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Chapter 35

Preparing for Drought: A Methodology

Donald A. Wilhite

Introduction

Preparedness was defined in chapter 1 as predisaster activities designed to increase the level of readiness or improve operational and institutional capabilities for responding to an emergency. Drought preparedness has encountered increasing support from governments in recent years at various levels because of escalating impacts and the ineffectiveness and costs of emergency assistance programs that have little noticeable return. For example, between 1970 and 1984, state and federal government in Australia expended more than A\$925 million on drought relief under the Natural Disaster Relief Arrangements (Wilhite 1986). The Republic of South Africa spent R2.5 billion for drought relief from the mid-1970s to the mid-1980s (Wilhite 1987). Both of these nations have now adopted national drought policies that promote self-reliance and more of a risk management approach to drought management.

Coping strategies for responding to and preparing for drought are numerous and range from individual or household level to national level. The series of chapters included in this section of the book provide case studies of these approaches at various levels of government. Government policy responses to drought can be broadly classified into three types (Parry and Carter 1987): pre-impact programs for impact reduction; post-impact government interventions; and contingency arrangements or preparedness plans. Pre-impact government programs are defined as those that attempt to mitigate the future effects of drought. Specific drought-related examples include the development of an early warning system, augmentation of water supplies, demand reduction (such as water conservation programs), and crop insurance.

Post-impact government interventions refer to those reactive programs or tactics implemented by government in response to drought or some other extreme climatic event. This includes a wide range of reactive emergency measures such as low-interest loans, transportation subsidies for livestock and livestock feed, provision of food, water transport, and drilling wells for irrigation and public water supplies. This reactive crisis management approach has been criticized by scientists, government officials, and many relief recipients as inefficient, ineffective, and untimely (Wilhite 1993). More recently, the provision of emergency relief in times of drought has also been criticized as being a disincentive to the sustainable use of natural resources because it does not promote self-reliance (Bruwer 1993, White et al. 1993). In fact, this approach may increase vulnerability to drought as well as to other natural hazards.

Contingency arrangements refer to policies and plans that can be useful in preparing for drought. These are usually developed at national and provincial levels, with linkages to the local level. The ultimate goal of these preparedness plans is to reduce vulnerability to future episodes of drought. Until recently, nations had devoted little effort to drought preparedness, preferring instead the traditional reactive or crisis management approach.

Deficiencies of previous drought assessment and response efforts are well documented (Wilhite 1992). They include (1) lack of appropriate climatic indices and early warning systems as well as lack of triggers for initiating specific actions; (2) insufficient data bases for assessing water shortages and potential impacts; (3) inadequate tools and methodologies for early estimates of impacts in various sectors; (4) insufficient information flow within and between levels of government on drought severity, impacts, and appropriate policy responses; (5) inappropriate or untimely emergency assistance programs; (6) poorly targeted emergency assistance programs that do not reach vulnerable population groups and economic sectors; (7) meager financial and human resources that are poorly allocated; (8) lack of emphasis on proactive mitigation programs aimed at reducing vulnerability to drought; (9) institutional deficiencies that inhibit effective emergency response; and (10) lack of coordination of policies and programs within (horizontal) and between (vertical) levels of government.

Increasingly, nations are pursuing a more proactive approach that emphasizes the principles of risk management and sustainable development. Because of the multitude of impacts associated with drought and the numerous governmental agencies that have responsibility for some aspect of monitoring, assessment, response, mitigation, and planning, developing a policy and plan must be an integrated process, involving all levels of government. This chapter provides an overview of a planning process that can be adopted by governments to develop a more comprehensive and proactive approach to drought management and planning. This process has been used widely at various levels of governments throughout the world as a model for preparation of a drought contingency plan. As the number of drought plans increases, governments can also refer to these plans as functional models, drawing from the experiences (i.e., lessons learned) of others. Given the increased emphasis on natural hazards management as a result of the declaration of the 1990s as the International Decade for Natural Disaster Reduction, models such as the one presented here are useful for those who want to initiate the drought planning process. Drought con-

tingency or preparedness planning also interfaces with the current global emphasis on sustainable development (i.e., UN Conference on Environment and Development and the UN Commission on Sustainable Development) and its obvious linkages to natural hazards management, as well as to the goals of the international convention on combating desertification. This convention has as one of its cornerstones the task of fostering development of preparedness plans for drought-prone nations. A discussion of this program is included in the chapter by Tallow in this volume (see chapter 44).

Developing a Drought Preparedness Plan

The factors that may stimulate governments to develop drought plans are numerous and vary from one country to another. In 1986, a call by the secretary general of the World Meteorological Organization (WMO) for the development of drought plans (Obasi 1986) likely resulted in greater attention to drought preparedness by some governments. However, internal factors, such as the occurrence of severe drought and concomitant economic, social, and environmental impacts, are more apt to stimulate the planning process at the national or provincial level. Although both external and internal factors are important, internal support ultimately must be present for the process to move forward.

Wilhite and Rhodes (1994) recently concluded that the increase in the number of states with drought plans in the United States could not be explained on the basis of the climatology of drought. This is understandable since the impacts associated with drought are a product of both the occurrence of meteorological drought and the demand placed on water and other natural resources by human activities. Wilhite and Rhodes found that social, political, and institutional influences may be more important than recent drought experiences, speculating that the increase in state drought planning activities may also have been the result of improved capabilities of state governments in conjunction with the Reagan administration's "New Federalism" initiative and concurrent federal regulatory mandates to state and local governments, states' concerns about federal intrusion into state-level water resource planning and water rights, and some states' early experiences in working with the newly formed Federal Emergency Management Agency (FEMA). Drought climatology and these other factors likely combine to explain the large increase in state drought plans between the early 1980s and late 1990s. In 1997, twenty-seven of the fifty states had prepared drought plans, and another six are in the early stages of plan development (see fig. 39.2). Only three states had developed drought plans in 1982. The planning process in New Mexico, Texas, and Oklahoma is a direct result of the severe drought that affected the southwestern and southern Great Plains states during 1996.

The decision to prepare a drought plan almost always rests with a high-ranking political official. If this official does not initiate the plan development process, the person must be convinced of the need for a plan and the benefits that will accrue if the process is to go forward. This may be a formidable and time-consuming task. Proponents of a plan must begin by determining support for the planning process within key government agencies and assessing what expertise exists to assist with the process. Consensus building is an important part of the process that (if done properly) will enhance the chances of success-

fully initiating and completing the plan. In some cases, a national or regional water resources management or development plan may already exist and a drought plan, once completed, could be incorporated into this broader strategy.

Although the principles of drought planning have been known for some time, progress toward preparedness in most countries has been conspicuously absent. This lack of progress would indicate that impediments or constraints to drought planning exist and must be addressed if the planning process is to be successful.

Constraints to drought planning

Institutional, political, budgetary, and human resource constraints often make drought planning difficult (Wilhite and Easterling 1987a). One major constraint that exists worldwide is a lack of understanding of drought by politicians, policy makers, technical staff, and the general public. Lack of communication and cooperation among scientists and inadequate communication between scientists and policy makers on the significance of drought planning also complicate efforts to initiate steps toward preparedness. Because drought occurs infrequently in some regions, governments may ignore the problem or give it low priority. Inadequate financial resources to provide assistance and competing institutional jurisdictions between and within levels of government may also serve to discourage governments from undertaking planning. Other constraints include technological limits (such as difficulties in predicting and detecting drought), insufficient data bases, and inappropriate mitigation technologies.

Policy makers and bureaucrats need to understand that droughts, like floods, are a normal feature of climate. Their recurrence is inevitable. Although we cannot influence the occurrence of the natural event (i.e., meteorological drought), we can lessen vulnerability through more reliable forecasts, improved early warning systems, and appropriate and timely mitigation and preparedness measures. Drought manifests itself in ways that span the jurisdiction of numerous bureaucratic organizations (e.g., agricultural, water resources, health, and so forth) and levels of government (e.g., national, state, and local). Competing interests, institutional rivalry, and the desire to protect their agency missions (i.e., "turf protection") impede the development of concise drought assessment and response initiatives. To solve these problems, policy makers and bureaucrats, as well as the general public, must be educated about the consequences of drought and the advantages of preparedness. Drought is an interdisciplinary problem that requires input by many disciplines and policy makers.

The development of a drought preparedness plan is a significant step in adopting a preventive, anticipatory approach to resource management. Planning, if undertaken properly and implemented during nondrought periods, can improve governmental ability to respond in a timely and effective manner during periods of crisis. Thus, planning can mitigate and, in some cases, prevent impacts while reducing physical and emotional hardship. Planning is a dynamic process that must incorporate both traditional and emerging technologies and take into consideration socioeconomic, agricultural, technological, and political trends.

It is sometimes difficult to determine the benefits of drought preparedness versus the costs of being unprepared. There is little doubt that preparedness requires financial and

human resources that are, at times, scarce. This cost has been and will continue to be an impediment. Preparedness costs are fixed and occur now while drought costs are uncertain and will occur later. Further complicating this issue is the fact that the costs of drought are not solely economic. They must also be stated in terms of human suffering, damage to biological resources, and the degradation of the physical environment, items whose values are inherently difficult to estimate.

Post-drought evaluations have shown assessment and response efforts of governments with a low level of preparedness to be largely ineffective, poorly coordinated, untimely, and inefficient in terms of the allocation of resources. Although government expenditures for drought relief are significant and unanticipated, they are usually poorly documented. However, a few examples do exist. During the droughts of the mid-1970s in the United States, specifically 1974, 1976, and 1977, the federal government spent more than US\$7 billion on drought relief programs (Wilhite et al. 1986). As a result of the drought of 1988, the federal government spent US\$3.9 billion on drought relief programs and US\$2.5 billion on farm credit programs (Riebsame et al. 1991). A disaster relief package was also passed by the US Congress in August 1989 in response to a continuation of drought conditions. Other examples of government expenditures for drought relief were cited previously in this chapter. When compared to these expenditures, a small investment in mitigation programs in advance of drought is a sound economic decision. The rationale for implementing preventive or pre-impact measures must be weighed not only against a retrospective analysis of relief costs but also against future relief costs and savings accrued through reduced economic, social, and environmental impacts. Though difficult to quantify, these savings will be significant.

It is equally important to remind decision makers and policy officials that, in most instances, drought planning efforts will use *existing* political and institutional structures at appropriate levels of government, thus minimizing start-up and maintenance costs. It is also quite likely that some savings may be realized as a result of improved coordination and the elimination of some duplication of effort between agencies or levels of government. Also, plans should be incorporated into general natural disaster and/or water management and development plans wherever possible. This reduces the cost of preparedness substantially. Politicians and many other decision makers simply must be better informed about drought, its impacts, and alternative management approaches and how existing information and technology can be used more effectively to reduce impacts at a relatively modest cost.

Developing a Drought Policy and Preparedness Plan: A Methodology

A planning process was developed recently in the United States to facilitate the preparation of drought plans by state government decision makers (Wilhite 1991). This process was based on methodology originally proposed in 1987 to synthesize the discussions and recommendations of participants at an international symposium and workshop on drought (Wilhite and Easterling 1987b). For the application of this methodology to states in the United States, three existing state drought plans were studied to determine the best

attributes of those plans for incorporation in the process (Wilhite 1991 and 1992). This process has also been modified for application to developing countries through direct interaction with foreign governments resulting from a series of regional training seminars on drought management and preparedness, organized and conducted by the International Drought Information Center at the University of Nebraska–Lincoln (fig. 35.1). The first of these seminars was held in 1989 in Botswana for eastern and southern Africa. This seminar was followed by seminars in Asia (1991) and Latin America (1993). The ten-step drought planning methodology discussed in this chapter was used as a primary instructional resource for these meetings. These seminars were sponsored by the United Nations Environment Programme (UNEP), US National Oceanic and Atmospheric Administration (NOAA), and WMO. In Latin America, the training seminar was also sponsored by the Organization of American States. An outgrowth of these training seminars was a guidebook for developing countries, *Preparing for Drought* (Wilhite 1992), sponsored by UNEP. Workshops on drought and desertification were also held in The Gambia in 1995 for the West African region and in Israel in 1997. Both meetings were sponsored by WMO.

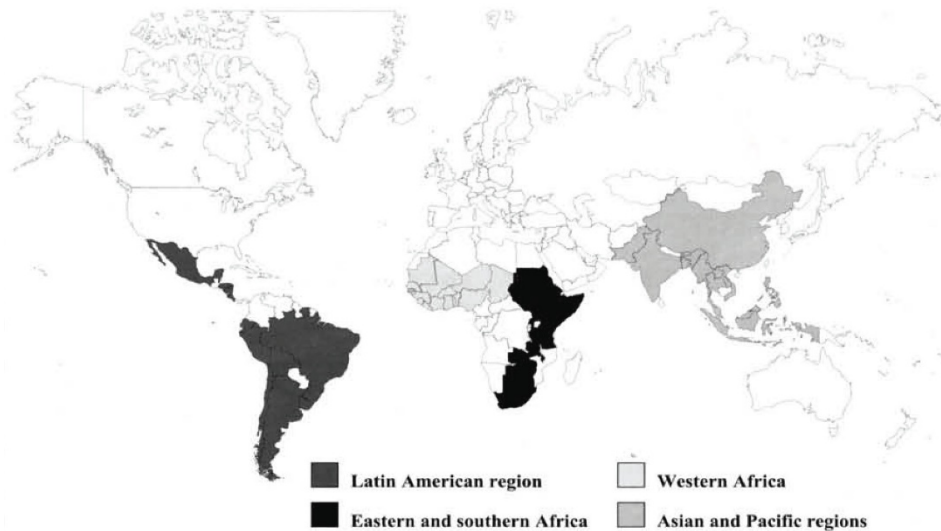


Figure 35.1. Countries participating in the four regional training seminars on drought management and preparedness, conducted between 1989 and 1995.

The planning process has been used or proposed for use in other political settings and geographical scales (i.e., local, state, regional, and national—see, for example, Great Lakes Commission 1990, SARCCUS 1990, Oladipo 1993, Moran 1995). The framework described below outlines the ten steps considered essential to the planning process (fig. 35.2). The first four steps actually involve appraising the resources available to support plan development and designing tactics to gain public support for the process. The process addresses the principal issues associated with drought planning and is intended to be flexible (i.e., governments can add, delete, or modify steps as necessary).



Figure 35.2. The ten-step planning process.

Step I. Appointment of national drought commission

The planning process is initiated through the appointment of a national drought commission (NDC) or authority. The appropriate name for this group (e.g., *commission*, *committee*, or *task force*) will vary from region to region. The NDC has two purposes. First, during plan development, the NDC will supervise and coordinate the development of the preparedness plan. Second, after the plan is implemented and during times of drought when the plan is activated, the NDC will assume the role of policy coordinator, reviewing alternative policy response options and making recommendations to political officials. The NDC is central to this planning process and will be referred to throughout the discussion of the proposed methodology.

The NDC should include representatives of the most relevant mission agencies, recognizing the multidisciplinary nature of drought, its diverse impacts, and the importance of both the assessment and mitigation/response components in any comprehensive plan, and how this plan must be integrated with long-term sustainable development objectives. Agencies to consider for inclusion on the commission are meteorological services, agriculture, water resources, planning, public water supply, natural resources, environmental protection, health, finance, economic and rural development, emergency management, and tourism. A representative from the head of state's office should also be included. Consideration should be given to including key representatives from universities, media (or a public information specialist), and environmental and/or special public interest groups. The purpose of including a public information specialist is to guarantee that the NDC gives

attention to how it will communicate information about drought severity and mitigative actions to the public during drought periods. The actual makeup of the NDC would be quite different from one country to another, reflecting different political infrastructures and the unique combination of economic, social, and environmental impacts associated with drought.

The NDC will need to consider at a later time whether it would be prudent to formalize the plan through the legislative (or some other) process. The danger in not formalizing the plan is that a change in political or administrative leadership may lead to the decay of the plan's infrastructure. It must be emphasized that political interest in drought quickly wanes when the crisis is over; concern and panic during a drought are swiftly replaced by apathy once the rains have returned and drought conditions have abated. (This sequence of events is commonly referred to as the hydro-illogical cycle—see fig. 35.3.) Likewise, institutional memory is short. A drought plan (and associated infrastructure) that is ad hoc by nature may cease to exist in a relatively short time. Formalizing the plan after its completion will guarantee that the infrastructure is in place to assist future generations in managing water resources during periods of scarcity.

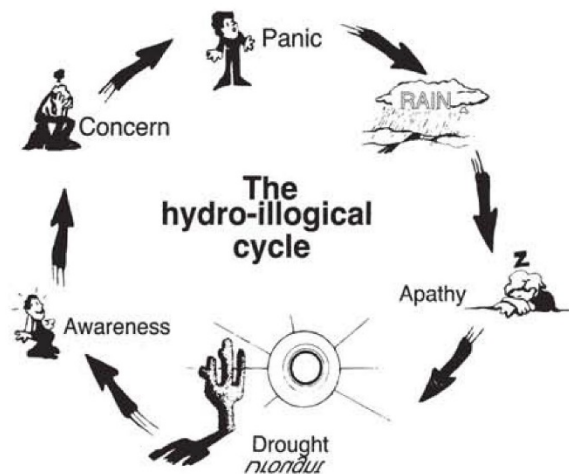


Figure 35.3. The hydro-illogical cycle.
Source: Wilhite 1992

Step 2. Statement of drought policy and plan objectives

As their first official action, the NDC must formulate a national drought policy and the objectives of the drought plan. The objectives of a drought *policy* differ from those of a drought *plan*. These differences must be made clear at the outset of the planning process. A drought *policy* is broadly stated and expresses the purpose of government involvement in drought assessment, mitigation, and response programs. Ultimately, the goal of a national policy should be to reduce vulnerability to drought by encouraging sustainable development. Drought *plan* objectives are more specific and action-oriented. Typically, the objectives of drought policy have not been stated explicitly by government. What generally exists in many countries is a *de facto* policy, one defined by the most pressing needs of the

moment. Ironically, under these circumstances, it is the specific instruments of that policy (such as relief measures) that define the objectives of the policy. Without clearly stated drought policy objectives, the effectiveness of assessment and response activities is difficult to evaluate.

The objectives of drought policy will differ considerably between countries. Based on a comparative analysis of drought assessment and response efforts in the United States and Australia, three objectives of a national policy have been proposed (Wilhite 1986). First, assistance should encourage or provide incentives for agricultural producers, municipalities, and other water-dependent sectors or groups to adopt appropriate and efficient management practices that help to mitigate the effects of drought. Mitigation is defined here as 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. Mitigation activities must be interpreted more broadly for drought than for other natural hazards because of the nonstructural nature of most drought impacts. Emergency assistance or relief measures in Australia (White et al. 1993), the United States (Wilhite 1991), South Africa (Bruwer 1993), and other countries have discouraged self-reliance by encouraging the adoption of management practices that are often inappropriate or unsustainable in a particular setting. This objective emphasizes accepting drought as a normal part of climate and preparing for or managing drought risks as a routine course of business.

Second, assistance, if provided, should be given in an equitable, consistent, and predictable manner to all without regard to economic circumstances, industry, or geographic region. The ultimate goal of a drought preparedness plan is to reduce vulnerability and the need for governmental intervention. However, when assistance must be provided, it will likely be provided in many forms, including technical aid. Whatever the form, those at risk must know what to expect from government during drought so that they can better prepare to manage that risk. The role of nongovernmental organizations (NGOs) in assistance efforts must also be precisely defined so that they complement governmental assistance efforts.

Third, the importance of protecting the natural and agricultural resource base must be recognized. This objective emphasizes the importance of promoting development that is sustainable in the long term. Clearly, many government programs and development projects have been shortsighted, increasing vulnerability to future episodes of drought. For example, agricultural policies that encourage the expansion of agriculture into marginal land areas are not sound when evaluated in the context of sustainability. The development of a national drought policy should lead to an evaluation of all pertinent government programs to ensure that they are consistent with the goals of that policy.

At the initiation of the planning process, members of the NDC should consider many questions pertaining to the development of a national drought policy, including the following:

- What is the purpose and role of government in preparing for drought, assessing impacts, and responding to drought?
- What should be the scope of the plan (i.e., agricultural, municipal water use, or multi-impact in design)?

- What consideration should be given to food supply and distribution or maintaining the nutritional status of various population groups?
- What are the linkages between drought and land degradation processes (i.e., desertification), natural hazards management, and sustainable development?
- What are the most drought-prone areas of the country?
- What are the most vulnerable sectors of the nation's economy?
- What are the principal social and environmental concerns associated with drought?
- Who are the most vulnerable population groups?
- Will the drought plan be a vehicle to resolve conflict between water users during periods of shortage?
- What resources (human and financial) is the government (and donor organizations) willing to commit to the planning process and in support of the plan once it is completed?
- What are the legal and social implications of the plan?

Following the development of a national drought policy, the next action of the NDC is to identify the specific objectives of the plan. Drought planning is defined as actions taken by individual citizens, industry, government, NGOs, and others in advance of drought for the purpose of mitigating some of the impacts and conflicts associated with its occurrence (Wilhite 1991). To be successful, drought planning must be integrated between levels of government, involving the private sector, where appropriate, early in the planning process. Some governments (e.g., Australia, India, South Africa, the United States) are now taking a more proactive approach to drought management. For the majority of nations, however, much remains to be done.

A general statement of purpose for a drought plan is to provide government with an effective and systematic means of assessing and responding to and mitigating the effects of drought. Drought plan objectives will, of course, vary between countries (and between political jurisdictions within countries), and they should reflect the unique physical, environmental, socioeconomic, and political characteristics of those countries (or provinces). Objectives that should be considered include the following:

- To provide timely and systematic data collection, analysis, and dissemination of drought-related information for the purpose of early warning of impending drought. The purpose of this information is to assist decision makers at all levels in making critical decisions, particularly in climate-sensitive sectors or businesses or industries.
- To establish proper criteria to identify and designate drought-affected areas and to trigger the initiation and termination of various assessment, mitigation, and response activities by governmental agencies, NGOs, and others during drought emergencies.

- To provide an organizational structure that assures information flow between and within levels of government, defines the duties and responsibilities of all agencies with respect to drought, and facilitates the decision-making process.
- To develop a set of appropriate emergency and longer-term programs to be used in assessing, responding to, and mitigating the effects of extended periods of water shortage.
- To provide a mechanism to ensure the timely and accurate assessment of drought impact on agriculture, industry, municipalities, wildlife, health, and other areas as appropriate.
- To provide accurate and timely information to the media to keep the public informed of current conditions and appropriate mitigation and response actions.
- To establish and pursue a strategy to remove obstacles to the equitable allocation of water during shortages and to provide incentives to encourage water conservation.
- To establish a set of procedures to evaluate and revise the plan on a continuous basis to keep the plan responsive to national needs.

It is suggested that countries consider these objectives in the context of their vulnerability to drought and add to, delete, or modify them as appropriate.

Step 3. Avoiding and resolving conflict between environmental and economic sectors

Political, social, and economic interests often clash during drought conditions as competition for scarce water resources intensifies, and it may be difficult to achieve compromises under these circumstances. To reduce the risk of conflict between water users during periods of shortage, it is essential for the public to receive a balanced interpretation of changing conditions through the media and from other sources. The NDC should ensure that frequent, thorough, and accurate news releases are issued to explain changing conditions and complex problem areas that exist and situations in which solutions will require compromises on both sides. To lessen the potential for conflict, the views of citizens and environmental and other special interest groups must be considered in the drought planning process at an early stage. Although the level of involvement of these groups will no doubt vary from one setting to another, the power of these interest groups in policy making is worth noting. Public interest organizations in some countries have initiated and participated in the development of natural resource policies and plans for some time and have extensive experience with this process. The involvement of these groups in determining appropriate policy goals strengthens the overall policy and plan. Moreover, this involvement ensures that the diverse values of society are represented adequately in the policy and plan. Creating an advisory group made up of representatives of these groups is recommended as a means of addressing their concerns.

Step 4. Inventory of natural, biological, and human resources and financial and legal constraints

An inventory of natural, biological, and human resources, including the identification of financial and legal constraints, may need to be initiated by the NDC. In many cases, much information already exists concerning available resources, particularly in the natural and biological resource areas. Generally speaking, less information is available in developing countries. It is also important to determine the vulnerability of these resources to periods of water shortage that result from drought. *Resources* include, for example, physical and biological resources, human expertise, infrastructure, and capital available to government. The most obvious natural resource of importance is water: Where is it located, how accessible is it, of what quality is it? *Biological resources* refer to the quantity and quality of grasslands/rangelands, forests, wildlife, and so forth. *Human resources* include the labor needed to develop water resources, lay pipeline, haul water and livestock feed, process citizen complaints, provide technical assistance, and direct citizens to available services. In addition, representatives of government determine what local, state, or national agencies may be called into action.

Financial constraints would include costs of hauling water or livestock feed, new program or data collection costs, and so forth. These costs must be weighed against the losses that may result in the absence of the drought plan. It should also be recognized that the financial resources available to government vary annually and from one administration to another. This may provide additional incentives for governments to formalize drought plans through the legislative or another process (see Step 1), thus assuring that funds to carry out existing programs are available. *Legal constraints* include user water rights, existing public trust laws, methods available to control usage, requirements for public water suppliers, and emergency and other powers of political and government officials during water shortages.

An inventory of these resources would reveal assets and liabilities that might enhance or inhibit fulfillment of the objectives of the planning process. This systematic survey should include resources available at various levels of government and the often unique resources available at universities. A comprehensive assessment of available resources would provide the information necessary for further action by the NDC. The NDC may also want to undertake an examination of drought plans available in adjacent and/or climatically similar countries.

Step 5. Development of the drought plan

The NDC will be the coordinating body for the development of a drought plan. Once completed, the plan is envisioned to follow a stepwise or phased approach as water conditions deteriorate and more stringent actions are needed. Thresholds must be established such that, when exceeded, certain actions are triggered within government agencies, as defined by the structure of the plan.

A drought plan should have three primary organizational components: monitoring or early warning, impact assessment, and mitigation (including emergency response). Although these are distinct activities, formal linkages will need to be incorporated in the plan for it to function properly and be responsive to provincial and local needs and evolving

conditions. These three organizational components are discussed in detail below. The names given to these components are intended to be generic, principally referring to the function of the committees. An organizational chart illustrating the linkages between these components of the drought plan is shown in figure 35.4.

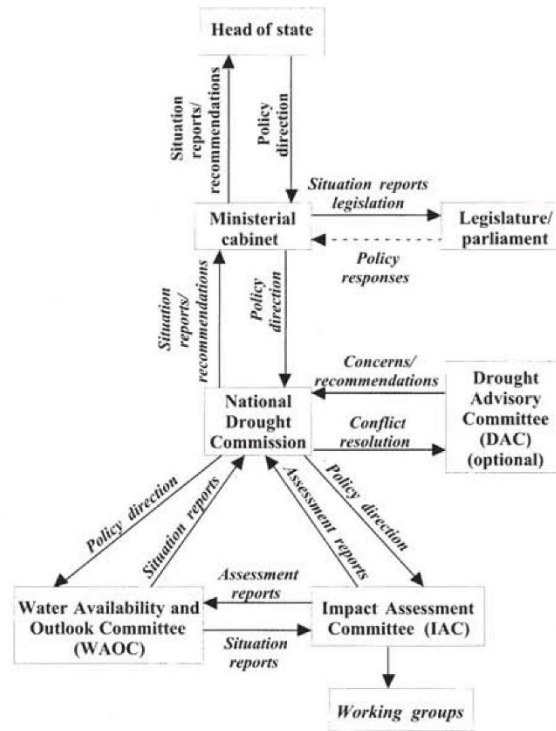


Figure 35.4. Organizational structure of a drought mitigation plan.

The organizational components shown in figure 35.4 represent the recommended structure of a national plan. It is essential that any national plan be integrated with provincial and local levels of government and also connected with food security plans, sustainable development plans, water resource plans, and so forth. These linkages are not depicted in the organizational chart. Each of the committees may have a counterpart at the provincial and local level with well-established linkages to the national committees. These provincial and local committees will facilitate not only data collection and feedback on programs and policies but also the dissemination of informational products and advisories and the implementation of policies.

Monitoring component: Water Availability and Outlook Committee (WAOC)

A water availability and outlook committee (WAOC) must be established to monitor current and estimate likely future water availability and moisture conditions. The chairperson of this committee should be a permanent member of the NDC. The WAOC would have five primary duties during the plan development process.

1. Inventory data availability and current observational networks for all meteorological and climate-related variables (e.g., snowpack, streamflow, reservoir levels).
2. Determine primary user needs and develop and/or modify current data and information delivery systems.
3. Define drought and develop triggers for initiating action by various committees or for various programs.
4. Develop an early warning system that incorporates all components of the hydrologic system.
5. Identify drought management areas based on the unique vulnerabilities of specific regions or population groups.

Membership of the committee should include representatives from agencies with responsibilities for forecasting and monitoring the relevant indicators of the water balance (i.e., meteorological variables such as precipitation and temperature, soil moisture, snowpack, surface water storage, groundwater, and streamflow). In some instances, many agencies at national and other levels of government may have responsibility for monitoring these indicators. It is not necessary for all of these agencies to have representation on this committee. Rather, it is recommended that data and information on each of the applicable indicators be considered in the committee's evaluation of the water situation and outlook for the country.

It is important for the WAOC to be a permanent committee, meeting regularly to determine the status of and outlook for water conditions. The committee should meet on a monthly basis throughout the year or regularly just preceding and during the period of most concern. One advantage of regular meetings is that the committee will function as a team because of continuous interaction. Another advantage is that a permanent committee can be useful in the early warning of emerging and potentially serious water problems, whether they are due to shortage or surplus situations. It is common for shortage and surplus situations to exist simultaneously within a country. WAOC meetings will be more frequent if climatic conditions warrant.

Impact component: Impact Assessment Committee (IAC)

During periods of drought, impacts will be far-reaching and cut across economic sectors and the responsibilities of various levels of government. The impact assessment committee (IAC) will represent those economic sectors most likely to be affected by drought (e.g., agriculture, transportation). The IAC should be composed of an interagency team of agency heads or their representatives, and its chairperson should be a permanent member of the NDC. It may also be advisable to include university scientists and representatives of international organizations that have expertise in early estimations of impact. The IAC should consider both direct and indirect losses resulting from drought. Often drought assistance is provided only to those experiencing direct losses while agricultural and other businesses experiencing secondary impacts are largely ignored. Because of the obvious

dependency of the IAC on the WAOC, frequent communication between the two is essential.

The IAC must give significant attention to the full range of impacts associated with drought and mechanisms to lessen those impacts, and also determine how to target assistance to those economic sectors or vulnerable population groups as the need arises. One of the principal deficiencies of past response efforts has been the inability of government to direct the necessary form of assistance to the economic sector or population group in a timely manner. Assistance that is misdirected or untimely is of little or no value and is quite costly to taxpayers. The IAC must work closely with both the WAOC and the NDC to ensure that this does not occur.

Mitigation and response component: National Drought Commission

The third and final element of a drought plan is the mitigation and response component. The responsibility of this component is to pursue the creation of long-term programs to lessen vulnerability to drought while acting on the information and recommendations of the IAC. The IAC should evaluate the range of assistance available from government and other sources to assist agricultural producers, municipalities, and others during times of emergency. As people become more self-reliant, the need for government intervention will diminish. Because this is a policy-making body, it should be composed of senior-level policy officials, precisely the same makeup as the NDC. Therefore, in addition to overseeing the development of the preparedness plan, the NDC should assume the mitigation and response role following plan development.

During the plan development process, the NDC should inventory all forms of assistance available from government and nongovernment sources during severe drought. The NDC should evaluate short-term programs for their ability to address emergency situations and long-term mitigation programs for their ability to reduce vulnerability to drought. The NDC may want to consider transferring this task to the IAC. The NDC (or IAC) should also recommend other forms of assistance programs that could be developed to respond to drought. During periods of drought, the NDC will make recommendations to the head of state or appropriate representative concerning specific actions that need to be taken.

Drought assistance should be defined in a very broad way to include all forms of technical and relief programs available from government and nongovernment sources. Rational response options must be determined for each of the principal impact sectors identified by the IAC. These options should examine appropriate drought mitigation measures on three time scales: (1) short-term (reactive or emergency) measures implemented during drought; (2) medium-term (recovery) measures implemented to reduce the length of the post-drought recovery period; and (3) long-term (proactive) measures or programs implemented in an attempt to reduce societal vulnerability to future drought. In many instances, local input should be sought to determine the forms of assistance needed by the various impact sectors.

Societal vulnerability to drought may be influenced substantially by non-drought-related actions taken or policies implemented during nondrought periods. The national drought policy objectives formulated in Step 2 will be especially beneficial at this time. Government must consider the effects of emergency programs on long-term development objectives

and guard against implementing emergency programs that draw resources from development programs or interfere with their fulfillment, as has happened in Brazil (Magalhães 1993). Emergency programs should foster the achievement of development objectives.

Step 6. Identification of research needs and institutional gaps

Step 6 is to be carried out concurrently with Step 5. The purpose of this step is to identify research needed in support of the objectives of the drought plan and to recommend research projects to remove deficiencies that may exist. It is unlikely that research needs and institutional gaps will be known until the various committees formed in association with the drought planning process have been through the planning process. Compiling information on research needs and institutional gaps is a function of the NDC. For example, the WAOC may recommend establishing or enhancing an existing groundwater monitoring network. The NDC may find it desirable to create a multidisciplinary scientific advisory panel that could evaluate research proposals, establish funding priorities, and seek financial support from appropriate international or regional organizations, NGOs, or donor governments.

It is likely that institutional deficiencies will be identified as part of Step 6. Agency responsibilities or missions may need to be modified to support activities of the drought plan, and these modifications may require legislative action.

Step 7. Synthesis of scientific and policy issues

Previous steps in the planning process have considered scientific and policy issues separately, concentrating largely on assessing the status of the science or on the existing or necessary institutional arrangements to support the plan. An essential aspect of the planning process is the synthesis of the science and policy of drought and drought management. This is the purpose of Step 7.

The policy maker's understanding of the scientific issues and technical constraints involved in addressing problems associated with drought is often negligible. Likewise, scientists generally have a poor understanding of existing policy constraints that affect drought response. A panel of researchers and policy experts have concluded that communication and understanding between the science and policy communities is poorly developed and must be enhanced if the drought planning process is to be successful (Wilhite and Easterling 1987a). Direct and extensive contact is required between the two groups to distinguish what is feasible from what is desirable for a broad range of science and policy issues. Integration of science and policy during the planning process will also be useful in setting research priorities and synthesizing current understanding. The NDC should consider various alternatives to bring these groups together.

Crucial to this integration process is the provision within the planning process of a means to facilitate scientific information exchange between scientists and policy makers. Since this is not their primary mission, it is unlikely that scientists will freely devote extensive attention to tailoring and otherwise making available research results on a frequent or continuous basis. One way to achieve this interaction is to appoint a specific liaison person or group to facilitate the exchange of information.

Step 8. Implementation of the drought plan

The drought plan should be implemented by the NDC to give maximum visibility to the program and credit to the agencies and organizations that have a leadership or supporting role in its operation. As with emergency response plans for other natural hazards, all or a portion of the system should be tested under simulated drought conditions before it is implemented. A "virtual reality" drought simulation exercise has been developed recently in the United States to assist decision makers in the decision process (Werick 1994). It is also suggested that announcement and implementation occur just before the most drought-sensitive season to take advantage of inherent public interest. In an agricultural setting, this would be in advance of planting or at some other critical time during the growing season. The cooperation of the media is essential to publicizing the plan, and they must be informed fully of the rationale for the plan as well as its purpose, objectives, assessment and response procedures, and organizational framework. If a representative of the media or a public information specialist is a member of the NDC, as recommended, this person should be an invaluable resource in carrying out this step of the planning process.

Training of personnel who will be actively involved in the operation of the plan is also critical if the plan is to achieve its specified goals. This training should include not only persons in the principal national agencies involved in the activated plan but also persons at the provincial and local levels of government who will provide valuable input in the decision-making process. The key players in the drought plan must thoroughly understand their responsibilities during drought and how these responsibilities relate to those of other organizations and levels of government. If they do not understand the plan and how it functions, it will fail.

In the absence of drought over several consecutive years, the NDC should conduct simulation exercises to keep leadership informed of their responsibilities during drought. This is a common practice in natural disaster mitigation (e.g., earthquakes, hurricanes); it should be no different for drought. Changes in political leadership, institutional change, retirements, promotions, and transfers to other positions can disrupt the integrity of the plan.

Step 9. Development of multilevel educational and training programs

Educational and training programs should concentrate on several points. First, a greater level of understanding must be established to heighten public awareness of drought and water conservation and the ways in which individual citizens and the public and private sectors can help to mitigate impacts in the short and long term. The educational process might begin with the development of a media awareness program. This program would include provisions to improve the media's understanding of the drought problem and the complexity of the management issues involved as well as a mechanism to ensure the timely and reliable flow of information to all members of the media (e.g., via news conferences). Second, the NDC should initiate an information program aimed at educating the general population about drought and water management and what they can do as individuals to conserve water in the short run. Educational programs must be long-term in design, concentrating on achieving a better understanding of water conservation issues among all age

groups and economic sectors. If such programs are not developed, governmental and public interest in and support for drought planning and water conservation will wane during periods of non-drought conditions.

Step 10. Development of drought plan evaluation procedures

The final step in the establishment of a drought plan is the creation of a detailed set of procedures to ensure adequate evaluation. To maximize the effectiveness of the plan, two modes of evaluation must be in place:

1. An ongoing or operational evaluation program that considers how societal changes such as new technology, the availability of new research results, legislative action, and changes in political leadership may affect the operation of the plan.
2. A post-drought evaluation or audit program that documents and critically analyzes the assessment and response actions of government, NGOs, and others as appropriate and implements recommendations for improving the system.

The first mode of evaluation is intended to express drought planning as a dynamic process, rather than a discrete event. The operational evaluation program is proposed to keep the drought assessment and response system current and responsive to national needs. Following the initial establishment of the plan, it should be monitored routinely to ensure that societal changes that may affect water supply and/or demand or regulatory practices are considered for incorporation. Accordingly, drought plans should be revised periodically.

The second mode of evaluation is the post-drought audit, which should be conducted or commissioned by governments in response to each major drought episode. Institutional memory fades quickly following drought as a result of changes in political administration, natural attrition of persons in primary leadership positions, and the destruction of critical documentation of events and actions taken. Post-drought evaluations should include an analysis of the physical aspects of the drought: its impacts on soil, groundwater, plants, and animals; its economic and social consequences; and the extent to which predrought planning was useful in mitigating impacts, in facilitating relief or assistance to stricken areas, and in post-drought recovery. Attention must also be directed to situations in which drought coping mechanisms worked and where societies exhibited resilience; evaluations should not focus only on those situations in which coping mechanisms failed. Provisions must be made to implement the recommendations emanating from this evaluation process. Evaluations of previous responses to severe drought are recommended as a planning aid to determine those actions (both technical and relief) that have been most effective.

The post-drought evaluation process will identify numerous topics that may require research in order for them to be more adequately addressed during future drought episodes. For example, little is known about the effects of government drought assistance programs. Do they facilitate or hinder the recovery process? Extensive research may be required on the environmental and socioeconomic effects of prolonged rainfall deficiency on various hydrological features such as soil water and groundwater. Investigation of the

effects of drought on land use, vegetation, and soil is essential to the impact assessment process.

To ensure an unbiased appraisal, governments should place the responsibility for evaluating drought and societal response to it in the hands of nongovernmental organizations such as universities and/or specialized agencies or corporations. An excellent example of this practice in operation is the evaluation of India's Food for Work Programme (Sinha et al. 1987). Although the program is implemented by state government, it is evaluated by an independent body, the Planning Commission (Wilhite and Easterling 1989).

Drought Preparedness Methodologies: Other Models

Government entities and others interested in developing a drought plan are encouraged to consider a variety of models or methodologies. One such methodology is the product of an effort by Werick and Whipple (1994) as part of the National Study of Water Management during Drought of the US Army Corps of Engineers. This methodology recommends the following seven steps in the development of a drought preparedness plan:

1. Build a team and identify problems.
2. Develop objectives and metrics for evaluation.
3. Describe the status quo (i.e., what will happen in future droughts if the community does nothing more to prepare itself).
4. Formulate alternatives to the status quo.
5. Evaluate alternatives and develop study team recommendations.
6. Institutionalize the plan.
7. Exercise and update the plan and use it during droughts.

This process is based on federal planning principles in the United States but adds two additional steps (2 and 7) to reflect the importance of the nonfederal role in drought planning and the need for nonstructural solutions in resolving water management problems associated with drought.

The American Water Works Association (1992) has created a process for developing a drought management plan that focuses on the needs of urban water managers. This process reflects a sequence of six steps:

1. Obtaining public input and involvement.
2. Defining goals and objectives.
3. Assessing water supply and demand conditions.
4. Defining drought indicators.
5. Identifying and assessing drought mitigation measures.
6. Developing a drought index and management strategy.

This report considers the primary benefit of a drought management plan, versus an ad hoc crisis management response, to be a reduction in the possibility of a community either

over- or under-reacting to a water supply emergency. The report also notes that a drought plan can identify measured responses to a prolonged water shortage and reduce the chances the public will perceive the actions of the water utility to be arbitrary or ill-conceived. The by-product of a well-conceived plan will be to instill public confidence in the water utility and the actions taken in response to the emergency.

The similarity of this model to the ten-step process described earlier in this chapter is obvious. Each strives to obtain the same goal (i.e., improved preparedness and a reduction in impacts) through the implementation of a logical process leading to plan development. The critical issue is not which process is followed but rather whether the outcome of the process is workable and consistent with national (local or provincial) goals, and whether the process has involved stakeholders at each step. Consulting several generic models and actual operational plans being used by other groups will only serve to enhance the chances of the planning process being successful. Ultimately, each plan will be unique because of the distinct socioeconomic, political, and environmental characteristics of the region.

Summary and Conclusions

Post-drought evaluations of government response to drought have demonstrated that the reactive or crisis management approach has led to ineffective, poorly coordinated, and untimely responses. The magnitude of economic, social, and environmental losses in the past several decades in developing and developed countries has pointed out the current and apparent escalating vulnerability of all nations to extended episodes of severe drought. Increased awareness and understanding of drought has led a growing number of governments to take a more proactive approach to drought management by attempting to reduce impacts in the short term and vulnerability in the long term. This approach must integrate drought policy with issues of sustainable development.

The development of drought policies that promote risk management and the preparation of contingency plans exemplify a philosophical change by governments in their approach to drought management. Drought preparedness plans promote greater coordination within and between levels of government; improved procedures for monitoring, assessing, responding to, and mitigating the effects of severe water shortages; and more efficient use of natural, financial, and human resources.

It is recommended that the governments of all drought-prone nations formulate drought preparedness plans. The essential elements to consider in the formulation of these plans were presented in this chapter in a ten-step process to facilitate plan development. Other generic models were also discussed. A preparedness plan will lead to a more effective, efficient, and timely approach to drought management, with greater emphasis on long-term vulnerability reduction, as opposed to short-term emergency response. Governments are advised to consider the proposed planning process carefully, modifying or adapting it to their particular circumstances by adding or deleting steps as necessary.

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