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Chapter 9

DEVELOPING A DROUGHT PLANNING EVALUATION SYSTEM IN THE UNITED STATES

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1. INTRODUCTION

Drought is a normal part of the climate cycle, affecting every climate regime on the planet. Drought indicates a special period in which an unusual moisture scarcity causes a serious hydrological imbalance. Drought is related to the timing and effectiveness of the rains, high temperature, high wind, and low humidity. The typical impacts of drought may include dry lands, low or empty water-supply reservoirs, low groundwater levels (dried up wells), crop damage, and ensuing environmental degradation. In the United States, drought accounts for losses in the billions of dollars. In fact, a FEMA (1995) report estimates the average annual losses due to drought at \$6-8 billion, on a par with hurricanes, making these the two most costly hazards impacting our country. Drought often affects several sectors (agriculture, recreation and tourism, energy, forestry, and others) at the same time and typically impacts large areas and many people. These impacts serve as indicators of our vulnerability and risk during extended periods of rainfall deficits.

Our vulnerability to drought is affected by (among other factors) population growth and shifts, urbanization and sprawl, demographic characteristics, technology, water use trends, government policy, social behavior, and environmental awareness. These factors are continually changing, and society's vulnerability to drought can increase or decrease in response to these changes. Although drought is a natural hazard, society can reduce its

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vulnerability and therefore lessen the risks associated with drought episodes. The impacts of drought, like those of other natural hazards, can be reduced through mitigation and preparedness. Planning ahead in an attempt to mitigate drought gives decision makers the chance to relieve the most suffering at the least expense. Reacting to drought in “crisis mode” decreases self-reliance and increases dependence on government and donors (Wilhite and Pulwarty, 2005).

As a proof of concept approach, this paper looks into the process of comparing and evaluating state drought plans within the United States. The idea of evaluating (scoring) drought plans may be new, but similar methods have been applied to other hazards and in other planning fields, such as the environmental and urban/rural planning sectors (Baer 1997; Berke 2000; Brody 2003; Tang et al. 2008). Even so, the planning profession itself has developed relatively few criteria for evaluating the quality of plans, so plan quality is difficult to define (Baer 1997). Now, and in a changing climate with changing vulnerabilities, Brody (2003) aptly notes that planners must be flexible, adapting and planning for changing conditions by gearing their efforts more toward uncertainty and surprise. Thus, the purpose of this paper is to assess the potential transferability of evaluation techniques in other fields and hazards to the evaluation of drought plans in the United States.

2. THE CURRENT STATE OF DROUGHT PLANNING

One of the core missions of the U.S. National Drought Mitigation Center (NDMC) is to assist various entities in developing drought plans. Drought preparedness plans promote a more proactive risk management approach to drought management. They help people reduce their vulnerability to drought and dependence on emergency assistance from governments and international aid organizations. The process of developing a plan will identify vulnerable areas, population groups, and economic and environmental sectors. The process also seeks to identify data and informational gaps and research and institutional needs. Ultimately, preparedness plans will improve coordination and integration within and between levels of government; procedures for monitoring, assessing, and responding to water shortages; information flow to primary users; and efficiency of resource allocation. The goals of these plans are to reduce water shortage impacts, personal hardships, and conflicts between water and other natural resource users. These plans should promote self-reliance by systematically addressing issues of principal concern to the region or nation in question (Wilhite et al., 2005).

The complexity of drought impacts requires a preventive, anticipatory approach to risk reduction. How can governments reduce their vulnerability to drought? The first steps involve the formulation of a drought policy with clearly stated objectives and the development of a preparedness plan that lays out a strategy to achieve these objectives.

In 1983, only three states had drought plans. Progress since that time has brought the total to 37, with the latest efforts focused on developing drought plans that are more proactive, or “mitigative”, in nature (as noted in blue in the figure below). Drought preparedness plans contain three critical components: (1) a comprehensive early warning system, (2) risk and impact assessment procedures, and (3) mitigation and response strategies (Wilhite et al., 2005). These components complement one another and represent an integrated approach

that addresses both short- and long-term management and mitigation issues. More details on the specific indicator criteria will be described in the following section.



3. EVALUATION METHODS AND CRITERIA

In the mid-1990s, scholars identified a series of indicators for quantitatively assessing plan quality (Berke et al. 1997). Berke (1998) highlights the role of state growth management in reducing natural hazards risks. Similar frameworks are used to measure the quality of natural hazard planning on a local scale (Berke et al. 1996; Godschalk et al. 1999). Burby et al. (1999, 2000) further proposed the creation of hazard-resilient communities through land-use planning. These studies in the middle and late 1990s have greatly advanced our understanding on plan quality of natural hazard elements and provide an insight on the influence factors on hazard management plan quality (Baer 1997; Burby and Dalton 1994; Berke 1995; Berke and French 1994; Berke et al. 1996; Berke et al. 1997; Burby et al. 1997; Godschalk et al. 1998). However, no research has been done to evaluate drought planning quality. This study uses the following framework to evaluate drought planning quality.

3.1. Scoring

This study adopted and applied a modified scoring system based on a 0-5 (with 5 being the highest score) scale following the examples of readings and case studies. The drought

plan criteria chosen below were taken and modified from Wilhite et al.'s (2000) 10-Step Drought Planning Process, a methodology designed to serve as a checklist for planners interested in developing a state drought plan. The respective strengths and weaknesses of the state plans evaluated were used to assign evaluation scores to each criterion. The criteria chosen are described below. All criteria have been assigned equal weights with each parameter worth a maximum score of 5 and a minimum of 0 (assigned in the case of no mention at all of said criteria). Each plan is evaluated subjectively to determine what indicators (criteria) have been integrated (or at least mentioned/considered in the plan's language) into the respective drought plans. The study is only aimed at evaluating those states that already have a plan and not those that are currently developing one.

3.2. Evaluation Criteria

Most of the evaluation criteria below have been taken from Wilhite et al. (2000) and have been modified, or added to, for the purposes of this paper. The full descriptions of most of these criteria can be found on the National Drought Mitigation Center's website (from Wilhite) at drought.unl.edu. The criteria chosen for this exercise are:

3.2.1. Have a plan

The most fundamental criterion is whether the state has a drought plan. If not, the score assigned would be "0". Full credit and a score of "5" is given regardless of whether the plan is response oriented or mitigative in nature.

3.2.2. Have a mitigation plan

Additional credit is given to those states that have completed a plan that is proactive and mitigative in nature. A score of "5" will be given if the state's drought plan is considered to be a mitigation plan as determined by the National Drought Mitigation Center (2009) in their "Status of State Drought Plans" assessment, found at <http://drought.unl.edu/mitigate/status.htm>. Response plans, multi-hazard plans containing a drought component, or other operational plans (such as water plans) can receive partial scoring credit if mitigation wording or future risk assessment or mitigation actions are at least mentioned or considered.

3.2.3. Drought task force

A key political leader initiates the drought planning or oversight process through appointment of a drought task force. The task force has two purposes. First, it supervises and coordinates development of the plan. Second, after the plan is developed and during times of drought when the plan is activated, the task force coordinates actions, implements mitigation and response programs, and makes policy recommendations to the appropriate political leader(s).

The task force should reflect the multidisciplinary nature of drought and its impacts, and it should include appropriate representatives of government agencies (provincial, federal) and universities where appropriate expertise is available. Environmental and public interest groups and others from the private sector can be included as appropriate. The task force should include a public information official who is familiar with local media's needs and

preferences and a public participation practitioner who can help establish a process that includes and accommodates both well-funded and disadvantaged stakeholder and interest groups.

3.2.4. Purpose and objectives

The general purpose and objectives for the drought plan should be clearly stated. Government officials should consider many questions as they define the purpose of the plan:

- Purpose and role of government in drought mitigation and response efforts
- Scope of the plan
- Most drought-prone areas of the state or nation
- Historical impacts of drought
- Historical responses to drought
- Most vulnerable economic and social sectors
- Role of the plan in resolving conflict between water users and other vulnerable groups during periods of shortage
- Current trends (e.g., land and water use, population growth) that may increase or decrease vulnerability and conflicts in the future
- Resources (human and economic) the government is willing to commit to the planning process
- Legal and social implications of the plan
- Principal environmental concerns caused by drought

The plan should be aimed at providing government with an effective and systematic means of assessing drought conditions, developing mitigation actions and programs to reduce risk in advance of drought, and developing response options that minimize economic stress, environmental losses, and social hardships during drought.

The plan should also identify specific objectives that support the purpose of the plan. Drought plan objectives will vary within and between countries and should reflect the unique physical, environmental, socioeconomic, and political characteristics of the region in question. For a provincial, state, or regional plan, objectives that should be considered include the following:

- Collect and analyze drought-related information in a timely and systematic manner.
- Establish criteria for declaring drought emergencies and triggering various mitigation and response activities.
- Provide an organizational structure and delivery system that ensures information flow between and within levels of government.
- Define the duties and responsibilities of all agencies with respect to drought.
- Maintain a current inventory of government programs used in assessing and responding to drought emergencies.

3.2.5. Stakeholder participation

Social, economic, and environmental values often clash as competition for scarce water resources intensifies. Therefore, it is essential for task force members to identify all citizen

groups (stakeholders) that have a stake in drought planning and understand their interests. These groups must be involved early and continuously for fair representation and effective drought management and planning. Discussing concerns early in the process gives participants a chance to develop an understanding of one another's various viewpoints and generate collaborative solutions. Although the level of involvement of these groups will vary notably from location to location, the power of public interest groups in policy making is considerable. In fact, these groups are likely to impede progress in the development of plans if they are not included in the process. The task force should also protect the interests of stakeholders who may lack the financial resources to serve as their own advocates. One way to facilitate public participation is to establish a citizens' advisory council as a permanent feature of the drought plan, to help the task force keep information flowing and resolve conflicts between stakeholders.

3.2.6. Resources inventory and risk assessment

An inventory of natural, biological, and human resources, including the identification of constraints that may impede the planning process, may need to be initiated by the task force. In many cases, provincial and federal agencies already possess considerable information about natural and biological resources. It is important to determine the vulnerability of these resources to periods of water shortage that result from drought. The most obvious *natural resource* of importance is water: its location, accessibility, and quality. *Biological resources* refer to the quantity and quality of grasslands or rangelands, forests, wildlife, and so forth. *Human resources* include the labor needed to develop water resources, lay pipeline, haul water and livestock feed, process citizen complaints, provide technical assistance, and direct citizens to available services.

In drought planning, making the transition from crisis to risk management is difficult because, historically, little has been done to understand and address the risks associated with drought. To solve this problem, areas of high risk should be identified, as should actions that can be taken to reduce those risks before a drought occurs. Risk is defined by both the exposure of a location to the drought hazard and the vulnerability of that location to periods of drought-induced water shortages (Blaikie et al., 1994). Drought is a natural event; it is important to define the exposure (i.e., frequency of drought of various intensities and durations) of various parts of the state or region to the drought hazard. Some areas are likely to be more at risk than others. Vulnerability, on the other hand, is affected by social factors such as population growth and migration trends, urbanization, changes in land use, government policies, water use trends, diversity of economic base, and cultural composition.

3.2.7. Identify research and data gaps and needs

As research and data needs and gaps in institutional responsibility become apparent during the drought planning process, the drought task force should compile a list of those deficiencies and make recommendations to the appropriate person, or government body, on how to remedy them. For example, the monitoring committee may recommend establishing an automated weather station network or initiating research on the development of a climate or water supply index to help monitor water supplies and trigger specific actions by state government.

3.2.8. Dissemination and education

If the public has been engaged throughout the process of establishing a drought plan, there may already be better-than-normal awareness of drought and drought planning by the time the plan is in place. During drought, the task force should work with public information professionals to keep the public well informed of the status of water supplies, whether conditions are approaching “trigger points” that will lead to requests for voluntary or mandatory use restrictions, and how victims of drought can access assistance. All pertinent information should be posted on the drought task force’s website so that the public can get information directly from the task force without having to rely on mass media.

A broad-based education program to raise awareness of short- and long-term water supply issues will help ensure that people know how to respond to drought when it occurs and that drought planning and awareness does not lose ground during non-drought years.

3.2.9. Coordination and implementation

The drought plan should have three primary components: (1) monitoring, early warning, and prediction; (2) risk and impact assessment; and (3) mitigation and response. A committee should be established to focus on the first two of these needs; the drought task force can in most instances carry out the mitigation and response function. The committees will have their own tasks and goals, but well-established communication and information flow between committees and the task force is necessary to ensure effective planning. Plans must clearly define agency/entity roles and responsibilities in order to ensure good communication and smoother implementation during a drought crisis. Plans will be evaluated with an eye on assessing how the above factors are integrated within the plan.

3.2.10. Evaluation and revision of the plan

Periodic testing, evaluation, and updating of the drought plan are essential to keeping the plan responsive to local, state, provincial, or national needs. Two modes of evaluation (ongoing and post-drought) are needed to maximize the effectiveness of the system. To ensure an unbiased appraisal, governments may wish to place the responsibility for evaluating drought and societal response to it in the hands of nongovernmental organizations such as universities or specialized research institutes.

4. CASE STUDIES

From the 37 state drought plans in place, we chose 4 to initially test the scoring system. In choosing the plans, the goal was to choose one plan that is a traditional response, or operating, plan. Two of the plans are mitigation plans, as determined by the NDMC, and the fourth plan is one that delegates planning authority to the local level. The plans were also chosen based on geographic location to account for different drought characteristics and planning methods in the East, Southeast, Southwest, and Great Plains. The states chosen were Nebraska (mitigation plan), New Mexico (mitigation plan), Florida (delegated to local authorities) and Connecticut (response plan). All of these plans can be found on-line at <http://drought.unl.edu/plan/stateplans.htm>.

5. RESULTS AND CONCLUSIONS

The results of the evaluation exercise below (Table 1) show the comparison of the drought plans according to the evaluation criteria outlined above. As expected, the mitigation oriented plans in New Mexico (48 out of 50) and Nebraska (39) graded the highest using this evaluation scheme. However, a high score does not necessarily indicate a complete plan. For example, Nebraska's plan does not provide any real backing for evaluation or revision, and little attention is given to research and data needs. New Mexico does stand out by far as having the most complete plan of those evaluated. Many states have used the New Mexico plan as a model to emulate in many regards. It had very few weaknesses when analyzed with the 10 criteria chosen for this study. Perhaps a survey tool or more thorough research would reveal some weaknesses, but this plan was well thought out and, according to a quick review of their website, it is still being used and implemented as of early 2010.

Connecticut and Florida both scored 34 out of a possible 50. This is not surprising given the operational response-oriented nature of the plan in Connecticut, which is much more geared toward water supply and demand. In the case of Florida, planning for drought is delegated to the local authorities (usually water oriented) who are in charge of managing their water resources during times of drought. To their credit, both Florida and Connecticut mention the need for future mitigative actions and risk assessments. As outlined in the scoring criteria, partial credit is given for considering these criteria even though these two state plans are clearly oriented more toward response activities. Incidentally, these same two states also score lower marks in the area of resources inventory and risk assessment. Again, this type of activity is more mitigative in nature, and it illustrates what ultimately sets states with a proactive, mitigative approach apart from states that don't take such an approach. The recent trend in drought planning over the past decade or so has been more focused on mitigation planning, and this is the approach the NDMC recommends to the states we work with.

This study only looked into a few of the many potential drought plan indicator criteria given the time constraints of undertaking a more thorough research approach. Further research might include a thorough review of all state drought plans or a more detailed look into state drought mitigation, response, and monitoring efforts. Such studies could help document what works best in the drought planning arena, and they would fill a unique research niche.

6. POLICY RECOMMENDATIONS

From the results of these four state drought plan quality evaluations, this paper provides the following policy recommendations.

First, state-level drought management agencies need to improve the factual basis of drought plans. One of the important functions in drought plans is to identify potential drought risk areas if they are to plan appropriately for the future. State drought planning should provide timely and systematic data collection, data analysis, and data dissemination of drought-related information. It is important for state-level drought management agencies to identify and designate drought-affected areas of the state. The drought-affected areas provide the factual base for drought management decision makers to trigger the phasing in and out of

various drought risk assessment and drought response activities by inter-organizational agencies during times of drought. The state-level drought plan should include a vehicle for the timely and accurate reporting and/or assessment of drought impacts on agriculture, tourism, industry, wildlife, and human health.

Table 1. Comparison of state drought plans utilizing evaluation criteria

DROUGHT PLAN	Nebraska	Florida	New Mexico	Connecticut
Have a Drought Plan	5	5	5	5
Mitigation Plan	5	2	5	2
Task Force	5	4	5	3
Purpose & Objectives	5	5	5	5
Stakeholder Participation	5	4	5	2
Resources Inventory and Risk Assessment	5	2	5	2
Research and Data Needs	1	2	4	4
Dissemination and Education	4	5	5	4
Coordination and				
Implementation	3	4	4	4
Evaluation and Revision	1	1	5	3
Total Score	39	34	48	34

Second, state agencies should commit appropriate resources and practical objectives to their drought preparedness, response, mitigation, and recovery plans. Drought plans need adequate drought awareness and a strong commitment by the public and decision makers in supporting drought preparedness. Increasing drought awareness and recognition of drought as a natural hazard among the multiple local jurisdictions is an effective way to reduce drought risk. The goals and objectives for drought management should be clear and applicable.

Third, inter-organizational coordination for drought planning and monitoring is extremely important because droughts are slow onset in nature, relatively longer in duration, and typically impact larger spatial regions, and they do little in the way of structural damage when compared to other natural hazards. The state drought plan needs to define a process aimed at guiding multiple state-level agencies to better coordinate their drought-related activities. The successfully integrated drought plan can coordinate the monitoring, communication, risk assessment, vulnerability assessment, and preparedness activities for successively dealing with more severe drought stages. The state drought plan also needs to identify the primary responsibilities of the state and local entities for managing drought-related activities. In addition, it is important to promote effective mobilization of public and private resources in managing drought mitigation efforts. An effective drought plan should hinge on communication among multiple agencies and water suppliers and the timely dissemination of clear and succinct drought information to decision makers, the media, and the general public.

Fourth, more effective policies, tools, and strategies should be introduced into state-level drought planning. The state agencies should adopt some regulatory policies (e.g., land use

permits, special zoning, buffers, building ordinances, hazard reviews, or specific drought legislation) to help mitigate drought hazards. The state agencies should also adopt some incentives (e.g., tax abatement, density bonus, low-interest loans, voluntary community groups, or drought insurance) to mitigate the drought hazard. The drought plans should establish and pursue a series of effective policies to remove management obstacles toward the equitable allocation of water during shortages and to provide incentives to encourage water conservation.

Lastly, drought plans should specify drought implementation, monitoring, and updating mechanisms and timelines. Drought plans need to clearly specify the appropriate personnel and financial resources, and responsibilities, to ensure that drought planning implementation can be realized operationally on the ground. Drought plans should set up a series of procedures aimed at evaluating and updating the plan on a continuous cycle in order to keep the plan updated and responsive to a state and its constituents' needs.

In summary, this study is just a starting point to further develop a drought planning evaluation system in the United States. The ultimate value of the rating system is not just in comparing between plans, but is intended for individual states or entities to use in developing or evaluating their own plans with a goal of using the system to ultimately help them better their plans. Also, a good plan in terms of a rating on paper doesn't ensure or equate to a good plan in terms of operations. Having a good plan does provide an entity with the opportunity to use that plan or improve on that plan in the future. In the end, it is still up to the entity to follow and use the plan as well as update it on a regular basis. Future study will extend the scope from state-level drought plans to local jurisdictions' drought plans.

REFERENCES

- Baer, W. C. (1997). General plan evaluation criteria: An approach to making better plans. *J. Am. Plan. Assoc.*, 63(3), 329-344.
- Berke, P. (1995). Evaluation environmental plan quality: The case of planning for sustainable development in New Zealand. *J. Environ. Plan. Manage.*, 37(2), 155-169.
- Berke, P. & French, S. (1994). The influence of state planning mandates on local plan quality. *J. Plan. Educ. Res.*, 13, 237-250.
- Berke, P., Roenigk, D., Kaiser, E. & Burby, R. (1996). Enhancing plan quality: Evaluation the role of the state planning mandates for natural hazard mitigation. *J. Environ. Plan. Manage.*, 39, 79-96.
- Berke, P., Dixon, J. & Ericksen, N. (1997). Coercive and cooperative intergovernmental mandates: A comparative analysis of Florida and New Zealand environmental plans. *Environ. Plan. B-Plan. Des.*, 24, 451-468.
- Berke, P. R. (1998). Reducing natural hazard risks through state growth management. *J. Am. Plan. Assoc.*, 64(1), 76-87.
- Berke, P. R. (2000). Are we planning for sustainable development? *J. Am. Plan. Assoc.*, 66(1), 21-33.
- Blaikie, P., Cannon, T., Davis, I. & Wisner, B. (1994). *At Risk: Natural Hazards, People's Vulnerability, and Disasters*. Routledge, London, United Kingdom.

- Brody, S. (2003). Are we learning to make better plans? A longitudinal analysis of plan quality associated with natural hazards. *J. Plan. Educ. Res.*, 23(2), 191-201.
- Burby, R. J. & Dalton, L. (1994). Plans can matter! The role of land use plans and state planning mandates in limiting the development of hazardous areas. *Public Adm. Rev.*, 54(3), 229-237.
- Burby, R. J., Beatley, T., Berke, P. R., Deyle, R. E., French, S. P., Godschalk, D. R., Kaiser, E. J., Kartez, J. D., May, P. J., Olshansky, R., Paterson, R. G. & Platt, R. H. (1999). Unleashing the power of planning to create disaster-resistant communities. *J. Am. Plan. Assoc.*, 65(3), 247-258.
- Burby, R. J., Deyle, R. E., Godschalk, D. R. & Olshansky, R. B. (2000). Creating hazard resilient communities through land-use planning. *Nat. Hazards Rev.*, 1(2), 99-106.
- Burby, R. J., May, P., Berke, P., Dalton, L., French, S. & Kaiser, E. (1997). *Making Governments Plan: State Experiments in Managing Land Use*. Johns Hopkins Univ. Press, Baltimore, Maryland.
- FEMA. (1995). National Mitigation Strategy. *Federal Emergency Management Agency*, Washington, D.C.
- Godschalk, D. R., Beatley, T., Berke, P., Brower, D. J. & Kaiser, E. J. (1999). *Natural Hazard Mitigation*. Island Press, Washington, D.C.
- Godschalk, D. R., Kaiser, E. & Berke, P. (1998). Integrating hazard mitigation and local land-use planning. In *Cooperating with Nature: Confronting Natural Hazards with Land-use Planning for Sustainable Communities*. R.J. Burby, ed. John Henry Press, Washington, D.C., 85-118.
- NDMC. (2009). National Drought Mitigation Center website: <http://drought.unl.edu>.
- Tang, Z., Lindell, M. K., Prater, C. S. & Brody, S. D. (2008). Measuring tsunami planning capacity on U.S. Pacific Coast. *Natural Hazards Review*, 9(2), 91-100.
- Wilhite, D. A., Hayes, M. J., Knutson, C. & Smith, K. H. (2000). Planning for drought: Moving from crisis to risk management. *J. Am. Water Res. Assoc.*, 36(4), 697-710.
- Wilhite, D. A., Hayes, M. J. & Knutson, C. L. (2005). Drought preparedness planning: Building institutional capacity. In: *Drought and Water Crisis: Science, Technology, and Management Issues*, D. A. Wilhite, (ed.). CRC Press (Taylor and Francis), New York, 93-135.
- Wilhite, D. A. & Pulwarty, R. (2005). Lessons learned and the road ahead. In: *Drought and Water Crisis: Science, Technology, and Management Issues*, D. A. Wilhite, (ed.). CRC Press (Taylor and Francis), New York, 389-398.