The Júcar River Basin District (RBD), with an area of 42,989 km², has an irregular hydrology characteristic of Mediterranean basins. Drought and flood episodes are highly common within its territory, even during the same year, and the balance between water supply and demand is very fragile. Agricultural water demand accounts for nearly 80% of water demand. In general, agricultural demand appears to be stable or decreasing, whereas urban/industrial demand is forecasted to rise. Moreover, in the Valencia coastal plain, between the mouths of rivers Jucar and Turía, there is a shallow lake called Albufera, with an associated wetland. Both the lake and the wetland depend on return flows from irrigation areas in both basins, and also on groundwater flows from the coastal aquifer beneath the plain.

The district suffers from dry periods lasting up to 10 years, alternating with relatively wet periods. This makes water scarcity during dry periods one of the worst problems the water managers must address. This situation has triggered an increased use of non-conventional resources in recent years, such as reuse of wastewater or desalination of seawater. Additionally, conjunctive use of surface-ground waters has been historically a very important option in the district to provide robustness against droughts.

### The Case Study context

The Júcar River Basin District (RBD), with an area of 42,989 km², has an irregular hydrology characteristic of Mediterranean basins. Drought and flood episodes are highly common within its territory, even during the same year, and the balance between water supply and demand is very fragile. Agricultural water demand accounts for nearly 80% of water demand. In general, agricultural demand appears to be stable or decreasing, whereas urban/industrial demand is forecasted to rise. Moreover, in the Valencia coastal plain, between the mouths of rivers Jucar and Turía, there is a shallow lake called Albufera, with an associated wetland. Both the lake and the wetland depend on return flows from irrigation areas in both basins, and also on groundwater flows from the coastal aquifer beneath the plain.

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### Drought as a natural hazard: past & future

In the last 70 years, since records exist, the basin has suffered several drought events alternately with humid periods. According to this, and to the characteristics of Mediterranean climate of the basin, it is likely that the same alternation of dry-humid periods has occurred in the past and will probably occur in the future with more severe impacts due to increasing human pressures and climate change.

The major drought events in modern history were: 1983-1986 (extreme); 1992-1996 (extreme); 1997-2000 (mid); and, most recently, 2004-2008 (extreme). Except for a few local cases, the three first drought periods passed without restrictions on urban supply and did not greatly affect the agricultural production in the mid and northern part of the territory. The situation was quite different in the southern part, where the demands are larger than the supply of renewable resources and therefore the drought aggravated the already difficult situation. The figure shows the spatial distribution of precipitation during the drought of 1997-2000 where the difference between the southern part and the rest of the basin can be observed.
Júcar River Basin District, Spain

Operative Droughts in Water Resource Systems

The Jucar River Basin Water Resources System Case Study Forum

National authorities
Spanish Ministry of Environment
State Secretariat of Rural and Water Environment

Regional authorities
Júcar River Basin District Authority
Generalitat Valenciana
Junta de Castilla - La Mancha

Local authorities
Metropolitan Area of Valencia
Municipality of Albacete
Municipality of Sagunto
Other municipalities

Water Users
Urban water suppliers
Farmers Associations
Iberdrola S.A.

Other stakeholders
Xuquer Viu
Acció Ecologista Agró
Recreational Activities Enterprises
Universidad Politecnica de Valencia
Universidad de Valencia
Universidad de Castilla La Mancha

Current vulnerability to drought

The Jucar River Basin is one of the most vulnerable areas of the western Mediterranean region, due to high water exploitation indexes and to environmental and water quality problems when droughts appear. In the future the situation can worsen, if both human pressures increase and variability of precipitation is higher and temperatures are also higher.

Historically, all sectors suffered severe impacts. Currently, the most severe impacts concern mostly agriculture and hydroelectricity, as urban water supply and the environmental sensible areas have priority. But economic impacts also affect municipalities, since they have to pay more for water in order to purchase water rights or alternative sources of water; and they also affect society, in order to cover the costs of environmental measures during drought.

In addition, natural areas such as the Albufera Lake and other humid areas, intimately tied to hydrology, present a high vulnerability to drought situations. A decrease on inflows occurs during droughts that endangers the minimum flow necessary to preserve these zones and would produce a serious damage to ecosystems of high environmental or ecological value. Water flow reduction can be also associated to a worsening of water quality.

Alternate sources of water in drought situations are aquifers through emergency pumping, mainly for irrigation purposes, but also for urban supply in some cases. Therefore aquifer overexploitation, together with their quality deterioration, must be considered when developing emergency plans to mitigate drought impacts.

In the future, impacts will be higher, at least economically, and it will be harder for agriculture to obtain adequate supply. Moreover, the WFD requirements imply that more water will be assigned to environmental issues, which will inevitably remove water resources from other uses.

Research challenges within the context of Drought-R&SPI

For practical purposes, the research for the JRBD case of study of Drought-R&SPI project will mostly concentrate on the Jucar River Basin Water Resources System, where the experience acquired in the management of the last severe drought episode (2005-2008) was really useful for learning purposes. Therefore, the research challenges can be:

1. Understanding the mechanisms of drought occurrence, and the impacts they have in a large scale case;
2. Finding the best indicators for drought monitoring so that the proper measures and planning can be developed in advance;
3. Developing an appropriate plan of measures for drought impact mitigation in several areas (e.g. agriculture, urban supply, environmental protection, etc.) both prior to drought occurrence and during the emergency episode;
4. Evaluating the effectiveness of the developed measures if they had been available in previous drought episodes;
5. Assessing future drought vulnerabilities due to climatic change and human development in the study area;
6. Development and use of Integrative Decision Support Systems to respond to previous points 1 to 5, and as a Common Shared Vision of the Water Resource System for participative solutions of conflicts due to drought situations.