6TH WORLD WATER FORUM

Water footprint accounting of green and blue water for the Guadalquivir river basin (Spain).

WORLD WATER FORUM
MARSEILLE, FRANCE '12
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Aurélien Dumont,
Prof. M.Ramón Llamas,
Observatorio del agua,
Fundación M. Botín –
Universidad Complutense,
Madrid

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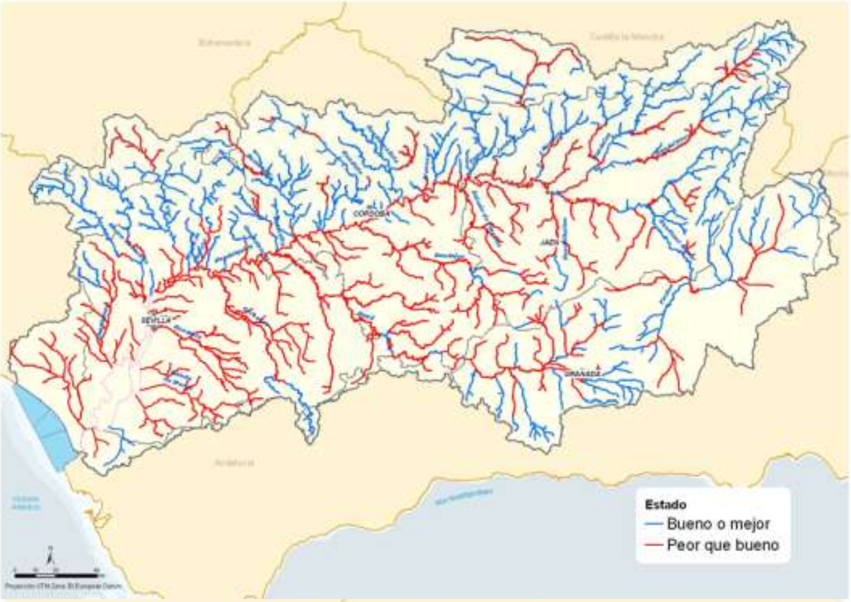
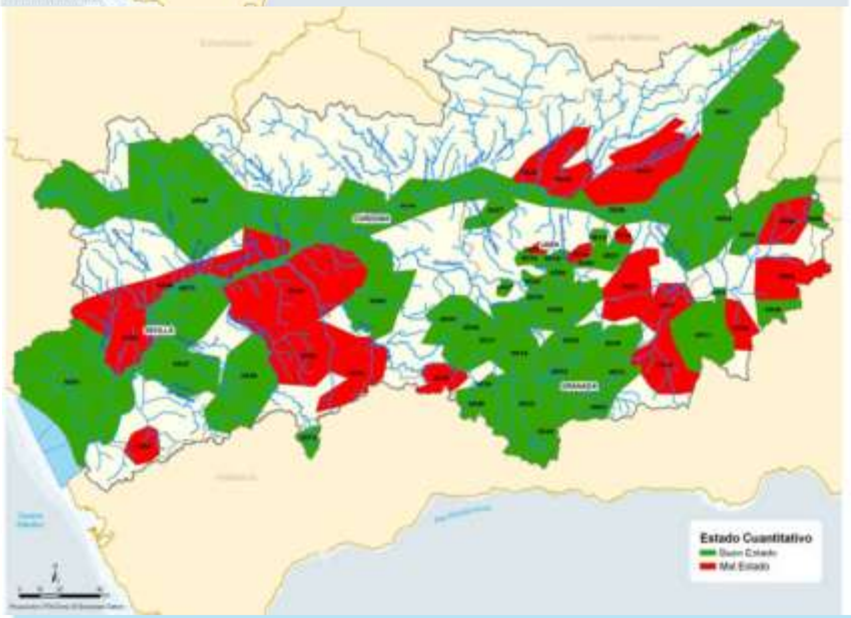
Guadalquivir river basin



A)

Status of the Guadalquivir river basin Water bodies:
A) Surface water;
B) Groundwater.



B)

Water footprint as a Water accounting methodology

- WF within a geographically delineated area (River basin)

WF consumers = WF production + WF imports – WF exports

→ ***for IRWM*** (WF production)

- Green water and Blue water.

- Accounting by sector: …and for each production:

Sectors	Productions (Agriculture)
•Agriculture	•Corn
•Livestock	•Vegetables
•Domestic supply	•Citrus fruits
•Tourism	•Olive groves
•Industry	•etc
•Dams	

Water footprint as a Water accounting methodology

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BLUE WATER

The WF is a detailed water accounting method, accounting for all the water **consumption** components:

- "1. Water **evaporates**;
- 2. Water is **incorporated into the product**;
- 3. Water does not return to the same catchment area, for example, it is **returned to another catchment area or the sea**;
- 4. Water does **not return in the same period**, for example, it is withdrawn in a scarce period and returned in a wet period." (Hoekstra et al., 2011)

Return flows are computed only if they are not "re-used" dowstream in the river basin.

"Water consumption" is a complementary indicator to water use, withdrawal or demand.

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Methodology: WF Agriculture

Period of study
1997-2008

Green WF (m^3) = EVT = % of precipitations

Blue WF(m^3) = Evaportranspiration in the field

-Applied irrigation volume changes depending on the administrative restriction based on the water level in dams.

Livestock

$-V_{drink}$
$-V_{exp.mgmt}$

Direct consumption=> WF within the catchment

$-V_{feed}$

Indirect consumption=> WF within the catchment + Importations

Crop area already included in the agrarian statistics

Pasture (Green water)

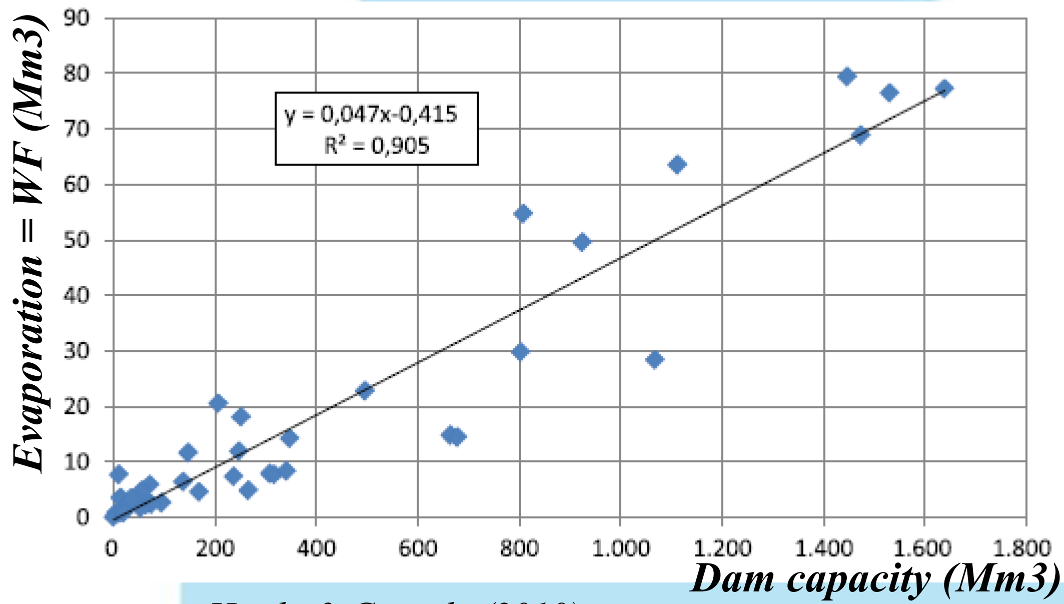
Methodology: WF domestic supply, tourism and industry

Data on withdrawal, CHG(2010)

Return flows
(72% for domestic use– 44% for industrial use)

WATER FOOTPRINT

Dams:



Hardy & Garrido (2010).

Water footprint and other indicators

Water footprint: Consumptive use of **blue** and **green** water	Economic value of water Social and environmental indicators

Indicators considered in the present study.

Detailed water accounting within the basin based on the Water footprint assessment methodology

+

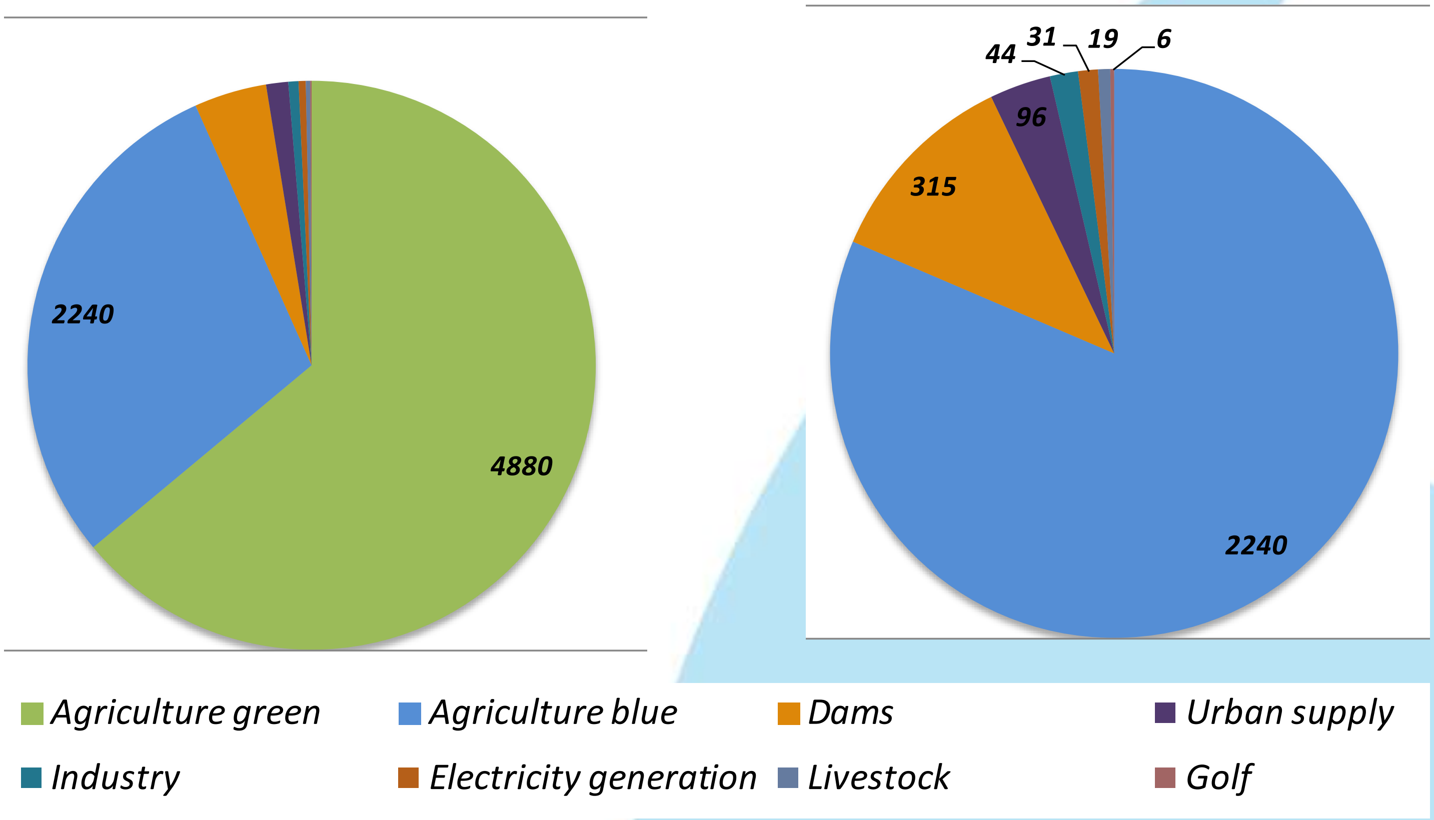
Indicators of the value of water

⇩

Improved management of water ressources

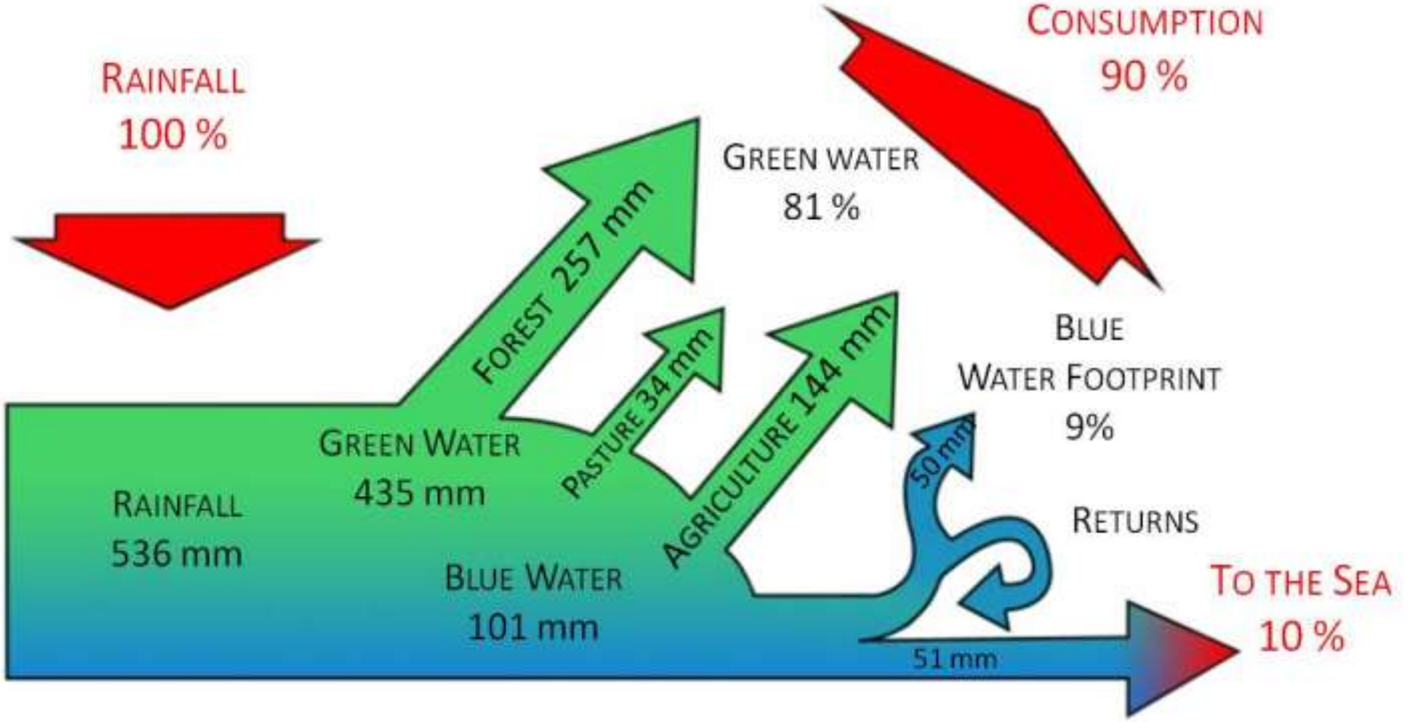
Agriculture: $\text{€ (market value)}_{crop} / WF_{crop}$

The WF of the Guadalquivir river basin: Results



Synthesis of the sectoral WF for the Guadalquivir River Basin (Mm^3).

The WF of the Guadalquivir river basin: Results



Salmoral et al. (2011) - Adapted from Falkenmark (2009)

Integration of the Water footprint within the hydrologic cycle

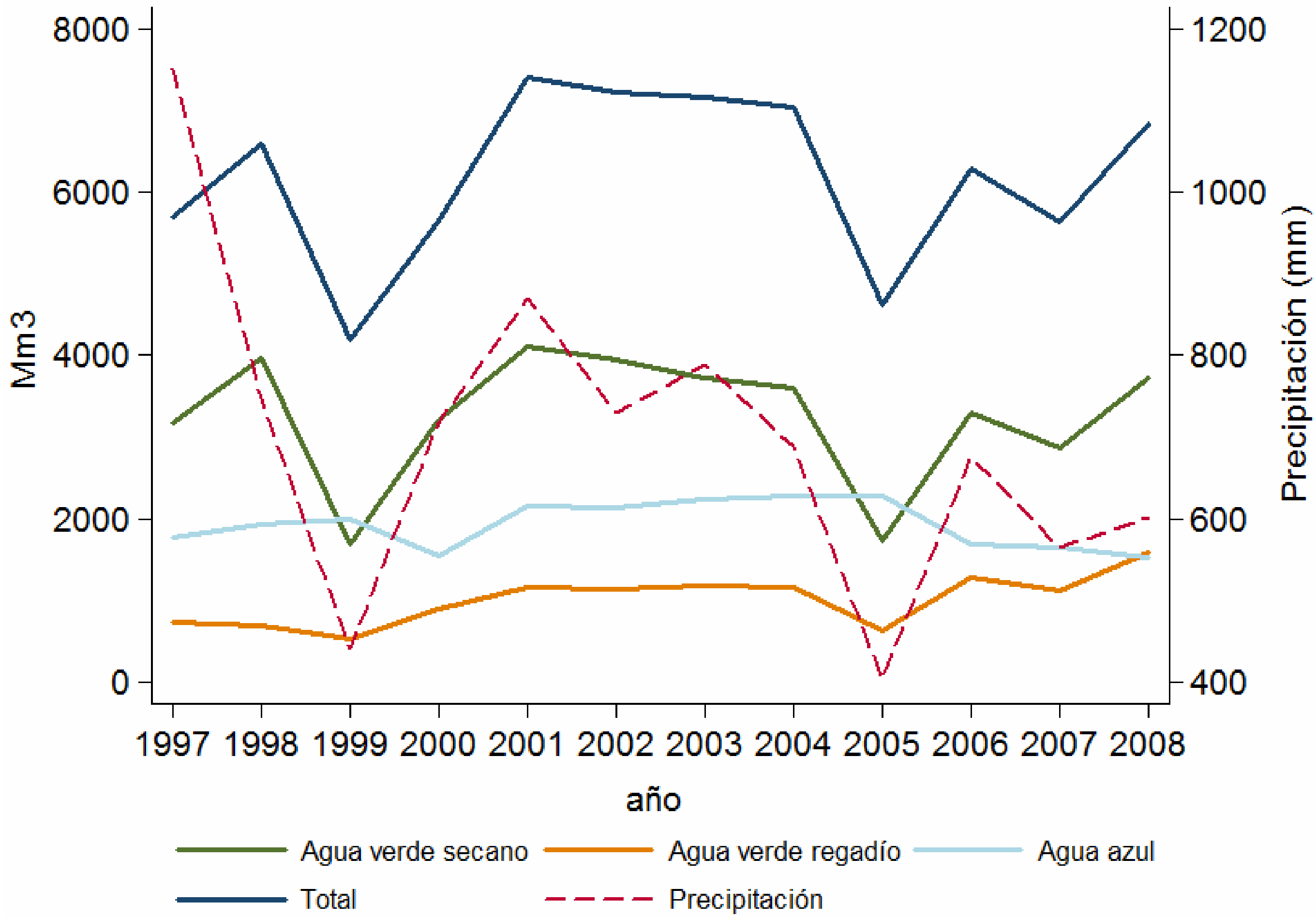
The WF of the Guadalquivir river basin: Results

The WF of Agriculture

- **Total WF:**
  4.200-7.400 Mm³

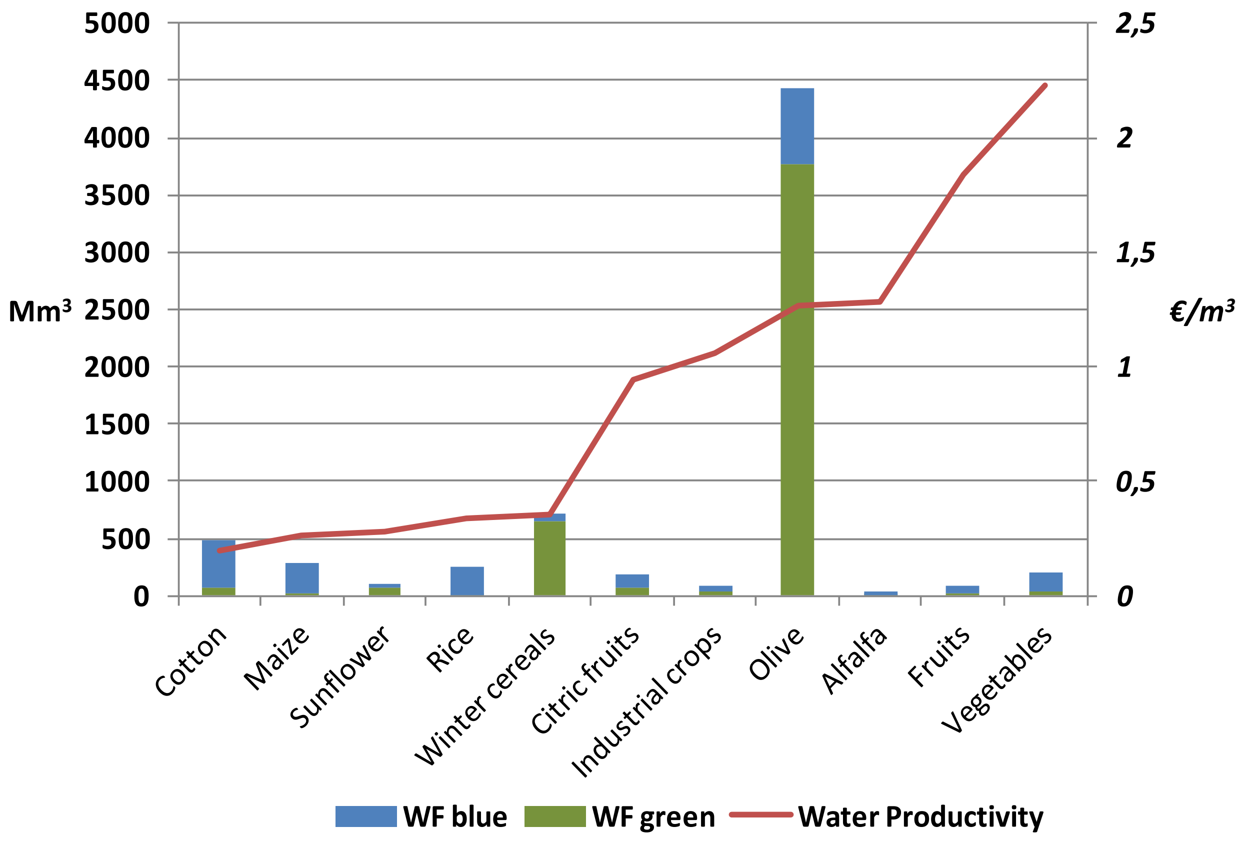
- **Green WF:**
  2.200-5.300 Mm³

- **Blue WF:**
  1.500-2.300 Mm³



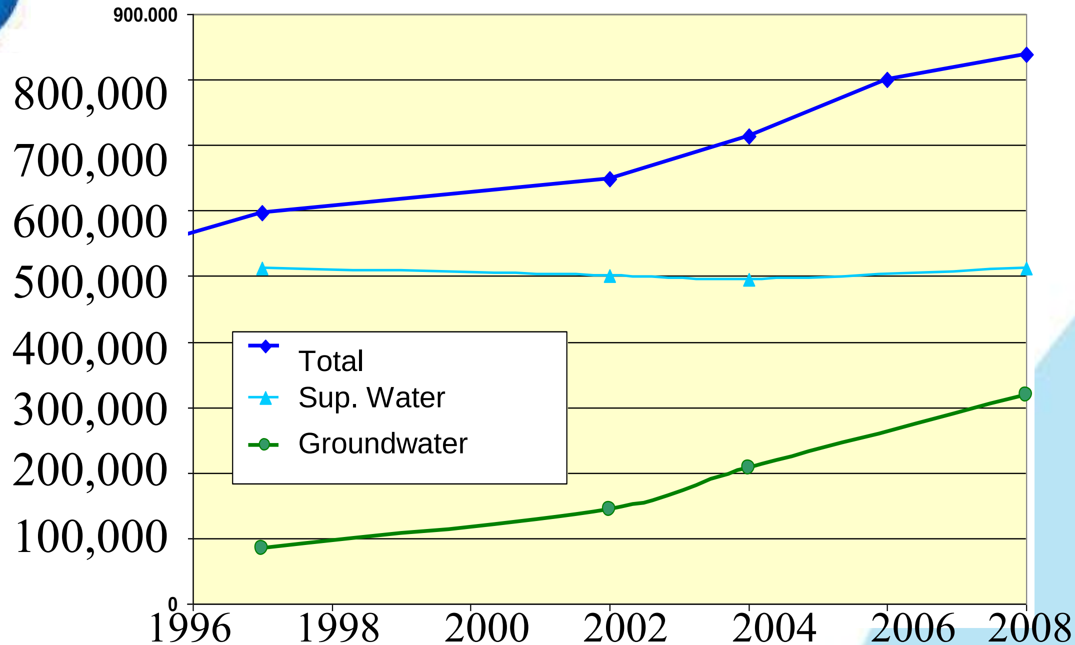
1997-2008: ↑ 29% irrigation area =>250.000 ha

The WF of the Guadalquivir river basin: Results



The WF and "water productivity" by crop (year 2003).

The 'Water bubble' of olive oil production



Source: Corominas, 2011.

Evolution of irrigated area (ha) by origin of water.

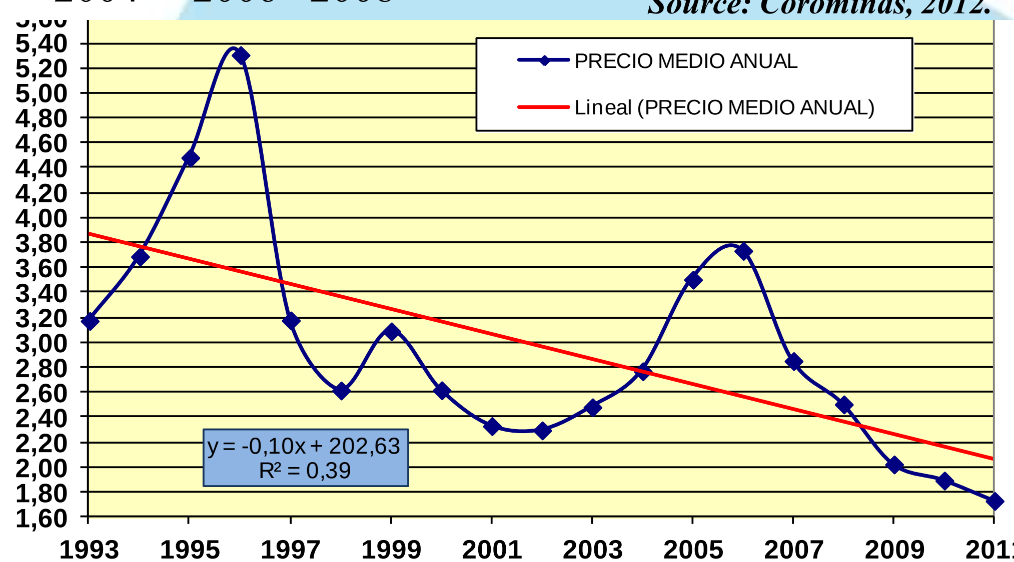
1997-2008:

Groundwater irrigated olive groves

+ 250.000 ha

+ 300 Mm³

Source: Corominas, 2012.



Evolution of the price of olive oil 1993-2011.

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Conclusions and Key points

- ***Recommendations regarding the Guadalquivir river basin***
  - A large fraction of the water used for irrigation generates little economic returns and employment: Reduction of the WF with limited economic and social costs?
  - Reducing the blue WF (groundwater) of olive to alleviate the stressful situation and the current "Water bubble Paradox".

    ⟹ *Possible solution: Incentive for rain-fed farming or deficit irrigation.*
  - New uses: Water should be obtain from existing uses:

    > *Ex: Thermosolar plants: + 16 Mm^3 before 2015.*

- ***Key points regarding Water footprint as a Water accounting method***
  - The WF integrates only the consumptive fraction of water use / "appropriation of water resources": return flows are not computed. e.g. essential to assess the effect of possible demand reduction measures.
  - WF is useful for hydrologic balance at basin scale and taking into account green water allows to integrate land use and water policy and to recognize its value for crop production.
  - A detailed accounting of the WF and its value, not only for the big sectors of the economy but also within the sectors (e.g. different crops for agriculture), allows to identify the activities that are more valuable for the area.

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