XII SIMPÓSIO DE RECURSOS HÍDRICOS DO NORDESTE

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Governança e os desafios institucionais da Gestão Hídrica no NE

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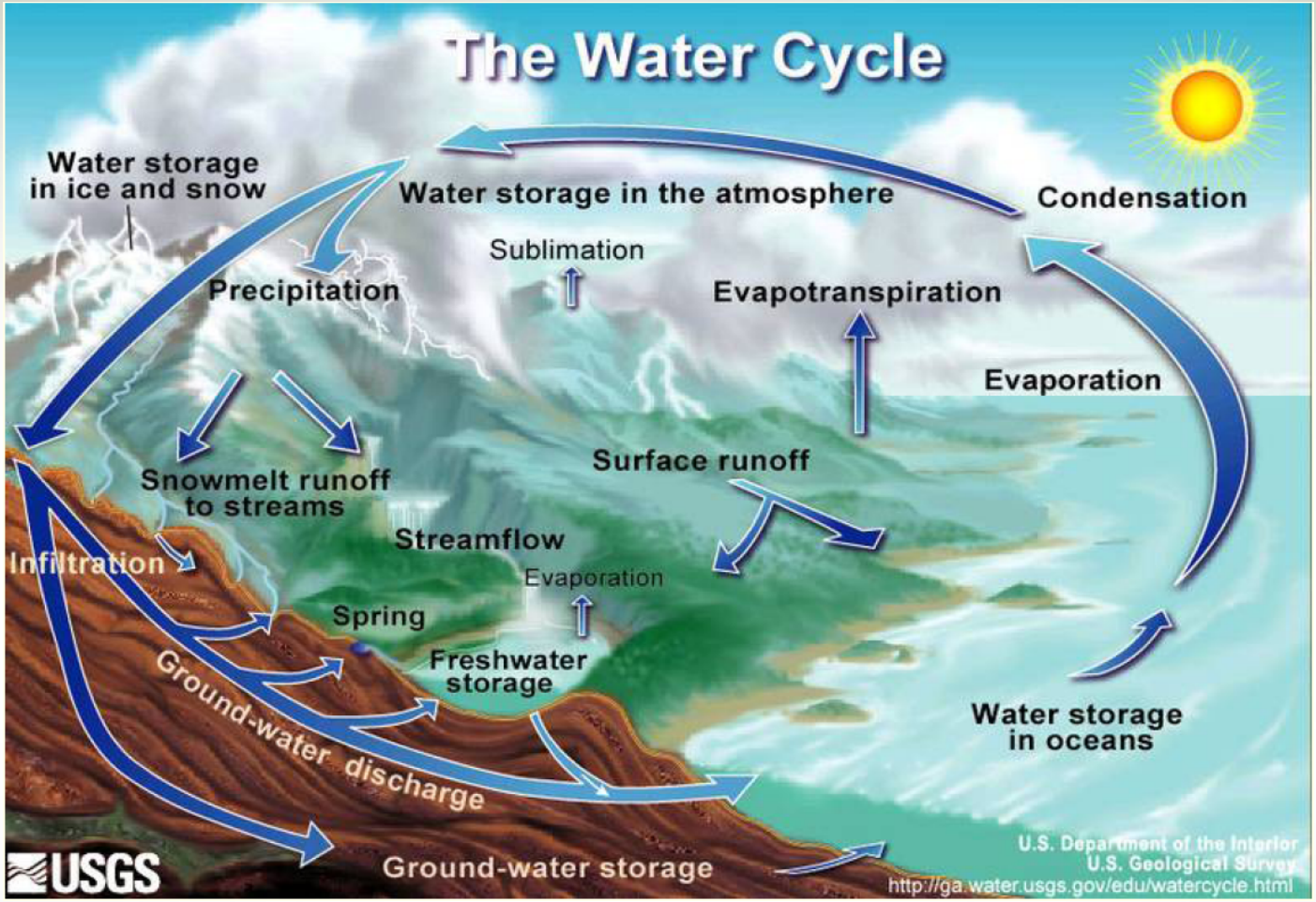
Outline

- Challenges to water management
- Integrated management
- Climate change
- Urbanization



The water balance:

Inflow – Outflow = Δ storage

Precipitation – (Evaporation + Runoff) = Δ storage

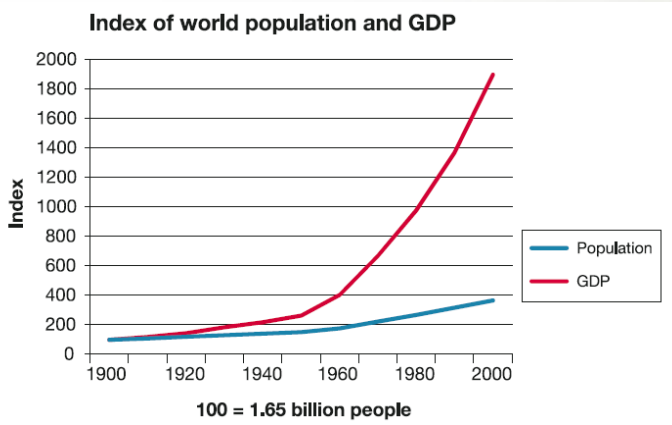
Challenges: population growth and development

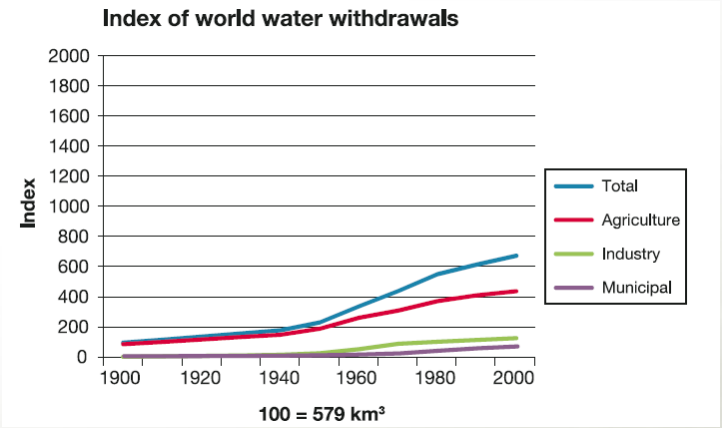
Over the last century:

- Population growth ↑ 4 fold
- Water withdrawls ↑ 8 fold
- GDP ↑ 19 fold

Implications are double edged:

- Development allows us to better manage resources
- Increased wealth increases per capita water demand (due to increase in consumption of material goods and changing diet)





We need to act.
What can we learn from history?

Examples of previous collapses in society due to overuse of natural resources – Greek society

Ancient Greece: Deforestation, leading to erosion of topsoil, loss of fertility of land and its carrying capacity. Recognition of problem but not enough action (too late, too little) to halt the decline of the civilization.

*Present Greece "**D**esertification in Greece is a gradually emerging danger. … soil erosion, often leading to the final and almost total loss of productivity, as well as the drastic reduction of water resources." (Ministry of Environment, Greece 2011)

Sustainability – long term, inter-generational equity

- 1987 Brundtland Report
- 1992 Rio Summit
- 1997 Kyoto Summit
- World Water Commission
- World Water Vision
- World Water Forum: The Hague, March 2000 ...

→ **Recognition that our water resources must be managed in a sustainable and integrated manner**

New approach : Integrated Water Resources Management

"a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems"

Global Water Partnership. (2000). Integrated water resources management. Stockholm, Sweden: Global Water Partnership.

Water conservation

- Supply-side management: increase infrastructure to supply demands, environment not usually considered.
- Demand-side management: combines sociopolitical, economic, and technological strategies to "save money, conserve water, and reduce environmental impacts". (20-50% water use savings easily achievable)
- Soft-path approach: by considering the services water delivers rather than looking at water solely as an end product. This approach has four guiding principles:
  - "Treating water as a service rather than as an end in itself"
  - "Ensuring ecological sustainability"
  - "Conserving quality as well as quantity"
  - "Backcasting" (creating a desired future and working backwards to the present that will make it possible) to develop new policy

  Strategies: socio-political (permitting, codes, standards), economic (water pricing), technological (metering, irrigation techniques, recycling)

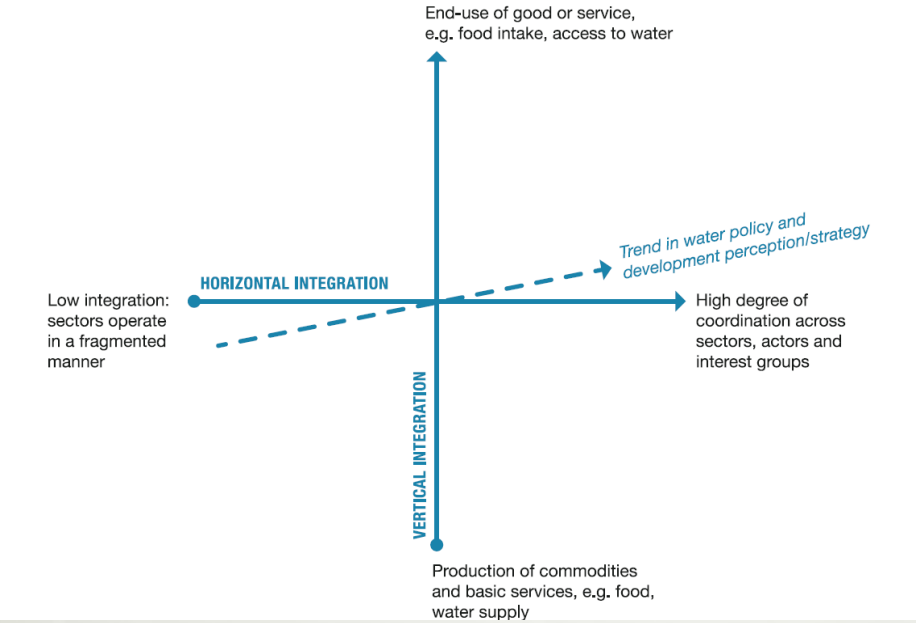
Governance concepts

- *Legitimacy* of the organization's authority to govern
- *Transparency* in the decision-making process
- *Accountability* of actors and their responsibilities, including integrity concerns
- *Inclusiveness* of the different stakeholders
- *Fairness* in the service delivery or allocation of uses
- *Integration* of water policy making at horizontal and vertical levels
- *Capacity* of organizations and individuals managing water
- *Adaptability* to a changing environment

Source : OECD (2011).

Integration: vertical and horizontal

Need to integrate vertically between levels of jurisdiction and horizontally across sectors and stakeholders.



A schematic illustration of the *horizontal* and *vertical* integration of policy and the management of resources and the goods and services produced

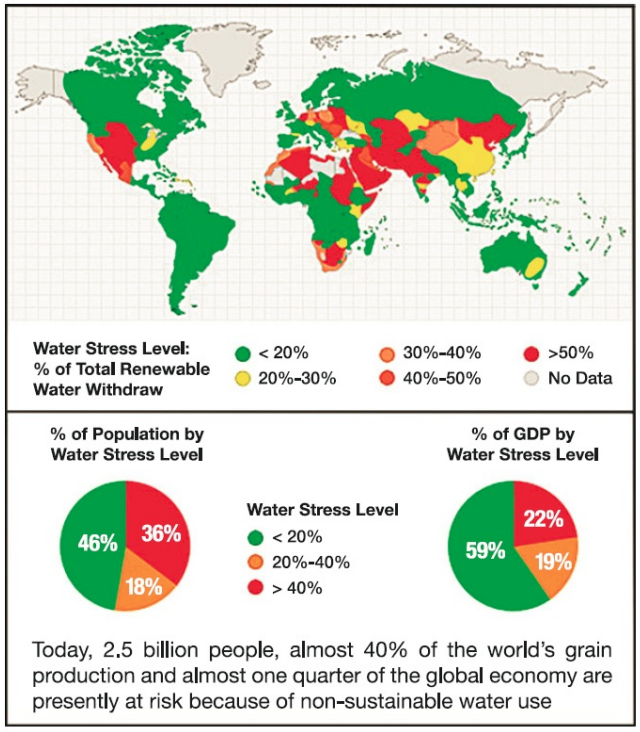
Source:The Gulbenkian Think Tank on Water and the Future of Humanity (2014) Water and the Future of Humanity: Revisiting Water Security, Springer, 236 pp.

Water Stress and Challenges to Water Management

Increased population, GDP, and water demand means increased water stress

Two challenges to water management:

- Climate change, which increases water stress and uncertainty in planning
- Increasing urbanisation, especially in the emerging economies and the developing world.



Predicted water stress given current water management and use trends to 2050.

Source : Illustration courtesy of Growing Blue: www.growingblue.com

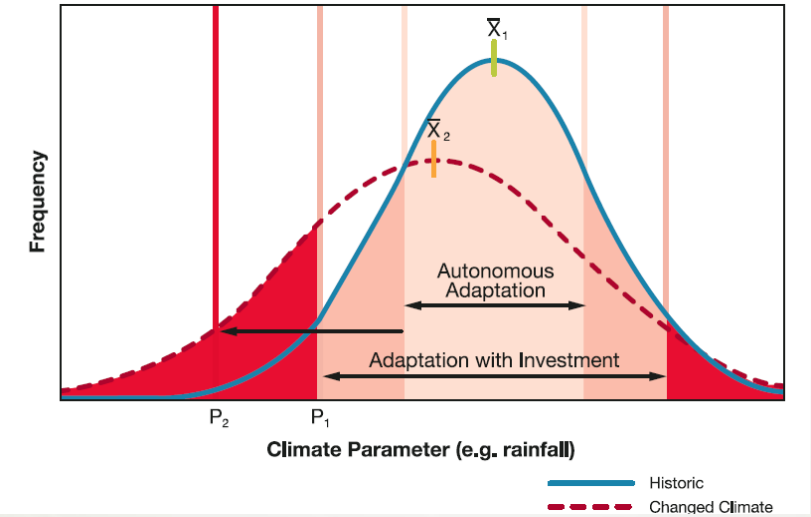
Water management in a Variable and Changing Climate

- Climate variability and change impact water availability, safety and ecosystems.
- However, we are uncertain how it will affect water availability and extreme weather, particularly at the regional or local scale and over a range of time scales.
- Water demand will also change with climate change.

The question is how do we deal with the uncertainty and how do we integrate it into water management.

Adapting to uncertainty due to climate change

In light of the uncertainty and large variability in future predictions, more robust and flexible solutions need to be designed and management needs to also be more flexible.



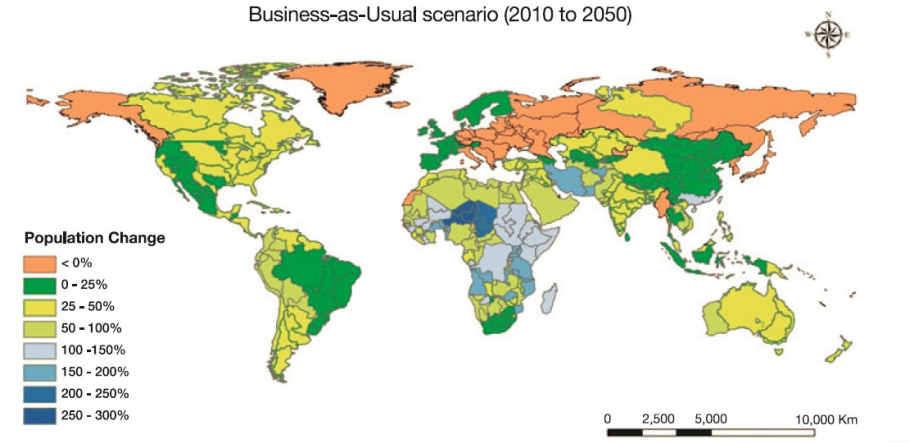
Change in the probability function of a climate variable.

Source:The Gulbenkian Think Tank on Water and the Future of Humanity (2014) Water and the Future of Humanity: Revisiting Water Security, Springer, 236 pp.

Urban areas: water and sanitation

Most of the population increase will occur in urban areas with rapid urbanisation rates urban areas with urbanisation rates. rapid infrastructure is required

Urban areas provide opportunities for social and economic development but . The provision of



Percentage population change 2010–2050.

Sources : IFPRI 2010, calculations made by IWMI; Sood et

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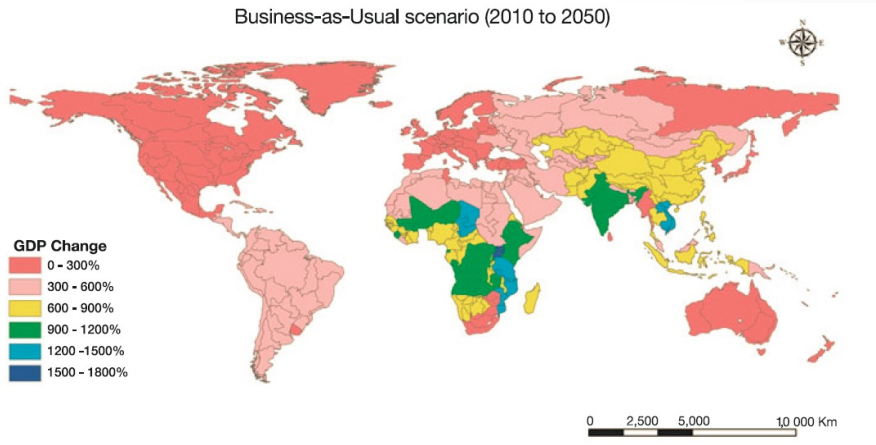
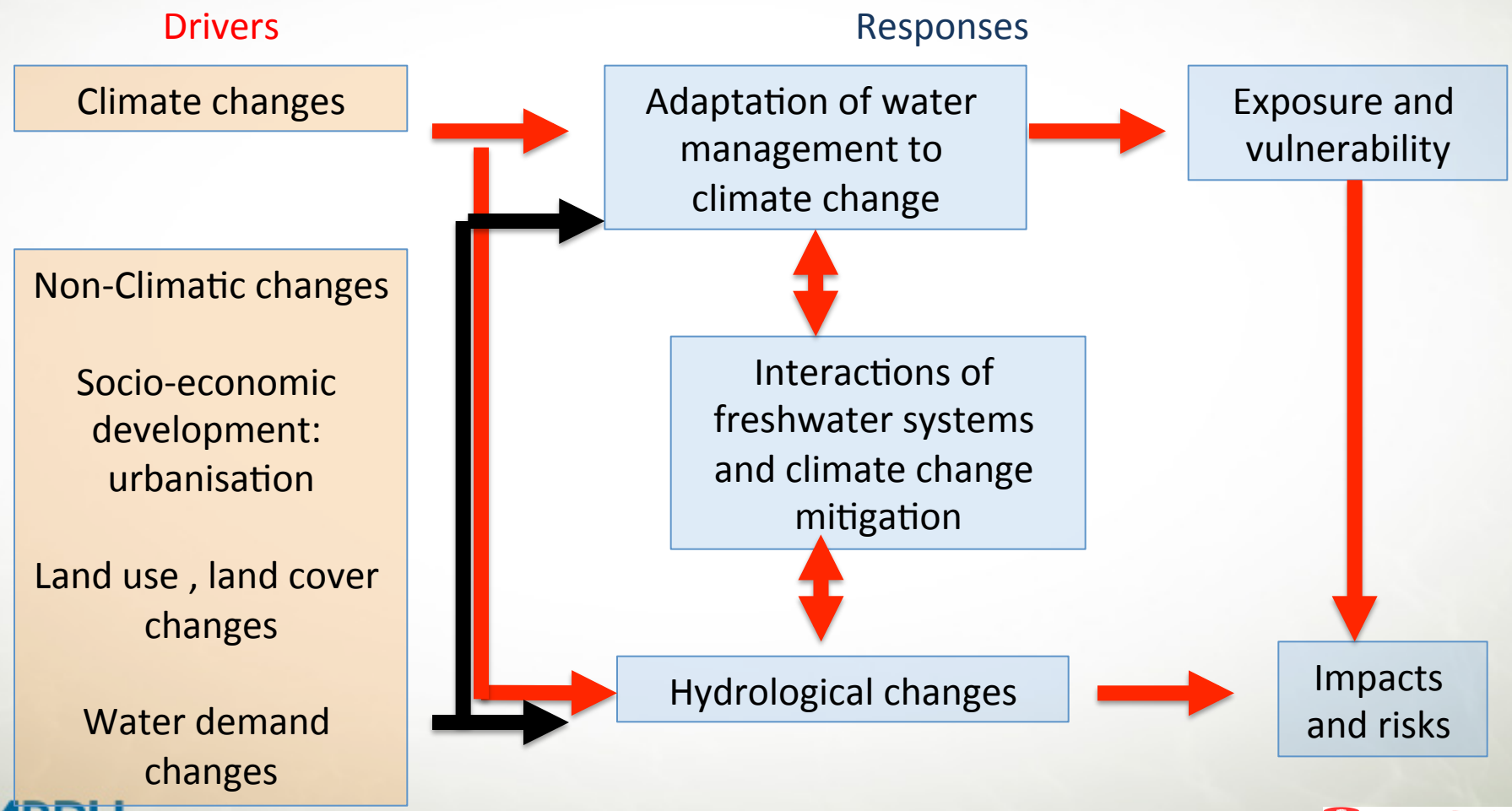


GDP change 2010–2050

Sources : IFPRI (2010), calculations made by IWMI; see Sood et al. (2013) (map prepared by Aditya Sood, IWMI)

Framework and linkages for considering impacts of climatic and social changes on freshwater systems



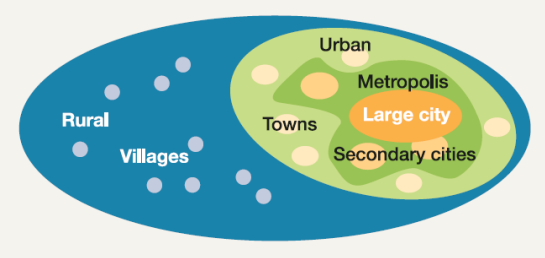
Source: IPCC 2014

Context of Urban Centers

- Urban centers are production, consumption and housing areas with high population densities, which are sustained by natural resources and products outside their political boundaries.

  Without proper treatment, urban centres degrade their environment by discharging the waste products produced from their activities.

Urban areas and their rural support system



- By 2050, urban dwellers will be 85 – 90% of the population in developed countries and 65% in developing countries.
- Slum dwellers will increase by 10% annually (UN HABITAT 2011).
- Dramatic health consequences will develop if they are not provided with potable water and sanitation.
- Urban drainage is necessary both with and without sanitation.
- Developed countries ageing infrastructure needs investment.

Source:The Gulbenkian Think Tank on Water and the Future of Humanity (2014)

Questions for Urban Centers

Water borne sanitation was a solution of the Victorian period when cities were smaller and there was no water stress.

The solution to sanitation today needs to be different:

- due to water stress (high water demand and degradation of water quality)
- due to the resources in the waste, which should recycled (e.g. N, P in waste is sufficient for all agriculture (Wolgast))

Change in approach for the solution:

- Water supply: need to consider the type of water required for the use and not just supply potable water for all uses (blue, green, black, brown, yellow and gray water)

- Sanitation: need to consider type provided (dry), cycle of services, disease management, social acceptance of solution, recycling of resources.

Decision Making and Management

The solution to urban water management challenges is multi-purpose and multi-objective requiring new decision making mechanisms.

- All urban services must be considered together.

The complexity will require increasingly sophisticated knowledge of solutions that have both technical and social dimensions.

- There will need to be a restructuring of existing institutions.

Integrated urban water resources management (IUWRM):

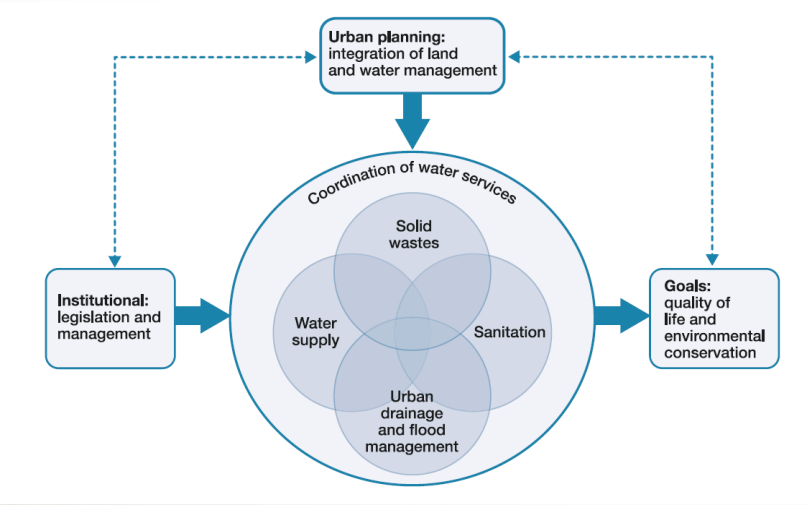
- Encompass all water sources
- Matches the quality of sources with use
- Considers water storage, distribution, treatment and recycling as a cycle.
- Takes into account other nonurban users
- Recognizes and seeks to align the formal and non-formal institutions governing water in cities.
- Seeks to balance economic efficiency, social equity and environmental sustainability.

(Bhari 2012)

Integrated Urban Water Resources Management

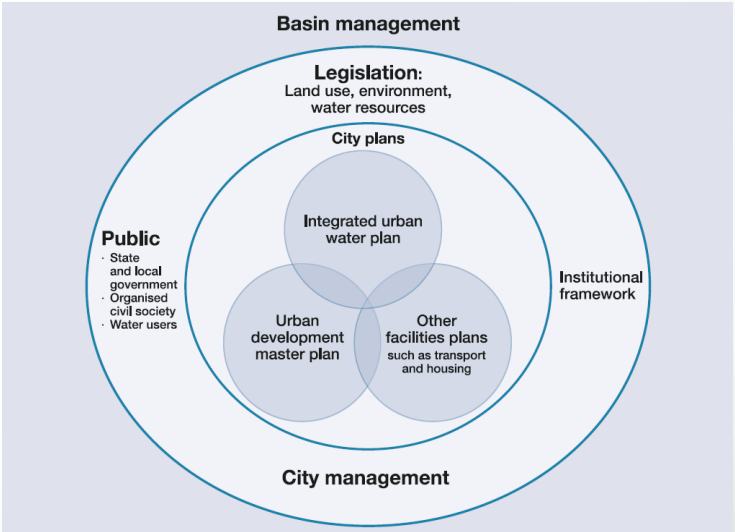
Integrated Urban Management is a concentrated challenge that lies within the greater basin management context.

Urban planners have an important role in helping governments overcome fragmentation in public policy formulation and decision-making.



Integrated Urban Water Resources Management

Source: Tucci (2009)



Framework for integrated urban water management and land-use planning.

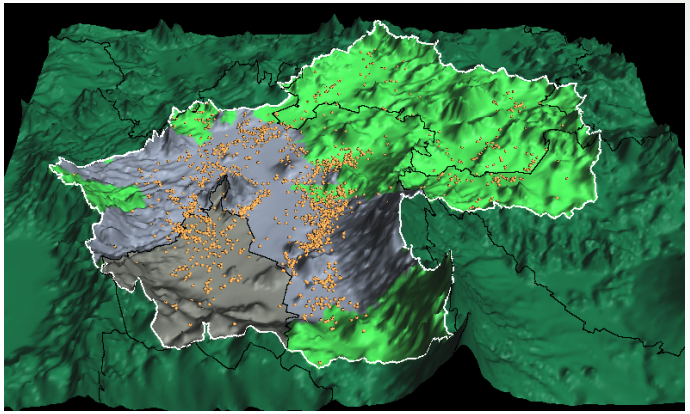
Source : Bahri (2012)

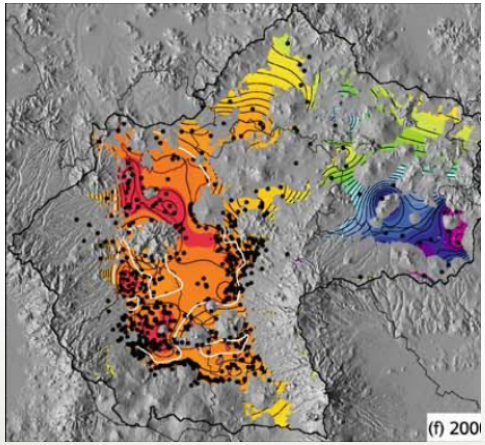
IUWRM: Mexico City Basin

variable water supply, partial coverage of sanitation collection but no treatment

Mexico City Basin:
- Closed high altitude basin with a population of 20 million.
- 5 political entities and 4 water agencies managing the resource.

Total water supply ⟹ 70.5 m^3/s
- 67% groundwater : 18 m^3/s overexploitation
- 28% imported : 20 m^3/s
- 5% surface





Land subsidence due to decrease in potentiometric levels of 7.5 – 15 m since 1847.

Problems:
- unsustainable water use
- land subsidence
- no sanitation treatment

Objectives:
Develop regional groundwater model (comprehensive relational database, soil-water balance, aquifer recharge ⇒ groundwater model)

Jaime Carrera-Hernández, Ph.D. (2007)