

**WATER, WETLANDS AND CLIMATE CHANGE**  
**Building Linkages for their Integrated Management**

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**Mediterranean Regional Roundtable**  
**Athens, Greece,**  
**December 10-11, 2002**

**Drought Preparedness and Risk Management in the**  
**Mediterranean Region**

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**December 2002**



IUCN Centre for Mediterranean Cooperation



Global Water Partnership – Mediterranean

## Preface

The Global Water Partnership (GWP), the Dialogue on Water and Climate Change, and IUCN-The World Conservation Union, have joined forces to facilitate an exchange of views on the common challenges faced by Mediterranean societies in enhancing their capacities to adapt to climate change.

Scientific consensus is that climate change would have a pervasive influence on the future demand, supply and quality of fresh water resources in the Mediterranean, and would add pressure to water and environment resources, and coastal systems currently under stress. All sectors of the economy, environment and society may be vulnerable to one degree or another, where steps to increase the capacity to adapt to greater hydrological variability, including more frequent flood and drought extremes are required.

Under Article 4 of the UNFCCC, it was agreed all Parties would develop short, medium, and long-term strategies for climate adaptation in a phased manner, taking into account the different socio-economic contexts. A number of Mediterranean countries are now at the preliminary stages of identifying and formulating specific climate change adaptation strategies and responses, while others have yet to start.

This document is one of twelve country base-line studies and thematic papers prepared as background material for a Roundtable meeting in Athens, Greece in December 2002, to discuss key linkages between climate change, water and wetlands resource and management in the Mediterranean. While the primary aim is to exchange views, perspectives and experience on climate change adaptation planning, the discussion would also explore the opportunities to enhance synergies in responses to the UNFCCC and Ramsar Conventions.

Eight country base-line studies were prepared for:

- |          |           |
|----------|-----------|
| ☞ Cyprus | ☞ Morocco |
| ☞ France | ☞ Spain   |
| ☞ Greece | ☞ Tunisia |
| ☞ Italy  | ☞ Turkey  |

The four crosscutting thematic papers are:

- ☞ Mediterranean Water Resource Planning and Climate Change Adaptation
- ☞ National Approaches to Drought Preparation in the Mediterranean
- ☞ Adaptation Strategies for Improved Flood Management in the Mediterranean
- ☞ Biophysical and Socio-Economic Impacts of Climate Change on Water and Wetlands in the Mediterranean

Electronic copies of the reports and paper noted above may be downloaded from the web page of The IUCN Centre for Mediterranean Cooperation at [www.uicnmed.org](http://www.uicnmed.org). Project funding for this initiative was provided by the Global Dialogue on Water and Climate Change. The IUCN Centre for Mediterranean Cooperation receives core funding from the Spanish Ministry for Environment and the Junta of Andalucia.

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**The views, conclusions, and recommendations contained herein are those of the authors, and are not necessarily the views of the Governments of the countries concerned, the GWP, the Dialogue on Water and Climate Change, or the IUCN.**

## Summary

The vulnerability to climate variability in the Mediterranean has intensified with today's demographic, economic growth and resource use patterns, and as a consequence, the scale and urgency of the adaptation challenge has increased. Several studies indicate that global climate change will add to the existing problems resulting from drought and desertification, especially in North African and eastern Mediterranean countries, where water resources are already limited and fragile. The climate change models also show that the increased prevalence and intensity of these episodes, together with hotter and dryer climates, will increase the threats posed to ecosystems, human health, and national economies of the countries involved. Based on these studies and simulations, it is often reported that drought severity and frequency have increased in conjunction with climate change in the region, although clear evidence for this has yet to be provided. *Climate change, drought and desertification are interrelated*, but these processes should not be confused or interchangeably referred to if we are to address the complex issues of drought and water management in the Mediterranean region on a sound scientific basis.

The objective of this paper is to provide an overview of the drought phenomenon and its impacts in the Mediterranean, and highlight how existing drought management policies vary from country to country. This considers the current approaches to drought preparedness and mitigation in the region, the main shortcomings of the existing drought preparedness policies, the major opportunities to improve drought preparedness in the region, and the critical steps and roles of stakeholders to improve cooperation efforts on drought preparedness at the local, national, and regional level.

In the Mediterranean, drought is a naturally occurring phenomenon and a normal part of climatic variability. It is a *recurring event* that has strongly influenced the physical, natural and human features of the Mediterranean region over the millennium. The vulnerability to drought in different Mediterranean countries depends on the degree of exposure to aridity and drought management policies. The compounded effect of hazard and vulnerability generally represents the risk associated with the drought event. While south-eastern areas of the Mediterranean region are more vulnerable than Northern areas, nothing can be done to reduce the recurrence of the drought events themselves. Consequently, drought management should not be regarded as managing a temporary crisis as would think most decision makers in the region. Rather, it should be seen as a risk management process with emphasis on monitoring and managing emerging stress conditions and other hazards associated with climate variability. As a natural hazard, drought is a complex, slow-onset phenomenon, that essentially *unpredictable* and can only be *monitored*. Weather forecast does not mean drought prediction even in the case of meteorological drought. Our predictive capacity for agricultural, hydrological and socio-economic droughts is even more limited, if not predictable at all. While scientific advances in seasonal climate prediction have been made in many tropical regions with substantial opportunities for weather predictability, our global understanding of the climate system in the Mediterranean as a whole currently limits skill in this region to very modest levels.

Evidence shows that drought episodes occurred more frequently during the 1980s and 1990s than previous decades, with increasingly dramatic economic, social and environmental consequences, particularly in the south-eastern countries of the region. Analysis of the drought management policies in these countries indicates that decision-makers have reacted mainly through a crisis-management approach, declaring a national drought emergency programme to alleviate drought impacts on people, crops, livestock, pasture and forest. For example, in most south-eastern countries, almost all national efforts and international assistance during the recent drought situation have been focused on drought relief operations and short-term costly response programmes. Relief packages generally include provisions of emergency drinking water and food supplies for the most seriously affected populations, emergency fodder supplies for livestock, as well as the Government's procurement programmes to create job opportunities for jobless farmers and herders and to minimise crop and livestock losses. The Governments usually approve an emergency aid package, which is delivered

primarily in the form of loans and grants. Regardless of the country considered, the national drought emergency programmes have been so far implemented as the drought events occur. Despite considerable efforts to achieve implementation of these programmes, *effective evaluation* of drought effects nationwide and regionally, and of the programme impacts on beneficiaries and their environment is yet to be carried out. In the northern Mediterranean countries, extreme events such as droughts provide the most severe tests of water resource management capacities. Despite growing concerns, most reports suggest that surprisingly enough, even in the developed part of the Mediterranean, few countries only have national drought policy in place. The focus is more on water management in terms of supply and demand regardless of drought occurrence, and in terms of water quality and environmental resource conservation, rather than on developing comprehensive, long-term drought preparedness policies and plans of actions that may significantly reduce the risks and vulnerabilities to extreme weather events.

Across the Mediterranean, ongoing long-duration drought has highlighted the lack of a national drought strategy and action plans. In all countries, a clearly stated national drought management policy is essential to clarify the role of the central and provincial government ministries and agencies as well as the role of NGOs and water users themselves in implementing national drought preparedness and response programmes. A national drought plan process will provide a dynamic framework to assess an ongoing set of actions to prepare for and effectively respond to drought, including periodic reviews of achievements and priorities, readjustment of goals, means and resources, as well as strengthening institutional arrangements, planning, and policy making mechanisms for drought mitigation. Effective information and early warning systems are the foundation for effective drought policies and plans. Given the importance of early warning for the operationalisation of national drought preparedness, strengthening the early warning systems should be considered as an integral component of strengthening the countries's drought management capacities. In some countries, elements of the drought early warning system are already in place but need strengthening, networking and co-ordination at the central as well as the provincial levels.

The drought management strategy should include sufficient capacity for contingency planning before the onset of the emerging drought conditions and appropriate policies to reduce vulnerability and increase resilience to drought. These basic aspects of drought preparedness and risk management that need urgently attention. Working towards a long-term drought management strategy, Mediterranean countries need to establish the institutional capacity to assess the frequency, severity and localisation of droughts and their various effects and impacts on crops, livestock, environment and wellbeing of rural populations. Based on these developments, vulnerability profiles may be properly assessed and drought-sensitive activities or economic sectors objectively determined and addressed. From this standpoint, drought management must be coordinated with the wider resource management policies and practices in each country.

Comprehensive preparedness and response to drought risks can also be strengthened through regional and international coordination. Mediterranean drought preparedness networking is one way to provide the opportunity for Nations of the region to share experiences and lessons learned through a virtual network, using the web as the information delivery system. Exchange of information and expertise on drought policies, planning methodologies, early warning systems, impact assessment and emergency response measures, mitigation actions, stakeholder involvement, and procedures for addressing environmental conflicts are all critical to improving the level of drought preparedness within countries and on a regional scale

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## Introduction

The vulnerability to climate variability in the Mediterranean has intensified with today's demographic, economic growth and resource use patterns, as a consequence the scale and urgency of the adaptation challenge has increased. Several studies indicate that global climate change will add more to the existing problems resulting from drought and desertification, especially in North African and eastern Mediterranean countries, where water resources are already limited and fragile. *Climate change, drought and desertification are interrelated*, but these processes should not be confused or interchangeably referred to if we are to address the complex issues of drought and water management in the Mediterranean region on a sound scientific basis. Furthermore, in this region drought can no longer be considered as an exceptional event, but rather as a natural phenomenon linked to the climate of the region and to the hydrological system management.

### 1. Climate variability, aridity and vulnerability to drought in the Mediterranean

The Mediterranean region has diverse climatic conditions with generally low and highly variable annual rainfall and high degree of aridity, particularly in south-eastern parts of the basin. The typically prevailing climatic conditions are characterized by extended periods of dry spells and wet periods with a regime of irregular precipitation, with flash flood, associated with low probabilities of occurrence. Interannual rainfall variability is also high, within the range of 25-50 percent in sub-humid and semi-arid parts to 50-100 percent in the arid and hyper-arid zones (UNESCO, 1979). As a result of aridity and rainfall variability, the region is extremely vulnerable to drought. Mismanagement of the drought inevitably leads to irreversible damage like desertification. This process differs from drought but represents the ultimate consequence of it if no timely adequate measure is taken.

Drought is a natural event and a normal part of the climate in any region of the world and may be defined as a rainfall deficiency, significantly below normal, which impacts human productive activities. As a natural hazard, drought imposes differential vulnerability on society and the compounded impact of hazard and vulnerability represents the risk associated with the drought event (Wilhite, 2000). Therefore, drought management should not be regarded as managing a temporary crisis as would think decision makers and drought managers in the region. Rather, it should be seen as a risk management process with emphasis on monitoring and managing emerging stress conditions and other hazards associated with climate variability. An important feature of the drought as a hazard is that it is essentially *unpredictable* and can only be *monitored*. Weather forecast does not mean drought predictability. While scientific advances in seasonal climate prediction have been made in many tropical regions with substantial opportunities for weather predictability (but *not drought predictability*), our global understanding of the climate system in the Mediterranean currently limits skill in this region to very modest levels. One thing is certain, however, the drought is a *recurring event* that affects the livelihood of millions of people in the Mediterranean, particularly in south-eastern parts of the region.

#### 1.1. Drought recurrence in the region

The causes of the drought in the Mediterranean region are very complex. Contrasting geographic locations and topographic variations (seaside, mountains, hills, flat lands, and desert) with their oceanic or continental influences, exposure to western and eastern wind systems and exposure to the Azores atmospheric pressure systems are among the physical determinants which explain the spatial scale and intensity of the drought in the region. On the other hand, demographic pressure and human activities have also led to wide ecosystem degradation over the past decades and have certainly exacerbated the vulnerability to drought in the region through increased cultivation of marginal and fragile arid lands, soil erosion, run-off and desertification.

Historical evidence corroborated by tree ring studies in North Africa clearly indicates that drought is a *structurally recurrent phenomenon* in the Mediterranean. In Tunisia, drought episodes have been traced back to the year 707 and in the period 1907-1997 alone, say the 20<sup>th</sup> century, 23 dry years were observed. In Morocco, the number of drought episodes as revealed by tree ring evaluation over 1000 years (Chbouki, 1992; Stockton, 1988) varied from century to century around an average of 22 dry years per century. For example, there were 31 dry years in the 14<sup>th</sup> century, 25 in the 15<sup>th</sup> century, 12 in the 16<sup>th</sup>, 22 in the 17<sup>th</sup>, 16 in the 18<sup>th</sup>, 19 dry years in the 19<sup>th</sup> century and in the 20<sup>th</sup> century 22 drought episodes, of which ten occurred during the last two decades and included the three successive dry years of 1999, 2000 and 2001. The drought is also a recurring event in the Middle East, where Jordan is a significant example. The country is predominantly arid; it has long ago experienced chronic water shortages and suffered from severe shortage since the 1960s. The droughts in Jordan, Syria, Palestine, but also in Afghanistan, Pakistan and Iran, the worst ever recorded in decades, have recently intensified and become more frequent. Drought events have also been more frequent after the 70's in Mediterranean Europe. Examples are the dry episodes in Cyprus in the periods 1989-91 and 1996-2001, in Greece in the periods 1982-83 and 1988-90, in Italy during 1989-1991, in Spain in the periods 1982-83 and 1990-95, and in south France in 1976 and from 1989 to 1992.

Therefore, in Mediterranean countries, drought can no longer be considered as an exceptional event, but rather as a natural phenomenon linked to the climate of the region and to the hydrological system management. Drought refers to an unusual deficit of precipitation over a rather extended period, and should be managed using sound risk management principles to anticipate its effects and to lessen its impacts on productive economic activities, social well-being and natural environment.

## **1.2. Impacts of drought in the region**

The most significant impacts of drought, particularly in south-eastern parts of the region, are severe water shortages, depressed agricultural production, decreased family income of rural communities, increased dependency on food import and increased environmental degradation. Despite notable increases of agricultural production in 1998 which were recorded in Egypt and Turkey and a significant recovery in Algeria, Morocco and Tunisia, the on-going drought of 1999, 2000 and 2001 shaped to a very large extent the performance of agriculture and caused sharp annual fluctuations in crop and livestock production in these countries. The impact of drought is most evident in cereal production as cereals are mainly grown under rain-fed conditions. For example, cereal production in Morocco varied from a high output of 10 million tons in a good season like 1996 to below 2 million tons in a dry year like 2000, giving a 'dry year : good year production ratio' of 1 to 5. At the regional level, net agricultural production in North Africa and Middle East fell by 4.2 percent in 1999, and saw no improvement in subsequent years. As a result of successive droughts and other factors including policy reforms, the south-eastern part of the Mediterranean is becoming increasingly more dependent on imported food items and the countries more vulnerable to any sharp rise in the international market prices, which further complicates their vulnerability to the recurrence of drought episodes. In most of these countries, economic development is heavily dependant upon growth in the agriculture and livestock sector, as an important proportion of GDP is considered agriculture-dependent. Therefore, any setback to crops and livestock due to drought or other natural hazards is likely to severely impact economic growth and increase the incidence of poverty among the rural societies in these diverse south-eastern countries of the Mediterranean.

Droughts have also important consequences on environmental degradation in these countries. The persisting and intensifying drought has caused significant damage to the environment and to the region's biological diversity, including both animal and plant species. Wildlife has been severely affected as a result of shortage of drinking water, lack of feed, dried wetlands and degradation of wildlife habitats. In several wetlands of national / international significance, the aquatic life has disappeared. Herbivores are among the first animal species to be affected due to lack of feed. Dryness of wetlands and natural lakes may have caused irreversible environmental damage in some countries.

Water scarcity is one of the most challenging issues in the Mediterranean region, particularly in North Africa and Middle East countries, although some Mediterranean countries of Europe, notably Spain and Portugal, may also experience severe water shortages in the event of a drought. The whole region is concerned with water quality. The situation is presently exacerbated by drought hazards becoming more frequent. Heavy reliance on surface and underground water generally prevails in all countries and most of the water, 60 to 90 percent, is used for agriculture, particularly in North Africa and the Middle East, but also in Spain which records one of the highest water demand levels in the European Union, with cereal crops accounting for almost 30 % of the total irrigated area. In France and Spain, irrigated areas have vastly grown since the 70's, pushing further water exploitation. Irrigation techniques, crop types and average irrigation water doses differ from country to country; some countries would use irrigation as a complement to rainfall yields, but in general irrigation stands as the main source for water. In addition, present gravity-dominated irrigation techniques in southern Mediterranean are fairly water-consuming with efficiencies ranging from 0.5 to 0.7 at best. Thus, all over the region, water demand is steadily increasing while water supply is steadily decreasing. This is happening with conflicting user pressures from domestic, agriculture, industrial and tourism activities, making how to balance the *water equation* and to increase *water use efficiency* a big challenge for water managers and decision makers, particularly under drought conditions.

In Mediterranean Europe, drought may not have significant impact on economic activities but can greatly affect natural ecosystems and environment. In Italy, the 1989-1991 drought reduced the flow of some rivers and may have greatly influenced their ecological quality. In Spain, the very low level of precipitation in the 90s' caused a decrease of run-off, of more than 60 % in the Tajo, Guadiana, Guadalquivir, Sur river basins and Canary islands, and a significant reduction in the storage average regulation capacity of reservoirs. This extreme drought had also an adverse effect on aquatic ecosystems and landscape in a lot of regions; drying rivers and deteriorating water quality have turned into not only a water shortage problem, but into a large environmental degradation issue. Some analysts argue that drought frequency and severity have increased in conjunction with climate change in the region although clear evidence has yet to be provided.

### **1.3. Climate change, drought and desertification**

The most recent IPCC reports, the Intergovernmental Panel on Climate Change, confirm small global warming in the region and forecast more over the next century but past changes in rainfall patterns and future predictions are not well established. Recent review of scientific basis for climate change in the region suggests that global models project little significant change to rainfall amount and its seasonal distribution for the next two decades, although models of run-off show slight reductions over the whole area, leading to reduced water availability. Temperature increases will increase water stress on crops across much of the region from Morocco to Iran. Predicted changes to rainfall amounts and distribution are less reliable. There is concern, however, that southern parts of Algeria, north and west Egypt and Yemen have become wetter while eastern Egypt, Sudan, Palestine and Jordan are now drier than they used to be in recent decades. Based on IPCC (2001) model simulations, projections indicate that water scarcity may be severely increased by future changing climatic patterns in the Mediterranean. *Climate change*, *drought* and *desertification* are interrelated, but these concepts should not be confused or interchangeably used if we are to address the complex issues of drought and water management in the Mediterranean region on a sound scientific basis.

## **2. Current approaches to drought preparedness in the region**

### **2.1. Major attributes of national policies on drought management**

Available information clearly indicates that drought episodes have occurred more frequently during the 1980s and 1990s, and they are still on-going, with dramatic economic, social and environmental consequences, particularly in the south-eastern countries of the region. Analysis of the drought management policies in these countries indicates that decision makers have reacted to the drought episodes mainly through a crisis-management approach by declaring a *national drought emergency programme* to alleviate drought impacts on people, crops, livestock, pasture and forest. During the recent drought situation, in most south-eastern countries of the region, almost all national efforts and international assistance have been focused on drought relief operations and short term costly response programmes.

This kind of policies may be illustrated by considering practical experiences from different countries of the south-eastern part of the Mediterranean where Morocco is taken as an example. For this country, as for most countries in the region, when a drought occurs nationwide the *policy* so far applied consists of setting up a *national drought emergency programme* to be monitored by an *inter-government committee*, which stands for a *National Drought Task Force*. Headed by the Ministry of Agriculture, this political decision making body proposes a package of *emergency measures* to be implemented across the country. There are also *regional / provincial drought committees* to monitor implementation of the *centrally* planned measures. To implement the proposed activities, funds are made available to ease the deleterious impacts of the drought and to assist affected rural populations in solving the problems associated with, (i) Drinking water, (ii) Livestock protection, (iii) Creation of job opportunities, and (iv) Agricultural tax relaxation or credit debt relief. Depending on the country, the national programme may or may not have an additional modest component devoted to public sensitisation about water use and environment protection under drought conditions. The programme implementation generally takes place regardless of the existing regional differences in drought impacts within the country and does not always reflect the real needs in the different parts of the country.

For the *2000 national drought relief programme* in Morocco, the Government has initially budgeted a domestic fund of about \$US 650 million for drought relief and mitigation activities over the 15 month-period from April 2000 to July 2001. This is an important core fund which accounted for one third of the whole annual investment budget of the country. The fund was disbursed as 9.4 percent for the drinking water component, 19.4 percent for livestock feeding and sanitation, 60.5 percent to create jobs in rural areas, 4.5 percent to stabilize market prices of cereal grains, 3.8 percent to limit forest degradation, 1.8 percent to cover the agricultural credit forgiveness, and the remaining 0.5 percent for communication and public awareness. There is also a pilot crop insurance sub-programme against the risk of cereal crop failure in the drought-prone areas of the country. The whole programme was designed to meet the urgent needs of the targeted populations in different parts of the country over a *fifteen month-period* in contrast with the shorter three to six month implementation period which generally prevailed before 2000. With regards to the level of investment, the period of implementation and the preliminary results, the programme has been credited with relative success although an *effective evaluation* of its *real impacts* and of the way it was implemented has yet to be carried out, regionally and nationwide.

Therefore, relief packages generally include provisions of emergency drinking water / food supplies for the most seriously affected populations, emergency fodder supplies for livestock, as well as the Government's procurement programmes to create job opportunities for jobless farmers and herders and to minimise crop and livestock losses. The Governments usually approve an emergency aid package, which is delivered primarily in the form of loans and grants. Regardless of the country considered, the national drought emergency programmes have been so far implemented as the drought events occur. Despite considerable efforts to achieve implementation of these programmes, effective evaluation of drought effects nationwide and regionally, and of the programme impacts on beneficiaries and their environment has to be made.

In the northern Mediterranean countries, extreme events such as droughts provide the most severe tests of water resource management capacities. Yet despite growing concerns, most reports suggest that surprisingly enough, even in the developed part of the Mediterranean, few countries only have national drought policy in place. The focus is more on water management in terms of supply and demand regardless of drought occurrence, and in terms of water quality and environmental resource conservation, rather than on developing comprehensive, long-term drought preparedness policies and plans of actions that may significantly reduce the risks and vulnerabilities to extreme weather events. However, governments and civil society as well as research and education institutions are becoming more concerned about drought issues and drought planning efforts have undertaken at the river basin level, particularly in Spain, Portugal and France. Drought management programme in Spain also includes a crop insurance policy as part of the risk management package associated with the natural hazards.

## **2.2. Major shortcomings of the current approaches to drought preparedness**

Globally, the Mediterranean countries have mainly controlled the water by the supply-side management approach, which is dam-building oriented in an attempt to correct discrepancies of spatial water distribution and to balance supply and demand at the country level. Because of water over-exploitation and occurrence of successive droughts, the balance has now become increasingly precarious. Available information on water planning in some countries indicates that methodologies regarding definitions of key normative variables for supply and demand of different sectors, hypotheses and assumptions for determining the water demand forecast and for proposing possible scenarios are heterogeneous across the countries. This makes difficult the comparative analysis between countries. An example of these difficulties is the comparison of the situation in Spain where data from the ‘White Paper on Water’ are for the planning horizon of 2012, with that in France where data refer to the horizon 2010 and 2020.

In most countries, the ongoing long drought has confirmed the critical gap concerning lack of a long term national drought strategy and action plan to prepare for, face and solve problems in the event of a drought. For all these countries, there is no clearly stated national drought management policy although such policy is essential to the understanding of the role of the central ministries and provincial government agencies as well as of the operating NGO’s in implementing the national drought preparedness and response programmes. On the other hand, if a comprehensive long term national drought plan is available, which is not yet the case for most countries, it will provide a dynamic framework for an ongoing set of actions for preparing for and effectively responding to drought, including periodic reviews of achievements and priorities, readjustment of goals, means and resources, as well as strengthening institutional arrangements, planning, and policy making mechanisms for drought preparedness and mitigation. At present, such coordinating mechanisms do not function properly as the different components of drought management are separately dealt with in different departments and agencies. Little coordination of information occurs between meteorological departments, agricultural extension services, water supply authorities, or NGOs.

In an expert meeting on drought early warning systems in the Mediterranean jointly prepared by World Meteorological Organization (WMO) and US National Drought Mitigation Center, held in 2000 in Lisbon, it was considered that effective information delivery and early warning systems are the foundation for effective drought policies and plans. Given the importance of early warning for the operationalisation of national drought preparedness, strengthening the early warning systems should be considered as an integral component of strengthening the countries's drought management capacities. It has also been noted that in most south-eastern countries meteorological departments are not well prepared to function effectively in drought early warning systems for the agricultural sector because of shortcomings in analytical tools, poorly conceived or prepared informational products, and deficient data sharing practices. In some countries, however, elements of the drought early warning system are in place but need strengthening, networking and co-ordination at the central as well as the provincial levels. This expert meeting also discussed the main shortcomings to the current approaches

to drought management in the Mediterranean, with particular focus on drought early warning systems. The shortcomings were noted in the following areas (Wilhite, 2000, 2002):

- *data networks*—inadequate density and data quality of meteorological and hydrological networks and lack of data networks on all major climate and water supply parameters;
- *data sharing*—inadequate data sharing between government agencies and the high cost of data limit the application of data in drought preparedness, mitigation, and response;
- *early warning system products*—data and information products are often not user friendly and users are often not trained in the application of this information to decision making;
- *drought forecasts*—unreliable seasonal forecasts and the lack of specificity of information provided by forecasts limit the use of this information by farmers and others;
- *drought monitoring tools*—inadequate indices for detecting the early onset and end of drought, although the Standardized Precipitation Index (SPI) was cited as an important new monitoring tool to detect the early emergence of drought;
- *integrated drought/climate monitoring*—drought monitoring systems should be integrated and based on multiple indicators to fully understand drought magnitude, spatial extent, and impacts;
- *impact assessment methodology*—lack of impact assessment methodology hinders impact estimates and the activation of mitigation and response programs;
- *delivery systems*—data and information on emerging drought conditions, seasonal forecasts, and other products are often not delivered to users in a timely manner;
- *global early warning system*—no historical drought data base exists and there is no global drought assessment product that is based on one or two key indicators, which could be helpful to international organizations, NGOs, and others.

An important shortcoming of current policies is that when the drought cycle is over, the activity of the inter-government committee (or that of the national drought task force) is abandoned. Should the drought recur, this on-off process is routinely activated and virtually little is learnt on how to seriously cope with drought disasters in the future. Other shortcoming of the current approaches to drought preparedness and mitigation in the Mediterranean is lack of an *effective evaluation* of real impacts of the actions and measures taken to alleviate the drought effects within the framework of the national drought emergency programmes.

### **3. Major opportunities to improve drought preparedness in the region**

So far, drought management and mitigation interventions have been mostly concentrated on short term drought relief operations. Although the Governments have strongly responded in the relief programme to the current drought crisis, they also recognise the urgent need to develop appropriate strategy and action plan for drought preparedness and mitigation at the long run. Experience elsewhere has shown that countries with long term drought management policies, like Australia, South Africa and some States of the USA are generally better prepared to deal with drought than those just managing the crisis. Based on this assessment, participants of the expert group meeting in Lisbon (2000) as well as those of the regional FAO workshop on “National capacity building for drought mitigation in the Near East”, recently held in Rabat (November 2002) made several recommendations to improve drought preparedness in the Mediterranean, on the short term and on the longer term basis.

#### **3.1. Opportunities to improve drought preparedness in the short term**

The recommendations that pertained directly to early warning systems were that these systems should be considered an integral part of drought preparedness and mitigation plans and that priority should be given to improving existing observation networks and establishing new meteorological, agricultural, and hydrological networks. This will enable each country to build databases and information which are necessary for drought monitoring and assessment. Then, exchange of knowledge and information within countries and between countries is essential to improve drought preparedness in the short term. Questions such as, what is a drought and how serious it is in different region of a country, when does a drought start and when does it end, how and what adverse effects does it causes, what must be done to reduce the effects of droughts, who does what and many other questions are not yet clearly answered or not yet properly addressed. For the moment there are few cases where clear orientations are taken toward developing methodologies and tools, to be better prepared for drought management. These experiences or models can be used to advance further our knowledge on drought management in the Mediterranean. The appropriate mean for this is to organize seminar and training workshop on the issues of drought preparedness, mitigation and response. Examples of such opportunities were demonstrated in an international workshop on Drought management strategies in the Mediterranean, jointly organised in Rabat, 1-2 November 1999, where practical drought planning experiences and models from Australia, South Africa, Spain, USA and Morocco were presented and discussed. This has shown that countries with long term drought management policies, like Australia, are generally better prepared to deal with the drought than those just managing the crisis.

In fact, some Mediterranean countries and International Organisations operating in the area (FAO, CIHEAM, and ICARDA) and NGOs are showing their concern for the drought problem and are initiating actions for Drought Preparedness. For example, an Advanced Course on "Management Strategies to Mitigate Drought in the Mediterranean: Monitoring, Risk Analysis and Contingency Planning" took place in Rabat (Morocco) in May 2001, jointly organised by CIHEAM / IAM Zaragoza and the Institut Agronomique et Vétérinaire Hassan II, with the contribution of EC - DG I. The course dealt with concepts such as drought monitoring, drought risk and impact assessment, drought preparedness, mitigation and response. Lecturers from Egypt, Morocco, Spain, Syria (ICARDA), South Africa, and USA (National Drought Mitigation Centre - Nebraska) took part in the course. The course was followed by participants from Algeria, Egypt, Jordan, Malta, Morocco, Portugal, Spain, Syria, Tunisia and Turkey all of them concerned with drought planning in their countries. On the last day of the course a Meeting was organised to prospect the possibilities of launching a "Mediterranean Network on Management Strategies to Mitigate Drought". The meeting was attended by the participants and lecturers in the course. In the meeting, the existence of a Mediterranean Network on the topic was considered as very necessary and appropriate and it was recommended that means should be destined for its creation. There was a large consensus about the objectives and actions, all of them very much related with the above mentioned.

Another course on "Seasonal Weather Information for Sustainable Agricultural Management in the Mediterranean Region" was organised in Cairo (Egypt), in January 2002, in collaboration with the Central Laboratory for Agricultural Climate, Egypt (ARC - CLAC) with the contribution of EC - DG I. The main goal was to analyse the use of climate information in regional and national agricultural policies in the Mediterranean countries in order to encourage the adoption of strategies that can reduce and control the negative effects of climate in the agricultural system. This was an opportunity to explore the interactions of climate information with a broad range of agricultural applications, among them agronomy, food production systems, water resources, and rural development. Conferences were given by specialists from: Egypt, Morocco, Niger and USA. The participants were experts from Albania, Algeria, Egypt, Greece, Jordan, Italy, Lebanon, Morocco, Portugal, Syria, Tunisia and Turkey. The creation of a Network was also recommended with the purpose of sharing experiences and ideas for advancing the collaboration of agriculture and climate communities in order to create improved information for users at all scales relevant to sustainable agriculture in the region, from regional planners to the farm level. The topics to be dealt with by the Network should reflect the key climate risk management issues in the Mediterranean, including drought mitigation, water allocation and integrated management of crop pests and diseases.

### **3.2. Opportunities to improve drought preparedness in the longer term**

Working towards the development of a long term drought management strategy, the Mediterranean countries need to establish the institutional capacity to assess the frequency, severity and localisation of droughts and their various effects and impacts on crops, livestock, environment and wellbeing of rural populations. Based on these developments, vulnerability profiles may be properly assessed and drought-sensitive activities or economic sectors may be objectively determined and addressed. It is recognized that more comprehensive preparedness and response to drought risks are an integral part of climate change adaptation planning and that drought management must be coordinated with the wider resource management policies and practices in each country and between countries of the Mediterranean.

Comprehensive long term drought preparedness plan should have the following six components:

- Drought resilience policies;
- Monitoring and early warning systems;
- Drought contingency planning;
- Drought mitigation measures;
  - Relief measures; and
- Rehabilitation measures.

Risk management principles should be the key to drought preparedness approaches which are already operational in some countries such as U.S., Australia and South Africa. A practical step-by-step process is established for identifying actions that can be taken to reduce potential drought-related impacts before a drought occurs (Knutson et al. 1998). Step 1 begins with making sure that the right people are brought together and supplied with adequate data to make informed and equitable decisions during the process. Steps 2 and 3 narrow the focus of the study by identifying high priority drought-related impacts that are relevant to the user's location or activity. Step 4 demonstrates that in order to reduce the potential for the identified impacts to occur in the future, it is necessary to understand the underlying environmental, economic, and social causes of the impacts. Finally, Steps 5 and 6 utilise all of the previous information to identify feasible, cost-effective, and equitable actions that can be taken to address the identified causes. In this manner, true drought vulnerabilities can be addressed that will subsequently reduce drought-related economic, environmental and social impacts and risk. Part of the risk management approach may be the development of drought management package in the form of "insurance against natural hazard", which has been recommended in the UN Plan of Action to Combat Desertification and adopted by some of countries of the region such as Morocco where a system of insurance against drought hazards is operational since five years. Spain and other northern Mediterranean countries also have crop insurance schemes against drought and other hazards.

Around these activities, a proposal for a Research Project has been submitted to the MEDA Call "Euro-Mediterranean Regional Programme for Local Water Management", with the title "Mediterranean Drought Preparedness and Mitigation Planning". The ultimate objective of the Project is to provide Guidelines for Drought Preparedness Plans and the Framework for the setting up of a Drought Preparedness Network for the Mediterranean countries. Six countries (Cyprus, Greece, Italy, Morocco, Spain and Tunisia) have participated in the preparation and submission of the proposal. This has permitted a good identification of experts and institutions concerned with drought in the Mediterranean region.

### **3.3. Opportunities to improve drought preparedness via sustainable drylands development**

The development issues of dryland agriculture in rain-fed fragile ecologies of the south-eastern Mediterranean region were specifically discussed in an international ministerial meeting held in Morocco in June 2001, which led to the Rabat Declaration. The meeting brought together policy and

decision makers along with international donor agencies to discuss opportunities for sustainable investment in dryland ecosystems of West Asia and North Africa. The overall objective of the meeting was to provide a forum for interactions between policy makers and donor community to promote the commitment and partnership to address persistent rural poverty, *vulnerability to drought*, and growing natural resource degradation in the drylands ecosystems of the region. It is now recognized that under investment by governments in drylands development and overexploitation of the land, water and other natural resources has led to loss of soil fertility, crop and livestock productivity, forest and biodiversity. The compounded adverse effects of drought and desertification in dryland areas will accelerate the rates of rural migration to urban centres, exacerbate the extent of poverty and lead to far reaching social and economic impacts on societies. Thus, coordination mechanisms are needed among various stakeholders to address the drought issues at local, national and regional levels.

#### **4. Drought networking and coordination at local, national and regional level**

##### **4.1. Coordination of drought preparedness activities at the local / national level**

Coordination of drought preparedness activities at the local / national level is currently lacking in most countries of the region. To overcome this shortcoming, one first should differentiate between meteorological drought, hydrological drought, agricultural drought and socio-economic drought. Meteorological drought is region-specific and relates to the degree of dryness and the duration of the dry period within the region. Agricultural drought is crop-specific and depends on the amount and timing of rain relative to crop growth cycles as affected by soil moisture deficit. Hydrological drought relates to shortfall in levels of surface and / or sub-surface water supply. Socio-economic drought reflects the dysfunction of market prices as affected by distortions of offer and demand of inputs, commodities and employment opportunities under the prevailing drought conditions. Clearly, this is an operational definition of drought with reference to its various impacts on water availability, crop production and livestock, household income, rural society livelihood and on environment. Each type of drought has to be addressed by the subject matter specialised institution with a participatory approach in each country. Then key national institutions dealing with drought management of one type or another should all be represented in a national drought network, either in the form of a drought watch or other form of organised mutual consultation partnership, including representatives of central / local administration, education and research institutions, and NGO's.

Current new initiative in the region towards the implementation of such model is the establishment in Morocco of the *National Drought Observatory* to develop a national drought policy plan with the close institutional collaboration of policy makers and universities. The aim of this effort is to develop an institutional capacity to deal with drought early warning system and with information delivery system to users and drought managers. A direct output of this initiative is to strengthen institutional capacity in drought early warning, drought monitoring and impacts assessment. The Observatory would also strengthen co-ordination mechanisms for drought response by various stakeholders to affected areas and vulnerable social groups. The stakeholders refer to government institutions, non-government organizations, farmers, representatives of civil society and donors that play a key role in drought management.

If this initiative is to be adopted by other countries of the region, the stakeholders concerned with drought management in each country need to be assisted to perform the following tasks (see Wilhite, 2000, 2002):

- Define drought policy and planning objectives from the national and provincial perspective.
- Collect, analyze, and deliver drought-related information in a timely and systematic manner.
- Characterize drought and reliable indicators for early warning of emerging drought conditions.
- Conduct vulnerability assessment profiles to determine population groups, economic sectors, and areas most at risk to drought.

- Ensure timely and reliable assessments of drought severity and impacts indicators to be used by the decision makers in their contingency planning efforts.
- Establish objective criteria for declaring drought and for triggering mitigation and response programmes.
- Integrate the risks associated with drought into long-term policies to promote the resilience (i.e., to reduce the vulnerability) of the affected populations and of the national economies to the drought episodes.

#### **4.2. Coordination of drought preparedness activities at the regional / international level**

Following the Lisbon 2000 expert meeting on drought early warning systems in the Mediterranean, and the Rabat 2001 meeting referred to above, an other “Expert consultation and workshop on drought mitigation for the Near East and the Mediterranean” was held in Aleppo (Syria) in May 2001, organized by FAO, ICARDA and the Department of Civil and Environmental Engineering of Catania University (DICA), with partial financial support from EC DGXII. Furthermore, the bases for another meeting were established, which took place also in Aleppo, in November 2001, during which FAO, ICARDA, EC and IAMZ representatives discussed about the contents and structure of a Mediterranean Network on Drought, extended to the Near East and Central Asia, with similar objectives and proposed actions. More recently, the regional FAO workshop on “Capacity building for drought mitigation in the Near East “, jointly organized with the National Drought Observatory of Morocco, took place in Rabat, in November 2002, and stressed the importance of regional cooperation and networking in the area of drought management in the longer term. The International Drought Information Center / National Drought Mitigation Center (Nebraska), represented in the meeting by its Director also proposed scientific and technical support to put in practice the concept of Global drought preparedness network in the Mediterranean region.

The objectives of the proposed Mediterranean drought management network will be achieved through the promotion of research and exchanges of information, methodologies and tools in the following areas:

- Analysis of droughts in the region, watershed or water supply system, from a climatologically/hydrological point of view, in order to provide useful information on drought occurrences and their characteristics. This should include both the definition of appropriate indices to identify past droughts and to monitor current conditions, as well as probabilistic characterisation of drought occurrences.
- Drought impact assessment to identify the direct consequences of droughts, such as reduced crop yields, livestock losses and reservoir depletion, but also secondary consequences such as abandonment of agricultural activities, shifts in population. The analysis must be carried out with reference to different drought severities and will highlight sectors, populations or activities that are vulnerable to droughts.
- Vulnerability assessment to identify the underlying causes of drought impacts. Such underlying causes can be related to structural problems, such as lack of adequate hydraulic infrastructures, but also to management, economic and social features that increase the vulnerability of the region, watershed or water supply system under analysis.
- Action identification, to define appropriate actions to reduce drought risk. This step will identify the short and long term actions, programmes or policies to be implemented in advance of drought, or in its early stages, to reduce the degree of risk to people, property or productive capacity. Emergency measures should also be included, but only in the framework of a comprehensive mitigation strategy.

## **Conclusion and Recommendations**

The drought responses programmes in most Mediterranean countries have so far focused on the effects of drought *afterward* rather than on anticipatory and participatory measures that would meet the real needs of the affected populations and handicapped groups. What is needed is more than focusing on assessment of the impacts of drought *ex post* and emergency relief measures. Rather, the countries policy makers and the concerned regional / international stakeholders should react through the formulation and implementation of strategic management policies of drought *ex ante* to build the *in-country* capacity needed to cope with this recurring event in an effective way and at the long run. At the same, drought networking efforts in the region as a whole should have full support from governments, regional/international organizations and stakeholders. Only then, the sustainable development strategies proposed for the region would embody the elements of adaptation to drought, incorporate risk management in economic policies, address the water scarcity issues through efficient and equitable water use and above all, reduce vulnerability of rural societies in the region.

Therefore, governments of the Mediterranean countries are called upon to:

- Develop national drought planning and action programmes for combating drought, with particular emphasis on policies, required infrastructures, co-ordination, community participation, political commitment, raising public awareness, and provision of finance.
- Give due support to co-ordination mechanisms, at country level, that would accommodate co-operative programmes, joint activities, and institutional set-ups, leading to harmonization of national drought preparedness plans among neighbouring countries.

It is also recommended that relevant regional and international organizations, NGO's and other stakeholders in the region join their efforts to:

- Provide assistance and funding related to drought preparedness activities
- Intensify their co-ordination efforts for the development of medium and long term 'Agency Strategy' in support of drought mitigation and preparedness plans, at country and regional levels

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