

Breaking the Hydro-Illogical Cycle: Progress or Status Quo for Drought Management in the United States

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Abstract: Drought is a naturally occurring event that is associated with virtually all climatic regions. Given its slow onset and other characteristics, including its spatial dimensions and duration, impacts are difficult to assess and have been, historically, poorly documented. These impacts are strongly influenced by a society's exposure to the hazard and the vulnerability of that society to the hazard. This vulnerability is continually changing in response to increasing population, land use changes, technology, government policies, and many other factors. Therefore, each drought event is superimposed on a society with differing vulnerabilities than existed when the previous drought event occurred. Drought impacts are increasing worldwide, both as a result of these changing vulnerabilities and, perhaps, because of an increase in the frequency, severity, and duration of drought events. To lessen societal vulnerability, it is imperative for nations to move away from the crisis management approach to drought management, often characterized by the hydro-illogical cycle, and toward a more proactive, risk-based approach, including the adoption of national drought policies that reflect this new paradigm. Emphasis must be given to the development of improved drought monitoring and early warning systems and the delivery of this information to decision makers at all levels. It is also essential that vulnerability assessments be conducted in order to determine who and what is at risk and why. A final step is the identification and implementation of appropriate mitigation measures or actions that will reduce future impacts on economic sectors and population groups. The goal of this process is to develop drought preparedness plans well in advance of a drought event in order to enhance the coping capacity of society and reduce impacts. National drought policies that promote this concept as an essential part of drought management are encouraged for all drought-prone nations. This paper reviews recent progress in the United States toward a more risk-based approach to drought management and the formulation of a national drought policy. The lessons learned from the United States may be applicable to other nations who are trying to adopt a more risk-based management approach.

Key words: drought management, drought planning, drought policy, drought risk management.

1. INTRODUCTION

Drought is a complex, pervasive natural hazard, often referred to as a "creeping phenomenon" (Tannehill 1947). As a result of its complexity, literally hundreds of definitions of drought exist, reflecting different climatic characteristics from region to region and sector-specific impacts. Conceptually speaking, drought results from a deficiency of precipitation from expected or normal that, when this deficiency is extended over a season or longer period of time, is insufficient to meet the demands of human activities. Droughts are typically classified as meteorological, agricultural, hydrological, or socioeconomic (Wilhite and Glantz 1985; Dracup et al. 1980). However, all types of drought originate from a deficiency of precipitation that results in water shortage for some activity or some group. Of course, the severity of drought in both a temporal and spatial sense can be exacerbated by other factors such as high temperatures, low relative humidity, and high winds. Drought must be considered a relative, rather than absolute, condition. The ultimate results of these precipitation deficiencies are, at times, enormous economic and environmental impacts as well as personal hardship. These impacts ripple through the economy, producing significant secondary and tertiary impacts as well.

Impacts of drought appear to be increasing in both developing and developed countries, a clear indication of nonsustainable development in many cases and, perhaps, providing an indication of changes in climate and its variability resulting from an enhanced greenhouse effect or global

warming. Lessening the impacts of future drought events will require nations to pursue development of drought policies that emphasize a wide range of risk management techniques, including improved monitoring and early warning systems, preparedness plans, and appropriate mitigation actions and programs. The goal is to move away from the traditional crisis-based management approach that is characterized by the hydro-illogical cycle. This approach is institutionally imbedded in drought management in most countries and it continues to be a challenge to depart from this mindset of reacting to drought and its impacts after it reaches a significant level of severity.

2. DROUGHT MANAGEMENT: THE CRISIS MANAGEMENT APPROACH

The approach taken by essentially all governments at both the national and local level is to react to drought through what is commonly referred to as the hydro-illogical cycle (Fig. 1). This approach is characterized by a growing level of concern as the severity of the drought increases over a period of several months or more. However, no drought management plan is in place that oversees government agency responses or the coordination of those responses. It is widely known that responding to crisis is largely ineffective, and the actions of the multiple government agencies with responsibilities for responding to the drought conditions are usually poorly coordinated. This type of response is largely directed at addressing the impacts that are occurring. These impacts are a reflection of societal vulnerability. This largely reactive approach actually leads to an increase in societal vulnerability since the recipients of drought relief or assistance programs become dependent on government programs to rescue them by providing resources to survive the crisis. This approach discourages the development of self-reliance and implementation of improved resource management practices.

All drought-prone regions have a “reference” drought that has helped to focus attention on the devastating impacts that can be associated with a severe drought episode. For the United States, the reference drought for most parts of the country is the severe drought that began in 1931 and extended through 1939 for many parts of the country and is associated with the famous “Dust Bowl” period in American history. This series of drought years was noteworthy for several reasons. First, the severity, duration, and spatial extent of the drought during a critical settlement period in the nation’s history and the economic depression of the period resulted in substantial economic, environmental, and social impacts across the country, including the exodus of many people from the Great Plains to the far western states, especially California and Oregon. The peak drought year, in terms of areal coverage, was 1934, when 65% of the country experienced severe to extreme drought. Second, it was the first time the federal government had become actively engaged in drought relief. Previously, the federal government had largely relied on the efforts of private organizations, such as the Red Cross, and churches to provide relief to the victims of drought (Wilhite 1983; Wilhite et al. 1986). The government’s engagement in drought relief included a combination of reactive programs and several more noteworthy mitigation-type measures directed at reducing the vulnerability of the Great Plains and other regions. Most noteworthy was the formation of the Soil Conservation Service within the U.S. Department of Agriculture. This agency’s mission was to improve soil and water management and conservation practices throughout the country. Of course, during this period there was no drought early warning system in place, as government entities relied largely on precipitation departures from normal to make assessments of drought severity.

The impacts of drought are much more complex today, a trend that will continue. Once largely characterized as a problem for the agricultural sector, the impacts of drought have now escalated and cascaded into many other sectors such as energy, transportation, recreation and tourism, urban water supply, and water quality. The environmental and social impacts are also more dramatic,

resulting in significant conflicts between water users. These impacts cascade as drought conditions evolve from a short-term precipitation deficiency, commonly referred to as meteorological drought, to a longer-term period of precipitation deficiency leading to agricultural and hydrological drought, as illustrated in Fig. 2. Agricultural drought is associated with deficiencies in soil moisture, which, in turn, affects agricultural production. As precipitation deficiencies continue, shortages in hydrological systems (i.e., reservoirs and lakes, streamflow, ground water levels) begin to emerge, resulting in significant impacts in the other sectors mentioned above.

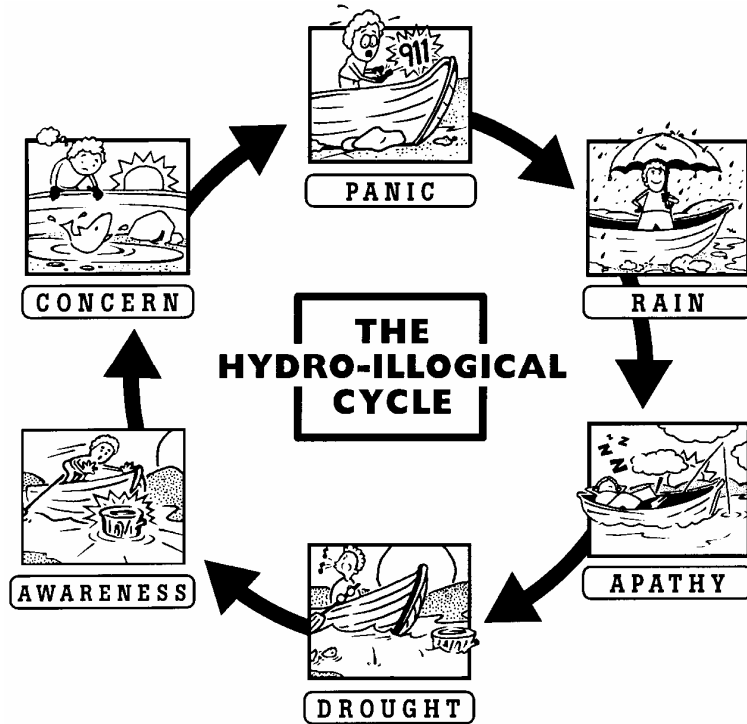


Fig. 1. The hydro-illogical cycle (Source: NDMC website, <http://drought.unl.edu/Planning/HydroillogicalCycle.aspx>)

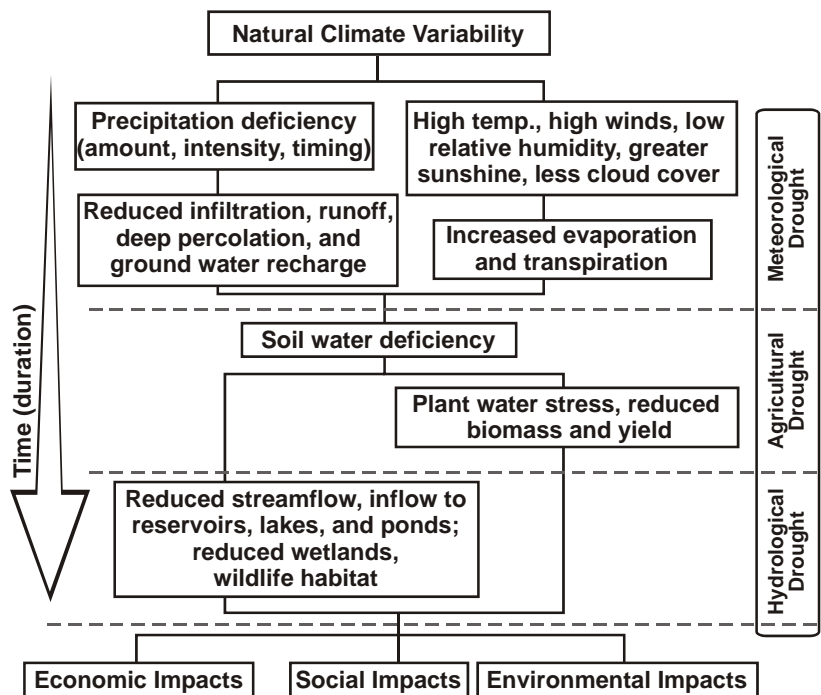


Fig. 2. The evolution of drought types and impacts (Source: National Drought Mitigation Center, University of Nebraska–Lincoln)

Fig. 3 represents the historical occurrence of drought in the United States for the period of 1895 to 2011, expressed as the percent area of the country experiencing severe to extreme drought. Several important features of drought are illustrated in this figure during the period of record. First, drought affects a portion of the country each year, ranging from less than 10% in some years to more than 40% in several major drought episodes. Second, the percent area affected is highly variable during this period of record, but drought events tend to cluster, such as during the 1930s, 1950s, 1960s, and so forth. The recent series of drought years have been rather dramatic in terms of duration, intensity, and spatial extent, beginning in the late 1990s and continuing to present. The major drought events illustrated in this figure are also important for another reason—each one represents a “window of opportunity” for improved drought management and planning. Referring once again to Fig. 1, each major drought episode captures the attention of the public, natural resource managers, and policy makers by highlighting the complex series of impacts associated with these events and the need for a more proactive, risk-based management approach.

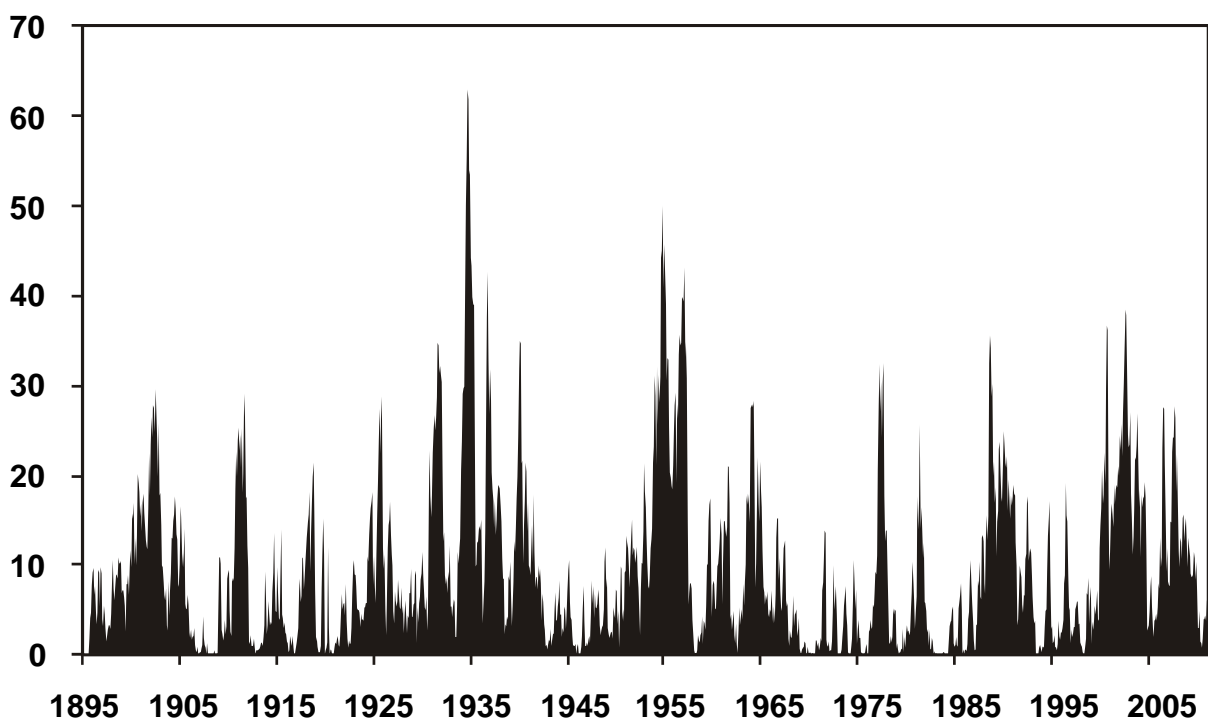


Fig. 3. Percent area of the United States in severe and extreme drought, 1895–2011 (Source: Compiled from data from NOAA's National Climatic Data Center)

3. CURRENT AND FUTURE DROUGHTS: KEY OBSERVATIONS

It is clear from the recent occurrences of drought in the United States that there is a growing need to enhance planning and policy efforts to deal with the expanding drought impacts and their complexities. Several key points are to be noted. First, the impacts from recent droughts have led to greater sectoral impacts and reflect the increasing vulnerability of much of the country to periods of severe and extended water shortages. Second, there is a significant migration of population in the United States to more water-short areas in the southwest, south-central, and far western states, as well as a significant shift in population to the southeastern states, particularly Georgia and Florida. This shift in population was noteworthy between 1990 and 2000, and the latest census information through 2010 indicates that these shifts to the west and southeast are continuing. Percentage increases during the 1990s ranged from 30% to more than 60% in the states of Arizona, Colorado, Utah, and Nevada. These already water-short states in the western United States are now being further water-stressed as population increases dramatically and water seems to be more limited as a

result of warmer winters, declining snowpack and runoff, and higher rates of evapotranspiration. Third, water demand is increasing rapidly in many parts of the country in association with expanding populations. Thus, conflicts between water use sectors are increasingly leading to greater transboundary issues between states and with Mexico and Canada. Fourth, many river basins in the country are currently fully or over-appropriated. The ability of states to manage water supplies with an expanding population under various climate change scenarios is an important area of concern for many decision makers. Finally, many feel that current water laws and institutions are outmoded and unable to deal with these expanding pressures of a growing population and changing vulnerabilities to increased climate variability and changes in climate state.

Projections of an increased frequency and severity of drought conditions from the most recent IPCC report (2007) provide further cause for concern. Using the output from the A1B scenario, a significant increase in drought is expected for Central America, the southwestern United States, the Amazon Basin, southern Africa, the Mediterranean Basin, Australia, and Indonesia. Some of these regions are currently significantly water-stressed, so a trend toward increased drought is cause for significant concern.

The pattern of drought in the United States over the past decade is also of concern and illustrates several key points with regard to drought occurrence and patterns. As noted in Fig. 3, the spatial extent of drought has been quite variable in terms of area affected over this period, with portions of the western and southeastern United States experiencing severe drought conditions in most of these years. A representative sample of the U.S. Drought Monitor maps from the period from 2000 to 2010 is provided in Fig. 4. The U.S. Drought Monitor map is compiled weekly by the National Drought Mitigation Center (NDMC), the U.S. Department of Agriculture (USDA), and the National Oceanic and Atmospheric Administration (NOAA). Fig. 4 illustrates the spatial dimensions of drought and its severity in four years of the past decade to illustrate the point that drought is a national issue in the United States, thus requiring a national approach or policy that reinforces the need for a more consistent proactive approach for drought management. The series of weekly U.S. Drought Monitor maps from 1999 to current is available on the website of the National Drought Mitigation Center (<http://droughtmonitor.unl.edu>). Viewing these maps over any sequence of months during this period illustrates another important point regarding drought occurrence: the shifting epicenter of drought from month to month and from year to year for persistent droughts. Because of the long duration of drought events, the areas of greatest severity are continuously changing from month to month and year to year. Also of note from Fig. 3 is that only one year (2010) in the sequence from 2000 to 2010 experienced minimal drought occurrence in the country. However, drought returned in 2011 (Fig. 5) and affected most of the southern United States, stretching from Arizona to Florida, with the hardest-hit areas being Texas, Oklahoma, New Mexico, and Arizona.

4. DROUGHT RISK REDUCTION

To reduce the impacts of drought there is an urgent need to focus attention on the identification of the most vulnerable sectors, population groups, or regions. A risk assessment of the historical and most recent impacts associated with drought allows us to quickly highlight these areas and implement mitigation measures that will improve the coping capacity (i.e., resilience) of these sectors, groups, and regions. This risk-based management approach is illustrated in Fig. 6, the Cycle of Disaster Management, which is composed of the crisis management elements and the risk management elements. To build greater societal resilience, it is critically important for more emphasis to be directed at the risk management portion of this cycle.

The risk associated with drought (and other natural hazards) is a reflection of both a region's exposure to drought conditions and its vulnerability. Exposure is defined by the frequency and severity of historical drought occurrences and current trends. Vulnerability is defined by a long series of social factors, including population growth and migration patterns, land use changes, technology, urbanization, environmental degradation, water use trends, government policies, and

environmental awareness of the population, to name a few. It is difficult to assess how trends in each of these and other factors affect vulnerability, but it is clear that each drought event overlays a society with vulnerabilities that are different from the previous event. Tracking these changes/trends is critically important as part of a drought planning and mitigation strategy.

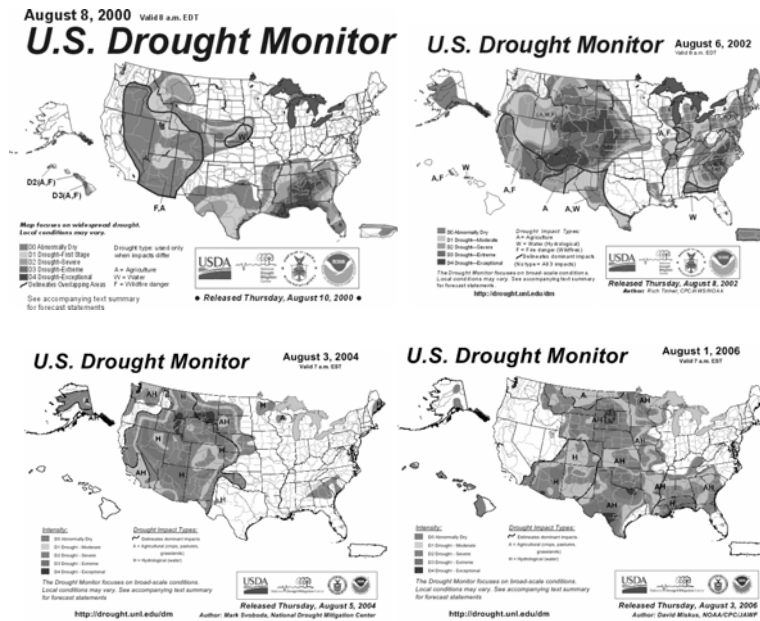


Fig. 4. Weekly U.S. Drought Monitor maps for 2000, 2002, 2004, and 2006 (Source: U.S. Drought Monitor; <http://droughtmonitor.unl.edu>)

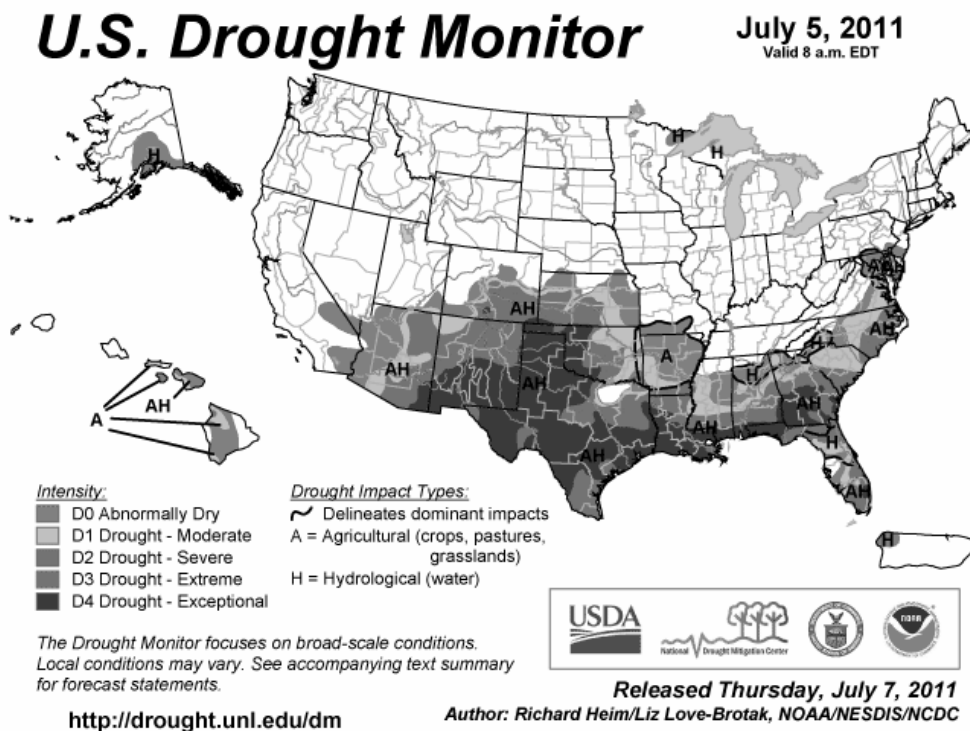


Fig. 5. U.S. Drought Monitor for July 5, 2011 (Source: U.S. Drought Monitor; <http://droughtmonitor.unl.edu>)

Referring again to the types of drought in the context of drought risk reduction, as meteorological drought continues and begins to cause impacts in the agricultural sector and in water management (i.e., hydrological drought), there is less emphasis on the actual departure of

precipitation from normal or expected and more emphasis on management practices that may increase the resilience of society to water shortages as manifested in the impacts that occur. For example, impacts on agriculture can be substantially influenced by cultivation practices, crop type, irrigation efficiency, and so forth. Likewise, hydrological drought is affected by management practices that are associated with reservoir management and the management of other ground and surface water resources. Mitigating the impacts of drought is related to the proper management of resources in these sectors.

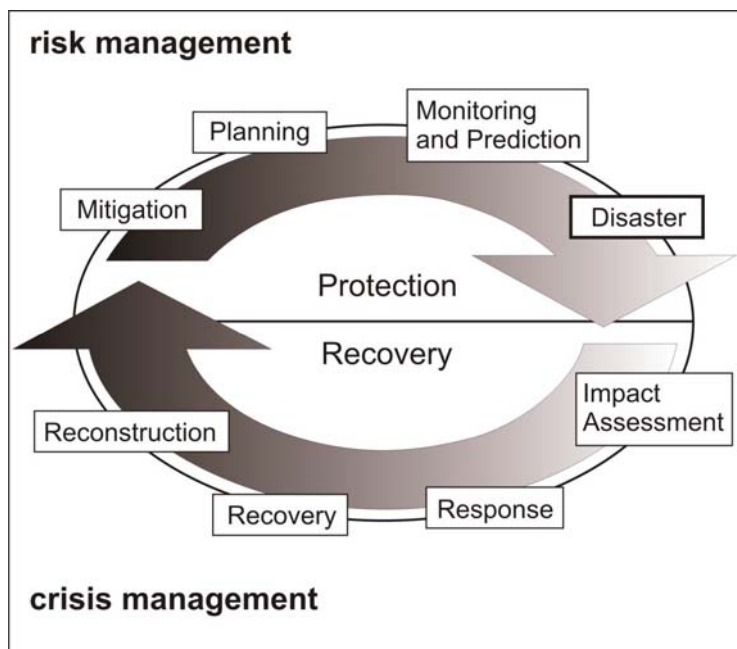


Fig. 6. The cycle of disaster management reflects two components, crisis management and risk management
(Source: National Drought Mitigation Center, <http://drought.unl.edu>)

4. STATUS OF DROUGHT PLANNING IN THE UNITED STATES

Drought planning can and should occur at all levels, from local to regional to national. Significant progress has been made in drought planning at the state level from the early 1980s, when there were only 3 states with drought plans, to today. At present, 47 states have drought plans, and 11 of those states are increasingly emphasizing mitigation as a key component of their plans (Fig. 7). States in the southwestern and south-central portions of the country have made the greatest progress. Many other states have plans in place, but the emphasis of these plans is directed more toward response, i.e., reacting to crisis. As states move along the continuum from response to mitigation planning, there is an increasing need to deliver better and more timely information on drought status and early warning, including improved seasonal forecasts, to decision makers and other users. It is also important for these users or stakeholders to be involved in the development of products or decision support tools to ensure their needs are being met.

The NDMC has been working with states to stress the importance of developing a mitigation plan in order to be better prepared for future drought episodes. Most states have incorporated, in some form, a 10-Step Planning Process that was originally developed in 1991 (Wilhite 1991). A description of this planning process is included later in this paper. This model has been used by most U.S. states in the development of a drought mitigation plan. The key elements of a drought mitigation plan are:

1. Monitoring, early warning, and information delivery systems, including integrated monitoring of key indicators, the use of appropriate indicators and indices, and the development of decision support tools;

2. Risk and impact assessment, including conduct of vulnerability assessment and the monitoring and archiving of drought impacts;
3. Mitigation and response measures to increase coping capacity.

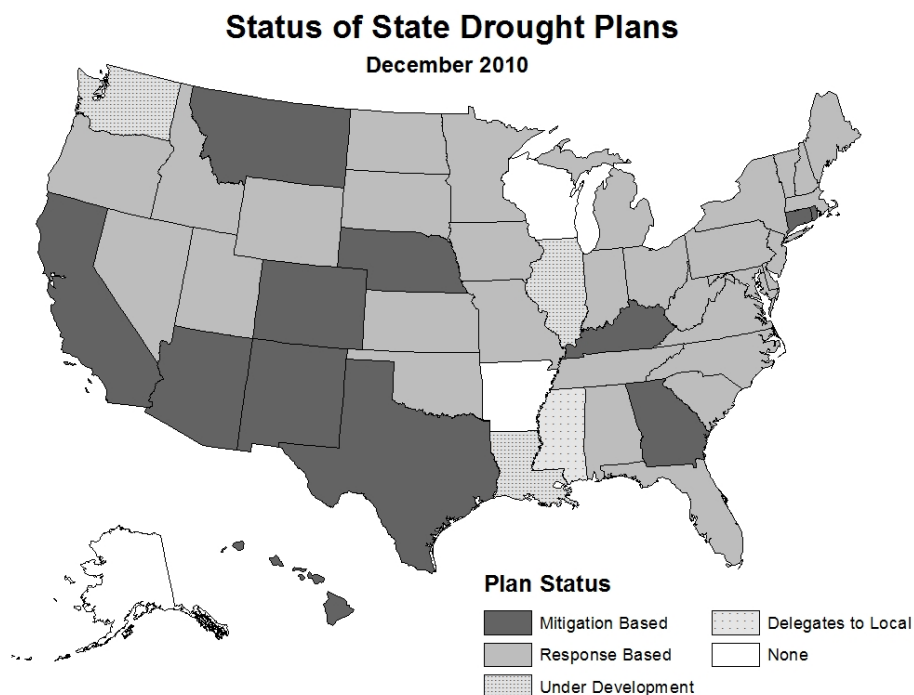


Fig. 7. Status of drought planning in the United States, 2010
(Source: NDMC website, <http://drought.unl.edu/Planning/PlanningInfoByState.aspx>)

Because of the increasing emphasis on drought risk management at the state level in the United States, there has been increasing pressure on the federal government to devote more attention to this approach as well. This bottom-up approach has been quite effective in initiating several bills introduced in Congress. These bills will be discussed in more detail later in this paper.

6. DROUGHT POLICY: CHARACTERISTICS AND THE WAY FORWARD

As a beginning point in the discussion of drought policy, it is important to identify the various types of drought policies that are available and have been utilized for drought management. The most common approach, and the one most often followed by both developing and developed nations, is post-impact government (or nongovernment) interventions. These interventions are normally relief measures in the form of emergency assistance programs aimed at providing money or other specific types of assistance (e.g., livestock feed, water, food) to the victims (or those experiencing the most severe impacts) of the drought. This reactive approach is seriously flawed from the perspective of vulnerability reduction since the recipients of this assistance are not expected to change behaviors or resource management practices as a condition of the assistance. For example, livestock producers that do not maintain adequate on-farm storage of feed for livestock as a drought management strategy will be those that first experience the impacts of extended precipitation shortfalls. These producers will be the first that turn to the government or other organizations for assistance in order to maintain herds until the drought is over and feedstocks return to adequate levels. This reliance on the government for relief is contrary to the philosophy of encouraging self-reliance through producer investment in creating improved coping capacity. Government assistance or incentives that encourage these investments would be a philosophical change in how governments respond and would promote a change in the expectations of livestock

producers as to the role of government in these response efforts. The more traditional approach of providing relief is also flawed in terms of the timing of assistance being provided. It often takes weeks or months for assistance to be received, at times well beyond the window of when the relief would be of greatest value in addressing the impacts of drought.

A second type of drought policy approach is the development of pre-impact government programs that are intended to reduce vulnerability and impacts. In the natural hazards field, these types of programs or measures are commonly referred to as mitigation measures. Mitigation in the context of natural hazards is different from mitigation in the context of climate change, where the focus is on reducing greenhouse gas (GHG) emissions. These types of measures are numerous but appear to be less obvious to many when associated with drought since impacts are generally non-structural. These measures would include establishing comprehensive early warning systems, improving seasonal forecasts, increasing emphasis on water conservation (demand reduction), increasing or augmenting water supplies through greater utilization of ground water resources, constructing reservoirs, interconnecting water supplies between neighboring communities, drought planning, and awareness building and education. A more exhaustive list of these measures was compiled through a survey of states and other entities in the United States following several drought episodes in the late 1980s and early 1990s (Wilhite and Rhodes 1993). Insurance programs, currently available in many countries, would also fall into this category of policy types.

The final type of policy response is the development and implementation of preparedness plans and policies, which would include organizational frameworks and operational arrangements developed in advance of drought and maintained in between drought episodes by government or other entities. This approach represents an attempt to create greater institutional capacity focused on improved coordination and collaboration within and between levels of government and with stakeholders in the plethora of private organizations with a vested interest in drought management (i.e., communities, natural resource districts or managers, utilities, agribusiness, farm organizations, and others).

6.1. Principle Elements of a Drought Risk Reduction Policy Framework

Drought policy options should be provided in each of four principle areas: (1) risk and early warning, including vulnerability analysis, impact assessment, and communication; (2) mitigation and preparedness, including the application of effective and affordable practices; (3) awareness and education, including a well-informed public and a participatory process and (4) policy governance, including political commitment and responsibilities (UNISDR 2009). Another important component of this framework is the inclusion of policy options for emergency response and relief. In all cases, when severe drought occurs, governments and other organizations must provide some form of emergency relief to those sectors most affected. It is critically important, as a part of a drought risk reduction policy, for this assistance to be provided in a form that does not run counter to the goals and objectives of the national drought policy, which would include a strong emphasis on the sustainability of the natural resource base.

Drought planning, as an integral part of drought policy, can take many forms and approaches. It is important to note that planning must occur on multiple government levels from local to national, and the objectives of these policies at the local, state, or regional levels must reflect the goals of national drought policies. Stakeholders must be engaged at all levels. Drought planning should also occur at the river basin scale, so the result may be overlapping authorities between political jurisdictions (i.e., local, state, regional).

Drought planning can be defined as actions taken by individual citizens, industry, government, and others before drought occurs with the purpose of reducing or mitigating impacts and conflicts arising from drought. It can take the following forms: response planning or mitigation planning. In the United States, where drought planning at the state level has become widespread over the past 25 years, most state drought plans first began as response plans—i.e., reactive plans that implemented actions when drought emerged, often with the goal of formulating requests for assistance from the

federal government, most often the U.S. Department of Agriculture. Over the past 10 years, there has been an impressive shift of emphasis toward mitigation planning by many states. Currently, 47 of the 50 U.S. states have drought plans, and 11 of these states are placing an ever-increasing emphasis on mitigation as a primary means of reducing societal vulnerability. Interestingly, a greater emphasis on mitigation planning has necessarily resulted in increased pressure for scientists to provide more timely information in the form of better seasonal forecasts, improved decision support tools, and higher resolution analysis for natural resource managers, government officials, and policy makers.

The 10-step planning process referred to previously (Wilhite 1991) has been modified on numerous occasions to incorporate a greater emphasis on mitigation in the planning process (Wilhite et al. 2000; Wilhite et al. 2005a). These steps are listed in Fig. 8. The process is intended to be generic—adaptable to each location because of differences in institutional capacity, etc. In brief, Steps 1-4 of the 10-step planning process focus on making sure the right people are brought together, have a clear understanding of the process, know what the drought plan must accomplish, and are supplied with adequate data to make fair and equitable decisions when formulating and writing the actual drought plan. Step 5 describes the process of developing an organizational structure for completion of the tasks necessary to prepare the plan. The plan should be viewed as a process, rather than a discrete event that produces a static document. A risk assessment is undertaken in conjunction with this step in order to construct a vulnerability profile for key economic sectors, population groups, regions, and communities. Steps 6 and 7 detail the need for ongoing research and coordination between scientists and policy makers. Steps 8 and 9 stress the importance of promoting and testing the plan before drought occurs. Finally, Step 10 emphasizes revising the plan to keep it current and making an evaluation of the plan's effectiveness in the post-drought period. Although the steps are sequential, many of these tasks are addressed simultaneously under the leadership of a drought task force and its complement of committees and working groups. These steps, and the tasks included in each, provide a “checklist” that should be considered and may be completed as part of the planning process.

Step 1	<i>Appoint</i> a drought task force
Step 2	<i>State</i> the purpose and objectives of the drought mitigation plan
Step 3	<i>Seek</i> stakeholder participation and <i>resolve</i> conflict
Step 4	<i>Inventory</i> resources and <i>identify</i> groups at risk
Step 5	Establish and <i>write</i> drought plan
Step 6	<i>Identify</i> research needs and <i>fill</i> institutional gaps
Step 7	<i>Integrate</i> science and policy
Step 8	<i>Publicize</i> the drought plan— <i>build</i> public awareness and consensus
Step 9	<i>Develop</i> education programs
Step 10	<i>Evaluate and revise</i> drought plan

Fig. 8. The 10-step planning process (Source: National Drought Mitigation Center, University of Nebraska–Lincoln)

The organizational structure proposed in support of this 10-step planning process is shown in Fig. 9. This structure includes the formation of a drought task force to coordinate the drought planning process, both during the development stage and the implementation stage, and a monitoring committee and a risk assessment committee. This structure has worked effectively in

most states, although it has been modified or adapted to the specific needs of each of the states with drought plans.

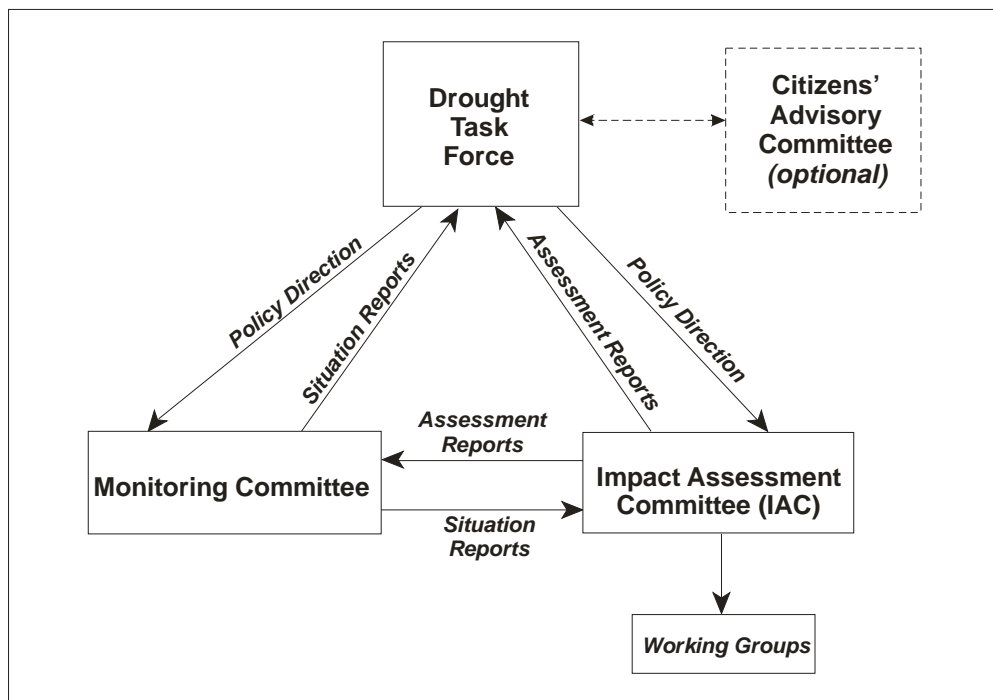


Fig. 9. An organizational structure for the 10-step planning process
(Source: National Drought Mitigation Center, University of Nebraska–Lincoln)

6.2. Drought Policy

The development and implementation of a drought policy is intended to alter a nation's approach to drought management. Over the past decade, drought policy and preparedness has received increasing attention from governments, international and regional organizations, and nongovernmental organizations. Simply stated, a national drought policy should establish a clear set of principles or operating guidelines to govern the management of 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. The overriding principle of drought policy should be an emphasis on risk management through the application of preparedness and mitigation measures (Wilhite et al. 2005b). The policy must reflect regional differences in drought characteristics, vulnerability, and impacts. The goal of the policy is to reduce risk by developing better awareness and understanding of the drought hazard and the underlying causes of societal vulnerability. As stated previously, the principles of risk management can be promoted by encouraging the improvement and application of seasonal and shorter-term forecasts, developing integrated monitoring and drought early warning systems and associated information delivery systems, developing preparedness plans at various levels of government, adopting mitigation actions and programs, creating a safety net of emergency response programs that ensure timely and targeted relief, and providing an organizational structure that enhances coordination within and between levels of government and with stakeholders.

As vulnerability to drought has increased globally, greater attention has been directed to reducing risks associated with its occurrence through the introduction of planning to improve operational capabilities (i.e., climate and water supply monitoring, building institutional capacity) and mitigation measures that are aimed at reducing drought impacts. This change in emphasis is long overdue. 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 pre-disaster 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 in the future. 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.

6.3. Drought Policy Objectives

The objectives associated with a national drought policy will, of course, vary from nation to nation but, in principle, will likely reflect some common themes. These objectives would likely

- Encourage vulnerable economic sectors and population groups to adopt self-reliant measures that promote risk management;
- Promote sustainable use of the agricultural and natural resource base; and
- Facilitate early recovery from drought through actions consistent with national drought policy objectives.

In the United States, there has been considerable discussion of drought policy over the past decade, beginning with passage of the National Drought Policy Act of 1998 (Public Law 105-199). This bill was introduced in Congress as a direct result of the 1996 drought and the initiatives referred to previously. This bill created the National Drought Policy Commission (NDPC) to “provide advice and recommendations on creation of an integrated, coordinated Federal policy designed to prepare for and respond to serious drought emergencies”. The NDPC’s report, submitted to Congress and the president in May 2000, recommended that the United States establish a national drought policy emphasizing preparedness (NDPC 2000). The goals of this policy would be to:

1. incorporate planning, implementation of plans and proactive mitigation measures, risk management, resource stewardship, environmental considerations, and public education as key elements of an effective national drought policy;
2. improve collaboration among scientists and managers to enhance observation networks, monitoring, prediction, information delivery, and applied research and to foster public understanding of and preparedness for drought;
3. develop and incorporate comprehensive insurance and financial strategies into drought preparedness plans;
4. maintain a safety net of emergency relief that emphasizes sound stewardship of natural resources and self-help; and
5. coordinate drought programs and resources effectively, efficiently, and in a customer-oriented manner.

The NDPC further recommended creation of a long-term, continuing National Drought Council composed of federal and nonfederal members to implement the recommendations of the NDPC. The NDPC further recommended that Congress designate the secretary of agriculture as the co-chair of the Council with a nonfederal co-chair to be elected by the nonfederal Council members. An interim National Drought Council was established by the secretary of agriculture following submission of the NDPC report, pending action on a permanent council by the U.S. Congress.

In July 2003, the National Drought Preparedness Act was introduced in the U.S. Congress. The purpose of this bill was “to improve national drought preparedness, mitigation, and response efforts” (National Drought Preparedness Act of 2003 [S. 1454]). The bill, if it were passed, would authorize creation of a National Drought Council within the Office of the Secretary of Agriculture. Membership on the council was to be composed of both federal and nonfederal persons. The Council would assist in coordinating drought preparedness activities between the federal government and state, local, and tribal governments. A National Office of Drought Preparedness

was proposed within the U.S. Department of Agriculture to provide assistance to the Council. The Council was to be directed by the bill to develop a “comprehensive National Drought Policy Action Plan” that

- delineates and integrates responsibilities for activities relating to drought (including drought preparedness, mitigation, research, risk management, training, and emergency relief) among federal agencies;
- ensures that those activities are coordinated with the activities of the states, local governments, Indian tribes, and neighboring countries;
- is integrated with drought management programs of the states, Indian tribes, local governments, watershed groups, and private entities; and
- avoids duplicating federal, state, tribal, local, watershed, and private drought preparedness and monitoring programs in existence.

Another area of emphasis of this bill was to improve the national integrated drought monitoring system by enhancing monitoring and climate and water supply forecasting efforts, funding specific research activities, and developing an effective drought information delivery system to improve the flow of information to decision makers at all levels of government and to the private sector. Although the National Drought Preparedness Act was introduced in the U.S. Congress on three separate occasions, it was never passed. However, a spinoff of this bill was a bill to establish a National Integrated Drought Information System (NIDIS). This bill was passed by the U.S. Congress in 2006 (Public Law 109-430), and its implementation is continuing under the leadership of the National Oceanic and Atmospheric Administration (NOAA) in collaboration with other federal partners, national and regional organizations, and states (<http://drought.gov>).

7. SUMMARY AND CONCLUSION

For the most part, previous responses to drought in the United States and other parts of the world have been reactive, representing the crisis management approach. This approach, characterized by the hydro-illogical cycle, has been ineffective (i.e., assistance poorly targeted to specific impacts or population groups), poorly coordinated, and untimely; more importantly, it has done little to reduce the risks associated with drought. In fact, the economic, social, and environmental impacts of drought have increased significantly in recent decades. A similar trend exists for all natural hazards.

From this author’s perspective, the top ten challenges for progress in drought risk management can be characterized as follows:

1. As a natural hazard, drought does not get the respect that other hazards receive because of the lack of structural impacts and the fact that loss of life is nonexistent or minimal in most instances. Thus, its impacts are invisible to the general public and not as apparent to policy makers at all levels of government. Improving awareness of drought and its impacts should be a key priority of scientists and policy makers.
2. Drought monitoring/early warning is complex, requiring data from all elements of the hydrological system and the blending of this information for assessing the severity of drought and its potential impacts.
3. Drought predictability is low in most cases, especially on a seasonal or longer basis, except where strong teleconnections exist to ocean sea surface anomalies.
4. Decision-support tools and delivery systems are generally not available in many countries, and those that are available must be improved and tailored to the needs of users.
5. Impacts are poorly understood and documented in almost all cases, further reducing understanding of the effects of drought on society and how investments in mitigation measures are justified as cost-effective.
6. Drought relief discourages a risk-based management approach because it reduces self-reliance and increases reliance on government.

7. Institutional inertia constrains change from crisis to risk management because federal and other agencies and ministries repeat the same practices and policies with each subsequent drought episode. Drought assistance programs are ingrained in the institutional structure of government.
8. The effect of societal changes on vulnerability is poorly understood because of the lack of research on this critical element of risk-based management.
9. Drought mitigation actions are less obvious to most decision makers because these measures are usually nonstructural in nature.
10. Political will for a national drought policy and drought risk management is weak at all levels of government because drought relief is often a pathway to reelection for officials and there is poor understanding of drought impacts and the proven cost-effectiveness of mitigation over relief.

This paper presents a broad overview of drought and the challenges and opportunities associated with improved planning and policy in terms of their ability to reduce societal vulnerability. The concepts presented can provide a model for the United States and other drought-prone nations to use to improve their level of preparedness for drought, with the ultimate goal of reducing societal vulnerability to this pervasive natural hazard. A 10-step planning process is presented that has been used at all levels of government in the United States and in other countries to guide the development of a drought mitigation plan. The goal of this planning process is to change significantly the way we prepare for and respond to drought by placing greater emphasis on risk management and the adoption of appropriate mitigation actions. The 10 steps included in this process are considered generic in order to enable governments to choose those steps and components that are most applicable to their situation. The risk assessment methodology is designed to guide governments through the process of evaluating and prioritizing impacts and identifying mitigation actions and tools that can be used to reduce these impacts for future drought episodes. Drought planning must be viewed as an ongoing process, continuously evaluating our changing vulnerabilities and how governments and stakeholders can work in partnership to lessen risk. National drought policies are important since they can channel drought planning efforts to a more proactive, risk-based management approach.

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