

DROUGHT MANAGEMENT IN INDIA

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INTRODUCTION

Water is the essential ingredient of life. Unless it is in balanced quantity, any deficit or excess may cause physiographic imbalance. Similarly, for an entire region, too, deficit or excess of the normal requirement of water may cause imbalance in the regions physical, social, or economic situation. Since the beginning of the existence of mankind, drought has affected human activity throughout the world.

Historical records of drought confirm the fact that it has occurred in almost every part of the world at some time or other. Many civilizations have perished due to abnormally long persistent deficiency of rainfall. Syrian Desert is one such example. In India, drought is a frequent natural calamity which finds in all the great epics of the country. One of the earliest droughts in India has been referred in 'Vayu Purana'. In Ramayana also, there is description of drought during the period of king Dasaratha. In Mahabharata, there is mention of serious drought during the reign of Emperor Mandhata of the race of Ikshvaku. Written records also give evidence of occurrence of several famines like the one which occurred about 160 years before Mahabharata war during the reign of King Shantanu, the ruler of Hastinapur.

During the reign of king Trishanku, father of famous King Harishchandra, a famine is said to have occurred. King Chandragupta Maurya's reign was also witness to a serious famine. In pre-Independence period, the large catastrophic effect of frequent droughts and famine caught the attention of the then British rulers in the nineteenth century when a series of famine commissions and an Irrigation Commission were setup to go into the various aspects of the problem and to suggest suitable measures to mitigate the distress of the people. Indian Finance Commission in 1880 has mentioned occurrences of severe famine and drought conditions in the then north-west province and Punjab. In 1942-44, the great Bengal famine occurred. Despite tremendous developments in almost every field, drought continues to torment our society constantly. Even such areas which normally have sufficient precipitation to meet various needs of the area are confronted with occurrences of drought of shorter or longer duration at some time or other.

According to an estimate, about 108 million hectare, which works out to about one-third of the total geographical area of 329 million hectare of the country, are affected by drought. It has been estimated that number of people living in drought prone districts is around 263 million which is more than 26 percent of the total population of the country (as estimated in the year 2000). Hence, a major part of our country is in the grip of this natural calamity in spite of crores of rupees being spent by the Government on drought combating measures every year. In view of its impact on a wide spectrum of social concerns, a proper understanding and scientific study of drought is extremely essential so that suitable and effective drought proofing measures are formulated in order to minimize or eliminate the adverse impacts of drought on the economy of the country.

The conventional attitude to a drought as a phenomenon of arid and semi-arid areas is changing because even areas with high average rainfall often face acute water scarcity. Cheerapunji, the world's highest rainfall area, is facing severe drinking water shortages. Drought in the state of Orissa, with an average rainfall of 1100 mm, surprised many. A water scarcity condition in the Himalayan region is also not uncommon. This shows that drought is just not the scarcity or absence of rainfall, but is more related to water resource management (or mismanagement).

Drought is a natural hazard that differs from other hazards since it has a slow onset, evolves over months or even years, affects a large spatial extent, and cause little structural damage. Its onset and end and severity are often difficult to determine. Like other hazards, the impacts of drought span economic, environmental and social sectors and can be reduced through mitigation and preparedness. Because droughts are a normal part of climate variability

for virtually all regions, it is important to develop plans to deal with these extended periods of water shortage in a timely, systematic manner as they evolve. Experience has shown that the democratic form of governance has handled droughts more efficiently than others, as demonstrated by the situation in India before and after independence.

Drought conditions have been widespread in North Africa, the Mid-East, West Asian countries, India, China and have also known to occur in North Central, and South America. The increased frequency and intensity of extreme weather events such as droughts, floods, heat/ cold waves, cyclones, delayed or early onset of rains, long dry spells, early withdrawal, during the last two decades has been attribute to global warming. Drought in India occurs in areas with high as well as regions with meager rainfall. Water scarcity conditions in the Himalayan region are also not uncommon. Drought is no longer mere scarcity or the absence of rainfall, but related to inefficient water resource management. Requirement of over 80-90 % of the drinking water and over 50 % for irrigation is met from groundwater. The control of this resource is with the owner of land. Water is being over exploited and not harvested. Without effective and large scale rainwater harvesting, only limited recharge is taking place. Analysis of incidence of droughts over the last two centuries in India does not show any increase in the incidence of droughts in recent years. However, their severity appears to have increased. India in 2002 experienced its worst drought in 20 years. However the probability of drought in India varies from once in 2 years in Western Rajasthan to once in 15 years in Assam.

THE CONCEPT OF DROUGHT

Drought has many definitions, but mostly it originates from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long term average condition of balance between precipitation and evapotranspiration (i.e., evaporation+transpiration) in a particular area, a condition often perceived as "normal". It is also related to the timing (i.e., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness (i.e., rainfall intensity, number of rainfall events) of the rains. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with it in many regions of the world and can significantly aggravate its severity.

There are four disciplinary definitions of drought, which are as follows: Meteorological Drought Meteorological drought is defined usually on the basis of the degree of dryness (in comparison to some "normal" or average amount) and the duration of the dry period. Definitions of meteorological drought must be considered as region specific since the atmospheric conditions that result in deficiencies of precipitation are highly variable from region to region. For example, some definitions of meteorological drought identify periods of drought on the basis of the number of days with precipitation less than some specified threshold.

Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts. Focusing on precipitation shortages, differences between actual and potential evapotranspiration. Soil water deficits, reduced ground water or reservoir levels, and so forth. Plant water demand depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil. A good definition of agricultural Version 2 CE IIT, Kharagpur drought should be able to account for the variable susceptibility of crops during different stages of crop development, from emergence to maturity.

Deficient topsoil moisture at planting may hinder germination, leading to low plant populations per hectare and a reduction of final yield. However, if topsoil moisture is sufficient for early growth requirements, deficiencies in subsoil moisture at this early stage may not affect final yield if subsoil moisture is replenished as the growing season progresses or if rainfall meets plant water needs. Hydrological Drought Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (i.e., streamflow, reservoir and lake levels, ground water). The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system.

Hydrological droughts are usually out of phase with or lag the occurrence of meteorological and agricultural droughts. It takes longer for precipitation deficiencies to show up in components of the hydrological system such as soil moisture, streamflow, and ground water and reservoir levels. As a result, these impacts are out of phase with

impacts in other economic sectors. Socioeconomic Drought Socioeconomic definitions of drought associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought. It differs from the aforementioned types of drought because its occurrence depends on the time and space processes of supply a demand to identify or classify droughts. The supply of many economic goods, such as water, forage, food grains, fish, and hydroelectric power, depends on weather. Because of the natural variability of climate, water supply is ample in some years but unable to meet human and environmental needs in other years. Socioeconomic drought occurs when the demand for an economic goods exceeds supply as a result of a weather-related shortfall in water supply.

The sequence of impacts associated with meteorological, agricultural, and hydrological drought further emphasizes their differences. When drought begins, the agricultural sector is usually the first to be affected because of its heavy dependence on stored soil water. Soil water can be rapidly depleted during extended dry periods. If precipitation deficiencies continue, then people dependent on other sources of water will begin to feel the effects of the shortage.

Classification of Droughts

Droughts are classified into meteorological droughts, hydrological droughts and agricultural droughts .

- Meteorological drought is classified based on rainfall deficiency with respect to long term average – 25% or less is normal, 26-50% is moderate and more than 50% is severe.
- Hydrological drought occurs when water level in surface and sub surface falls leading to a lack of water for normal and specific needs.
- Agricultural drought is identified by 4 consecutive weeks of meteorological drought, weekly rainfall is 50 mm from 15/5/ to 15/10, 6 such consecutive weeks rest of the year and crop planted is 80% in kharif season.

Drought affected areas of India

Drought

Irrigation Commission of India in 1972 identified 67 districts located in 8 states and having an area of 49.73 million hectare as drought-prone. Subsequently, the National Commission on Agriculture in 1976 identified a few more drought districts. The drought identification studies carried out by Central Water Commission during 1975-82 considered 99 districts for the study located in 13 states having an area of about 108 million hectares which included those identified by the above two Commissions.

For the purpose of study, a smaller unit viz., taluka, was adopted instead of district as a whole and the number of drought affected talukas were identified as 315 out of a total of 725 talukas in the 99 districts. Thus, out of 108 million hectare, only 51.12 million hectare spread over 74 districts can be considered as drought prone areas.

Impact of Drought

Mostly, the impact attributable to drought is extensive/comprehensive, sometimes even difficult to identify. The problem is further compounded by the fact that drought invariably is handled as a 'crisis situation' and a short-term problem. At the household level, individuals perceive drought as a natural hazard, beyond human control. Both lead to different kinds of approaches and solutions. They also lead to many undesirable consequences. In the long run, defining drought only as a crisis situation or a natural phenomenon beyond human control merely serves to undermine the confidence and capabilities of the people to respond to drought. As a result, they become more and more dependent on the government and expect relief on a larger scale and for a longer time.

Social resilience is undermined leading to beliefs that nothing else is possible, that there is really no remedy that will promote self-dependence. The impact of a drought on the overall economy of the country is evident both at the macro and micro levels. It is either direct or indirect and varies in nature and intensity. The extent and intensity of drought impact is determined by prevailing economic conditions, the structure of the agricultural sector, management of water resources, cereal reserves, internal and external conflicts etc. Micro level impact is largely on the entitlement to produce and procure food, depending upon the social structure, class, village and household resource endowments.

The direct impact of drought is generally classified under four categories, viz. physical, social, economic and environmental. The relative and absolute magnitudes of each impact will however, depend on specific regional

characteristics. Droughts cause a loss of assets in crops, livestock and productive capital as these are immediate consequences of water shortage. The lingering impact is felt in the lack of quality seeds in the subsequent season.

Current Challenges in Drought Management

Drought management encompasses three vital components namely, (1) drought intensity assessment and monitoring; (2) drought declaration and prioritization of areas for drought management and (3) development and implementation of drought management strategies. Each step in drought management needs holistic approach to ensure effective end result. Currently, drought management faces the following challenges among others.

National Disaster Management Guidelines: Management of Drought: Current Challenges In Drought Management.

These guidelines will ensure that: - i. All contemporary knowledge, experience and information are taken on board, clear destinations identified and road maps drawn with milestones clearly marked off through a wide consultative process involving all stakeholders. ii. The evolution and practice of standard procedures for declaration of drought including the time of declaration is promoted and the gravity of the risk and the vulnerability of various States are duly understood. iii. Development of standard procedures for drought vulnerability assessment and generation of vulnerability maps in each state is undertaken. iv. The critical areas for minimising loss of lives, livelihood and property are addressed purposefully and systematically. v. Measures are put in place for drought proofing of chronically drought-prone areas. vi. The India Drought Management Centre (IDMC) is set up. vii. Organization and development of a centralized data base at state level and at nation level related to drought intensity assessment, drought declaration, vulnerability assessment and drought management are undertaken on priority. Grievance Management Systems are put in place for ensuring that benefits reach the intended beneficiaries. viii. Application of ICT is promoted not only to create the databases, but also for effective monitoring the measures being taken. Effective use of e-mail, Video Conferencing, mobile phones for reducing time lag in traditional systems is encouraged. ix. Remote sensing technology and data warehousing is promoted to study historical and future trends of the drought occurrence and its effects. x. There is institutional participation and use of collective expertise in the drought intensity assessment/drought declaration/drought vulnerability assessment. Expert advisory systems are set up for providing advice to the affected population to mitigate the effects xi. A common policy is evolved to dovetail short-term relief measures into long-term interventions being handled in different Ministries/ Departments for comprehensive and all-inclusive Drought Management. xii. Global and National best practices in Drought Management are identified and adopted. 9 Status and Context Drought Management involves active and continuous participation with not only various States in the country but also several Ministries/ Departments of Central Government involved in various activities of Drought Management.

National Institutions/Agencies

National Disaster Management Authority (NDMA)

The NDMA, as the apex body for disaster management, is headed by the Prime Minister and has the responsibility for laying down policies, plans and guidelines for DM and coordinating their enforcement and implementation for ensuring timely and effective response to disasters. The guidelines will assist the Central Ministries, Departments and States to formulate their respective DM plans. NDMA has issued guidelines on Earthquakes, Chemical (Industrial) Disaster, Preparation of State Disaster Management Plans, Medical Preparedness and Mass Casualty Management, Floods, Cyclones, Pandemic Preparedness Beyond Health, Nuclear and Radiological Emergencies, Biological Disaster, Landslides & Snow Avalanches and Chemical Terrorism. The guidelines for the management of disasters including Urban Flooding, Tsunami, Nuclear – Radiological – Part II (Classified.), Micro Finance & Risk Insurance, Role of NGOs in Disaster Management and Community based Disaster Management are under preparation.

National Disaster Response Force (NDRF)

For the purpose of specialised response to a threatening disaster situation or disasters both natural and man-made, the DM Act, 2005 has mandated the creation of a National Disaster Response Force (NDRF). The general superintendence, direction and control of this force is vested in and exercised by the NDMA and the command and

supervision of the NDRF vests in an officer appointed by the central government as the Director General of the NDRF.

National Institute for Disaster Management

The National Institute for Disaster Management (NIDM), which functions within the framework of the broad policy and guidelines laid down by the NDMA, has capacity development as one of its major responsibilities, along with training, research, documentation and the development of a national level information database. It will network with other knowledge-based institutions and assist in imparting training to trainers, DM officials, etc. It will also be responsible for synergizing research activities and will be geared to emerge as a 'centre of excellence' at the national and international levels.

Central Water Commission

The Central Water Commission (CWC) is an apex agency in the field of water resources including flood management in India. The River Management Wing headed by the Member (RM) and ex-officio Additional Secretary to the Government of India looks after Flood Management in the country excepting the Ganga and the Brahmaputra river basins for which the GOI has created separate organisations.

National Remote Sensing Centre

The Department of Space has established a Decision Support Centre (DSC) at the National Remote Sensing Centre (NRSC) under the Indian Space Research Organisation's (ISRO) disaster management support (DMS) programme. DSC is an operational service provider for spaceenabled inputs together with other important data layers for its use in disaster management by the central ministries and departments and the state governments in pre-disaster, during disaster and post-disaster phases.

National Rainfed Area Authority (NRAA)

The Government of India, set up the National Rainfed Area Authority (NRAA), under the Ministry of Agriculture in 2006, to address the issue of drought mitigation on a long-term basis. The NRAA has been set up as an institution of experts to provide knowledge inputs with reference to systematic upgrading and management of the country's dry-land and rain-fed agriculture.

Conclusion

The word 'drought' indicates scarcity of water for ecosystems, land and human use, resulting in failing crops, livestock, livelihoods and human health. Drought is a complex and least understood natural disaster, the impacts of which often depend upon the nature of socio environmental background in the region, and affects more people than any other disaster. Within the framework of disaster management now, it is not viewed mainly as a meteorological or physical phenomenon but more often as a complex environmental or social challenge. Unsuitability of water resources in terms of feasibility or water quality, water losses due to evaporation, over exploitation and wastage, over use of water for non agricultural and non-human purposes are some of the attributes aggravating agricultural drought and ecological crisis. Most drought management strategies, manuals and guidelines still fail to recognize the scientific or strategic relevance of these aspects in causing or aggravating droughts. Climate change and adaptation awareness have brought in the realization of the need to focus on natural resource and ecosystem approach for disaster management. The Ministry of Home Affairs, National Disaster Management Authority and Ministry of Agriculture, GOI have recently brought out a systematically developed Drought Manual and Drought Disaster Management Guidelines. Despite these being lengthy and comprehensive documents with excellent compilation of state-of-the-art literature critical gaps exist in recognizing the scientific understanding on systems approach. The national disaster management guidelines according to the national policy prescribe a national action plan for drought mitigation as well. The world is witnessing a second paradigm shift in disaster management, i.e. 'to ecosystem approach in climate change adaptation and disaster risk management'. It is now important to work for alternatives to rainfall databased drought prediction systems. Implications of global climate-change impacts coupled with local environmental modifications (land use, geomorphological changes, natural resource degradation) need to be assessed with the application of strategic environmental assessments. Suitable models of anticipatory environmental impact assessment can be developed further for long-term drought risk management. While drought management

integration with programmes of forestry, watershed, public health, pollution control, wetland conservation, and biovillage concept are recognized now, linkages with the management of epidemics, forest fire and pest, environmental health, power generation, and socio-political conflict, including risk of terrorism and war-related disasters still need to be institutionalized. It is also important to recognize the issues of 'urban drought' and 'water drinking industries' management framework.

