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Improving Drought Early Warning Systems in the Context of Drought Preparedness and Mitigation

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Editor's Note: *The following article is the executive summary of the Expert Group Meeting on Early Warning Systems for Drought Preparedness and Drought Management, held September 5–7, 2000, in Lisbon, Portugal. It originally appeared in the Proceedings of the meeting, published in December 2000 by the World Meteorological Organization and edited by Donald Wilhite, M. V. K. Sivakumar, and Deborah Wood.*

Introduction

Effective drought early warning systems are an integral part of efforts worldwide to improve drought preparedness. Timely and reliable data and information must be the cornerstone of effective drought policies and plans. In pursuit of the goal of improving the effectiveness of drought early warning systems, participants of the experts meeting were asked to address three fundamental questions:

1. What is your assessment of the current status of drought early warning systems?
2. What are the shortcomings, limitations, and needs for drought early warning systems?
3. How can drought early warning systems be improved to better support drought preparedness and mitigation efforts at the local, national, and international level?

Participants identified the primary users of data and information derived from drought early warning systems as a first step in evaluating the status of early warning systems. Users were diverse, including government agencies, farmers, extension services, insurance companies, media, donors, NGOs, and the general public. Leadership for drought early warning systems is provided principally by meteorological or agricultural services. In general, where meteorological services were the lead agency, the information tended to be more meteorologically based. In contrast, leadership for drought early warning systems that were more agriculturally based tended to take a more multidisciplinary or integrated approach to monitoring. An integrated approach is considered preferable because information from all elements of the hydrologic system must be considered to obtain a comprehensive assessment of climate and water supply conditions. Although forecasting and monitoring are considered critical components of all early warning systems, there appeared to be little evidence of the beneficial use of that information by farmers.

It was noted that few countries currently have a national drought policy in place. Australia is an exception and progress in South Africa and the United States was noted. It was apparent that other countries were moving in the direction of a national drought policy. In some instances, subnational policies were in existence. Comprehensive early warning systems should be the foundation on which national drought policies and plans are constructed. Although many countries have some type of drought early warning system in place, these systems are not comprehensive and have very limited financial and human resource inputs.

Shortcomings and Needs of Drought Early Warning Systems

Participants noted the following shortcomings and needs of existing drought early warning systems:

Data Networks. In many countries, the density of meteorological and hydrological stations is insufficient to provide adequate coverage for drought monitoring. A wide range of data is necessary to adequately monitor climate and water supply status (i.e., precipitation, temperature, streamflow, ground water and reservoir

levels, soil moisture, snow pack). These data are often not available at the density required for accurate assessments. Data quality (i.e., missing data) and length of record also represent critical deficiencies in data networks for many locations. Existing data networks need to be maintained and expanded in coverage and data reporting needs to be automated wherever possible to ensure timely receipt of data.

Data Sharing. Meteorological and hydrological data often are not widely shared between agencies of government. This restricts early assessment of drought and other climate conditions and retards its use in drought preparedness, mitigation, and response. In some countries, the high cost of data acquisition from meteorological services restricts the flow of information for timely assessments and for use in research. Memoranda of Understanding (MOUs) between government agencies would facilitate data sharing and use and could bring tremendous societal benefits.

Early Warning System Products. Data and information products produced by early warning systems often are not user friendly. Many products are too complicated and do not provide the type of information needed by users for making decisions. Users are seldom trained on how to apply this information in the decision-making process or consulted before product development. Many products are not evaluated for their utility in decision making. User needs should be assessed and products evaluated through permanent feedback mechanisms.

Drought Forecasts. Long-term drought forecasts (a season or more in advance) are not reliable in most instances. Drought forecasts often do not provide the specificity of information needed by farmers and others (e.g., the beginning and end of the rainy season, distribution of rainfall within the growing season) to be useful for operational decisions. Greater investments in research to improve the reliability of seasonal forecasts would provide significant economic benefits to society if these forecasts were expressed in user-friendly terms and users were trained in how these forecasts can be applied to reduce climate risks.

Drought Monitoring Tools. Tools for detecting the early onset (and end) of drought are inadequate. The Standardized Precipitation Index (SPI) was noted as an important new tool that is receiving widespread acceptance in many countries. The SPI needs to be tested and applied in more drought-prone areas, and the results should be shared. Triggers for specific mitigation and response actions are often unreliable because of the inadequacy of detection tools and inadequate linkages between indices and impacts. Integrated assessment products are preferred, but few attempts have been made to integrate meteorological and hydrological information into a single product for purposes of detecting and tracking drought conditions and development. The Drought Monitor product recently developed in the United States could serve as a model. More research is needed on climate indices such as the SPI as an early warning tool and the relationship between SPI values and impacts in specific sectors to form the basis for triggers for mitigation and response actions. Also, drought should be monitored on weekly rather than monthly time intervals in order to more accurately evaluate changes in severity and spatial characteristics. Satellite-derived remote sensing data (AVHRR) offers considerable advantages and should be an integral part of drought early warning systems.

Integrated Drought/Climate Monitoring. It is critical that an integrated approach to climate monitoring be employed to obtain a comprehensive assessment of the status of climate and water supply. Too often, drought severity is expressed only in terms of precipitation departures from normal, neglecting information about soil moisture, reservoir and ground water levels, streamflow, snow pack, and vegetation health. Seasonal climate forecasts may also provide valuable information regarding whether conditions are likely to improve or deteriorate in the coming months. Use of multiple climate indices and parameters provides monitoring specialists with an assortment of tools, each with its own strengths and weaknesses. Understanding these strengths and weaknesses will provide a scientific basis for accepting or rejecting indicators. By comparing multiple drought indicators, the relationships be-

tween these indices/tools will be better understood. The experience in the United States with the integrated drought assessment tool, the Drought Monitor, during 1999–2000 is potentially a good model to follow in future assessment efforts for some countries. This product integrates six different indicators/parameters, including vegetation health, in its assessment of drought severity in the United States.

Impact Assessment Methodology. One of the missing links in early warning systems is the connection between climate/drought indices and impacts. The lack of effective impact assessment methodologies has hindered the activation of mitigation and response programs and reliable assessments of drought-related impacts. Impact assessment methodologies need to be improved in order to help document the magnitude of drought impacts and the benefits of mitigation over response. Significant investment in interdisciplinary research on impact assessment methodologies could result in considerable progress in addressing this problem. Social scientists should be an integral part of the research team necessary to address this issue.

Delivery systems. Data and information on emerging drought conditions, seasonal forecasts, and other products often are not delivered to users in a timely manner. This characteristic significantly limits the usefulness of these products for most users. It is critical that delivery systems be improved and that they be location appropriate. For example, the Internet provides the most timely and cost-effective method of information delivery in many settings but is inappropriate in most developing countries. Electronic and print media, as well as local extension networks, need to be used more fully as part of a comprehensive delivery system to diverse user groups.

Global Early Warning System. Because of the many definitions and characteristics of drought, no historical drought data base exists. Similarly, no global drought assessment product illustrating current and emerging drought conditions is available to governments, international organizations, donors, and NGOs. A global drought assessment product that relies on one or two key variables (e.g., precipitation, vegetation health) would be a valuable tool to provide early warning of areas of potential concern.

Recommendations

Considerations:

- Recognizing that drought is a natural hazard that is quite distinct from other natural hazards in terms of its slow onset, spatial extent, and nonstructural impacts, the participants of the meeting recommend that countries develop national drought policies and preparedness plans that address the unique features of drought.
- Acknowledging that significant diversity exists within each country, the participants of the meeting emphasized the need to conduct risk assessments to identify and address the most vulnerable people and sectors at the national and subnational level. It is also essential to identify the information needs of all users at the local level.
- Recognizing that drought is a complex phenomenon, a comprehensive drought early warning system must be at the foundation of a national drought policy and preparedness plan.

In the light of the above considerations, the participants of the meeting propose the following:

Recommendation 1:
A drought preparedness and mitigation plan should be integrative and proactive, and should incorporate the following elements:

- Drought monitoring and early warning system;
- Drought risk and impact assessment; and
- Institutional arrangements, including mitigation and response actions and programs.

All of the above elements must be underpinned by research.

Recommendation 2:
As a first step, a vulnerability profile should be completed to capture the socioeconomic conditions of diverse population groups.

Recommendation 3:
Priority should be given to improving existing observation networks and establishing new meteorological, agricultural, and hydrological networks, as well as associated analytical and predictive tools and models. This effort would include:

- identifying weaknesses in the current observation system, including the critical needs of marginal areas and the most drought-prone areas;
- drought monitoring products that are prepared in collaboration with decision makers and presented in an easy-to-understand format; and
- periodic user evaluation of drought monitoring products.

Recommendation 4:
Social, economic, and environmental assessments of drought impacts must be addressed by:

- identifying appropriate and relevant physical and social indicators;
- developing triggers that link indicators of drought severity to impacts during the onset and termination of drought conditions; and
- appropriate interpretation of information and clearly expressing that assessment to decision makers in a timely manner.

Recommendation 5:
Develop institutional capacity for national drought policy and planning that includes the creation of a drought task force or commission composed of government agencies with principal responsibility for drought preparedness, monitoring and assessment, mitigation, and response. This task force could also include key stakeholder/citizen groups, NGOs, and donors.

The objectives of a national drought policy should be broadly stated and

- establish a clear set of principles or operating guidelines to govern drought management;
- be consistent and equitable for all regions, population groups, and economic/social sectors;
- be consistent with the goals of sustainable development;
- reflect regional differences in drought characteristics, vulnerability, and impacts;
- promote principles of risk management by encouraging development of
  - reliable forecasts
  - comprehensive early warning systems
  - preparedness plans at all government levels
  - mitigation policies and programs that reduce drought impacts
  - a coordinated emergency response program that ensures timely and targeted relief during drought emergencies.

Drought plan objectives are more specific and will vary between countries, reflecting the unique physical, environmental, socioeconomic, and political characteristics of the country. A national drought preparedness plan should include the following:

1. Collection and analysis of drought-related information in a timely and systematic manner.
2. Criteria for declaring drought emergencies and triggering various mitigation and response activities.
3. An organizational structure and a delivery system that assures information flow between and within levels of government.
4. Definition of the duties and responsibilities of all agencies with respect to drought.
5. Maintenance of a current inventory of mitigation and response programs used in assessing and responding to drought conditions.
6. Identification of drought-prone areas and vulnerable economic sectors, individuals, or environments.
7. Identification of mitigation actions that can be taken to address vulnerabilities and reduce drought impacts.

8. A mechanism to ensure timely and accurate assessment of drought's impacts on agriculture, industry, municipalities, wildlife, tourism and recreation, health, and other areas.
9. Provision of accurate, timely information to media in print and electronic form (e.g., via TV, radio, and the World Wide Web) to keep the public informed of current conditions and response actions.
10. A strategy to remove obstacles to the equitable allocation of water during shortages and requirements or incentives to encourage water conservation.
11. A set of procedures to continually evaluate and exercise the plan and provisions to periodically revise the plan so it will stay responsive to the needs of the country.

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