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Drought Management Plans in the Spanish River Basins

T. Estrela and E. Vargas
*Deputy Water Director
Ministry of Environment, and Rural and Marine Affairs,
Agustín de Betancourt 25, 28071 Madrid, Spain

SUMMARY – During the past recent years, Spain has suffered a significant dry season, which still persists nowadays. Drought events occur frequently, seriously impacting the environment and water availability, causing important socio-economic impacts. These situations highlight the need of a planned and integrated management of water resources, in order to prevent and mitigate the drought linked negative effects. In order to minimise the negative environmental, economic and social impacts caused by drought, the Spanish water policy framework introduces the development of a hydrological indicator national system, which acts as a reference for River Basin Authorities to establish Drought Management Plans (DMP). Following an important launching period in 2006, the Plans were approved through Ministerial Order in March 2007. The DMPs include mitigation measures to be applied in the different water resources management systems, which represent water planning units within river basins. Prior to their approval, the Plans were submitted through a Strategic Environmental Assessment (SEA) and the consequent public participation and dissemination process. Since their implementation, the DMPs have provided the bases for a planned drought management, establishing drought phases and describing the measures that should be progressively applied and the needed monitoring and follow-up processes. Furthermore, the Plans include methods and measures previously agreed by all participating stakeholders: civil society, public administration and scientific community. The main results include a more control and planned management of droughts that has allowed prioritising uses, ensuring public urban supply and minimising environmental degradation. Therefore, the DMPs represent important reference documents that can help in reducing drought impacts, through a planned and participative approach. This article describes the DMPs development process, their contents and the results obtained since their implementation.

Key words: Drought, water resources, mitigation, prevention, hydrological planning, drought indicators, water scarcity.

Introduction and legal framework

Historically, Spain has suffered important dry periods that have caused severe impacts, and have made difficult the water management process to satisfy basic needs, such as urban water supply. Water restrictions and saving awareness campaigns became common practices, which transmitted the need of legal and technical tools to promote a planned drought management.

A clear example of a relevant drought season is the one that started in the hydrological year 2004/05 all over the Spanish territory, which continued in the most vulnerable areas during the following hydrological years and currently persists.

To minimize environmental, economic and social impacts caused by drought situations, the Water Act on the National Hydrologic Plan established that the Ministry of Environment had to achieve, for the river basins dependent on the Ministry, a hydrologic indicator system that would allow forecasting droughts. This indicator system would become a general reference for the River Basin Authorities to formally declare, in a homogeneous way, possible drought and emergency situations.

An indicator based on different parameters (precipitation, reservoir levels, groundwater levels, etc.) was determined, as well as the status and associated colours of drought phases.

The Water Act established that Drought Management Plans had to come into force, and be developed by the River Basin Authorities (RBAs). For this purpose, in 2005, the Directorate General for Water elaborated a guidance document with common grounds to coordinate the development of the Plans. The eight River Basin Authorities finished their task the following year, and the Plans were finally published and approved in March 2007, and made public through the different administration web sites.

Development process of the Plans

During the development process of the Drought Management Plans (Fig. 1), a Strategic Environmental Assessment (SEA) took place in compliance with Law 9/2006 (April 28) concerning the assessment of certain plans and programmes effects on the environment.

The SEA established the phases to elaborate the DMPs, achieving a transparent process ensuring public participation throughout the whole development process.

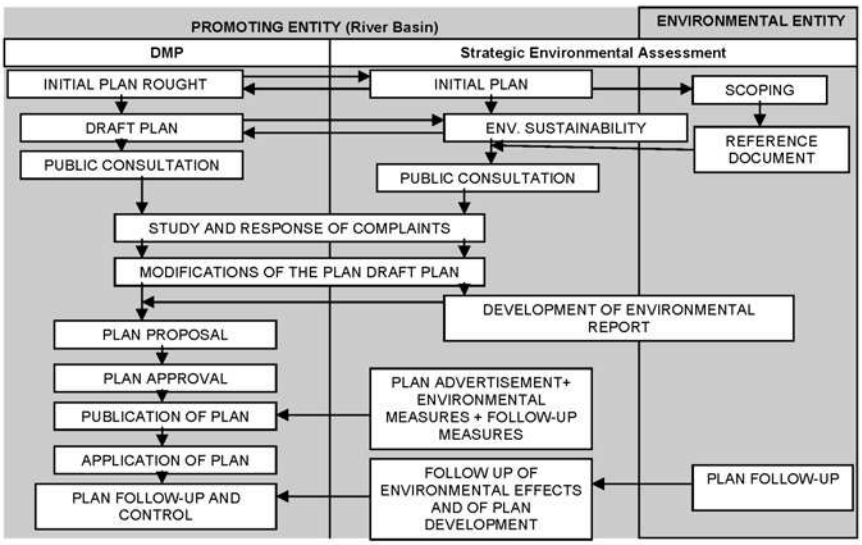

Fig. 1. Diagram of the Drought Management Plans development.

Once the initial plans were developed in June 2006, a scoping process started by the identification of interested parties. Afterward, RBAs developed reference documents, and started the public consultation process of the Plans' drafts and their Environmental Sustainability Reports, which lasted two months. The SEA process produced important remarks such as the identification of possible impacts on vulnerable areas due to the variation of the hydraulic inputs caused by the DMP's measures, identification of vulnerable habitats, special and sensitive fluvial elements, and implementation of more exhaustive surveillance plans.

Then, the DMPs were submitted to the river basins Water Councils to obtain their assessment report, and the process finalized with the approval of the Plans by the Ministry of Environment and their publication on the Official Spanish Bulletin through Ministerial Order MMA/698/2007.

The public review process of the Plans highlighted the absence of information on economic impacts. This remark was highly emphasized by the agricultural sector, since it is highly affected by droughts, and by having to cede water volumes to the prioritized urban use. The Directorate General for Water is currently developing studies on the economic impacts caused by droughts jointly with the Polytechnic University of Madrid. Once the studies produce solid results, the conclusions will be incorporated among other updates into the follow-up reports of the DMPs, enriching the drought assessment and facilitating the decision-making process.

Contents and objectives of the Drought Management Plans

DMPs are reference documents and useful and efficient tools to manage water resources under drought episodes. Their action methods and established measures must be applied once they have been previously agreed by the interested parties: civil society, administration, scientific community, NGOs, etc.

The specific objectives of the DMPs are as follows:

(i) Guarantee water availability required to sustain population life and health.

(ii) Avoid or minimize negative drought effects on the ecological status of water bodies, especially on the ecological water flows, avoiding in any case, any permanent negative effects.

(iii) Minimize negative effects on public water supply.

(iv) Minimize negative effects on economic activities, according to the prioritization of uses established by water policies and river basin management plans.

To achieve these objectives, the DMPs identify the most adequate mitigation measures, adapted to the different established drought thresholds and phases (Fig. 2). Drought status and follow-up maps reflecting this information are published monthly (Fig. 3). During a normal phase, the measures derive from the regular management practices. As the drought progresses and a more critical situation is achieved, measures go from control and information, to conservation and restriction types.

TYPES OF MITIGATION MEASURES							
Indicator	1-0.5	0.5-0.4	0.4-0.3	0.3-0.2	0.2-0.15	0.15-0.1	0.1-0
Status	Normal	Pre-alert		Alert		Emergency	
Objective	Planning	Information-control		Conservation		Restrictions	
Type of measure	Strategic			Tactics		Emergency	

Fig. 2. Type of mitigating measures according to the established threshold.

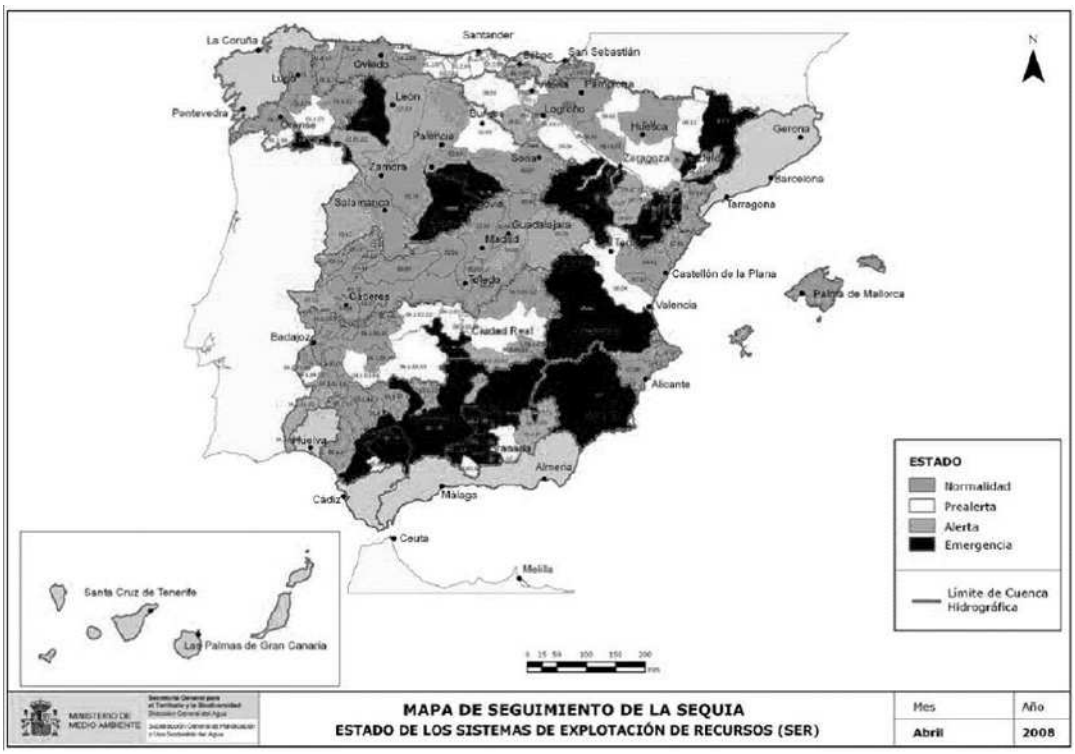

Fig. 3. Drought status map of Spain, April 2008.

DMPs include a drought diagnosis, a program of measures, in addition to a follow-up and management system.

The drought diagnosis includes the identification and characterization of land and environmental elements. This part of the DMP analyses and characterizes historical droughts as well as learnt lessons through those episodes. It includes also one of the most relevant elements of the Plans, which are the indicators, thresholds and drought phases definitions.

The indicators system allows adopting the different mitigation measures in the water resources management systems and applying them in the water public domain use. Basic indicators are selected in each case, taking into account the specificities of each river basin, and include:

(i) Reservoir levels.

(ii) Groundwater levels.

(iii) Flow inputs.

(iv) Precipitation.

Before their use, indicators were weighted and compared to historical series to ensure their applicability and degree of confidence. Numerical values and thresholds were obtained to allow a more simple comparability. This indicator system is currently being improved by including parameters related to water quality and environmental effects.

Other key part of the DMPs is the programme of measures, which defines and describes the different types of measures that can be applied in each area, according to the drought phase, as was shown in Fig. 2.

Last, the DMPs include a management and follow-up system that allows analyzing the implementation of measures, using corrective measures in case the established objectives are not met. This part of the Plan describes the methodology to develop follow-up reports, and analyses each drought period as it occurs.

European activity

The obtained results and accumulated experience in managing droughts has leaded to the development of different works at the European level. Spain has leaded, for instance, jointly with France and Italy, the Water Scarcity and Droughts Expert Network within the Water Framework Directive (2000/60/EC) Common Implementation Strategy. Accordingly, the DG for Water coordinated the development of a Drought Management Plan report, complementary to the River Basin Management Plans, which the European Water Directors approved in Lisbon on November 2007.

In addition, the Ministry has actively participated in the process linked to the Communication to the European Council and Parliament "Addressing the challenge of water scarcity and drought in the European Union", published in 18 July 2007 (EC, 2007). In agreement with this Communication, Spain defends the implementation of a European strategy to tackle this issue and the establishment of a European Drought Observatory.

Additional works focus on research activities, including the project funded by the EC "XEROCHORE-An Exercise to Assess Research Needs and Policy Choices in Areas of Drought".

Conclusions

The DMPs are being applied by the Spanish River Basin Authorities and are publically available through the corresponding web sites and administration offices. They serve as reference documents to manage drought episodes and minimize the associated social, environmental and economic

impacts. The acquired experience in drought management and DMPs development has been shared at the European and international level, and has translated into an EU report to promote their use and application.

The Spanish Drought Management Plans are allowing a planned drought management coordinated by River Basin Authorities, and as their main achievement, they have avoided applying restrictions in urban areas throughout the current drought period. These Plans establish drought phases, describe appropriate measures to apply according to homogenized national drought indicators, mitigate this extreme phenomenon's negative effects and foster a comprehensive follow-up of its episodes and evolution. They are powerful tools, which, through agreed bases among stakeholders, prioritise uses and protect water ecosystems under stressed situations.

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