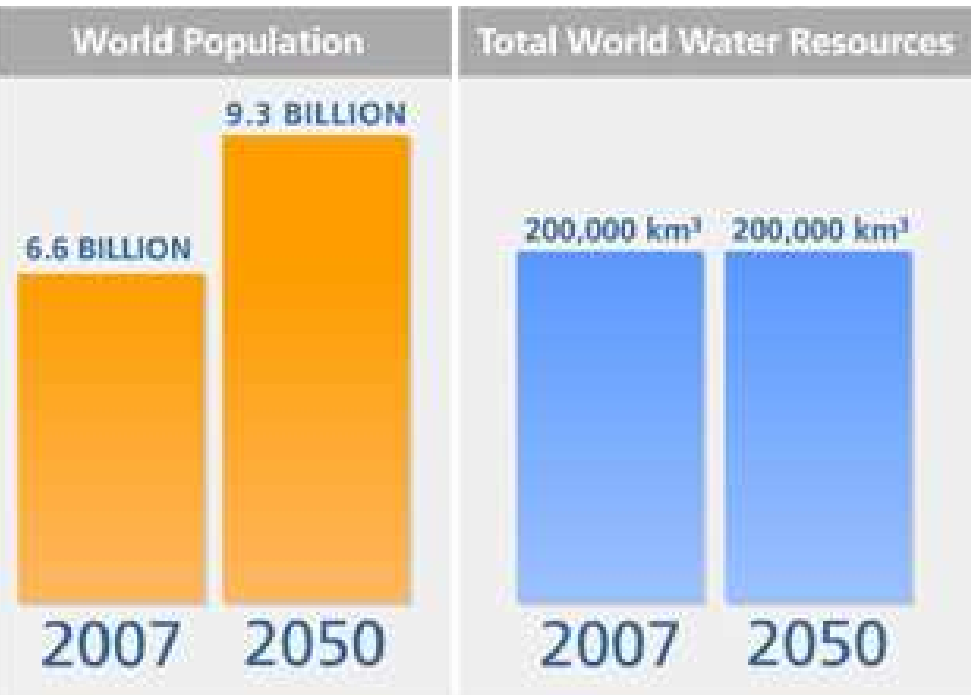
2-4 litres

DAILY DRINKING
REQUIREMENTS



- 1
- 1

Water, people and food

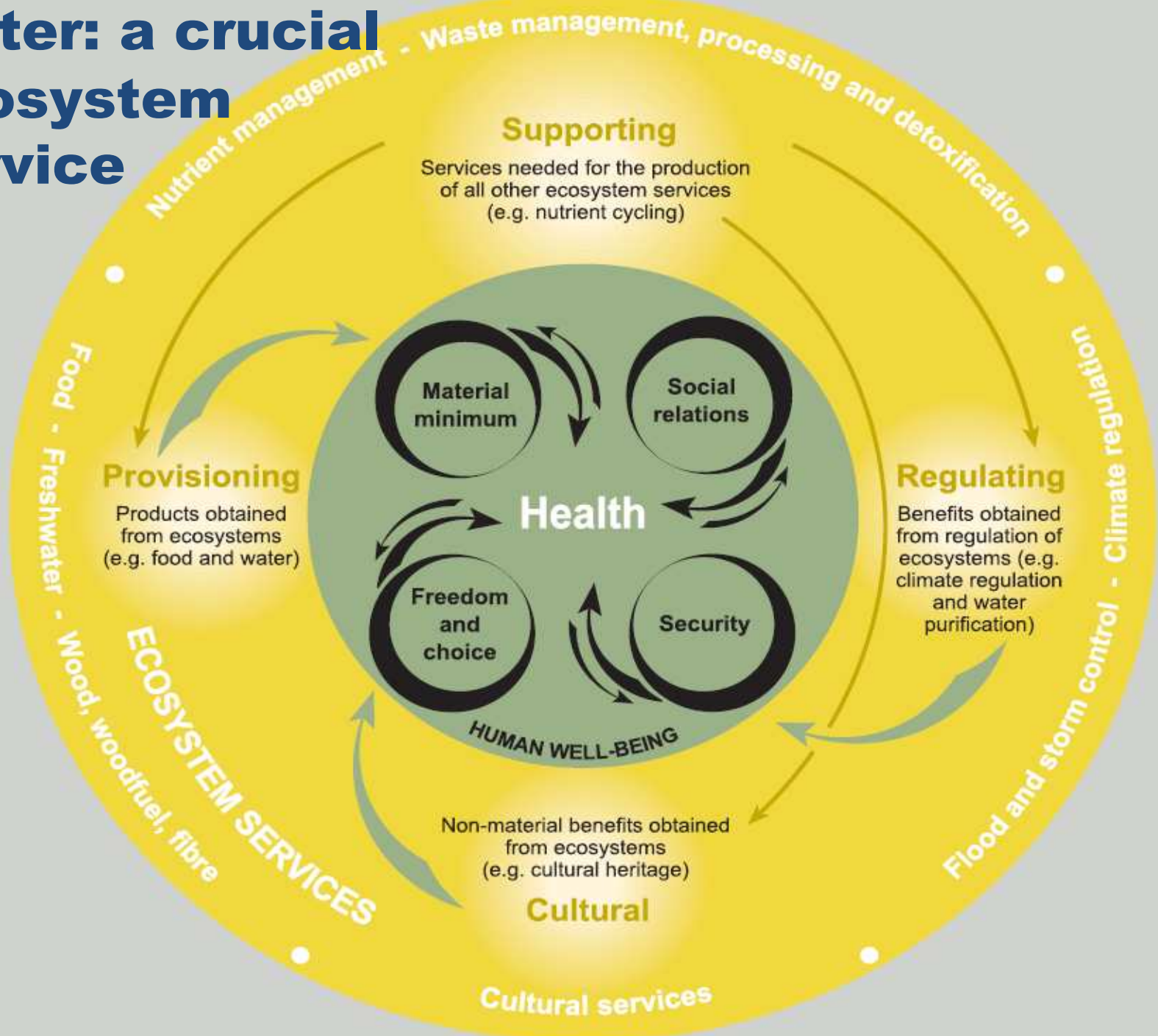


Water footprint

1,000-3,000 liter of water: 1kg of rice

13,000 to 15,000 liter of water: 1 kg of grain-fed beef

Water: a crucial ecosystem service



Water, climate change, biodiversity and soil

Desertification Land Degradation & Drought

Mitigation & Adaptation

CLIMATE CHANGE

global temperature increase
climate variability

reduced carbon reserves & increased CO2

extreme weather events

increase of social vulnerability, poverty

sea level rise

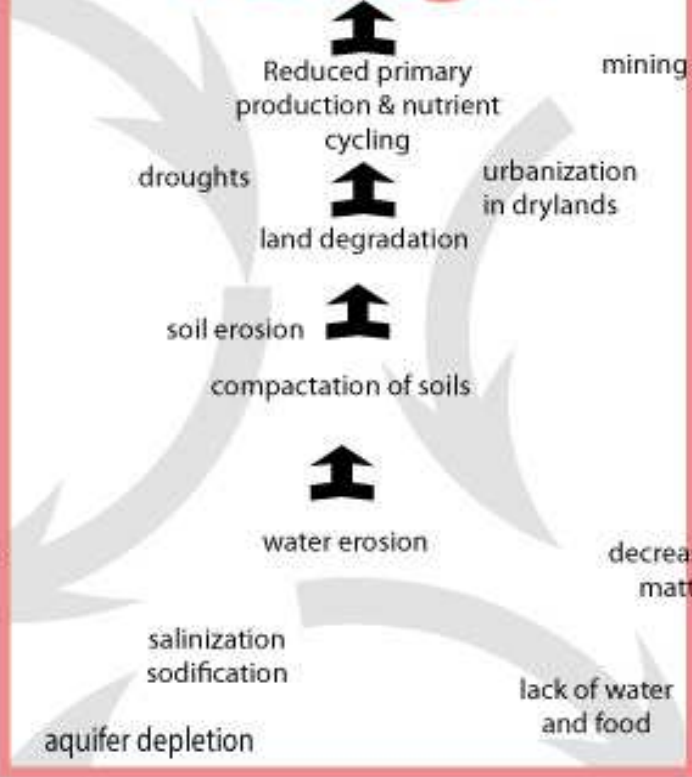
rainfall variability

pollution

accumulation of toxic substance in water & soil

watershed degradation

poor irrigation



BIODIVERSITY LOSS

decreased land & soil organism' species diversity

land use change

reduced soil conservation

fauna loss

plant diseases & resistance

decrease in organic matters in soils

change in community structure & ethnic diversity

migration urbanization slums

forest fires

land slides

hydro meteorological disasters

gender vulnerability & survival strategies

WATER STRESS

CC increases number of water & vectorborne diseases

💧 Free of organisms

- ◆ bacteria
- ◆ virus
- ◆ protozoarios

💧 Free from toxic substances

- inorganic
- organic

💧 Aesthetically acceptable

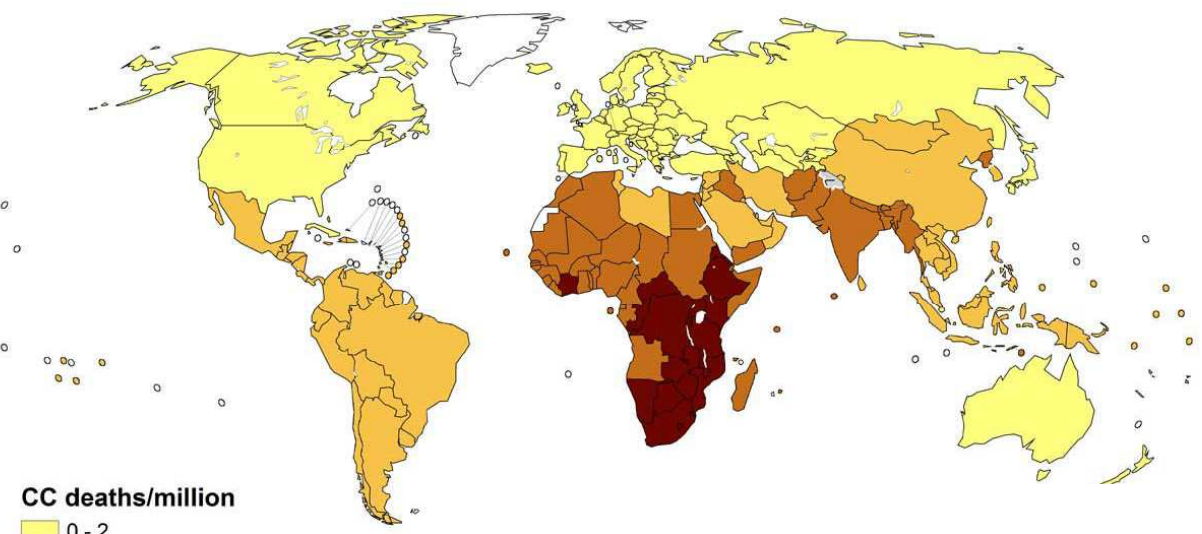
- flavor
- odor
- color



CC a health threat

- **Waterborne:** 884 millions (13%) are missing safe water, produce 88% of diarrhea and 3.4 millions deaths/year; **vectorborne** deaths: 3 million
- **Water, sanitation** and hygiene can prevent at least 9.1% of global disease & 6.3% of all deaths.
- 2.5 billion people — half of the developing world — **lack** access to improved sanitation (more than 35% of the world's population); improved sanitation could **save lives** of 1.5 million children/ year (UNICEF)
- Water and sanitation produce **economic benefits** ranging from US\$ 5 to US\$ 46 per US\$ 1 invested all over the world. Clean water in the **U.S.** had a return of 23 to 1 during the first half of the 20th century.

Deaths from climate change

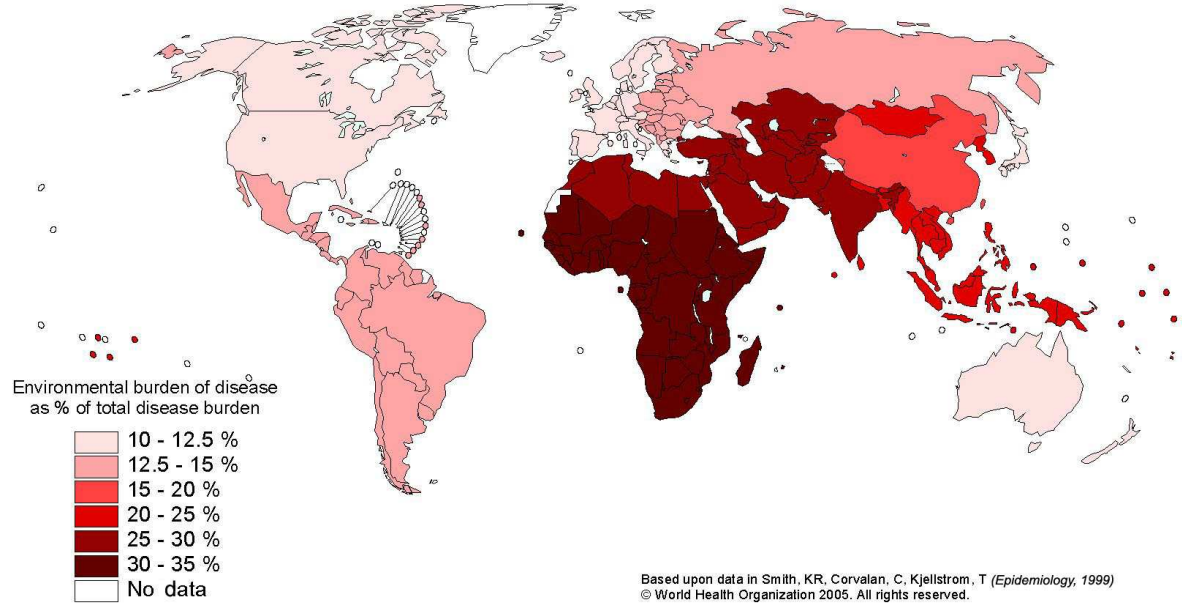


CC deaths/million
 0 - 2
 2 - 40
 40 - 80
 80 - 120

Estimates by WHO sut
 Copyright WHO 2005.



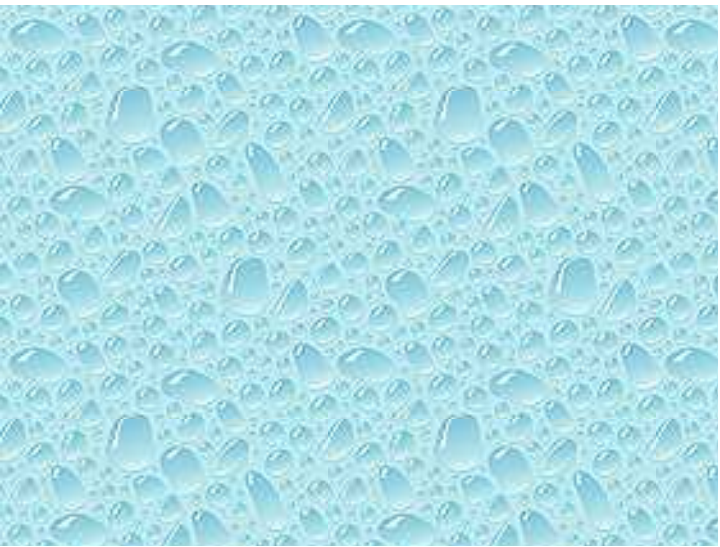
Environmental burden of disease globally



Environmental burden of disease as % of total disease burden

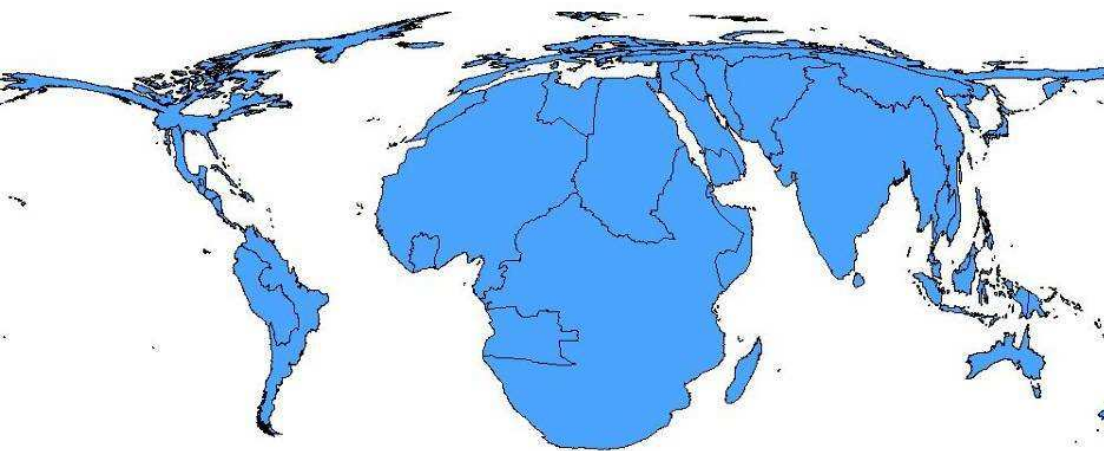
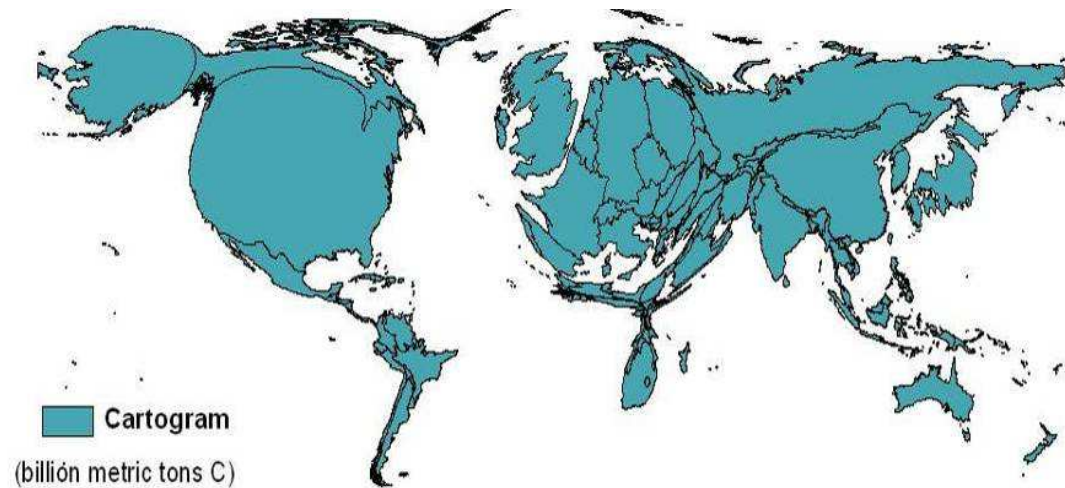
10 - 12.5 %
 12.5 - 15 %
 15 - 20 %
 20 - 25 %
 25 - 30 %
 30 - 35 %
 No data

Based upon data in Smith, KR, Corvalan, C, Kjellstrom, T (*Epidemiology*, 1999)
 © World Health Organization 2005. All rights reserved.



Cumulative Greenhouse Gas Emissions, 2002

Global responsibility and ethics

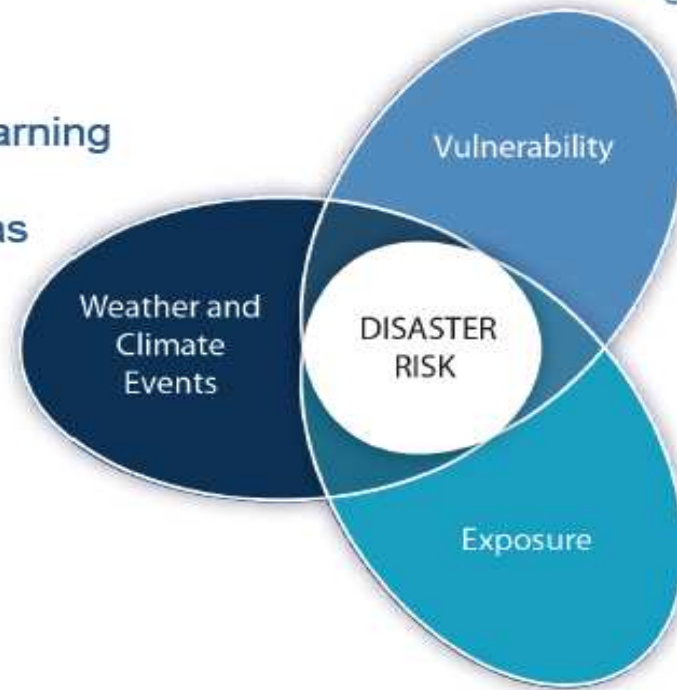


Mortality rate attributable to climate change, 2000



Environmental & social vulnerability, exposure and disaster risks management (DRM)

- improved forecasting for warning systems
- reduction of greenhouse gas emissions



- poverty reduction
- better education and awareness
- sustainable development

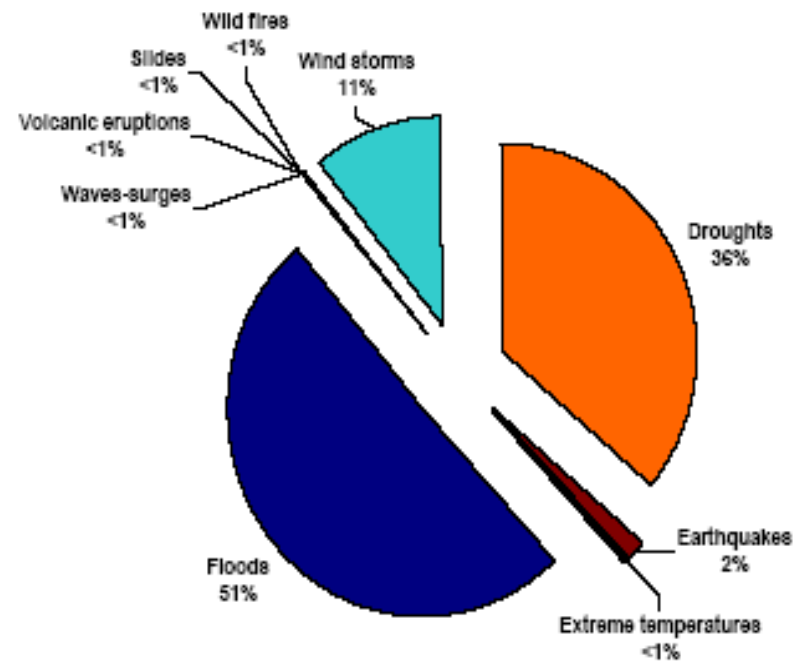
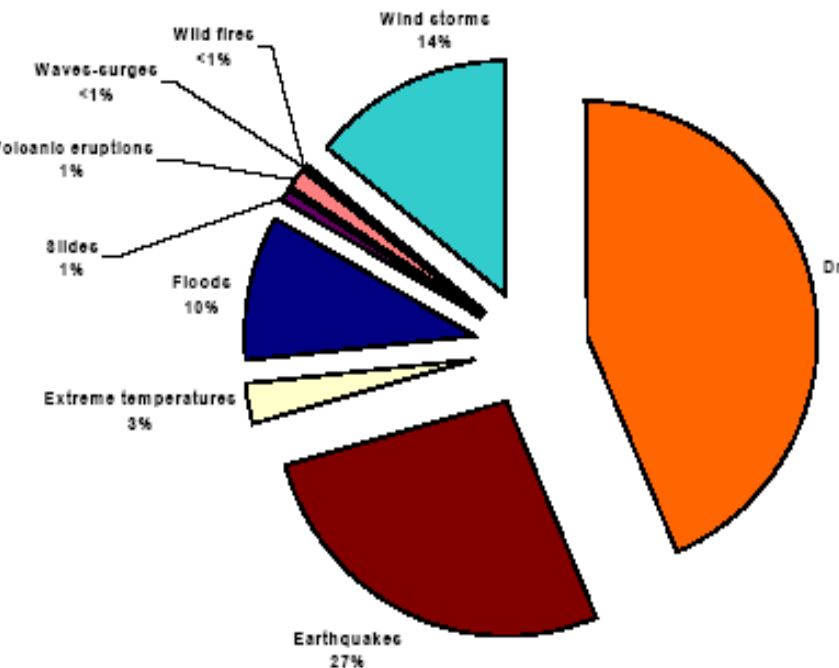
- asset relocation
- weather-proofing assets
- early warning systems

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INTERGOVERNMENTAL PANEL ON climate change



30 years of fatalities and people affected by disasters (1974-2003)



(1) injured + homeless + affected

Total: 2.066.273 dead

5 076 494 541 affected

Source: Hoyois and Guha-Sapir (2004)

Economic losses from climate-related disasters have increased, with large spatial and interannual variation, but are higher in industrialized countries, while fatalities are higher in developing countries.

Managing the risks: hurricanes in the USA, Mexico, Central America and the Caribbean

Risk Factors

- population growth
- increasing property value
- higher storm surge with sea level rise



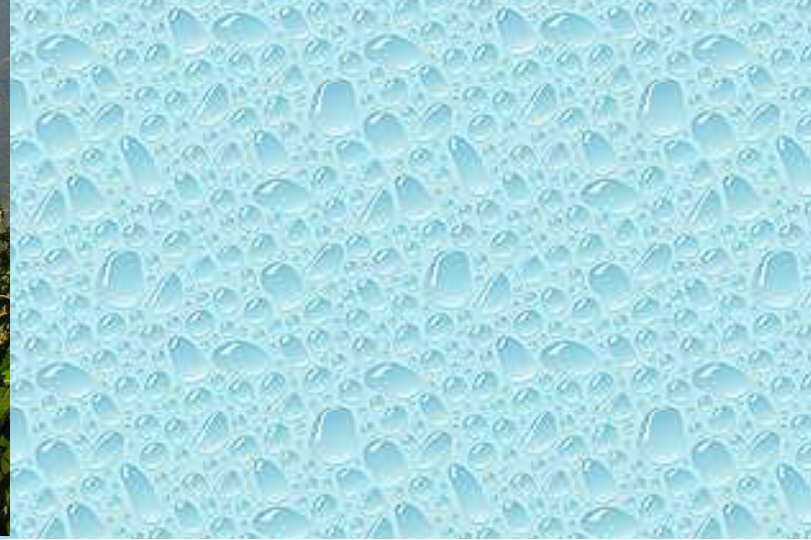
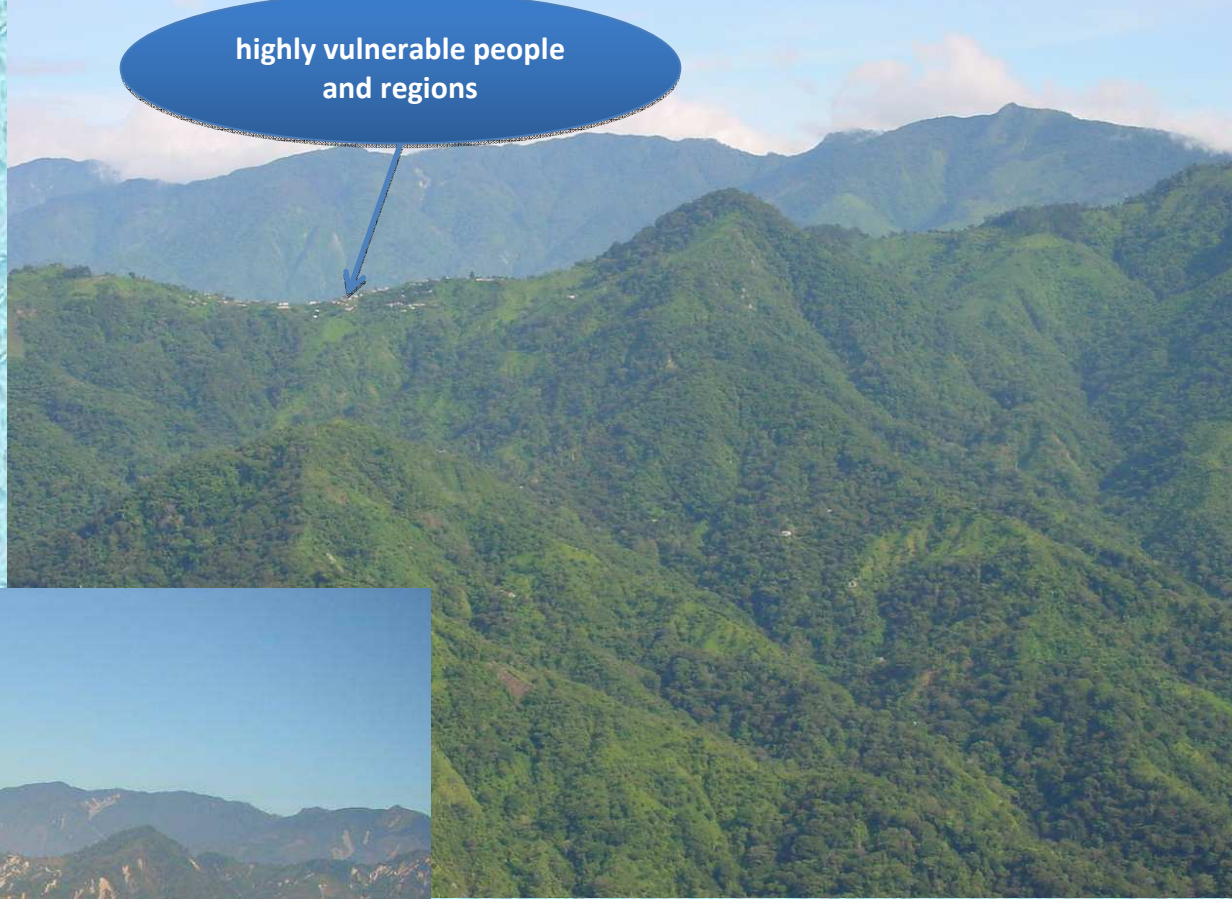
Risk Management/ Adaptation

- better forecasting
- warning systems
- stricter building codes
- regional risk pooling

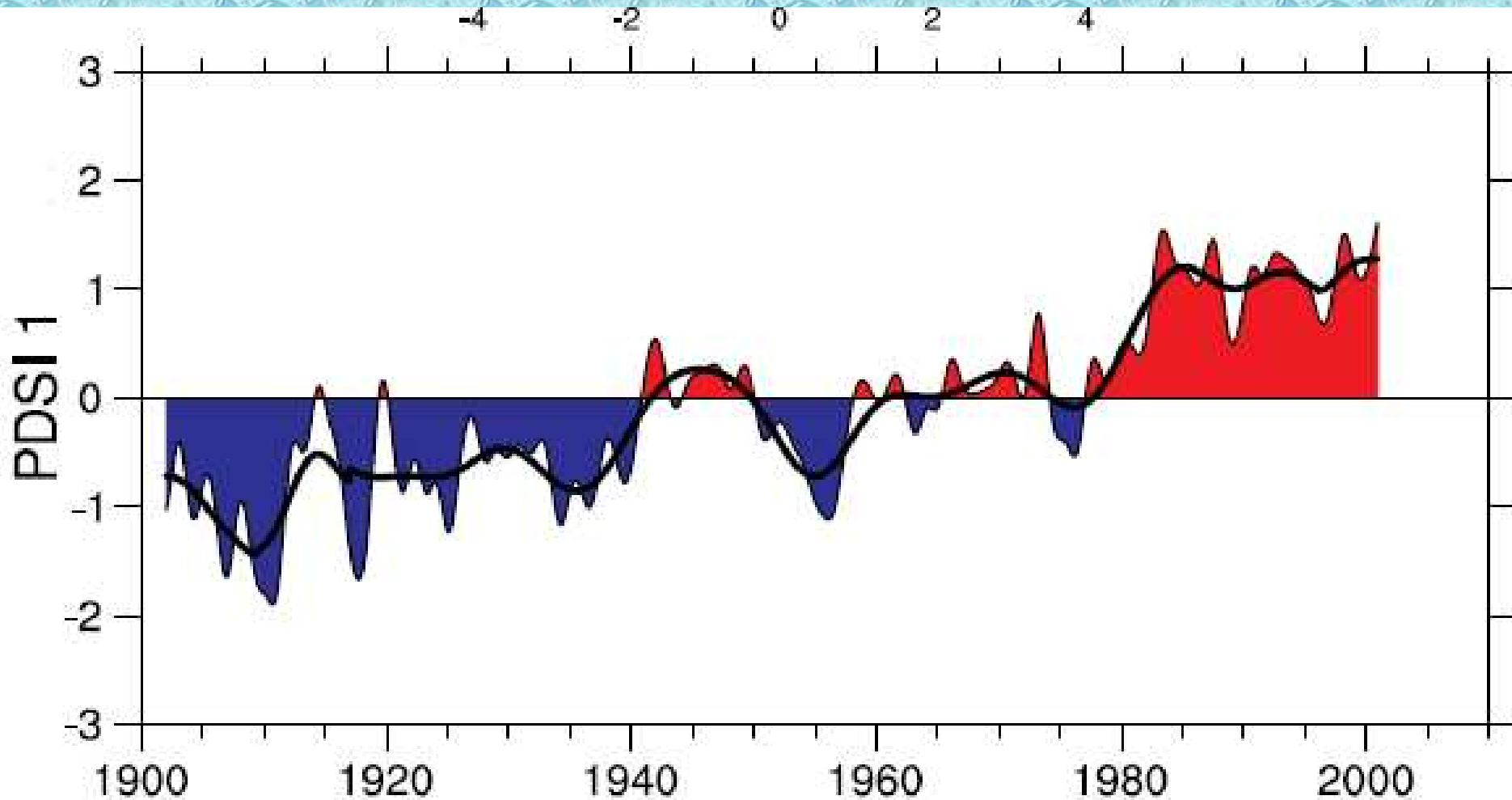
Projected globally: *likely* increase in average maximum wind speed and associated heavy rainfall (although not in all regions)

**Environmental
vulnerability
increases risks
during extreme
events of
vulnerable people**

highly vulnerable people
and regions



Drought and environmental vulnerability due to climate change: Palmer drought severity index: 1900-2002



Climate change impacts rainfed agriculture and produce hunger



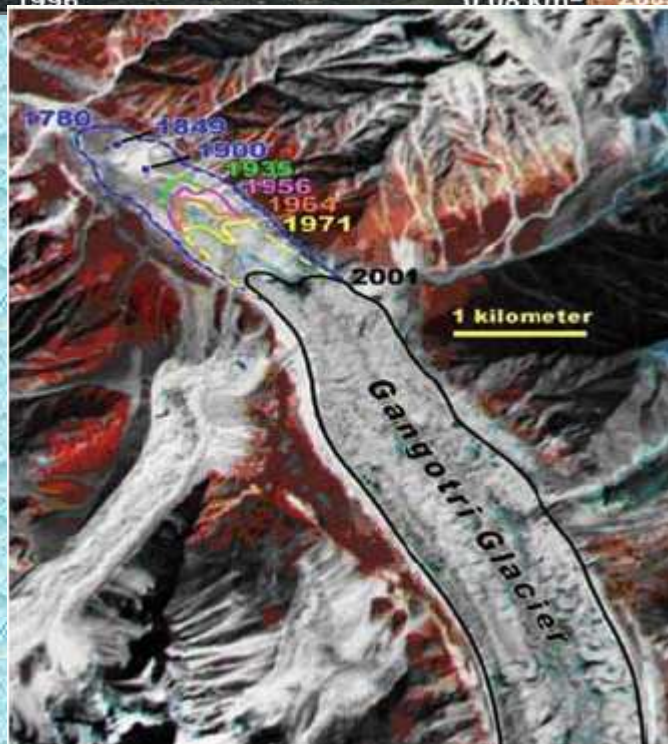
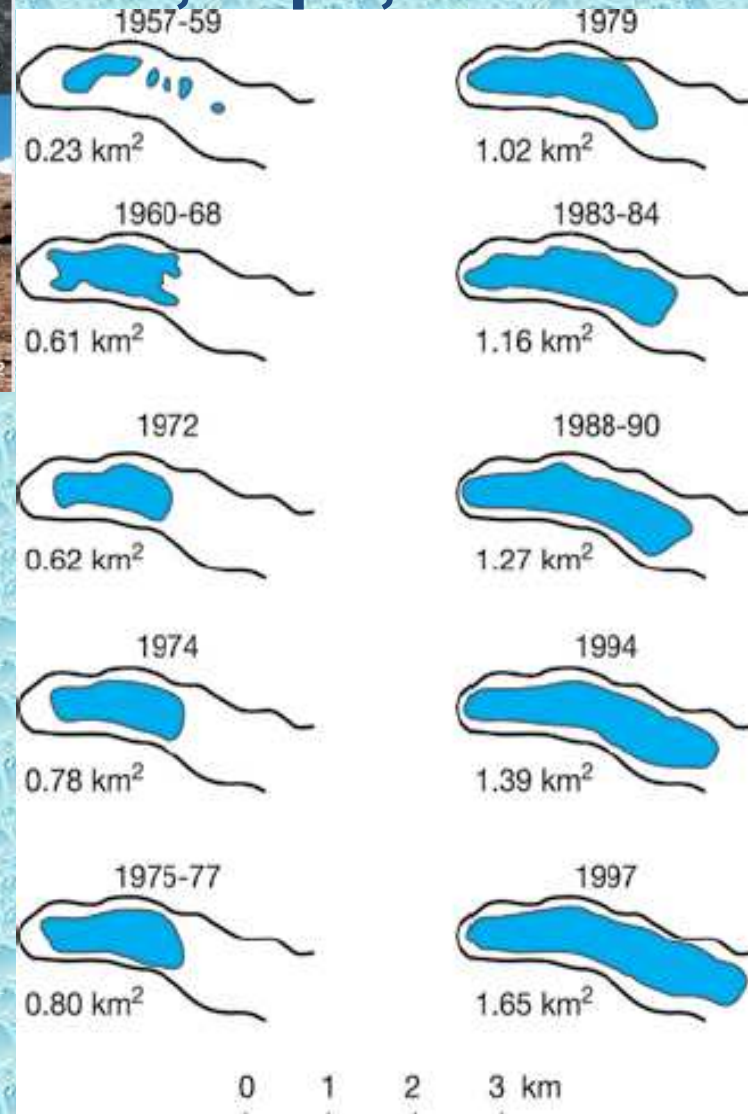
- 80% of world's agricultural area generates 63% of food in **rainfed** fields; drylands cover 40% of land with 40% of people
- one billion of people is **hungry**; 2050: 10-20% more risk of hunger (WFP); CC may increase hunger in 10 million children in 2030; each day 27,000 people die from hunger (3 million children/year)
- **Women** in sub Saharan Africa manage household food supply, but lack services & resources; 93% rainfed land
- **Upgrading** rainfed agriculture gives social, food, economic & environmental benefits

Climate change impact	Direct consequences for food systems
Increased frequency and severity of extreme weather events	<ul style="list-style-type: none"> • Crop failure or reduced yields • Loss of livestock • Damage to fisheries and forests • Destruction of agricultural inputs, such as seeds and tools • Either an excess or shortage of water • Increased land degradation and desertification • Disruption of food supply-chains • Increased costs for marketing and distributing food
Rising temperatures	<ul style="list-style-type: none"> • Increased evapotranspiration, resulting in reduced soil moisture • Greater destruction of crops and trees by pests • Greater threats to human health (e.g. disease and heat stress) that reduce the productivity and availability of agricultural labour • Greater threats to livestock health • Reduced quantity and reliability of agricultural yields • Greater need for cooling/refrigeration to maintain food quality and safety • Greater threat of wildfires
Shifting agricultural seasons and erratic rainfall	<ul style="list-style-type: none"> • Reduced quantity and quality of agricultural yields and forest products • Either an excess or shortage of water • Greater need for irrigation
Sea level rise	<ul style="list-style-type: none"> • Damage to coastal fisheries • Direct loss of cultivable land due to inundation and salinisation of soil • Salinisation of water sources

Glacier melting produces water risks



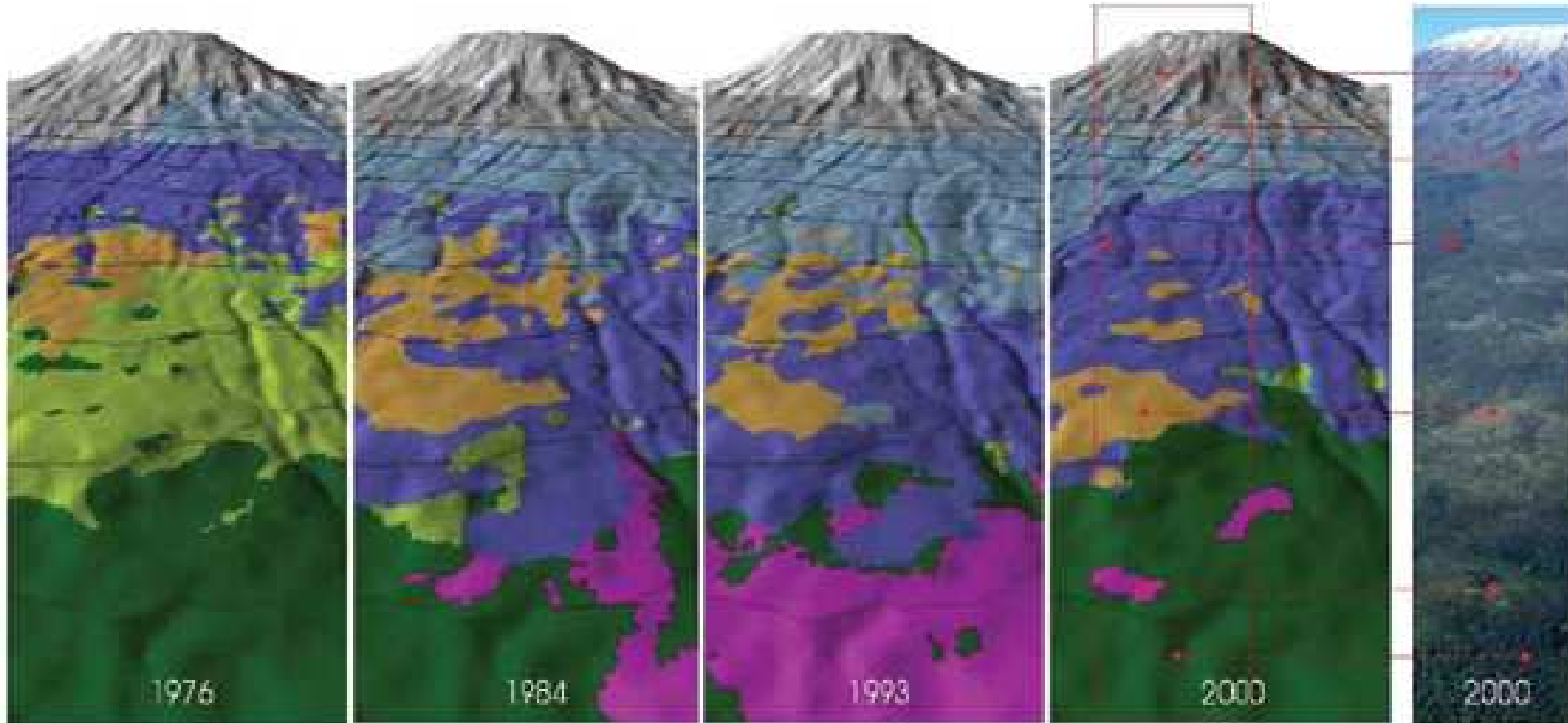
Tsho Rolpa glacier lake, Nepal, 1997



Chacaltaya glacier, Bolivia

Gangotri glacier retraced since 1780-2001

Water availability: Environmental changes floods and droughts on Mt. Kilimanjaro



LEGEND

- | | |
|-----------------------------------|--------------|
| Snow/Glacier | Erica bush |
| Bare rock | Grassland |
| Helichrysum
cushion vegetation | Erica forest |
| Forest clearing | Forest |

Gender vulnerability and discrimination increase social vulnerability and destroy livelihood

Managing the risks: **drought** in the context of **food security** in **the drylands**

Risk factors

- more variable rain
- ecosystem degradation
- hotter days
- discrimination of women
- poor health and education conditions



Risk Management/Adaptation

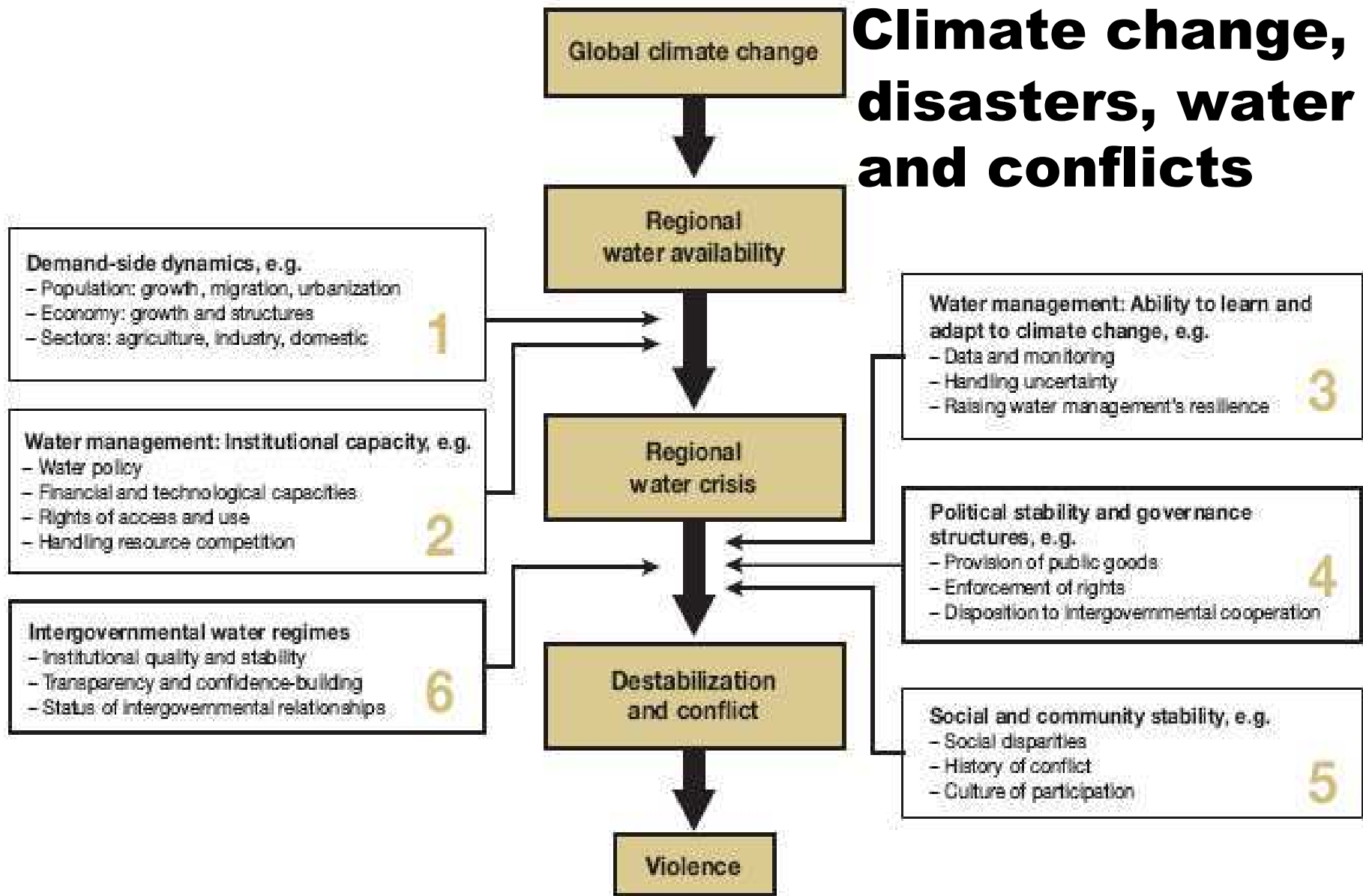
- improved water management
- sustainable farming practice
- drought-resistant crops
- drought forecasting

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INTERGOVERNMENTAL PANEL ON climate change



Climate change, disasters, water and conflicts



Boxes 1 – 6: Dimensions of influence with key factors

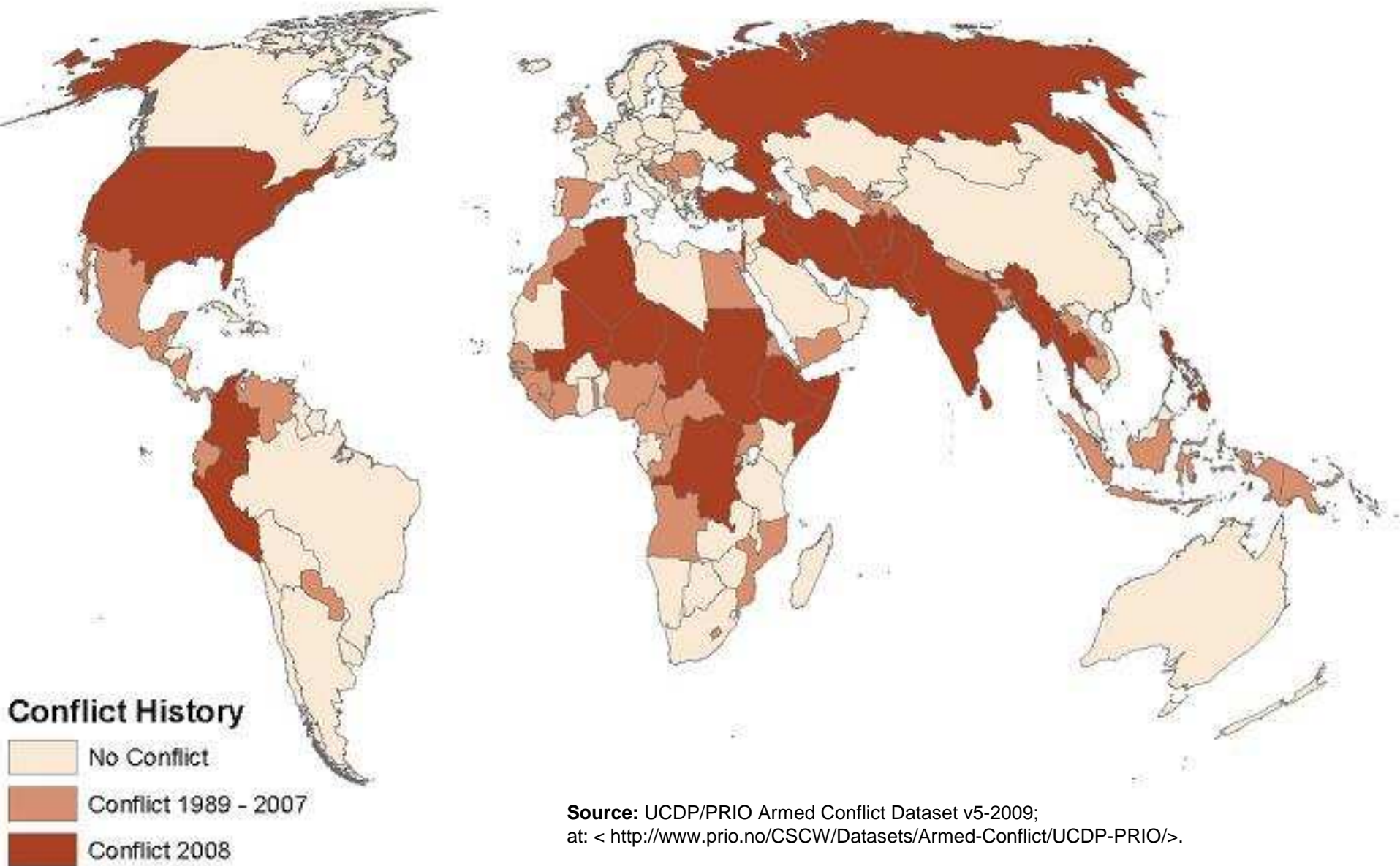


Central causal chain

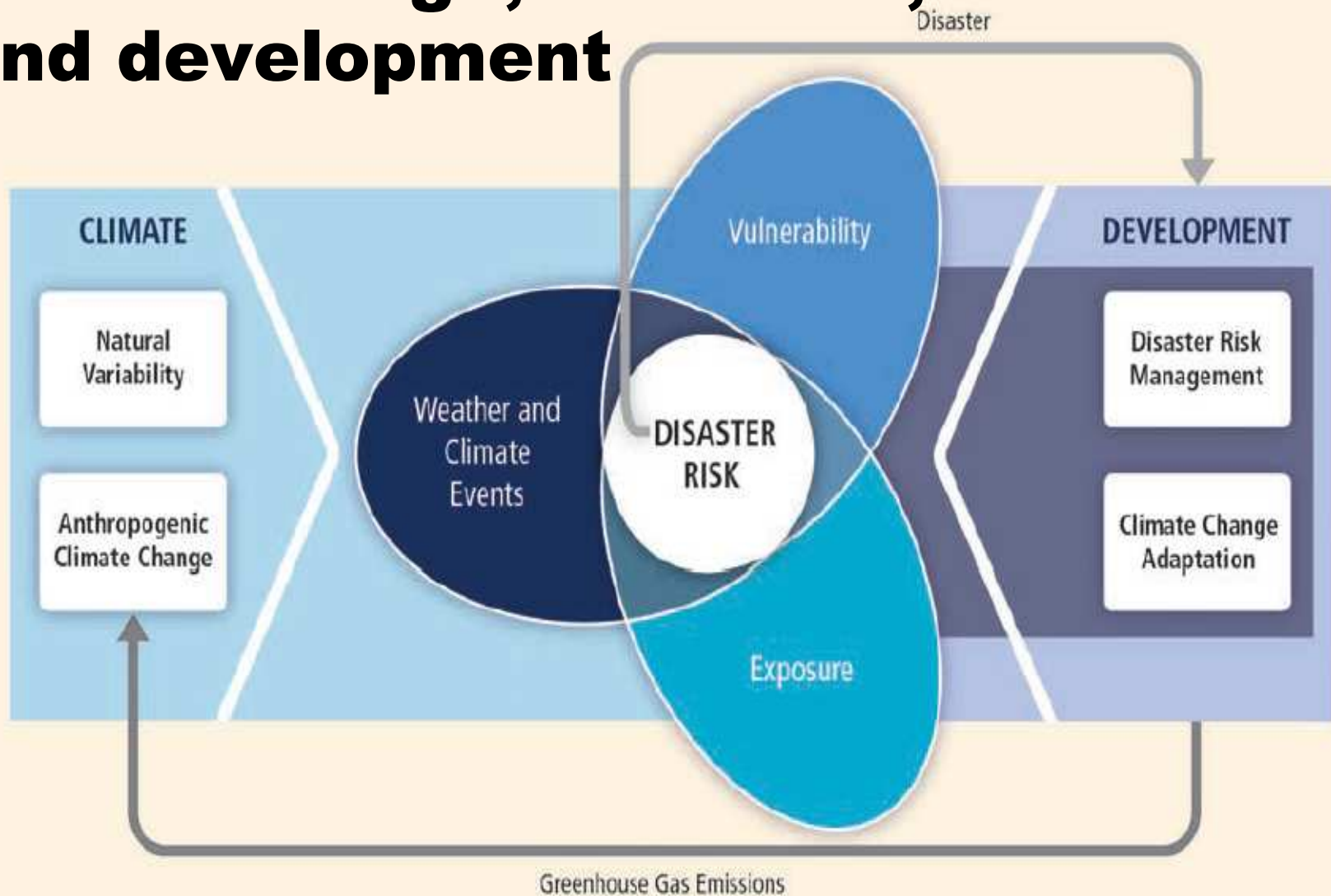


Influence of key factors on the central causal chain

Climate change & armed conflicts (1989-2008)



Climate Change, disasters, vulnerability and development



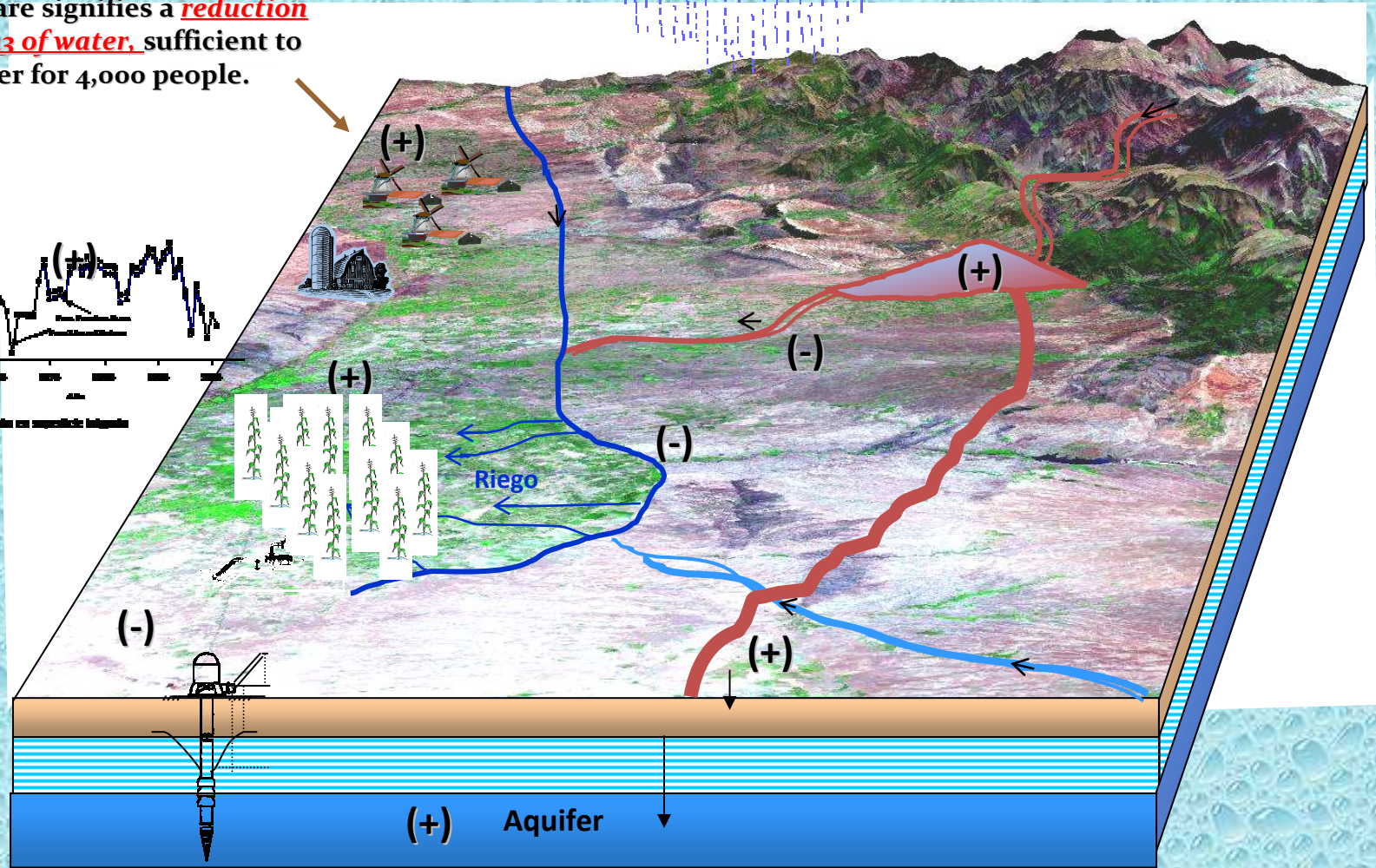
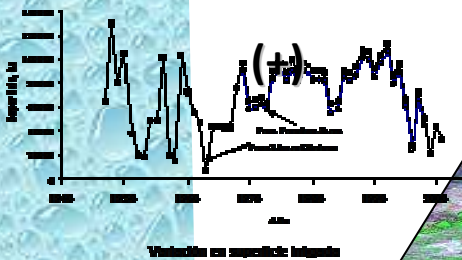
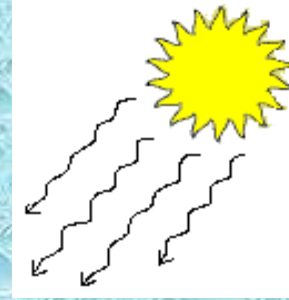
Resilience building: bottom-up and top-down, early warning, DRM, and development processes



The most effective strategies offer **development benefits** in the relatively near term and **reduce vulnerability** over the longer term

Impact in cascade: Water saving, IWRM, drought and livelihood

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.



Thank you for your attention
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