THEMATIC SESSION B3: DROUGHT
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ABSTRACTS

ASSESSMENT OF DROUGHT INDICATOR AND VULNERABILITY

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Non-availability or deficit of water as when required (crop watering, drinking etc) is termed as Drought. This deficit could happen even during flood, when the excess flow is of non-usable in nature for consumption or utilization. As the drought risk is not only due to meteorological but also due to socio-economic and technological changes and the ideal index should be derived from a biophysical model having strong linkages to social and economic outcomes. The impacts of drought also vary with affected sector, thus making different definitions of drought relevant to specific affected groups. As the water is vital to all, the perception of drought also varies with the people concerned.

As the drought conditions creep into the system at a slow rate, the prescription for drought management (before, during and after the event) include:- on-set identification, status of intensity, mitigation measures for re-orientation or change and information dissemination activities. This requires an understanding of the past events and comparison with the present day conditions. The voluminous information is available in the form of text,

analogue, numerical and graphics representing the spatial and temporal situations. They are to be stored in a geo-information base that could be easily accessed and updated in minimizing the resources loss. Geo-information base has the critical information and knowledge required for Decision Support System (DSS). This is transformed into a number of facts and rules and their corresponding actions for the different combinations of each objective's attributes. Rule Based System (RBS) can be grouped into various stages of development such as: a) Problem definition and expert selection b) knowledge engineering (climatological, hydrologic and hydro-geologic attributes, agriculture attributes, and socio-economic attributes c) interference engine and d) verification and validation.

The indicators are designed to: (1) integrate large amounts of data about water-supply sources; (2) communicate to the public and decision-makers accurate information; (3) reasonable; (4) based on real-time data; and (5) distributed quickly over the public awareness campaign modes including television and Internet.

Vulnerability index was developed as a linear combination of set of standardized variables. Parameters of significance were grouped into: - Frequency of events (historical), climate (Time series of rainfall, rainfall fluctuation, evaporation, aridity), resource availability (vegetation cover, food- crop area, cash crop & water- surface & ground water), demand (population density, Growth, industry), distribution loss (surface storage, medical facility, system efficiency) and sharing of resources (proximity to infra-structure facility) etc. Even though all these factors are inter-related, the weights of these factors were assigned based on the observed deficits. Spatial distribution of villages that are vulnerable to drought and its intensity under different rainfall scenario was prepared for Addkkal region of

Mehaboobnagar region of Andhra Pradesh. Legend showing the anticipated intensity of suffering and the water supply augmentation strategies in combating the drought is proposed.

DOWNSCALING DISASTERS TO RESOURCE SUSTAINABILITY: CASE OF DROUGHT MITIGATION CHALLENGES

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A drought is an extended period when water availability falls below the statistical requirements for a region. It is a complex slow-onset phenomenon that affects more than any other natural hazards and results in serious economic, social and environmental losses in both developing and developed countries.

There are cases where agricultural and environmental droughts prevail annually despite of no significant meteorological records of indicating drought risks. In many places seasonal floods are often and regularly followed by server water scarcities. Socio-economic drought may also occur in the cases where hydrological water is available but is not fit for objective use.

Therefore, is a required to carry out an assessment of S&T opportunities & scope for drought prevention & mitigation to explore & design an integration of land & water resource management strategy for reducing the risks of drought and mitigation of the likely occurrence on a long-term basis, while ensuring better ecosystem-health as a resource supporting system for sustained livelihood and alternative employment on local or regional basis.

Present paper is based on a systematic enquiry on the sources of the causes of droughts, analysis of prevailing drought conditions & types (in India), past and present drought management measures, audit of present efforts, and

interrogating S&T based community approached for a sustainable drought mitigation strategy layout. Principles and operational framework of the Preventive Disaster Management (PDM), the concept evolved by the authors, is discussed in the paper with reference to drought occurrence reduction.

DROUGHT MITIGATION LOOMS IN BUNDELKHAND REGION

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Water is increasingly becoming a scarce resource in many parts of the India. Several regions of the country receive scanty rainfall and hence are perennially drought prone. When consecutive monsoon failures occur, these areas become severely affected by drought, as is being witnessed currently.

The Bundelkhand region is located in the central plains of India and stretches over 13 districts of northern Madhya Pradesh (MP) and southern Uttar Pradesh (UP). It bounded to the north by the Yamuna River and to the south by the hills of the Vindhyan Plateau. The main tributaries of the Yamuna are the Betwa, Ken, Baghain, Pahuj and Dhasan Rivers, most of which are important sources of irrigation water. During fifteenth century AD water tanks, ponds and reservoirs were already being used for water harvesting and irrigation purpose. Many of these structures have fallen into poor condition or have been destroyed due to encroachment. The region is facing drought problem since last 4 years though the annual rain fall of the region is about 900 mm. The underground water table has gone down due to excessive water extraction and moderate water recharging. The decline in groundwater levels has further undermined water security in the region and accelerated desertification and erosion. The water used to available up to 20-30 feet below the soil but nowadays very difficult to available up to 100-200 feet. The drought conditions have pushed villagers to move to cities in search of jobs, whereas women and girls have to collect water on their heads from the long distance. In the recent years, the year 2002, & 2004 were severe in terms of drought, with loss to crop, livestock and property assessed at Rs.7540 crores and Rs. 7292 crores respectively.

DROUGHT MONITORING AND ITS MANAGEMENT- ROLE OF INDIA METEOROLOGICAL DEPAREMENT (IMD)

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Drought is an extreme climatic event results from the scarcity of water over an extended period of time and is associated with high temperatures, strong winds and low relative humidity. It has been the recurring problem of India and will continue to remain so for many years to come. It imparts a creeping long term setbacks to the socio-economic fabric of the society which has the misfortune to be visited by it.

India Meteorological Department (IMD) plays crucial role in monitoring and managing drought. IMD has developed Aridity Index based on rainfall, potential evapotranspiration and actual evapotranspiration, taking into account soil moisture and using water budgeting method. Aridity anomalies are worked out based on this index and these anomalies are classified into various categories of arid conditions like Mild Arid (Aridity anomaly 1 – 25%), Moderate Arid (Aridity anomaly 26 – 50%) and Severe Arid (Aridity anomalies more than 50%). These anomalies are used for near real time monitoring and assessment of agricultural droughts over the country on a weekly/fortnightly interval. This indirectly helps to assess the moisture stress experienced by growing plants.

Besides monitoring, different technological approaches viz. Engineering, Physiological, Genetic and Agronomic Approaches form a key role in managing drought menace effectively to mitigate the adverse impact of drought on crops. Engineering Approaches are aimed at soil and moisture conservation. Physiological approaches emphasis transpiration reduction, root growth encouragement and protection of cytoplasmic proteins. Genetic approaches mainly focus at developing new drought resistant plant types. Agronomic approaches like reorientation of cropping pattern, use of suitable cultivars, moderate fertilizer use, adoption of inter-cropping, life saving irrigation and contingent crop planning in the case of delayed onset of monsoon, breaks in monsoon, uneven distribution of monsoon rains in space and time and early cessation of monsoon rains have been found to be very effective short term measures in alleviating adverse impacts of drought on crops.

Keeping in view the above aspects, this paper aims at presenting a scenario of drought, as being monitored by IMD, for the monsoon-2006 and discusses the role of different technological approaches to mitigate the adverse impact of drought on crops.

DROUGHT CHARACTERISATION IN DRY FARMING REGIONS OF BIHAR STATE IN RELATION TO GROWTH PHASES OF RICE AND WHEAT

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Crop production in Bihar is largely dependent on rainfall and prevailing weather conditions and mainly affected by two natural disasters drought and flood. To address the drought intensities and its duration, water balance technique has been utilized to calculate the Moisture Availability index (MAI) and Aridity index and classification of drought intensities. The length of growing period and the distribution (probability of occurrence) of MAI at different threshold values with various phenophases in respect of rice and wheat crops at six stations of dry farming regions of Bihar state were analyzed in this paper. Study of yearly drought using aridity index method indicated that the frequency of occurrence of droughts was more at Patna, Gaya, Baghalpur and Dumka than that at Ranchi and Hazaribagh. It was found that at 50 percent probability level, the length of growing period for rice crop ranged from 19-21 weeks at Patna, Gaya, Bhagalpur, while at other stations (Dumka, Ranchi and Hazaribagh) it was 22-26 weeks. The above analysis revealed that chances of failure due to drought were more at seedling stage of rice crop while those for wheat were more at flowering stage.

WETLAND MECHANISMS AND VALUES FOR DROUGHT MITIGATON: SCIENTIFIC & COMMUNITY INTERVENTIONS

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Wetlands are the transitional zone between land and water, and comprise lakes, ponds, oxbow lakes, surface waterlogged land, playa, swamps, reservoirs, tanks, abandoned quarries and ash ponds. Wetlands play myriad roles – flood & erosion control, water purification, sediment trapping, pollution & nutrient treatment, and ecotourism.

However, one of the most significant environmental & socio-economic value – ground water discharge & recharge, that is very important and anciently known, for drought mitigation have ever been underemphasized partially due to overemphasizing post disaster relief strategies coupled with lack of S&T inputs in drought mitigation. Wetland vegetation plays role in slowing down the floodwater flow.

Environmental droughts are one of the recognized categories of droughts that emphasize decreasing water availability to ecosystem sustainability leading to short-term and long-term socio-economic distress.

The present paper presents an assessment of scientific and community role that wetlands play in mitigation of droughts and maintaining water supply to ecosystem and surrounding social communities during lean season and the livelihood or employment alternatives as relief measures. A protocol for value addition and restoration has been delineated and suggested for wetland role in drought mitigation in India, in the lights of Preventive Disaster Management (PDM) options, the concept evolved by the authors.

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conservation. Physiological approaches emphasis transpiration reduction, root growth encouragement and protection of cytoplasmic proteins. Genetic approaches mainly focus at developing new drought resistant plant types. Agronomic approaches like reorientation of cropping pattern, use of suitable cultivars, moderate fertilizer use, adoption of inter-cropping, life saving irrigation and contingent crop planning in the case of delayed onset of monsoon, breaks in monsoon, uneven distribution of monsoon rains in space and time and early cessation of monsoon rains have been found to be very effective short term measures in alleviating adverse impacts of drought on crops.

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DROUGHT PREDICTION AND AGRO-ADVISORY IN INDIA – A CASE STUDY

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India has been one of the agricultural economy based country. Despite, rapid increase in industrialization and allied service sectors in recent decade, still, about 60% of population depends on agriculture. Agriculture sector alone is expected to contribute at least 4 % to meet the planned target of 10% GDP by year 2010. At present the sector produces about 24 % of gross domestic production of the country.

Kharif and Rabi are the major crops seasons for India. The crops and agricultural production vary with the rainfall pattern during monsoon. In past few years there has been increase in extreme weather events, drought and floods. Drought is considered by many to be the most complex but least understood of all natural hazards, affecting more people than any other hazard (Hagman 1984). Recently, India suffered of drought in 2002 with seasonal(June-September) all India rainfall 19% below normal after all India drought occurred during June-September,1987. However one part or other parts of the countries suffer from drought invariably every year. Sub-Saharan Africa, the drought of early to mid 1980s was reported to have adversely affected more than 40 million people. The 1991-92 droughts in Southern Africa affected 20 million people and resulted in a deficit of cereal supplies of more than 6.7 million tons (SADCC, 1992). Lessons from developed and developing countries demonstrate that drought results in significant impacts , regardless of level of developments although the character of these impacts will differ profoundly Subbiah, 1993; Benson and Clay, 1998, 2000; Wilhite, 2000; Wilhite and Vanyarkho, 2000).

Predicting drought is a difficult and challenging task. Viewing the importance, National Centre Centre For Medium Range Weather Forecasting (NCMRWF), established by the Govt. of India, for prediction of weather and establishment of 127 agro-advisory service units (AASUs) representing the respective agro-climatic zones of India. NCMRWF is equipped with global T80 (operational), T170 (experimental) numerical weather predictions (NWP) and regional (MM5, ETA, WRF) models with CRAY-X1E supercomputing facility. Also, NCMRWF has established 107 AASUs so far. NCMRWF prepares model generated and observation based bi-weekly weather forecast with broad agro-advisory and disseminate to the respective AAS units on every Tuesday and Friday. At AAS units, panel of agricultural experts prepare agro-advisory for the farmers/agro-industry of concerned agro-climatic zone. The final advisory is widely circulated through mass media so that the farmers/agro-industrialist of the region may utilize the expert’s advisories. Keeping great importance of SW monsoon and its impact on Kharif crop in consideration, NCMRWF started preparing medium range prediction of rainfall on sub-divisional scale and actual observation based agro-advisory for farmers, near real time every week during the monsoon season, since 2004.

Monsoon 2006 has been a normal monsoon with all India seasonal rainfall 99% of normal. Although, 26 subdivisions received excess/normal rainfall, but, 10 subdivisions were deficient during the season. Uttar Pradesh and Haryana have been part of 10 subdivisions where rainfall has been deficient. Variation of rainfall was closely watched on different spatial and temporal viz. weekly cumulative seasonal scales during the season. Present study comprises of weekly weather prediction and accordingly prepared agro-advisories for crucial facets during the monsoon period 2006. NWP models in their predictions were able to give clear signatures of changes according to movement of rain bearing systems. Areas devoid or having poor rain could be detected in advance. It is possible to reduce agricultural losses by advanced prediction of poor or no rain situations, timely dissemination of weather based agro-advisories to farmers and planners