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## Planning for Drought: The Role of State Government

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### Abstract

Although droughts are a frequent occurrence over much of the United States, response by state and federal government has been ineffective and poorly coordinated. Recently, several states have recognized the value of drought emergency planning and have developed plans to assist them in responding more effectively to prolonged periods of water shortage. These states have created an organizational structure to coordinate the assessment and response activities of state and federal agencies. Each state's drought response plan is unique since each state's water supply and management problems, and their consequent impacts, are unique. The drought response plans developed by Colorado, South Dakota, and New York are reviewed here in detail. We recommend that other states affected by frequent and severe water shortages also develop drought emergency plans. These plans will enhance state government's ability to implement effective measures in a timely manner and, ultimately, may provide added incentive for the federal government to develop the national drought response plan called for by the General Accounting Office in 1979.

**Keywords:** drought planning, drought impact, water management, state government

## Introduction

Three major and widespread drought episodes, and numerous minor ones, have affected the United States during the 20th century. During each of the major drought occurrences (i.e., 1930s, 1950s, and 1970s) the federal government has provided assistance to drought-affected areas to alleviate economic hardship and facilitate recovery. The nature and scope of this federal effort has recently been documented by Wilhite (1983).

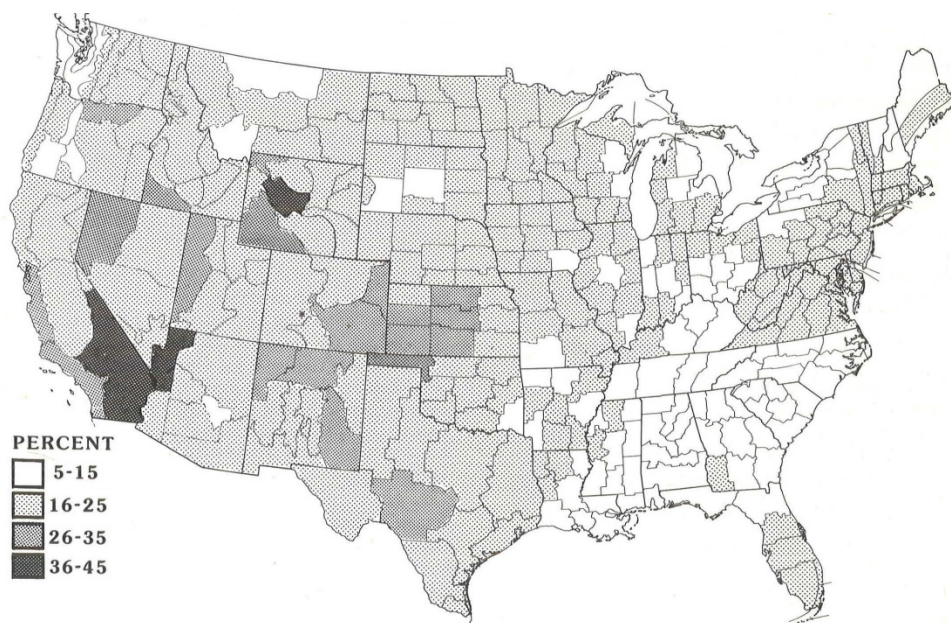
Before the mid-1970s, state involvement in drought response had been limited, for the most part, to collecting data on the local effects of drought to substantiate state requests for federal assistance. During 1976–77, many states took a more active role in drought response by establishing drought task forces and regional alliances with neighboring states. Generally speaking, the task forces served as a pass-through for information about federal drought assistance programs. Regional alliances were used by states to communicate information about drought conditions to federal agencies. States also worked through these alliances to stimulate additional drought response activity in the Carter administration. In response to the 1976–77 and subsequent droughts, some states now take a more active role in planning for future droughts.

Drought emergency planning by state and federal governments in the United States lags behind that in certain other developed countries. For example, in Australia and Canada considerably more effort has been directed toward drought planning at both the state (province) and federal levels of government. Governments in the United States, as well as citizens, often have responded to drought through crisis management. In crisis management the time to act is perceived by decision makers to be short. Reaction to crisis often results in the implementation of hastily prepared assessment and response procedures, which, characteristically, may lead to ineffective, poorly coordinated and untimely response (GAO, 1979; Wilhite, 1983; Wilhite, et al., 1984). If planning were initiated between periods of drought, the opportunity would exist to develop an organized response that might address issues and specific problem areas more effectively. Also, the limited resources available to government to mitigate the effects of drought could be allocated in an optimal manner.

## Frequency of Drought Occurrence in the United States

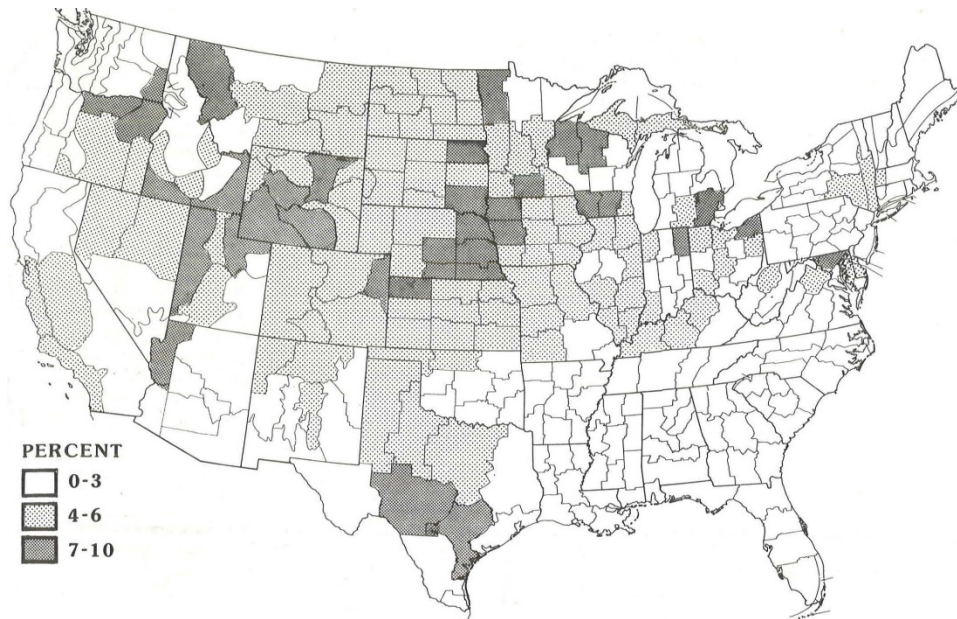
A widely used index for measuring the severity of meteorological drought was developed by Palmer (1965). Palmer's purpose in developing the index was to derive a "general methodology for evaluating the meteorological anomaly of drought in terms of an index which permits time and space comparisons of drought severity." Although it is commonly referred to as a drought index, the Palmer Index actually is used to evaluate prolonged periods of abnormally wet or dry weather. Index values generally fall within a range of -6 to +6. Values between -2 and +2 represent near normal conditions while values less than -4 or greater than +4 reflect extreme dryness or wetness, respectively. The index integrates antecedent weather conditions over a period of months and, therefore, reacts slowly to deteriorating soil moisture conditions. As a result, each computed monthly value reflects antecedent or accumulated weather conditions over a period of several months.

The frequency of moderate to extreme Palmer drought occurrences ( $\leq -2.0$ ) for the period 1931–78 is shown in figure 1. Drought, defined in this way, occurred as often as 40 percent of the time in the Southwest but seldom (approximately 6 percent of the time) in the Southeast. The frequency of moderate to extreme drought occurrence in most of the Great Plains and Midwest states, the primary grain-producing region in the nation, is between 15 and 30 percent.



**Figure 1.** Moderate to extreme drought frequency in the United States according to the Palmer Drought Index (values  $\leq -2.0$ ), based on the 1931–78 period.

Figure 2 shows the frequency of extreme drought occurrence (Palmer Index  $\leq -4.0$ ) in the United States during the same period. The map shows clearly that episodes of extreme drought are a particular characteristic of the climates of Great Plains, Midwest, and Rocky Mountain states as well as the southern half of California. Figures 1 and 2 show that many states are affected by frequent or severe periods of drought. Droughts generally lead to water shortages. The majority of states, it would seem, could benefit from the development of drought emergency plans.



**Figure 2.** Extreme drought frequency in the United States according to the Palmer Drought Index (values  $\leq -4.0$ ), based on the 1931–78 period.

### The Status of Drought Emergency Planning

In late 1982 we conducted a survey to determine the status of state drought emergency planning in the United States. Survey results are shown in figure 3. Without exception, all states that have developed plans have done so in response to the mid-1970s or subsequent droughts. This indicates a growing belief among policy makers that planning can reduce significantly the potential effects of water shortages induced by drought.

Our 1982 survey revealed an interesting pattern of states with, or currently developing, drought plans. One might expect that the water-short western states would have perceived the need to develop such plans well ahead of states located in the more humid East. The actual pattern (fig. 3) indicates that several eastern states have developed or propose to develop drought plans. These states have already experienced critical water shortages because of drought—coupled with the high demand on their water supplies because of increasing population (Perkey, et al., 1983) and antiquated water supply systems.



unable to deal with the problems. The New York plan does not provide for additional assistance personnel but does propose to study (and provides recommendations to mitigate the effects of) a "worst case" drought. South Dakota and Colorado also emphasize data collection and dissemination, but New York relies primarily on existing studies for data. This situation reflects differences between states in data availability.

### *The Colorado Plan*

The purpose of Colorado's plan is to provide an "effective and systematic means for the State . . . to deal with emergency drought problems which may occur over the short or long term" (Colorado Division of Disaster Emergency Services, 1981). The plan calls for an assessment system and a response system. Assessments are usually produced continuously throughout drought periods, but responses are made only when needs and impacts have been identified and evaluated. A flow diagram of the Colorado Drought System is shown in figure 4.

The assessment system is responsible for gathering and evaluating data about the nature of drought conditions and their impact. This system also helps to identify problems that are beyond the ability of local government to resolve. The organizational structure for the assessment system is composed of representatives from concerned agencies. These representatives form task forces to develop and process information on water availability. Nine such task forces focus on a variety of potential problem areas; they provide information that would help define impact to agency representatives composing the response system.

The Water Availability Task Force is composed of representatives of the Division of Disaster Emergency Services, Colorado Division of Water Resources, State Climatologist's Office, Soil Conservation Service (SCS), National Weather Service (NWS), U.S. Geological Survey, and Bureau of Land Management. The Water Availability Task Force provides data on snowpack, precipitation, temperature, soil moisture, stream flow, reservoir and ground water levels. The Palmer Drought Index and Surface Water Supply Index (SWSI) are derived to give the state an "objective" indicator of water supply conditions in each river basin (Dezman, et al., 1983). The SWSI was developed by the Colorado Division of Water Resources to quantify surface water supply availability for those sectors of the economy dependent on river or reservoir water. The Palmer Drought Index is used for interpreting the water availability of dry land farming areas. Weather forecasts are also examined by this task force for the possible impact of weather on future water supplies. The Monthly Water Supply Outlook (published by the Soil Conservation Service and the National Weather Service), Colorado Division of Water Resources, State Climatologist, U.S. Geological Survey, and Bureau of Land Management provide the needed data for these analyses.

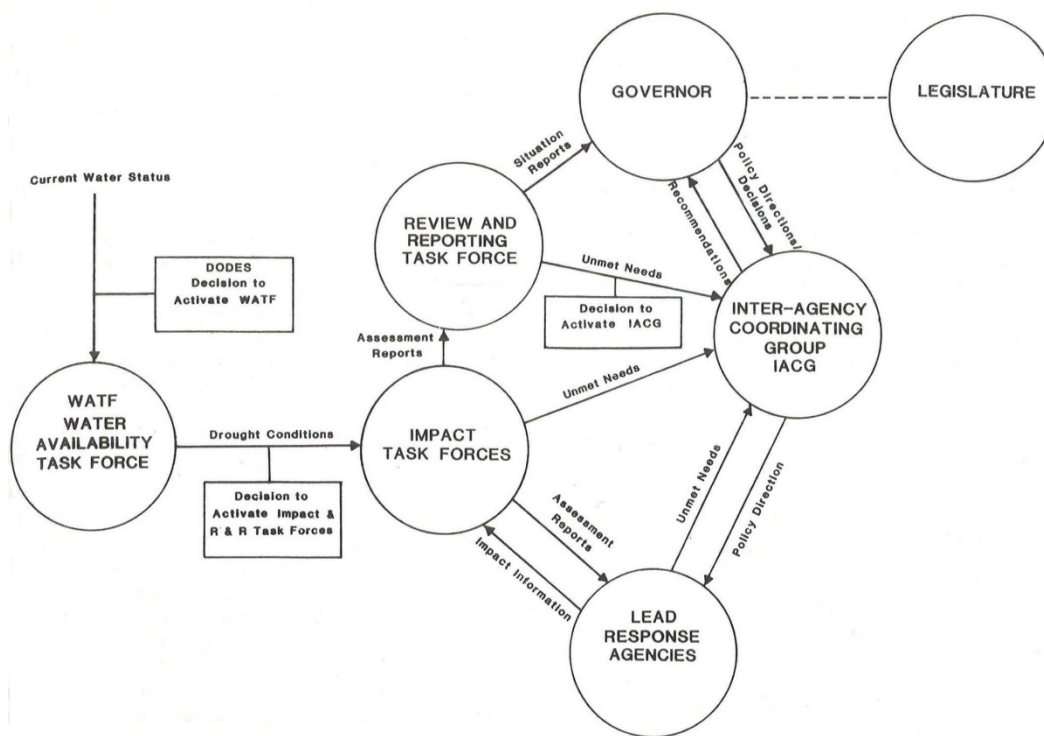


Figure 4. Flow diagram of the Colorado Drought System.

Another group, the Agricultural Industry Task Force, assesses the impacts of drought on agriculture. It is composed of representatives of the Colorado Department of Agriculture, U.S. Department of Agriculture, Colorado Division of Water Resources, State-Federal Extension Service, and Agricultural Industry Advisory Groups. Task forces are generally chaired by midlevel managers from state government who are likely to have access to a wide range of government and private data sources. The task force chairmen provide the Review and Reporting Task Force with analyzed information (see fig. 4), which in turn incorporates the information in reports to the governor and the media as well as to other components of the response system.

The second major element of the Colorado drought plan, the response system, is composed of various government departments. When they receive impact assessments requiring responses, assistance is provided through existing programs and according to regular departmental procedures. Response actions include news releases to the media and the allocation of funds and other resources to the affected area. The departments or agencies most involved with the various drought problems are assigned leadership functions for drought assistance. For example, the Department of Local Affairs provides assistance when drought adversely affects municipal water supplies, tourism, or commerce; the Department of Natural Resources deals with water shortage and wildlife problems.

Other response agencies and their areas of responsibility include the Department of Agriculture, agricultural problems; State Forester, wildfire protection; and Office of Planning



and Budgeting, economic problems. If response agencies can no longer provide drought assistance, or if drought conditions worsen, or emergency conditions threaten, an inter-agency coordinating group (see fig. 4) can be activated by a proclamation of the governor. This group is composed of senior-level managers of involved state government departments. It acts with or through these departments, makes recommendations, ensures inter-agency coordination, and determines when to disband itself.

The plan also makes provision for limited expansion beyond normal government processes. Such expansion generally involves creation of a full-time position(s) to handle public inquiries or the flow of drought information; it may also involve designating a state field representative as state liaison to local government to coordinate various programs. The interagency coordinating group is responsible for the state liaison and recommendations on whether to hire additional staff or field representatives.

### *The South Dakota Plan*

South Dakota's 1977 Drought Recovery Plan was replaced with State Drought Recovery Operations Procedures (South Dakota State Department of Agriculture, 1981), an addition to the state's *Emergency Operations Plan for Natural Disasters*. Whereas the first plan was created during a drought emergency and dealt primarily with short-term response measures for that drought, the more recent plan is concerned with all aspects of future droughts.

In the latest plan, South Dakota relies primarily on state agencies to assist local governments during drought. Objectives of the plan are to: (1) identify the mechanism used for drought response and recovery; (2) determine criteria for activating the state's response system; (3) list agencies and responsibilities in the drought response plan; and (4) specify response actions to be implemented during the emergency or disaster. The organizational framework for the plan included a task force with representatives from the governor's office, Department of Agriculture, Military and Veterans' Affairs, Game, Fish, and Parks, and Water and Natural Resources. This group monitors drought conditions and meets periodically to discuss the effects of drought. Representatives from various departments are invited to serve on the task force on an on-call basis. Also included in the plan are provisions for a drought assistance office, a temporary organization of drought task force members which meets daily rather than periodically. The drought assistance office is called when task force members can no longer deal with problems during their regular meetings.

Under the plan's operational structure, the Department of Water and Natural Resources is responsible for assessing drought conditions and making recommendations on the necessity of assembling a drought task force. However, the governor is responsible for determining whether to designate a task force or, alternatively, a drought assistance office.

If the task force is activated, its responsibility is to monitor drought development. It establishes a drought damage assessment system, assembles and analyzes data, and recommends actions to mitigate drought impacts. The Department of Water and Natural Resources is responsible for collecting and preparing weather data provided by the State Climatologist and the National Weather Service; the Department of Agriculture provides data on drought conditions in the agricultural sector; the Department of Game, Fish, and Parks maintains records of fire danger and drought impact on fish, wildlife, forests, and

recreational areas; and various support agencies, such as the Department of Transportation and the Department of Economic and Tourism Development, also provide information on drought impacts within their areas of concern. Task force members are asked to collect data that reflects the situation in both the economic and social sectors; from these reports the group makes assessments of severity, projects trends, inventories resources, and recommends actions. The director of the task force (or, if designated, the drought assistance office) receives and disseminates this information in the form of reports. The task force coordinator is required by the state *Emergency Operations Plan for Natural Disasters* to prepare reports; additional studies (such as progressive situation reports, synopses of task force actions and recommendations from each meeting) are also requested. The last action of the task force is to prepare a final report summarizing actions of the group and presenting its recommendations for future task forces. The information disseminated by the group is retained for use in future droughts.

If the task force is unable to resolve drought problems, a drought assistance office is activated. The membership of this office includes the task force coordinator, who may also serve as coordinator of the drought assistance office; state agencies involved in the task force; and, at the request of the coordinator, representatives of other state agencies. This group continues to collect and analyze drought information data, works with federal agencies to mitigate drought impacts, and serves as a clearing-house for drought-related inquiries. The group is responsible for providing the governor with information on drought impact on a regular basis; they also assist the governor's office in preparing and disseminating information for the public. A final report and assessment data are prepared and retained for "guidance in future drought operations."

### *The New York Plan*

The New York Drought Preparedness Plan (New York State Drought Management Task Force, 1982) is interesting because the need for such a plan is not as obvious as it is in Colorado and South Dakota. New York State usually has abundant water supplies and severe droughts are infrequent; yet the plan recognizes the possible occurrence of a drought of disastrous proportions. The plan deals with drought prevention and/or mitigation, response, and recovery, and it encompasses both short- and long-term actions. The State Drought Management Task Force, which developed the plan, was brought together initially in December 1980 to coordinate state drought response activities and assist localities. The Task Force continued its work as drought moderated in the early summer of 1981 because of the "seriousness and unpredictability of droughts in New York State."

The Task Force considers both immediate needs and long-term drought management strategies. Their recommendations, in order of priority, include the following: (1) replenish and expand the preparedness stockpile (this includes pipes and pumps); (2) complete water system drought contingency plans; (3) enact state water finance authority legislation; (4) complete local, regional, and state drought plans; (5) implement state water conservation (for both normal conditions and drought emergencies); (6) provide drought technical assistance (for both normal conditions and drought emergencies); (7) enact mandatory water metering legislation; and (8) examine proposed water allocation legislation. Many of these recommendations dealt with southeastern New York, which has been affected by

droughts more frequently than any other part of the state. The task force recommended that eight projects and project investigations involving water supply be undertaken in southeastern New York.

The Task Force also prepared a report on management actions for state and local agencies. This report outlined actions to be taken by the Drought Management Task Force, State Disaster Preparedness Commission, and state and local agencies during normal and drought conditions. The Task Force further distinguished four levels of drought condition—drought alert, drought warning, drought emergency, and drought disaster. In formulating their drought management plan, the Task Force inventoried available state resources and capabilities; most of the management actions were designed to be carried out within these existing resources. During “normal” conditions, state and local agencies are to monitor drought status, develop and keep current drought contingency plans, and maintain adequate supplies to implement drought plans (if necessary). Throughout the various stages of drought the Task Force recommends that these actions continue, in addition to more specific drought-related actions. In general, during drought conditions the Drought Management Task Force, Disaster Preparedness Commission, and state agencies continue to monitor and assess the drought situation, provide and coordinate assistance, and request federal assistance when necessary. Local agencies request assistance from state and federal agencies, if necessary, and also handle all water conservation or restriction efforts.

### **Summary and Conclusions**

Severe droughts frequently plague large portions of the United States. In response to the mid-1970s and subsequent droughts, several states have developed and implemented state response plans. The plans differ in makeup, reflecting unique water supply and management problems. Local planning is also emphasized since impacts can be highly variable within relatively small geographical areas. Drought contingency plans will help these states deal more effectively with future water shortages.

The development of drought plans by several eastern states indicates that these states, even though located in a more humid climate, recently have become more aware of their sensitivity to periods of water shortage. In our opinion the fact that only a few of the western states have developed drought plans does not indicate, in most cases, the absence of need, but rather the absence of leadership within state government for this critical area of water management.

The primary purpose of a state drought contingency plan should be to provide an effective and systematic means of assessing and responding to water shortages resulting from drought. Each state plan should address both the assessment and response capabilities of government. Assessment procedures must be developed to provide objective, reliable, and timely information on problems related to water supply and potential impacts. To accomplish this goal, a data collection, analysis, and dissemination system must be assembled well in advance of drought-related water shortages. At issue is not only what data should be collected, but by whom and at what sampling rate and areal density. Just as important

are provisions for the analysis and dissemination of data. The best data, if improperly "packaged" and ineffectively disseminated, will not produce the desired result.

The responsibilities of local, state and federal agencies in responding to drought must be well defined. This requires an efficient organizational structure to coordinate both the assessment and response functions of government. Regulatory powers must be prescribed (with legislative authority) to appropriate agencies in order for resources to be allocated in a consistent, equitable, and timely manner. Assistance programs must be available "on the shelf" for implementation in times of need. The development of a national drought plan, as called for by the General Accounting Office (1979), Wilhite, et al. (1984), and Wilhite, et al. (1985), would facilitate the response process.

To develop this assessment and response capability, state drought plans should include five basic objectives. First, information on drought must be collected, analyzed, and disseminated in a timely and systematic way. Second, criteria must be established for determining start-up and shut-down of various state and federal assessment and response activities during drought emergencies. Third, an organizational structure must be designed by state government that assures information flow within and between levels of government and defines duties and responsibilities of all involved agencies. Fourth, an inventory of state and federal agency responsibilities in assessing and responding to drought emergencies must be prepared and kept current. Finally, methods of assessing the impacts of drought, especially in agriculture, must be improved.

In our opinion, if the procedures recommended in this paper were adopted by states that experience frequent and severe water shortages caused by drought, governmental ability to implement effective measures in a timely manner would be greatly improved. A better coordinated response by state government would, hopefully, provide added incentive for the federal government to improve its assessment and response efforts. In this way, crisis management, an approach taken frequently by governmental entities in the United States in response to drought, might be replaced with programs of calm and directed positive actions.

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