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**Drought in the Arab World**



By

The International Centre for Agricultural Research in the Dry Areas

(ICARDA)



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## EXECUTIVE SUMMARY

Most of the Arab countries are located in Arid and semi-arid areas of North Africa and West Asia. Rainfall in this area is low and its distribution is very variable. Drought has become more frequent in this zone, especially during the last three decades. Moreover, the available water per capita in some Arab countries is already below the severe poverty level.

The major agricultural production environments in the region are rainfed, Badia and irrigated areas. Rainfed and Badia are affected by drought and desertification which have negative impacts on the livelihoods of the populations and involve the increasing migration from the rural to the urban areas. Irrigated zones are however, more productive, but they suffer from the low quality of water and the non adapted management of natural resources (water and land). Consequently, interventions to reduce the desertification and drought effects are considered as the highest priority in the Arab world.

The increase of the frequency and intensity of drought during the last two decades has involved the reduction of cereal and animal production. This has increased the imports of agricultural products and especially cereals in many countries such as Morocco, Tunisia, Jordan, etc. Drought phenomenon has also affected the price of agricultural products in certain countries like Mauritania. Other consequences of drought are land and water resources degradation and loss of biodiversity due to the overgrazing and deforestation.

Recently, many Arab countries have become more concerned with the problem of drought and some progress in dealing with this natural disaster has been achieved. Among the actions taken are the establishment of national committees or units where different ministries are represented to coordinate efforts and actions to reduce the effects of drought on the populations, crops and livestock and hence to improve the livelihood of the poor. Local committees have been also constituted to implement drought relief measures set up by the national committee.

Among the crisis (short term) measures used in the region are the provision of supplementary feeds to safeguard livestock with the predominant investments going to subsidies towards the distribution and costs of concentrates, the wells digging and irrigation equipment purchase. Debt forgiveness, rescheduling of credits and creation of work activities in the rural areas have been also part of the Governments' programs under severe drought conditions.

Governments recognize also the urgent need to develop long term drought risk management strategies. These strategies have been encouraged by the international and regional organizations through experts' consultations and meetings with decision makers and the development and implementation of drought projects and networks.

Other actions that need to be implemented are the improvement of the management of crops, land and water resources through the use of techniques that help conserve water and increase inputs (water and fertilizers) use efficiency. Among these are deficit and supplemental irrigation, water harvesting, varieties and breeds that tolerate drought, no-till or minimum tillage systems and adapted pasture, range and livestock management.

To overcome the problems of drought and reduce its effects, there is a need to increase the coordination of drought management at the local, national and regional levels and support and encourage research on drought and natural resources management in the Arab countries.

Among the recommendations and future approaches to deal with drought in the Arab world are the implementation of adapted technical, institutional and policy strategies. As a matter of fact, it is necessary to draw drought vulnerability maps, to develop and use the drought early warning system and risk management strategies using a participatory manner and to encourage the micro-credit and drought insurance approach as a risk management tool to deal with drought in collaboration with national, regional and international organizations.

## 1. INTRODUCTION

Most of the Arab countries are located in the hyper arid, arid and semi-arid bio-climatic zones of and West Asia and North Africa (WANA) and East of Africa. These areas are characterized by low (200–400 mm) and high fluctuations of the precipitation. Drought has become more frequent in the Arab Region. The population in Arab world has more than doubled in 30 years growing from 125 million in 1970s to exceed 280 million in 2000 and it is expected to reach more than 400 million in 2030 (UN, 2003) and hence many countries are already living under water stress conditions. As a matter of fact, only a few countries (IRAQ, Syria, Lebanon, for example) have now more than 1000 m<sup>3</sup> of available water per capita which is considered as water stress threshold and most of the others are already at or even below the absolute or severe poverty level of 500 m<sup>3</sup> of water per capita (Tropp and Jagerskog, 2006).

## 2. AGRO-ECOSYSTEMS IN THE ARAB WORLD

The main production and land use environments are the rainfed, rangelands (Badia) and irrigated areas. These environments are described below (ICARDA, 2003).

### 2.1 RAINFED AREAS

The total rainfed areas (dependent on rainfall) are estimated at 80% of the total cultivated lands where a large proportion of the region's agricultural livelihoods are based on dryland farming systems. While irrigated areas may produce far higher yields per unit area yet the marketable surpluses, the overall value of dryland production is much greater than its market value due to social and other indirect benefits associated with these systems. Rainfed production is dependent on low and extremely variable rainfall and, therefore, productivity is low and unstable. This is further affected by frequent droughts and continuing land degradation.

### 2.2 RANGELANDS (BADIA) AND NATURAL FORESTS

*Rangelands (Badia)* represent the drier environments of the Arab countries. These marginal areas of low annual rainfall averages are home to a substantial proportion of the region's rural and poorest populations. Water is the over-riding constraint. The low and highly variable rainfall is often inadequate for economic crop production. The distribution of precipitation in these areas is highly erratic both within and between years. Most of the limited rainfall comes in sporadic, intense and unpredictable storms. Usually rainfall on soils with low infiltration rates, results in surface runoff and uncontrolled rill and gully water erosion. Thus, much of the limited rainfall is lost either directly by evaporation from the soil surface or to run-off, which, if not intercepted, collects in wadis or flat areas where it eventually evaporates or lost to marine coastal areas. The end result is that the greater part of the precipitation is lost back to the atmosphere or marine areas, land is degraded by erosion, and vegetation, except in those areas where rainwater collects, is limited and subject to severe water stress.

Intervention in these extensive areas (rainfed and rangelands) is needed if land degradation is to be halted or reversed and the productivity and livelihoods of rural communities are to be improved. Due to its limited resources and perceived lack of returns, investments in development in the *badia* have been low in relation to the number of households that depend on it. Moreover, given the vulnerability and fragility of the natural resources, and in the absence of suitable development plans, national policies have tended towards minimizing intervention and disturbance to the existing system. Consequently, productivity remains low, degradation continues and rural populations seek alternative income-earning opportunities elsewhere. Increasing migration from these areas not only creates added economic and social pressures in urban areas,

but can lead to the collapse of traditional systems of land, water and vegetation management, leading to further degradation of the *badia*. The challenge here is to enhance productivity and halt land degradation in these areas through the improved management of the natural resources.

As to the relatively limited areas of natural forests (4% of the total area) they are also exposed to several degradation factors including tree cutting for wood, fuel and cultivation of the land in addition to forest fires. These degradation factors lead to continued reduction of forest areas and large economic losses.

### 2.3 PERMANENT IRRIGATED AREAS

These areas are associated with the permanent availability of surface water such as rivers and of renewable groundwater resources or the conjunctive use of both resources. These irrigated areas provide most of the food in this region because irrigation permits more intensive agriculture, variable products and production through the whole year. Recently, the demands of expanding populations and drought that has become more frequent (causing less water storage in dams and aquifers recharge) have increased the pressure to increase production from these systems, threatening their sustainability. Lower quality water is being widely used without proper management causing salinity and deterioration of the environment. The irrigated areas will continue to be vital for food security in the region. To meet increasing demands for food, many countries of the region, such as Egypt and Syria, are expanding their irrigated areas. However, with decreasing water resources for agriculture the major water source that can be made available for new lands is the water that can be saved from irrigating old lands. Saving water in irrigated areas is a top priority almost everywhere in the world, but is of particular importance in the dry areas where water scarcity is extreme and increasing.

All the agricultural environments described above are important for the economies of many of the Arab countries and are unfortunately affected by drought and desertification. Consequently, it is crucial to find solutions to these constraints to land productivity.

## 3 DROUGHT AND ITS IMPACTS IN THE ARAB COUNTRIES

During the last two decades, many countries of the Arab world have suffered drought events that have become more frequent with varied intensity and duration which differ from one area to another. Droughts that hit most of the countries of North Africa in early 1980s and early 1990s and most of the countries of WANA during the consecutive three years of 1998–2000 had substantial negative effects on agricultural productions, natural resources and socio-economic aspects.

In all Arab countries, only around 14% of the total area is considered as arable land and only 4% of the total area is under cultivation at present. However, agriculture plays, in general, an important role in their economies both as a generator of foreign exchange, domestic food and feed demand satisfaction. When severe drought occurs, it is the agricultural sector that is most affected through the reduction of agricultural production. In fact, droughts that occurred in the last three decades affected most of the Mashreq and Maghreb region. Hamadallah (2001) stated that the 1999 drought caused in Syria an estimated loss of 40% of cereal grain production and a reduction in livestock production and in Jordan a productions of less than 1% of cereals and less than 40% of red meat and milk. In Jordan, the small farmers and herders were the ones who were the most affected. For North Africa, it was shown (<http://www.fao.org/DOCREP/MEETING/005/Y6067E.htm>) that during the last two decades, Morocco experienced drought events during 1980–85 and 1990–95 that involved the import of high quantities of cereals (mainly bread wheat) to meet the needs of the population. Because of drought of 1999–2000, this country imported for 2001 year about 5 million tons of wheat (compared to 2.4 in normal year). As in

Morocco, Tunisia suffered also drought during the same periods (1982–83 and 1993–95). In Mauritania, the two successive dry years involved crop failure and pastures production drastic reduction and hence resulted in high food and feed prices. For livestock production, Hazell et al. (2001) stated that in 1945 drought, 25% of cattle and 39% of sheep either died or were sold prematurely on a glutted market in Morocco. In Jordan, at least 70% of camel herd died due to the drought effect of the period 1958 and 1962. In Jordan also, around 30% of sheep flock died or was slaughtered prematurely in 1997 drought. The 1983-84 drought in Syria, caused a slaughtering of 25% of national flock due to a shortage of feed (Oram and de Haan, 1995).

In general, because of the persistence of drought in many regions of Arab world, most of the countries are becoming more and more dependent on food imports. For example in the Near East (FAO, 2002), agricultural imports (cereals, dairy products, sugar and vegetable oil) represent around 25% of the region's total commodities imports.

The high frequency of drought episodes has put also a lot of pressure on natural resources and biodiversity and affected the equilibrium of the existing ecosystems in the region. As an example of ecosystem transformation due to drought and human activities is that of rangeland and natural pastures. In 1950s, the main source of feed needs (70%) of small ruminants (Ngaido, 2002) came from this system. Unfortunately, these areas are experiencing now high degradation. In fact, the biodiversity is decreasing very rapidly due to the overgrazing caused by the progressive increase of flock numbers (50% increase of livestock number during the last five years) and inappropriate animal and natural vegetation management. Moreover, rangeland and pastures are shrinking (10–25% of 1950s situation) because of the increasing transformation of these areas into cropped land and the introduction of intensive irrigation systems. Cropping of marginal lands has enhanced soil degradation and desertification. In Tunisia, the contribution of rangelands to livestock diet has decreased from 65% to 10% (Nefzaoui, 2002). In Jordan, these ecosystems used to provide 70% of feed requirements for animal grazing; today, it has declined to 20-30% (Roussan, 2002)

## **4. EFFORTS AND ACHIEVEMENTS**

### **4.1. ACHIEVEMENTS IN COPING WITH DROUGHT**

Since drought has recently become more frequent and leads, in some cases, to serious disasters like famine, displacement of people, death of man and livestock as well as the degradation of natural resources, the Arab Governments have become more concerned with this problem and some progress in dealing with drought has been achieved. However, these efforts remain a lot below the expectations and the measures that could be taken to reform the present approach. Such approach developed is based on crisis management and not too much on risk management.

With the assistance from international organizations, the Arab countries have focused on drought relief measures. In fact, as a response to recent reoccurring droughts, most of the Arab countries have established a drought unit where different concerned ministries are represented to coordinate efforts to deal with the drought crisis and its impacts. This is a positive initiative and it has solved some of the conflicts and the lack of coordination among different administrations and agencies concerned with water and drought issues. A national contingency plan and drought emergency program to monitor (Through inter-governmental National Committee) and alleviate drought impacts on people, crops, livestock and agro-pastoral systems is launched. The National committee is usually headed by a high political authority such as the Minister of Agriculture or even the prime minister (case of Morocco). Provincial or local committees are also formed to implement drought relief measures adopted by the national committee. Among the coping measures adopted in the region are, the provision of supplementary feeds to safeguard livestock with the predominant investments

going to subsidies towards the costs and distribution of concentrates, especially barley, the authorization and encouragement of wells digging and subsidies of irrigation equipments. Debt forgiveness, rescheduling of credit and creation of work opportunities in the rural areas have been also a part of the program in certain countries suffering from severe drought conditions. These reactive actions are also accompanied, in some countries, by certain proactive measures such as the follow up of water resources availability in dams in order to prioritize and rationalize its use when drought starts to become severe. In fact, the high priority action under drought is to meet human and livestock needs (drinking water) and to maintain the perennial crops (trees) through irrigation and watering of annual crops. Other measures taken are establishing agricultural insurance system launched by certain countries like Morocco and the policy of increasing seed production to guaranty the farmers' needs during the growing season following the droughty year.

Although Governmental plans are mainly based on crisis management of drought, they also recognize the urgent need to develop long term risk management strategies based on drought preparedness and mitigation. This is due to the effort of international organizations to enhance the awareness of the seriousness of drought especially to decision makers. In fact, it is recognized now that the Arab countries have become more involved in regional and international workshops, networks and research programs aiming at the development of strategies for long term drought management. Moreover, the actions described below show that research and academic institutions are joining their efforts at national and regional levels to help find long term solutions to this natural hazard. Research activities are related to the development of decision making tools and drought mitigation strategies. Some of these activities are summarized as follows.

- A "FAO-ICARDA-EC Expert Consultation and Workshop on Drought Mitigation in the Near East and the Mediterranean that was organized at ICARDA headquarters in Aleppo Syria in May 2001;
- A drought information network that was launched by FAO and ICARDA as main founders and CIHEAM and the European Commission as collaborators;
- A Mediterranean and MENA (where many Arab countries are located) project (MEDROPLAN) on the development of tools for drought risk management conducted by different NARS in collaboration with ICARDA, CIHEAM-Zaragoza, which is now developed into a regional network. The methodology has been already tested in pilot sites in some countries.
- For the Maghreb region, a network for the development of drought early warning systems (SMAS) which was established between Morocco, Algeria and Tunisia and it is coordinated by OSS. The plan of action was launched and some activities have started.

One last effort on drought management and which is very relevant to the Arab countries is the development of "the Network on Drought Management for the Near East, Mediterranean and Central Asia (NEMEDCA Drought Network) coordinated by ICARDA, FAO-RNE, IAM (CIHEAM) Zaragoza. This Network is based on the tools and guidelines developed through the MEDROPLAN project.

NEMEDCA Drought Network is divided into 3 Sub-networks

- Mediterranean Sub-network: Albania, Algeria, Cyprus, Egypt, France, Greece, Italy, Jordan, Lebanon, Libya, Malta, Mauritania, Morocco, Palestine, Portugal, Spain, Syria, Tunisia and Turkey;
- The Nile valley, Red Sea and Arabian Peninsula Sub-network: Djibouti, Eritrea, Ethiopia, Somalia and Sudan, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates;

- Central and West Asia Sub-network: Iraq, Iran, Kazakhstan, Pakistan, Tajikistan, Turkmenistan and Uzbekistan.

The overall objective of the NEMEDCA is *to enhance technical cooperation among concerned national regional and international organizations in the region, particularly the exchange of information, and experiences among the member countries*. The specific objectives are:

- Promoting risk, vulnerability and impact assessment of the effects of drought considering ecological, agricultural and socio-economic dimensions at national and regional levels;
- Contributing to the creation, development and coordination of drought preparedness and mitigation plans, including harmonization of methodologies and approaches used in member countries. In that context, the MEDROPLAN Drought Management Guidelines should constitute a reference;
- Facilitating the development of national, sub-regional and regional project proposals to address drought priority areas;
- Streamlining exchange of information on monitoring tools and data on early warning among members;
- Promoting the exchange of information on mitigation practices and coping mechanisms to support the decision making process in member countries;
- Strengthening and developing human and institutional capabilities at the national level;
- Promoting cooperation in planning and implementing drought mitigation programs at national and regional levels;
- Disseminating information among concerned organizations / institutions on pertinent drought issues and promoting professional contacts, study tours, expert meetings, training courses, etc.;
- Coordinating activities with other relevant regional and international networks.

In addition to these actions related mainly to networking and development of early warning system, research on drought mitigation aspects has been conducted by ICARDA (based on its mandate in dry areas) in collaboration with the NARS in the Arab countries. However, to deal more with drought, water scarcity and climate change that have become severe and more frequent during the last two decades in the Arab region, the Center has recently adjusted its research strategy. The approach adopted is integrative and community based in order to help in the improvement of the most vulnerable rural and poor people livelihoods and to preserve natural resources that have become more exposed to degradation and scarcity. In fact, new and more *improved crop, water and land management techniques* have been tested at the community level. The objective is to introduce the technologies that improve water conservation and water use efficiency at the farm level both in irrigated and rainfed areas and hence to contribution to mitigation of drought. Among the technologies related to water use efficiency are *deficit irrigation and bed planting and improved furrow irrigation* that are alternatives to surface irrigation (the least efficient technique). Moreover, adapted agronomic packages such as appropriate use of *fertilizers and pests management and cultivation of varieties* that improve water productivity and nutrient use efficiency have been designed and recommended. Under conditions of rainfed areas, techniques such as *supplemental irrigation, conservation tillage (no-till) and water harvesting systems* have been developed and adopted by farmers. Moreover, many *drought tolerant varieties* of cereals, legumes and forages have been selected and used by farmers and herders. For the agro-pastoral systems, adapted management of livestock and pastures based on the local knowledge has been tested and implemented.

## **5. CHALLENGES AND CONSTRAINTS FOR DROUGHT MITIGATION**

Although the Arab Governments have become more concerned and aware of the need to develop drought management strategies, there are some obstacles to realize this objective. Some of these obstacles are described below.

Since agriculture is the main sector that liable to drought which is a phenomenon of an off and on nature, the adverse impacts of this hazard on food and feed are rapidly overlooked by the decision makers and even by the communities as soon as the period of drought is followed by a rainy period and agricultural production is increased. Consequently, the activity of the inter-government committee is abandoned or delayed. Moreover, because of the assistance and drought compensation provided by the Governments, the farmers become dependent on these aids that represent high cost for governmental annual budgets and consequently, drought risk management strategies are not taken into consideration on permanent basis. In addition, the national and regional institutions established to manage drought remain inadequate and in general they are not properly operational.

Another constraint is that very few of the Arab countries have a comprehensive long term national drought strategy and there is no or a little coordination and cooperation at local, national and regional levels. Operational early warning systems - interconnected with international ones - which are the bases for effective drought policies and plans, does not exist in the Arab world. The development of such systems requires biophysical and socio-economic data and expertise which are lacking and are not shared by most concerned Arab countries. Moreover, although many drought mitigation measures are available, they are not adopted because of the inefficiency of the technology dissemination and exchange systems due to the lack or minimal investment in agriculture in dry areas and in related research/development programs.

To solve the problems of drought in the Arab countries, the development of drought preparedness and mitigation plans are of significant need to guaranty the sustainable development of their resources.

## **6. RECOMMENDATIONS AND THE WAY FORWARD**

In general, a comprehensive drought mitigation action plan implies the following six components (FAO, 2002):

- Drought resilience policies;
- Early warning and monitoring systems;
- Drought contingency planning;
- Drought mitigation measures;
- Relief measures;
- Rehabilitation measures.

Consequently, the comprehensive system should take into consideration the technical (drought early warning and mitigation), institutional and policies aspects and hence, it has to encourage the risk and proactive measures. The key aspects that need to be developed for proper drought risk management in the Arab world are pointed out below.

### **6.1. DROUGHT EARLY WARNING**

Drought early warning is an important step in drought risk management. Many early warning indices have been developed worldwide; based on modeling and proven accurate and credible information compiled by

competent scientists at varying scales (short, medium and long terms). Among the needed data are the standardized precipitation index (SPI), the surface water supply index (SWSI), the standardized water index (SWI), the field monitoring and remote sensing systems and the socio-economic indicators. These indices/indicators should be used in an integrative way to have a better idea of drought severity.

## 6.2. AGRO-ECOLOGICAL CHARACTERIZATION AND MAPPING OF DROUGHT VULNERABILITY

Agro-ecological characterization survey can help identify and map zones that are homogenous in terms of climate conditions, soil characteristics, landscapes, water resources under varied land use. Such approach would allow the establishment of drought vulnerability profiles, the drawing of drought risk maps and the choice of adapted strategies of drought (management techniques). Pertinent tools and procedures have been developed by ICARDA in collaboration with some NARS and they are available to be used by Arab countries.

## 6.3. DROUGHT MITIGATION

Drought mitigation programs should take into consideration the local and indigenous knowledge. The combination of the local knowledge and scientific approaches would be fruitful. Risk management approach has to be encouraged. In fact, early drought warning has to be provided early enough to allow the producers and the Government to launch on time the drought preparedness programs. Moreover, drought mitigation technologies described above should be promoted.

## 6.4. POLICIES AND ORGANIZATION

The micro-finance strategy used in some arid zones in agriculture should be tested and extended to the Arab world and other sectors (pastoral and agro-pastoral sectors) because it can play an important role in the risk management. In fact, the micro-credit can help farmers acquire inputs, use conservation techniques and pastoralists replace livestock after drought and the micro-insurance protect them from the incidences of crop failure and animal losses. One of the Arab countries that adopted successfully the insurance approach in cereal production is Morocco (Bernardi, 1996). This approach is based on the difference between average and potential yields. In livestock production

Swift (2002) described two forms of this insurance used in Angola that can be one the promising option for Arab countries where pastoral systems prevail. These are livestock mortality-based insurance and weather-based insurance. In the first case, the index is the average death rate of all animals except those born in the current year because of their high loss rate. In the second case, the index is the weather-based such as a rainfall below certain threshold. In both cases, the agro-pastoralists could buy standard insurance certificates against higher than average levels of mortality or lower than a weather threshold in the district concerned. All herders who buy the insurance certificates receive indemnity and hence the ones who have lower mortality rates are rewarded for their skill and good management. The advantages of using the mortality rate or weather as the index to trigger indemnity payment are that data are usually available in most countries, the method is simple to use, there is little opportunity for adverse selection or moral hazard and administrative costs are low. The main constraint to the success of the index-based insurance is the high frequency of drought events that may threaten the viability of insurers who face the possibility of very large pay-outs, especially in the early years before the companies have not yet built up reserves. Insurers may solve this problem through international re-insurance or investment in catastrophe funds that countries can use to cope with such risks

There is a need for the creation of an operational and sustainable task force (central drought management unit or committee) to develop, coordinate and implement the drought mitigation program. This committee has to be multi-disciplinary and include the decision makers and stakeholders at national, provincial and local levels. It needs to be coordinated by an appropriate political leader that has the power to take actions early enough and convince the government and donors fund drought management plans. Drought Early Warning and mitigation system should be established with a more technical duty. It should include scientists who provide drought early warning and mitigation measures. At the local level, multi-institution groups have to be constituted to gather raw data needed by the scientific committee.

Risk management of drought requires the participation of the producers, the administration, research institutions, the NGOs, international organizations and donors. In addition to that the Arab countries should create a Network on drought to exchange information and experiences.

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