

Monitoring of the progresses achieved, promoting of the WDM policies in the Mediterranean and the difficulties experienced

WATER DEMAND MANAGEMENT

SPANISH EXPERIENCE

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4th Regional workshop on WDM in the Mediterranean

2nd Mediterranean Water Forum

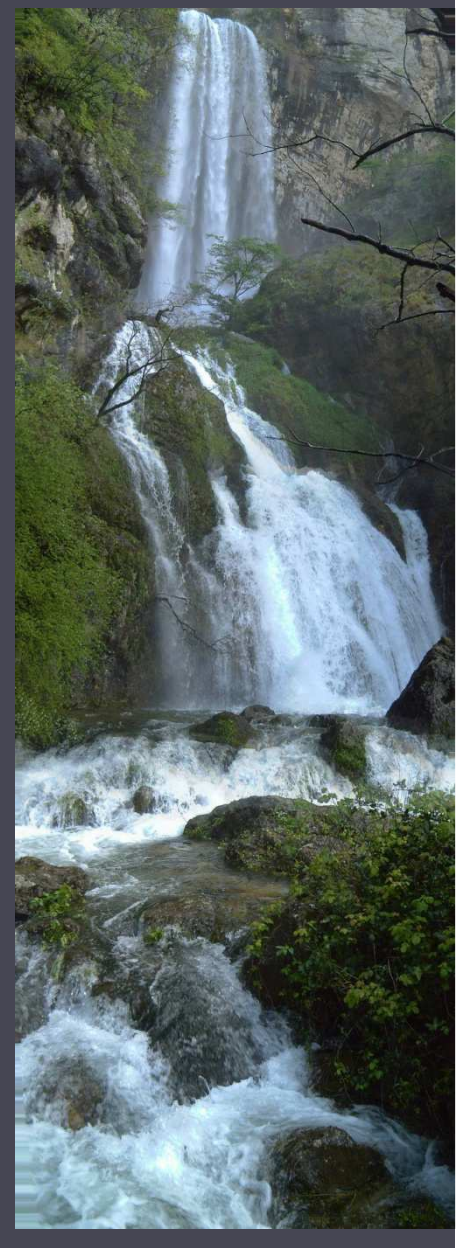
INDEX OF CONTENTS

1. State of Water Resources in Spain
2. Pressures and Threats on Water Resources
3. Future Trends in terms of Water Demand
4. Measures of Water Demand Management
5. Main Indicators related to WDM
6. Impact of these Measures
7. Successful Story in Terms of WDM
8. Conclusion

1. STATE OF WATER RESOURCES IN SPAIN

Water resources assessment. Natural water resources

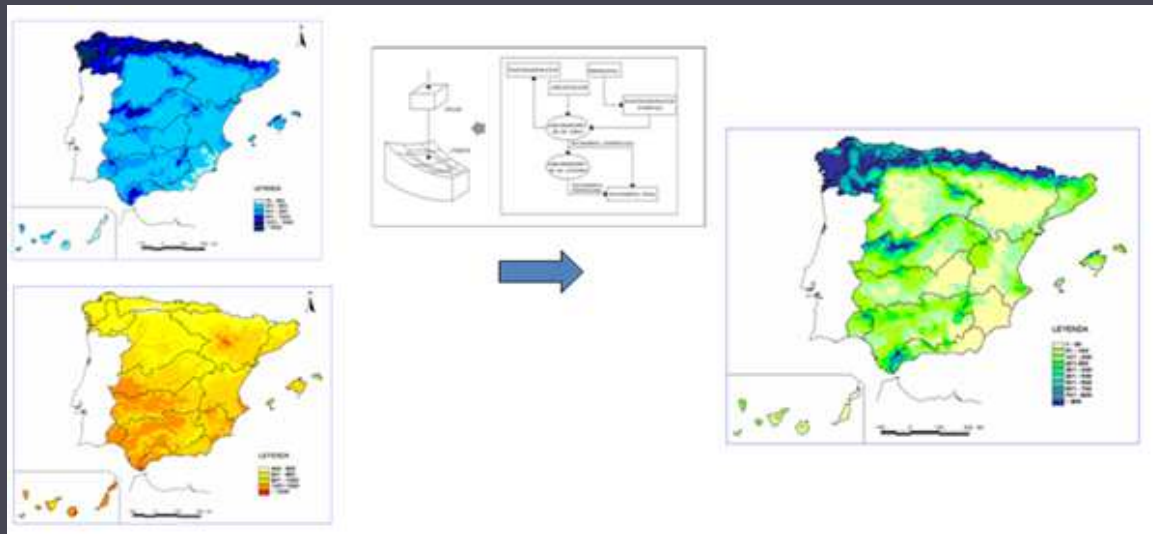
- Rainfall:
 - Annual: more than 1.600 mm (north) to 300 mm (southeast).
 - Average: 690 mm/year (december: highest rainfall, July driest)
- Runoff (direct surface runoff + underground runoff)
 - Average: 220 mm/year, equalling some 111.000 hm³/year
- Water resources evaluation in natural regime is carried out in the River Basin Management Plan (RBMP)



1. STATE OF WATER RESOURCES IN SPAIN

Water resources assessment. Natural water resources

- Method used for the whole of Spain: SIMPA model (developed by Centre for Hydrographic Studies)
- Distributed and conceptual hydrological model operating on a monthly basis
- Spanish territory: half a million dimension cells 1.000 m x 1.000 m.



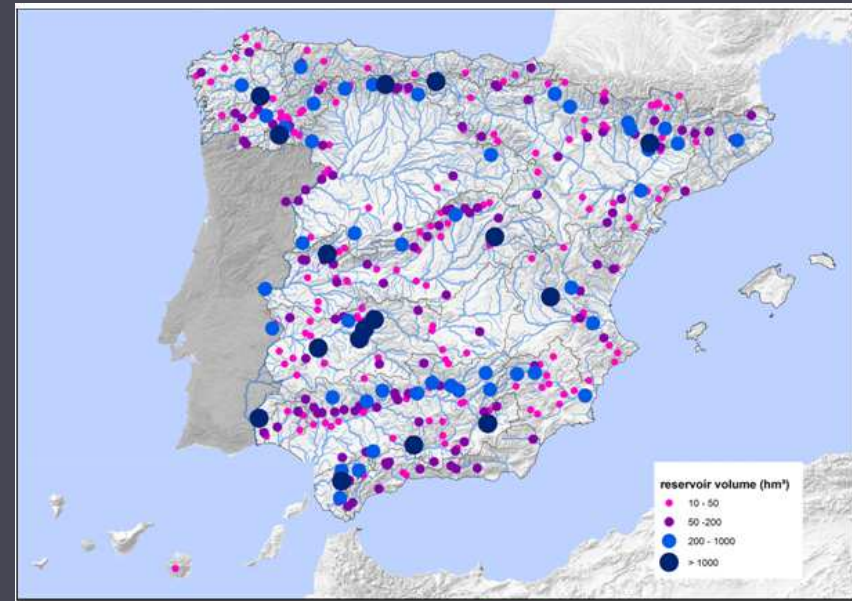
**Modelling
runoff with
SIMPA model**

Total runoff: 220mm/year

1. STATE OF WATER RESOURCES IN SPAIN

Available water resources

- Natural water resources
- Environmental and geopolitical restrictions.
- Hydraulic infrastructure:
More than 1.200 great dams with a total capacity of 56.500 Hm³
- Non-conventional resources:
Desalination and wastewater reuse



Map of reservoirs with more than 10 Hm³ of storage capacity

1. STATE OF WATER RESOURCES IN SPAIN

Water uses priorities

- Order of preference: established in the RBMP.

1° Urban supply.

2° Irrigation and agricultural uses.

3° Industrial uses for electrical energy production.

4° Other industrial uses not specified on the previous.

5° Aquiculture.

6° Recreational uses.

7° Navigation and aquatic transportation.

8° Other uses.

- Supremacy for urban supply.

- Environmental flows considered environmental restrictions.

- Competition between uses: the order has implications regarding water allocations, permit/licence granting, etc.

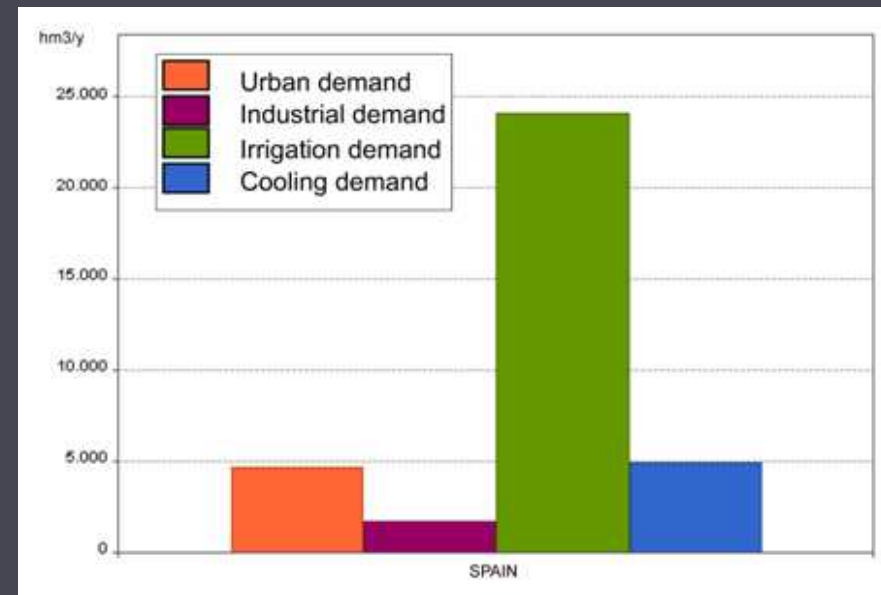


1. STATE OF WATER RESOURCES IN SPAIN

Water Uses: The different types of use of water resources.

Water Demand: The volume of water (quantity and quality that users are willing to acquire in order to meet a specific production or consumption purpose

- **Consumptive**
(urban, agricultural, industrial,...)
- **Non-consumptive**
(hydropower plants, aquiculture,...)
- **Importance of water demand for irrigation.**



Water demands in Spain (hm³/year)

Urban: **4.667**; Industrial: **1.647**;

Irrigation: **24.094**; Cooling: **4.915**

Total: 35.323 hm³/year (75% irrigation)

Consumption: 20.784 hm³/year

Return: 14.539 hm³/year

2. PRESSURES AND THREATS ON WATER RESOURCES

Point source pollution

- Waste
- Dumping site

Abstraction

- Water licence

Difusse source pollution

- Agriculture
- Livestock
- Airports
- Transport road
- Contaminated soil
- Petrol station

Artificial recharge

Regulation

- Reservoir regulation
- Hydroelectric drifting
- Transfers

Morphological alterations

- Dams
- Bridges
- Channelling
- Bank protection
- Dredging

Land uses

- Forest fire
- Forestry exploitation
- Aggregate removal

Others

- Non-native species
- Contaminated sediments
- Recreational activities

 Surface waters

 Groundwaters

 Groundwaters and surface waters

2. THREATS ON WATER RESOURCES

Fragile balance between resources and demands

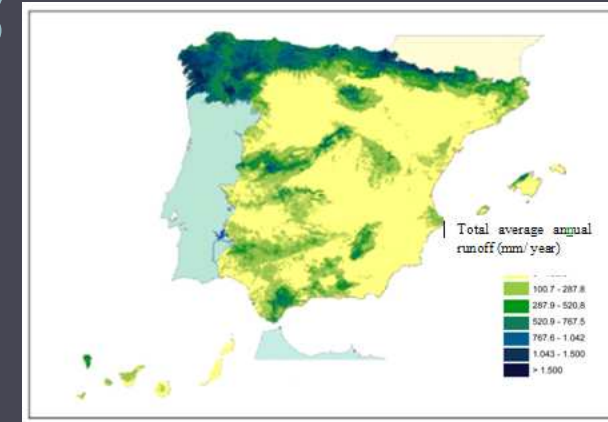
- Heterogeneous spatial and temporal distribution of rainfall
- Heterogeneous spatial and temporal distribution of demands
- Limited water resource: conflicting water demands
- General solutions for the whole territory → It is not possible

Water scarcity and droughts

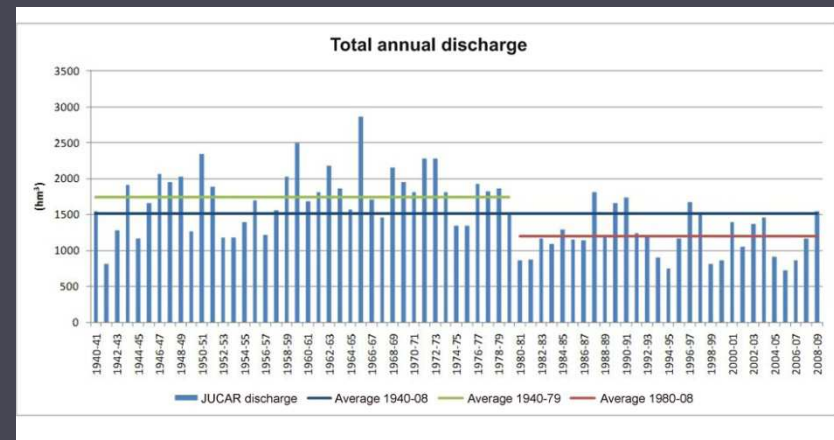
- Water demands exceeds the water resources exploitable under sustainable conditions
- Water consumption index: water consumption / potential water resource

Climate change

- Decrease in rainfall and discharge in the “dry Spain”
- Increase in water resource variability is expected.
- The most critical Spanish areas are arid and semiarid ones where water scarcity and drought problems are greater.



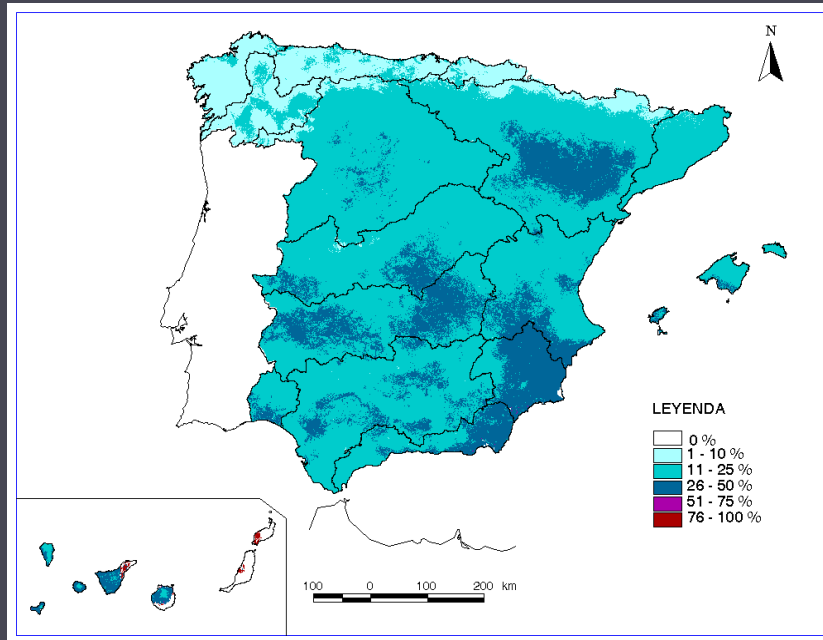
Map of the total average annual runoff in mm/year.
Source: SIA-MAGRAMA



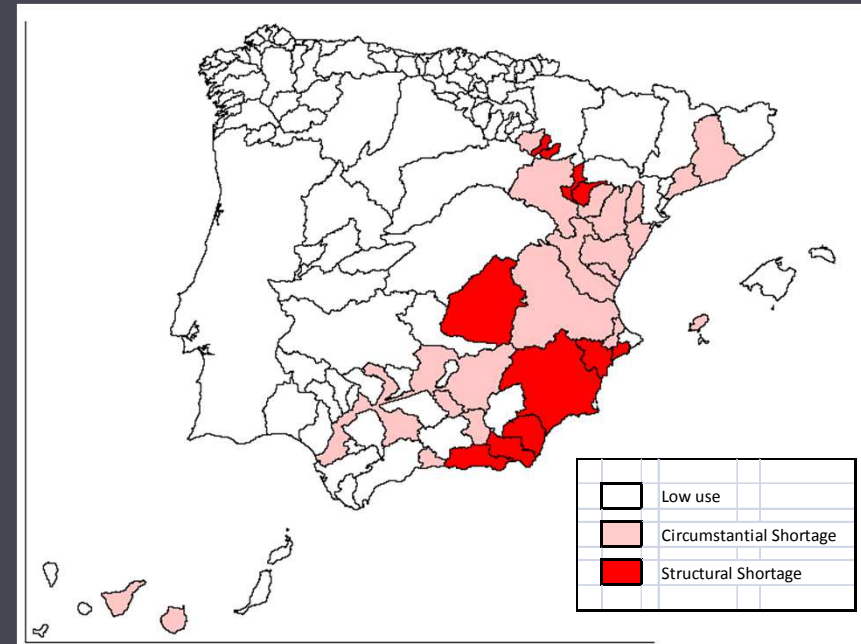
Total annual discharge in the simulation model of the Júcar water resources system. Source: CHJ

2. THREATS ON WATER RESOURCES

Impact on water resources and vulnerability



Impact on runoff reduction for a decrease of 5% in mean annual precipitation and an increase of 1°C in mean annual temperature (year 2030)



Vulnerability: water scarcity risk in water resource systems

Source: White Paper on Water in Spain, MMA (2000)

3. FUTURE TRENDS IN TERMS OF WATER DEMAND

Estimation of forecasted demands

- Scenarios 2015, 2021 and 2027
- Evolution prediction of population (↑), industry (↑) irrigation surface (↓)
- Modernisation of irrigated areas(savings and improvement of the quality)
- Increase the efficiency of the systems

Increase of non-conventional resources

- Reuses and desalinization
- Very important to the fragile balance between resources and demands



Pinedo Waste Water Treatment Plant (Valencia)

4. MEASURES OF WATER DEMAND MANAGEMENT

1. Improvement of the efficiency in urban and industrial supply
2. Improvement of the efficiency in irrigation
3. Measures related with water pricing policies
4. Public awareness-raising campaigns and use of domestic water-saving devices.
5. Control and reduction of withdrawals
6. Infrastructural measures for dealing with urban and irrigation demand.
7. Legal and administrative instruments
8. Actions in favour of less water-demanding crops
9. Measures to counteract water stress and droughts

5. MAIN INDICATORS RELATED TO WDM

For all types of demands

- Volume of water supplied
- Losses in the distribution network
- Consumption
- Returns
- Treated water volumen
- Reused water volumen
- Desalinated water volumen
- Water infraestructures investment
- Water price



Agricultural demand

- Meteorology
- Irrigation needs
 - Surface
 - Location
 - types of crops
- Water price
- Irrigation system's efficiency
- Types of irrigation

Urban demand

- Supplied water demand
 - Level of income
 - Pricing policies
 - Supply network's efficiency
 - Population's awareness
- Population

Industrial Demand

- Number of industrial establishments
- Employment
- Production
- Raw material
- Production Processes
- New technologies



6. IMPACT OF THESE MEASURES

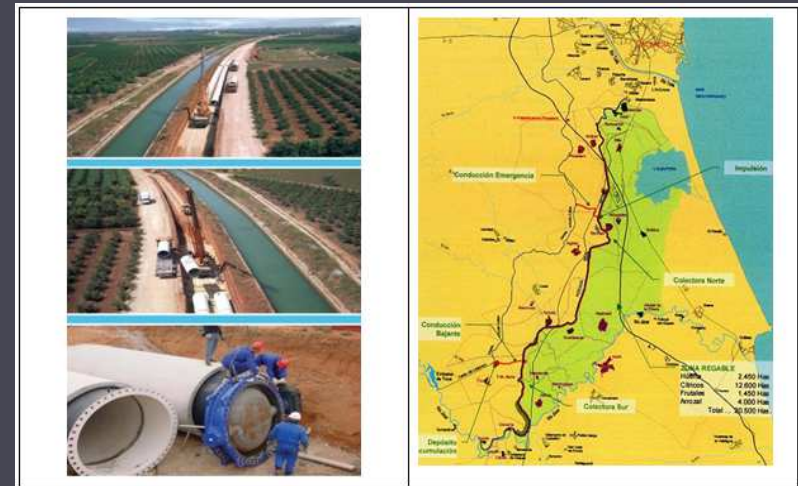
1. Improvement of systems's efficiency
2. Decrease of the losses in the distribution network
3. Improvement of knowledge, control and management resources (withdrawal, water supplied, consumption, return)
4. Optimization of water resources
5. Economical savings
6. Achievement of planning objectives (quantitative and qualitative)
7. Legal guarantee and flexibility



7. SUCCESSFUL STORY IN TERMS OF WDM

1. Modernisation of irrigated areas

- Savings and rationalization of water use
- Recovery of over-exploited aquifers
- Reduce diffuse pollution
- Innovation and development in irrigation systems
- Meters to control water consumption in agricultural parcel.
- Improvement of drainage system
- Local irrigation system by remote control

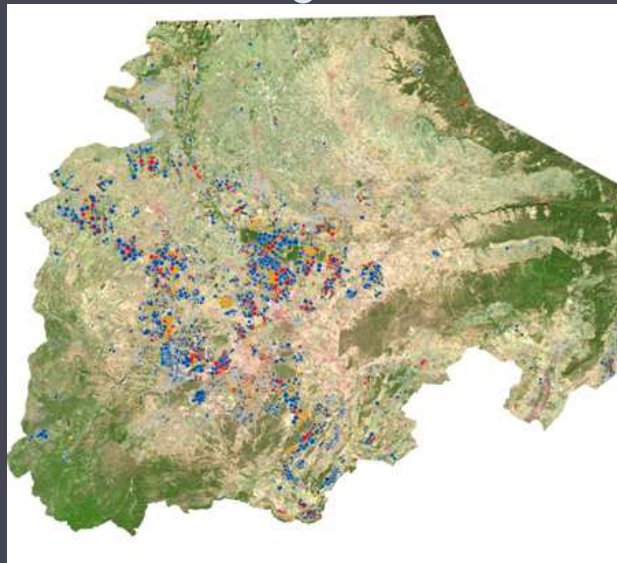


Modernisation works in the Acequia Real del Júcar Irrigators Community

7. SUCCESSFUL STORY IN TERMS OF WDM

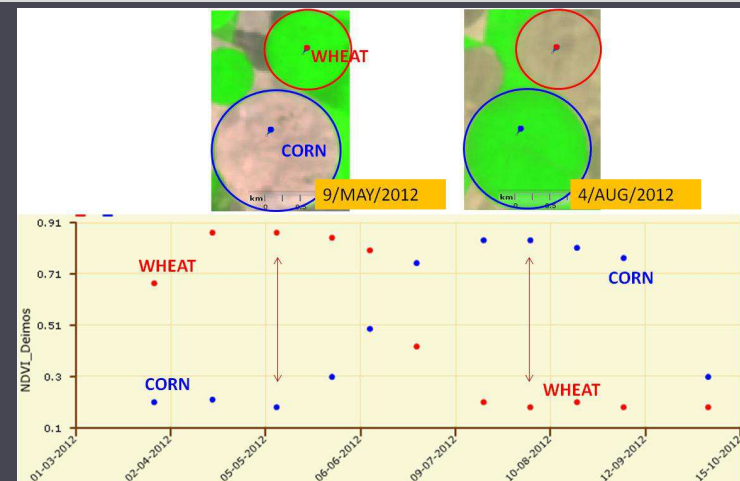
2. Tools for water demands estimates

- Indirect methods from population, irrigated area, unit consumption, efficiency,...
- Water supply data for the main unit demands
- Remote sensing for determining crop evolution



Irrigation crops identification by remote sensing in Mancha Oriental aquifer

NDVI images in an area of the Mancha Oriental aquifer and temporal evolution of the NDVI



7. SUCCESSFUL STORY IN TERMS OF WDM

3. Water Accounts in EU

- 2 pilot projects (2011-2012) and 7 pilot projects (2012-2013) in Spain launched by the Environment Directorate-General of the EC.
- Main purpose of elaborating water accounts in the United Nations' System of Environmental-Economic Accounting for Water (SEEA-W).
- The projects aims at obtaining and assessing socio-economic, environmental and climatic data, and develop updated water balances according to water availability and existing demands



7. SUCCESSFUL STORY IN TERMS OF WDM

4. Instruments to increase the flexibility of the licensing system

- The rights transfer contracts.
 - To reallocate resources for new uses. Agreement between two users.
 - Temporary rights.
 - Possible existence of economic compensation.
- The rights exchange centres.
 - To palliate the effects in drought situations, aquifer overexploitation, groundwater in danger....
 - Public offers of water rights acquisition to transfer them to other users.
 - During the drought period 2005-2008, this tool alleviated water scarcity in the most affected Spanish basins.

8. CONCLUSION

- Fragile balance between resources and demands. Heterogeneous spatial and temporal distribution of rainfall and demands.
- Climate change: decrease in rainfall and discharge in the “dry Spain”
- Droughts and Water scarcity: Water demands exceeds the water resources exploitable
- Increase of Non-conventional resources (Desalination and wastewater reuse)
- Tools for water demands estimates
- Modernisation of irrigated areas: Achievement of environmental objectives (quantitative and qualitative water)
- Improvement of systems’s efficiency, control and management resources
- Instruments to increase the flexibility of the licensing system

**THANK YOU
FOR YOUR ATTENTION!**

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