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Drought perception and societal consequences *

EVAN VLACHOS **

1. Drought: the periodic disaster

Since the beginning of recorded history, drought has been the constant companion of humanity. There is no single region of the planet where drought has not affected peoples' activities in one way or the other at one time or another. Over the years, drought impacts have been felt in agriculture, urban water supply, industry, pollution control, energy, transportation, recreation and a host of other activities related to water and society.

Looking back, many societies have accepted droughts as the inevitable vagaries of nature or acts of God to be endured. In modern times, however, the interaction between water and society has produced a changing attitude as control over the physical environment has increased and technology and social organization have made possible successful manipulation of natural resources.

However, population expansion, rapid urbanization and industrialization and competing and conflicting demands have more recently complicated natural water shortages. Even more, potential climatic shifts, large scale dislocations, socio-economic changes, and national and international events have coalesced into the creation of large scale apprehensions and have focused attention to the need for more integrated, anticipatory and far-reaching water policies and strategies. In both the popular mind as well as in significant parts of the professional literature, there seems to be an increasing recognition that even the former relative stability of climate tends to disappear. Indeed, weather oscillations have increased the concern as to present and future impacts of long-term climatic changes on the surrounding environment.

Such views tend to reinforce a free-floating apprehension as to human vulnerability and concerns towards an environment that can be further mismanaged or abused. The findings that periods of gentle climates between ice ages are becoming much shorter than had ever been thought before have reinforced the preoccupation with the doom and gloom of rapid changes and the proximity of potential catastrophes (Vlachos, 1989). The implication of these observations is that, e. g., the drought of 1988 in the U.S. and of 1990 in Europe expanded the scope of concern to incorporate broader climatic transformations, raising heated discussions as to factual knowledge on the extent and severity of on-going changes; creating serious disputes among various parties-at-interest as to what is at stake and as to what could be particular policy interventions; and, finally, reinforcing important value conflicts as to the roots of the crisis, the use of resources and postures toward the global environment.

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** International School for Water Resources, Colorado State University, Fort Collins, Colorado 80523 USA.

The relevance of such broad concerns is obvious if one considers also a prevailing apocalyptic mood as to the future of the planet, the sensationalist stories linking such items as the «greenhouse effect», «acid rain», «deforestation», «desertification», «ozone holes», «heat waves», etc., etc. Short-term weather vagaries and simplistic meteorological interpretations get confused with more sober analyses, while prophets of doom compete for attention as colorful doomsday scenarios unfold in the popular press.

While the summer of 1990 may have brought some respite to the doomsday views of heat and drought in the United States (although drought has been endemic in the West), events in Europe reinforced widespread concern. Fires swept through the forests of circum-Mediterranean countries, trains were cancelled in England for fear of buckled rails, water reserves in Athens were reduced to 45 days, and a continent-wide drought brought in Europe the year of the heat. And, as Hamer reports, in the past two years there has been a major shift in Europe's climates. Southeastern England enjoyed an almost Mediterranean weather, while Mediterranean countries suffered from an almost sub-Saharan drought. (Interestingly, Hamer notes that Spain — but not Madrid — was the chief exception to the Mediterranean drought.) (Hamer, 1990:20.)

One important item in linking potential climatic anomalies and droughts is the extent of differential «vulnerabilities». Such vulnerabilities include the entire gamut of environmental, technological, economic and social resiliency in terms of being capable to recognize, respond to and in the long-run sustain shocks of short-and long-term climatic fluctuations. In the simplest form, the exposure to risk and the level of reaction against natural hazards vary greatly from community to community and from nation to nation.

Drought is essentially a meteorological phenomenon, namely an extended period of time with inadequate precipitation. Such a definition could be perhaps general enough to describe one of the major hazards of humanity. Unfortunately unlike other hazards and crises, drought represents a «non-event». It is very difficult to identify and to clearly determine its onset as well as termination point, especially in cases of protracted drought. At the same time, to various professionals, drought implies a variety of things. To the meteorologist drought simply connotes a period of abnormally dry weather or the lack of precipitation. To the hydrologist, drought is viewed as a sufficient lack of water causing significant hydrologic imbalance to a given area. To the economist it means important economic impacts. To the sociologist it implies social dislocation and stresses in a given social structure.

Thus, it is important to emphasize that drought as a natural hazard differs from many other hazards in some important ways. First, drought is a hazard that is quite pervasive in nature, it is a «creeping phenomenon» and its effects accumulate slowly and tend to persist over longer periods of time. This is a characteristic that has tremendous importance in that not only it differs from such dramatic and sudden short-lived phenomena as floods, hurricanes, earthquakes, etc.; but, because, quite often, its effects are late to be understood and by the time intervention is called upon, it may be organizationally late for producing relief. At the same time, there is another major way that drought (particularly agricultural drought) differs from other hazards, namely that its effects are intricately related to the economic and social fabric of a given region or an entire nation. While effects do not include the dramatic human losses that other events may have, they produce effects that may have far-reaching consequences in terms of eventual population shifts, population reductions and alterations of the surrounding social structure (Yevjevich et al., 1983).

So far, the general term of drought has been used to describe essentially inadequate precipitation over time. But various concepts used exemplify a prevailing confusion among all such terms which signify «dry environments» or «water deficiencies». The terms vary all the way from the extremes of desert to aridity, to drought and to temporary «water shortages». There are four different terms that are important for some initial separation between physical and social conditions with regard to what we can summarily label «water deficiencies».

a) *Aridity*, signifies a permanent natural condition and a stable climatic feature of a given region.

b) *Drought* refers to a temporary feature of the climate or to regular or unpredictable climatic changes.

c) *Water shortages* is a term that can be understood mostly as a man-made phenomenon reflecting the concern with temporary and small area water deficiencies.

d) *Desertification* is part of a process of alteration of the ecological regime often associated with aridity and/or drought but principally brought about by man-

made activities which change to a significant degree the surrounding ecosystem.

Drought, according to some, is neither a hazard nor a disaster, but both of these terms are used by policy researchers to describe drought. Thus, we have the obvious dilemma that drought is perceived in different ways. This difference in viewpoint is explained as follows. A hazard, according to the dictionary, is defined as «...a chance happening...an accident...a possible source of danger....» A disaster is defined as «...an occurrence causing widespread destruction and distress...a grave misfortune...a total failure....» These definitions reveal that it is the element of *expectation* that determines whether a drought is a hazard or disaster or not. The water manager experiences a drought and states, «We have planned statistically for this expected drought; we didn't know when it would occur, but we knew it would.» The farmer or local politician states, «What a disaster...we have run out of water...we were totally unprepared for this surprise drought.» (And, it is interesting to notice here, the definition of drought by Howe as «a shortage of precipitation of seasonal or longer duration relative to the expectations of users» — C. W. Howe. *National Resource Economics*. N. Y: John Wiley, 1979, p. 280).

This difference in *perception* is one of the central problems of water management for drought. If decision makers fail to allow water managers to prepare properly for drought, then drought is a surprise when it occurs. The water managers knew it would occur but they were powerless to prepare for it. Politicians did not want to face the prospect of preparing for it, since the chances that it would happen during their terms were small. Thus, the reason that drought is a hazard and a disaster is that although it is statistically expected, it is not politically nor economically expected. If water managers are to take measures to improve preparation for drought, these problems of expectation must be faced (Grigg and Vlachos, 1990).

Whatever the term, whatever the theory, there seems to be general agreement that «drought» (dryness or «xerasia» to borrow a Greek term) is an unavoidable aspect, especially of arid and semi-arid environments and a historical companion of many early and contemporary civilizations. Droughts are still recognized as the most serious hazard, especially to agriculture, in nearly every part of the world. Increasing urbanization and industrialization are also becoming important determinants of major dislocations, as concentrated populations dependent on water tend to be affected by variations in climate and of vagaries in water supply. The real problem arises not from the occurrence of the periodic droughts, but from the failure to mold habits and to create a culture that is much more in harmony with the surrounding environmental reality. For example, the human cultural patterns in arid and semi-arid environments must be adapted to such a way as to survive the driest years, not to push the land to its limits in years of favorable rainfall, and generally to recognize a flexible way of responding to a rapidly changing environment.

These last remarks are particularly important when one considers the rapid social changes, globalization and interdependence that characterize recent societal transformations. These forces increase the complexification of surrounding physical and social systems, intensifying the severity and duration of drought impacts and consequences. Modern society, because of its size, complexity, vulnerability, diversity, environmental alterations, etc., contains a comparatively high degree of potential disorganization. They are all expressions of larger stresses and strains resulting not only from physical hazards; but also from such interdependent transformations as population changes, spatial imbalances, the rapid pace of technological changes and of significant environmental despoliation.

2. Environmental conflicts and droughts

The previous part attempted to outline a background of concern not only by introducing a set of environmental challenges associated with dry environments and the conceptual difficulties in separating the various expressions of drought; but, also to relate the perennial presence of drought in civilization and the fateful consequences of human activities, especially in arid and semi-arid environments.

Environmental stress has been used as the key concept to denote both the presence and the range of symptoms associated with transforming natural environments. The initial agricultural activities which have always been identified with any major discussion of droughts have more recently been substituted with new forces and new stresses associated with such items as energy-related developments, rapid urbanization, and expanding industrialization.

The expanding concerns with environmental stress tend to reinforce prevailing fears that something fundamental is changing in the relationship between the individual and nature. As a matter of fact, a number of scientists believe that the world strains today are signals of fundamental and perhaps unsolvable crises: namely, the approach of physical limits to human and material growth.

This argument is accentuated by increased awareness as to what the human presence is doing into the surrounding ecosystem and to the natural laws concerning young and mature ecosystems. The key question asked has to do with either the tolerance, resiliency, or recuperability of the surrounding environment and reflect a concern with the assimilative capacity of the environment to absorb human intervention or to meet increasing demands. Central, then, to all such discussions is the question of carrying capacity and of the limits to growth in a functioning ecosystem.

A further question that arises is how much one can «push» systems before irreversible adverse changes take place. Thus, assimilative capacity, carrying capacity, and the tolerance of the ecosystems are important parts of the interrelationship of individual, culture and environment and of problems resulting from a non-harmonious relationship between these three elements, especially because of resource intensive lifestyles.

Increasing concern with potential far-reaching climatic shifts and their consequences for society have also raised questions as to how to communicate findings, share the range of topics with a variety of publics, and help improve decision making through solid knowledge exchange and implementable actions. The challenges facing agriculture are particularly acute given the centrality of food production for future survival and the paucity of information as to agricultural processes among increasing segments of urban populations.

Furthermore, the literature on the environmental plight, changing socio-economic circumstances, systemic interdependencies in ecosystems, and the challenges of development and preservation have become a virtual torrent of solid data, of speculative scenarios, of opinion, and, of contradictory findings and conclusions. In such a «noisy» information environment the crucial task is not only to disseminate information but to do so within a context of valid, reliable, and relevant knowledge, characterized by sensitivity to a variety of audiences and through the use of consistent conceptual and methodological premises (Vlachos, 1990).

It is at this point that there are three basic areas of disagreement or conflict which tend to affect perception, awareness and response to drought (and for that matter to any use of natural resources).

The first we may describe as *cognitive conflict*, representing among all parties involved disagreements about the «facts», the true nature of trends, and as to the «critical» variables comprising various models of reality. Here one finds, among others, healthy debates as to data and statistics, about estimates and probabilities, and as to what constitutes important developments and significant trends. The resolution of such conflicts or disagreements is dependent on further research as factual differences can be accommodated by advances in knowledge.

The second basic area of disagreement and source of conflict is what one may describe as «*stakeholder*» *conflicts*, reflecting coalitions of social power, or «parties-at-interest», or the different perspectives of the question of «who is at stake». Relevant disagreements here relate such important items as equity (who pays and who benefits); aspects of tradeoffs (including multi-objective considerations); and doubts as to representation, i. e., the legitimacy of representing particular groups or the community at large.

Finally, more fundamental disagreements arise from *ideological conflicts*. Such disagreements and conflicts represent the ultimate expression of social values, disagreements as to visions of society, models of development and of posture toward present and future (optimism vs. pessimism). This type of conflict represents not only all encompassing points of view but also ideological axes of collecting data, of representing solutions, and of estimating potential far-reaching consequences of droughts.

3. Drought perception and value's context

Drought has been described as a dynamic process, varying both spatially and temporally. Given the dynamic elements and the variability of various coping mechanisms, a systems approach has been suggested as a framework for examining responses to this phenomenon. At the same time, our conventional understanding of drought must be seen mostly as a predictable result of human interaction with the sur-

rounding environment. The scale of human exploitation, the range of human activities and the socio-cultural responses to stressed environments, are all part of an intricate relationship between physical and human environments.

An emphasis on drought as a «sociological» phenomenon extending beyond hydrological and soil conditions, to encompass consequences on the well-being of human communities constitutes the central preoccupation with a socio-cultural context. The last underscores a number of important concerns, including:

a) changing social environments because of urbanization, sprawl, increasing densities, or industrialization which in tern may affect vulnerability to drought of larger segments of population;

b) responses to drought which are becoming more complex as more interdependent systems are affected and the calls for more integrated, long-range planning are increasing; and, c) responses to drought which require also broader mobilization of institutions and people in order to accommodate adaptive policies for resource scarcities, climatic vagaries, and the uncertainty of future environments.

The sociological context of droughts allows us also to introduce the concept of an «incongruence» between the realities of living in drought-prone areas and the «humid» mentality of urban populations. It is a cultural lag in mental images (call it perception) about the surrounding environment and a disparity between contemporary life and natural ecological processes.

The above should make a point quite clear by now, i.e., that droughts are not strictly a physical phenomenon but rather part of an interplay between the natural systems responsible for variations in available precipitation and the particular human use systems which are quite susceptible to such variations. Drought is produced fundamentally by human activities, technologies and institutions. Their eventual severity is determined by the degree to which excessive demands are put on the long-run availability of moisture. A drought's dynamic nature is eventually determined from the adjustments and adaptations that society makes in order to cope with risks and uncertainties of a sometimes unpredictable climate and from the mechanisms that society devises for adapting to regular variations as well as to surprises. The last implies that the dependency and specialization of individual communities, fostered by economic and particularly urban development, reduce the ability of people to respond effectively, or narrow the range of normal environmental variability with which they are able to cope on their own.

The existing literature recognizes that there is a widespread false confidence as to the return of rainfall, the carrying capacity of the land, and as to the resilience of the surrounding ecosystem. The optimism generated by intervals of abundant rainfall reinforces apathy and confidence as to the providence of nature to be followed by the concern, if not panic, with the next drought (what some authors described as the «hydro-illogical cycle»). This argument is particularly important as the increasing scope of urbanization and industrialization is producing demands which, coupled with agricultural water use expansion over the past years, is also producing a highly complex and interdependent social system. Thus, it has been pointed out that one of the causes of the «industrialization» of agriculture has been the diminished ability of farmers to deal with normal climatic variations.

The series of geographic and other studies that have been made in order to investigate reactions to environmental stresses have pointed out that attitudes to such hazards are often complex and not always «logical» or «rational». As such they have by necessity led to difficulties in formulating effective official relief policies. Indeed, lessons learned from droughts must be questioned since they are highly dependent on the perception of the observers and of those recording the events. For example, as the work of Saarinen points out, as aridity increases so also do increase a farmer's estimates of the possibilities of drought occurrence and so also increases the degree of agreement of farmer's estimates of drought occurrence and the scientific measure of drought frequency. Perception, then, of drought is a key social element that must be brought into any discussion. As it has been pointed out, if drought is whatever the inhabitants of a particular region perceive it to be, we must also know at what point the need for remedial action is felt. This perception of the drought hazard varies according to:

a) the degree of aridity; b) the amount of experience; and c) certain personality differences (Saarinen, 1966). Yet, it should be noticed that drought perception studies have exclusively concentrated on farmers who are particularly sensitive to climatic variations. The greater the amount of drought experienced, the

more accurate the perception of the drought risk. This is something that definitely lacks in the case of the urban dweller, an increasing «stakeholder» group and an important element of comprehensive water resources policies.

The last remark points out also that experience and frequency of occurrence of drought are important factors in the perception of and reaction to the gamut of «dryness» described in the first section. We may even suggest the term «xerasia ethos» which reflects the sensitivity to change signs in aridity, dry periods, droughts and ultimately desertification. The question that we must raise here is that of the «oscillation of perception, or how changes in climate, social activities, and in the ecosystem affect the attitudes and actions of people in such areas. Furthermore, how does the differentiation between rural and urban activities affect perception of the drought hazard and recognition of the importance of presumed large-scale social and environmental transformations?

The centrality and importance of drought perception is reinforced by other studies of natural hazards and risk perception. Burton has already hypothesized that heightened hazard perception could be expected where the hazard is directly related to the resource use (Burton et al., 1978). Psychologists and behavioral scientists have also pointed out the socio- psychological consequences of differential perceptions. Similarly, geographers have pointed out how variations in the perception of natural hazards depend on dominant use, frequency of natural events and personal experiences.

Other recent findings from disaster literature point out that public perception of risk is a multi-dimensional concept or a social process rather than a single variable. Research here has also emphasized that the public is comprised of different kinds of people. For drought it would be important to differentiate between perceptions of users (public at large); perception of managers and professionals; and, perceptions of policy makers (including politicians).

Perception is also related to the communication of risk. Public risk information and communication help the public perceive both short- and long-term consequences. Risk communication (and the related concept of «warning») have been linked with the users' environment (physical and social cues); social attributes (e. g., social network, economic resources, and demographic characteristics); and psychological attributes (such as knowledge and experience with risk).

If we are, then, to relate the historical evolution of water development with the exigencies of the present, a challenging situation emerges in many countries. On the one hand, there exists an established cultural, legal and institutional system of water resources resulting in established societal equilibriums and systems. On the other hand, scarcity, increasing new demands and a more complex political and social structure clamor for attention and press for changes. The early close relationship between water and agriculture has been changing because of the forceful presence and expanding power of municipal and industrial interests either upstream or downstream of a given valley. The hue and cry about pollution, the stringent voices of conservation and of return to nature are also forcing significant changes in the earlier isolated water resources development. Drought forces us to face the dilemma of both development and conservation and of accommodating traditional cultures and complex social structures in often fragile ecosystems.

A requisite broader ecological frame of reference implies two major elements that relate human activities to the environment, namely, *interaction* and *adaptation*. Ecology, to start with, reflects not only how human utilization of nature influences and is influenced by social organization and cultural values (the interrelationships between population, culturally styled needs and wants, technology and methods of production and the ways of dividing natural resources); but also how adaptive behavior or coping mechanisms and ways of dealing with people and resources are developed in order to attain goals and solve problems. Thus, in this mutually reinforcing relationship between nature and society as mediated by culture, the key problem of adaptive behavior revolves around the question of how people respond to severe constraints, people with cultural goals and expectations that are generally much greater than those they might achieve with the available resources (Bennett, 1969). The literature of human ecology is rich in inference as to how populations and their culture exist in a reciprocal relationship with the surrounding environment. The key to survival that appears in the literature is the capacity for adaptation. Historians and other social scientists have pointed out that such cultural traits as flexibility, reserves and mobility are the most important, indispensable and

inevitable values in the cultural pattern of many regions.

But one may ask at this point that while this adaptation assumes essentially an agricultural frame of mind to what extent current socio-economic changes can reflect the transforming attitudes, values and beliefs that provide us with a key as to the future of many world regions. The effort here centers around the quest to investigate the public, private and other management schemes to determine incentives, to understand government regulations, to examine legislative and judicial decision making, and to analyze individual and group perceptions of natural resources, especially by urban populations who have a different relationship with land compared to that of traditional agricultural practices.

4. On managing droughts

The previous pages attempted to emphasize that the very definition of drought, the long historical and cultural experiences, and differential perception have created a situation that requires more complex and integrated approaches in understanding and managing this phenomenon.

Disagreements and confusion about drought and debates as to whether drought is a hazard or a disaster impede actions. The diversity of definitions is an indicator of the complexity of drought, and constitutes a barrier to understanding its onset, duration and ending. At the same time drought researchers should do better to find ways to present explanations and management procedures that the public can understand and support.

This will also enable data agencies to respond better to the need for interpretive information.

The differences in perception of whether drought is a disaster/hazard, or an expected event to be prepared for, shows the need for education of officials and of the general public. Many water managers in humid climates have not experienced drought and have a false sense of security. There is also a general lack of institutional memory about droughts among the population. Political leaders and executives of water resources management agencies need to understand the complex nature of water management and the need for studies and comprehensive preparation for drought. Drought severity and magnitude are not known until events are over. The inability to define a drought in terms of a start and stop point hinders systematic, anticipatory management.

The gamut of recent developments points out that a rapidly changing socio-economic context contributes to a *mature* ecosystem, which in turn provides us with new sources of stress. Furthermore, in the context of competing and conflicting demands, shifting populations, and the new economic activities, hard decisions must be made in allocating and re-allocating scarce resources. It is difficult to discuss perceptions and new social forces and developments without referring to such transcending water-related issues as political controversies over water rights, interbasin transfer, and increasing concern with water quality.

Generally, the variety of drought strategies and coping mechanisms must be understood through implementive measures at various hierarchical levels of systems, compatible both physically and institutionally with each corresponding level of such an hierarchy. At the individual level, decisions are usually made primarily on the basis of assessment of individual cost effectiveness with little attention given to the larger communities or to far-reaching secondary effects. The policies required for local communities are, on the other hand, directed towards integration, coordination, and facilitation of individual drought strategies. On yet a larger scale, is the problem of the optimal development and management of water resources for multi-purpose use. This approach implies that drought strategies, although seemingly simple in their physical characteristics, are extremely complex in their socio-economic aspects. This helps explain why there are few, if any readily identifiable drought strategies at higher levels of proposed hierarchies, such as the national and international levels.

Seeing droughts as «creeping phenomena» involves great uncertainty and poses formidable management problems. In this regard, effective management requires congruence in perception, frequent preventive measures, forecasting capabilities, and contingency plans for mobilizing needed resources for mitigation, relief and recover operations. At the same time, drought effects illustrate vividly the interrelationship among resources and underline the importance of perceiving resource scarcity as a problem of *total resource management.* Central to such an approach are such contested issues as the nature and extent of climatic shifts, the role of anthropogenic changes (especially urbanization and industrialization), overdraft of groundwater, the effects of soil

erosion, and the far-reaching effects of altered water quality. Connected also to the above are such larger concerns and concepts as carrying capacity, the potential for adaptability to arid environments, a metabolizing environment, thresholds and trigger points, and more broadly, the interdependence of resources.

It is also important to emphasize one particular point that may have been lost in this discussion so far, namely, the importance of cumulative effects. Indeed, when the next drought does come, there is every reason to believe that it should be perhaps as bad or even worse than anyone that we have had before, because of the vulnerability of society, the complexity and interdependence of the system at both the national and international levels, and the fact that changes in the structure of the regional economy serve to magnify the effects of the periodic and endemic manifestations of drought.

Recent prolonged dry periods have raised our awareness of drought problems which may increase in the future due to escalating consumptive demands and other socio-economic trends. The main challenge is how to make drought response work effectively in the unique situations represented in different institutional environments and in different regions and countries. We need to use what we have learned about drought to make water management work better in normal times, to combat problems of scarcity, to accommodate competing uses, and to respond to continuing challenges of controlling water pollution. In essence, we must improve decision support systems for both drought responses and overall water management.

The stage is, thus, set for introducing public participation or involvement as a necessary ingredient of a more elaborate process of identifying the nature and extent of drought; for generating a richer range of options in responding to the challenges of drought; for developing strategies sensitive to a variety of conditions and contexts; for assessing and evaluating the far-reaching impacts and consequences on the larger social structure; for creating a risk rather than crisis management approach; and, for building the basis for implementation in a combination of environmental soundness, technical appropriateness, economic viability, social desirability and political feasibility. What is really needed is a new planning context that recognizes the convergence of professional expertise, broad policy considerations and public sentiment and involvement.

The very terms of «public» and «participation» are so widely used as to be taken for granted and as being self-explanatory. However, the definitions of «public participation» vary and their meaning is sometimes colored by the disciplinary background of particular authors. It is not of importance here to provide an exact definition, but only to recognize that there is a distinction between *public awareness* (implying one-way information and alerting to community issues); *public involvement* (indicating two-way communication and a means of engaging community members in the exchange of information); and, finally, *public participation* (being the most intense form of interaction between authorities, professionals and citizens). These three levels represent also different needs for and applications of data, information and knowledge.

As related previously, there is agreement in the literature that there is no single public, but rather a whole series of *publics* which tend to crystallize around particular issues. The public represents a heterogeneous amalgam of actors, clustered around a diversity of issues, and differentiated by degree of involvement such as: the mass public, the interested public and the public as individuals. Within the many publics, interest groups can be identified as revolving around common interests and objectives. Such groups can readily become pressure groups or special interest groups when they focus their attention and efforts on a particular subject. These publics and interest groups are not lone individuals, but are knit together by a complex linkage of social systems and subsystems.

The shift and emphasis on public participation is not only an attempt to fight the traditional «professional isolation» or elitism in water resources planning and management. It is part of the commitment to relate public demands, to involve all parties-at-interest or constituencies, and to increase the overall awareness as to the nature, extent and potential consequences of drought in a particular locality. Many studies have pointed out that there is a strong correlation between the methods of communication (particularly the degree of public participation) and the public's willingness to accept a given proposal.

An «effective» participatory process should among others enable planners to test the social acceptability of their assumptions and program proposals as well as enable involved members of the public to express their preferences among potential drought

management alternatives. The effectiveness of such a process of involvement and joint decision-making would provide opportunities for members of the public who wish to participate to do so; increase awareness as to the availability of such participation opportunities; make available adequate information to the publics so that they can participate effectively; and make it possible for relevant government agencies to respond effectively to the inputs and activities of the people.

The heightened concern with droughts and other natural hazards has made integrated water management imperative as a result of the confluence of three conditions. First, drought problems are becoming a more or less regular occurrence, especially due to the increasing concern with long-term climatic changes. Second, because of new causes of drought result of man-made actions and continuous anthropogenic perturbations. And, third, because of competing and conflicting demands between agricultural, industrial and urban water management interests. Overall, drought problems are said to be increasing not so much because of changing climate (although that may be a problem in the future), but because of changing demands. Thus, drought has two dimensions, supply side and demand side, and any long term solution or management scheme should contain a balanced approach between supply and demand measures.

Reflecting on previous remarks on hazards, it seems that the management of change associated with stressed environments and with human activities, especially in drylands, requires a larger management strategy that should be a mix of human responses to hazards as affected by four factors: a) the presence of extreme events, dependent on the frequency, duration, speed of onset, and spatial dispersion of droughts; b) the localized experience with hazards and the success of adjustment; c) the intensity of resource use, including higher capital labor investment per unit area, etc.; and, d) the level of material wealth attained, implying that the presence of great material wealth increases the awareness threshold as contrasted, e. g., to conditions of poverty.

In looking over the events and responses to drought in the last two years, the problem has not been the lack of techniques for planning or technologies for managing water. More, it has been the lack of a systematic model as to how planning and management can be made effective and implementable within the governmental system of a country and with sensitivity to public perception and public demands. The key concern, therefore, remains the centrality of decision-making and problem solving in a more complex socio-political contexct than one that demands simple models of quantitative analysis. This context demands simple models of quantitative analysis. This context emphasizes first the creation of a technical and management robustness through proper environmental scanning; and second, underscores the need for mobilization by developing the proper institutions, personnel and procedures for maximizing comprehensive and integrated water management.

The impediments to change and the resistance to any action are proportional to the amount of change required in the general social structure as well as proportional to the strengths of social values' changes. They are particularly dramatic when they threaten vested interests, can potentially alter lifestyles, and threaten existing networks of longestablished social values and practices. Perhaps one way of looking at the discussion of impediments, at both the local and other levels, is to look at institutional arrangements identified with proper water resources management. Here one can relate the need for institutional arrangements which ultimately facilitate social choice; reflect in some reasonable way political efficacy and the willingness of all political actors or units to run risks and incur costs; facilitate decisions based on an understanding of the far-reaching consequences resulting from a mix of social values and from an expanded time horizon; recognize a decision making process which takes into account preferences and interests of those clearly affected by a particular decision; and, finally, produce decisions which are not only acceptable as legitimate but are also the result of a balance between what is socially desirable, economically viable, technically and ecologically sound, legally pertinent and politically feasible.

Whether with logarithmic graphs, rigorous scientific analysis, or with speculative journalistic accounts the conclusion must be that hysteria, panic or overreaction are not the proper responses to our shared concern with changing climate, recurring droughts or other extreme hydrologic events. There can be remedies for more prudent responses, including interdisciplinary research, expanded knowledge, sophisticated models that can make forecasts over decades, holistic vision, and broader new paradigms

in science; strong conservation measures; detailed monitoring; and, finally, institutional changes and international agreements enhancing the flow of information and the sharing of knowledge, establishing long-term environmental scanning, and mobilizing people and organizations for concerted institutional responses.

Perhaps one way to summarize the responses and adjustments to drought is by developing a vigilance strategy (Vlachos, 1989). The concrete outcome would be a contingency planning posture involving three basic premises. The first would be expanded knowledge, allowing us to understand and forecast climatic changes, develop basic science, improve measurement, and utilize remote sensing data processing and information storage and retrieval technologies. The second premise is continued vigilance in terms of systems of monitoring and of assessing the consequences of different types of natural or human-induced changes, especially through sensitive warning systems. The third premise of such a broad strategy is to increase our respect for nature by learning to live with a highly complex interrelationship of humans, biosphere and climate.

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ABSTRACT

The central emphasis of this paper is on the importance of perception in determining the extent of consequences and the range of alternatives in managing droughts. To understand responses to drought the paper outlines first the main characteristics of this periodic disaster; describes pervasive environmental conflicts and the broader implications of ecosystemic transformations; examines the shifting perceptions of drought and the mechanisms of risk communication; and, relates perception and cognition with policy options in managing droughts through increased awareness, involvement and participation of all affected parties