URBAN WATER
an essential body of integrated water resources management

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Madrid, 13 November, 2012

6 BFWW: Integrated Water Resource Management in the XXI Century

FUNDACIÓN BOTÍN

OUTLINE

- Introduction
- The globalization era
- The urban metabolism concept
- Agricultural and urban uses: a comparison.
- Urban – environment interactions
- Urban water (UW) must be integrated into IWRM
- Barriers to integrate UW into the IWRM
- The way forward
- Conclusions

INTRODUCTION

- Integrated water resources management is a framework for planning, organizing and operating water systems to unify and balance the relevant views and goals of stakeholders (Grigg, 2008)
- The main goal of this workshop is to present the experience on the applicability of IWRM to the case of Spain, analysing clearly and objectively the advantages and problems (6BFWW presentation)
- The main goal of this presentation is to evidence that the urban water use is one of the most relevant ingredients of an IWRM

THE GLOBALIZATION ERA

- If there are problems in ***Madrid***, there are in ***Milwaukee*** (Obama at the G20 meeting, May 2012)

- We are living the globalization era, mainly
  - Communication. Scale: the world
  - Economy. Scale: the world

- Water scale globalization: watershed

(although interties can upgrade the scale: Contiguous inter basins)

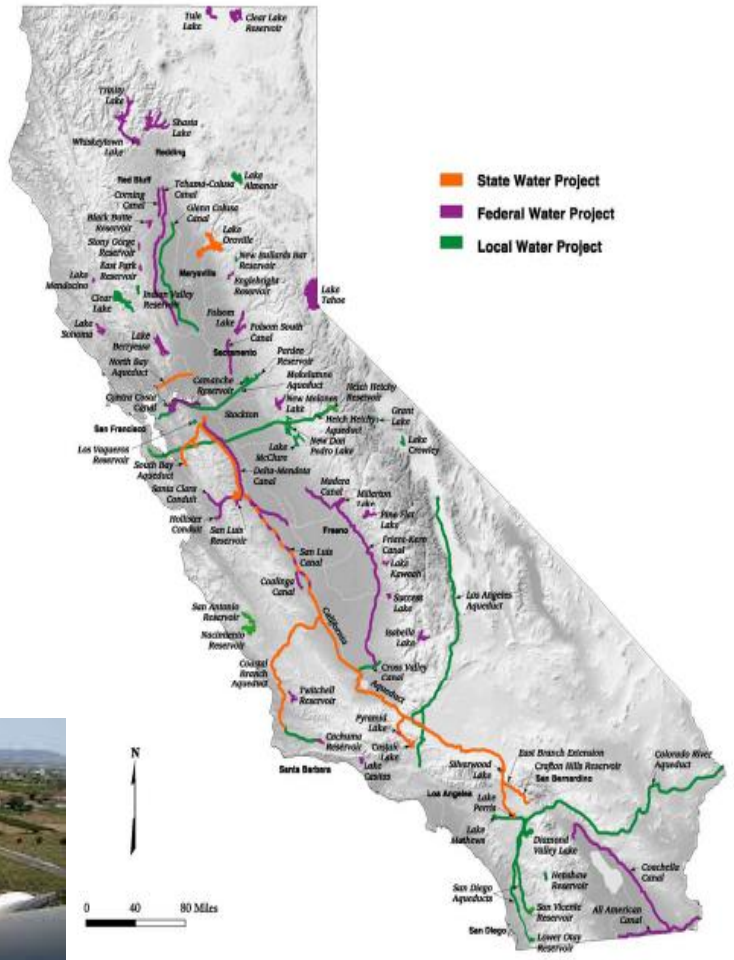
THE GLOBALIZATION ERA

There are dozens of large inter-basin transfers around the world, most of them concentrated in Australia, Canada, China, India and the United States (wikipedia)

First one in the world, the Roman gold mine at Las Médulas, in Spain (Pliny the Elder)

Las Médulas

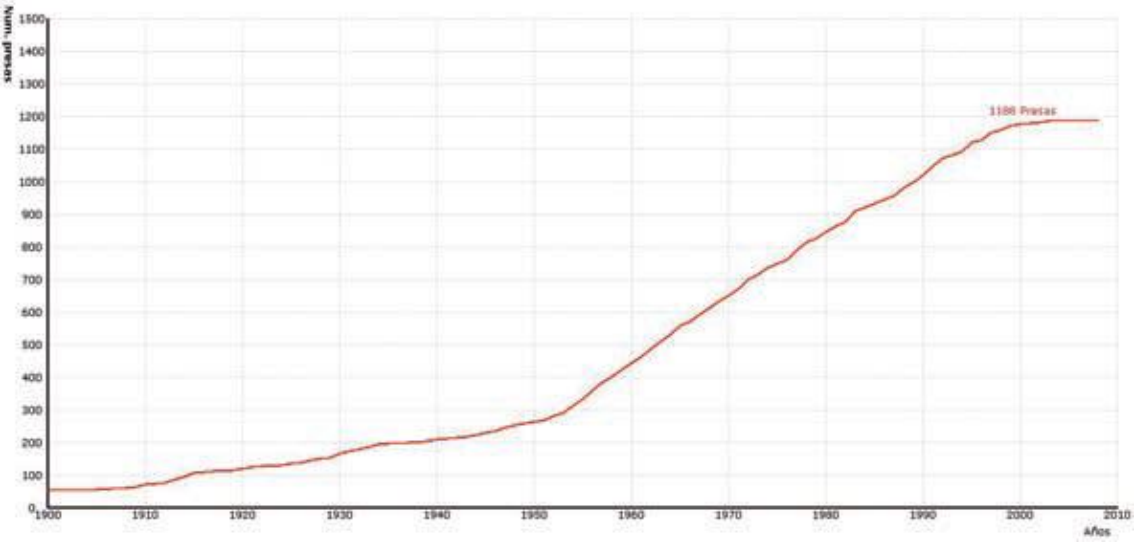
Tajo - Segura



California

THE GLOBALIZATION ERA

XX Century. The big dams and water transfers era



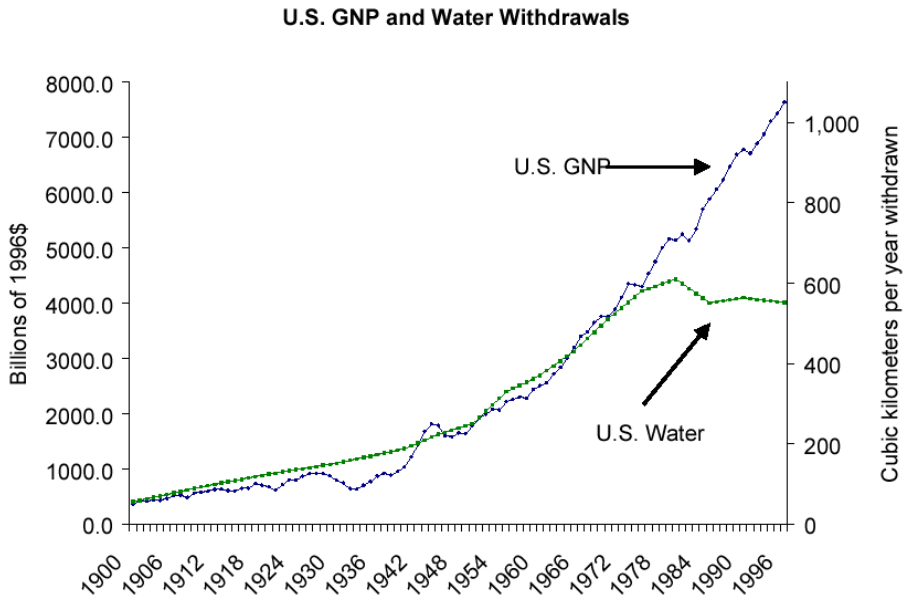
Number of large dams constructed in Spain in the XX century (Yagüe and de Cea, 2008)

Hoover dam, 1936

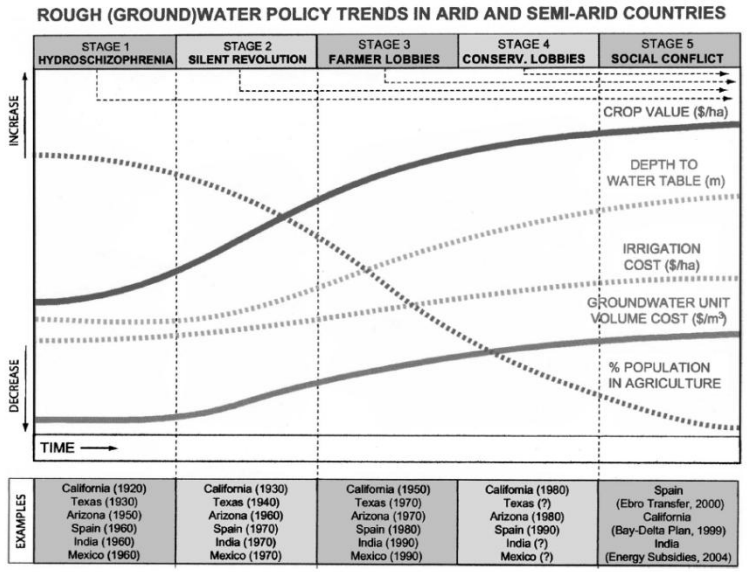
THE GLOBALIZATION ERA

and water consumption (not just surface water, but underground water as well)increases dramatically all around the world:

USA Water withdrawals (Gleick, 2003)



Depth to water table evolution (Llamas and Martínez, 2005)



THE GLOBALIZATION ERA

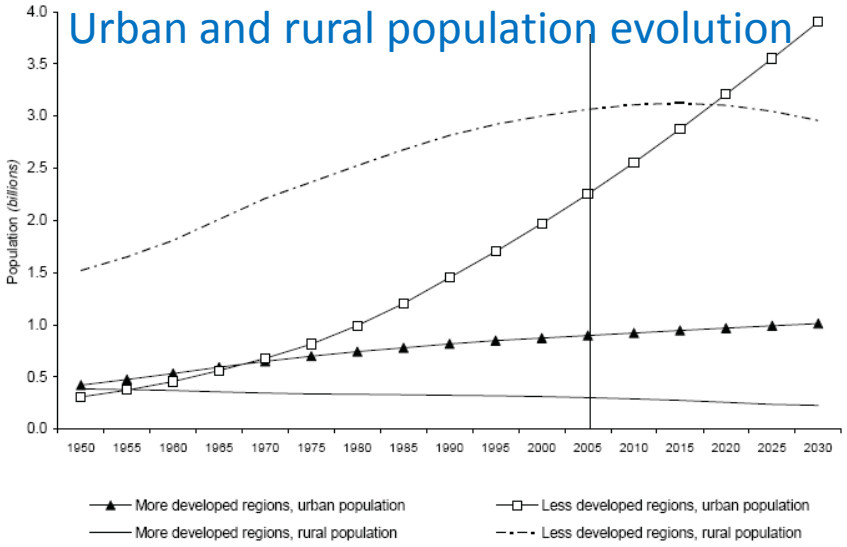
Collateral effects of this new era. Society become to be aware of the environmental impacts from ≈1960 on:

Clean water

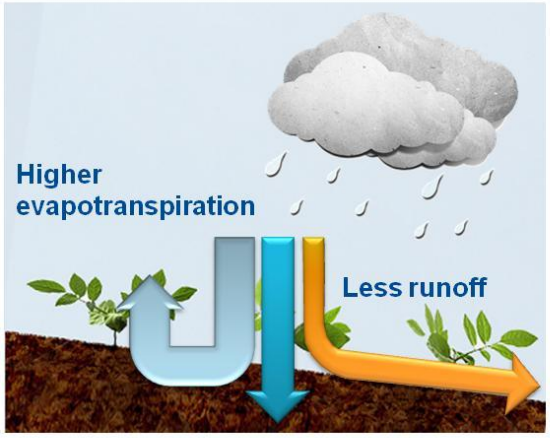
Water polluted

THE GLOBALIZATION ERA

And new challenges arise,…

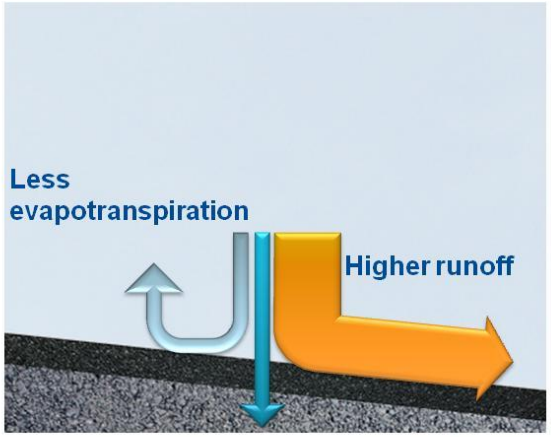


Natural water cycle



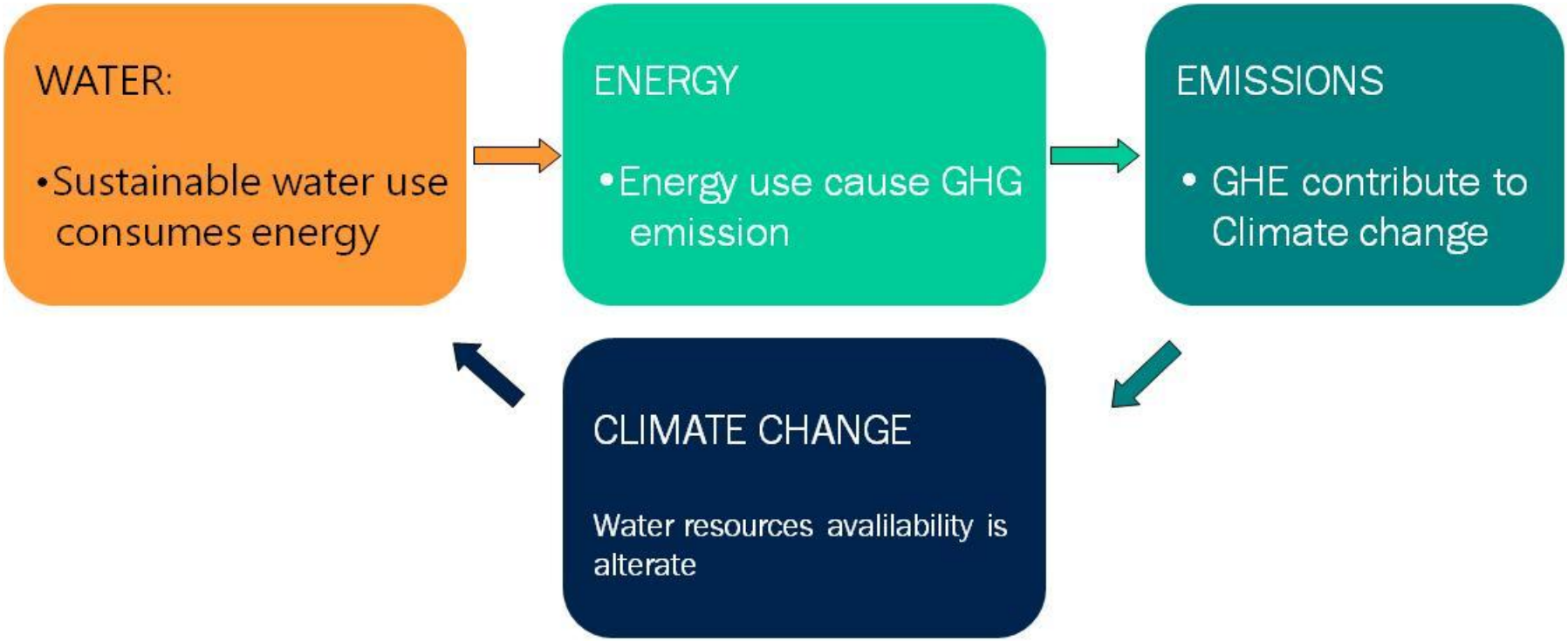
Higher aquifer recharge

Urbanization effects



Less aquifer recharge

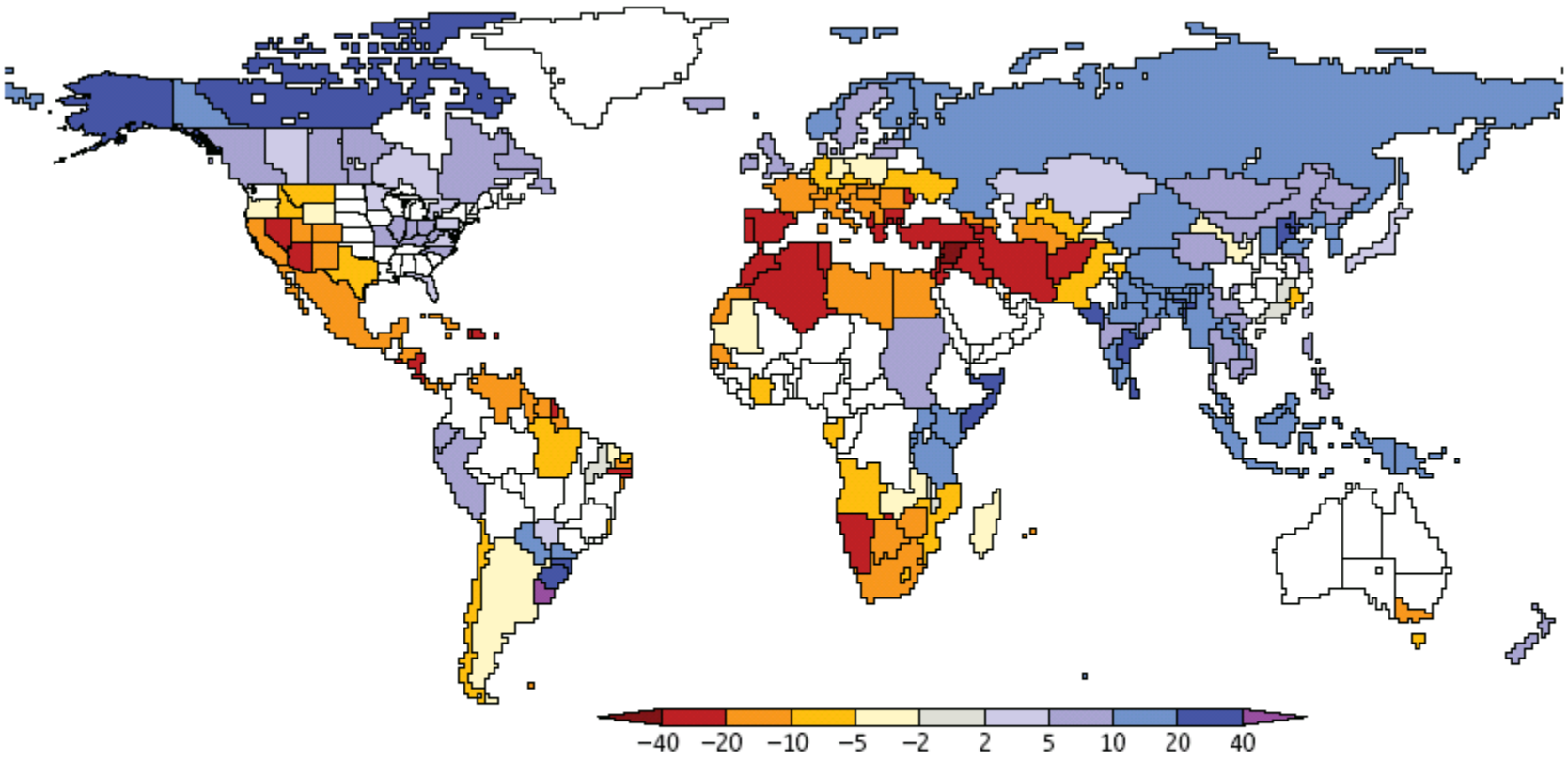
THE GLOBALIZATION ERA



IN THE XXI CENTURY ALL IS INTERCONECTED

THE GLOBALIZATION ERA

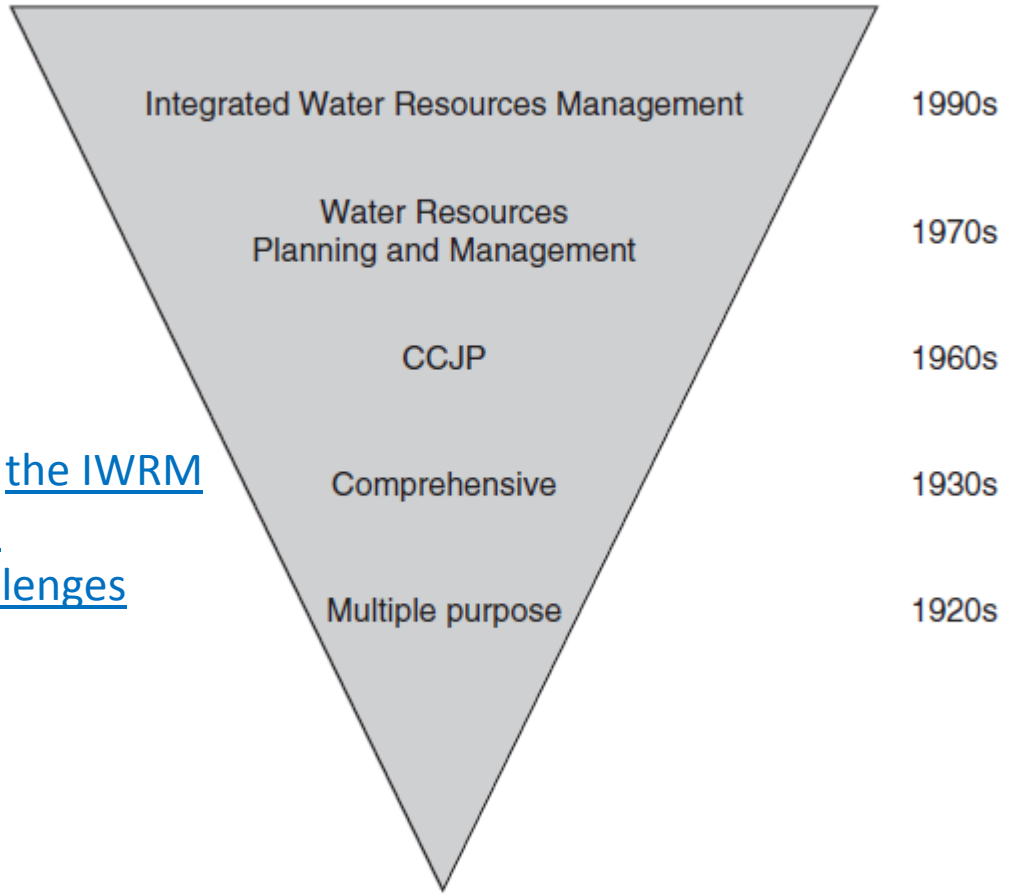
And new challenges , as climatic change, arise,...



Human influences. Dramatic changes in runoff volume from ice-free land are projected in many parts of the world by the middle of the 21st century (relative to historical conditions from the 1900 to 1970 period). Color denotes percentage change (median value from 12 climate models). Where a country or smaller political unit is colored, 8 or more of 12 models agreed on the direction (increase versus decrease) of runoff change under the Intergovernmental Panel on Climate Change's "SRES A1B" emissions scenario.

THE GLOBALIZATION ERA

Although always behind, the IWRM concept follows the pace of the problems and challenges



EVOLUTION OF THE IWRM CONCEPT (Grigg, 2008)

THE GLOBALIZATION ERA

The ideas follow the pace but not the solutions
AND THERE ARE BIG PROBLEMS:

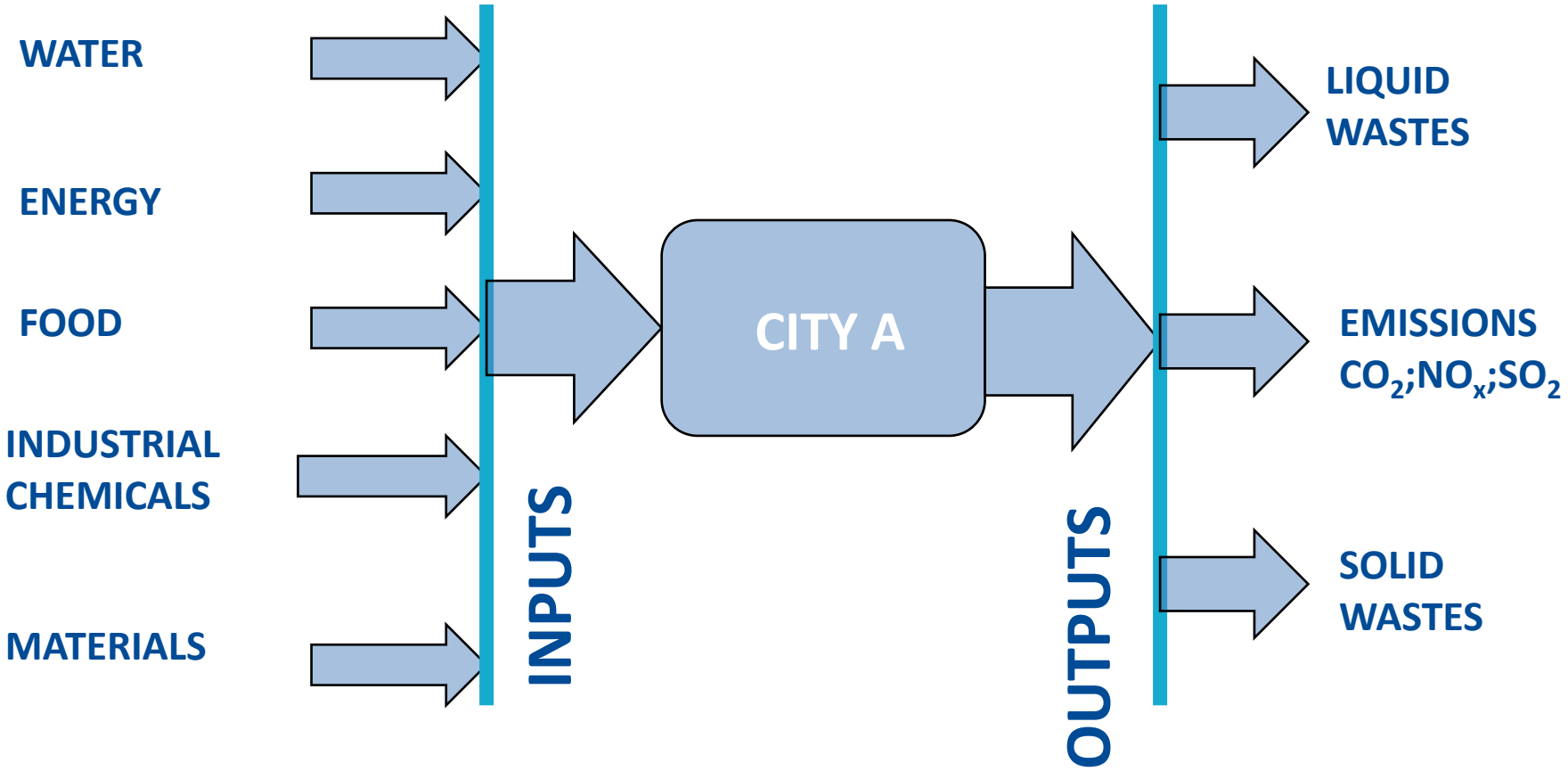
- ❑ Water institutions atomization
- ❑ Culture
- ❑ Awareness
- ❑ And even worst: in Spain political boundaries makes much more complex IWRM solutions.

INERTIA AND THE WEIGHT OF THE "BUSINESS AS USUAL" BURDEN TO SOLVE ACTUAL PROBLEMS WITH ACTUAL APPROACHES AND SOLUTIONS

(Later we will be back to this crucial point)

THE URBAN METABOLISM CONCEPT

(the relevance of the urban water into IWRM)



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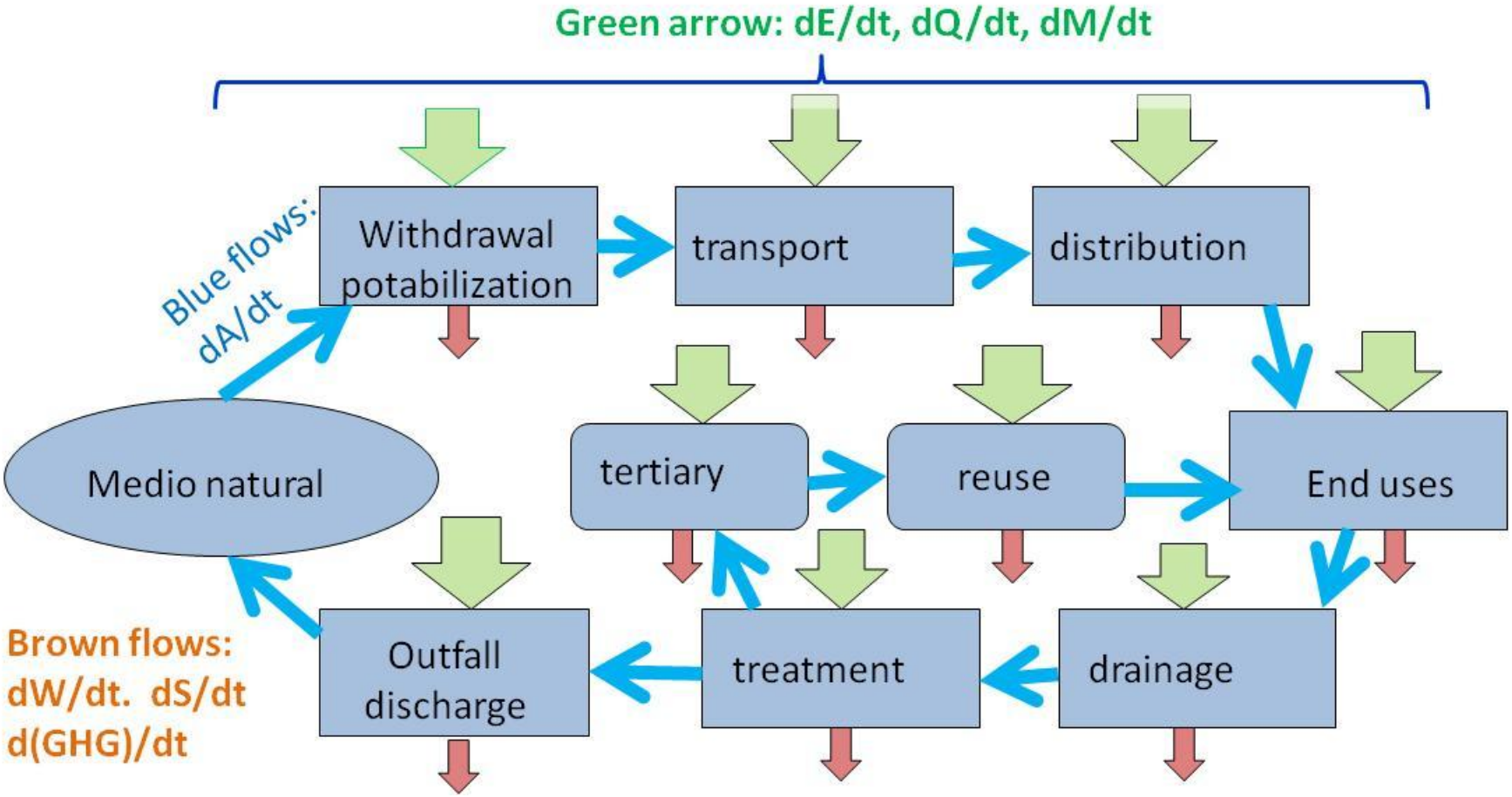
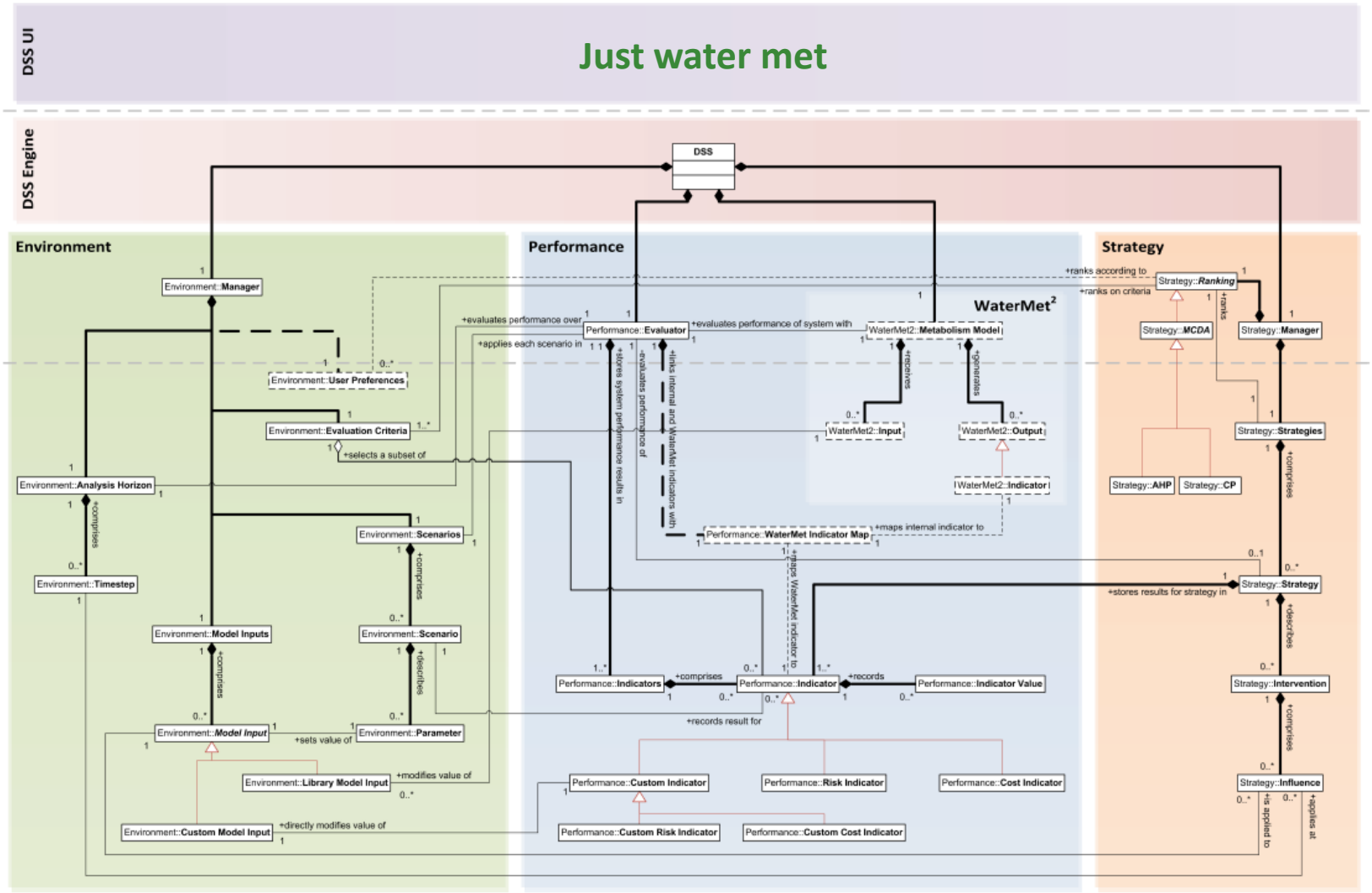


THE URBAN METABOLISM CONCEPT

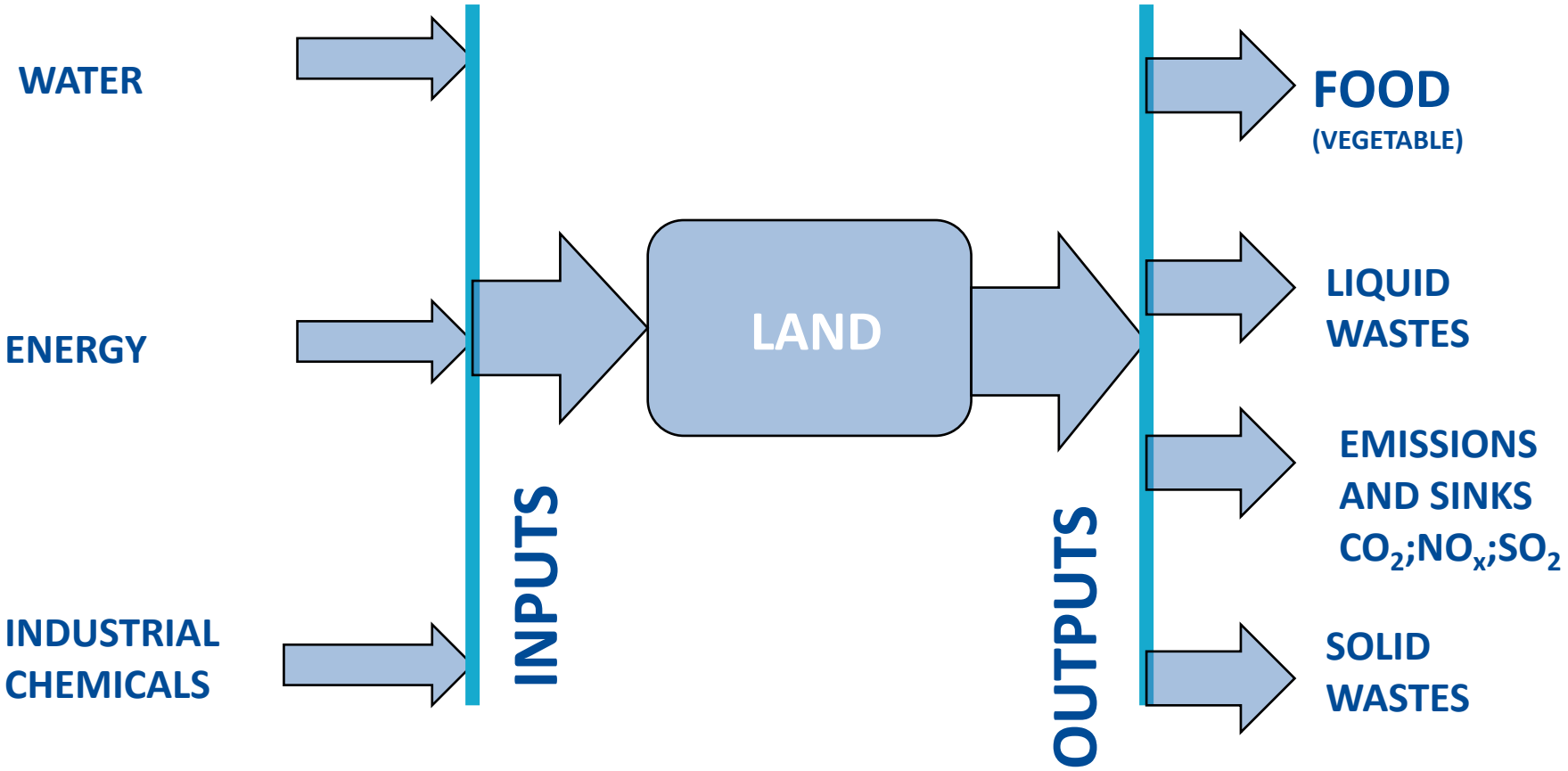
(the relevance of the urban water into IWRM)

Appendix B



THE AGRICULTURAL METABOLISM CONCEPT

ANY HUMAN LAND USE (urban, agricultural, forest,…) HAS ITS OWN METABOLISM



THE URBAN METABOLISM CONCEPT

(urban versus agricultural inputs)

BASE: 1 km^2

URBAN USE:6000 h/km^2 (Valencia city)

Water = 250 l/h d → 547.500 m^3 /year

Electric energy = 5700 kWh/h y → 3.42 x 10^7 kWh/y

AGRICULTURAL USE: oranges irrigation drip

Water = 4000 m^3/ha → 400.000 m^3 /year

Electric energy = 0.25 kWh/m^3 → 10^5 kWh/y

THE URBAN METABOLISM CONCEPT

(urban versus agricultural water inputs)

- Urban water use is more intensive than irrigation use
  (for the preceding comparison)

BUT:

- Average irrigation demand (Corominas, 2009) = 6500 m^3/ha
- Spain urban density population (in average) = 4700 h/m^2

Spain water demand

- Urban = 47.000.000 h (250 l/h d) = 4300 hm^3
- Agricultural = 3760 ha (6500 m^3/ha) = 24400 hm^3

URBAN AVERAGE INTENSITY:

- Intensity = 4300 m^3/ha (urban surface = 10.000 km^2)

THE URBAN METABOLISM CONCEPT

(urban versus agricultural: other inputs)

- Electric energy demand (per unit of surface)
  - urban intensity is 342 times higher
- Other sources of energy (petrol, gas,…)
  - The comparison has no sense
- Other inputs
  - Chemical agricultural intensity = 10 tm/km^2
  - Urban chemical intensity (farm medicals, detergents and soaps,…) = The comparison has no sense
  - Materials and Food = do not exists as agricultural inputs

AGRICULTURAL AND URBAN USES: A COMPARISON (outputs)

- Waste water:

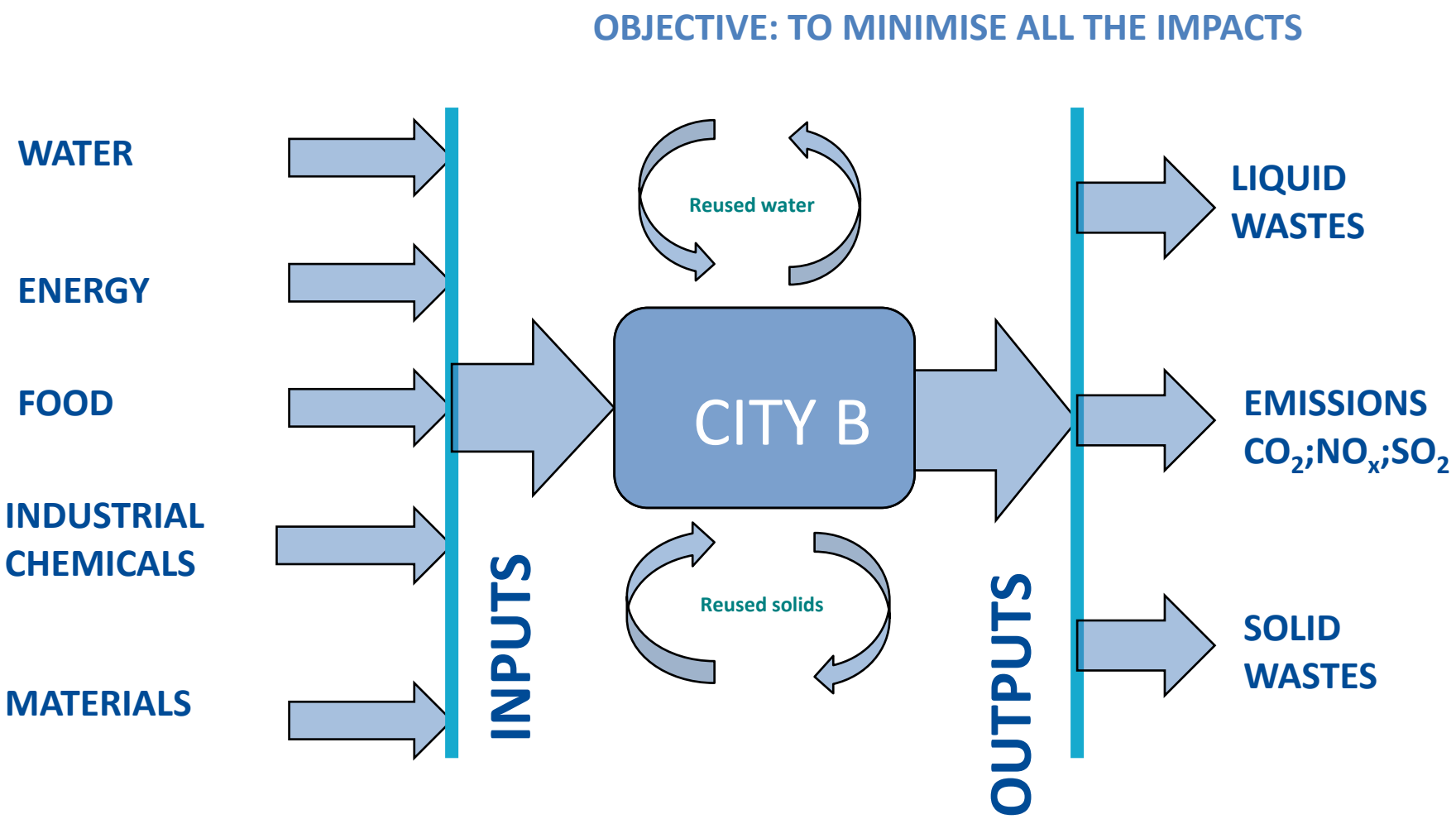
  point source pollution (must be treated) versus
  diffusion pollution (must be controlled)

- GHG emissions:
  - Cities are responsible for 80 per cent of total GHG emissions
  - Land use (during its productivity era) is like a sink of GHG emissions

- Solid waste
  - urban solid waste = 500 kg/h y
  - Agricultural = negligible

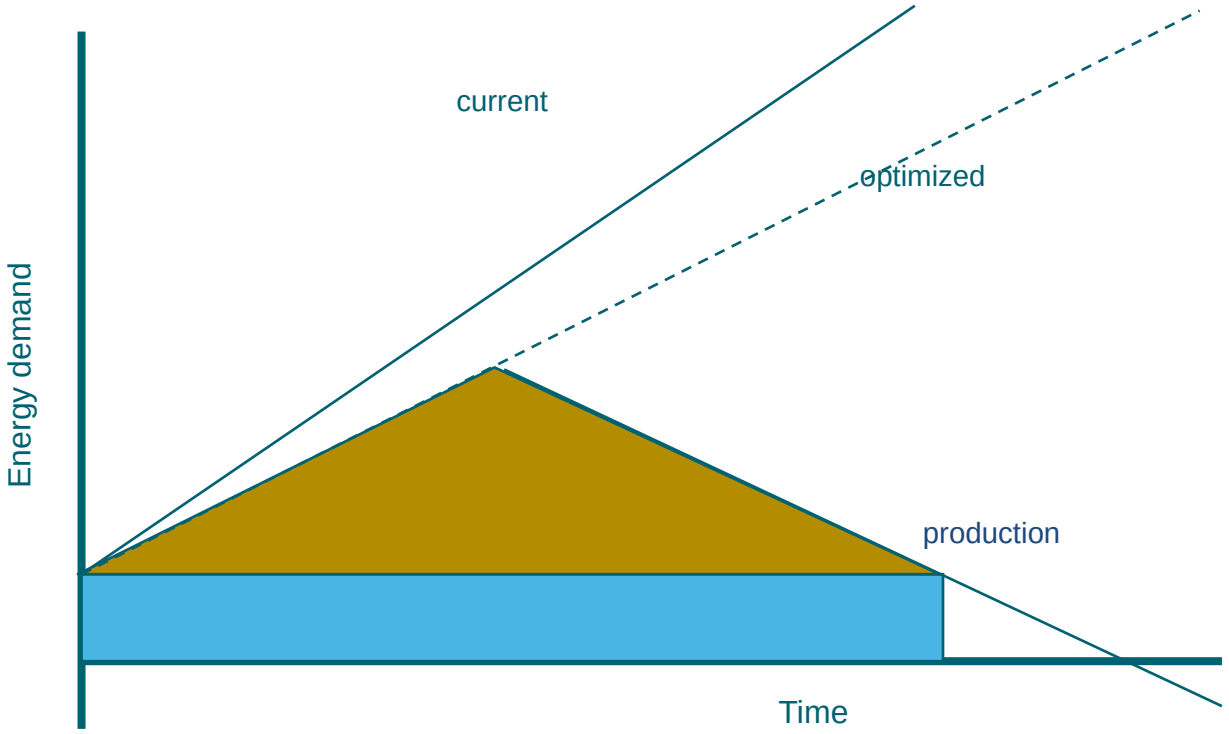
THE URBAN METABOLISM CONCEPT

(the relevance of the urban water into IWRM)



THE URBAN METABOLISM CONCEPT

(NEUTRAL CARBON, BUT,…, IN JUST ONE PHASE)



Energy use over time with and without optimisation and new approaches in the urban water cycle

UW MUST BE INTEGRATED INTO IWRM

(watershed ➡ urban water impacts)

As urban water has (and supports) major impacts from the environment, it has not sense to include it in a IWRM

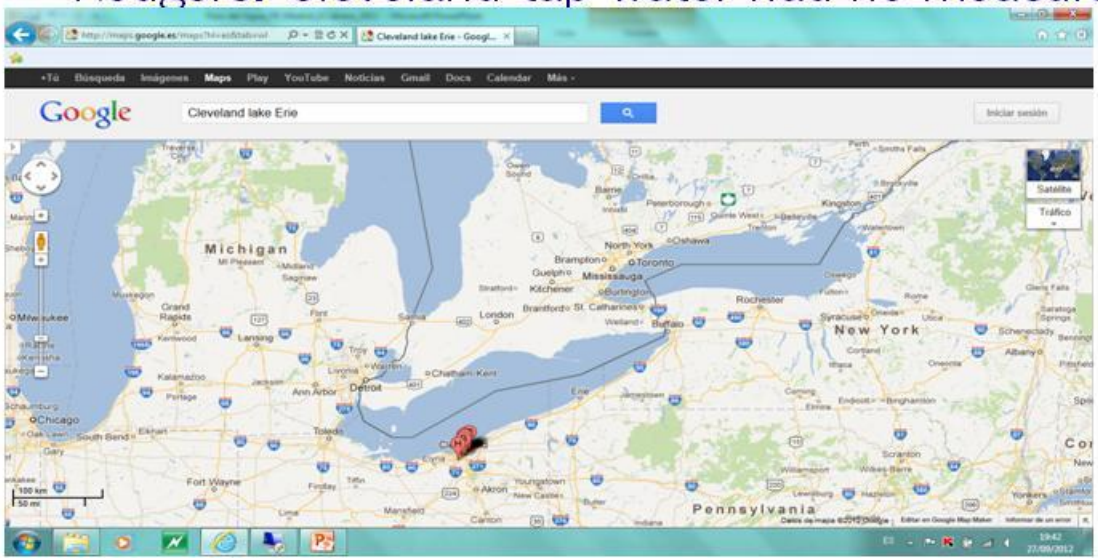
From watershed to urban water:

- QUANTITY IMPACTS (water supply guaranty)
  - ✓ Multiuse water management (particularly important in drought periods)
  - ✓ Aquifer depletion (in some areas, aquifer water table fell continuously)
- QUALITY IMPACTS (potable drink water)
  - ✓ Organic water pollutants (problems with THM for superficial waters)
  - ✓ Non-point nitrate groundwater pollution (nitrates > 50 mg/l)
- OTHER URBAN IMPACTS
  - ✓Floods and dam breaks
  - ✓Differential subsidence due to groundwater piezometric level drawdown

UW MUST BE INTEGRATED INTO IWRM

(watershed ➡ urban water impacts)

- The label says Fiji because it's not bottled in Cleveland," says the full-page ad running in magazines such as Esquire.
- After seeing the ad, public utilities director Julius Ciaccia ordered the bottled water tested.
- The results: 6.31 micrograms of arsenic per liter in the Fiji bottle, said Cleveland water quality manager Maggie Rodgers. Cleveland tap water had no measurable arsenic.



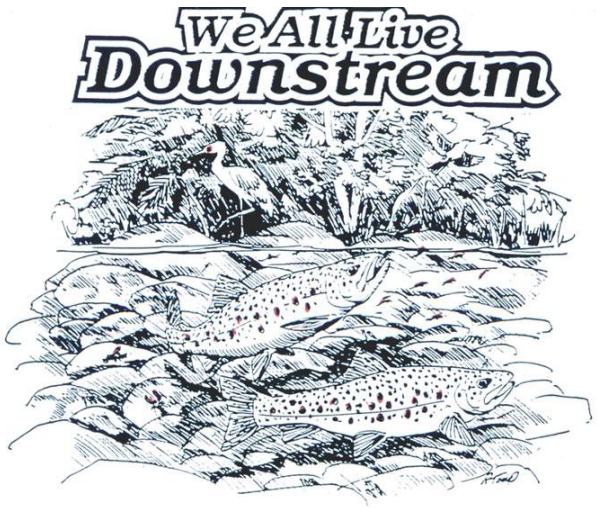
UW MUST BE INTEGRATED INTO IWRM

(urban water impacts ➡ watershed)

As urban water has (and supports) major impacts from the environment, it has not sense to include it in a IWRM

From urban water to watershed :

- QUANTITY IMPACTS (natural hydrologic cycle is altered)
  - ✓ Urban surface runoff contribute to floods
  - ✓ Urban surface runoff minimizes infiltration
- QUALITY IMPACTS (main pollution comes from urban water)
  - ✓ Urban and industrial wastewater contamination
  - ✓ Combined sewer overflow (CSO) contamination
- OTHER WATERSHED IMPACTS
  - ✓Biodiversity alteration
  - ✓Thermal contamination (energy production)

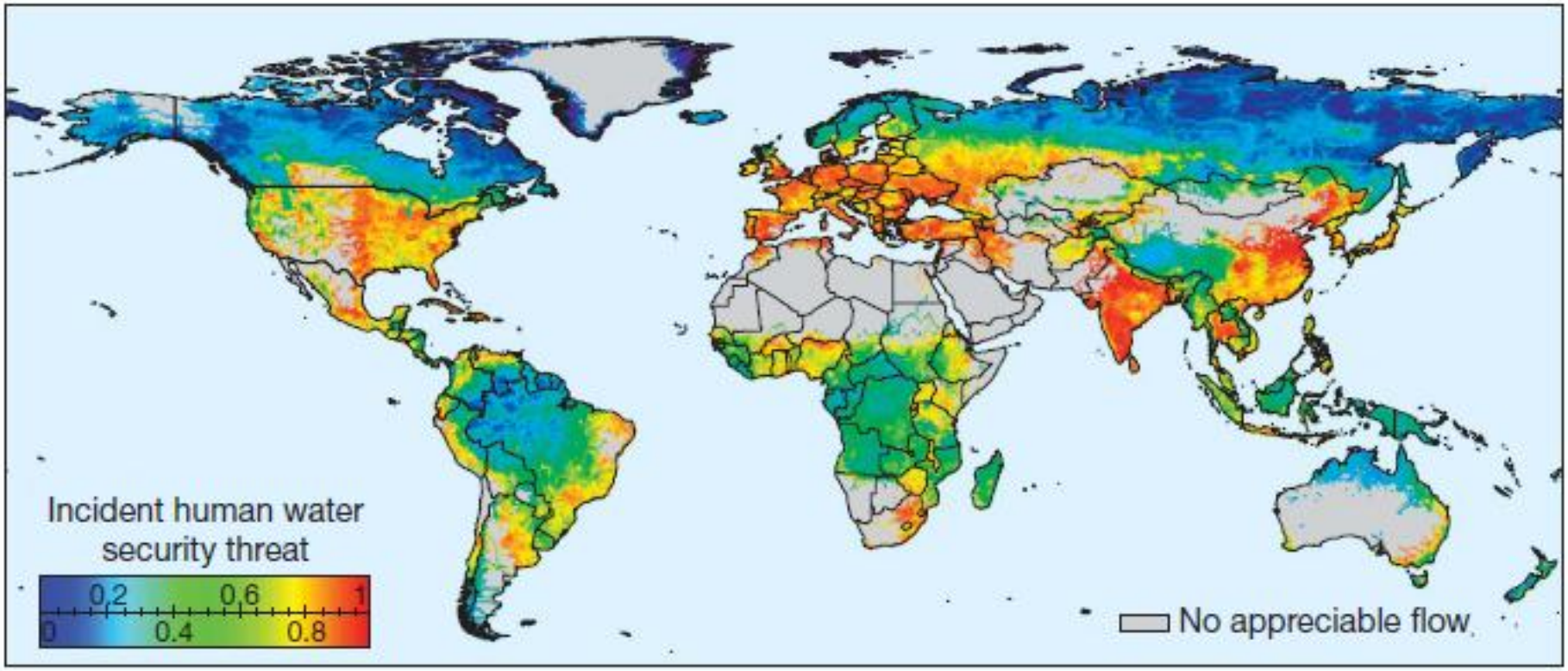


UW MUST BE INTEGRATED IN THE IWRM

Global threats to human water security and river biodiversity

Nature September, 2010

C. J. Vörösmarty[1]*, P. B. McIntyre[2]*†, M. O. Gessner[3], D. Dudgeon[4], A. Prusevich[5], P. Green[1], S. Glidden[5], S. E. Bunn[6], C. A. Sullivan[7], C. Reidy Liermann[8] & P. M. Davies[9]



Stressors were organized under four themes (catchment disturbance, pollution, water resource development and biotic factors). They are strongly linked to urban population

UW MUST BE INTEGRATED IN THE IWRM

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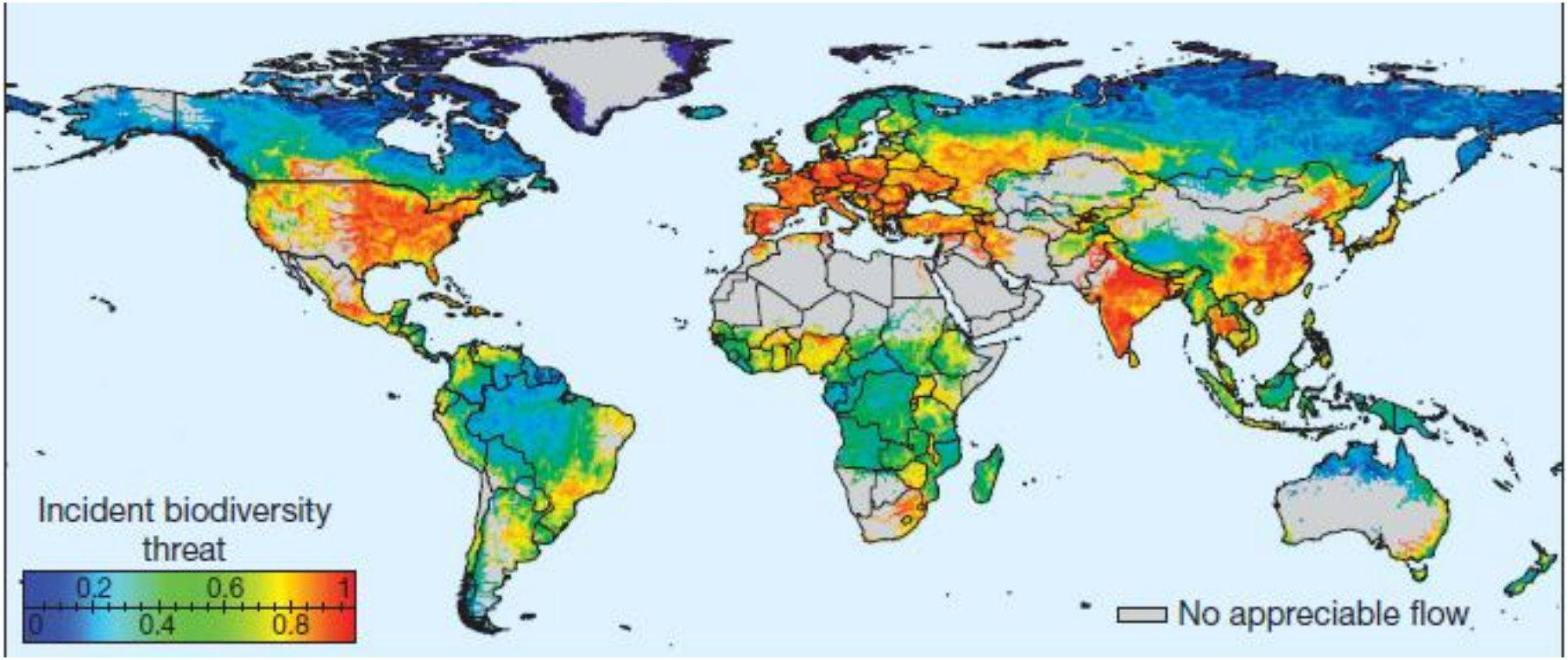

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UW MUST BE INTEGRATED IN THE IWRM

IN CONCLUSION. If the four broad essential reasons that justify IWRM approaches are :

1. The negative externalities that arise from the uncoordinated use of the physically interdependent water and land resources.
2. The opportunity costs which arise when factors of production (including water, land and capital) are employed for low value/benefit purposes.
3. The negative externalities and opportunity costs which arise from the uncoordinated provision (non-provision) of interdependent basic services such as health, education and sanitation.
4. The cost savings which can occur by widening the ran savings which can occur by widening the range of provision or management options.

NONE OF THESE BROAD REASONS ARE EXCLUSIVE TO URBAN WATER PROBLEMS
(Urban Water and Sanitation Services: An IWRM Approach)

UW MUST BE INTEGRATED IN THE IWRM

IN CONCLUSION:

- IWRM analysis require Top – Down approaches to achieve a global vision of the state of the watershed

- IWRM require Bottom – up actions to put in practice the results of the diagnostic. For instance, if one of the main conclusion is that a given amount of water must be saved, actions as a new water economic policy must be put in practice.

UW MUST BE INTEGRATED IN THE IWRM

SUCCES HISTORY OF UW integrated on the IWRM:

- ***Farmers and municipalities in Denmark*** (global cost savings)
  - The farmers renounced to use nitrated as fertilizer
  - The water company has not need to remove the nitrates from the water
  - Municipality compensate the farmers for the loss of crop, but it cost less than to apply the chemical correction.

UNSUCCES HISTORY OF UW integrated on the IWRM:

- ***Water reuse from the Pinedo wastewater in Valencia*** **(**negative externalities and opportunity costs)
  - The farmers irrigated their land with water coming from Turia river.
  - A proposal to irrigate with treated water from PINEDO
  - The state will pay the necessary infrastructure (pumping station, pipes,..) and the farmers will pay just the energy for pumping water.
  - As up to now they are irrigating at cero cost, the refuse the agreement.
  - Some IWRM action is missed to arrange a win - win solution

UW MUST BE INTEGRATED IN THE IWRM

(sustainable urban drainage)

OBJECTIVE.-

To replicate the behavior of the environment

UW MUST BE INTEGRATED IN THE IWRM

OTHER HISTORY OF UW integrated on the IWRM:

Kansas City has made a commitment to use green infrastructure as a way to address its combined sewer overflows and to become one of the most sustainable cities in the country. As part of Kansas City's federally-mandated Overflow Control Program, a 744-acre green infrastructure project is underway in one watershed to reduce combined sewer overflows. Green infrastructure is used to intercept storm water, keeping it out of the combined sewer system, reducing the overflow and the amount of excess water that gets pumped and treated. To further enhance the green infrastructure efforts, the City is working with residents and neighbors to make improvements on their own properties by reducing water consumption and reducing the amount of storm water that leaves a property through runoff or direct connections to the sewer system. Kansas City's project is one of the largest green infrastructure projects in the United States to reduce combined sewer overflows.

BARRIERS TO INTEGRATE UW INTO IWRM

Atomized urban water administration
(The case of SPAIN)

1. Municipality (the main responsible)
2. Provincial authority (prices approval)
3. Regional water authority (waste water plants control)
4. Regional energy authority
5. Regional sanitary authority (tap water quality control)
6. Watershed authority (quantity control and outfalls quality control)
7. National sanitary authority (water quality levels)
8. National water authority
9. Energy economic authority
10. Others

BARRIERS TO INTEGRATE UW INTO IWRM

- Atomized administration Coordination is, indeed, impossible.
- Regional political interest.
- The weight of the history
- Poor environmental education
- Lack of transparency. Water is a public resource, and people must know how this valuable resource is used.
- Law and rules were adopted when water problems were totally different to the present ones.
- Vested interests very consolidated.

THE WAY FORWARD

(to skip the preceding drawbacks)

- Institutional reform. The objective: work coordinately
- To take off the water policy from the political arena.
- Public awareness and education
- To be transparent. If agricultural water is subsidized, the society must know how much costs the effort.
- To adapt progressively low and rules to the new economic context.
- To eradicate totally vested interests.
- To promote mechanisms to control better the system

CONCLUSIONS

- We live in a globalized world
- Water is, at the water basin scale, is globalized as well.
- Nobody discuss the need to evaluate problems and the solutions from a global perspective
- In Spain we have in face a long way. But for this reason it is crucial to start to work asap.