

# Use of Hydrological Drought Indices in Spain



1, 2 September 2011

Jorge Ureta Maeso

Ministry of Environment, Rural and Marine Affairs, Spain

## Use of Hydrological Drought Indices in Spain

### SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

---

- Main tools for drought planning used by the Spanish General Administration
  - Indicators Set to control the hydrological status of water bodies by river basin authorities.
  - Special Plans for Situations of Alert and Temporary Drought
  - Urban Water Supply Emergency Plans in towns with more than 20.000 inhabitants

## **Use of Hydrological Drought Indices in Spain**

SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

---

# Special Plans for Situations of Alert and Temporary Drought

## Use of Hydrological Drought Indices in Spain

### SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

**New approach** → FROM a crisis management system, focused on immediate reaction to the problems posed by drought

↓  
TO a well-planned system for preventing water scarcity and drought

→ Tackling the hydrological droughts not the meteorological

**Definition** → Management Plan that allows to detect hydrological drought and adopts mitigation measures in advance that minimize the effects on water demand and on the environment

→ It is NOT an Infrastructure Plan, although it can include measures related to infrastructures

**The DMP were approved by Ministerial Order (MAM/698/2007) in 2007**

## Use of Hydrological Drought Indices in Spain

### SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

---

#### **Specific objectives :**

- Guarantee water availability to sustain population life and health.
- Avoid or minimize negative drought effects on the ecological status of water bodies.
- Minimize negative effects on public water supply.
- Minimize negative effects on economic activities, according to the prioritization of uses established by the River Basin Management Plans.

## Use of Hydrological Drought Indices in Spain

### SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

---

#### Tools:

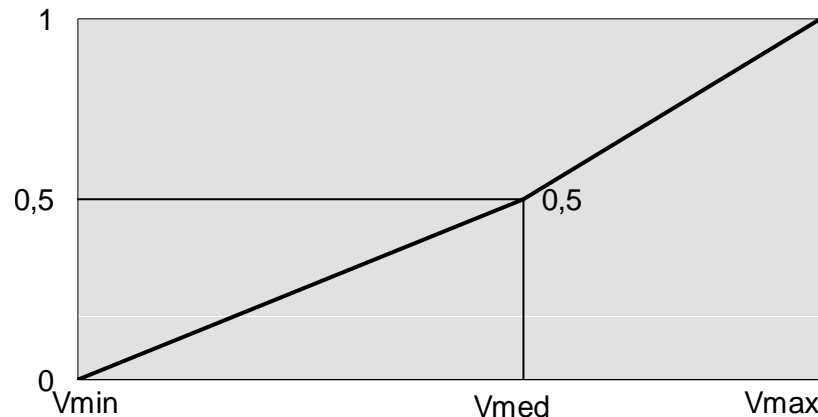
- **Indicator system** → which allows the early detection of droughts by establishing progressive thresholds on drought gravity.
- **Programme of measures** → which defines the measures to put in place in function of the phase
- **Management system** → which allows to adopt the measures.
- **Follow-up system** → thanks to specific indicators allows to determinate the correctly function of these plans.

## Use of Hydrological Drought Indices in Spain

### SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

#### Indicator system

- Each river basin develops its own set of indicators adapted to its specific characteristics.
- All the indicators are normalised to values from 0 to 1, which allows the combination of different indicators by weighted additions.



$$- \text{Si } V_i \geq V_{med} \Rightarrow I_e = \frac{1}{2} \left[ 1 + \frac{V_i - V_{med}}{V_{max} - V_{med}} \right]$$

$$- \text{Si } V_i < V_{med} \Rightarrow I_e = \frac{V_i - V_{min}}{2(V_{med} - V_{min})}$$

## Use of Hydrological Drought Indices in Spain

### SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

---

- REPRESENTATIVE INDICATORS
  - Reservoir Storage Level Indicator and Reservoir Outflow
  - Streamflow Indicator in Gauging Stations
  - Piezometric Indicators
  - Pluviometric indicators
  - Snowpack



## Use of Hydrological Drought Indices in Spain

### SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

By using hydrological simulations, 4 drought phases had been established

1. Normal situation
2. Pre-alert situation
3. Alert situation
4. Emergency situation

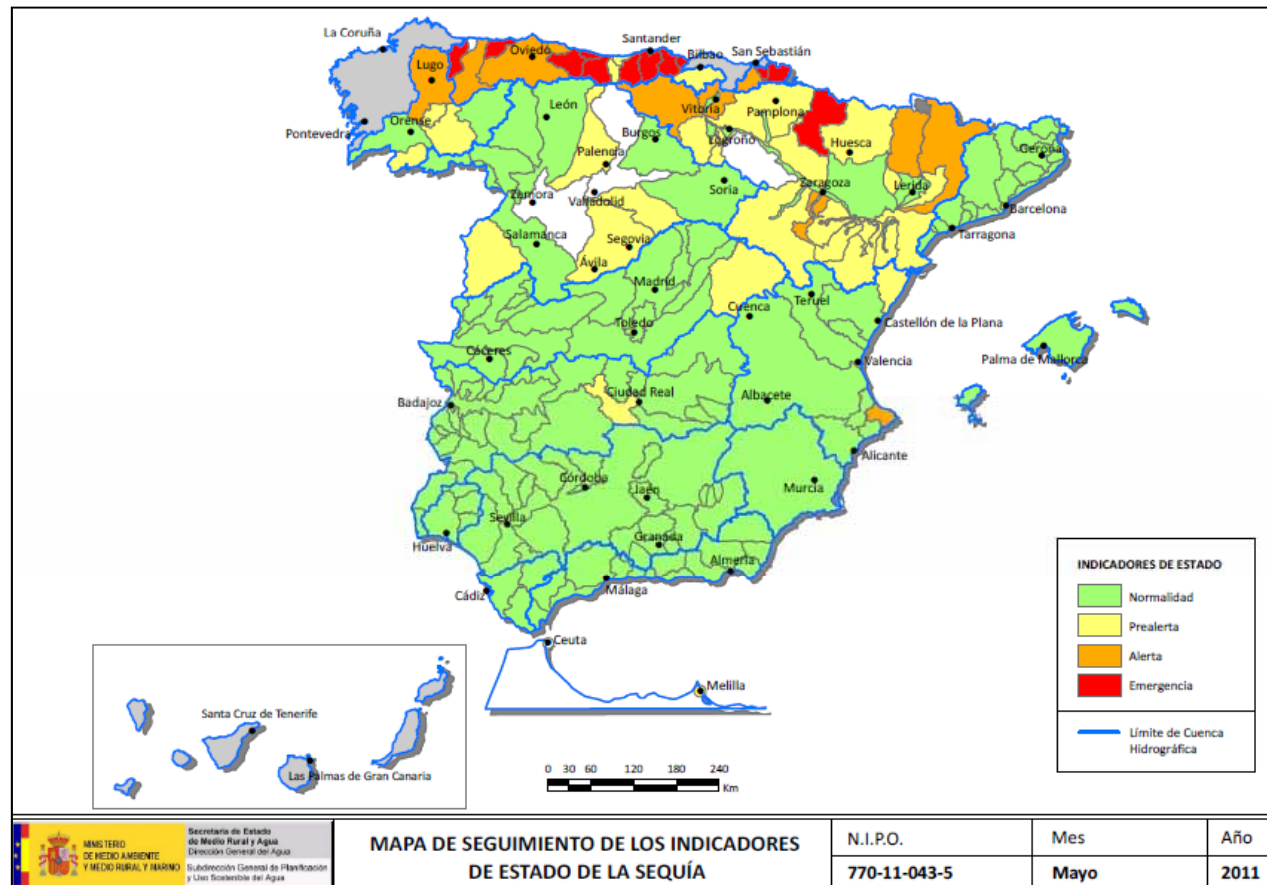


Since the DMPs were launched, the indicators have been recorded at least monthly, increasing in many cases to a weekly collection.

# Use of Hydrological Drought Indices in Spain

## SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

Taking into account the information provided by the indicators, maps relating to the drought situation in the country are created on a monthly basis.



## Use of Hydrological Drought Indices in Spain

### SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

#### Programme of measures

Each river basin elaborates a programme of measure to launch in the different phases of drought severity

| TYPES OF MITIGATION MEASURES |           |                     |              |              |
|------------------------------|-----------|---------------------|--------------|--------------|
| Status                       | Normal    | Pre-alert           | Alert        | Emergency    |
| Objective                    | Planning  | Information-control | Conservation | Restrictions |
| Type of measure              | Strategic | Tactics             |              | Emergency    |

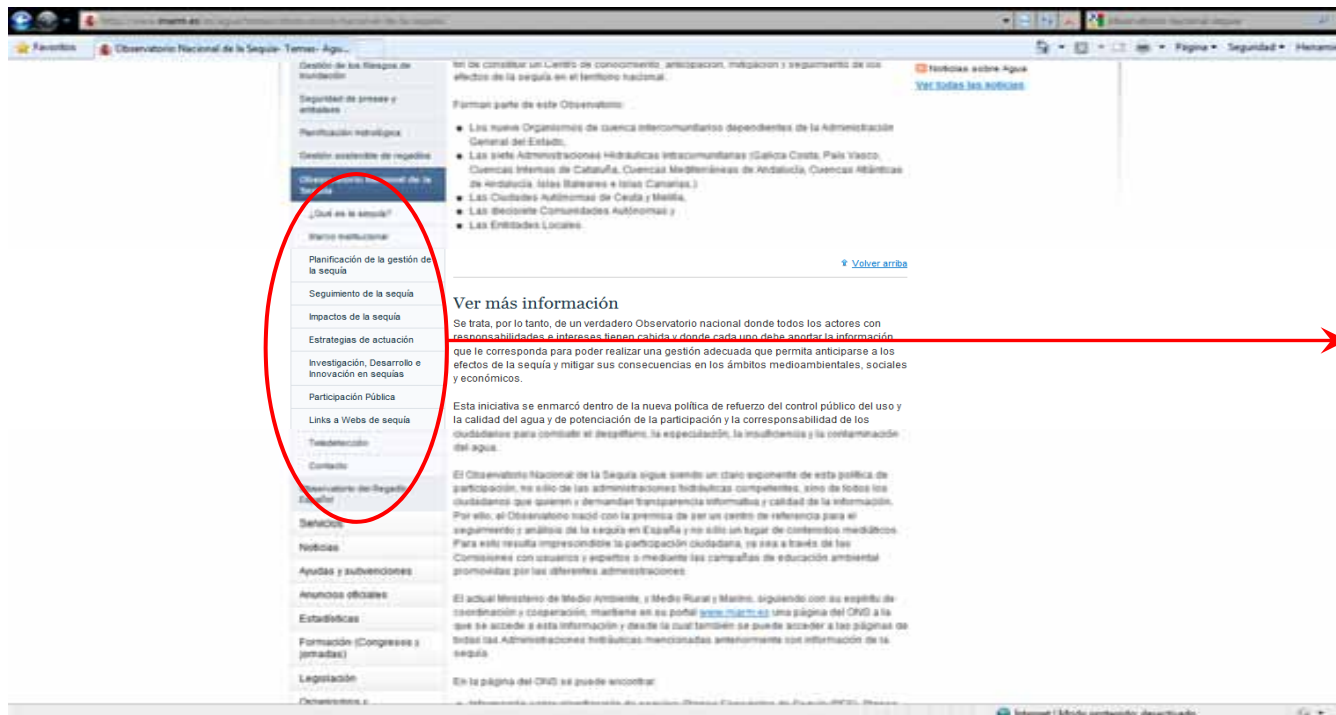
- Strategic measures → long term actions, included in the River Basin Management Plan
- Tactic measures → planned short term actions
- Emergency measures → extraordinary actions adapted to the extension, affected areas and gravity of the situation

# Use of Hydrological Drought Indices in Spain

## SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

### Drought National Observatory:

<http://www.marm.es/es/agua/temas/observatorio-nacional-de-la-sequia/>



|                                   |
|-----------------------------------|
| National Drought Observatory      |
| What is drought?                  |
| Institutional framework           |
| Drought management planning       |
| Drought monitoring                |
| The impact of drought             |
| Action strategies                 |
| Research, Development, Innovation |
| Public Participation              |
| Links to drought websites         |
| Remote sensing                    |
| Contact                           |

- Free access to the general public.
- Weekly reports on the drought situation.

# Use of Hydrological Drought Indices in Spain

## SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

### National Drought Observatory

What is drought?

Institutional framework

Drought management planning

Drought monitoring

The impact of drought

Action strategies

Research, Development, Innovation in drought

Public Participation

Links to drought websites

Remote sensing

Contact

The screenshot shows the website **marm.es** (Ministerio de Medio Ambiente y Medio Rural y Marino). The page is titled "Planificación de la gestión de la sequía" (Drought management planning). It features a navigation menu with options like "Ministerio", "Áreas de actividad", "Participación pública", "Cartografía y SIG", "Estadísticas", "Ayudas y subvenciones", "Sede Electrónica", "Sala de Prensa", and "Atención al ciudadano". The main content area includes a map of Spain showing the status of water resources (SER) and a news section with articles such as "El MARM invierte 40 millones de euros en dos proyectos de prevención de inundaciones en la provincia de Valencia" and "La reserva hidráulica se encuentra al 81.8% de su capacidad total".

## **Use of Hydrological Drought Indices in Spain**

SPECIAL PLANS FOR SITUATIONS OF ALERT AND TEMPORARY DROUGHT

---

Thank you for your  
attention!

Jorge Ureta Maeso

[jureta@hotmail.com](mailto:jureta@hotmail.com)