Water Resources Management in case of Water Shortage

Umberto Fratino

Dipartimento di Ingegneria Civile, Ambientale, Territorio, Edile e di Chimica

Politecnico di Bari

On July 22th, 2013 European Union foreign ministers promoted the "***WATER DIPLOMACY***" in order to avoid increased tensions due to water related problems in many regions of the world.

They were conscious that climate change and demographic growth can only exacerbate water conflicts.

WATER SCARCITY

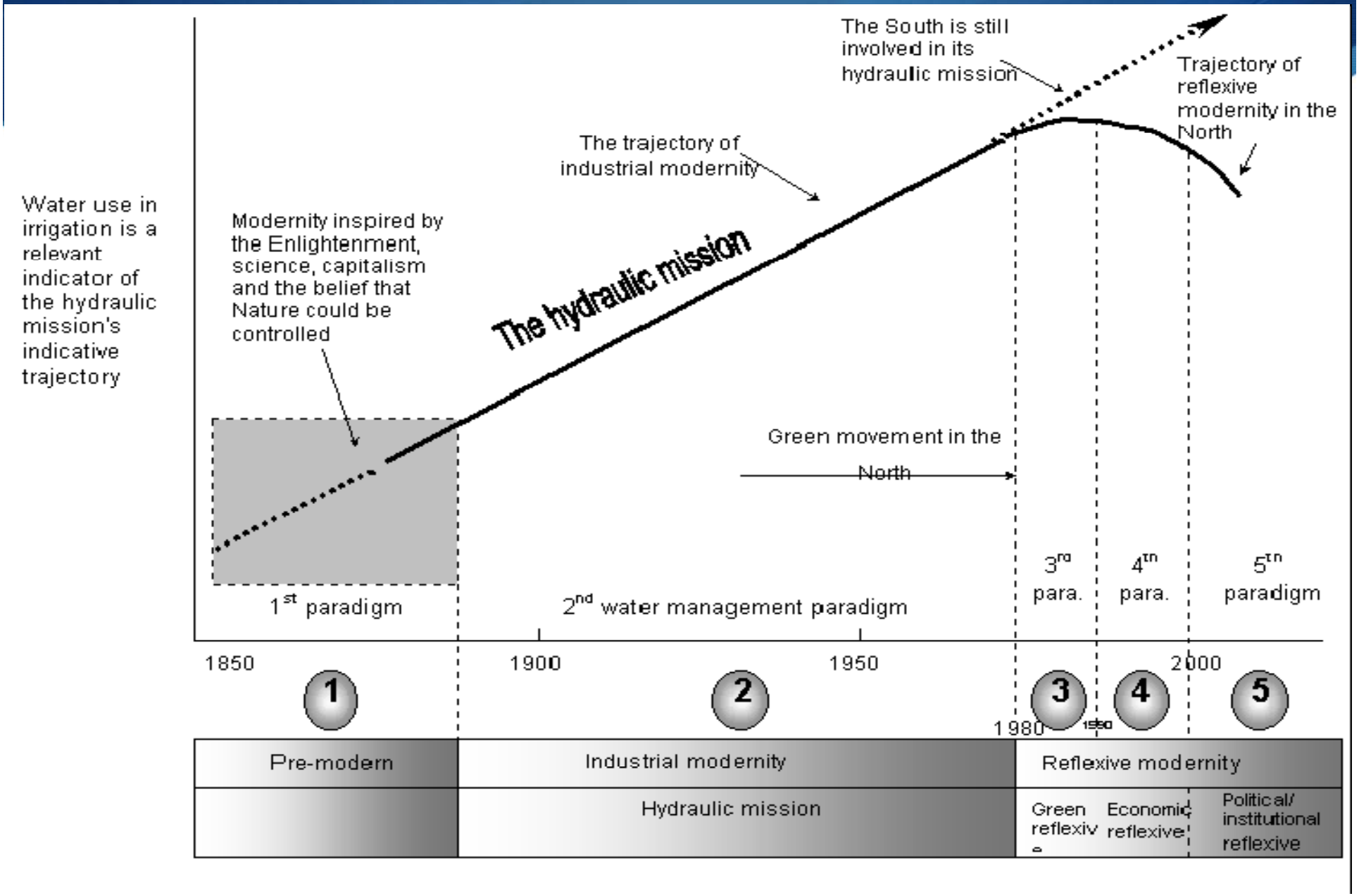
WATER USE HAS BEEN GROWING AT MORE THAN TWICE THE RATE OF POPULATION INCREASE IN THE LAST CENTURY

INCREASE IN WATER WITHDRAWALS BY 2025

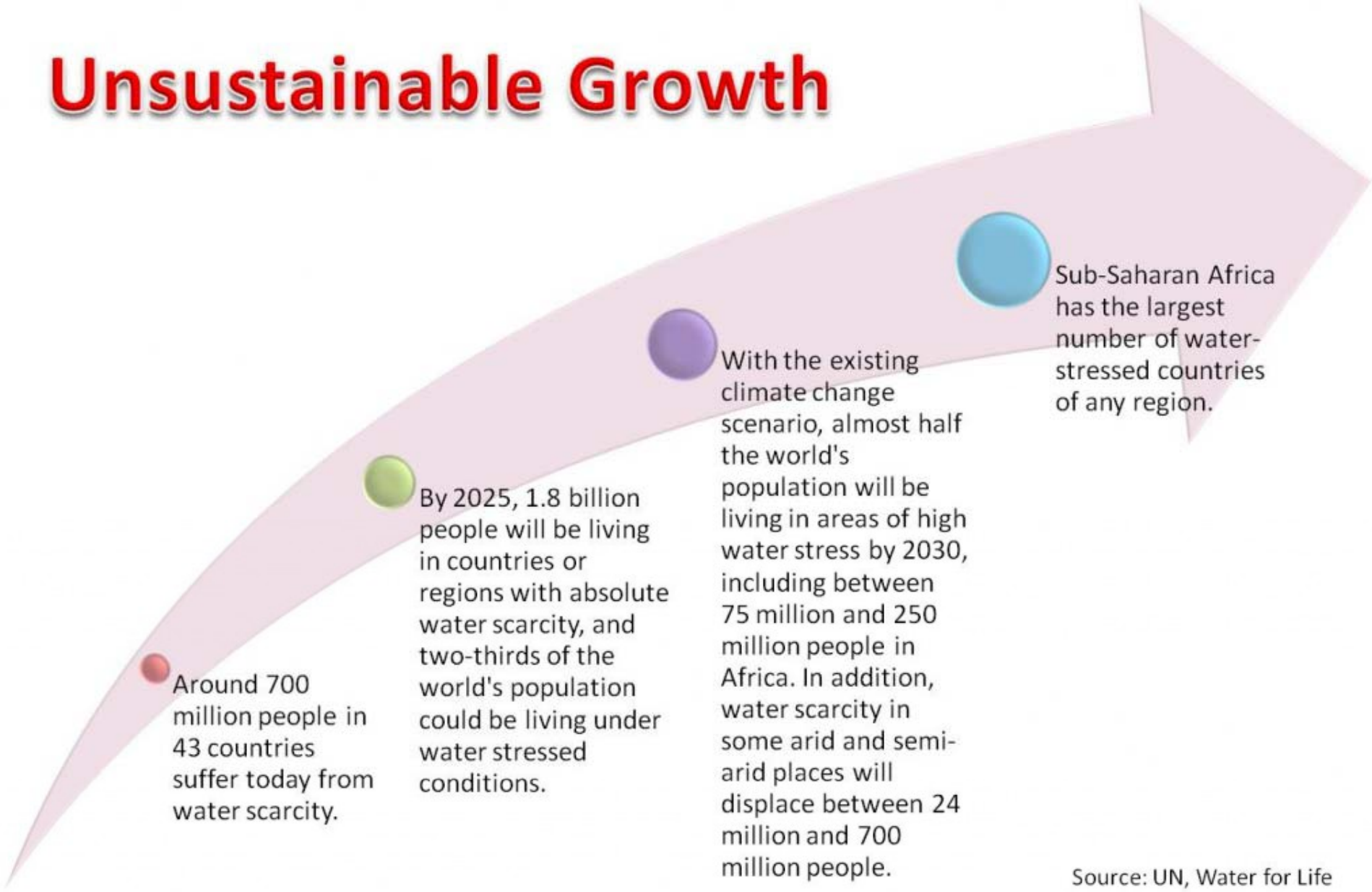
By 2025, 1800 million people will be living in countries or regions with absolute water scarcity, and two-thirds *of the world population could be under stress conditions*

UN WATER ORG

THE FIVE WATER PARADIGMS



Unsustainable Growth



Source: UN, Water for Life

Water: Cooperation *or* Competition?

Since 1947 there have been 300 international water agreements against 37 conflicts between states over water

Every year We withdraw 3,800 cubic km of freshwater

20% is used in industry

10% on domestic purposes

and a whopping 70% is used in agriculture

In response to the indigenous people's mobilization and protests, a convention was signed between the ministry and the Mazahua movement, but only for rather short-term measures.

The interests of the local population were not addressed in this water transfer project, which did not satisfy their basic needs (access to water and food production), narrowed their possibilities for development, and had negative impacts on their environment.

To avoid or resolve water-related conflicts in indigenous communities, indigenous people should be involved in the management of water resources on their territories and their water rights, as well as their social and cultural values should be recognized.

The Waters of the Mazahua

One-third of the water consumed in Mexico City metropolitan area comes from Mazahua indigenous people territories thanks to a 300 km-long system of dams, canals, tunnels, treatment plants and pumps.

The following factors often lie at the root of water tensions:

SCARCITY
when the demand for water exceeds the supply, creating competition between the different water uses

NEGLECT OF TREATIES
when provisions set by international agreements over freshwater are questioned or intentionally overlooked by certain parties

OVER-ABSTRACTION
when the permanent or temporary removal of water from rivers, canals, lakes, reservoirs or aquifers for human uses may put the water systems at risk

DIVERSION
when water from rivers or other surface sources is diverted from its course for various purposes through the construction of dams and other infrastructure

POLLUTION
from diffuse sources (e.g. agriculture, urban areas) as well as point sources (e.g. municipal sewage and industry) or following an accident

The Aral Sea disaster

In 1960 the Aral Sea was one the four largest lakes in the world with an area of 68,000 square km. Local fisheries represented annual catches of 40,000 tonnes and the area was surrounded with biologically rich marshes and wetlands.

By 2007, it had declined to 10% of its original size after the rivers that fed it were diverted by Soviet irrigation projects. Impacts include the pollution of surrounding land, lack of fresh water for the population, health problems, destruction of crops due to soil salinity, and the collapse of the fishing industry.

In 1992, the five countries of the basin - Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan and Kyrgyzstan - formed the Interstate Commission for Water Coordination of Central Asia. In 1994, they pledged 1% of their budgets to recover the sea. In 2005, Kazakhstan completed a dam project to replenish the North Aral Sea. In 2008, the water level had risen by 24 m from its lowest level in 2007.

Today, salinity has dropped, and fish are again found in sufficient numbers for some fishing to be viable but vast parts of the Aral Sea have been lost forever.

The number of large dams worldwide has risen from 500 in 1950 to 45,000 in 2013

The Nile Basin Initiative launched in 1999 "seeks to develop the river in a cooperative manner, share substantial socioeconomic benefits, and promote regional peace and security". But discord over the Nile treaties has continued.

However, only Egypt and Sudan are legally entitled to dam the river based on a series of treaties that have strained relations in the basin for over 50 years. Today, the shortages of water have prompted countries including Uganda, Sudan, Ethiopia and Kenya to question the treaties.

Tensions over the Nile River

The Nile river basin is home to over 160 million people and includes ten countries that rely significantly on its waters, since most have no effective rainfall, but also for fishing and hydroelectricity generation.

Despite tensions, no armed conflict has arisen in the modern era and countries understand that water is a means for greater cooperation. While a new agreement that satisfies all parties has not been found yet, countries have improved information sharing and scientific and technical cooperation, which is crucial to the sustainability of the river.

Urban-rural tensions in Zhengzhou, China

39% of Zhengzhou's population live in the city and 61% in the surrounding rural area. Groundwater represents about 70% of the water supply, 50% of which is used for agriculture, 31% for industry and 17% for domestic uses.

Groundwater remains over-exploited despite attempts to conserve water, and the city competes with rural areas for water use. Rural communities feel at a disadvantage especially because they cannot generate comparable financial returns.

Institutional frameworks are needed for ministries and agencies with differing mandates and goals to share information on the state of groundwater resources and the impacts of use.

Co-management would ensure that more surface water and treated wastewater is used for agriculture while urban users have priority over groundwater.

By 2030 47% of the world population will be living in areas of high water stress

There are 276 international river basins and transboundary aquifer systems in the world

of these lack any type of cooperative management framework

The Water Convention

Major industrial accidents may cause far-reaching transboundary effects and may lead to accidental water pollution.

The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) is intended to strengthen national measures for the protection and ecologically sound management of transboundary surface waters and groundwaters.

The Convention obliges parties to prevent, control and reduce transboundary impact, use transboundary waters in a reasonable and equitable way and ensure their sustainable management. Initially negotiated as a regional instrument in UNECE region, the Convention was amended in 2003 to allow accession by all the United Nations Member States.

2 Million Tonnes of sewage and industrial and agricultural waste is discharged into the world's waterways every year

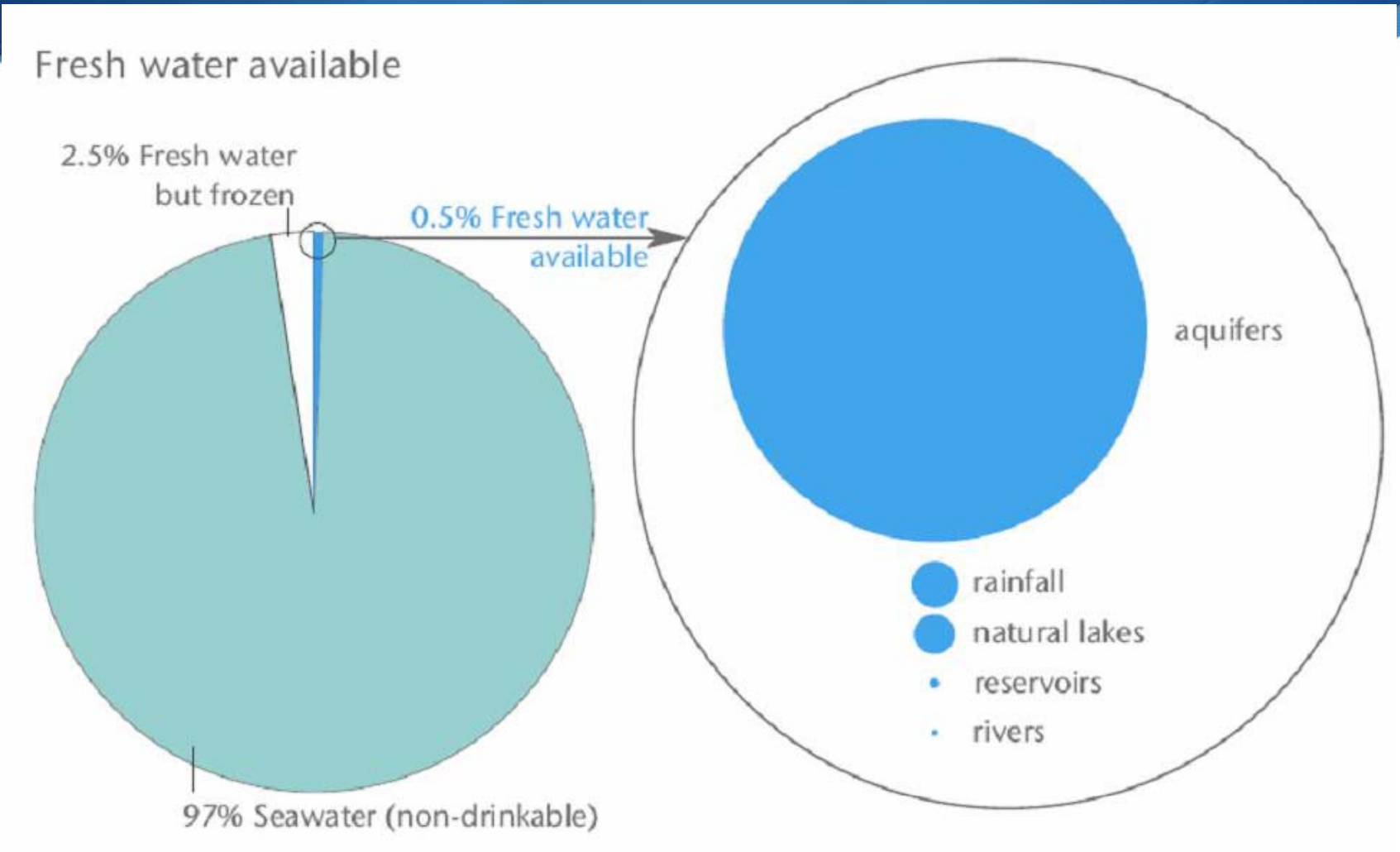
Every Second the urban population grows by 2 People

1.6 Billion People live in countries with absolute water scarcity

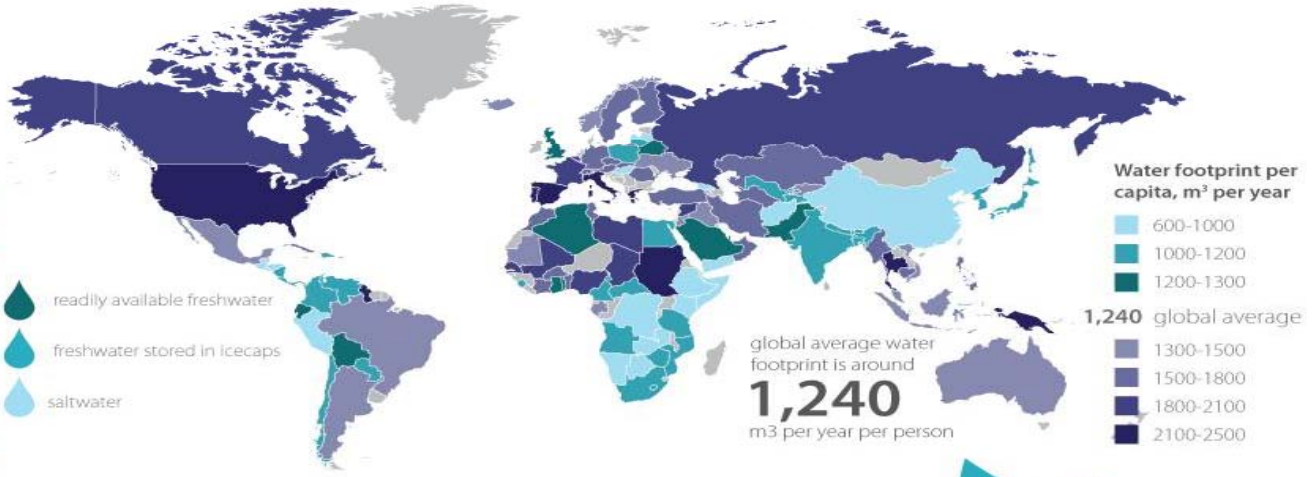
UN WATER World Water Day 2013 International Year of Water Cooperation

www.watercooperation2013.org

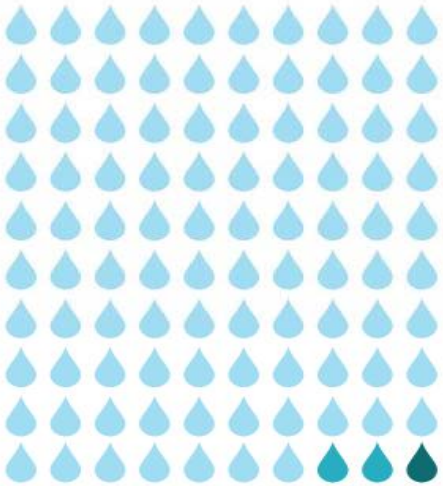
The Global Situation



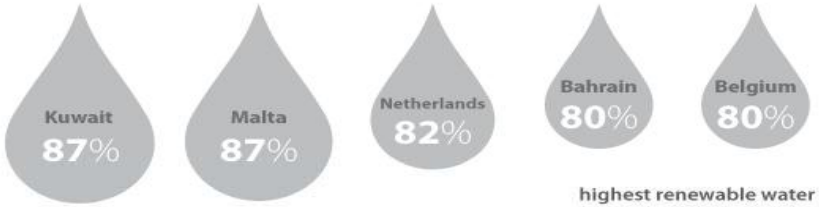
The 'water footprint' of a country is defined as the volume of water needed for the production of goods and services consumed by the inhabitants of the country.



amount of freshwater available



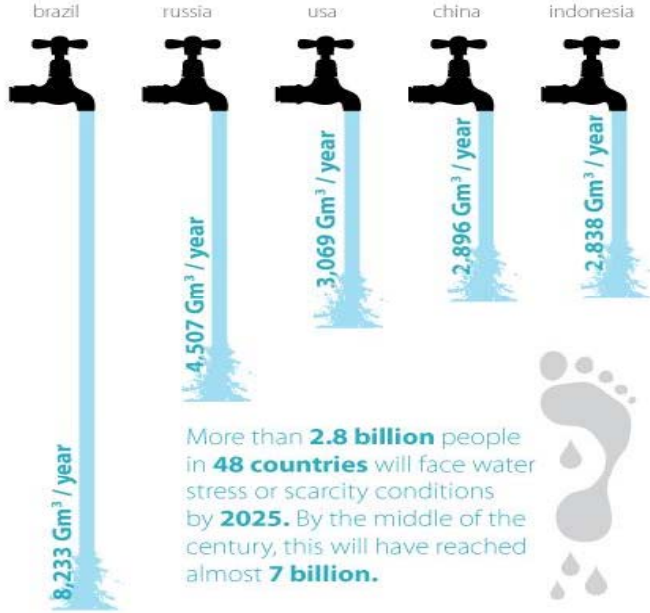
countries most dependent on water imports



70%
of existing freshwater is withdrawn for irrigation in agriculture

the highest water footprints per capita

highest renewable water resources



More than **2.8 billion** people in **48 countries** will face water stress or scarcity conditions by **2025.** By the middle of the century, this will have reached almost **7 billion.**

water footprint of different foods

24,000 litres
1kg of chocolate

15,500 litres
1kg of beef

4,400 litres
1kg of olives

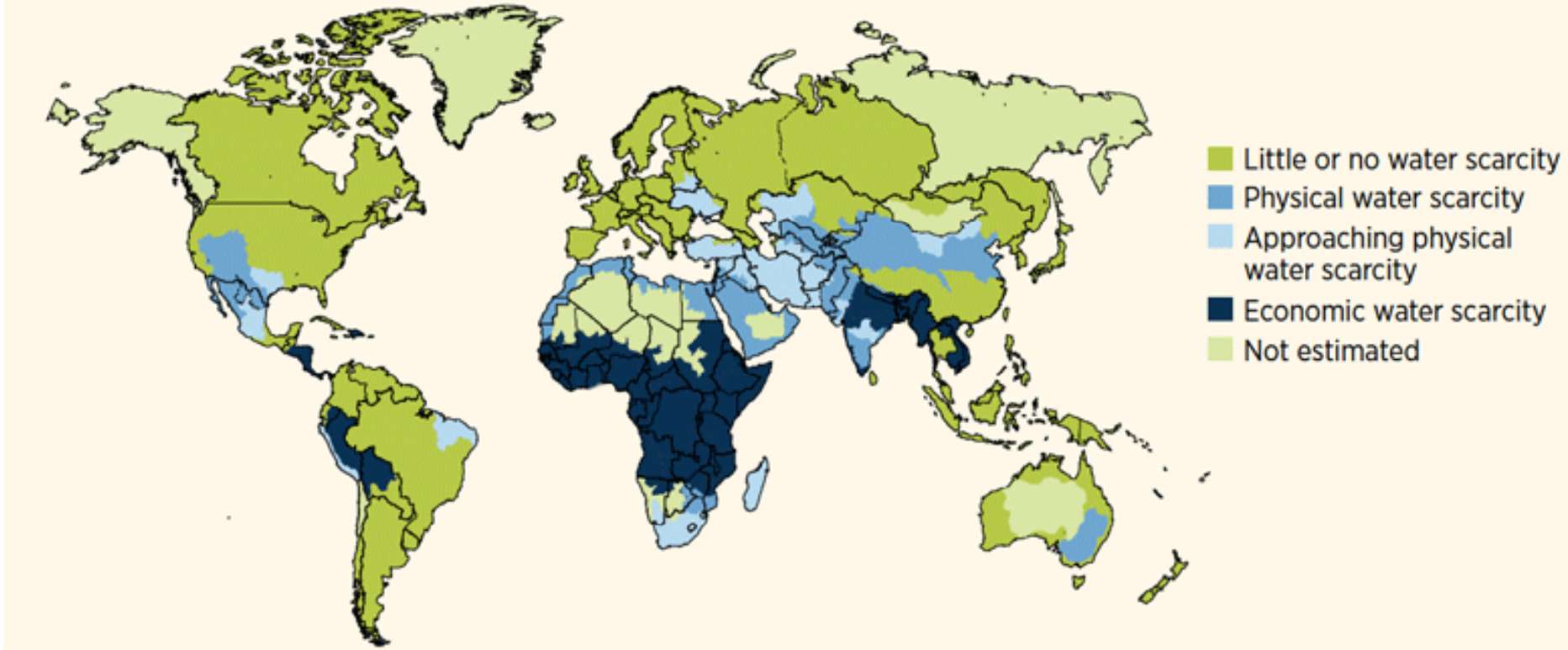
1,500 litres
1kg of sugar

140 litres
1 cup of coffee

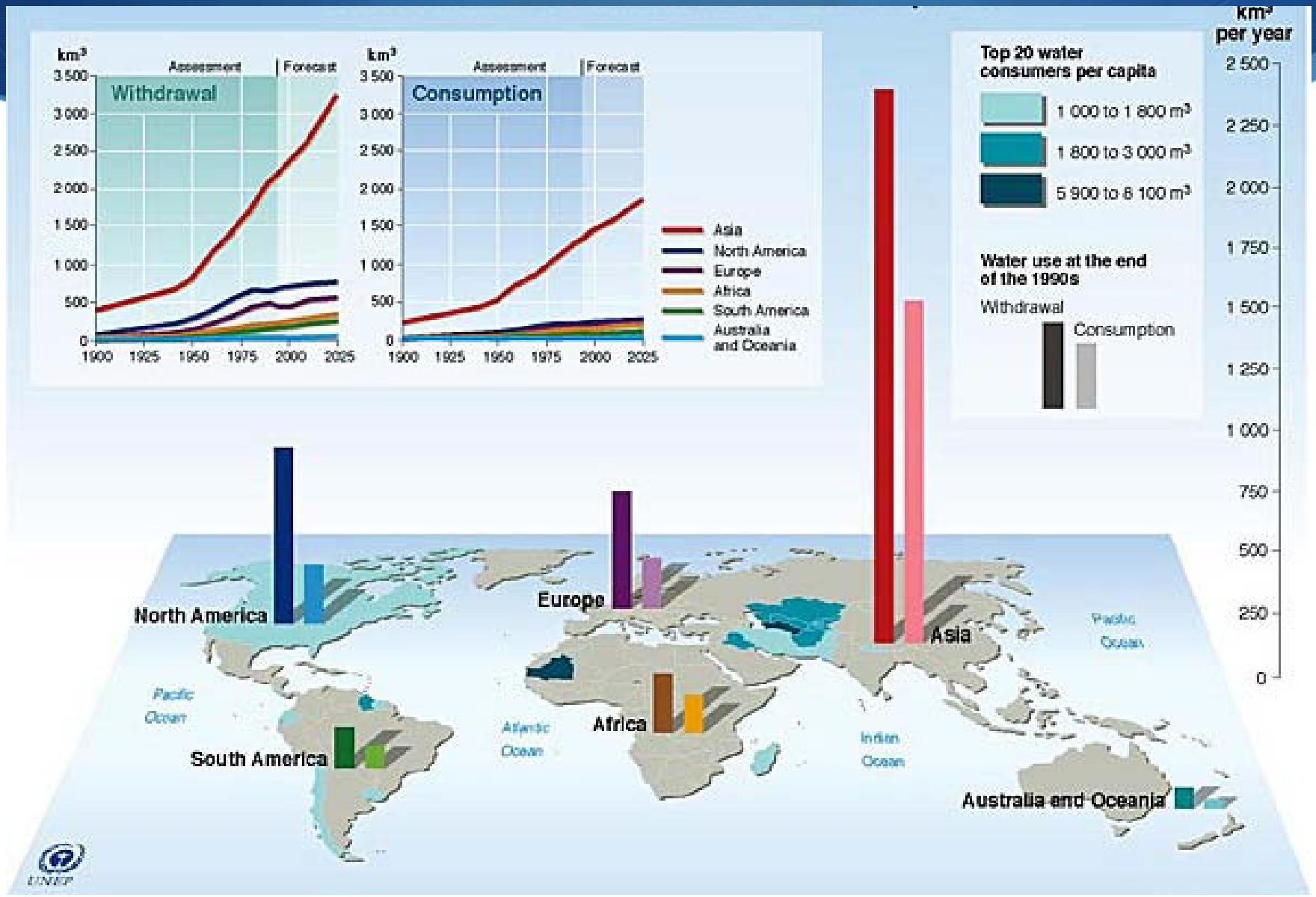
Source: WaterFootprint.org and WWF

Physical and economic water scarcity

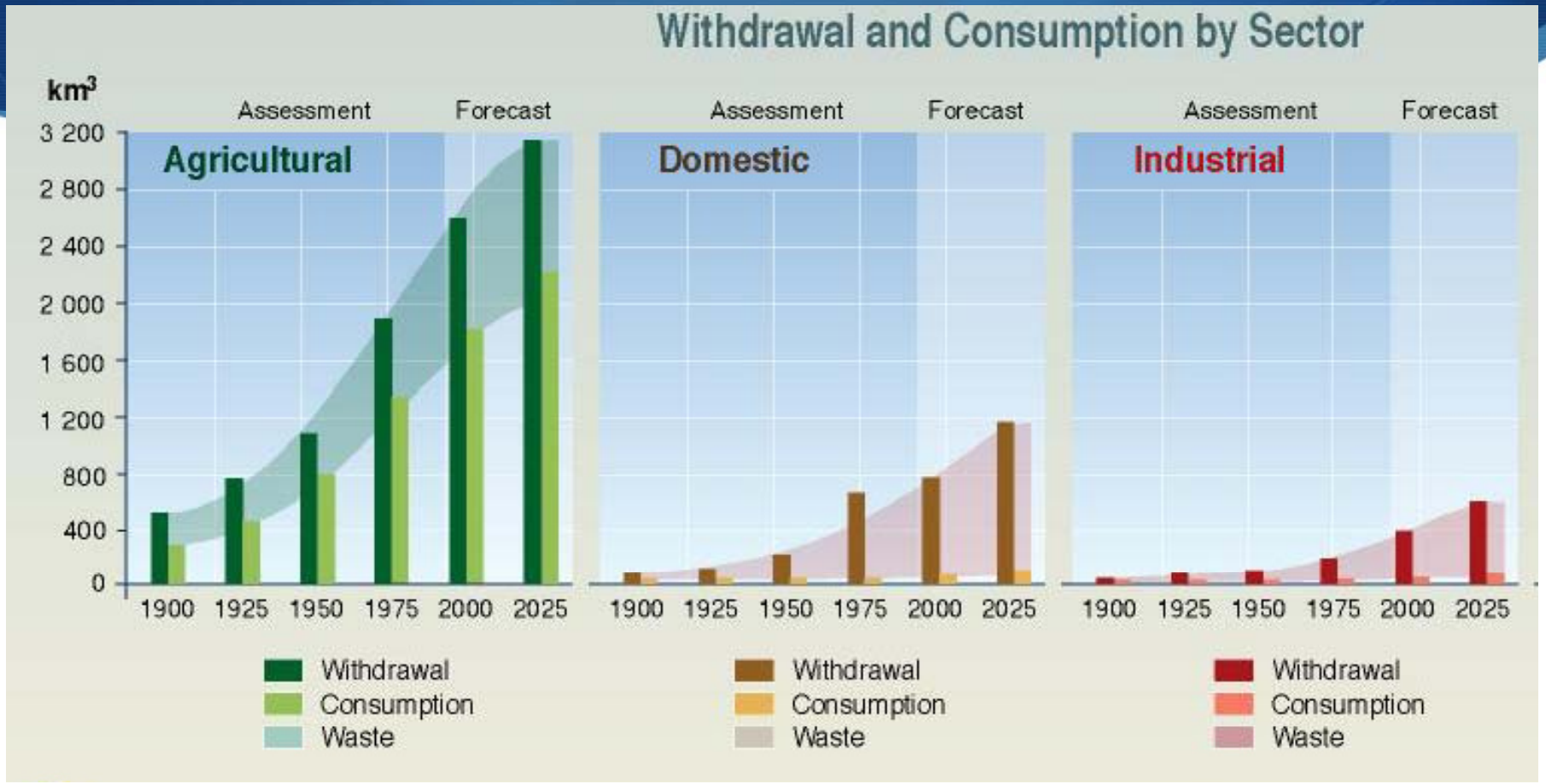
Global physical and economic water scarcity



Global Water Withdrawal & Consumption



Global Water Use



Four Ways People Contribute to Water Stress

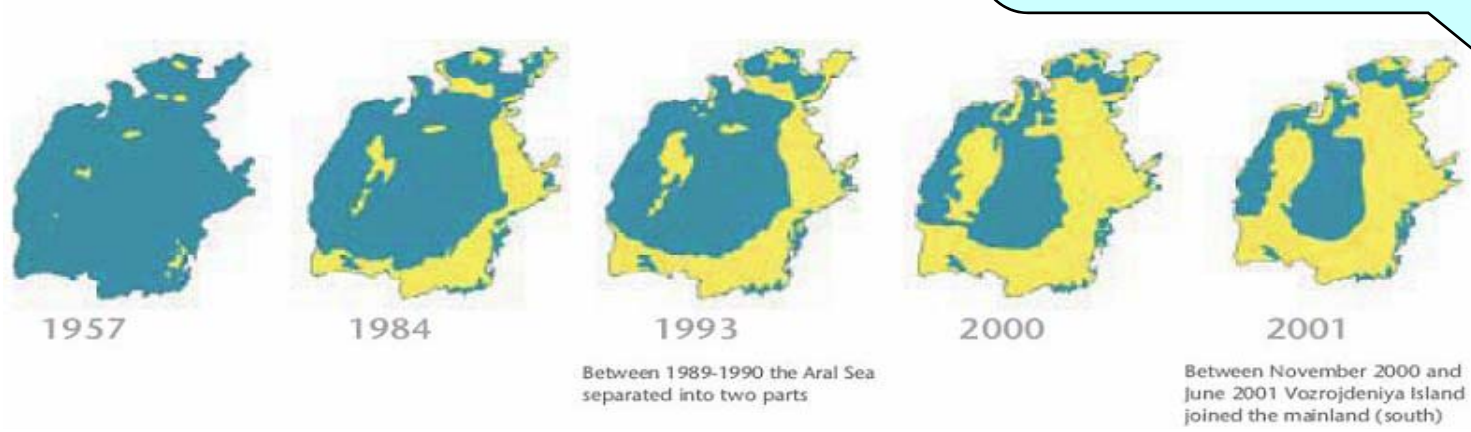
Excessive withdrawal from surface waters

Excessive withdrawal of water from underground aquifers

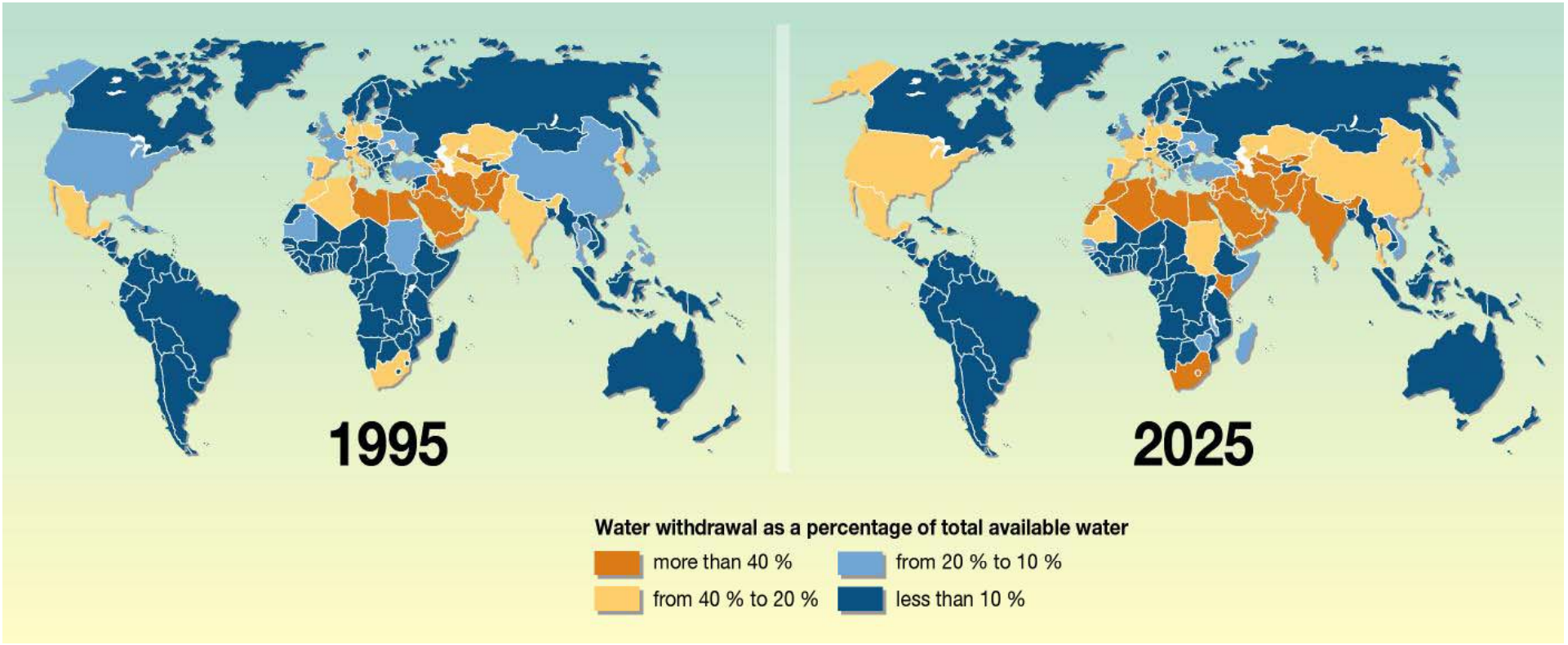
Pollution of fresh water resources

Inefficient use of freshwater

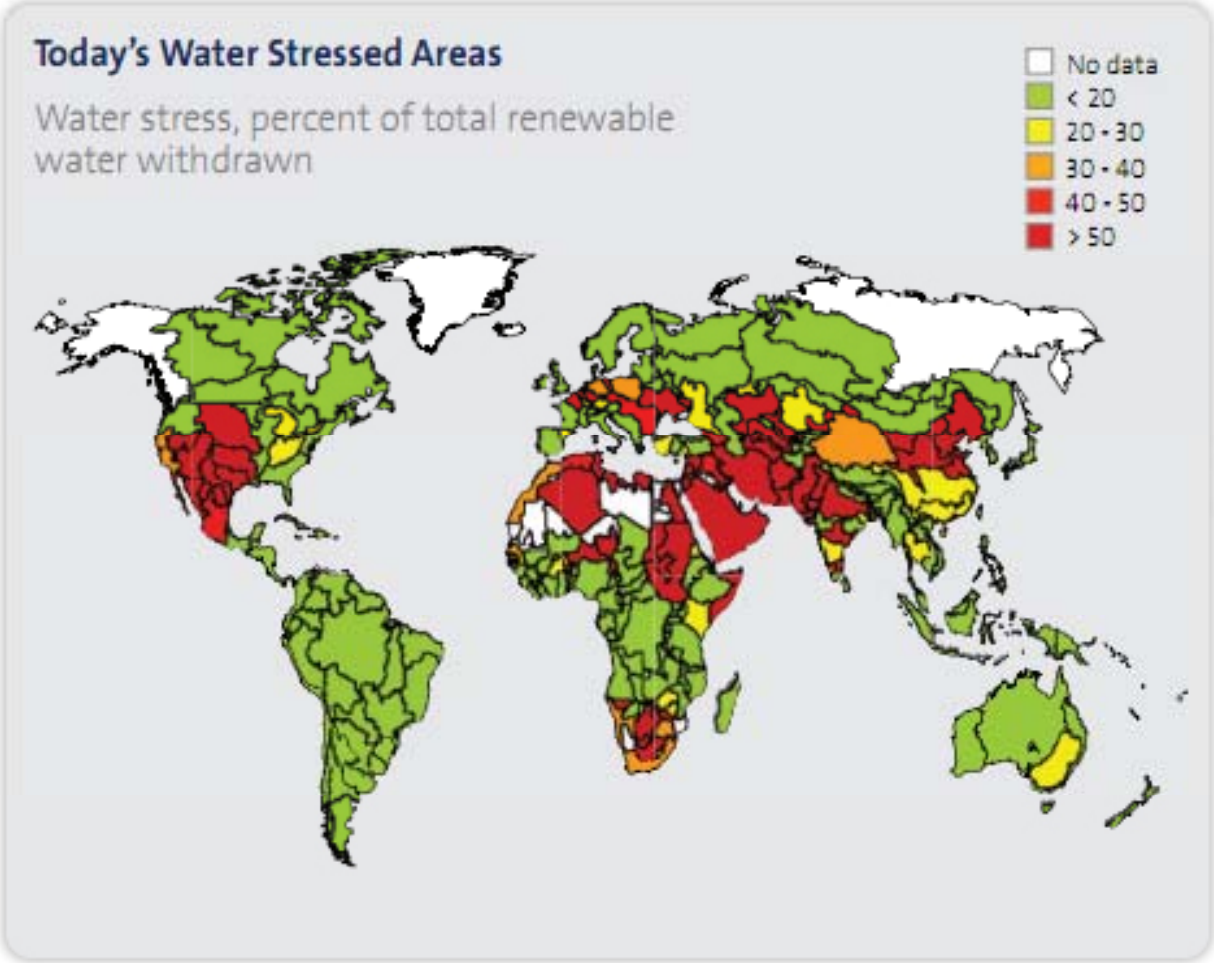
Over the past 30 years, the **Aral Sea** in the former Soviet Union has shrunk to less than half of its original size.

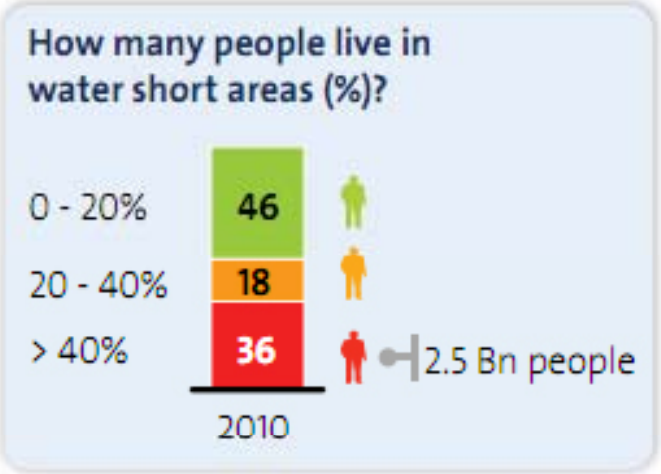


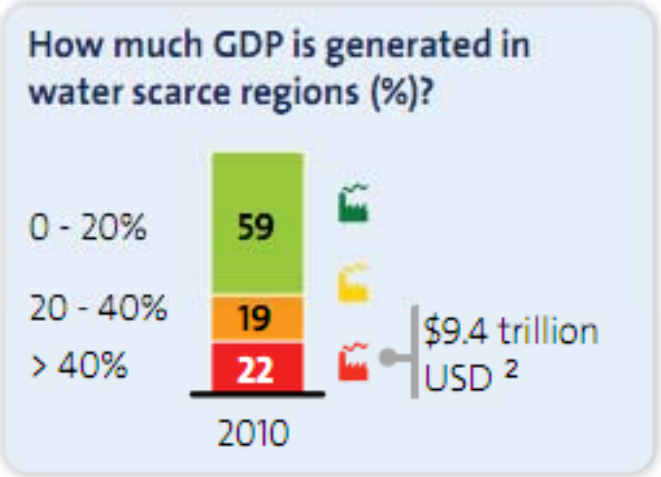
EXPECTED SITUATION



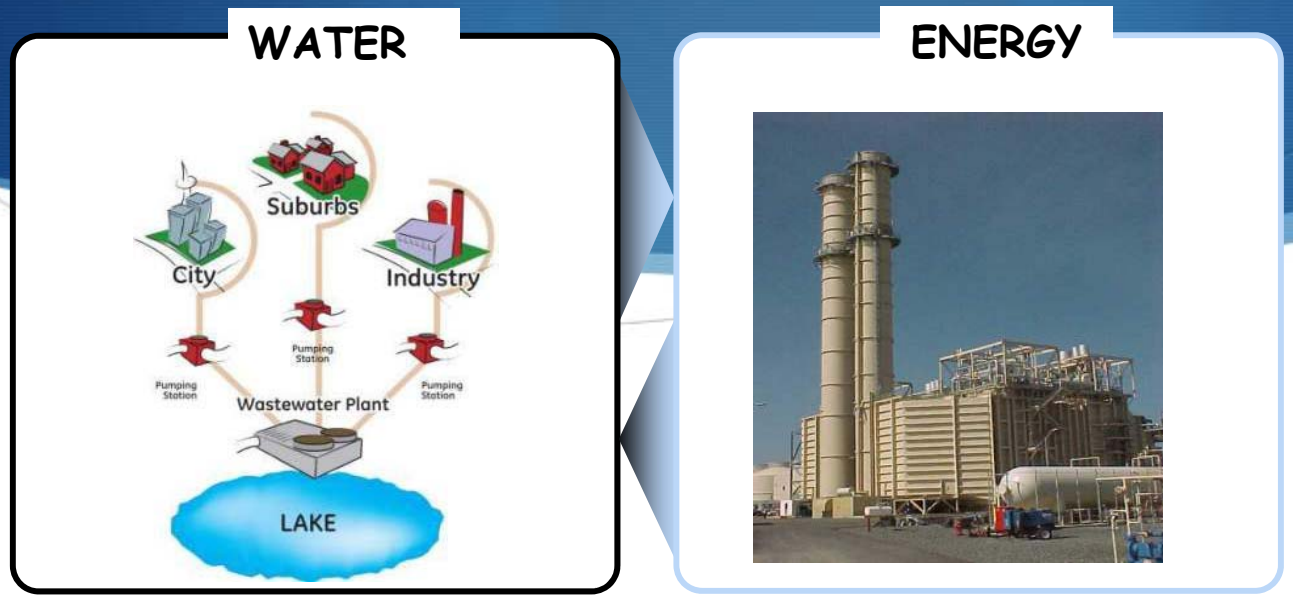
WATER STRESSED AREAS







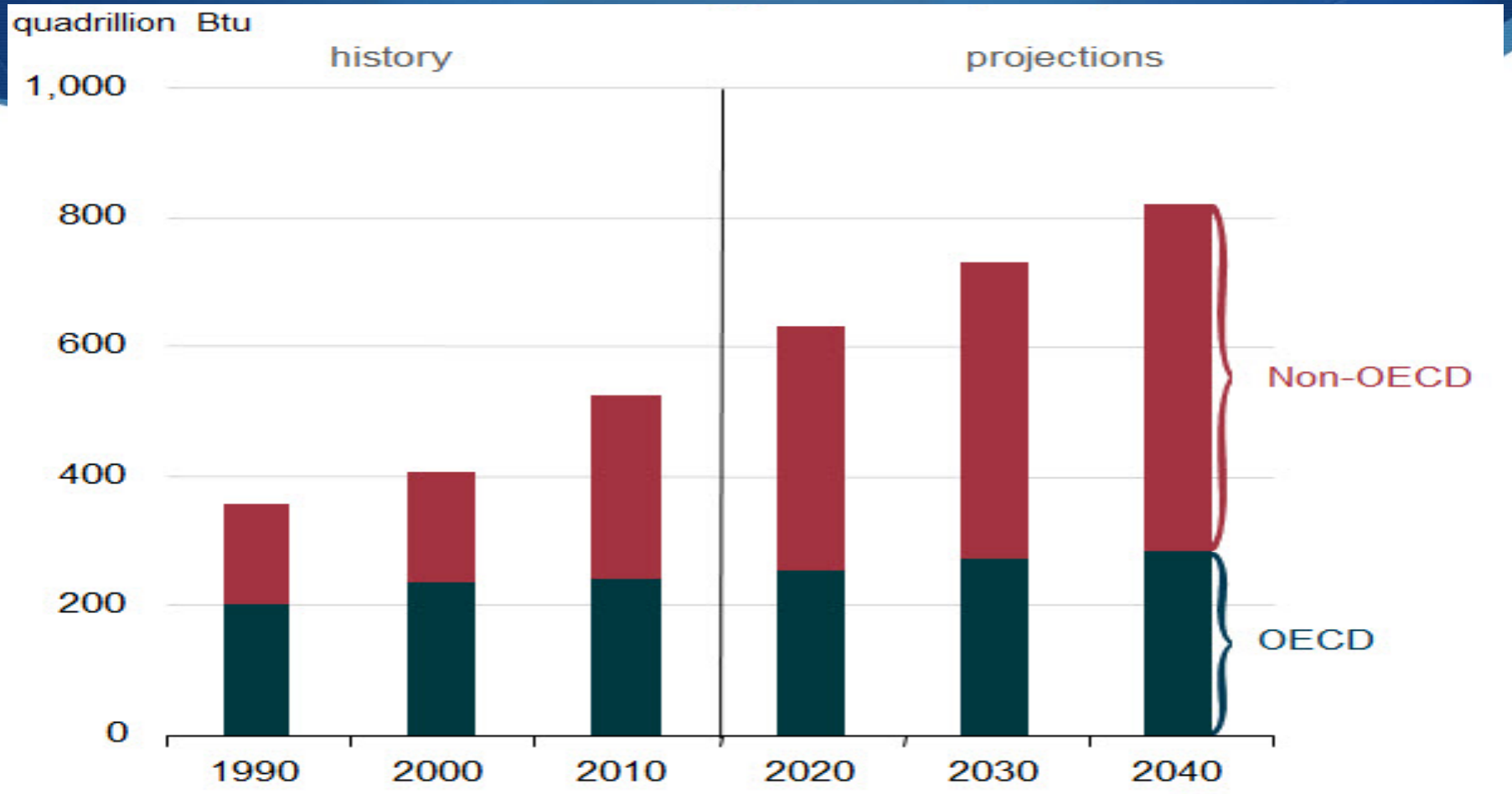
and more…



More than 15% of the annual energy consumed by a city is used for distributing and treating water.

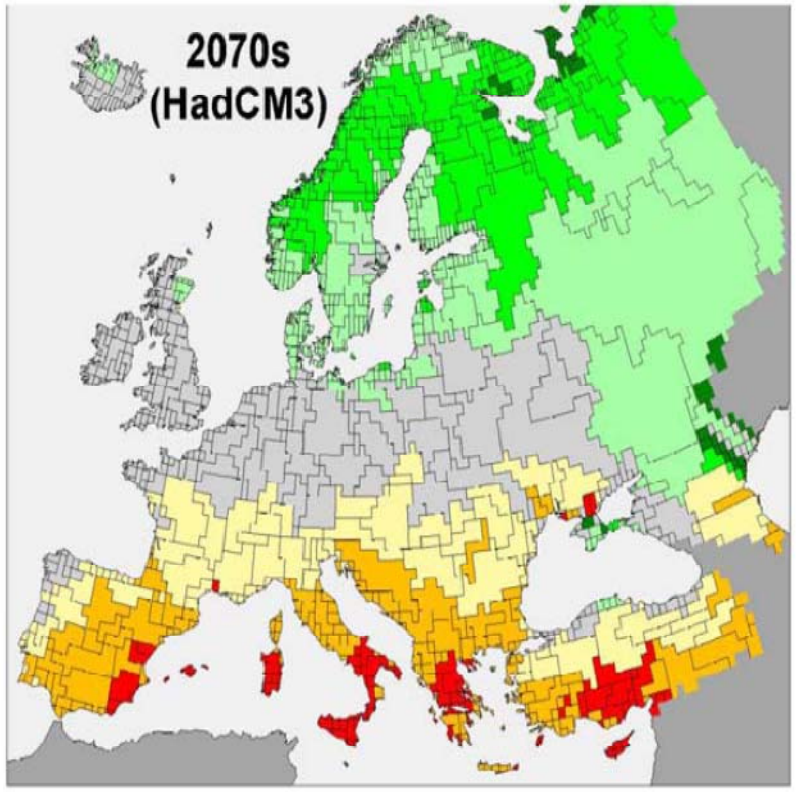
More than 50% of global industrial water consumption is used to generate power

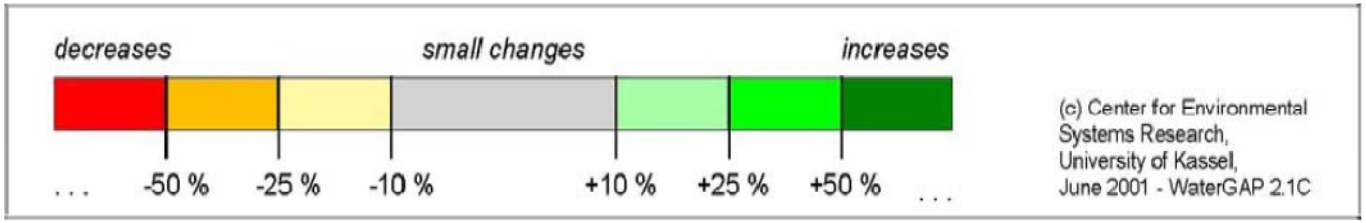
…and the world energy consumption is rapidly increasing



… mainly owing to BRIC countries (Brasil, Russia, India e China)

An unknown: Climate Change





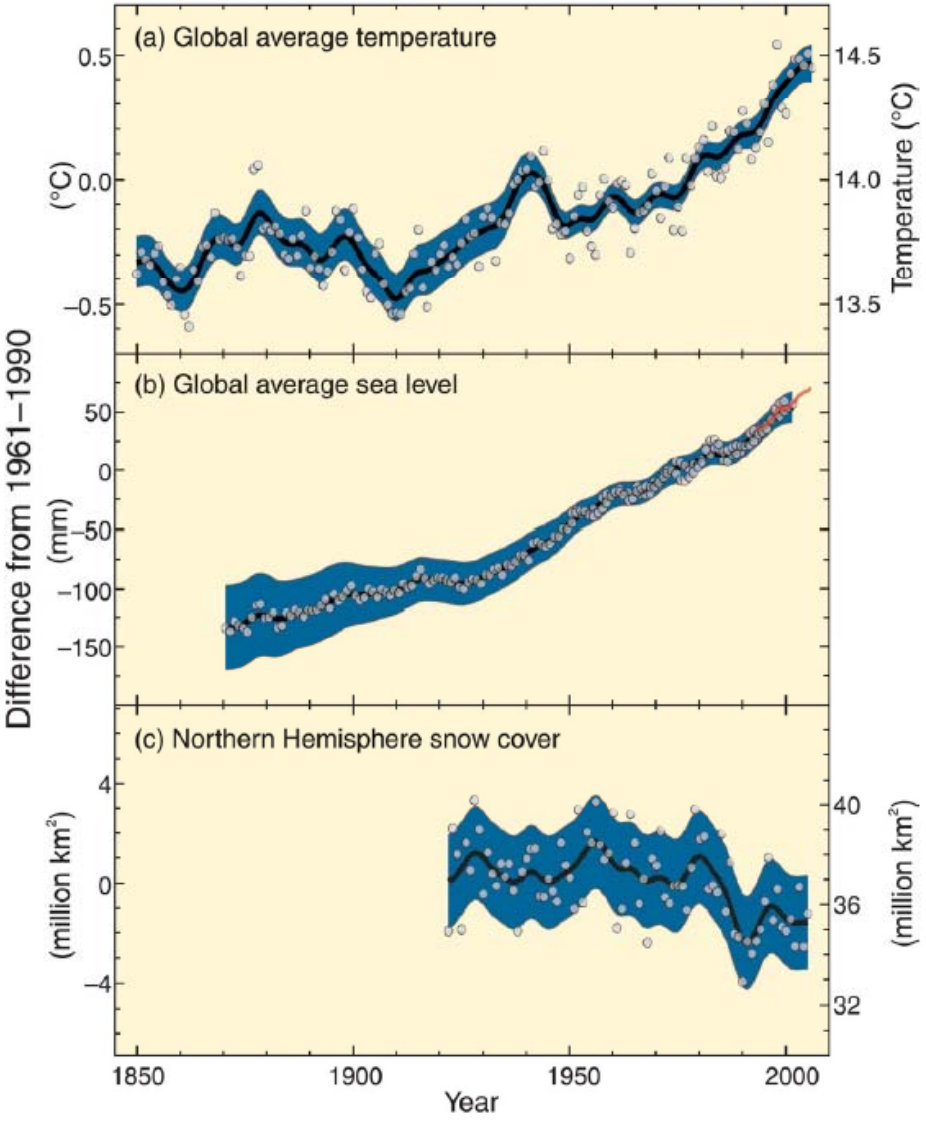
IPCC vision

"Climate change is a serious threat to development everywhere"

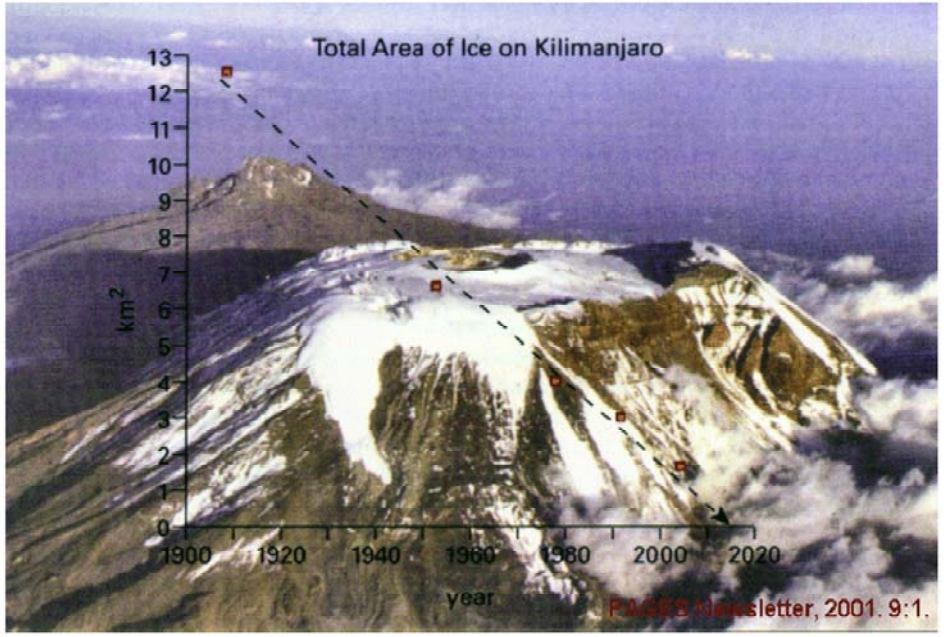
"Today, the time for doubt has passed. The IPCC has unequivocally affirmed the warming of our climate system, and linked it directly to uman activity"

"Slowing or even reversing the existing trends of global warming is the defining challenge of our ages"

"Galvanizing international action on global warming as one of main priorities as Secretary General"

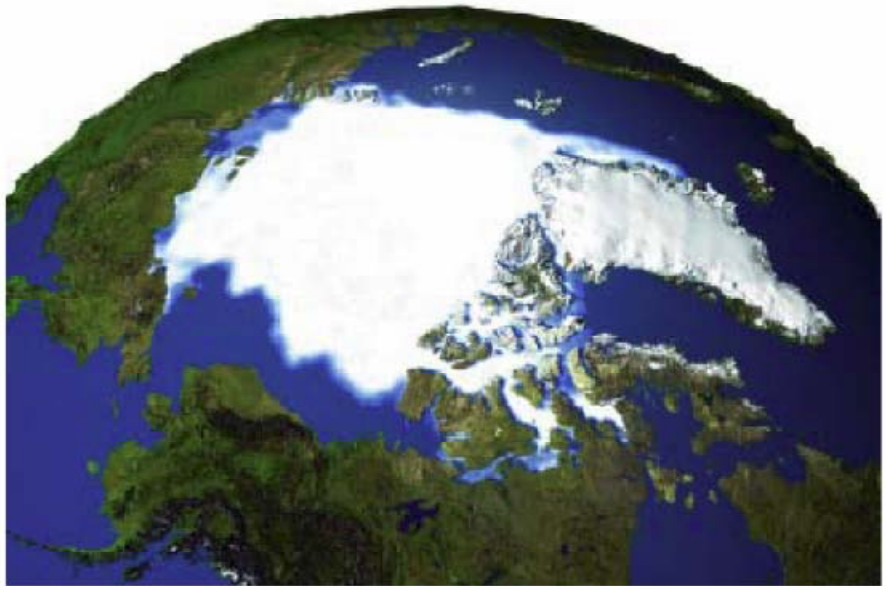


Some evidencies



- **Artic surface is reduced by 8% between 1978 and 2003**
- **Ice thickness is reduced by about 40% between 1960 and 1990**
- **Summer time grows about 5 days every 10 years**

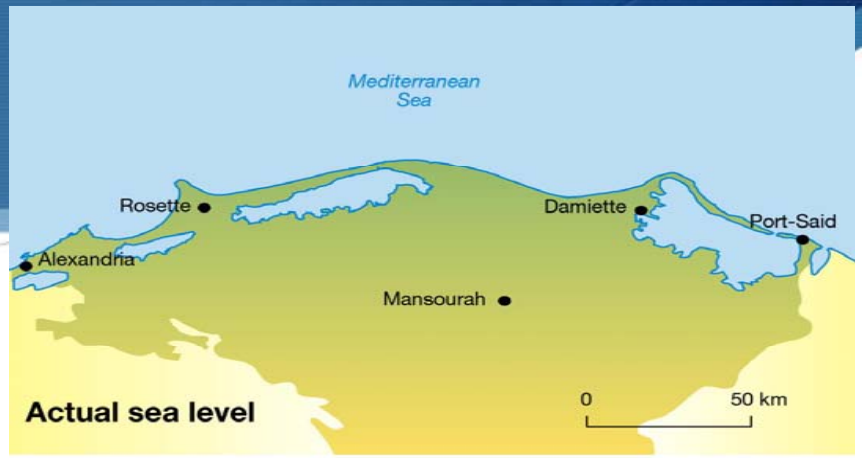
Observed sea ice September 1979

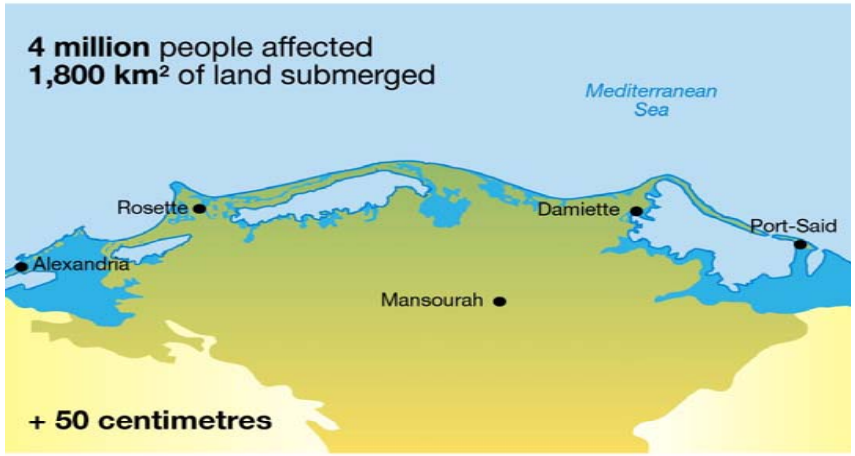


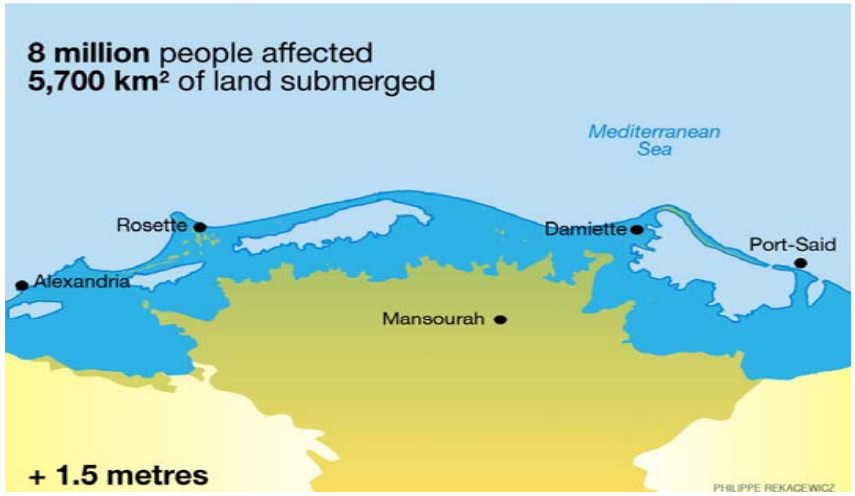
Observed sea ice September 2003

These two images, constructed from satellite data, compare arctic sea ice concentrations in September of 1979 and 2003. September is the month in which sea ice is at its yearly minimum and 1979 marks the first year that data of this kind became available in meaningful form. The lowest concentration of sea ice on record was in September 2002.

and the related risks

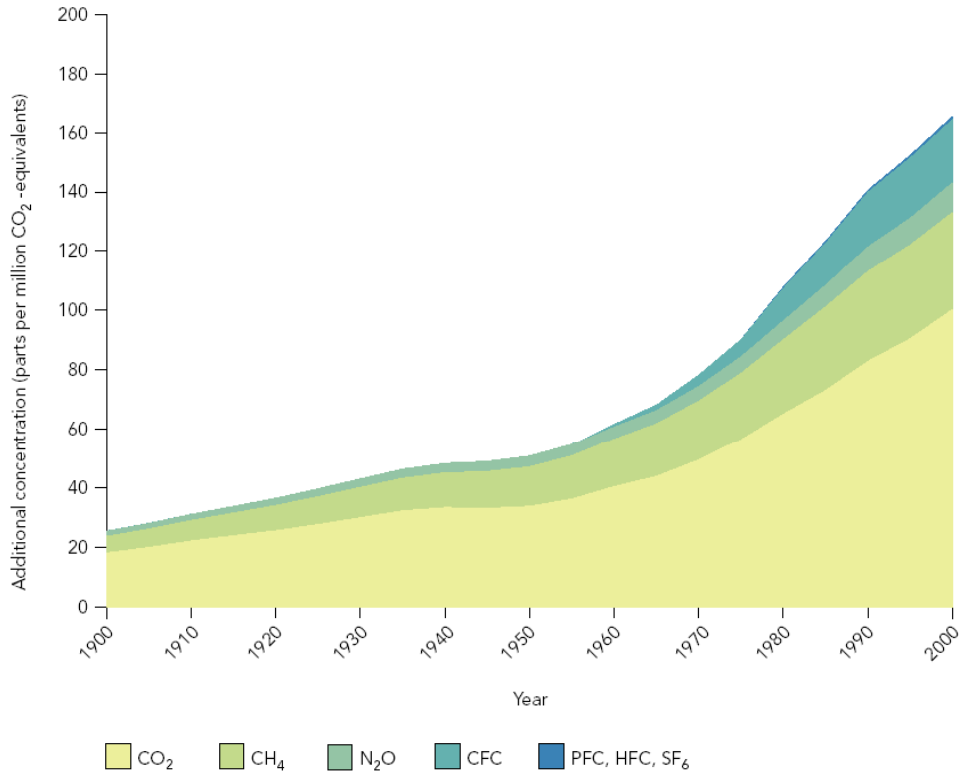


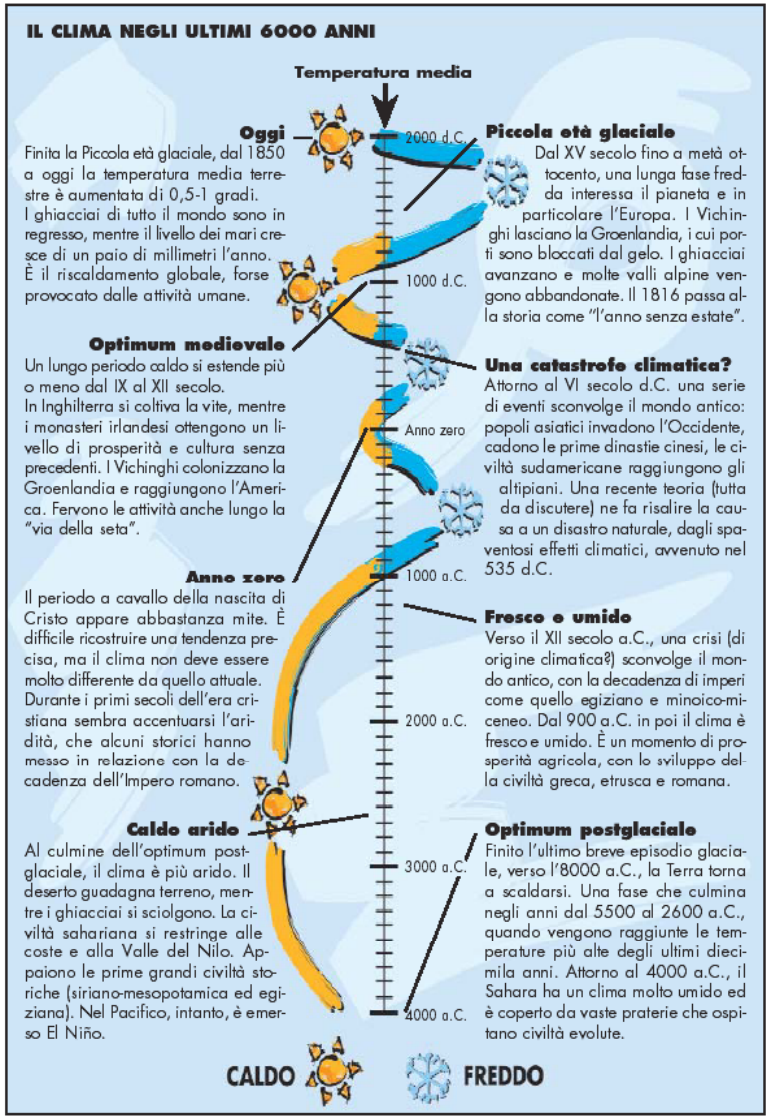




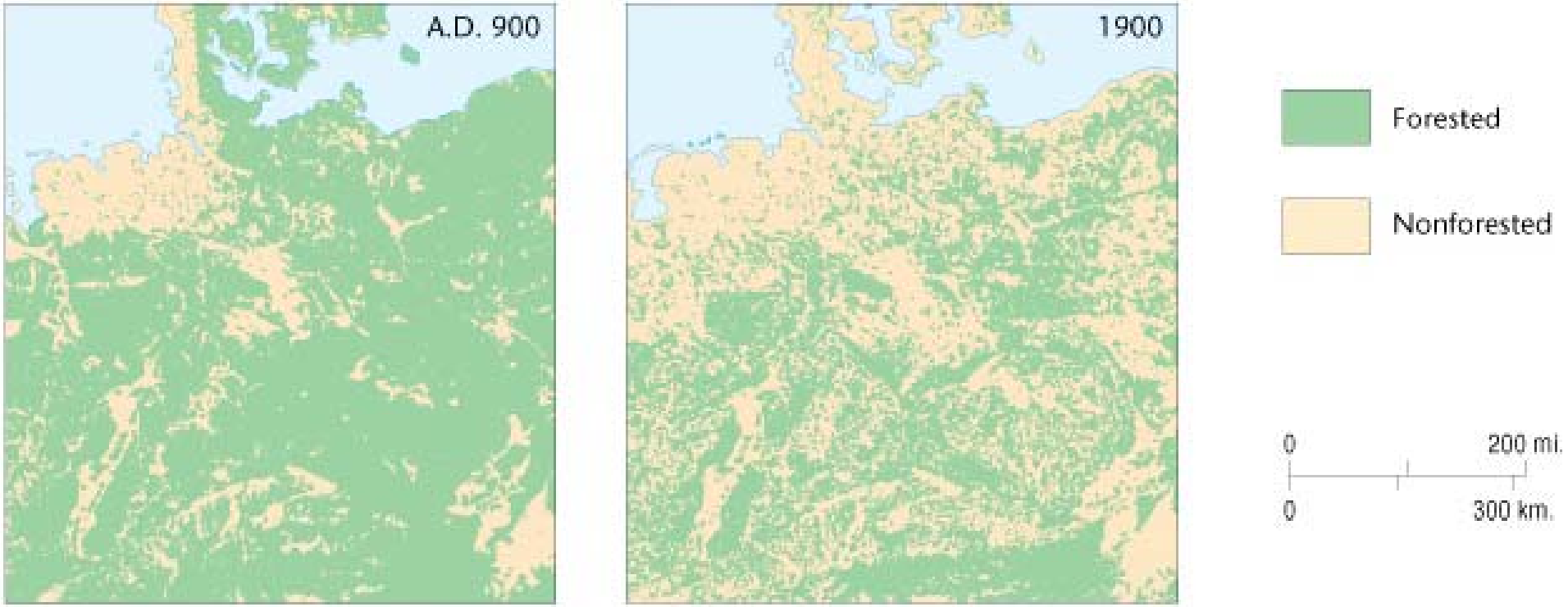
SOME DOUBTS…

Historical oscillation data?





or humans as modifiers



Primary objective of the UN International Year of Water Cooperation 2013 was to break down, analyze and achieve a common understanding on the essence of '**WATER COOPERATION**'.

where **Water Cooperation** refers to the peaceful management and use of water resources among various players and sectors and at different levels.

Budapest, 14 October 2013

A Sustainable World is a Water Secure World

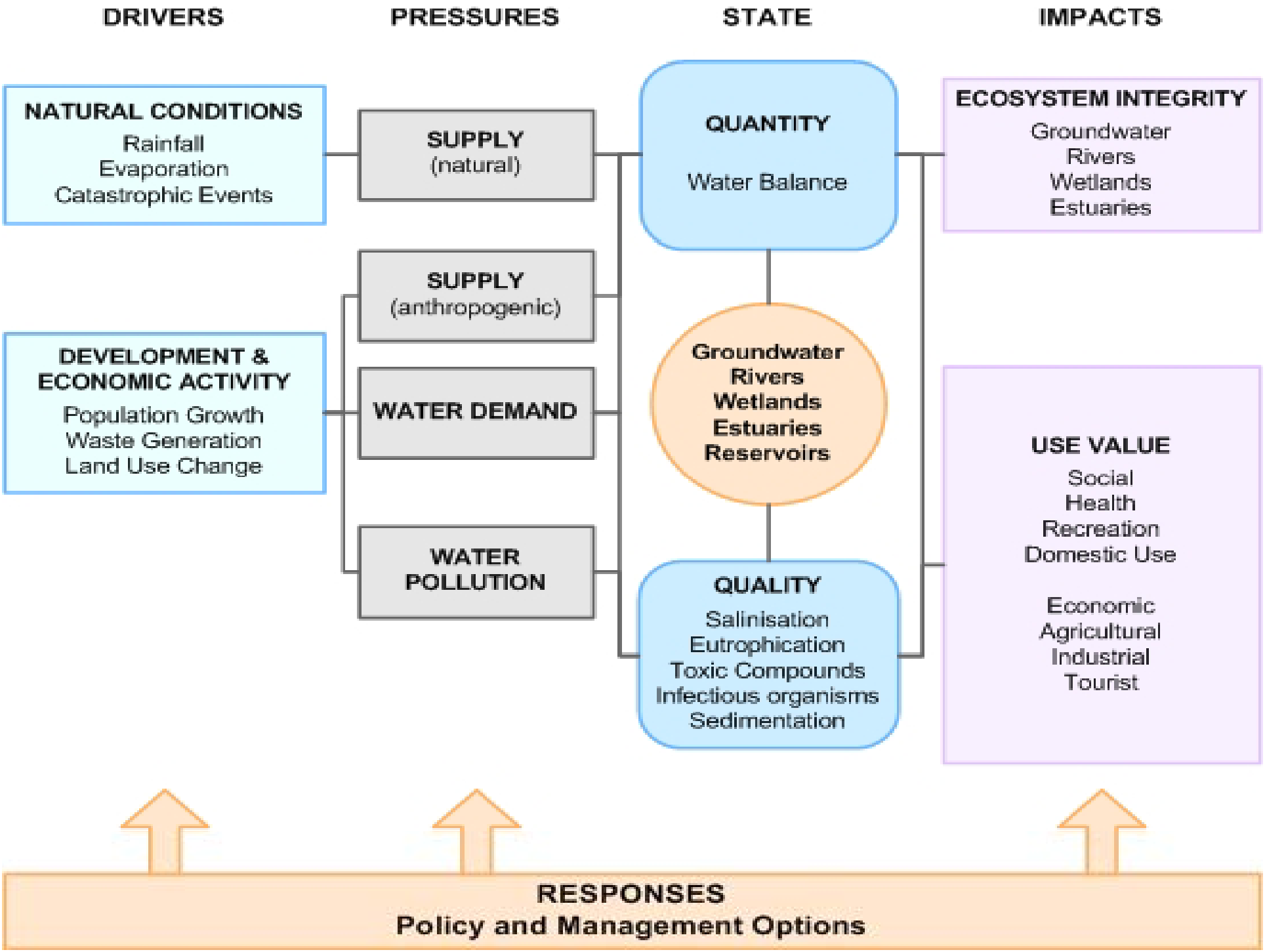
Policy dialogue on an emerging proposal for a dedicated Global Goal on Water Targets and Indicators

Smarter targets addressing the following main water-related issues:

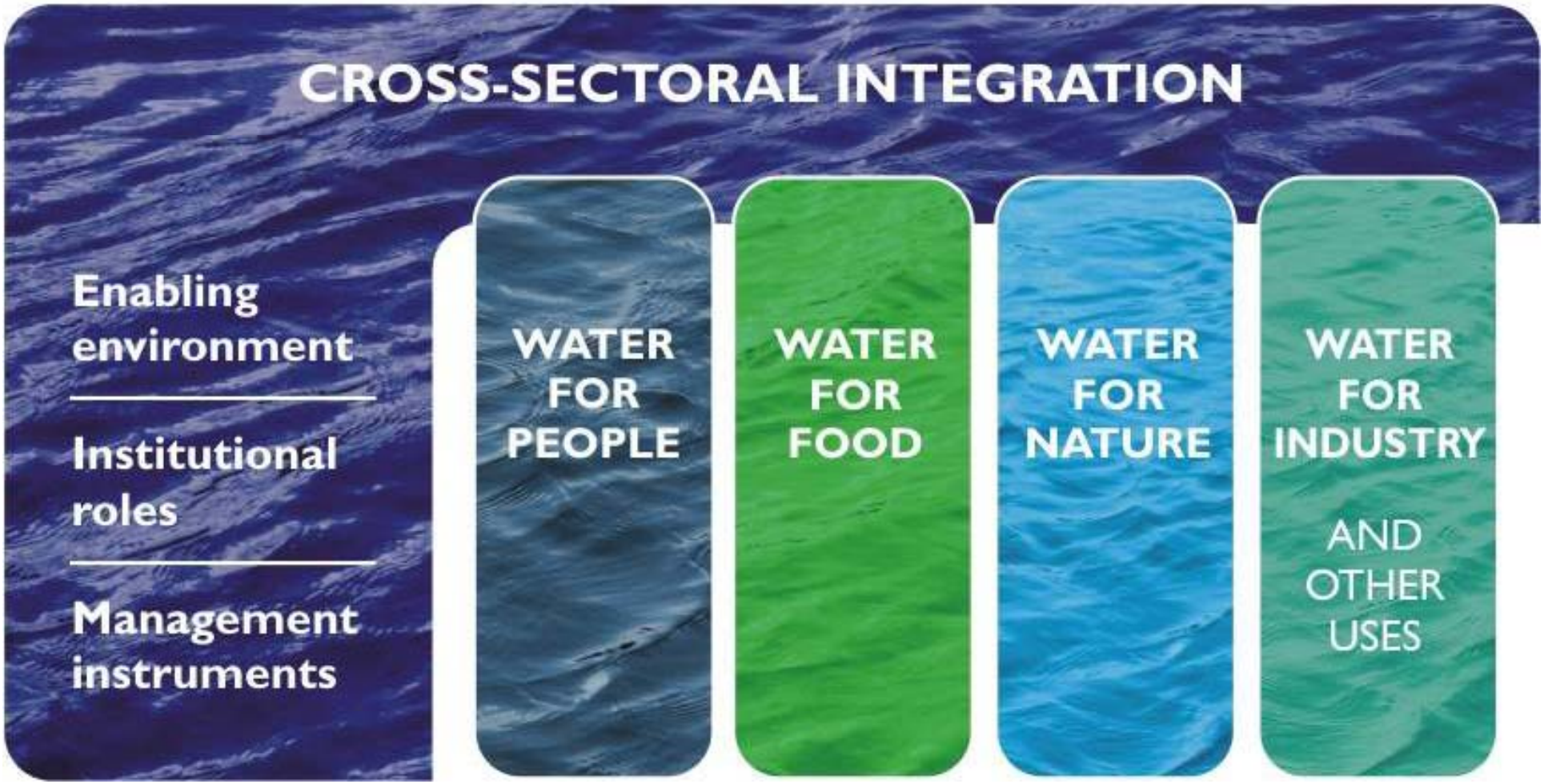
- ✓ Achieve universal access to safe drinking water and sanitation;
- ✓ **Improve integrated and cross-sectoral approaches to water resources management (IWRM);**
- ✓ Reduce pollution and increase collection, treatment and re-use of water;
- ✓ Increase resilience against the water-related impacts of global changes.

A possible answer: IWRM

Integrated Water Resources Management (IWRM) is a process which promotes the coordinated development and management of water, land and related resources **in order to maximize economic and social welfare in an equitable manner** without compromising the sustainability of vital ecosystems.

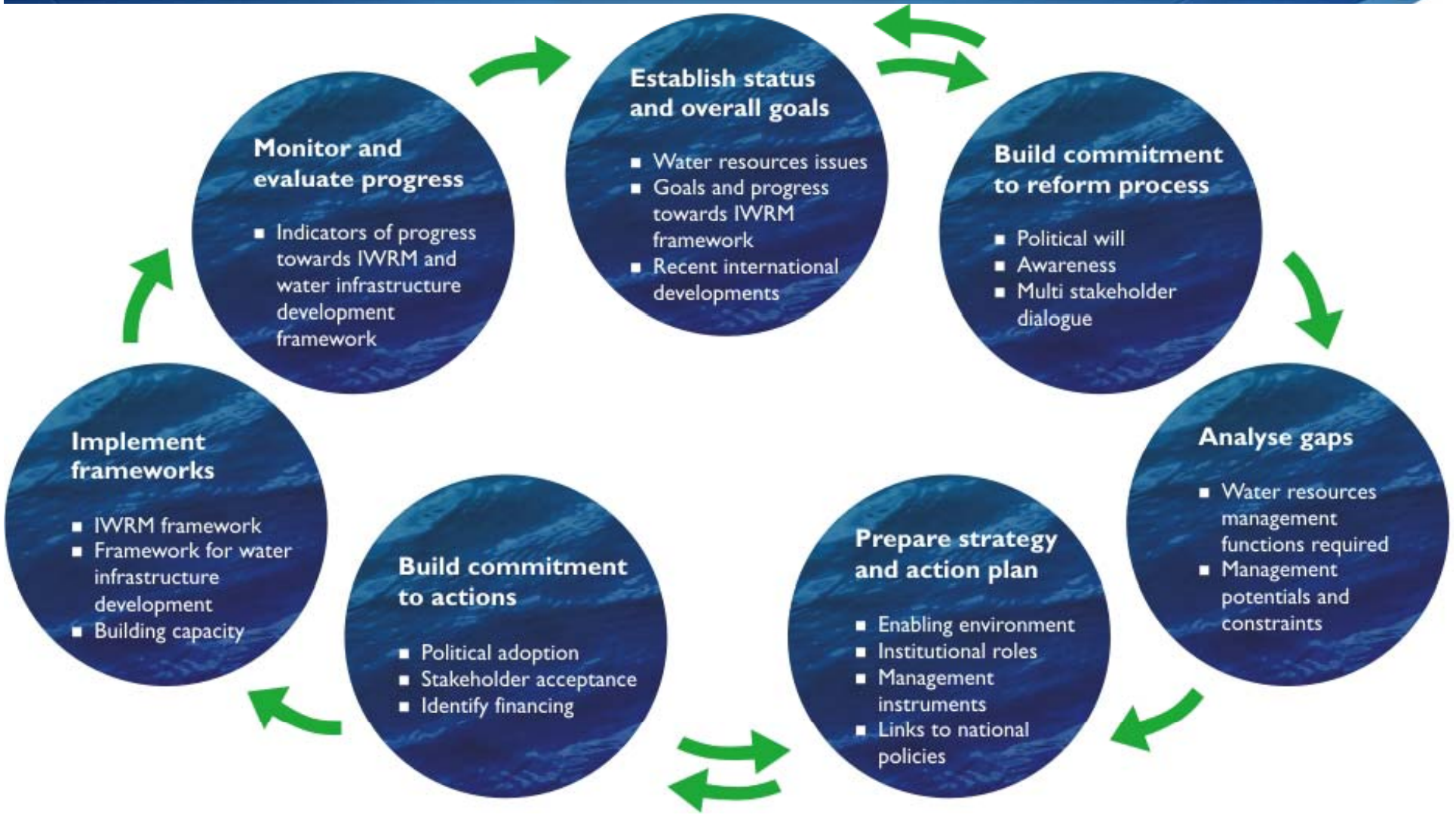

DRIVERS
PRESSURES
STATE
IMPACTS
NATURAL CONDITIONS
Rainfall
Evaporation
Catastrophic Events
DEVELOPMENT & ECONOMIC ACTIVITY
Population Growth
Waste Generation
Land Use Change
SUPPLY (natural)
SUPPLY (anthropogenic)
WATER DEMAND
WATER POLLUTION
QUANTITY
Water Balance
Groundwater
Rivers
Wetlands
Estuaries
Reservoirs
QUALITY
Salinisation
Eutrophication
Toxic Compounds
Infectious organisms
Sedimentation
ECOSYSTEM INTEGRITY
Groundwater
Rivers
Wetlands
Estuaries
USE VALUE
Social
Health
Recreation
Domestic Use
Economic
Agricultural
Industrial
Tourist
RESPONSES
Policy and Management Options

IWRM and its Relations to Sub-sectors



General Framework for IWRM

THE IWRM PLANNING CIRCLE

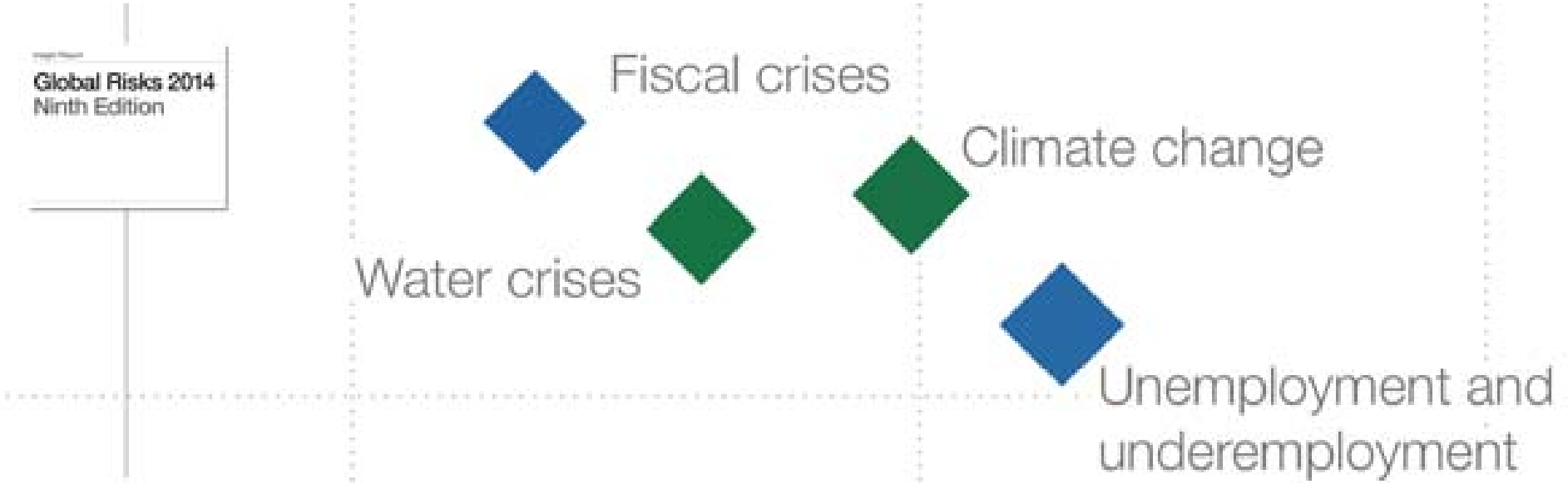


SEARCHING INNOVATION in the water sector is a great chance to enhance the cooperation process facilitating matchmaking between water innovators across the entire value chain.

Innovation means looking beyond the normal for solutions, using science and technology, but at the same time new approaches to achieving behavioral change

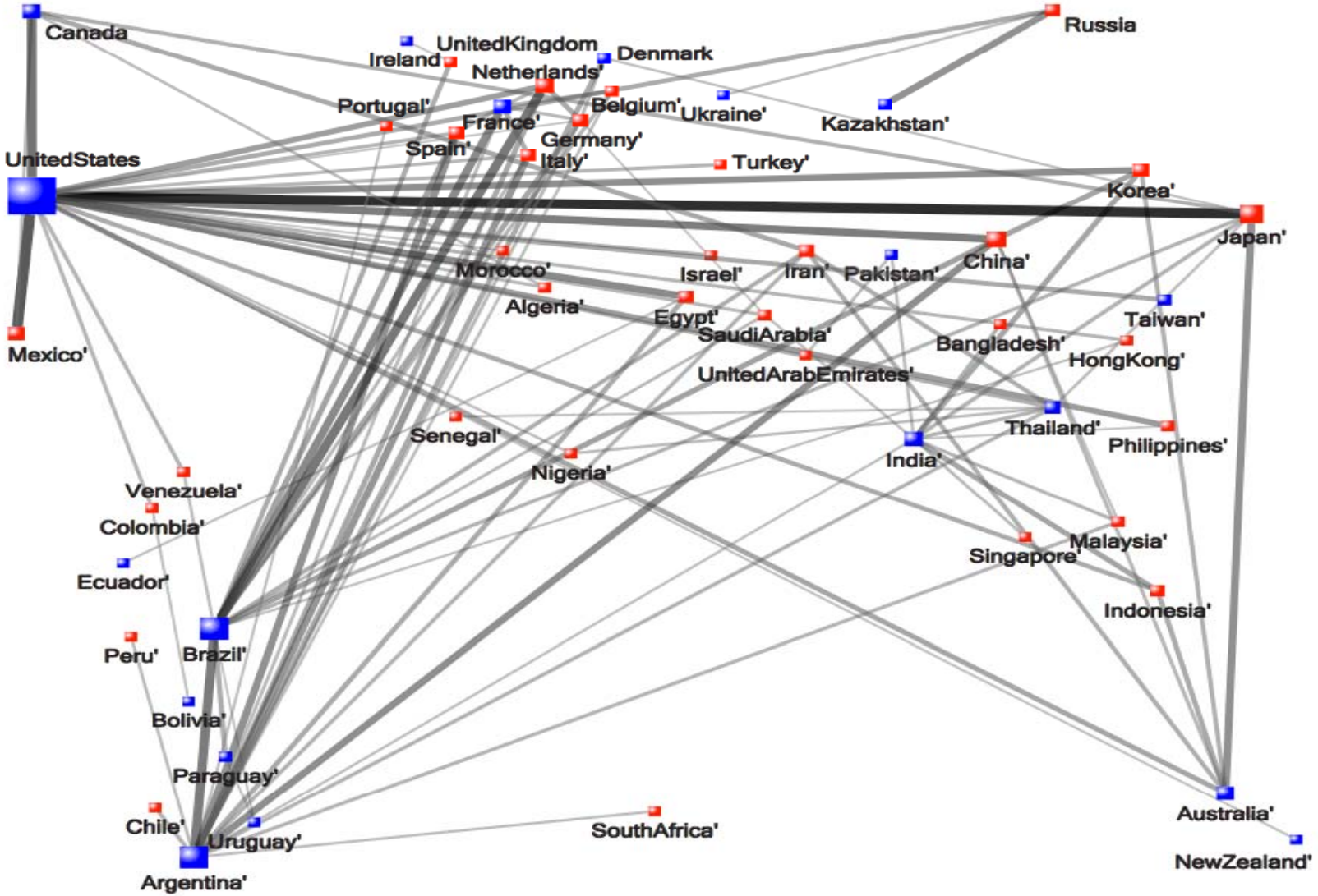
But, water industry by nature is conservative. It's focused on public health, reliable service, and compliance with regulations.
Those things add up to create a system that's resistant to change.

Water is a Top-three Global Risk,
It is always too much, too little, too dirty



(World Economic Forum, January 2014)

A last issue: The Water Virtual Trade



Thank you

The real magic of discovery lies not in seeing new landscapes, but in having new eyes

Marcel Proust