Planning for Drought: Principles and Practice

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The Drought Problem

During each decade hundreds of municipalities and agricultural water districts have their water supplies threatened by drought. A very substantial amount of research has been devoted to solving the drought problems. Through this research we have learned a great deal about the physical phenomenon of drought as well as its economic, ecological, social and political impacts (especially of recent droughts). Yet, we cannot predict droughts and our ability to plan for future droughts is severely limited. Few water agencies have prepared adequate drought contingency plans while their long-term drought planning follows some outdated rules that were set forth around the beginning of this century.

Both the principle and practice of drought planning are lacking. The principle is deficient because of our inadequate understanding of the societal problem of drought. A disproportionate amount of research is devoted to the physical phenomenon of drought while neglecting the context of societal responses and adjustments and the measurement of the adverse impacts caused by major droughts. The deficient practice is manifested during actual droughts which creat crisis situations and crisis management of drought.

Deficiencies in Practice

Water agencies who are responsible for supplying water for urban, agricultural and environmental purposes traditionally have perceived drought as a hydrologic problem and have pursued solutions which involved interventions into the hydrologic cycle. Water supply facilities were designed and built with substantial extra capacity so that they were protected from droughts by providing sufficient storage of surplus water in times of high rainfall for use during periods of drought. This traditional supply-oriented approach to drought management aims at assuming a "safe yield" of supply during some arbitrarily defined "design drought." The safe yield is the level of supply that can be maintained during the design drought so that the system would not be expected to experience any shortages during any drought that is less severe than the design drought.

Major river systems in this country include a significant amount of reservoir storage ranging from one to two years of average flow in the humid East, to three to five years of average flow in the arid and semiarid West. Also, significant amounts of runoff from smaller watersheds are retained in local lakes and reservoirs. The storage facilities are accompanied by aqueducts that in some regions can move water very long distances.

The provision of extra storage capacity for drought protection remains one of the most popular practices of drought management. However, a number of new environmental, social and economic considerations have contributed to a stalemate between environmental community and water supply institutions, and very few new projects have been built during the last two or three decades. Although the "extra storage" alternative for drought management have been placed beyond the reach of water supply agencies, they continue to make attempts to develop new supplies and ignore the possibility of other solutions to the drought problem. When demand for water grows while supplies remain constant, the risk of water shortages during a drought event continues to increase. Many of the agencies which face the increasing risks of shortages do very little to prepare for droughts. Rather, they wait until water shortages are imminent and then resort to some ad hoc response measures thus replacing the long-term drought mitigation through the provision of extra storage with crisis management. The latter tends to rely on water rationing and governmental relief so that the consequences of water shortages are absorbed by water users and taxpayers.

There are many reasons for the failure of water agencies develop and implement optimal drought management plans. Some of these reasons are related to deficiencies in planning principles (i.e., planning frameworks, measurement techniques and other planning tools). Other reasons are related to the resistance to change the traditional mold of water management. The drought literature contains several possible explanations for the deficiencies in the current practice of drought management.

First, the traditional concept of drought management is to plan for a design drought and wish away any chance of actual shortages by declaring that any shortages simply represent "system failure" and are not acceptable. The "no-shortage" rethoric is deeply entranched and it plays an important role in justifying the need for and investments in the development of new supplies. This "professional ideology" makes an open discussion of a full array of drought planning alternatives virtually impossible.

Second, water managers and their institutions perceive their roles and responsibilities in ways which inhibit them in taking a broader perspective in drought planning. They view an adequate community water supply as being an

essential service which promotes public health and safety, economic activity, and general community well-being. They see themselves as being responsible for providing water "on demand" and having no control over the efficiency of water use in their service territories. Drought is not considered by them as a sufficient reason for not delivering to their customers as much water as is needed. The narrow definitions of the roles of water institutions are sometimes blamed by the environmental community as the underlying reason for the built-in institutional bias toward development of new supplies at the expense of environmental in-stream uses of water.

Finally, even if the water agencies were willing to take an active role in pursuing a responsible and socially optimal drought management, they still would have to overcome several obstacles stemming from laws and regulations as well as political realities. For example, in some urban areas local governments use water supply planning as a tool for controlling urban growth. They oppose a development of new supplies or adoption of long-term water conservation because those would result in more water to support additional growth. Such policy often fails to prevent new growth, while exposing communities to severe shortages during drought. To cite an example, water supply agencies are often criticized for not raising the prices of water to a level where all wasteful uses of water in their service territory would be eliminated, thus obviating the need for additional supplies. However, both publicly and privately owned water utilities are not free to increase prices in order to achieve reductions in water use. The existing laws and regulations allow water providers only to recover their costs through water rates.

Deficiencies in Principles

Researchers of drought rarely confront the social desirability of securing ample supplies of water for urban, agricultural and environmental uses of water at all times. From society's point of view the degree to which the adverse consequences of drought should be mitigated could be determined, in theory, by comparing the social, economic and environmental costs of drought with and without additional intervention into the hydrologic cycle. However, there are very few studies which measured the economic, social or environmental consequences of previous droughts. Attributing changes in economic performance and environmental resources to drought is not a simple task. Attaching dollar values to these changes is even more difficult and almost impossible in the case of adverse impacts on the environment. Because of these difficulties, the researchers of drought tend to focus only on impacts that can be measured and valued in monetary terms (e.g., loss of production of electricity). Many other impacts with potentially higher economic losses are usually described in qualitative terms only. The deficiencies in measurement and valuation of drought impacts leave water managers with anecdotal evidence and speculations about such impacts.

The guidance for drought planning is also deficient. In general, drought management involves the use of long-term, short-term and emergency measures. The long-term measures are often, though not exclusively, structural. They include long-term improvements in water use efficiency or changes to existing water storage and transmission infrastructures. Short-term measures fall into the category of drought preparedness and are designed to lessen the impacts of a recognized, oncoming drought, with preplanned actions to induce reductions in water use or temporarily increase supplies. Finally, emergency measures are taken during crisis conditions to reduce immediately water use and provide relief to impacted parties when all other measures have been exploited. There is some confusion in the drought literature about the categories of measures and their roles in drought planning. Some believe that water agencies should plan for periodic "crises" in water supply caused by future droughts. Emergency measures such as disaster declarations and relief assistance should be a part of planning. Others believe that if crisis conditions can be avoided by planning for the use of long-term and short-term measures then they should be. They maintain that, by definition, a crisis situation should not be "planned for" because the main purpose of drought planning is to prevent crisis. Water supply agencies could include "water deficits" in their long-term water supply plans but not "water shortages which would result in crisis conditions.

The lack of an adequate conceptual framework for drought planning and severe deficiencies in information about drought incomes and the outcomes of many remedial measures directly contribute to the present status of drought planning in this country. Only recently, some studies have been undertaken in order to rectify this situation.

Research to Close the Gap

Although thousands of references on drought have been produced during the last several decades, the needs for more investigations with practical solutions to be proposed continue. After the drought of 1988-1989 that affected many regions of the United States, the President's budget included funds to begin a multiyear National Study of Water Management During Drought as part of the administration's 1990 budget. Authority for the study was given to the Assistant Secretary of the Army for Civil Works as provided in sections 707 and 729 of the Water Resources Development Act of 1986. Reports on several investigations conducted under the National Study are listed in the references section below. The scope and the level of funding for this study offer great hopes for making significant progress in learning how to manage future droughts and rectify the existing practices.

References

U.S. Army Corps of Engineers. 1991. "The National Study of Water Management During Drought (NSWMDD): Report on the First Year of Study." *IWR-Report 91-NDS-1*. Fort Belvoir, VA: Institute for Water Resources.

— 1991. "NSWMDD: A Preliminary Assessment of Corps of Engineers' Reservoirs, their Purposes and Susceptibility to Drought." *IWR Report 91-NDS-2*. (September) Fort Belvoir, VA: Institute for Water Resources.

— 1991. "NSWMDD: A Research Assessment." *IWR Report 91-NDS-3*. (August) Fort Belvoir, VA: Institute for Water Resources.

—. 1993. "NSWMDD: The Great California Drought of 1987-1992: Lessons for Water Management." *IWR Report 93-NDS-5*. Fort Belvoir, VA: Institute for Water Resources.