

# **DROUGHT VULNERABILITY AND IMPACTS ASSESSMENT IN TRANSBOUNDARY RIVER BASINS. THE IBERIAN PENINSULA CASE.**

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# Iberian transboundary river basins: context

# Iberian transboundary river basins

- **5 shared river basins** (Minho, Lima, Douro, Tejo and Guadiana) that cover more than 45% of the Iberian territory, 21% of that share corresponding to Portugal
- 70% of total water use on those shared river basins occurs in Spain
- 2/3 of the existing storage capacity is located in Spain
- In compliance with **EU Water Framework Directive (WFD)** both countries have recently approved (2016) the 2<sup>nd</sup> (6 years') cycle of the **River Basin Management Plans (RBMPs)** of (each countries' part of) the 4 shared transboundary RBDs (Minho and Lima in a same RBD)
- **Both PT and SP, under the work of the Albufeira Convention's Commission (CADC), declared the goal of developing a common and joint RBMP for each shared RBD**



(CADC: <http://www.cadc-albufeira.eu/>)

# The Albufeira Convention

**Convention on co-operation for Portuguese-Spanish River Basins Protection and Sustainable Use**, usually referenced as the Albufeira Convention (1998), aiming at:

- i. solving the 1964 and 1968 still active Conventions mutually recognised limitations (mostly concerned with sharing of hydro-electric potential and the bordering river stretches)
- ii. **defining the framework of bilateral co-operation** for freshwater and groundwater protection as also of the related aquatic ecosystems and also for sustainable use of the 5 shared rivers watershed resources.
- iii. **introducing a basin-based water management** and a decision-making process **in compliance with the WFD**, framed on coordinated River (sub-) Basin Management Plans, one per country.

The **Commission** for Convention Development and Appliance (**CADC**) integrates two Workgroups:

- ☐ Workgroup for Planning
- ☐ Workgroup for Information Exchange

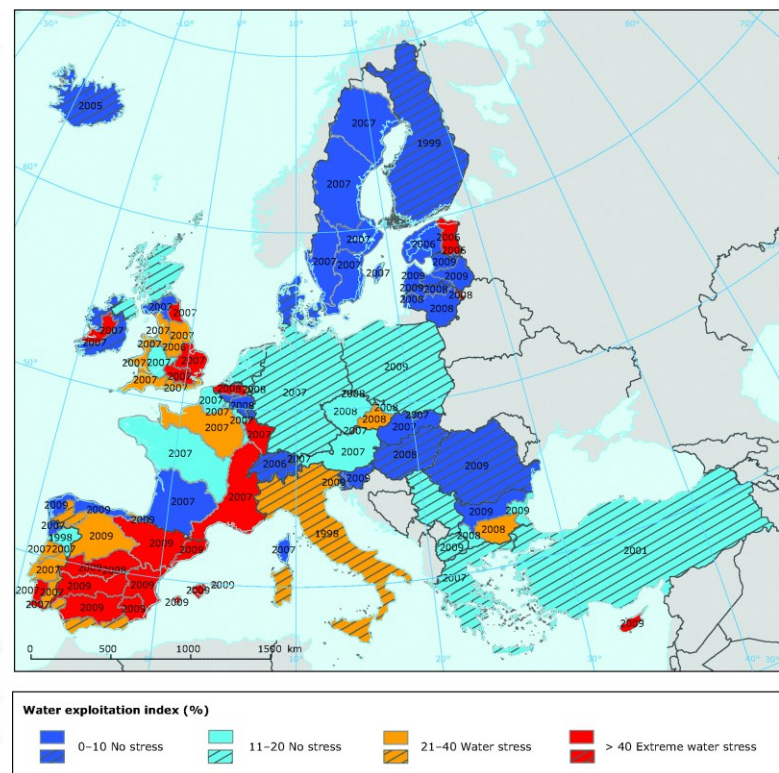
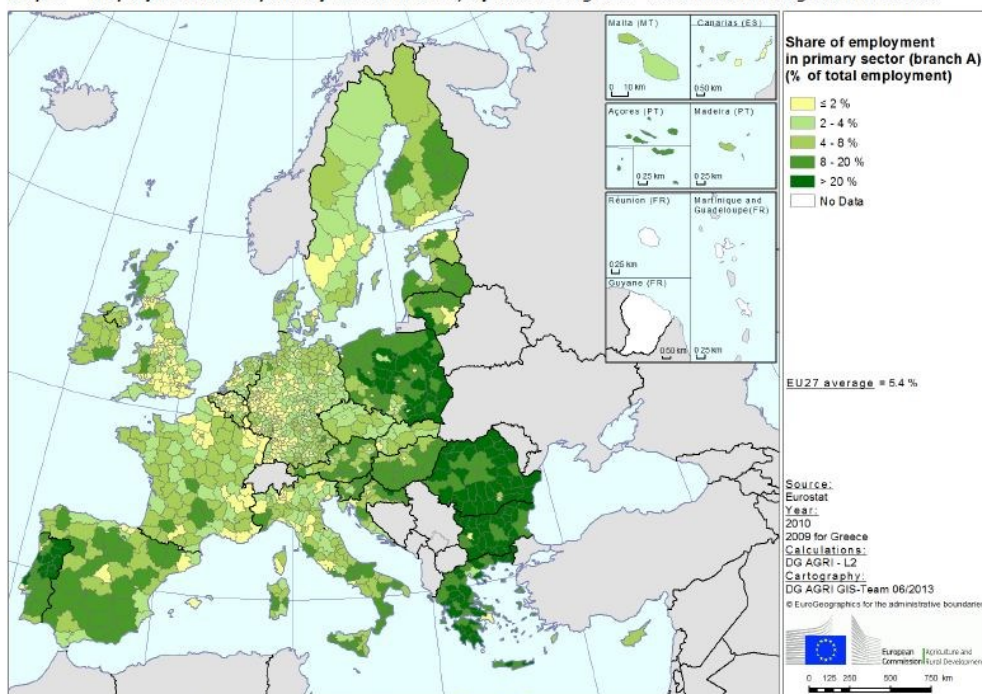
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# Drought vulnerability

# Water dependency / scarcity issue

- Mediterranean climate
- The primary sector (mostly agriculture & livestock) have an important share in GDP (in both countries) and on employment (in PT), bigger than EU average
- Significant water stress (Water Exploitation Index) in Iberian Peninsula

Map 1 Employment in the primary sector in 2010, by NUTS 3 regions - Data from the Regional Accounts



([http://ec.europa.eu/agriculture/rural-area-economics/briefs/pdf/08\\_en.pdf](http://ec.europa.eu/agriculture/rural-area-economics/briefs/pdf/08_en.pdf))

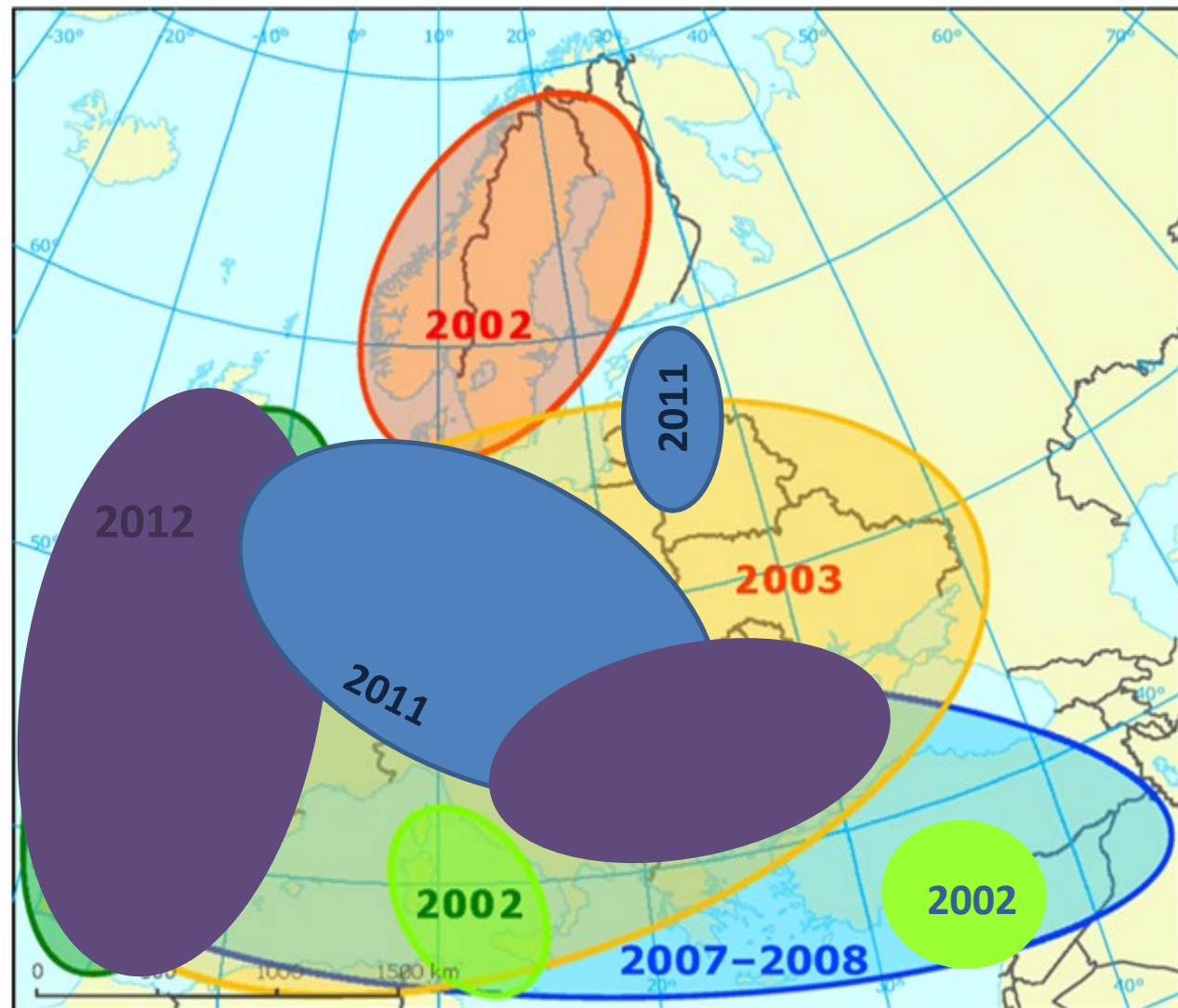
(<http://www.eea.europa.eu/publications/towards-efficient-use-of-water>)

# Occurrence of drought events

Drought events in Iberian Peninsula in the last two decades:

- 2003
- 2005\*
- 2007-2008
- 2012\*

\*More severe events



(<http://www.eea.europa.eu/data-and-maps/figures/main-drought-events-in-europe>)

# Climate change

## Key observed and projected climate change and impacts for the main regions in Europe

### Arctic

Temperature rise much larger than global average  
Decrease in Arctic sea ice coverage  
Decrease in Greenland ice sheet  
Decrease in permafrost areas  
Increasing risk of biodiversity loss  
Intensified shipping and exploitation of oil and gas resources

### Northern Europe

Temperature rise much larger than global average  
Decrease in snow, lake and river ice cover  
Increase in river flows  
Northward movement of species  
Increase in crop yields  
Decrease in energy demand for heating  
Increase in hydropower potential  
Increasing damage risk from winter storms  
Increase in summer tourism

### North-western Europe

Increase in winter precipitation  
Increase in river flow  
Northward movement of species  
Decrease in energy demand for heating  
Increasing risk of river and coastal flooding

### Mountain areas

Temperature rise larger than European average  
Decrease in glacier extent and volume  
Decrease in mountain permafrost areas  
Upward shift of plant and animal species  
High risk of species extinction in Alpine regions  
Increasing risk of soil erosion  
Decrease in ski tourism

### Coastal zones and regional seas

Sea-level rise  
Increase in sea surface temperatures  
Increase in ocean acidity  
Northward expansion of fish and plankton species  
Changes in phytoplankton communities  
Increasing risk for fish stocks

### Central and eastern Europe

Increase in warm temperature extremes  
Decrease in summer precipitation  
Increase in water temperature  
Increasing risk of forest fire  
Decrease in economic value of forests

### Mediterranean region

Temperature rise larger than European average	Increasing water demand for agriculture	Expansion of habitats for southern disease vectors
Decrease in annual precipitation	Decrease in crop yields	Decrease in hydropower potential
Decrease in annual river flow	Increasing risk of forest fire	Decrease in summer tourism and potential increase in other seasons
Increasing risk of biodiversity loss	Increase in mortality from heat waves	
Increasing risk of desertification		

Source: Climate change, impacts and vulnerability in Europe 2012, An indicator-based report, European Environment Agency

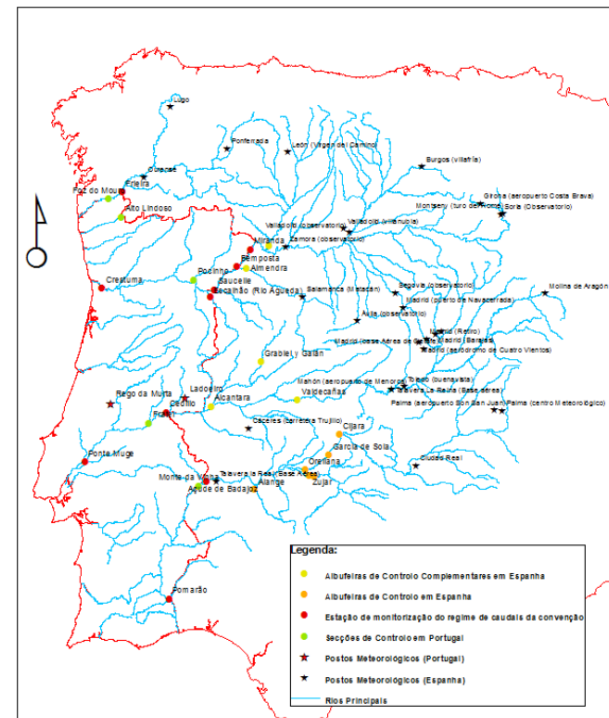
# Transboundary rivers' minimum flow requirements

- The Albufeira Convention establishes a **flow regime that defines minimum inflows at border section** (in Spain) and close to its respective mouths (in Portugal).
- However, the **defined minimum volumes are not applicable in exceptional years** (reduced precipitation)



**Situation of special vulnerability for Portugal**

Figura 15 - Pontos de controlo do regime de caudais da Convenção de Albufeira



Fonte: APA

**However, the minimum flow regime may be revised in order to take into account the environmental flow regimes to be established by the RBMPs**

- **Currently:** established by Spain RBMPs (with values bigger than the MF established by the Albufeira Convention); not still established by Portugal.

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## **Drought planning, monitoring and management**

# Drought planning



## Portugal

- There are no Drought Management Plans (at national and/or at the River Basin scales)
  - The River Basin Management Plans (2<sup>nd</sup> cycle) make reference to the National Plan for Prevention, Monitoring and Contingency for Drought Situations (PPMCSS), but not still approved and made public.
  - This National Plan foresees that all public water supply and irrigation supply management entities shall prepare a contingency plan for drought situations.
- 
- The National Water Plan refers the need to develop a **Drought Early Warning System** as also of water scarcity until 2021.
  - A pilot-version for a DEWS, developed by the former National Water Institute, was presented to public in 2011. However, it was not still implemented.



## Spain

- **Drought Management Plan (PES)** for each River Basin District (RBD) were approved in 2007
  - These drought plans were revised and adapted to the 2<sup>nd</sup> Cycle River Basin Management Plans.
  - Those plans (PES) state that all water supply systems with more than 20.000 inhabitants should have a emergency plan for drought situations. Currently, these plans are only developed for some large cities.
- 
- Current DMPs (PES) refer the need to define **mechanisms to forecast and early detect drought events**. To this end, drought indicators to be defined in next PES (2017) are foreseen to include **seasonal meteorological forecasts** (provided by AEMET).
  - There is a supporting indicator system (for drought warning and monitoring) at river basin level, managed by each RBD Administration. However, none still includes an early detection component.

# Drought monitoring: meteorological monitoring



Portugal



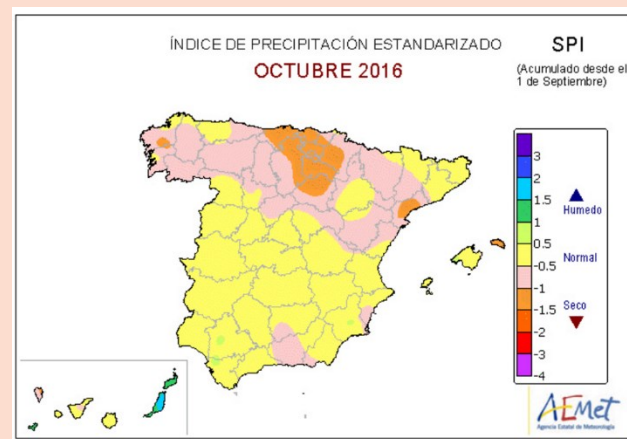
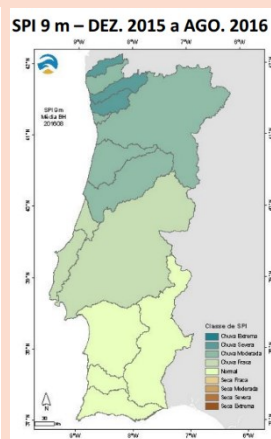
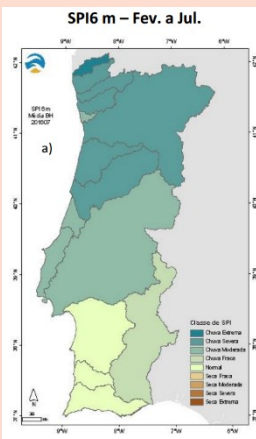
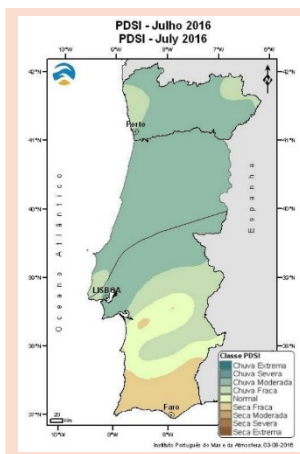
Spain



- Meteorological drought monitoring is carried out monthly based on mainly temperature and precipitation data, obtained in the IPMA stations network .
- Drought indices: PDSI and SPI (3, 6, 9 and 12).



- Meteorological drought monitoring is carried out monthly based on mainly precipitation data, obtained in the AEMET stations network .
- Drought indices: SPI (1, 3 and 6 months, and the elapsed part of hydrometeorological year; 1, 2 and 3 years).



([http://www.gpp.pt/seca2012/IPMA\\_ago2016.pdf](http://www.gpp.pt/seca2012/IPMA_ago2016.pdf))

([http://www.aemet.es/es/serviciosclimaticos/vigilancia\\_clima/vigilancia\\_sequia](http://www.aemet.es/es/serviciosclimaticos/vigilancia_clima/vigilancia_sequia))



- ## Normal, Pre-alert, Alert and Emergency

[illegible]

Figure 1 is a dual-axis line graph showing the evolution of the mean (med) and median (més) of the number of children per woman in Spain from October 2010 to September 2012. The left Y-axis represents the percentage (62.5% to 90.0%), and the right Y-axis represents the number of children (6750 to 9500). The 'med (%)' series (pink solid line) shows a peak in late 2011 followed by a decline. The 'més (%)' series (blue dashed line) shows a peak in early 2011 followed by a decline. Vertical arrows indicate the difference between the two series at various points.

## Spain

- “Índice de Estado”**  
(Index of Drought  
Status)

Dresden-Pillnitz, 16-18 November 2016

# Drought monitoring and management



Portugal



Spain

## Current situations

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>▪ The <b>Commission for the Prevention and Monitoring of the Effects of Drought and Climate Change</b>, established in 2012, is a permanent body responsible by monitoring the droughts evolution <u>at national level</u>. It is supported by a <b>National Drought Workgroup</b> (also a permanent body).</li><li>▪ The <b>National Drought Workgroup</b> gathers the information from IPMA and publishes <u>monthly</u> the <u>meteorological drought state</u> for the country</li></ul> | <ul style="list-style-type: none"><li>▪ Drought monitoring is performed by each <b>River Basin District Administration (RBDA)</b>, based on the indicator's system defined in the respective <u>Drought Management Plan</u> (active since 2007).</li><li>▪ The <b>National Drought Observatory</b> gathers the information from RBDA and publishes <u>monthly</u> the <u>meteorological and hydrological drought state</u> for the country</li></ul> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Declared drought situations

- |                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>▪ Drought management is performed by the <u>above referred Commission</u></li><li>▪ The <b>National Drought Workgroup</b> publishes <u>monthly and final reports</u> with information about the meteorological and hydrologic state and <u>the socio-economic impacts of droughts</u></li></ul> | <ul style="list-style-type: none"><li>▪ Drought management is performed by the each <b>River Basin Administration</b>, following the respective Drought Management Plan</li><li>▪ The <b>National Drought Observatory</b> publishes <u>weekly reports</u> with more detailed information about the hydrological situation and with the measures taken</li></ul> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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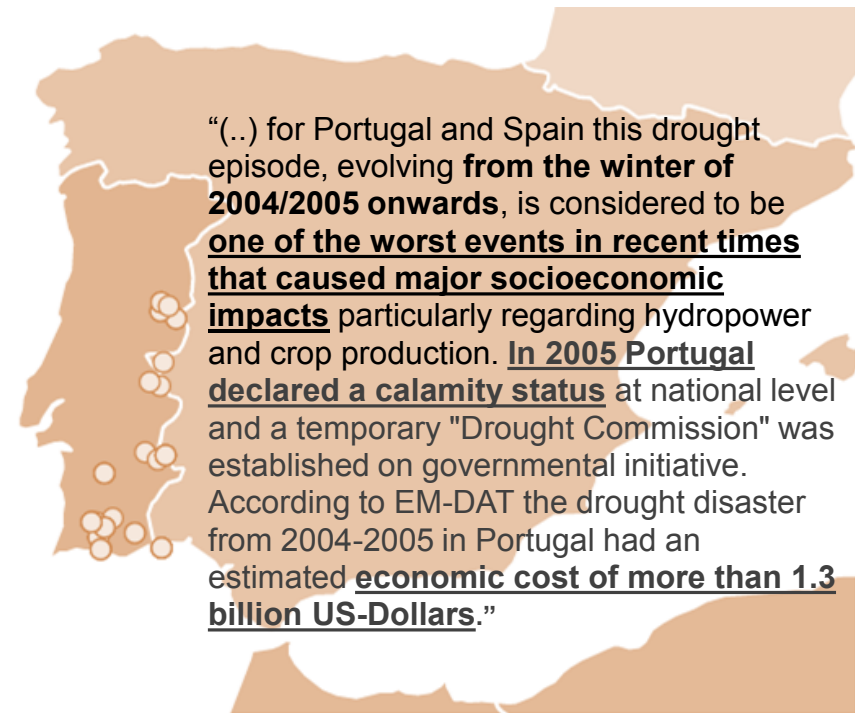
# Impacts assessment

# European Drought Impact Inventory and Database

Developed by the European Drought Centre (EDC)

- European Drought Reference (EDR) database
- European Drought Impact Report Inventory

			Climatological (SPI-6)		
Year	Location	Approx. Duration	Peak Date	Area (%)	Area (10 <sup>6</sup> km <sup>2</sup> )
1959	Northern Europe	5/1959-2/1960	17/10/1959	52.6	3,900
1972	Northern/Eastern Europe	12/1971-7/1972	25/3/1972	57.6	4,268
1973	Central Europe	1/1973-7/1973	20/2/1973	41.7	3,090
1975-1976	Europe	11/1975-2/1977	27/7/1976	61.0	4,521
1989-1990	Mediterranean	2/1989-10/1990	23/2/1989	43.8	3,248
1991-1995	Mediterranean	2/1992-10/1994	11/6/1993	45.5	3,373
1996-1997	Northern Europe	4/1995-7/1996	31/3/1996	49.6	3,674
2000	East/Southeast Europe	1/2001-3/2001	23/1/2001	30.5	2,261
2003	Europe	4/2003-11/2003	12/8/2003	54.8	4,063
2004-2007	Iberian Peninsula	7/2004-6/2007	25/2/2006	38.0	2,817
2007	Eastern Europe	2/2007-8/2007	30/4/2007	21.3	1,579



Location of drought impact reports. Darker colors refer to more reported impacts in the EDII. Scroll over each country to see more detail.

# Socio-economic impacts assessment

## Drought reports (on drought event periods):



### Portugal

- Drought socio-economic impacts assessed and presented in the monthly reports and resumed in the final report (e.g., in 2012 drought)



- The impacts on agriculture received special attention assessing various activities at regional scale, namely through:
  - agricultural production losses,
  - irrigation water availability,
  - production costs, etc.
- Also, the impacts on other situations like forest fires, electricity production or public supply were evaluated.



### Spain

- Reports of monitoring and balance of the declared drought situations do not present a socio-economic impacts evaluation.

A characterization of the effects of historic droughts was performed for the definition of the indicator system's drought levels in each **River Basin Drought Management Plan**

Drought Management Plans (approved in 2007) include a common proposal for a methodology to carry out the socio-economic impacts evaluation.

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## Final remarks

## Final remarks

- ✓ Portugal and Spain, under the umbrella of EU policy and bilateral agreements, have a declared goal of going from a current **basin-based coordinated water management to an integrated management of the shared river basins;**
- ✓ **In terms of drought monitoring, planning and management the two countries are currently at different stages,** Spain ahead with Drought Management Plans in place for about a decade;
- ✓ **Still a common set on indicators and drought alert levels should be agreed between the two countries;**
- ✓ **Also, the minimum flow regime discharges** defined by the Albufeira Convention shall be defined for drought situations, and made adequate to the **ecological flow regime values to be established** by the RBMPs;
- ✓ A great effort is needed to be made at bilateral level, **to integrate and address drought** monitoring, planning and management in **common, namely to frame a joint and integrated DEWS.**

**Obrigado / Tanks  
for Your attention**