



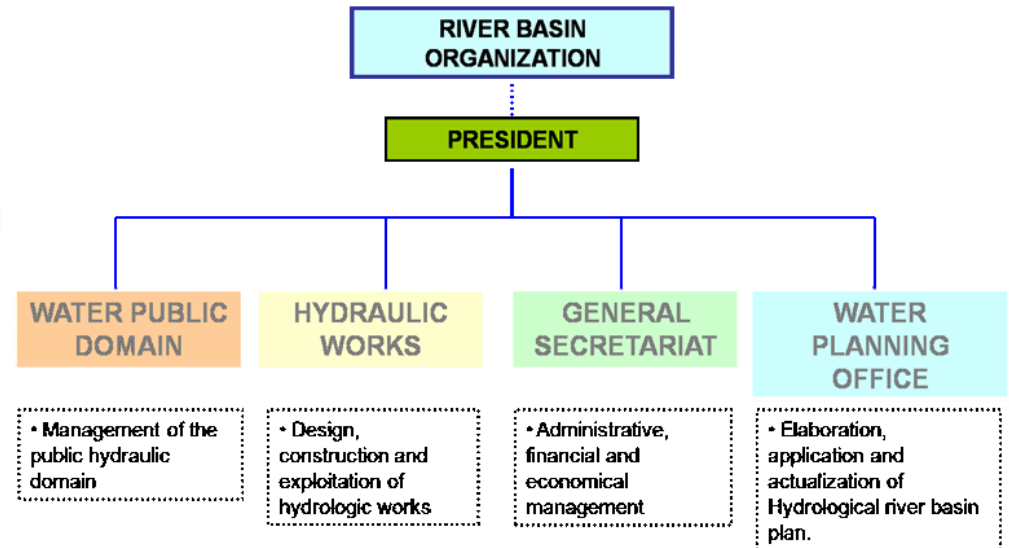
Presentation title: A research “end-user’s” perspective of IWRM research

Speaker: Teodoro Estrela, Deputy Director, Júcar River Basin Authority (Spain)

# Introduction

- WFD is representing a substantial change in the IWRM in EU countries and an opportunity to improve the water management in the River Basin Organisations (RBOs).
- Main changes in the Spanish water management are: water body protection, drought management, analysis of climate change impact, use of non conventional water resources, hydro economy, etc.
- There is a need of research regarding these topics in Spanish RBOs.

# Introduction

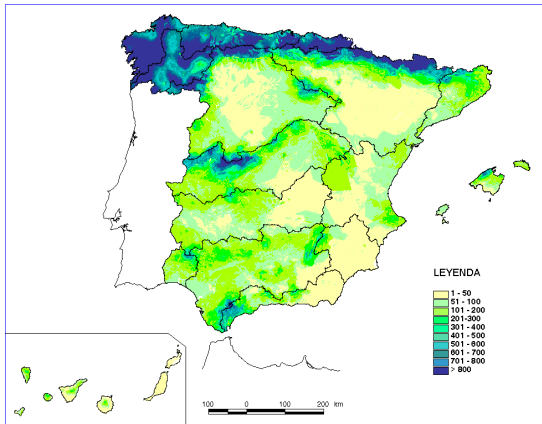


## River Basin Organisations

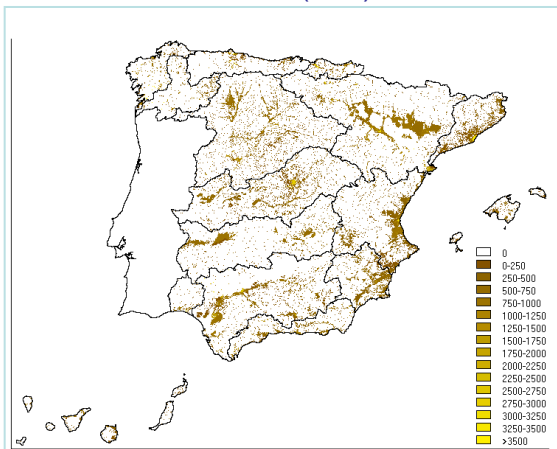
Regional organisations for the water resources management created in Spain between 1926 and 1934. The river basin management concept was established in these years.

- Water resources, droughts and climate change.
- Water uses and pressures on water bodies.
- Status of Water bodies.
- Economic issues.

# Water resources in Spain



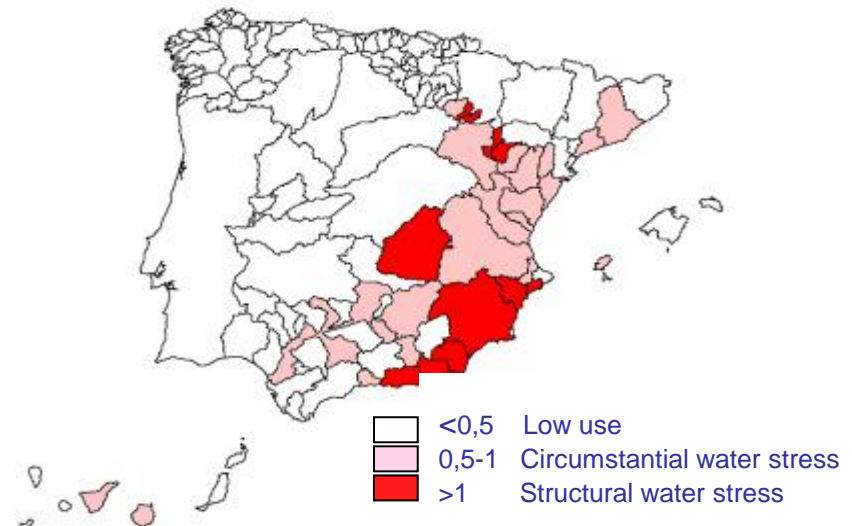
Mean annual runoff (mm)



Mean annual water demand (mm)

## Water is a scarce resource in Spain

- High irregularity in time and space
- Limited water resource: conflicting water demands

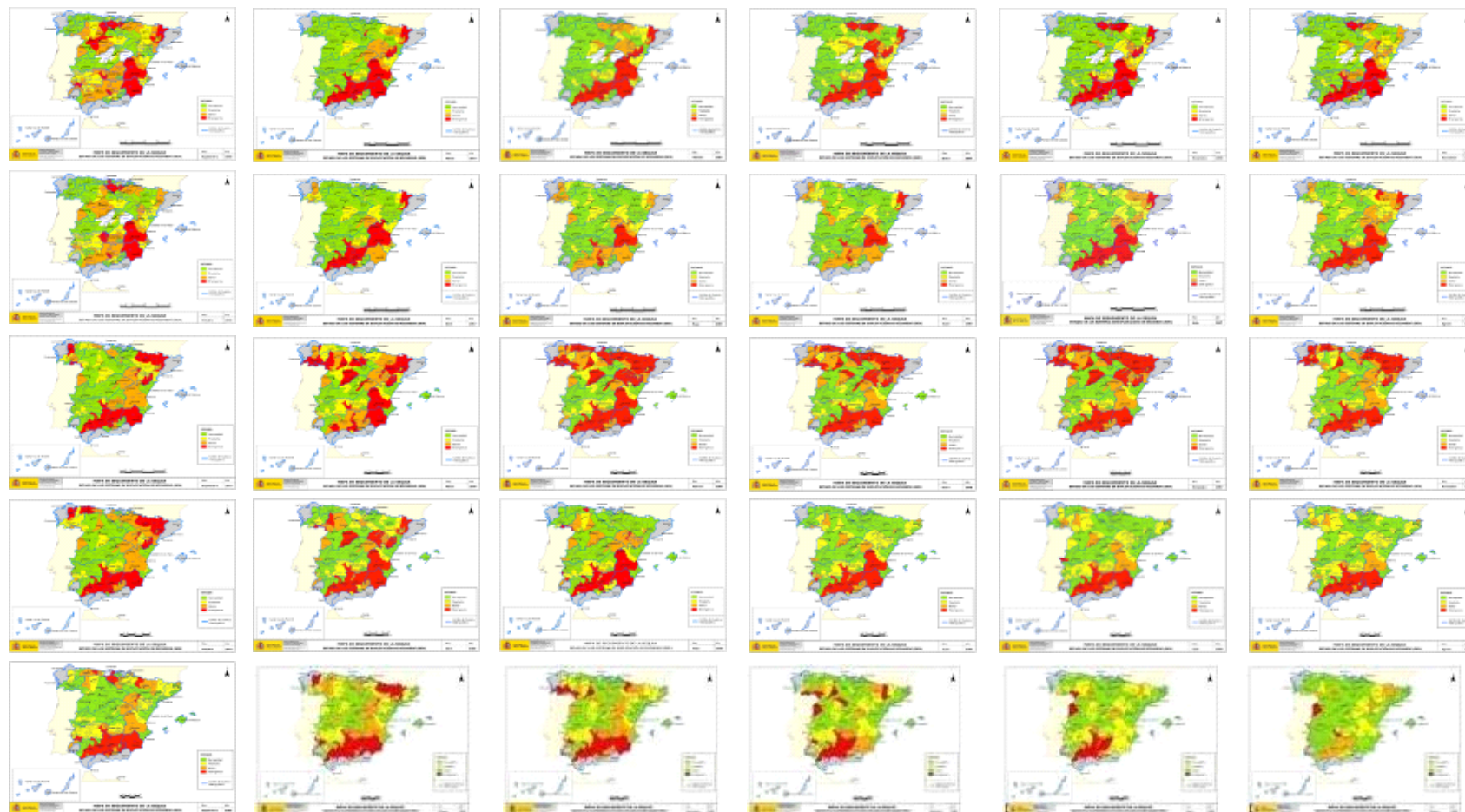


Water consumption index: water consumption / available water resource

# Drought Management

- The impacts produced by droughts can be exacerbated when occurring in regions with water scarcity.
- Traditionally, droughts have been managed as a crisis situation.
- The Law 10/2001 of the Master Water Plan, established the bases for a drought planned management.
  - The Ministry of Environment, for river basin organizations has established a **global hydrologic indicator system** to foresee drought situations and to be a reference for the formal declaration of droughts.
  - River Basin Organizations have developed **Drought Management Plans (DMPs)**. These plans were approved in 2007.

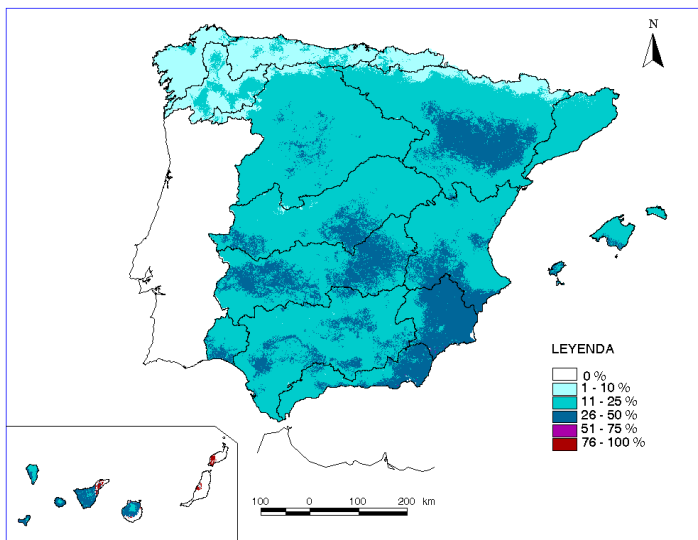
# Global system of hydrological indicators



Maps are published monthly since 2005 (MARM web page: [www.marm.es](http://www.marm.es))

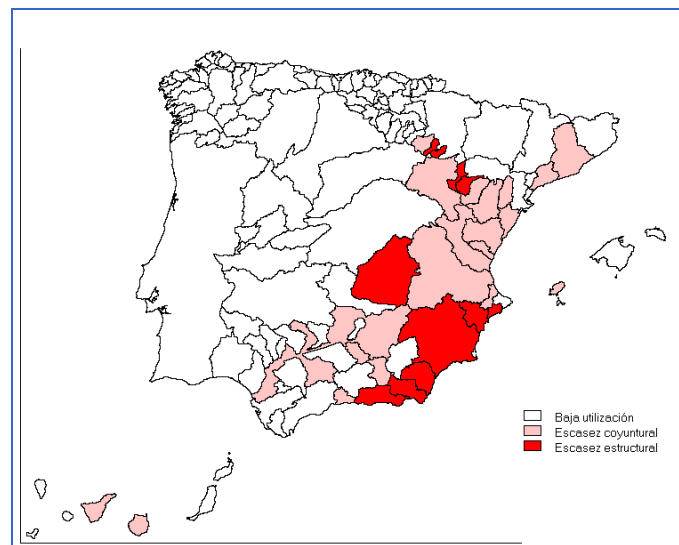
# Impacts of Climate Change

Preliminary assessment reports on climate change impacts in Spain show a significant decrease in water resources. The areas with the greatest reductions are the most vulnerable areas (water scarcity and droughts).



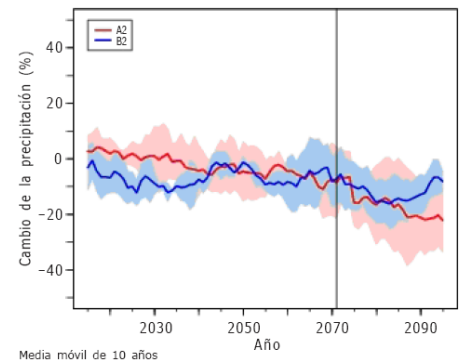
Impact on runoff reduction for a decrease of 5% in mean annual precipitation and an increase of 1°C in mean annual temperature (year 2030)

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

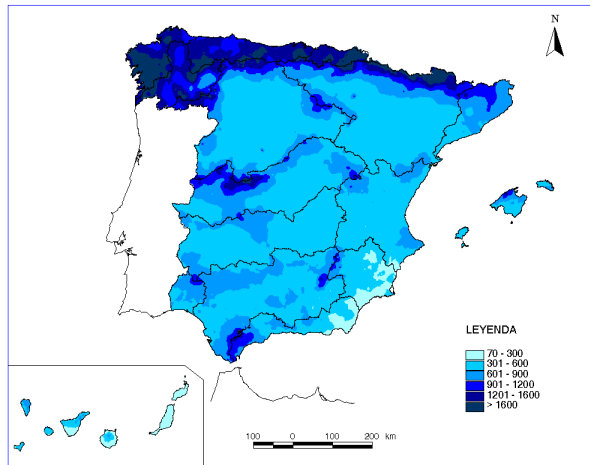


Vulnerability: water scarcity risk in water resource systems

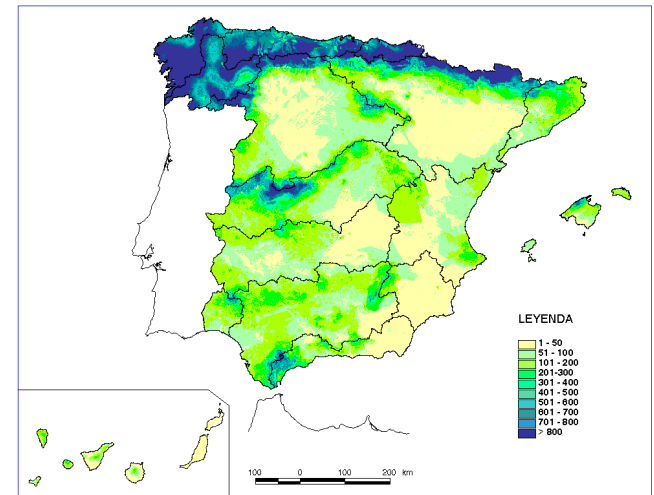
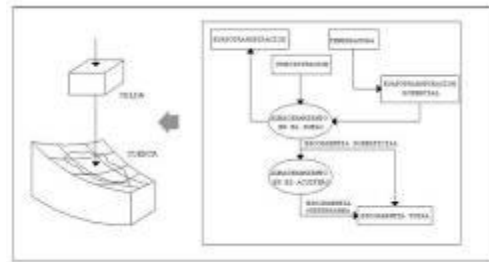
- The Ministry of Environment, Rural and Marine Affairs with the help of the Spanish Research Centres is updating studies about the effects of Climate Change on:
  - Water resources in natural conditions.
  - Water demand.
  - Water availability in water resources systems.
  - Ecological status of water bodies.
  
- Water resources simulation models using climate regionalised sceneries for Spain supplied by the State Meteorology Agency are being used.



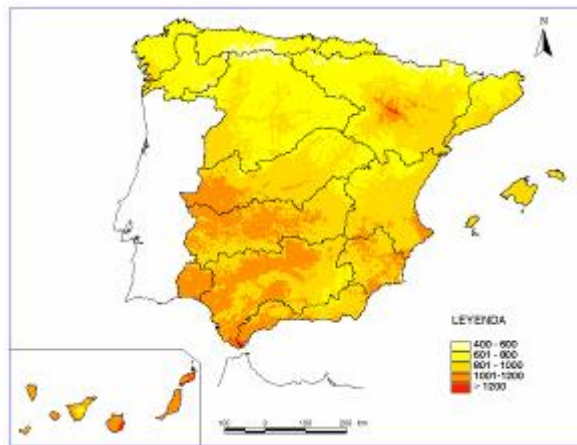
# Impacts of Climate Change



Precipitation



Runoff



Potential evapotranspiration

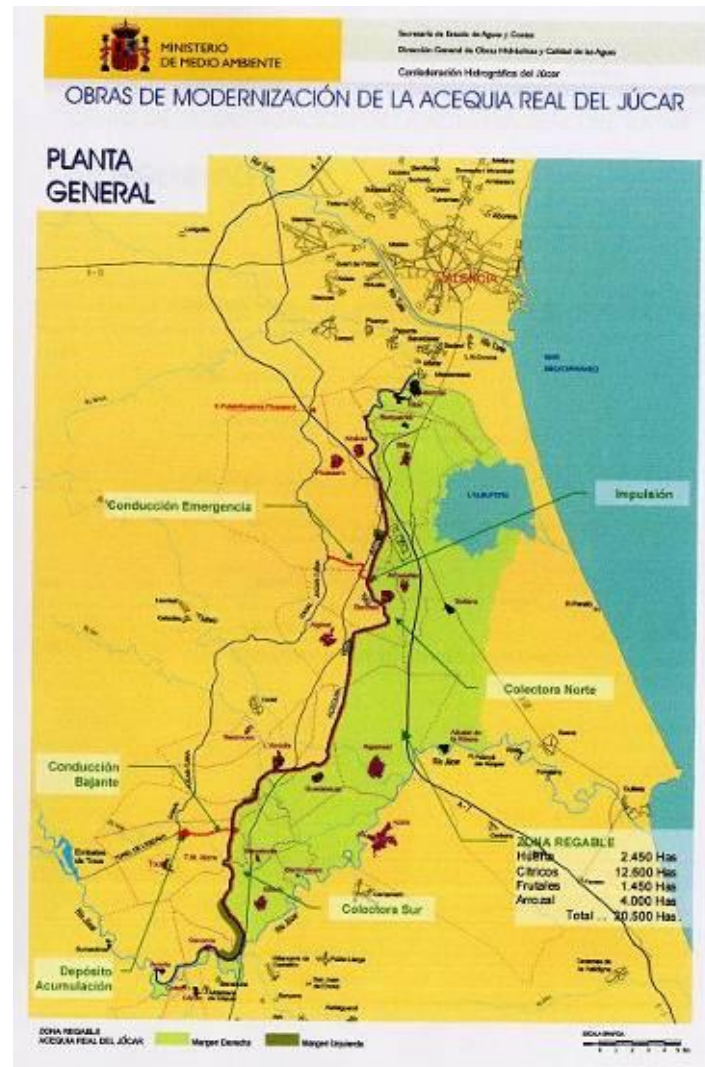
# Improving efficiency and control in irrigation

- Best practices for water savings.
- Efficiency and control instruments => improvement in “quality of life” for farmers.



**Fases de la Acción:**

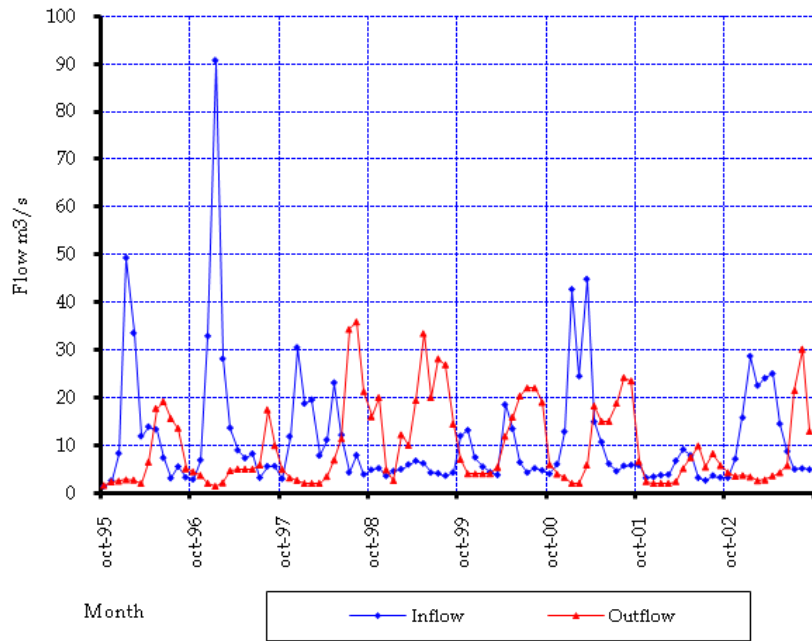
- **Red en alta:** Consiste en la conducción a presión que baja desde la salida del Túnel de la Lataja y discurre en paralelo al Canal Principal. Incluye obras complementarias.
- **Mejora del canal principal:** Obras destinadas a renjabilizar el funcionamiento del canal y mejorar la gestión.
- **Red de distribución a presión y cabezales de riego:** Conducciones a presión desde la red en alta hasta los cabezales de riego y sus conducciones.
- **Mejora de la red de distribución.**
- **Red de distribución hasta la parcela:** Dotación de una red desde el primer rudo después del cabezal de riego hasta cada parcela.
- **Cabezal y red de riego:** Consiste en el cabezal de cada parcela y su correspondiente red de riego.



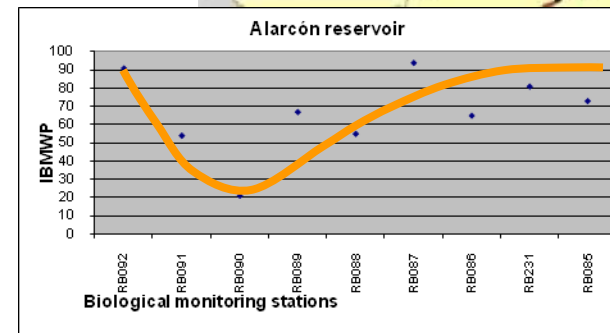
- Need to develop improved technologies for water reuse and desalination.
- Study of the possible impacts of salinity on poseidonia.



# Effects of water uses

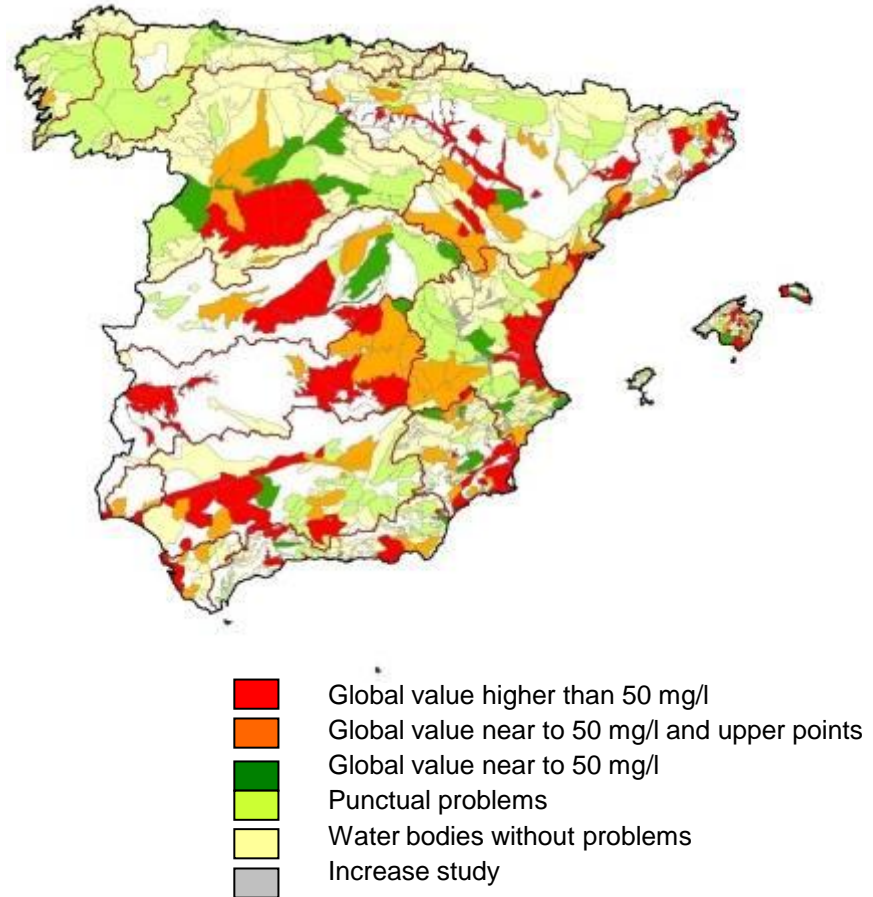


The effects of human interventions (dams, channels, ...) on the hydro-morphological and ecological status of water bodies must be analysed.



# Diffuse pollution

- Diffuse pollution problems in Spain are mainly caused by fertilisers and pesticides.
- Assessment methods for identifying and quantifying agricultural polluting sources are needed.
- Nitrate simulation models are being used to define WFD environmental objectives, including exemptions.



- The Spanish Water Act establishes environmental river flow regimes to maintain the fish life and the riverside vegetation.
- Elements of environmental flow regimes according to Spanish Regulation are:
  - Seasonal minimum flows
  - Maximum flow rates
  - Maintenance of ordinary floods if removed by the effect of dams

# Environmental river flows

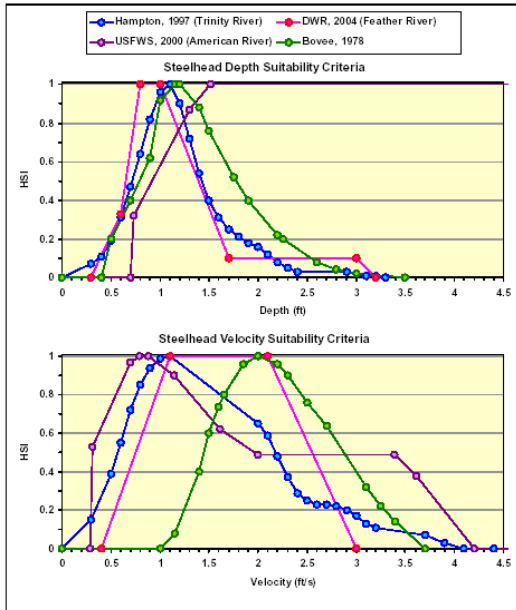
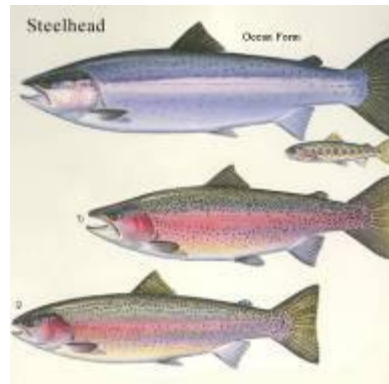


Figure C-1. Comparison of Steelhead Depth and Velocity Habitat Suitability Index (HSI) Curves

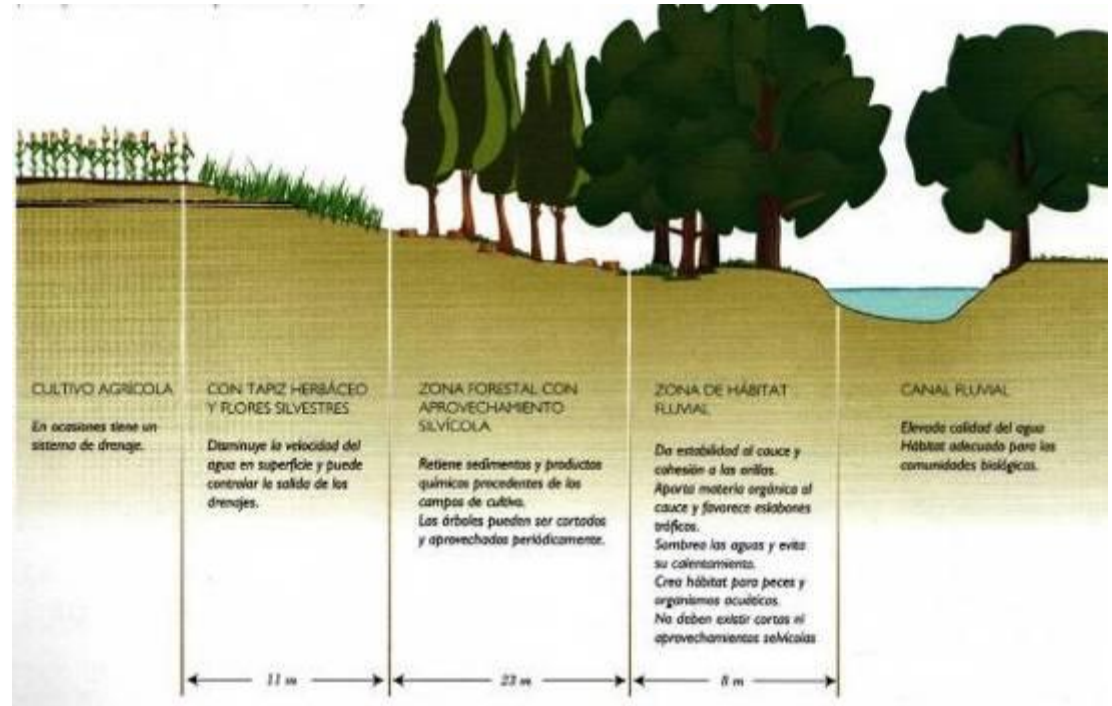


## Indexes of habitat sustainability

Batimetría																																	
Distancia a margen izquierda (m)	0	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5	23.5	24.5	25.5	26.5	27.0	28.5	29.5	30.5	30.6
Calado (m)	0.35	0.46	0.61	0.83	1.11	1.44	1.74	2.01	2.26	2.50	2.79	3.12	3.34	3.45	3.44	3.29	3.26	3.37	3.41	3.38	3.24	2.99	2.74	2.50	2.26	2.02	1.80	1.60	1.39	1.16	0.91	0.64	0.60
Margen izquierda (m) de	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	30.6
Margen izquierda (m) hasta	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	30.6	
Velocidad (m/s) en calado 0 a 0,5	0.00	0.00	0.02	0.06	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.18	0.19	0.21	0.24	0.25	0.24	0.23	0.23	0.23	0.22	0.21	0.20	0.19	0.18	0.16	0.14	0.12	0.09	0.07	0.06	0.00
0,5 a 1,0			0.00	0.00	0.04	0.11	0.14	0.14	0.15	0.18	0.20	0.23	0.24	0.25	0.26	0.27	0.28	0.27	0.26	0.26	0.26	0.25	0.24	0.21	0.19	0.16	0.13	0.10	0.07	0.04	0.02	0.01	
1,0 a 1,5				0.00	0.02	0.06	0.11	0.16	0.20	0.21	0.22	0.22	0.22	0.23	0.24	0.25	0.25	0.25	0.25	0.26	0.26	0.25	0.23	0.20	0.17	0.12	0.08	0.05	0.02	0.01	0.00	0.00	
1,5 a 2,0					0.00	0.03	0.08	0.13	0.18	0.20	0.21	0.22	0.23	0.23	0.24	0.24	0.24	0.24	0.24	0.24	0.25	0.24	0.21	0.19	0.17	0.13	0.07	0.03	0.01	0.00	0.00		
2,0 a 2,5						0.00	0.01	0.05	0.14	0.19	0.20	0.20	0.21	0.22	0.23	0.24	0.23	0.22	0.21	0.18	0.14	0.11	0.08	0.05	0.02	0.00	0.00						
2,5 a 3,0							0.00	0.01	0.02	0.05	0.11	0.14	0.15	0.16	0.17	0.18	0.19	0.19	0.18	0.14	0.07	0.02	0.01	0.00	0.00								
3,0 a 3,5								0.00	0.00	0.02	0.06	0.08	0.08	0.07	0.04	0.03	0.04	0.04	0.03	0.02	0.01	0.00	0.00										
3,5 a 4,0									0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00											
4,0 a 4,5										0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00											
4,5 a 5,0											0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00											
Calado máximo (m)	0.35	0.46	0.61	0.83	1.11	1.44	1.74	2.01	2.26	2.50	2.79	3.12	3.34	3.45	3.44	3.29	3.26	3.37	3.41	3.38	3.24	2.99	2.74	2.50	2.26	2.02	1.80	1.60	1.39	1.16	0.91	0.64	0.60
Caudal en la vertical (m³/s)		0.00	0.01	0.03	0.07	0.13	0.20	0.26	0.33	0.43	0.51	0.59	0.64	0.66	0.69	0.71	0.72	0.72	0.71	0.70	0.65	0.57	0.50	0.44	0.36	0.27	0.20	0.15	0.10	0.07	0.04	0.03	0.00
Sección en la vertical (m²)	0.00	0.20	0.54	0.72	0.97	1.28	1.59	1.88	2.13	2.38	2.64	2.95	3.23	3.40	3.44	3.36	3.27	3.32	3.39	3.40	3.31	3.12	2.86	2.62	2.38	2.14	1.91	1.70	1.75	1.91	1.03	0.78	0.06

Velocities obtained with hydraulic models

- Effect of hydro-morphological changes on riverine eco-systems.
- Develop of methods for the assessment of environmental flow regimes.
- River restoration strategies

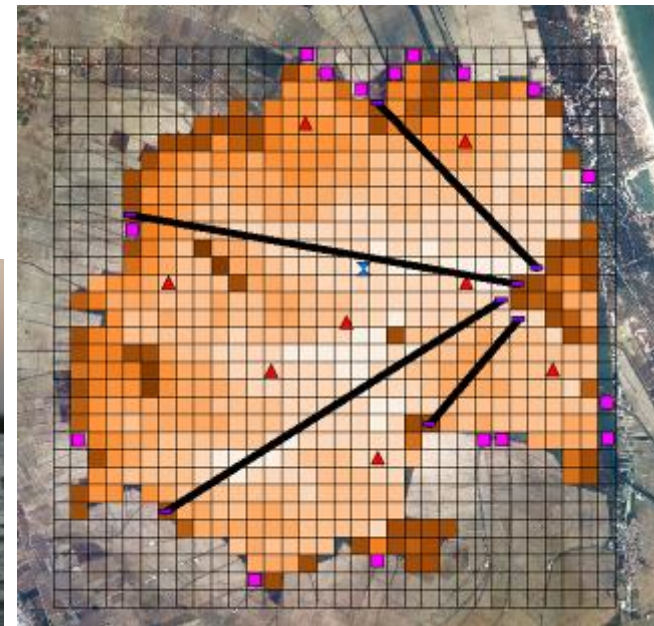
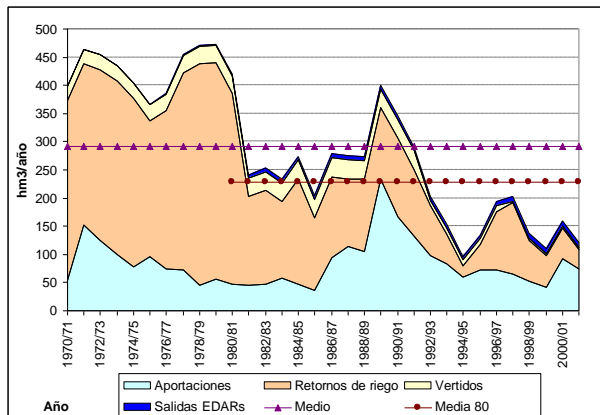


Spanish Ministry of Environment, Rural and Marine Affairs has published a Guide entitled “Methodologies for elaborating projects on river restoration”.

# Water needs in wetlands



Water needs (quantity and quality) of wetland ecosystems to maintain their functionality and structure



Hydrodynamics and water quality: 3D mathematic model

Inflows to Albufera Lake: hydrologic and hydraulic models

- Environmental and resource costs must be evaluated and incorporated in the cost recovery analysis.
- Tools to select the proper measures to reach the environmental objectives must be developed under a cost-efficiency analysis.
- Criteria to be applied on the disproportionate costs analysis.
- Water market scenarios for dealing with water scarcity and drought risk should be researched.
  - Interesting Spanish experience during 2004-2008 drought

# Conclusions

- Water Framework Directive is an opportunity to improve water research regarding IWRM.
- Research needs of organisations in charge of water management should be prioritised in research programmes.
- Coordination between River Basin Organisations, Consulting Firms, Research Institutes and Universities is crucial.