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Combating Drought through Preparedness

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Abstract

Drought is a complex, slow-onset phenomenon that affects more people than any other natural hazard and results in serious economic, social, and environmental impacts. Although drought affects virtually all climatic regimes and has significant consequences in both developed and developing countries, its impacts are especially serious in developing countries where dryland agriculture predominates. The impacts of drought are often an indicator of unsustainable land and water management practices, and drought assistance or relief provided by governments and donors encourages land managers and others to continue these practices. This often results in a greater dependence on government and a decline in self-reliance. Moving from crisis to risk management will require the adoption of a new paradigm for land managers, governments, international and regional development organizations, and nongovernmental organizations. This approach emphasizes preparedness, mitigation, and improved early warning systems (EWS) over emergency response and assistance measures. Article 10 of the Convention to Combat Desertification states that national action programs should be established to identify the factors contributing to desertification and practical measures necessary to combat desertification and mitigate the effects of drought. In the past 10 years, there has been considerable recognition by governments of the need to develop drought preparedness plans and policies to reduce the impacts of drought. Unfortunately, progress in drought preparedness during the last decade has been slow because most nations lack the institutional capacity and human and financial resources necessary to develop comprehensive drought plans and policies. Recent commitments by governments and international organizations and new drought monitoring technologies and planning and mitigation methodologies are cause for optimism. The challenge is the implementation of these new technologies and methodologies. It is critical for governments that possess this experience to share it with others through regional and global networks. One way to accomplish this goal is to create a network of regional networks on drought preparedness to expedite

the adoption of drought preparedness tools to lessen the hardships associated with severe and extended drought episodes.

Keywords: drought preparedness, drought policy, drought early warning systems, drought risk assessment, drought mitigation

1. Introduction

Drought is considered by many to be the most complex but least understood of all natural hazards, affecting more people than any other natural disaster (Hagman, 1984). However, there remains much confusion within the scientific and policy communities about its characteristics. It is precisely this confusion that explains, to some extent, the lack of progress in drought preparedness in most parts of the world. Drought is a slow-onset, creeping natural hazard that is a normal aspect of climate in virtually all regions of the world; however, it results in serious economic, social and environmental impacts. The onset and end of a drought are often difficult to determine, as is its severity. The impacts of drought are largely nonstructural and spread over a larger geographical area than damages from other natural hazards. The nonstructural characteristic of drought impacts has certainly hindered the development of accurate, reliable, and timely estimates of severity and, ultimately, the formulation of drought-preparedness plans by most governments. The impacts of drought, like those of other hazards, can be reduced through mitigation and preparedness.

Increasing society's capacity to cope more effectively with the extremes of climate and water resources variability (i.e., floods and droughts) is a critical aspect of integrated water resources management. Drought preparedness planning will also provide substantial benefit in preparing for potential changes in climate. Historically, more emphasis has been given to flood management than drought management. With growing pressure on water and other natural resources because of increasing and shifting populations (i.e., regional and rural to urban), it is imperative for all nations to improve their capacity to manage water supplies during water-short years.

Drought risk is a product of a region's exposure to the natural hazard and its vulnerability to extended periods of water shortage (Wilhite, 2000a). If nations and regions are to make progress in reducing the serious consequences of drought, they must improve their understanding of the hazard and the factors that influence vulnerability. It is critical for drought-prone regions to understand better their drought climatology (i.e., the probability of drought at different levels of intensity and duration) and establish comprehensive and integrated drought early-warning systems (EWS) that incorporate climate, soil and water supply factors such as precipitation, temperature, soil moisture, snowpack, reservoir and lake levels, groundwater levels and streamflow.

Vulnerability to drought is influenced by a multitude of factors, including population growth and regional shifts in population, urbanization, technology, government policies, land use and other natural resource management practices, desertification processes, water use trends and increasing environmental awareness. Therefore, the magnitudes of drought impact may increase in the future along with an increased frequency of occurrence

of the natural event (i.e., meteorological drought), changes in the factors that affect vulnerability, or a combination of these elements. National drought policies and preparedness plans in drought-prone nations should place an emphasis on risk management rather than following the traditional approach of crisis management. Crisis management decreases self-reliance and increases dependence on government and donors.

2. Drought policy and preparedness

In the past decade or so, drought policy and preparedness have received increasing attention from governments, international and regional organizations, and nongovernmental organizations. National drought policies should establish a clear set of operating guidelines to manage drought and its impacts. The policy should be consistent and equitable for all regions, population groups, and economic sectors and consistent with the goals of sustainable development. Drought policy should emphasize risk management through the application of preparedness and mitigation measures. Preparedness refers to predisaster activities designed to increase the level of readiness or improve operational and institutional capabilities for responding to a drought episode. Mitigation entails short- and long-term actions, programs, or policies implemented during and in advance of drought that reduce the degree of risk to human life, property, and productive capacity. These actions are most effective if taken before the event. Emergency response will always be a part of drought management, because it is unlikely that government and others can anticipate, avoid, or reduce all potential impacts through mitigation programs. A future drought event may also exceed the drought of record and the capacity of a region to respond. However, emergency response should be used sparingly and only if it is consistent with longer-term drought policy goals and objectives.

A national drought policy should be directed toward reducing risk by developing better awareness and understanding of the drought hazard and the underlying causes of societal vulnerability. Risk management can be improved by encouraging the application of seasonal and shorter-term forecasts, developing integrated monitoring and drought EWS and associated information delivery systems, developing preparedness plans at various levels of government, adopting mitigation actions and programs, and creating a safety net of emergency response measures for timely and targeted relief.

The traditional approach to drought management has been reactive, relying largely on crisis management. This approach has been ineffective because response is untimely, poorly coordinated, and poorly targeted to drought-stricken groups or areas. In addition, drought response is postimpact and relief tends to reinforce the status quo in terms of resource management. It is precisely these existing resource management practices that have often increased societal vulnerability to drought (i.e., exacerbated drought impacts). Many governments and others now understand the fallacy of crisis management and are striving to learn how to employ proper risk management techniques to reduce societal vulnerability to drought and therefore lessen the impacts associated with future drought events.

As vulnerability to drought has increased globally, greater attention has been directed to reducing risks through planning to improve operational capabilities (i.e., monitoring climate and water supply, building institutional capacity) and mitigation measures that

are aimed at reducing drought impacts. This change in emphasis is long overdue. Mitigating the effects of drought requires the use of all components of the cycle of disaster management (fig. 1), rather than only the crisis management portion. Typically, when a natural hazard event and resultant disaster has occurred, governments and donors have followed with impact assessment, response, recovery, and reconstruction activities to return the region or locality to a predisaster state. Historically, little attention has been given to preparedness, mitigation, and prediction/early warning actions (i.e., risk management) that could reduce future impacts and lessen the need for government intervention. Because of this emphasis on crisis management, society has generally moved from one disaster to another with little, if any, reduction in risk. In addition, in drought-prone regions another drought event is likely to occur before the region fully recovers from the last event.

Figure 1. Cycle of disaster management. *Source:* National Drought Mitigation Center, University of Nebraska, Lincoln, Nebraska, USA. First published in D. A. Wilhite (2000b).

This article will address two important trends in drought management. These are: (1) improved drought monitoring tools and early warning systems; and (2) an increased emphasis on drought policy, preparedness, and mitigation.

2.1. Monitoring drought: Unique challenges and recommendations

Effective early warning systems (EWS) for drought are an integral part of efforts worldwide to improve drought preparedness. Timely and reliable data and information must be the cornerstone of effective drought policies and plans. Monitoring drought presents some unique challenges because of the distinctive characteristics of drought. Several types of drought exist, and the factors or parameters that define them will differ from one type to another. For example, meteorological drought is principally defined by a shortfall from the expected or normal precipitation over an extended period of time, while agricultural drought is best characterized by deficiencies in soil moisture. This parameter is a critical factor in defining crop production potential. Hydrological drought, on the other hand, is best defined by deficiencies in surface and subsurface water supplies (i.e., reservoir and

groundwater levels, streamflow, and snowpack) and impacts generally lag behind the occurrence of meteorological and agricultural drought. These types of drought may coexist or may occur separately.

An expert group meeting on early warning systems for drought preparedness sponsored by the World Meteorological Organization (WMO) and others recently documented the status of drought EWS in several countries, the shortcomings and needs of such systems, and recommendations on how these systems can help achieve a greater level of drought preparedness (Wilhite et al., 2000a). Recent efforts in drought EWS in countries such as Brazil, China, Hungary, India, Nigeria, South Africa, and the United States were presented at the meeting, as well as reports on activities of regional drought monitoring centers in eastern and southern Africa and regional activities in West Asia and North Africa. The shortcomings of current drought EWS were noted in the following areas:

- *Data networks.* The density and data quality of meteorological and hydrological networks are inadequate, as are data networks on all major climate and water supply parameters.
- *Data sharing.* Inadequate data sharing among government agencies and the high cost of data limit their application 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.* Indices for detecting the early onset and end of drought are inadequate, 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 the magnitude, spatial extent, and impacts of drought.
- *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 database exists, nor is there a global drought assessment product based on one or two key indicators, which would be helpful to users.

The participants in the meeting recommended that early warning 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.

With regard to regional drought monitoring, centers in eastern and southern Africa have had a significant impact on the collection and dissemination of drought forecasts and information to diverse users throughout these regions since their formation a decade ago (Ambenje, 2000). The seasonal precipitation outlooks provide users with broad regional patterns several months in advance. During periods with a strong El Niño signal (i.e., higher probability of drought conditions in southern Africa), the value of this information increases significantly for agriculture and other weather-sensitive sectors. Discussions are ongoing regarding the establishment of other regional centers. The challenge is to link these activities closely with national drought policy and preparedness efforts in the regions.

2.1.1. Integrated drought monitoring: A US case study

Until recently, there was no comprehensive effort in the United States to consolidate or centralize drought monitoring activities being conducted by various federal, state, or regional entities. In 1998, discussion began between the National Drought Mitigation Center (NDMC) and meteorologists of the National Oceanic and Atmospheric Administration (NOAA) on the development of a classification system for droughts according to their severity. Although severity classification systems exist for other natural hazards, the US has not developed a classification system for drought that relies on multiple indicators (a key requirement for drought early warning systems). The Palmer Drought Severity Index (Palmer, 1965), in widespread use in the US, has serious limitations in detecting the emergence of drought (Alley, 1984; Guttman et al., 1992; Guttman, 1998) and, thus, has limited application for drought mitigation planning.

From the discussions referred to above, a drought classification scheme emerged that ranges from D1 to D4 (moderate, severe, extreme, and exceptional). In 1999, these discussions were expanded to include scientists at the US Department of Agriculture's Joint Agricultural Weather Facility. The purpose of these discussions was to create a partnership to develop and implement an integrated drought monitoring system and a suite of products available via the World Wide Web. What emerged from these discussions was a weekly map, the US Drought Monitor.

The Drought Monitor represents a weekly snapshot of current drought conditions; it is not a forecast. This assessment includes the 50 US states and Puerto Rico. The product consists of a color map, showing which parts of the United States are suffering from various degrees of drought (fig. 2). The text accompanying the map describes the current impacts of the drought, future threats, and prospects for improvement. The Drought Monitor is a synthesis of several different climate indices and indicators (e.g., Palmer Drought Severity Index, Standardized Precipitation Index, streamflow, reservoir levels, soil moisture, snowpack, satellite-based vegetation indices) and is by far the most user-friendly national drought monitoring product currently available in the US. It is particularly well-suited for use by mainstream media because it represents state-of-the-art scientific expertise and is packaged as a timely, colorful, unambiguous map. Currently, the World Wide Web is the primary distribution vehicle. NOAA also distributes the map through some internal channels. The obvious advantages of use of the web are that there are no distribution costs and the information is instantly available and always current. The obvious disadvantage is that access is not available to all. However, in the US most persons or organizations do have

web access. Dissemination of the product in the most timely and cost-effective manner has been one of its central goals.

Figure 2. US Drought Monitor. This weekly map is produced through a partnership between the National Drought Mitigation Center, US Department of Agriculture, and the National Oceanic and Atmospheric Administration. *Source:* National Drought Mitigation Center, University of Nebraska, Lincoln, Nebraska, USA.

User acceptance of the Drought Monitor has exceeded by far the greatest expectations of the agencies involved in its development. For example, during the summer of 2000, the Drought Monitor website was receiving more than 30,000 hits/week; it received more than 1.75 million hits in 2000. User hits in 2001 were similar and will likely exceed 4 million in 2002 because of widespread drought conditions in major regions of the US. If user numbers are extended to include those persons actually seeing the product, this number would be much greater since it is shown on many local television stations and national news broadcasts, and in local, regional and national newspapers. The media have been especially quick to pick up on and use the new product to inform their readers and listeners of the status of drought. In addition, the product has been widely used by agricultural producers, commodity brokers, water and natural resource managers, congressional delegations, and local, state, and federal agencies.

The approach taken by the United States in the development of the US drought monitor has received widespread recognition in many countries. Others are now evaluating the adaptation of this methodology to their local situation in order to improve monitoring efforts in support of drought policies and preparedness activities. Although the indicators and indices used in this assessment may differ, the methodology of using the Internet and multiple indicators to assess the severity and spatial extent of drought on a regular basis is worthy of further investigation in many countries or regions.

2.2. Drought policy and preparedness

There are four key components of an effective drought risk reduction strategy (O'Meagher et al., 2000). These include: the availability of timely and reliable information on which to base decisions, policies and institutional arrangements that encourage assessment, communication, and application of that information; a suite of appropriate risk management measures for decision-makers; and actions by decision-makers that are effective and consistent. In 1992, Australia adopted a national drought policy that applied these components through three objectives. These objectives were:

- To encourage primary producers and other sections of rural Australia to adopt self-reliant approaches to managing for climatic variability;
- To maintain and protect Australia's agricultural and environmental resource base during periods of extreme climate stress; and
- To ensure early recovery of agricultural and rural industries, consistent with long-term sustainable goals (O'Meagher et al., 2000).

Australia's national drought policy is widely known and its philosophy is often replicated in other settings.

2.2.1. Drought policy and planning trends in the US

In the United States, there has been significant progress in addressing the impacts of drought through the development of preparedness plans. The most noticeable progress has been at the state level, where the number of states with drought plans has increased dramatically during the past two decades. In 1982, only three states had drought plans in place. In 2001, 34 states had developed plans and five states were at various stages of plan development (fig. 3). The basic goal of state drought plans should be to improve the effectiveness of preparedness and response efforts by enhancing monitoring and early warning, risk and impact assessment, and mitigation and response. Drought plans developed by states in the 1980s and early 1990s were largely response-oriented and with limited attention to issues of early warning.

More recently, greater emphasis has been placed on risk assessment as a major element of drought plans. This element of a plan is directed at determining who and what is at risk and why (i.e., the development of vulnerability profiles). After obtaining a better understanding of the people, communities, and sectors most at risk, appropriate mitigation programs and actions can be identified. To be effective, drought mitigation plans must be

based on a more comprehensive and integrated early warning system that identifies appropriate triggers for the activation or deactivation of mitigation and response actions.

Figure 3. Status of state drought planning in the US, March 2002. *Source:* National Drought Mitigation Center, University of Nebraska, Lincoln, Nebraska, USA.

Plans should also contain provisions (i.e., an organizational structure) to improve coordination within agencies of state government and between local and federal government. Initially, state drought plans largely focused on response efforts aimed at improved coordination and shortening response time; today the trend is for states to place greater emphasis on mitigation as the fundamental element of a drought plan. Thus, many plans are more proactive, adopting a risk management approach to drought management. States such as Utah, Nebraska, and Colorado have revised their plans to further emphasize mitigation, and other states are engaged in that process. New Mexico, Texas, and Hawaii have recently developed plans that emphasize risk management, and other states currently engaged in the planning process are following a similar course of action. As states gain more experience with drought planning and mitigation action, the trend toward mitigation is expected to continue.

The growing number of states with drought plans suggests an increased concern at that level about the potential impacts and conflicts associated with extended water shortages and an attempt to address those concerns through planning. Initially, states were slow to develop drought plans because the planning process was unfamiliar. With the development of drought planning models (Wilhite, 1991; Wilhite et al., 2000b) and the availability of a greater number of drought plans for comparison, drought planning has become a less mysterious process for states. As states initiate the planning process, one of their first actions is to study the drought plans of other states to compare methodology and organizational structure.

The rapid adoption of drought plans by states is also a clear indication of their benefits. Drought plans provide the framework for improved coordination within and between levels of government. Early warning and monitoring systems are more comprehensive and integrated, and the delivery of this information to decision-makers at all levels is enhanced. Many states are now making full use of the Internet to disseminate information to a diverse set of users and decision makers. Through drought plans, the risks associated with drought can be better defined and addressed with proactive mitigation and response programs. The drought planning process also provides the opportunity to involve numerous stakeholders early and often in plan development, thus increasing the probability that conflicts between water users will be reduced during times of shortage. All of these actions can help to improve public awareness of the importance of water management and the value of protecting our limited water resources.

Local and indigenous governments are also giving greater attention to drought planning in the United States. Local drought or water shortage planning efforts in several states have been the direct result of state-level planning efforts. State drought plans often require local water suppliers to develop a drought plan that follows certain precise guidelines in order to be approved by the state. Several indigenous governments, such as the Hopi, Zuni, and Navajo, have also initiated drought planning efforts in which mitigation is a key component.

With the tremendous advances in drought planning at the state level in the US in recent years, states have become dissatisfied with the lack of progress at the federal level. Early into the 1995–96 drought that affected a large portion of the southwestern and south-central portions of the country, the lack of leadership and coordination at the federal level were obvious and continued with subsequent drought episodes. Recent initiatives toward development of a national drought policy are the direct result of those shortcomings (Wilhite, 2001).

The US Government is currently considering actions that could be taken in response to recommendations issued in May 2000 by the National Drought Policy Commission (NDPC, 2000). These recommendations were directed at developing a national drought policy that would emphasize preparedness and mitigation in future drought management efforts. One of the recommendations strongly endorses drought planning at all levels of government. An interim National Drought Council has been formed, and legislation was introduced in Congress in 2002 that will lead to a more permanent national drought council and a national drought policy.

2.2.2. Drought preparedness in Sub-Saharan Africa: Recent trends

In Sub-Saharan Africa, drought is a major threat to sustainable livelihoods, in particular in dryland areas of arid and semiarid regions (Glantz, 1987). Recent drought events have had serious economic, social, and environmental consequences and have resulted in land degradation, human migrations or relocations, famine, diseases, and loss of human life (UNDP/UNSO, 2000). In 1986, approximately 185 million people living in the dryland areas of Africa were at risk and 30 million were immediately threatened (Dinar and Keck, 2000). Drought has affected nearly all of the countries in western, eastern, and southern Africa in the past two decades, and in many cases on more than one occasion. These droughts

have resulted in a recurring deficiency of food supplies and the need for interventions by governments and international donors to alleviate food shortages to avert major losses of human life. For example, the 1991–92 drought in southern Africa resulted in a deficit of more than 6.7 million tons of cereal supplies, which affected more than 20 million people (Dinar and Keck, 2000). Past drought response programs have been reactive and have done little, if anything, to reduce the impacts of future droughts.

In 1997, a UNDP/UNSO project was initiated to assess the status of drought preparedness and mitigation activities in selected sub-Saharan African countries (2000). The project came up with a number of conclusions, summarized below, which were drawn from 11 southern African countries: Angola, Botswana, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe.

The following common themes were identified to describe the current status of drought preparedness and institutional capacity in sub-Saharan Africa:

- There is no permanent government body to deal with drought issues;
- Drought response is often coordinated through the natural disaster authority;
- Drought relief is directed toward human relief, protection of key assets, and recovery;
- Post-drought evaluation of response is not usually undertaken;
- Formal drought plans are rare and mainly directed at response actions;
- Drought and famine early warning systems commonly coexist;
- Vulnerability assessments often exist for sectors, groups, and areas at risk;
- Mitigation focuses on economic diversification and poverty reduction;
- Drought management is increasingly viewed as part of the development process; and
- Drought policies are usually lacking.

As expected, there is a wide range of institutional capacity to respond to drought emergencies in southern Africa. Although some countries have an organizational structure in place to coordinate the actions of government at various levels, as well as those of donors and nongovernmental organizations (NGOs), most have not developed a permanent institutional capacity. One of the common problems with drought and other natural hazards is maintaining interest in planning beyond the relatively short window of opportunity that follows the event, given the on-again, off-again nature of drought as illustrated by the hydro-illogical cycle (fig. 4). Interest in drought planning quickly wanes in the post-drought period when precipitation conditions have returned to normal or above-normal levels. The challenge is to break this cycle by developing and implementing comprehensive drought-preparedness plans that emphasize risk management.

Botswana and South Africa clearly stand apart from the other countries included in this assessment in terms of their experiences and current status of drought planning. Although Botswana does not have an identified drought policy and plan, it has had a long history

with various types of drought programs. Drought preparedness planning is part of development planning and the institutional structure is well defined, with local involvement at the district level.

Figure 4. The hydro-illogical cycle. *Source and copyright:* National Drought Mitigation Center, University of Nebraska, Lincoln, Nebraska, USA.

In South Africa, the National Consultative Drought Forum, established in 1992, was composed of representatives of government, church organizations, trade unions, and NGOs. The Forum led to a shift in emphasis from commercial farmers to a more comprehensive program that includes rural farmers, rural poor, and farm workers. Drought policies have changed to include greater equity for recipients of assistance, and are increasingly focused on improving levels of self-reliance, reducing risk in the agricultural sector, and stabilizing income. The National Drought Management Committee was established in 1995 with similar structures at the provincial and local levels of government. The primary objectives of this committee were to develop national disaster management policy, propose and review new legislation, promote community participation in disaster management, promote the establishment of an integrated disaster information system, and ensure risk reduction at the national level. The Government of South Africa is currently looking at additional revisions to the drought policy (Department of Constitutional Development, 1999; Monnik, 2000).

No drought policy or plan currently exists in Angola, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Swaziland, Zambia, or Zimbabwe, although some infrastructure does exist in most of these countries to respond to drought conditions. This has usually been only on a reactive or *ad hoc* crisis management basis. Two early warning systems are often in place, one focusing on monitoring climate and water supply conditions and the other emphasizing issues associated with food security. Vulnerable sectors, population

groups, or regions have been identified in many of these countries, but mitigation actions and programs have been limited. Response actions are generally a joint effort among government authorities, donors, NGOs, and others. Most of the countries mentioned above have made considerable progress in coordinating and incorporating the capacities of donors and NGOs in drought-related emergency responses. For example, in Swaziland, a consortium of NGOs has been identified to address the needs of vulnerable population groups.

Numerous constraints to drought policy and plan development were identified in the country reports. These included:

- Poor quality of meteorological networks;
- Minimal understanding of drought impacts;
- Lack of institutional capacity;
- Low level of involvement by NGOs in drought management;
- Lack of understanding of household vulnerability;
- Inadequate financial resources for drought management and human resources development;
- Need for expanded extension services;
- Inequitable access to land;
- Limited coordination among government agencies; and
- Reduced response/mitigation capability due to lack of drought policy and plan.

Future drought policy and planning needs were also identified in the country reports. Many of these needs are aimed at addressing the constraints referred to previously. In many countries it was reported that recommendations on drought policies and specific mitigation actions had been made in government reports or as a result of workshops focused on future drought planning and response needs. In many cases, however, these recommendations have not been implemented. For example, Namibia has developed a series of drought policy recommendations based on the elements of the 10-step drought planning process developed by the author (Wilhite, 1991; Wilhite et al., 2000b). The goal of the Namibian policy is to develop an efficient, equitable, and sustainable approach to drought management that shifts responsibility from government to the farmer. The tenets of that policy are to:

- Ensure household food security is not compromised by drought;
- Encourage and help farmers adopt a self-reliant approach to drought risk;
- Preserve reproductive capacity of the national livestock herd during drought;
- Ensure a continuous supply of potable water to communities and livestock;
- Prevent degradation of the natural resource base;
- Enable rural inhabitants and the agricultural sector to recover quickly following drought;
- Ensure the good health status of all Namibians; and

- Finance drought relief programs efficiently by establishing an independent and permanent national drought fund.

Increased interagency coordination and the need to enhance institutional capacity were also considered important. Other needs identified included: creation of a permanent national drought fund in support of mitigation and response measures; expanded meteorological networks and more comprehensive early warning systems; improved vulnerability assessments and vulnerability tracking systems; increased community participation and involvement; expanded NGO involvement in drought management; and the development of strategic grain reserves.

2.2.3. Global and regional trends

Awareness of the need to improve drought preparedness through the development of policies and plans has become well accepted, although the adoption process has been slow in many cases. Although most drought preparedness plans will have a national focus, regional organizations are more commonly recommending drought planning to member nations. For example, a workshop on drought mitigation organized in April 2000 recommended that countries in eastern and central Europe develop drought plans (Vermees and Szemessy, 2000). An international conference on drought mitigation and prevention of land desertification was organized by the International Commission on Irrigation and Drainage in April 2002 in Slovenia to further consider ways to institute drought mitigation planning activities in the region.

A workshop for the Mediterranean region was organized in May 2001 and recommended drought planning as a mechanism to reduce impacts and risks associated with drought and the creation of a regional drought preparedness network for the Mediterranean (CIHEAM, 2001). This workshop was held as a direct result of actions initiated by Morocco in 2000 to develop a national drought observatory. This national drought observatory will include proactive policies and plans, in addition to a comprehensive early warning system. This program is already serving as a model for other nations in the region. This workshop was followed with a ministerial-level meeting in June 2001 of nations from the West Asia and North Africa regions (WANA, 2001). The International Centre for Agricultural Research in the Dry Areas (ICARDA) organized a meeting in November 2001 to further discuss the formation of a drought-preparedness network. The Food and Agriculture Organization of the United Nations (FAO) is also involved in activities in the North Africa and the Mid-East region that are aimed at promoting regional drought preparedness.

It is clear that much of the interest in drought preparedness in these regions has been the direct result of the United Nations Convention to Combat Desertification (UNCCD, 1999). In other cases, recent progress may have been largely independent of this initiative.

2.3. Developing regional drought-preparedness networks

As new technologies, tools, and methodologies become available and are subsequently adopted by drought-prone countries and regions, the importance of sharing this information and experience is paramount to future advances in drought the preparedness. One

way to accomplish that goal is through the development of a network of regional networks for drought preparedness. Such networks, relying heavily on the Internet for linking institutions within and between regions, will facilitate the exchange of information and experience.

The NDMC (National Drought Mitigation Center) and the International Drought Information Center (IDIC) at the University of Nebraska are working in partnership with key UN agencies, US federal agencies, NGOs, and appropriate regional and national institutions to build a global drought-preparedness network that will promote the concepts of drought preparedness and mitigation with the goal of building greater institutional capacity to cope with future episodes of drought. In essence, this global drought partnership will enhance current national and regional institutional capacities through expansion of the NDMC's drought information clearinghouse on the World Wide Web and by building regional drought-preparedness networks. Working individually, many nations and regions will be unable to improve drought coping capacity. Collectively, working through global and regional partnerships, it is believed that the goal of reducing the magnitude of economic, environmental, and social impacts associated with drought in the 21st century can be achieved. Information on drought EWS, automated data collection techniques, drought indices and indicators, triggers for mitigation and response actions, planning methodologies, drought policies, and mitigation actions and programs are just a few of the areas where interaction among countries and regions can expedite progress on drought preparedness. Networks are emerging in the Mediterranean and West Asia regions and will probably develop in South America, North America, and eastern and central Europe in the near future.

3. Summary and future challenges

Drought is an insidious natural hazard that is a normal part of the climate of virtually all regions. It should not be viewed as merely a physical phenomenon. Rather, drought is the result of an interplay between a natural event and the demand placed on water supply by human use.

There are many challenges before us if we are to improve our management of droughts. First, drought must be accepted within the community of natural hazard scientists and policy-makers as a natural hazard. Because of its slow-onset characteristics and lack of structural impacts, it is often disregarded. This lack of recognition of the importance of drought by the natural hazards community has been an impediment to obtaining adequate research support and, in many instances, an obstacle to building awareness among policy-makers at the local, national, regional, and international level. This lack of awareness in turn has resulted in an underappreciation of drought and its far-reaching impacts. It has also perpetuated the process of dealing with drought in a crisis management mode, although the knowledge and technology necessary to improve preparedness and mitigation impacts are readily available.

A second challenge is to build awareness of drought as a normal part of climate. It is often considered to be a rare and random event—thus the lack of emphasis on preparedness and mitigation. Improved understanding of the different types of drought and the

need for multiple definitions and climatic/water supply indicators appropriate to various sectors, applications, and regions is a critical part of this awareness-building process.

A third challenge is to erase misunderstandings about drought and society's capacity to mitigate its effects. Many people consider drought to be purely a physical phenomenon. We may ask: if drought is a natural event, what control do we have over its occurrence and the impacts that result? Drought originates from a deficiency of precipitation over an extended period of time. The frequency or probability of occurrence of these deficiencies varies spatially and represents a location's exposure to the occurrence of drought. Some regions have greater exposure than others, and we do not have the capacity to alter that exposure.

As with other natural hazards, drought has both a physical and social component. It is the social factors, in combination with a group's exposure, that determine the risk to society. Some of the social factors that determine vulnerability are: level of development; population growth and its changing distribution and characteristics; demands on water and other natural resources; government policies (sustainable versus unsustainable resource management); technological changes; social behavior, and trends in environmental awareness and concerns. It is obvious that well-conceived policies, preparedness plans, and mitigation programs can greatly reduce societal vulnerability and therefore the risks associated with drought.

A fourth challenge is to convince policy-makers and other decision-makers that investments in mitigation are more cost-effective than post-impact assistance or relief programs. Evidence from around the world, although sketchy, illustrates that there is an escalating trend of losses associated with drought in both developing and developed countries. Also, the complexity of impacts is increasing. It seems clear that investments in preparedness and mitigation will pay large dividends in reducing the impacts of drought. A growing number of countries are realizing the potential advantages of drought planning. Governments are formulating policies and plans that address many of the deficiencies noted from previous response efforts, that were largely reactive. Most of the progress made in drought preparedness and mitigation has been accomplished in the past decade or so. Although the road ahead will be difficult and the learning curve steep, the potential rewards are numerous. The crisis management approach of responding to drought has existed for many decades and is ingrained in our culture and reflected in our institutions. Movement from crisis to risk management will certainly require a paradigm shift. The victims of drought have become accustomed to government assistance programs. In many instances, these misguided and misdirected government programs and policies have promoted the unsustainable use of natural resources. Many governments have now come to realize that drought response in the form of emergency assistance programs only reinforces inadequate or unsustainable practices and decreases self-reliance.

Policies that encourage self-reliance and the sustainable use of natural resources will be more effective in the long term and will reduce the need for government and donor intervention. A critical first step is to identify and quantify the sectors and population groups at risk from drought. Once this step is completed, policies, plans, and mitigation programs can be formulated to address these vulnerabilities in a systematic manner. As nations continue to build institutional capacity to cope with drought, it is imperative that these lessons

learned are shared with others. Forming regional drought-preparedness networks and linking them via the Internet to facilitate information sharing is a cost-effective way to accomplish that goal.

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