Drought Management Guidelines in the Mediterranean Region

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Instituto Agronómico Mediterráneo de Zaragoza, CIHEAM, Spain
Mediterranean Drought Preparedness and Mitigation Planning (MEDROPLAN)
Europe Aid Cooperation Office, MEDA WATER Programme
Contract number: ME8/AIDCO/2001/0515/59770 - P 027

Objectives

1. Develop Guidelines for Drought Preparedness Plans

2. Set up a Drought Preparedness Network for the Mediterranean countries (NEMEDCA)

Partners

- University of Cyprus
- National Technical University of Athens, Greece
- University of Catania, Italy
- Institut Agronomique et Vétérinaire Hasan II, Morocco
- Confederación Hidrográfica del Tajo; Canal de Isabel II;
- Fundación Ecología y Desarrollo; Universidad Politécnica de Madrid, Spain
- Direction Générale des Barrages et des Grands Travaux Hydrauliques, Ministère de l'Agriculture, Tunisia

Coordination

Dunixi Gabiña, Mediterranean Agronomic Institute of Zaragoza, Spain - iamz@iamz.ciheam.org
Ana Iglesias, Universidad Politécnica de Madrid, Spain - ana.iglesias@upm.es
http://www.iamz.ciheam.org/medroplan
MEDROPLAN Partner countries
Guidelines for drought management

What are the Guidelines?

• The Guidelines are a “manual” that provide an effective and systematic approach to develop drought management plans based on the existing scientific and technical knowledge and adapted to the socio-economic, political and environmental conditions.

• The Guidelines have been based on successful experiences in coping with drought risk in many regions. Most of the successful experiences emphasize risk-based management as a critical approach to mitigate the impacts associated with drought in societies with different vulnerabilities.

• The proposed approach can be applied in the Mediterranean region but also in other regions of the world suffering from drought.
Objectives of the Guidelines

- Moving from a **reactive to a proactive approach** to fighting drought (preparedness)
- Placing emphasis on the **institutional and legal framework** and on stakeholder participation
- Introducing a **wide range of methodologies to cope with drought**.
- Reaching the broadest audience of **decision makers and stakeholders**, technical and non-technical
- Introducing the **framework of drought management** and **describing the needed elements of drought management plans**
- Providing **scientific and detailed methodology** for drought analysis and management (Technical Annex)
Structure of the Guidelines

1. The **Drought Management Guidelines**, which are a summary of all the components developed within the framework of the project. Published in 6 languages (Arabic, English, French, Greek, Italian and Spanish)

2. **Examples of drought management experiences** in the 6 countries participating in the MEDROPLAN consortium

3. The **Technical Annex** to the Drought Management Guidelines, which is published in English as a special issue of the CIHEAM journal “Options Méditerranéennes”. The Technical Annex contains a deeper development of the issues dealt with in Drought Management.

4. The **MEDROPLAN website** that contains all the information contained in the documents mentioned previously and also provides a tutorial that guides the user in developing a drought management plan (CD version)
Components of the Guidelines

- Organizational component
- Methodological component
- Operational component
- Public review component

EXAMPLES of application

The planning framework
The planning framework

1. Defines the local, regional and national purpose for developing drought planning
   • Drought plan addresses the full range of possible risks or focuses on a few. This determines the choice of methodologies for developing the plan

2. Defines concepts and a common language
   • To increase the quality and acceptance of drought management plans
   • To increase acceptance of or trust in the science that is the basis of the planning
   • To provide essential information and insights about drought preparedness
Why are concepts necessary?

<table>
<thead>
<tr>
<th>Water Scarcity Regime</th>
<th>Nature produced</th>
<th>Man induced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary</td>
<td>Drought</td>
<td>Water shortage</td>
</tr>
<tr>
<td>Permanent</td>
<td>Aridity</td>
<td>Desertification</td>
</tr>
</tbody>
</table>

**Drought** Natural temporary imbalance of water availability (persistent lower-than-average precipitation).

**Water shortage** Man-induced temporary water imbalance.

**Aridity** Natural permanent imbalance in the water availability (low average annual precipitation).

**Desertification** Man-induced permanent imbalance in the availability of water (inappropriate land use).
Precipitation deficit

Unsaturated soil storage

Surface water storage

Groundwater storage

Surface flow deficit

Groundwater deficit

Water supply systems

Socio-economic systems

Economic, social, environmental impacts

Actions to increase water availability

Actions to reduce water demand

Actions to mitigate drought impacts

MEDROPLAN, Mediterranean Drought Preparedness and Mitigation Planning

Economic, social, environmental impacts
## Characteristics of the approaches to drought management

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Limitations</th>
</tr>
</thead>
</table>
| **Reactive**    | - Based on the implementation of actions after a drought event has occurred and is perceived.  
- Taken in emergency situations but not based in a contingency plan.  
- Often results in inefficient technical and economic solutions since actions are taken with little time for evaluating optimal actions.  
- Limited stakeholder participation |
| **Proactive or preventive** | - Actions designed in advance, with appropriate planning tools.  
- Includes stakeholder participation.  
- Provides both short and long term measures and includes early warning systems.  
- Includes a contingency plan for emergency situations.  
- The ineffective coordination and cooperation among institutions and the lack of policy to support and revise the proactive plan may lead to an inadequate planning. |
Components of the Guidelines

Organizational component

Methodological component

The planning framework

Operational component

Public review component

EXAMPLES of application
The organizational component

- The management of drought in a defined area requires integrative approaches and integrated management, based not only on the natural features, but also on socio-economic conditions of the area.

- Understanding the national institutional regime is a key factor for establishing effective and integrated drought management plans that incorporate monitoring, public participation, and contingency planning.

- The organizational component provides a common methodology for analysing the organizations and institutions relevant to water scarcity and drought management.
Expected outcome of the organizational component

- Explicit description of institutions and organizations, including stakeholders, with competence in water policy and administration

- Explicit description of the linkages and hierarchical relations among the organizations and institutions

- Information on existing drought preparedness and management plans

- Description of the data collection system in the country, specifying the institutions responsible, the type of reporting and accessibility, and the primary uses of the data

- Evaluation of the strengths and weaknesses of the legal and institutional framework and potential improvements
Components of the Guidelines

- Organizational component
- Methodological component
- The planning framework
- Operational component
- Public review component

EXAMPLES of application
Methodological component

• Defines the **technical approach** to link drought and management actions

• This includes:
  – Drought characterisation
  – Risk and vulnerability analysis (diagnostic)
  – Data, models, and tools
## Thresholds for the Indices Used

<table>
<thead>
<tr>
<th>SPI value</th>
<th>RDI&lt;sub&gt;st&lt;/sub&gt; value</th>
<th>Deciles Value</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.00 or more</td>
<td>2.00 or more</td>
<td>deciles 9-10: highest 20%</td>
<td>Extremely wet</td>
</tr>
<tr>
<td>1.50 to 1.99</td>
<td>1.50 to 1.99</td>
<td>deciles 7-8: next highest 20%</td>
<td>Severely wet</td>
</tr>
<tr>
<td>1.00 to 1.49</td>
<td>1.00 to 1.49</td>
<td>deciles 5-6: middle 20%</td>
<td>Moderately wet</td>
</tr>
<tr>
<td>0 to 0.99</td>
<td>0 to 0.99</td>
<td>deciles 3-4: next lowest 20%</td>
<td>Mildly wet</td>
</tr>
<tr>
<td>0 to -0.99</td>
<td>0 to -0.99</td>
<td>deciles 1-2: lowest 20%</td>
<td>Mild drought</td>
</tr>
<tr>
<td>-1.00 to -1.49</td>
<td>-1.00 to -1.49</td>
<td></td>
<td>Moderate drought</td>
</tr>
<tr>
<td>-1.50 to -1.99</td>
<td>-1.50 to -1.99</td>
<td></td>
<td>Severe drought</td>
</tr>
<tr>
<td>-2 or less</td>
<td>-2 or less</td>
<td></td>
<td>Extreme drought</td>
</tr>
</tbody>
</table>
Methodological component

- Defines the **technical approach** to link drought and management actions
- This includes:
  - Drought characterisation
  - Risk and vulnerability analysis (diagnostic)
  - Data, models, and tools
Risk analysis in agricultural systems
(Ameziane, Ouassou)

The occurrence of a disaster such as drought depends on two factors: hazard and vulnerability. The model generally used to address risk analysis in agriculture is:

\[ \text{Risk} = \text{Hazard} \times \text{Vulnerability} \]

From this model, three points are important to consider:

- Preventing the occurrence of drought is impossible; in the Mediterranean, drought can, at present, only be monitored.

- Understanding and characterizing the drought hazard in agriculture is therefore an essential component of risk analysis.

- Decreasing the impact of the drought risk by reducing the vulnerability of the agricultural systems is possible.
Defining hazard, vulnerability and risk in agriculture

**Hazard** is the probability of occurrence of a potentially damaging phenomenon (e.g. drought)

**Vulnerability** is the degree of loss resulting from the occurrence of the phenomenon

- **Exposure** is the nature and degree of which a the agricultural system is exposed to significant climatic variations

- **Sensitivity** is the degree to which the system is affected by drought

- **Adaptive capacity** is the ability of the system to adjust to climate variability and extremes in order to moderate potential damages or to cope with the consequences.
Methodology for creation of Risk map in agriculture

Classified hazard map
- Very low hazard
- Low hazard
- Moderately low hazard
- Moderate hazard
- High hazard
- Very high hazard

Risk map
- High risk
- Moderate risk
- Low risk

Classified vulnerability map
- Very low vulnerability
- Low vulnerability
- Moderate vulnerability
- High vulnerability

MEDROPLAN, Mediterranean Drought Preparedness and Mitigation Planning
### Drought Vulnerability Index (Iglesias)

<table>
<thead>
<tr>
<th>Component</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable natural capital</td>
<td>Agricultural water use; precipitation; soil degradation; area salinised</td>
</tr>
<tr>
<td>Human and civic capital</td>
<td>Life expectancy at birth; Literacy rate; Active population in agriculture; Population without sanitation water</td>
</tr>
<tr>
<td>Institutional response</td>
<td>Drought regulations; Coordination among institutions</td>
</tr>
<tr>
<td>Economic capacity</td>
<td>GDP and GDP from agriculture/GDP; Energy use; Population below poverty line; Access to drinkable water</td>
</tr>
<tr>
<td>Mechanisms of risk sharing</td>
<td>Insurance; Agricultural policies</td>
</tr>
<tr>
<td>Agricultural innovation</td>
<td>Cultivation techniques (fertiliser, machinery); Crop varieties</td>
</tr>
</tbody>
</table>
Drought Vulnerability Index

Scen 1 All components weighted equally
Scen 2 Human and civic resources more important
The planning framework

EXAMPLES of application

Organizational component
Methodological component
Operational component
Public review component
Operational component

Defines strategies to adopt drought management actions

Permanent measures

Measures to be implemented during drought
**METHODOLOGICAL COMPONENT**

**Objective:** define methods to assist in permanent drought planning and planning during a drought event and select the thresholds for management actions

**Characteristics:** Objectivity and simplicity in the presentation of the results

- **Drought characterisation and monitoring**
  - Methods of analysis: A combination of indicators and indices to characterize: meteorological, agricultural, hydrological and social drought

- **Evaluation of drought risk**
  - Methods of analysis:
    1. Qualitative evaluation of potential risk (consultation with stakeholders)
    2. Quantitative evaluation of probabilities of occurrence or damage

- **Evaluation of vulnerability to drought**
  - Methods of analysis:
    A combination of indicators and indices to define the characteristics of a system that makes it susceptible to suffer losses from drought

**OPERATIONAL COMPONENT**

**Objective:** define the operational measures of permanent drought planning and measures during a drought event (responding to drought)
Operational component

According to a proactive approach, operational component includes planning and implementation of the long and short term measures to reduce drought vulnerability and to mitigate drought impacts.

**Drought preparedness planning**
*(before a drought event)*
- Continuous monitoring & early warning  
  *Normal and drought periods*
- Establishing priorities
- Management objectives
- Defining thresholds
- Defining actions

**Implementation of plans**
*(during a drought event)*
- Triggering the implementation of actions  
  *during drought*
Defining threshold levels and management objectives

**INDICATORS**
(From Drought Monitoring System)

**PRE-ALERT**
Moderate risk of drought
Objective: ensure acceptance of the measures to be taken

**ALERT**
Expected drought likely will produce significant impacts
Objective: overcome situation, guarantee water supply

**EMERGENCY**
Impacts already occurred and severe water shortage if drought persists
Objective: minimize damage, giving the priority to the drinking water
Defining actions for drought management

MEASURES

PRE-ALERT
- Low cost, indirect, voluntary
- Non structural directed to influence water demand, avoid worse situations
- Focus on communication and awareness
- Intensification of monitoring and evaluation of worse case scenarios

ALERT
- Low cost, direct, mandatory, direct impact on consumption costs
- Non-structural directed to specific water use groups
- Water restrictions except for drinking water
- Changes in management
- Revision of tariffs
- Water Rights Exchange

EMERGENCY
- High cost, direct, mandatory, after the calamity declaration
- Structural, new marginal (for cost or quality) supply sources, water transfers
- Non structural, new groundwater abstraction and/or non conventional resources
- Water restrictions for all users
Sequential steps for planning and implementing drought management actions

**Planning**

- Estimation of available water resources and present and future demands
- Assessment of water shortage risk and drought impacts
- Definition of long term measures as a strategic preparedness plan included in the river basin plan
- Implementation of river basin plan
- Definition of actions to manage water supply systems under drought conditions
- Definition of short term measures in the drought contingency plan

**Monitoring & Implementation**

- Monitoring of hydro-meteorological variables and Status of water reserves
- Implementation of water supply system Management plan
- Declaration of natural disaster
- Implementation of drought contingency plan

<table>
<thead>
<tr>
<th>Normal Condition</th>
<th>Drought</th>
<th>Normal Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Condition</td>
<td>Drought</td>
<td>Normal Condition</td>
</tr>
<tr>
<td>Normal Condition</td>
<td>Drought</td>
<td>Normal Condition</td>
</tr>
</tbody>
</table>

- **ONSET**
- **ALERT**
- **EMERGENCY**
- **END**
# Long term measures (to reduce drought vulnerability)

<table>
<thead>
<tr>
<th>Category</th>
<th>Type of actions</th>
<th>Affected sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand reduction</td>
<td>Economic incentives for water saving</td>
<td>U A I R/E</td>
</tr>
<tr>
<td></td>
<td>Agronomic techniques for reducing water consumption</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Dry crops in place of irrigated crops</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Dual distribution network for urban use</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>Water recycling in industries</td>
<td>I</td>
</tr>
<tr>
<td>Water supply increase</td>
<td>Conveyance networks for bi-directional exchanges</td>
<td>U A I</td>
</tr>
<tr>
<td></td>
<td>Reuse of treated wastewater</td>
<td>A I R</td>
</tr>
<tr>
<td></td>
<td>Inter-basin and within-basin water transfers</td>
<td>U A I R</td>
</tr>
<tr>
<td></td>
<td>Construction of new reservoirs or increase of storage volume of existing reservoirs</td>
<td>U A I</td>
</tr>
<tr>
<td></td>
<td>Construction of farm ponds</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Desalination of brackish or saline waters</td>
<td>U A R</td>
</tr>
<tr>
<td></td>
<td>Control of seepage and evaporation losses</td>
<td>U A I</td>
</tr>
<tr>
<td>Impacts minimization</td>
<td>Education activities for improving drought preparedness and/or permanent water saving</td>
<td>U A I</td>
</tr>
<tr>
<td></td>
<td>Reallocation of water resources based on water quality requirements</td>
<td>U A I R</td>
</tr>
<tr>
<td></td>
<td>Development of early warning systems</td>
<td>U A I R</td>
</tr>
<tr>
<td></td>
<td>Implementation of a Drought Management Plan</td>
<td>U A I R</td>
</tr>
<tr>
<td></td>
<td>Insurance programmes</td>
<td>A I</td>
</tr>
</tbody>
</table>

U= urban; A= agricultural; I=industrial; R=recreational; E=environmental
# Short term drought mitigation measures

<table>
<thead>
<tr>
<th>Category</th>
<th>Type of actions</th>
<th>Affected sectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand reduction</td>
<td>Public information campaign for water saving</td>
<td>U A I R</td>
</tr>
<tr>
<td></td>
<td>Restriction in some urban water uses (e.g. car washing, gardening, etc.)</td>
<td>U</td>
</tr>
<tr>
<td></td>
<td>Restriction of irrigation of annual crops</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Pricing</td>
<td>U A I R</td>
</tr>
<tr>
<td></td>
<td>Mandatory rationing</td>
<td>U A I R</td>
</tr>
<tr>
<td>Water supply increase</td>
<td>Improvement of existing water systems efficiency (leak detection programmes, etc.)</td>
<td>U A I</td>
</tr>
<tr>
<td></td>
<td>Use of additional sources of low quality or high exploitation cost</td>
<td>U A I R</td>
</tr>
<tr>
<td></td>
<td>Over-exploitation of aquifers or use of groundwater reserves</td>
<td>U A I</td>
</tr>
<tr>
<td></td>
<td>Increased diversion by relaxing ecological or recreational use constraints</td>
<td>U A I R</td>
</tr>
<tr>
<td>Impacts minimization</td>
<td>Temporary reallocation of water resources</td>
<td>U A I R</td>
</tr>
<tr>
<td></td>
<td>Public aids to compensate income losses</td>
<td>U A I</td>
</tr>
<tr>
<td></td>
<td>Tax reduction or delay of payment deadline</td>
<td>U A I</td>
</tr>
<tr>
<td></td>
<td>Public aids for crops insurance</td>
<td>A</td>
</tr>
</tbody>
</table>

U= urban; A= agricultural; I=industrial; R=recreational
Components of the Guidelines

- Organizational component
- Methodological component
- The planning framework
- Operational component
- Public review component

EXAMPLES of application
Public review component

Why is it necessary to test the drought management plan?

– Singularity of drought events
– New collection of knowledge and previous experiences
– Dynamic drought, climate, institutions, society
Periodic adaptation of the plan

• Advisable periodic revision of the plan by institutions and stakeholders

• In-depth revision of drought management plan should be made after each drought episode, analysing:
  – response of all the aspects of the plan,
  – ability of prediction and warning,
  – effectiveness of adopted measures

• Continuous feedback process that keeps the plan updated.
LA SEQUÍA 2005–2008
EN LA CUENCA DEL EBRO:
VULNERABILIDAD, IMPACTOS
Y MEDIDAS DE GESTIÓN

The 2005-2008 Drought in the Ebro Valley:
Vulnerability, impacts and management measures

CEIGRAM
Research Centre for the Management of Agricultural and Environmental Risks

- Technical University of Madrid
- State Agency for Agricultural Insurance (ENESA). Ministry of Environment and Rural and Marine Affairs
- AGROMUTUA-MAVDA (private insurer in the agricultural sector)
• 2004-2005 Rainfall 30% lower than the average
• Rainfall recovered in 2006 and 2007, but water reserves remained lower than average (60% in 2004, 40% in 2005, 41% in 2006 and 45% in 2007
• Drought finished in Spring 2008

Figura 1. Evolución de las reservas embalsadas en el Ebro en 2003-05 (A) y 2005-08 (B) con respecto a la media de los 5 años (amarillo) y 10 años (azul)

Fuente: Boletín Hidrológico del MAGRAMA (2011)
Figura 2. Evolución de los índices de sequía regulados (A) y no regulados (B) en el Ebro (2004-08)

Fuente: Elaboración propia con datos de la CHE
Figura 3. Marco conceptual: impactos, pérdidas y costes de las sequías

Fuente: Elaboración propia
### Tabla 2. Distintas estimaciones del impacto de la sequía sobre el sector agrario en Aragón

<table>
<thead>
<tr>
<th>Provincia</th>
<th>Pérdidas de producción del regadio (M. de €)</th>
<th>Pérdidas de producción del secano (M. de €)</th>
<th>Pérdidas totales de producción de la agricultura (M. de €)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DGA</td>
<td>Modelo eq-CEIGRAM</td>
<td>DGA</td>
</tr>
<tr>
<td>Huesca</td>
<td>76,52</td>
<td>57,40</td>
<td>41,96</td>
</tr>
<tr>
<td>Teruel</td>
<td>2,05</td>
<td>0,00</td>
<td>38,90</td>
</tr>
<tr>
<td>Zaragoza</td>
<td>34,21</td>
<td>21,10</td>
<td>51,75</td>
</tr>
<tr>
<td>Aragón</td>
<td>112,80</td>
<td>78,13</td>
<td>132,06</td>
</tr>
</tbody>
</table>

1 Datos no publicados proporcionados por la Consejería de Agricultura y Alimentación de la Diputación General de Aragón (2010).
## Training and Capacity Building (Medroplan, Nemedca and Dewfora)

<table>
<thead>
<tr>
<th>Course</th>
<th>Participants</th>
<th>Collaborators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Course on &quot;Drought mitigation Methodologies, Tools and management Options&quot;. Aleppo, Syria, 18-22 June 2006</td>
<td>24 participants of 14 Mediterranean and Central Asia countries</td>
<td>In collaboration with FAO and ICARDA</td>
</tr>
<tr>
<td>Advanced Course on &quot;Drought forecasting and its use in informed decision making&quot;. Zaragoza, Spain, 23-27 September 2013</td>
<td>23 participants and 8 lecturers from 13 Mediterranean and non Mediterranean countries participated in the course</td>
<td>Dewfora, EU FP7 Project</td>
</tr>
<tr>
<td>Advanced Course on &quot;Design and implementation of drought management plans: organization, methodologies and actions&quot;. Zaragoza, Spain, 4-8 February 2008</td>
<td>12 lecturers form different countries (4 of them members of Medroplan team)</td>
<td>In collaboration with FAO and ICARDA</td>
</tr>
<tr>
<td>Hour</td>
<td>Monday 23</td>
<td>Tuesday 24</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>9:00-10:00</td>
<td>Opening</td>
<td>Forecasting meteorological drought</td>
</tr>
<tr>
<td>10:00-11:00</td>
<td>Introduction to drought and drought characterization <strong>L. Garrote</strong></td>
<td><strong>Coffee break</strong></td>
</tr>
<tr>
<td>11:00-12:00</td>
<td><strong>The principles of drought forecasting</strong></td>
<td>Forecasting meteorological drought</td>
</tr>
<tr>
<td>15:00-16:00</td>
<td><strong>Group discussion on drought forecasting in the participants' countries/regions</strong></td>
<td>Forecasting meteorological drought – Role play: weather forecasting game <strong>F. Pappenberger, E. Dutra, W. Landman and M. Zarouga</strong></td>
</tr>
<tr>
<td>16:00-17:00</td>
<td><strong>L. Garrote, W. Landman</strong></td>
<td>Case study: The Oum-er-Rbia basin – using meteorological and hydrological forecasting for assessing agricultural drought <strong>Y. Imani</strong></td>
</tr>
<tr>
<td>16:00-19:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Venue</td>
<td>Subject</td>
</tr>
<tr>
<td>---------------</td>
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<td>-------------------------------------------------------------------------</td>
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<tr>
<td>15-17 March 2004</td>
<td>Zaragoza (Spain)</td>
<td>Workshop no. 1. Drought Institutional Mapping, risk analysis and best practices</td>
</tr>
<tr>
<td>24-25 October 2005</td>
<td>Taormina (Italy)</td>
<td>Workshop no. 2. Presentation of Risk Analysis Studies, Best Practices Synthesis and Drought Identification, and discussion of best practices</td>
</tr>
<tr>
<td>Autumn 2006</td>
<td>All partner countries</td>
<td>Testing the Guidelines</td>
</tr>
<tr>
<td>15-16/05/07</td>
<td>Marrakech (Morocco)</td>
<td>Workshop no. 3. Presentation and discussion of the Guidelines</td>
</tr>
<tr>
<td>15-16 January 2008</td>
<td>Aleppo (Syria)</td>
<td>Seminar on Applicability of the Drought Management Guidelines in Egypt, Jordan, Lebanon, Palestine, Syria and Turkey.</td>
</tr>
<tr>
<td>11 June 2008</td>
<td>Zaragoza (Spain)</td>
<td>Seminar on Applicability and Application of the Drought Management Guidelines in Mediterranean countries</td>
</tr>
<tr>
<td>12-14 June 2008</td>
<td>Zaragoza (Spain)</td>
<td>International Conference: “Drought management: Scientific and technological innovations”</td>
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<td>7-8 October 2008</td>
<td>Tunis (Tunisia)</td>
<td>Seminar on Applicability and Application of the Drought Management Guidelines in Algeria, Morocco and Tunisia</td>
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Second International Conference on Drought Management

Economics of Drought and Drought Preparedness in a Climate Change Context

Istanbul, Turkey, 4 - 6 March 2010

Second Announcement
Instituto Agronómico Mediterráneo de Zaragoza (IAMZ)
IAMZ does not have regular faculty.

Every year IAMZ invites more than 400 lecturers from more than 50 countries.

Look for synergies with Spanish Universities for the MSc.

Official recognition by the Spanish Higher Education Ministry

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- 38% Public Research Institutions
- 10% Public Administration
- 6% Private Firms
- 6% International Organizations
Training: Participants (2002-2011)

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4832 from 102 different countries