

Recommendations on Drought Monitoring by the U.S. National Drought Policy Commission

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Abstract

In 1998, the U.S. Congress passed the National Drought Policy Act, stating that the nation would benefit from a national drought policy based on preparedness and mitigation to reduce the need for emergency relief. The Act acknowledged that there was no consistent, comprehensive policy driving the federal role to help reduce the impacts of drought. It also created the National Drought Policy Commission to advise Congress on how to develop such a comprehensive national policy to mitigate the impacts of drought, to improve public awareness, and to achieve federal/nonfederal partnerships for better coordination and response to drought. Preparedness is the foundation for such a policy. A major recommendation focused on improved collaboration among scientists and managers to enhance the effectiveness of observation networks, monitoring, prediction, information delivery, and applied research and to foster public understanding of and preparedness for drought.

Introduction

Drought has often been referred to as a creeping disaster because the lack of sufficient moisture can lead to profound implications for the environment and all segments of society. However, drought may affect each segment differently and be highly variable in its severity and magnitude on each segment. One of the basic reasons for this variability is the lack of a clear and concise definition of drought that is applicable to all disciplines. There are four main types of drought. Meteorological drought is based on a specified time period with precipitation averaging below a critical threshold. Agricultural drought refers to the lack of sufficient moisture available for crops, forests, rangelands, and livestock. Hydrological drought is associated with water supply systems such as river drainage basins and aquifers. A fourth definition of drought has been referred to as societal or economic drought. The latter definition is a complex interaction of the natural phenomenon, environmental degradation, and human impact. This lack of a uniform definition of drought points to one of the most serious problems related to the issue of drought. The response to this naturally occurring event is usually reactive (coming after the drought event has occurred) rather than proactive (i.e., mitigation measures as part of drought preparedness). The challenge is to develop a national drought policy with preparedness as its foundation. This chapter reviews the report of the National Drought Policy Commission, which takes aim at this challenge.

Background

Drought can have a major impact on society. Two notable drought events of the last century had tremendous environmental and societal implications. The drought years of the 1930s in the U.S. Great Plains ranked as the nation's top weather event of the 20th century, according to Hensen et al. (1999). These Dust Bowl years caused a legendary and influential migration from the southern Great Plains to California, revolutionized agricultural policy on the Plains, and synchronized with the Great Depression to compound the event's misery for millions of people. Hundreds of heat records from the 1930s still stand across the Plains. No other drought of the century encompassed nearly two-thirds of the nation in severe to extreme drought conditions as was the case in July 1934. In all, the decade-long drought turned 50 million acres into dust across the Plains. Across the Atlantic Ocean, recurring droughts in the West African Sahel between 1968 and 1973 directly affected 6 million of the region's inhabitants and 25 million cattle (Glantz 1977; Grainger 1990). The extremely delicate balance of nature can be irreversibly upset by the combination of natural climate variability and mismanagement of the land. In the case of Sahel desertification, excessive overgrazing denuded a dwindling vegetation resource during the drought years. In an effort to overcome the loss of water supplies, the construction of deep wells to tap water inadvertently aggravated the situation by maintaining an excessive carrying capacity of the land. The devastating results are well documented.

While these case studies highlight the disastrous consequences of two major drought episodes of the past century, it must be noted that drought conditions of varying severity and magnitude occur around the world in almost any given year. Few areas are spared the natural occurrence of drought and many areas have suffered from its impact. Although a better understanding of atmospheric phenomena and oceanic interactions is improving our ability to predict conditions conducive to drought, nations must have a proactive strategy to prepare for drought and to react in time to mitigate the effects of drought, with the goal of reducing the vulnerability of people and resources to the consequences of this natural event.

The U.S. National Drought Policy Commission (NDPC)

In the United States, drought has occurred in various parts of the country on a routine basis. After the 1930s, major drought episodes occurred in the southern Plains during the early 1950s, in the Northeast in the early 1960s, in the far West during the mid 1970s and again in the early 1980s, in the Midwest and parts of the Southeast in 1988, and in Hawaii and the East in the late 1990s. In July 1998, the U.S. Congress enacted Public Law 105-199, the National Drought Policy Act. This law created the National Drought Policy Commission (hereafter referred to as NDPC) to advise Congress on the formulation of a national drought policy based on preparedness, mitigation, and risk management rather than on crisis management. The law directed the Commission to conduct a thorough study of ongoing drought programs, to present a strategy that shifts from ad hoc federal action toward a systematic process similar to those for other natural disasters, and to integrate federal programs with state, local, and tribal programs to ensure a coordinated approach to drought response. This chapter will focus on the findings and recommendations of the final report that was submitted to the president and the Congress in May 2000.

Although drought frequently occurs in any given area of the United States, there is no national drought policy that focuses on reducing the impacts of this natural disaster. Many states and local governments include drought in their comprehensive water management, land use, and long-term planning strategies. Some have devised separate drought plans. Other private entrepreneurs and nonprofit groups with an interest in water management and environmental issues work with governments to carry out drought education projects and water conservation initiatives. State, local, and tribal governments must deal individually with each federal agency involved with drought assistance. Although the federal government plays a major role in responding to drought events, there is no single federal agency in a lead or coordinating position regarding drought. Therefore, crisis management, rather than planning and proactive mitigation measures, often characterizes the federal response to drought emergencies.

The consequences of drought are immense. At its most severe, drought creates vast, windblown dust bowls, eroding landscape, damaging terrestrial and aquatic wildlife habitat, contributing to widespread wildfire, and causing significant monetary losses. Drought may cause economic ruin to farmers and ranchers. It brings hardship to water-dependent enterprises such as commercial fishing. In many small towns and villages, downturns in farming have a rippling effect to other local businesses. Drought can have a devastating impact on agricultural workers and lead to difficult decisions regarding allocation of water and stringent water-use limitations. Drought puts drinking water supplies at risk and may hamper rural fire-fighting efforts. Drought creates or exacerbates conflicts over access to river basins and water systems. Thus, drought's impact is far-reaching and damage to the ecosystem may be irreversible.

Drought Triggers

What makes this issue even more complex is the very definition of drought, or, more specifically, the lack of a single definition that is applicable to all segments of society. In the Commission's final report, a generic definition states that "drought is a persistent and abnormal moisture deficiency having adverse impacts on vegetation, animals, or people." Declarations of droughts are often triggered by specific and well-defined conditions, such as specific reservoir level on a specific date. In some cases, there are well-defined exit points that trigger a resumption of normal activity. These drought triggers become the practical definition of drought for a particular region and for specific issues. Defining these triggers is an inseparable part of planning for and responding to droughts. Once these triggers are defined, a region is much better able to estimate the costs, expected frequency, and risks of drought response. However, in reality, drought is defined differently in different situations. For example, two months without rainfall during the growing season may result in serious drought conditions in subhumid climates. This same period may be normal in semiarid climates, where water reserves may be used for crops adapted to that region. National drought policy must therefore define drought so that it meets the needs of diverse water users and for diverse functions. It must be flexible enough to include a variety of drought situations. It must also be specific enough to distinguish between those situations that are true drought emergencies and those that are normal cyclical conditions. All of these factors must be accounted for in any definition, but it clearly illustrates the need for careful evaluation at the

regional level of the most appropriate “triggers” for a drought declaration and a drought termination.

A suite of objective drought thresholds could be supply-type triggers or demand-type triggers. Examples of supply-type triggers include precipitation less than a specified threshold for a season or a water year; the Palmer Drought Index -2.0 or less; and consolidated drought indices at the 20th percentile or less, such as used by the Drought Monitor. Examples of demand (impact) based triggers include water supply less than a threshold percent of normal and various crop loss thresholds. The United States experiences two types of drought. “Stored water” droughts occur when large stores of water in manmade reservoirs, natural lakes, and ground water aquifers are depleted by very long, unusually low periods of precipitation. “Natural water” droughts happen quickly and fairly frequently after just a few weeks or months of below-normal rainfall. Thus, numerous situations arise when those who share stored water are not affected by a natural water drought. However, as the demand for stored water increases with population and with more diverse uses of water, the vulnerability to more severe drought episodes also increases. From this discussion, it can be seen that the issue of drought is very complex and drought’s impact on various sectors of the economy is highly diverse. With this recognition of complexity and diversity, the next section will summarize some of the significant findings of the report.

Report Findings

Preparedness is a fundamental concept in a national drought policy. Preparedness includes drought planning, plan implementation, proactive mitigation measures, and public education. The Commission report found that preparedness may well reduce the social, economic, and environmental impacts of drought and the need for federal emergency relief expenditures in drought-stricken areas. A variety of entities are engaged in some form of drought preparedness. These include individuals, citizen organizations, local and state governments, tribes, and regional bodies. Often, this planning is conducted within the framework of comprehensive water management planning by entities ranging from water districts and large multicounty urban areas to state water resources agencies and regional river basin compacts and commissions. In a survey conducted for the final report, the NDPC found that 30 of the 50 states in the United States had drought plans, with most oriented toward relief rather than preparedness. The assessment revealed that in most states, drought responsibilities are normally located in the agencies that are responsible for the functions of agriculture, natural resources, water management, environment, or emergency management. Fewer than five states have independent, designated drought coordinators, while more than 20 states have drought task forces.

Regional entities generally comprise several states within a common geographic boundary or water management jurisdiction such as a river basin. It is clearly evident that regional drought planning or incorporation of drought concerns into comprehensive regional water management plans is essential for any strategy to be successful. For example, in June 1965, during the height of a serious drought in the northeastern United States, New York City stopped releases from its Delaware River reservoirs to maintain its withdrawal rate. With less fresh water flowing past the city of Philadelphia, there was a risk that salt water would be drawn into Philadelphia’s water

supply system. President Lyndon Johnson convened a special meeting of governors and mayors from the Delaware Basin that led to emergency measures for managing the Delaware River.

While the larger government entities can address the major issues related to drought, counties, towns, and rural areas must deal with the emergencies and respond to the disasters. These areas are facing suburban growth and development, which are increasing the demand for water and creating greater competition for available water. Local governments must be able to plan for future needs, but they need the technical data, tools, and resources to develop and implement these plans. Local governments must also inform and educate the local population about the need for drought planning, especially when an emergency is not imminent. It is at the local level where the most efficient and direct communication channels can be established to keep the population informed of drought emergencies that may be directly affecting a particular area.

Tribal lands in the western United States have experienced the vagaries of climate for many thousands of years, and the scope of tribal drought issues in current times is immense. There are 306 federally recognized tribes within the conterminous 48 states, with 289 of those west of the Mississippi River, where 95% of all tribal trust land is located. A total of six tribes were found to be developing drought contingency plans through cooperative agreements with the federal government. It is within these rural areas that the NDPC found the least available information that is critical to basic drought planning. Some tribes lack access to basic weather data that is essential not only for planning but also for triggering emergency response efforts.

In response to individual challenges over the years, Congress has created federal programs to lessen the impacts of drought. The NDPC found that 88 drought-related federal programs were funded within the past ten years and were spread over a number of federal departments and agencies. The programs were classed into four broad program categories: (1) preparedness, including planning and mitigation; (2) information, including monitoring/prediction and research; (3) insurance; and (4) emergency response. Of these programs, 7 provide assistance for drought planning; 42, drought mitigation; 22, drought-related monitoring/prediction and research; and 47, response. These numbers total more than 88 because some programs cover more than one facet of drought. For example, some of the mitigation programs also contain drought planning and response elements. Although these numbers seem large, a major criticism that was repeatedly heard at meetings and public hearings of the NDPC was that the federal action was an ad hoc approach to drought. Moreover, limited authorities and funds as well as lack of coordination among and within federal agencies hinder planning efforts.

To succeed in the development of national drought policy, the guiding principles should be:

1. Favor preparedness over insurance, insurance over relief, and incentives over regulation.
2. Set research priorities based on the potential of the research results to reduce drought impacts.
3. Coordinate the delivery of federal services through collaboration with nonfederal entities.

This policy requires a shift from the current emphasis on drought relief. Preparedness must become the cornerstone of the national drought policy. To achieve this objective, a pooling of nonfederal and federal

experience and the establishment of nonfederal/federal partnerships must be nurtured to develop the tools needed to formulate drought preparedness strategies, including incorporation of environmental concerns.

Report Recommendations

The NDPC recommended that Congress pass the National Drought Preparedness Act, which would establish a nonfederal/federal partnership through a national drought council. The primary function of the council would be to ensure that the goals of national drought policy are achieved. The five goals are briefly summarized before a more detailed discussion of drought monitoring efforts.

Goal 1: Incorporate planning, implementation of plans and proactive mitigation measures, risk management, resource stewardship, environmental considerations, and public education as the key elements of effective national drought policy.

Goal 2: Improve collaboration among scientists and managers to enhance the effectiveness of observation networks, monitoring, prediction, information delivery, and applied research and to foster public understanding of and preparedness for drought.

Goal 3: Develop and incorporate comprehensive insurance and financial strategies into drought preparedness plans.

Goal 4: Maintain a safety net of emergency relief that emphasizes sound stewardship of natural resources and self-help.

Goal 5: Coordinate drought programs and respond effectively, efficiently, and in a customer-oriented manner.

Drought Monitoring Networks

The NDPC emphasized the value and importance of observation networks, monitoring, prediction, information gateways and delivery, and research for effective drought preparedness. One of the first major tasks of the newly formed National Drought Council will be to convene a drought data monitoring, prediction, and research “summit” of multidisciplinary, geographically diverse representatives to ascertain the needs and expectations of all interested parties. Research priorities should address the impacts of drought on nonirrigated systems, aquatic ecosystems, wildlife, and other aspects of the natural environment, including the potential negative impacts of drought mitigation measures. Better coordination of governments and private entities in international drought monitoring, prediction, research, education, water conservation, and technology transfer is essential. Specific recommendations to meet the desired objectives are next discussed.

One of the five major goals (Goal #2 above) of the final report is the recommendation for the

development of a viable plan to maintain, modernize, expand, and coordinate a system of observation networks that meets the needs of the public at large. The plan should include cooperation with states, development and improvement of baseline historical data sets, and recognition of the Council recommendations. Priority should be given to filling the gaps on tribal lands and in rural America. To provide a measure of the complexity of this problem, an extensive network of weather observation sites is operated by various federal agencies in the United States. In fact, the NDPC reported that about 20 federal programs have some responsibility for drought monitoring/prediction and research. The National Weather Service manages a cooperative observer network that has been in existence for more than 100 years. The U.S. Department of Agriculture operates an automated weather observing network, mostly in the mountainous West, called the Snowpack Telemetry (SNOTEL) network, and a much less dense network, the Soil Climate Analysis Network (SCAN), in agricultural areas. The U.S. Forest Service operates its own Remote Automated Weather Stations (RAWS) network in the federally managed forest lands. The U.S. Geological Survey manages a stream gauging and ground water network for flood monitoring. These federal networks do not provide uniform coverage that is acceptable at the state or regional level.

Consequently, the number of nonfederal automated weather networks has increased over the past 20 years to fill some of the state and local needs. Brusberg and Hubbard (2000) reported the findings of a survey of nonfederal networks in the United States and Canada. Their preliminary results show 39 networks, with 33 in operation for less than 20 years and 15 in existence for less than 10 years. One interesting result was that nearly all of these networks have some type of partnership with private industry or universities. Many have some type of relationship with the public sector as well. Of the 39 networks offering responses, 12 indicated some type of arrangement at the federal or national level, and 15 have some form of partnership with state, provincial, or municipal levels of government. The survey found that quality assurance and quality control are practiced by a majority of these networks, but meta-datasets are highly variable, as would be expected with the wide range of purposes and inception dates. The authors recommended that a national registry for mesoscale networks be established for the purpose of information exchange, and the development of reasonable operational standards should be encouraged.

Although there is sharing of instrument and information technology, the greatest concerns regard quality control issues and industry (or community) standards for both data formats and equipment. The survey results also showed that user outreach was a significant concern, with a number of respondents (networks) wishing to discern the true utility of their products to the general public and expand their outreach. Another encouraging sign was the willingness expressed by the network managers to work together on mutually beneficial projects.

The NDPC found that federal monitoring/prediction programs often join with universities, private institutions, and nonfederal entities to provide information needed for effective drought preparedness and mitigation. For example, federal programs provide the basic data used by private weather services and other enterprises that play a vital role in transferring appropriate information at the farm level. The private weather services use the federally supplied data in developing tailored products for crop and irrigation management. However, it was also found that there was a strong need for an accessible

“gateway,” or point of contact, where high-quality, standardized, comprehensible current information and historical data are managed. Although there is a tremendous storehouse of drought-related scientific and technical research, the NDPC also found that the results of research are not always disseminated in a timely manner or through easily accessible modes. A consensus was that research results as well as technology transfers are key to effective drought planning, proactive mitigation, emergency response, and drought-related technical assistance and training. Therefore, these results must be made readily and widely available for planners and decision makers.

Conclusion

To establish an effective national drought information delivery system, a coordinated effort must be undertaken to bring more systematic data networks to rural and tribal areas. These networks must be integrated into a national program through partnerships between federal and nonfederal entities. A comprehensive information gateway must be established to provide users with free and open access to observational network data and drought monitoring, prediction, impact, assessment, preparedness, and mitigation measures. Links among federal and nonfederal sources are critical to ensure a comprehensive and collaborative system of data information. These drought products can then be used by planners and decision makers in a vast array of measures to cope with this natural disaster. The key elements of an effective national drought policy include planning, proactive mitigation, risk management, resource stewardship, and public education. All of these elements require detailed knowledge of observational data and research products that form the foundation for efforts to reduce drought impacts on society.

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