

Peer reviewed Journal

Impact Factor:5.13

ISSN-2230-9578

Journal of Research and Development

Multidisciplinary International Level Referred Journal

February-2021. Special Issue-11, Volume-6

Physical and Human Dimensions of Environment, Climate Change, and Sustainable Development

Chief Editor

Dr. R. V. Bhole

'Ravichandram' Survey No-101/1, Plot
No-23, Mundada Nagar, Jalgaon (M.S.)
425102

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Osmanabad (Maharashtra)

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Drought Disaster and its Effect on Agriculture of Karnataka

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Introduction:

Most of the natural disasters are directly related to the climate of India, cause massive losses of Indian life and property. **Droughts**, flash floods, cyclones, avalanches, landslides brought on by torrential rains and snowstorms pose the greatest threats. A disaster can be defined as any occurrence that causes damage, ecological disruption, loss of human life, deterioration of health and health services on a scale, sufficient to warrant an extraordinary response from outside the affected community or area (WHO). A natural disaster is a major adverse event resulting from natural processes of the Earth. A natural disaster can cause loss of life or property damage and typically leaves some economic damage in its wake, the severity of which depends on the affected population's resilience or ability to recover and also on the infrastructure available. An adverse event will not rise to the level of a disaster if it occurs in an area without vulnerable population. Natural hazards or Disaster are classified in to four categories. They are: (i) Climate Related Hazards: **Drought**, Flood, Cloudburst, Hailstorm, Lightning, Coastal Erosion, Storm Surge and Cyclone. (ii) Geological Hazards: Earthquake, Landslide and Tsunami. (iii) Hydrological Hazards: Groundwater Depletion and Aquifer Salinity. (iv) Biological Hazards: Plant and Insect Attack Human: Plague, Bird Flu, etc. Among the natural disasters drought is a temporary aberration unlike aridity, which is a permanent feature of climate. It is a normal, recurrent feature of climate and occurs in all climatic regimes and is usually characterized in terms of its spatial extension, intensity and duration. Conditions of drought appear when the rainfall is deficient in relation to the statistical multi-year average for a region, over an extended period of a season or year or even more (Manual for drought management, 2009). There are three types of droughts: (i) **Meteorological drought** is when the actual rainfall is much less than the climatologically mean of the area. The country as a whole may have a normal monsoon, but different meteorological districts and sub-divisions can have below normal rainfall. The rainfall categories for smaller areas are defined by their deviation from a meteorological area's normal rainfall. (ii) **Hydrological drought** results from the depletion of surface water causing very low stream flow and drying of lakes, rivers and reservoirs and (iii) **Agricultural drought** resulting from depletion of soil moisture resulting in acute crop stress and fall in agricultural productivity. India has been severely affected by droughts over the past years claiming millions of lives. The agriculture in India is totally dependent on rains, which when is not adequate results in poor yielding of crops. This is particularly true of major drought-prone regions such as southern and eastern Maharashtra, northern Karnataka, Andhra Pradesh, Orissa, Gujarat and Rajasthan. In India there is also a history of droughts leading to famines. During the major drought of 2000-2001, a total of eight states had fallen short of crops. Government policies and preventions play the most significant role in coping up with these environmental disasters.

In the most general sense, drought originates from a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group or environmental sector. Whatever the definition, it is clear that drought cannot be viewed solely as a physical phenomenon. Drought is a perennial feature in some parts of the Karnataka state. In fact drought is a significant environmental problem too as it is caused by rainfall less than the average of the year and no/ less rainfall extending over a long period of time. Experts in the field are of the conviction that drought can no more be considered a natural disaster. Rather it is manmade. If only the requisite awareness were to be generated among the people as to the need to save rainwater, droughts can be mitigated. Agricultural activities can be sustained throughout the year with the available rainfall in Karnataka state. In the year 2010-11 and 2014-16, there had been acute water scarcity and severe drought for the State of Karnataka due to failure of North East monsoon.

Study Area:

Karnataka covers an area of 1, 91,976 sq km and comprises humid, sub-humid, semi-arid and arid climatological regions. The population of the State is 6.11 crores, out of which 66% are rural based and dependent on agriculture. Two thirds of the geographical area falls under semi-arid to arid

conditions. Nearly 76% of the sown area is under rain fed agriculture and is vulnerable to the vagaries of the monsoon. Karnataka state, with its unique geophysical setting and socio-economic conditions is highly vulnerable to disasters. The state is prone to disasters due to number of factors, both natural and human induced, including adverse geo-climatic conditions, topographic features, environmental degradation, population growth, urbanization, industrialization, flawed development practices, etc. As far as the geographic dimensions of the Karnataka state is concerned, the five distinctive regions of the state i.e. Western Ghats, the northern dry plains, the southern humid hilly region and the coastal zone have their own specific problems. While on one hand the Western Ghats region is prone to disasters like landslides, the northern plain is affected by droughts and southern plains is affected by floods almost every year, while the coastal zone is susceptible to cyclones and storms. If we analyze the layers of vulnerability statistically, in 2014, out of 30 districts 23 of them are disaster prone. Almost 58.60 per cent of the geographical area is prone to droughts of moderate to very high intensity (68 per cent of the cultivable area is vulnerable to drought), over 12 per cent of land is prone to floods and river erosion. The 350 kms long coastline is prone to cyclones and tsunamis.

An Overview Of Drought In Karnataka:

On account of its multilayered vulnerability, the state has witnessed an increase in the frequency and intensity of disasters in the past resulting in widespread devastation. This inference is drawn only on the basis of disasters which have been reported. Many of the disasters, particularly in remote areas, go unreported because local administration lack the technical and human resources for community-level disaster monitoring and are not able to fully identify or map potential local hazards or develop the appropriate disaster management plans. Losses from low-intensity, but more extensive disaster events continue to affect housing, local infrastructure, and large numbers of people. These disasters at the local level are so frequent that many communities accept them as an integral part of their existence with varying degrees of success, learn to live with them. The Karnataka has experienced drought during the years 2001, 2002, 2003 and 2004 consecutively. During the year 2005, state was under heavy floods. During 2006, it experienced both flood and drought situations. During 2007, it repeatedly faced floods 4 times. For the years 2008 and 2009, there were both drought and flood in the State. During the year 2011 the monsoon moderate rain during September 2011. After four years severe drought occurred in most of part of Karnataka state in 2014, after that Govt of Karnataka has awakened to implement some important mitigation measures and prepared the action plan.

Recently Occurred 2014 - Drought Scenario:

During May-2014, the state as a whole recorded, 71.7 mm rainfall as against its normal rainfall of 85.2 mm, with departure from normal being (-) 16%. Out of 176 taluks in the State, 79 2nd and was on time. The progress of the monsoon trend was normal and covered most part of the State by June 10th, except parts of Bidar, Gulbarga, Yadgir and Raichur districts. Monsoon covered the entire state by June 15th. During June-2014 the State as a whole received actual rainfall of 200 mm as against its normal rainfall of 183 mm with (+) 10 % departure from normal. The interior parts of Karnataka received below normal rainfall but the rainfall was normal. excess in the districts of Malnad and coastal regions. During June rainfall was deficit in 58 talukas. During July, the state as a whole recorded 234 mm rainfall as against its normal rainfall of 266 mm with departure from normal being (-) 12 %. The districts of Chitradurga, Davanagere, Chamaraajanagara, Mysore, Belgaum, Haveri, Dharwad, Hassan and Chikmangalur recorded deficit rainfall. However, during the month 72 talukas recorded deficit /scanty rainfall. The coastal, Malnad and South interior Karnataka regions recorded below normal rainfall. The coastal, State received 230 mm rain as against normal rainfall of 196 mm with departure from normal of 17%. The rainfall was deficit during the month in the districts of Chitradurga and Bellary. The discussion indicates that the rainfall was more or less normal from May-August, 2014. About 18 districts were fully affected and 14 Taluks in other 5 districts were declared drought affected areas. The Government sanctioned a sum of Rs. 162.69 crores for providing drinking water supply besides Rs. 35 crores from Calamity Relief Fund (CRF) for road works in the districts of Gulbarga, Raichur, Koppala and Vijayapur. Scarcity of drinking water continued to be felt in 19 districts since 1996 to till date. The Government sanctioned a sum of Rs.111.79 crores from CRF to combat

drinking water scarcity. In the year 2011 scarcity of drinking water continued in 15 districts. The Government sanctioned a sum of Rs.126.44 crores from CRF to combat drinking water scarcity. In the year 2014, a sum of Rs.350 crores was sanctioned by the Government from CRF to meet the expenditure in connection with the drought situation which prevailed in 17 northern districts for providing sinking bore-wells, flushing of bore-wells, providing ring wells, construction of open wells, replacement of motor and for transportation of water.

During September, the State witnessed scanty rainfall in 17 districts of interior Karnataka with departure from normal up to (-) 81%. The coastal and Malnad region received excess rainfall during the month. South interior Karnataka recorded only 44 mm rain during the month as against the normal rainfall of 134 mm. The North interior Karnataka region received 57 mm rainfall as against normal rainfall of 152 mm. September 2011 rainfall was the second worst event in South Interior Karnataka since 1971 and in North Interior Karnataka, third worst event since 1971. Failure of Monsoon during September 2014 caused late season drought of rare severity. The dry spell in interior Karnataka during September 2014 continued to October 2014 in 13 districts of 77 taluks recorded deficit rainfall during the period October 1-14, 2014. Though the cumulative rainfall departure from normal for the State as a whole during June 1-14, 2014 was (-) 4% from normal, failure of monsoon during September and October resulted in late season drought.

The dry spell during the crop growth period causes agricultural drought. Agricultural drought occurs when soil moisture and rainfall are inadequate during the crop growing period causing extreme moisture stress and wilting. It thus arises from variable susceptibility of crops during different stages of crop development, from emergence to maturity. It is defined as a period of 4 consecutive weeks with a rainfall deficiency of more than 50 % of the long term average from mid-May to mid-October.

Drought Monitoring:

Karnataka has established institutional mechanism to monitor the drought indicators by setting up Drought Monitoring Cell way back in 1988. GPRS enabled Telemetric rain gauges have been installed and operational in all the 747 hoblies (villages) and 770 Gram Panchayats. GPRS enabled weather stations have been installed at 135 sites. Karnataka State Natural Disaster Monitoring Centre has taken a lead in monitoring the recurring drought situation on a scientific basis. The centre has made operational for various programmes on knowledge management and decision support system.

Moisture Adequacy Index:

Karnataka State Natural Disaster Monitoring Centre (KSNDMC) has developed moisture adequacy index based on rainfall, potential evapo-transpiration, actual evapo-transpiration, soil moisture condition, available water capacity of the soil and using soil water budgeting. Moisture adequacy index are classified into severe moisture stress (MAI < 25%), moderate moisture stress (MAI - 25.1 to 50%), agriculturally favorable (MAI - 50.1 to 75%) and Humid region (MAI >75%). As end of September 2014, 27% of the geographical area in the State was under moderate/severe moisture stress covering interior regions of the state. This indicator has assessed the moisture stress experienced by agriculture/ horticulture crops.

Normalized Difference Vegetation Index:

Assessment of agricultural drought and crop condition was carried out during Kharif 2014 by the State in association with National Remote Sensing Centre, Government of India. The report at the end of September has indicated drought condition prevailing in 20 districts of the Karnataka. It is also to be noted that out of 22 districts in the country under "Moderate drought", Karnataka had 11 districts under the category, which accounts to 50% of the total area in the country. Similarly out of the 49 districts in the country under "Mild drought", Karnataka has 11 districts falling under the said category constituting 22% of the total area of the country. Hence NDVI indicator had identified the drought situation in the State. Along with the above mentioned indicators, deficit rain, dry spell, moisture stress pattern were also vital indicators of drought.

Declaration Of Drought:

As per the recommendations of Cabinet Sub Committee in 2004, area with a continuous dry spell for more than 4 weeks period may be considered for declaring as drought affected. For declaring drought the following parameters were considered.

- Continuous dry spell of 4 weeks or more.

- Percentage departure of rain (-) 20% or more.

South West Monsoon drives the Kharif agricultural activities in the state of Karnataka. Generally September -30, 2014 is the normal withdrawal of South West Monsoon in the state. Taking into consideration the drought indicators, deficit rain, dry spell/moisture stress prevailed in 70 taluks of the state and thus they were declared as drought affected on October 4 2011 and 14 taluks were declared as drought affected on October 7. The situation was again reviewed on October 15 and 6 more taluks were declared as drought affected. With no respite in the situation, 9 more taluks were declared as drought affected on November 8. Thus in all 99 taluks were declared as drought affected in the State.

Impact Assessment:

The severe drought condition adversely affected not only agriculture, but other sectors like horticulture, livestock, etc. The summary of loss due to Drought during 2011, as per the memorandum submitted by Government of Karnataka, is presented in the below Table No:2:

Follow Up Action Taken:

The Government of Karnataka has been reviewing periodically the seasonal conditions of agriculture crops at State / district levels. Agriculture Department was conducting periodic review of status of agriculture. Department was also in constant touch with taluk and District officials through weekly video conference to review the crop conditions. Contingent action plan was prepared by scientists of agriculture university and was executed in the affected districts. Nodal-officers were appointed in all the districts to review the seasonal crop conditions. "Bho-Chetana" scheme was extended to all the districts during the year. The scheme focuses on retaining / increasing soil fertility and micro nutrients of agriculture land and increase crop production. About 23 lakh farmers were covered under this scheme in the whole state. Seeds and fertilizer requirements in the districts were monitored constantly. Steps were taken to distribute seeds at subsidized rates for alternate crops. Close watch on Crop cutting experiments and special attention was paid to ensure none of the experiments will lapse. Micro and Macro irrigation programmes continued to cover more land under irrigation for less utilization of ground water. Scientists from university of agriculture, horticulture and fisheries were closely monitoring the seasonal conditions and advising farmers to improve crop conditions.

TableNo:2 : Loss due to Drought and Claimed from Govt. of Karnataka State – 2014.

Sl. No.	Item	Estimated loss	Relief claimed as per CRF Norms (in crores)
1	Agriculture Crop loss		
2	Horticulture Crop loss	4245.84	202.54
3	Animal Husbandry	299.00	13.94
	a. Opening of Goshalas		39.92
	b. Purchase of Fodder mini kits		23.92
	c. Purchase of Fodder Banks		4.20
	d. Nutrient supply and Vety care		7.60
4	RDPR Dept		4.20
	a. Revival of PWS		122.04
	b. Revival of MWS		24.42
	c. Retrieval / hydro fracturing of bore-wells		24.52
	d. Drilling of new bore-wells		18.23
	e. Transportation of water		18.24
5	Additional funds under MGNREGS		36.63
6	Additional funds under Health Sector		4.80
7	Additional funds under Power Sector		10.00
	Grand Total	4544.84	330.00
			723.24

Source: Memorandum, Government of Karnataka.

The villages, which were facing / likely to face shortage of drinking water, were identified and contingent action plan was prepared and implemented to tackle the issue. This mainly included - constant monitoring for effective implementation of on-going drinking water schemes, quick

implementation of works approved during 2011, and repair and rejuvenation works, emergency supply of drinking water through tankers, purchase of more motor-pumps, extension of pipelines, effective implementation of flushing, deepening and hydro-fracturing works, functioning of control rooms at taluk level, drilling of bore-wells, steps to ensure effective supply of clean drinking water through tankers, etc. The MGNREGS is one of the flagship programmes being implemented in all the districts of Karnataka. For the livelihood of rural people, who are poorest among the poor, are required to be provided employment in order to avoid migration. In order to combat the drought situation effectively, all the implementing officers were instructed to gear up the administrative machinery for providing employment to the people, by implementing the employment generation works, especially in the drought affected taluks. Further, circulars and guidelines have been issued to set-up goshalas, fodder banks, veterinary care centers, funds were released to the districts to purchase fodder mini kits to grow adequate green fodder in the affected areas. Health packages, including necessary medicines, vaccination, etc. were supplied to the affected districts for health-care of the cattle.

Conclusion:

Karnataka State Government will formulate an action plan on the lines of National Action Plan on Climate Change in which solar energy will get due significance. In National action plan 8 national missions were mentioned to mitigate climate change. They are National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, National Mission for a "Green India", National Mission for Sustainable Agriculture and National Mission on Strategic Knowledge for Climate Change (Prime minister's council on climate change-2010). If the same missions persuaded in the state action plan, then it may achieve great success. It is strongly felt that a comprehensive vulnerability assessment of the various natural hazards of Karnataka needs to be undertaken. It must integrate the climate change considerations into all the developmental activities happening in the region.

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