

**FIFTH BOTIN FOUNDATION WATER WORKSHOP (5BFWW)
WATER AND FOOD CONFLICTS VERSUS COOPERATION IN A
GLOBALIZED WORLD**

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**THE NECESSARY EQUILIBRIUM BETWEEN
UTILITARIAN AND INTANGIBLE VALUES IN WATER
AND FOOD SECURITY**

by

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**Fundación
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1. INTRODUCTION (I)

- **Last decades advances in science and technology are already contributing to solving problems in water and food security with methods that were unthinkable only two decades ago.**
- **We will comment four significant advances.**

1. INTRODUCTION (II)

- **But this new technological-fix is not sufficient.**
- **It is necessary to consider other non technological factors.**

2. THE COMEST NUTSHELL (I)

- **UNESCO the World Commission on the Ethics of Science and Technology (COMEST) appointed a working group for analyzing the ethics of freshwater uses (1998-2000).**
- **The report of the working group was approved by the COMEST in 2001 and UNESCO published in 2004 a series of 13 monographs on water ethics.**

2. THE COMEST NUTSHELL (II)

- The essential message of the COMEST is:

**WATER MANAGEMENT DEMANDS
EQUILIBRIUM BETWEEN ITS UTILITARIAN AND
NON-UTILITARIAN (OR INTANGIBLE) VALUES**

2. THE COMEST NUTSHELL (III)

- **Utilitarian values are: irrigation, urban and rural water supply, energy, and others.**
- **Intangible values are: use in religious liturgies, landscape, ecosystems conservation and services. Some of them are controversial or not well defined.**

3. POTENTIAL RECENT ADVANCES IN SCIENCE AND TECHNOLOGY (I)

- **Natural resources are limited but human ingenuity is pointless (A. Berntel, 2009).**
- **There exist many promising research areas that may have a great impact in the development of agriculture (virtual water) but they still are controversial, or not mature yet, or expensive.**

3. POTENTIAL RECENT ADVANCES IN SCIENCE AND TECHNOLOGY (II)

AMONG THEM :

- **Nanotechnology,**
- **Ecological agriculture,**
- **Saltwater agriculture,**
- **Vertical farming in cities,**
- **Bio- engineering**
- **Photosynthesis process**

WE WILL NOT CONSIDER THEM NOW

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (I)

- **We are going to mention only a few advances that are available, relatively cheap and generally well accepted:**
 - a) Membrane technology**
 - b) Virtual water trade, facilitated by cheap and fast transport of food**
 - c) Intensive groundwater development silent revolution**
 - d) Information technology (IT)**

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (II)

A) MEMBRANE TECHNOLOGY(1)

The energy needed to desalinize one cubic meter of sea water has decrease from almost 20 kwh/m³ to less than 4 kwh/m³.

The most common technology today is **REVERSE OSMOSIS (RO)**.

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (III)

A) MEMBRANE TECHNOLOGY (2)

The current total cost for RO is US \$ 0.5-0.6/m³, with full time operation and large plants.

Smaller cost for (subterranean) brackish water (US \$ 0.10 – 0.20/m³), but this cost may increase significantly with the requirements to dispose the brines.

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (IV)

A) MEMBRANE TECHNOLOGY (4)

Currently in Spain about 7% of the population drinks (desalinated) sea water.

The cost of desalination is affordable in most cases for urban water supply in cities near the coast.

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (V)

A) MEMBRANE TECHNOLOGY (5)

Theoretically it can be used for irrigation of high value crops (greenhouse).

Value of crop >60.000 €/ha/yr

Cost of Water (5.000 m³ x US \$0.6/m³) 3.000 €

Cost of water < 5% of crop value

However, as long as groundwater is cheaper its use in agriculture is minimum. This is the Spanish current situation.

MOST FARMERS ARE NOT MENTALLY RETARDED.

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (VI)

■ EXAMPLES OF INCREASED WATER PRODUCTIVITY IN AGRICULTURE (SOURCE: ALLAN, 2009).

Farmers as *big water* managers key to increased water productivity.

1) North West Europe:

Farmers in North West Europe trebled rain-fed wheat yields from 3 to 9 tons/ha between 1961 and 1990. This is compared to the yield of 1 ton/ha in 1800 using the same volume of water.

2) India and China:

Indian and Chinese farmers increased wheat, rice and maize production between 1961 and 1990 by 4 and 5 times. Water productivity was not at this level but it was still in the order of three times higher.

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (VI bis)

3) Vietnam:

In Vietnam after the end of hostilities in 1975 Vietnamese farmers moved rice yields from 2.5 tons/ha to 7 tons/ha and increased to double and triple cropping so that some tracts were raising 20 tons/ha/yr. Vietnam is now the second rice exporter. It was importing in 1975.

4) Egypt:

Egypt has increased its wheat yields from 2 tons/ha in 1960 to 7 tons/ha today and yields and returns to water are still increasing. In the case of Egypt the increased returns have been due to blue water.

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (VII)

B) VIRTUAL WATER TRADE (1)

Virtual water is the amount of water necessary to produce a good o services.

| | | |
|-------------------|--------|-----------|
| 1 kgr wheat | 1.000 | kgr water |
| 1 kgr beef | 20.000 | kgr water |

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (VIII)

B) VIRTUAL WATER TRADE (2)

Water footprint (WF) means the amount of water (blue and green) that a human being or a collective group requires for all her/his needs (about 90% for food and fiber).

The WF is an indicator of water consumptive use of virtual water domestic or imported

| | |
|-----------------|------------------------------|
| vegetarian diet | ~800 m ³ /year |
| read meat diet | ~ 1.500 m ³ /year |

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (IX)

B) VIRTUAL WATER TRADE (3)

Total Water resources 110.000 km³/year
 Green Water 70.000 km³/year
 Blue Water 40.000 km³/year

Human needs

| <u>diet</u> | <u>population</u> | <u>km³/year (blue + green)</u> |
|-------------|------------------------|---|
| Vegetarian | 7.000.10 ⁶ | ~6.000 |
| Readmeat | 7.000.10 ⁶ | ~12.000 |
| Vegetarian | 10.000.10 ⁶ | ~8.000 |
| Readmeat | 10.000.10 ⁶ | ~15.000 |

BETWEEN 5-13% OF TOTAL WATER RESOURCES

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (X)

B) VIRTUAL WATER TRADE (4)

Food security is today more related to economic capacity than to water scarcity.

There exist some problems mainly related to:

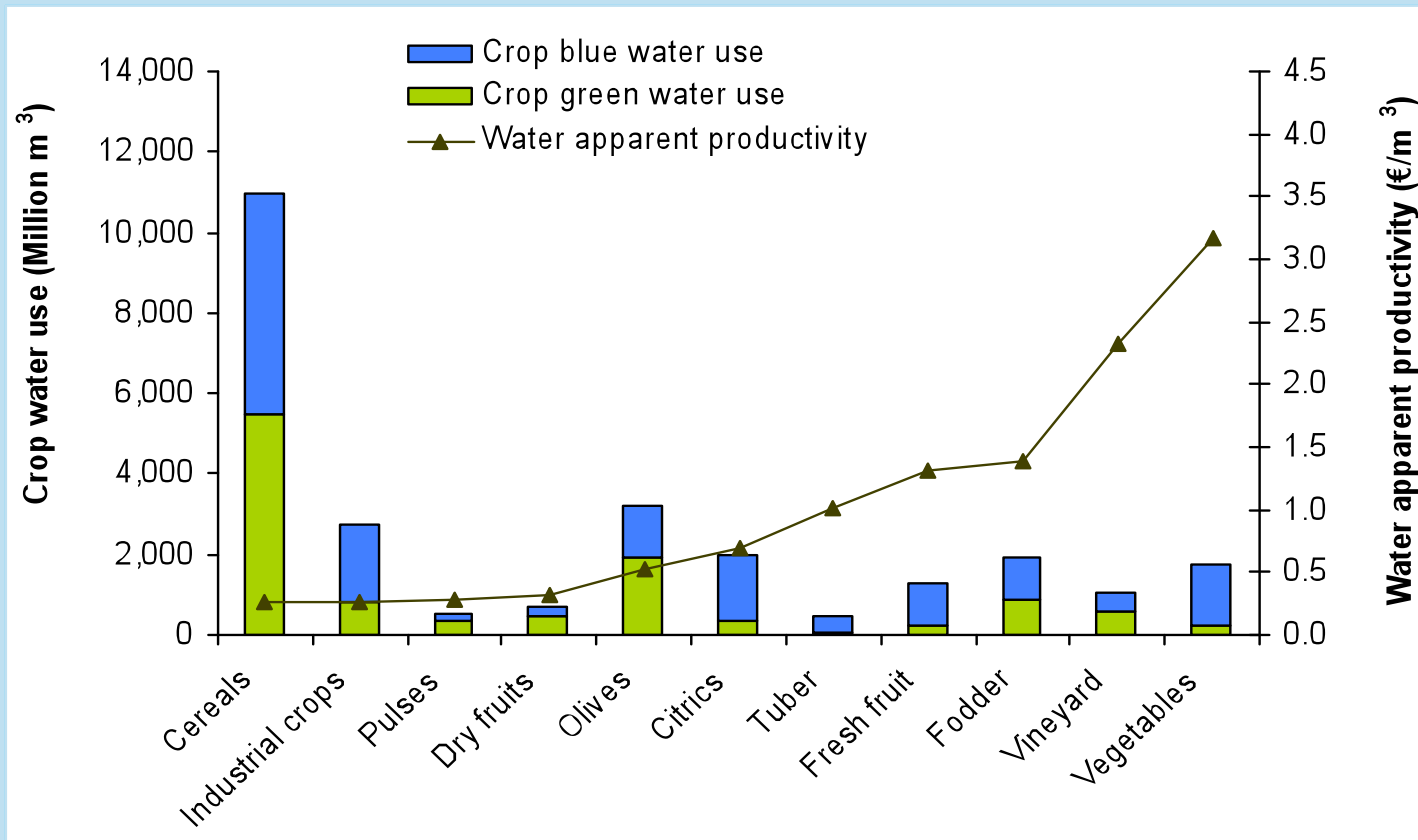
- 1) WTO regulations: a) Hidden monopolies and b) Threat of political embargo.

- 2) Domestic social changes required in the importer country.

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XI)

B) VIRTUAL WATER TRADE (5)

WATER APPARENT PRODUCTIVITY AND BLUE AND GREEN WATER FOOTPRINT OF CROP PRODUCTION IN SPANISH AGRICULTURE (AVERAGE YEAR) (AFTER GARRIDO, ET AL., 2010).



4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XII)

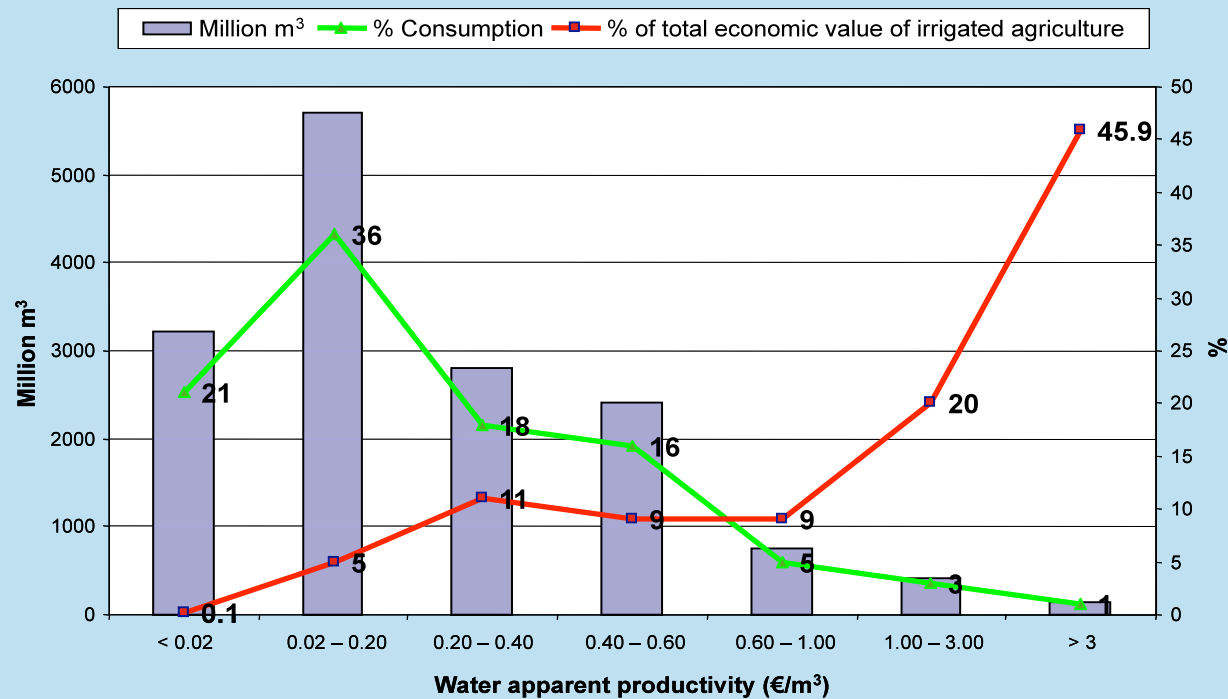
B) VIRTUAL WATER TRADE (6)

IRRIGATED AGRICULTURE IN SPAIN

BLUE WATER CONSUMPTION (10^6 M³), % OF BLUE WATER CONSUMPTION, AND % OF TOTAL ECONOMIC VALUE OF IRRIGATED AGRICULTURE VERSUS WATER APPARENT PRODUCTIVITY (€/M³) (AFTER ALDAYA ET AL., 2008).

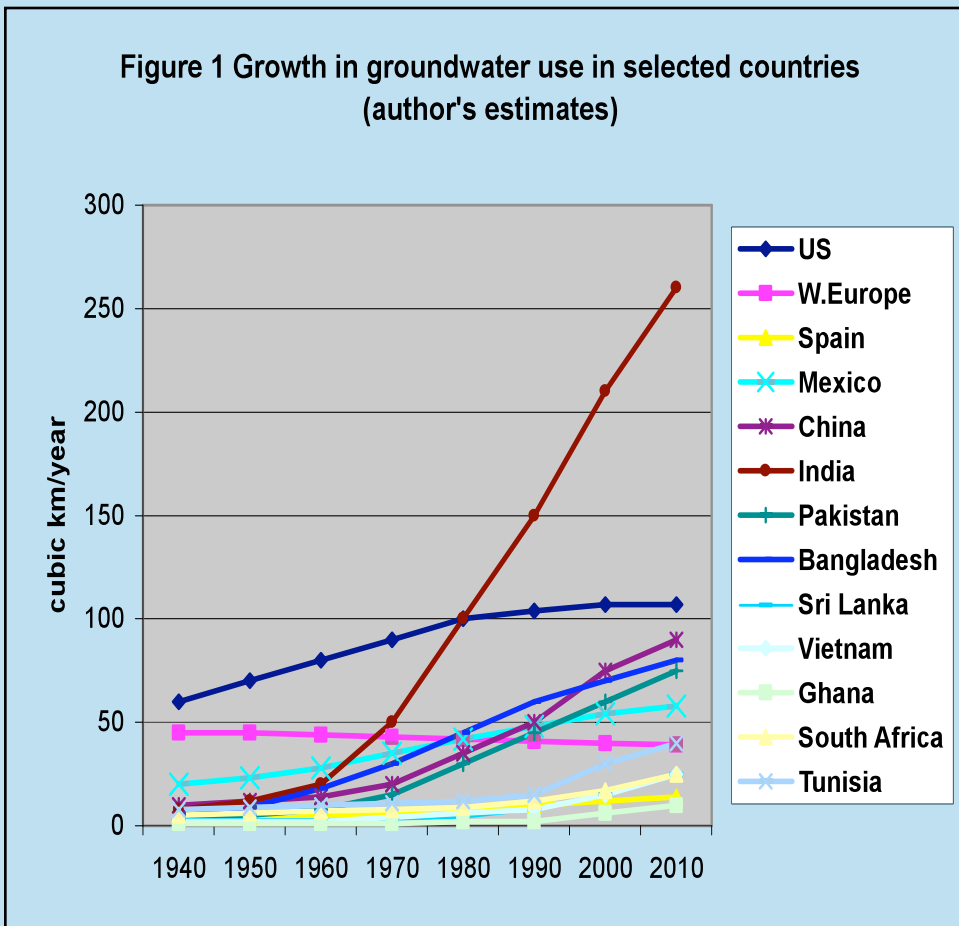
(€/M³)

Water consumption and value added by water productivity range



4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XIII)

C) GW SILENT REVOLUTION (1)



From 100 Km³/year

to

1.000 Km³/year

in 50 years

Source: Shah (2004 and 2009)

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XIV)

C) GW SILENT REVOLUTION (2)

- It has been carried out by million of modest individual farmers.
- Water decision makers have seldom paid attention to this phenomenon.
- It has produced great socio-economic benefits, as well as some problems (mainly environmental).
- **Documented problems to date are usually missing due to the enormous groundwater storage capacity of most aquifers and to the social changes.**

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XV)

C) GW SILENT REVOLUTION (3)

■ CAUSES OF THE SILENT REVOLUTION

- Wide availability of cheap well drilling technologies.
- Invention and commercialization of the submersible pump.
- Hydrogeology has become a solid body of science.

**HOWEVER, THE SILENT REVOLUTION IS MAINLY
MARKET DRIVEN, EXCEPT IN VERY POOR
COUNTRIES**

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XVI)

C) GW SILENT REVOLUTION (4)



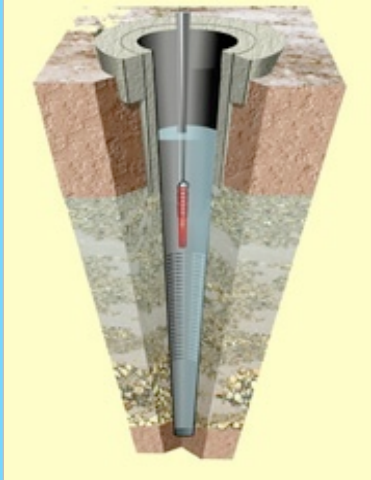
From the dug-well to the deep borehole.



From the water wheel to the pump.



From the water-witches to Hydrogeology.



4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XVII)

C) GW SILENT REVOLUTION (5)

- Cheap, quick and secure source of drinking water for people (poor and not-so-poor).
- Allows for “small” irrigation (e.g. India).
- Today most new irrigation surfaces are with groundwater (in India and Spain and in others regions).

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XVIII)

C) GW SILENT REVOLUTION (6)

- Low abstraction cost (even without “perverse” energy subsidies).

Abstraction cost usually between 0.02 – 0.20 US\$/m³

Irrigation cost dependent on crop type: 50 – 1000 US\$/ha

- Significantly “**more crops and jobs per drop**” than in surface water irrigation systems.
- In Industrial and emerging countries this motto is changing to “**more cash and nature per drop**”

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XIX)

C) GW SILENT REVOLUTION (7)

■ Negative effects may appear:

- Groundwater level depletion (often irrelevant, although the most frequently referred to).
- Groundwater quality degradation is usually the most important. It also may be due to poor land-use planning (e.g. Netherlands; Murray-Darling Basin, Australia).
- Land subsidence (Mexico, Osaka, Bangkok...).
- Ecological impacts on surface water courses and wetlands (irrelevant wherever poverty is the main ecological problem).

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XX)

C) GW SILENT REVOLUTION (8)

“Hydromyths”

- Paraphrasing Hamlet:

“FRAILTY, FRAILTY, THY NAME IS GROUNDWATER”

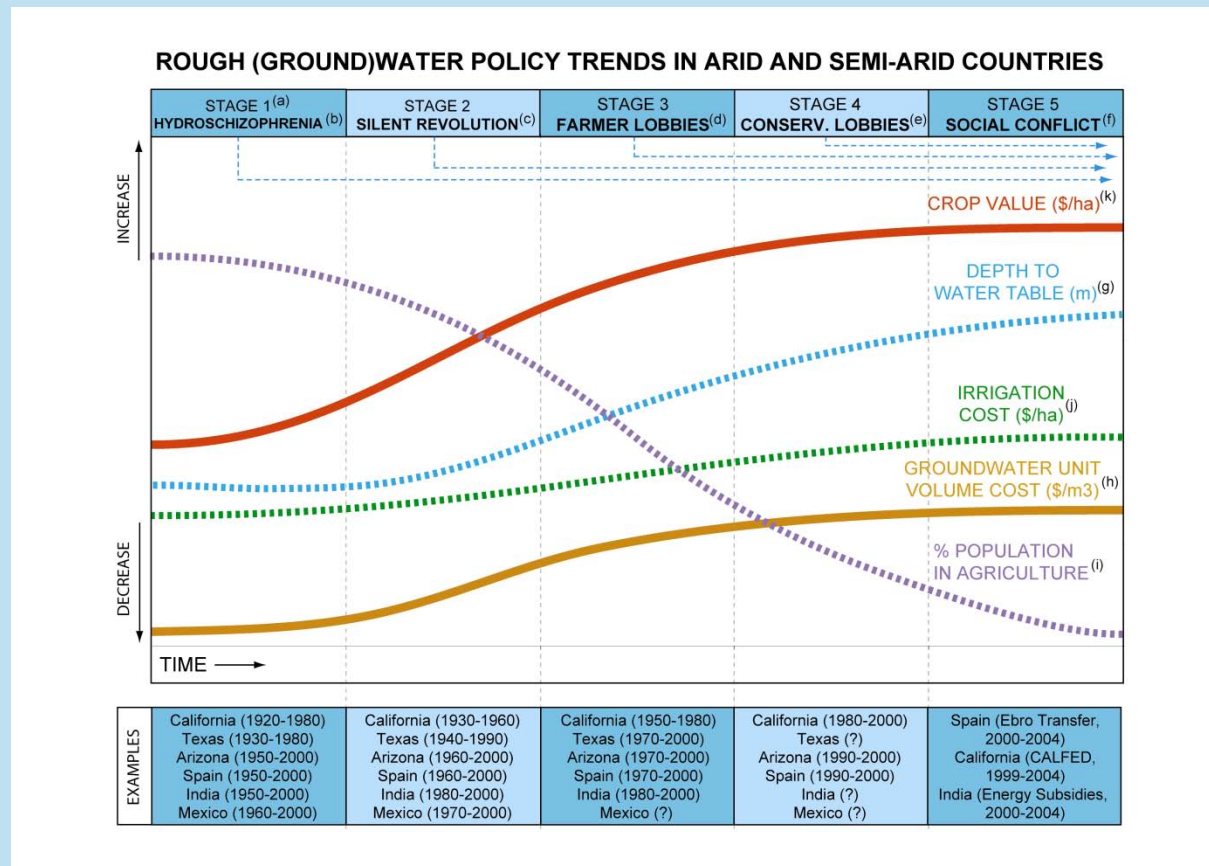
- “EVERY WATER WELL BECOMES DRY OR BRACKISH”

- Groundwater development is a “PILLAR OF SAND”, prone to collapse:

DOCUMENTED CASES OF SOCIO-ECONOMIC HAVOC CAUSED BY INTENSIVE GROUNDWATER USE ARE STILL PRACTICALLY UNKNOWN

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XXI)

C) GW SILENT REVOLUTION (9)



4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XXII)

C) GW SILENT REVOLUTION (10)



SARAGOSSA, Oct 2002



BRUSSELS, Sep 2001



VALENCIA, May 2003

**CLAMOROUS
SOCIAL CONFLICTS
IN SPAIN**

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XXIII)

D) INFORMATION TECHNOLOGY (1)

- Possibly the radical problem in most hydrological conflicts is the illusory accuracy of data, if they are not false. Half-truths are worse than open lies.
- Generally transparency and availability on these data is scarce.

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XXIV)

D) INFORMATION TECHNOLOGY (2)

- The most frequent inexact data are:
 - a) Irrigated surfaces and the types crops.
 - b) The inventory of groundwater uses and rights.
- Remote sensing can usually provide these data in a fast and cheap way.

4. FOUR SIGNIFICANT ADVANCES FOR WATER AND FOOD SECURITY (XXV)

D) INFORMATION TECHNOLOGY (3)

- GIS and Internet (or cell phones) allow to elaborate and disseminate the data to the general public with a small investment.
- Usually these problems could be solved quickly if there is political willingness.

5. SOCIAL ETHICS VERSUS ENVIRONMENTAL ETHICS (I)

- **In order to cope with this issues is relevant distinguishing between social and environmental ethics**
- **Social ethics deals with the relations between human beings. It is an old concern. For example: a) Hammurabi code (1800 bc); b) Aristotle ethics to Nikomachus (IV century bc).**
- **Environmental ethics is new. Less than a century. Before the humans were unable to disturb significantly the planet.**

5. SOCIAL ETHICS VERSUS ENVIRONMENTAL ETHICS (II)

- Currently there exist problems related to social ethics that have not been solved yet. For example, the right to water and sanitation.
- This right has been formally recognized by the United Nations only a few months ago. This is good but perhaps there are many declarations but small effectiveness.

5. SOCIAL ETHICS VERSUS ENVIRONMENTAL ETHICS (III)

- **The volume of water involved in this issue is barely 5% of the total water consumed by humanity.**
- **The amount of donations from rich countries to achieve the corresponding MDG is less than the money spent in pet food in the industrialized countries.**

5. SOCIAL ETHICS VERSUS ENVIRONMENTAL ETHICS (IV)

- Another social ethics issue is the right to food, “abolition of hunger”. It is other MDG not solved yet.
- There is not lack of food neither for the current nor for the near future population. The problem is mainly related to:
 - a) poverty in a few countries (about 10% of the global population).
 - b) lack of just and equitable international regulations for food trade.
 - c) persistence of the traditional ideas of food self-sufficiency

5. SOCIAL ETHICS VERSUS ENVIRONMENTAL ETHICS (V)

- The interest on the environmental ethics begun about fifty years ago with authors as Rachel Carson (The Silent Spring) and Lynn White, the American historian who wrote in 1967 that the ecological disasters were due to the Judeo-Christian interpretation of the genesis sentence “Grow and dominate the earth”.
- This was a catalyst for the use of “the tragedy of the commons” and the “lifeboat ethics. Today practically abandoned

5. SOCIAL ETHICS VERSUS ENVIRONMENTAL ETHICS (VI)

- **Today the debate continues but most authors coincide in admitting that humans are (or should be) the stewards of nature and not its tyrants or predators.**
- **About three decades ago the United Nations Commission on Environment and Development (UNCED) tried to find equilibrium between the care of nature and the human development. It introduced the fertile concept of sustainability.**

5. SOCIAL ETHICS VERSUS ENVIRONMENTAL ETHICS (VII)

- **The sustainability concept has many dimensions. at least three: Ecological, Economic and Social. Some authors consider ten or more.**
- **It depends on the circumstances of each region (Kuznets Law).**
- **This word many times has become a simplification that usually is meaningless or even may be misleading.**

5. SOCIAL ETHICS VERSUS ENVIRONMENTAL ETHICS (VIII)

- **Do a global ethics exist?**
- **Most people admit it, but their foundation is based in two different end approaches:**
 - a) **human beings as “Imago Dei,” in monotheistic religions.**
 - b) **human beings simply as an evolutionary virus or bacteria, in materialistic “religions”**
- **In my opinion the first approach leads to a more solid ethics.**

6. NEW MOTTO FOR INDUSTRIALIZED AND EMERGENT COUNTRIES (I)

- There is not a blue print. The solutions should be Taylor-made, according to the hydrological, economic and political situation of each country.
- Most effort of International Organizations has been dealing with the developing countries (from 1 to 2 billion people).
- In these countries the main problem is not water but extreme poverty.
- The usual goal in these countries is to achieve “more crops and jobs per drop”

6. NEW MOTTO FOR INDUSTRIALIZED AND EMERGENT COUNTRIES (II)

- Our suggestion is that it is important to pay more attention to the industrialized and emerging countries (from 5 to 6 billion people).
- In this countries the motto shuold be “more cash and care of nature per drop”

6. NEW MOTTO FOR INDUSTRIALIZED AND EMERGENT COUNTRIES (III)

- It is necessary to work with the powerful farmers lobbies to find a “win-win” solution.
- The current (and future) technological advances will facilitate this option.

7. CONCLUSIONS (I)

- **The advances of Science and Technology may help to solve many of the current issues or conflicts related to water and food scarcity (or security).**

7. CONCLUSIONS (II)

- **But the technological-fix is not enough. The main obstacles for the implementation of these advances are of ethical nature. They are related to a mix of ignorance, professional bias, neglect, lack of solidarity, and corruption. The proportion of the mix varies from country to country.**

7. CONCLUSIONS (III)

- **Probably the most relevant action for solving the current problems would be to achieve a more efficient, just, and equitable international regulation for the food trade.**

THANKS FOR YOUR ATTENTION

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