



## DROUGHTS AND EDUCATIONAL MEASURES: THE INDIA CHAPTER

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### Abstract

*Drought is a period of drier-than normal conditions that lead to water related problems. It may be as an extended period - a season, a year or more - of deficient rainfall relative to the statistical multi-year average for a region. It is a normal and recurrent feature of climate and may occur anywhere in the world, in all climate zones. Its features or characteristics vary from region to region. Different classifications of drought emphasize physical aspect of drought, particularly in the context of agriculture and crop production, its impacts are widespread across several sectors. Drought and famines have a long history in India but the recent, the drought of 2002 was ranked fifth in terms of magnitude when examined in overall terms of magnitude, spacing, dispersion and duration. The 2002 monsoon was one of the shortest in recorded history. The total loss in rural employment due to shrinkage of agriculture operations during the drought months was estimated as 1,250 million man days. The impact of droughts on day to day human life in rural regions is many a time severe beyond imagination because; food availability becomes dismal. Many go hungry, and few have food in stock. Availability of drinking water becomes very poor. Distribution of water by tankers is neither available nor sufficient and equitable. The water needs of cattle are not sufficiently met. Women and children are the worst affected. Productive youths are compelled to migrate to earn livelihood and the children, women, old and sick members of the family are left behind in the drought affected village without water, food, care and security. Suicide cases in the Marathwada region of Maharashtra, and a number of cases of malnutrition and starvation might be taken as examples of the effects of drought. Education can play a significant role in drought management and research. Interdisciplinary subjects like Ecology, Capacity Development, Environment Science etc, which have the characteristics to accommodate the knowledge and skills of various natural, social and agricultural sciences and to promote specialization modules on drought management, should be widely encouraged. Need of the hour to save the future of mankind on Planet Earth is to conduct more and more researches on various aspects of disaster management including drought management, environment sustainability and education for sustainable development. At the same time it should be ensured that the result or finding must go from lab to land.]*

**Keywords:** (i) Droughts in India (ii) Effects of Drought on Human Life (iii) Educational Measures (iv) Status of Research on Drought.



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**INTRODUCTION:** Drought may be as an extended period - a season, a year or more - of deficient rainfall relative to the statistical multi-year average for a region (**Earth Observatory, 2002**). It is a normal and recurrent feature of climate and may occur anywhere in the world, in all climate zones. Its features or characteristics vary from region to region. Simply, drought is a period of drier-than normal conditions that lead to water related problems. When rainfall is below normal for weeks, month or even years, it brings about a decline in the flow of rivers and streams and a drop in water level in reservoirs and wells. If dry weather persists and water supply-related problems increase, the dry period can be called a 'drought'. The first evidence of drought is usually seen in rainfall records. To determine the start of a drought, definitions specify the degree of departure from the average precipitation or some other climatic variable over a period of time. This is done by comparing the current situation to the historical average, often based on a 30-year period of record (**NDMC, 2003**). Drought cannot be confined to a single all-encompassing definition. It depends on differences in regions, need and disciplinary perspectives. When rainfall in Libya, for instance, is less than 180 mm it can be described as a drought situation. However in Bail Islands, a mere six days without rain can become a drought. Drought results from a long continued dry weather and/or insufficient rain, which cause loss of soil moisture, depletion of underground water supply and reduction of stream flow.

Drought is frequently defined according to disciplinary perspective. A **permanent drought** is characterized by extremely dry climate, drought vegetation and agriculture that is possible only by irrigation; **seasonal drought** requires crop duration to be synchronized with the rainy season; **contingent drought** is of irregular occurrence and frequent rainfall, in humid region. Physical aspects are also used to classify drought. These may be clubbed into three or four major groups:

**Meteorological drought** is related to deficiencies in rainfall compared to the average mean annual rainfall in an area. According to the India Meteorological Department (IMD) meteorological drought occurs when the seasonal rainfall received over an area is less than 75% of its long-term average value. If the rainfall deficit is between 26-50%, the drought is classified as 'moderate', and 'severe' if the deficit exceeds 50%. **Agricultural drought** occurs when there is insufficient soil moisture to meet the needs of a particular crop at a point in time. Deficit rainfall over cropped areas during their growth cycle can destroy crops or lead

to poor crop yields. Agricultural drought is typically witnessed after a meteorological drought, but before a hydrological drought. **Hydrological drought** is a deficiency in surface and sub surface water supply. It is measured as stream flows and also as lake, reservoir and groundwater levels. A sequence of impacts may be witnessed during the progression of a drought from meteorological, agriculture to hydrological. Meteorological drought is defined as a situation when there is significant decrease from normal precipitation over an area (i.e. more than 10%). Hydrological drought results from prolonged meteorological drought manifested in depletion of surface and subsurface water resource. It must be noted that hydrological drought could occur even when the rainfall is normal, if there has been a substantial reduction in surface water holding capacity. Agricultural drought is a situation when soil moisture and rainfall are inadequate to support healthy crop growth.

Though, most of the classifications emphasize physical aspects of drought, particularly in the context of agriculture and crop production, its impacts are wide spread across several sectors. The impact, response and intervention would vary depending on at what point of time in a crop calendar, there is a water or soil moisture deficit. Generally, three situations are recognized;

- (a) Early season: Delayed rainfall (delayed onset of monsoon), prolonged dry spells after onset;
- (b) Midseason: Inadequate soil moisture between two rain events; and
- (c) Late season: Early cessation of rains or insufficient rains.

#### **THE INDIA SITUATION IN HISTORICAL PERSPECTIVE:**

The traditional approach to drought as a phenomenon of arid and semi-arid areas is changing in India. Now, even regions with high rainfall, often face severe water scarcities. Cherrapunji in Meghalaya, one of the world's biggest rainfall areas, with over 11000 mm of rainfall, now faces drought for almost nine months of the year. On the other hand, the western part of Jaisalmer district of Rajasthan, one of the driest parts of the country, is recording around

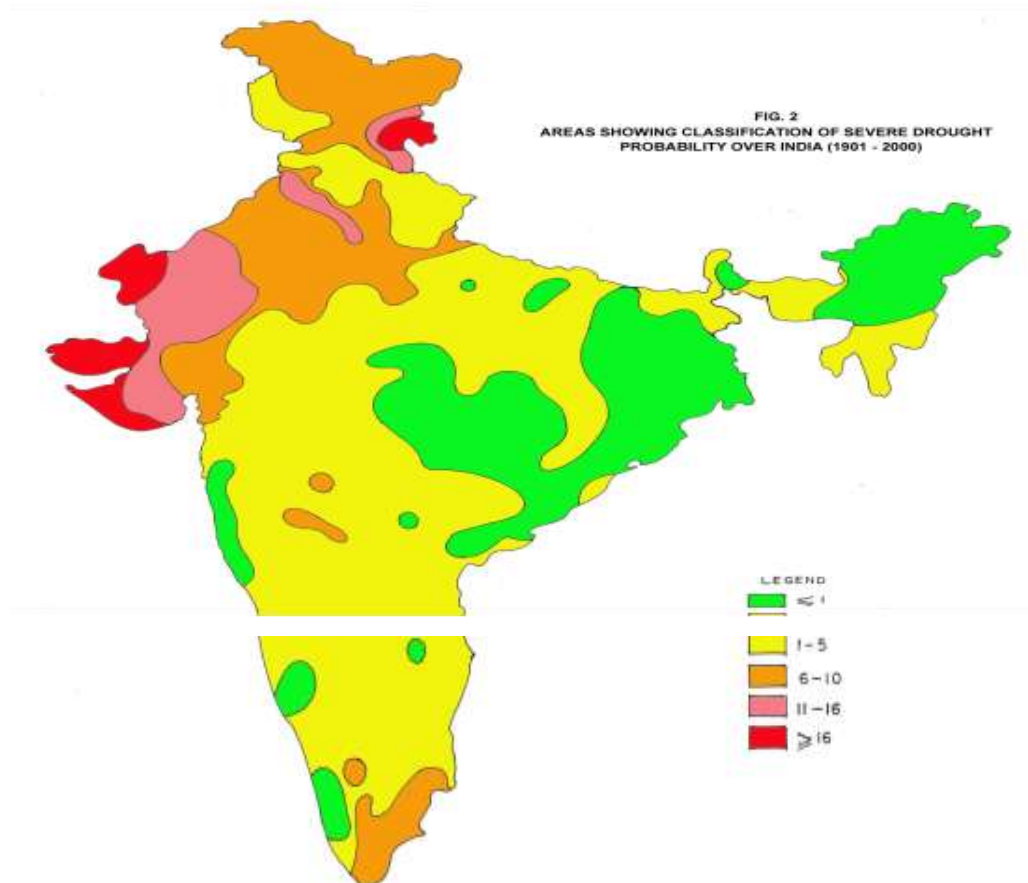


Figure-1: Scenario of Drought in 20<sup>th</sup> Century

Source: MDI, Pune, India

**Table-1: Drought Intensity (1801-2016)**

Period	Drought Years	No. of Years
1801-1825	1801, 1804, 1806, 1812, 1819, 1825	06
1826-1850	1832, 1833, 1837	03
1851-1875	1853, 1860, 1862, 1866, 1868, 1873	06
1876-1900	1877*+, 1891, 1899*	03
1901-1925	1901*, 1904, 1905*, 1907, 1911, 1913, 1915, 1918*+, 1920, 1925	10
1926-1950	1939, 1941*	02
1951-1975	1951, 1965*, 1966, 1968, 1972*+, 1974	06
1976-2000	1979*, 1982, 1985, 1987+,	04

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2001-2016	2002, 2009, 2014, 2015	04
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\*Severe drought years + phenomenal drought years.

Sources: 1. Inter-annual variations of Indian summer monsoon, 2. DRU, IMD, Pune.

9 cm of rain fall in a year. Total rainfall increases generally eastwards and with height. Increase in precipitation is high at an elevation of around 1,500 meters in the Himalaya Mountains. With average annual rainfall ranging between 20 cm to over 100cm, the primary challenge is to store this precious water for the dry season that may follow. The droughts in Odisha state, which has has an average rainfall of 1100 mm, remain a matter for continuing concern. Conditions of water scarcity in Himalayan regions are also not uncommon. Thus, drought is just not the security or lack of rainfall, but an issue related to water resources management. The requirement of over 80-90% of the drinking water and over 50% for irrigation is met from ground water in India. The control of this resource is with the owner of land. Without effective and large scale rainwater harvesting only limited recharge can take place. An earlier analysis of incidence of drought over the last two centuries in India does not show any increase in the frequency of drought in the recent years. However, the severity appears to have increased as given in table-1.

It is seen probability of severe drought in the range 1 to 5%. In some parts of northwest region, northern hilly region and peninsular region, probability of severe drought is in the range of 6 to 10%. Further ahead in parts of Northwest region and in small Hilly region the probability of severe drought is greater than 10%. in extreme Northwest region ,especially in the region of Saurashtra and Kutch, it is greater than 20% also. In Northwest India, some parts of west central India and central Northeast India, no severe drought is experienced. Last two centuries in India does not show any increase in the frequency of drought. In the recent years, however, the severity papers to have increased (Table 1 & figure-1).

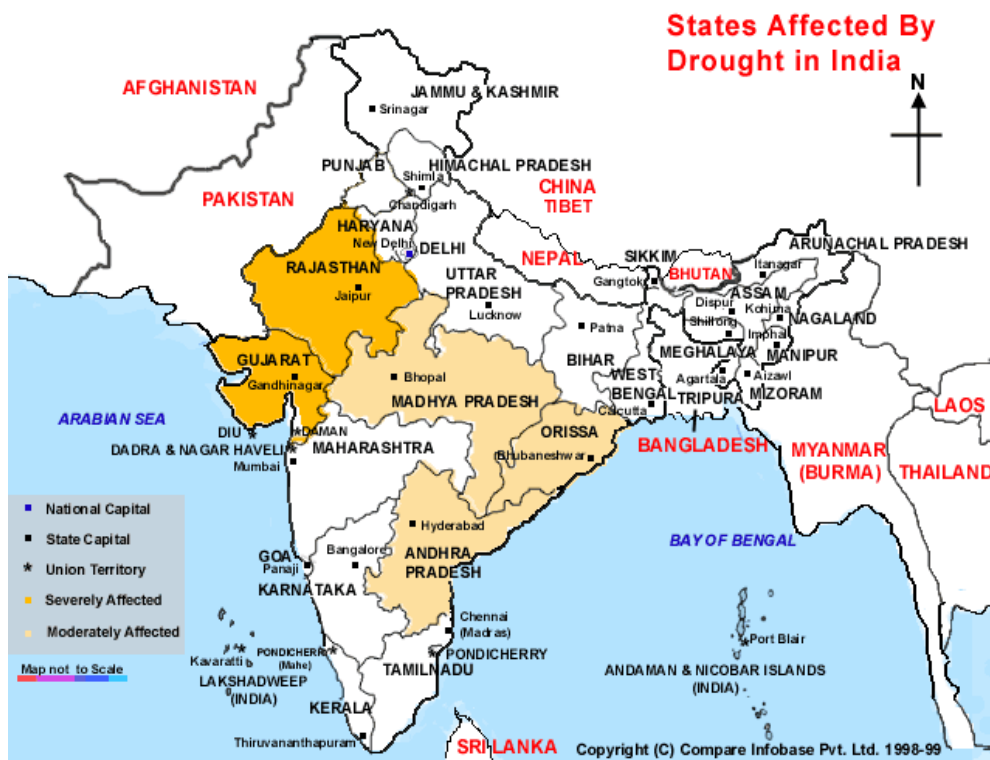


Figure-2: Scenario of Drought in Last Decade of 21<sup>st</sup> Century

Source: Drought Research Unit, India Meteorological Department, Pune, India

Drought and famine have a long history in India but the most recent, the drought of 2002, ranked fifth in term of magnitude when examined in overall terms of magnitude, spacing, dispersion and duration. The 2002 monsoon was one of the shortest in recorded history. The total loss in rural employment due to shrinkage of agriculture operation during the drought months was estimated at 1,250 million man days. The GDP in agriculture income was around Rs. 39,000 core (DAC, 2008). Through these are traditionally drought prone districts in India the condition of drought has gone worse in at present. According to the written answer of central cabinet minister of agriculture Mr. Shared Pawar in Lok Sabah on April, 23 2013, total 972 Block of 195 districts of sixteen states are facing severe drought situation (Hindustan, 2013).

**Table-2: Administrative Districts Chronically Affected by Drought Conditions**

States	Districts
ANDHRA PRADESH	Anantpur, Chittoor, Cuddapah, Hyderabad, Karnool, Mehboobnagar, Nalgonda, Prakasam
BIHAR	Munger, Nawadah, Rohtas, Bhojpur, Aurangabad, Gaya

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GUJRAT		Ahmedabad, Amrely, Banaskantha, Bhavnagar, Bharuch, Jamnagar, Kheda, Kutch, Mehsana, Panchmahal, Rajkot, Surendranagar
HARYANA		Bhiwani, Gurgaon, Mahendranagar, Rohtak
JAMMU	AND	Doda, Udhampur
KASHMIR		
KARNATKA		Bangalore, Belgaum, Bellary, Bijapur, Chitradurga, Chickmagalur, Dharwad, Gulbarga, Hassan, Kolar, Mandya, Mysore, Raichur, Tumkur
MADHYA PRADESH		Betul, Datia, Dewas, Dhar, Jhabhua, Khandak, Shahdol, Shahjapur, Sidhi, Ujjain
MAHARASHTRA		Ahmednagar, Aurangabad, Beed, Nanded, Nashik, Osmanabad, Pune, Parbhani, Sangli, Satara, Solapur
ODISHA		Phulbani, Kalahandi, Bolangir, Kendrapada
RAJASTHAN		Ajmer, Banaswada, Barmer, Churu, Dungarpur, Jaisalmer, Jalore, Jhunjunu, Jodhpur, Nagaur, Pali, Udaipur
TAMIL NADU		Coimbatore, Dharmapuri, Madurai, Ramanathapuram, Salem, Tiruchirapali, Tirunelveli, Kanyakumari
UTTER PRADESH		Allahabad, Banda, Hamirpur, Jalaun, Mirzapur, Varanasi
WEST BENGAL		Bankura, Midnapore, Purulia
JHARKHAND		Palamu
CHHATTISGARH		Khargaon

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#### **IMPACT OF DROUGHT:**

Mostly, the impact attributes to drought is comprehensive, 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, individual 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.

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 impact of drought 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 food, depending upon the social structure, class, village and house hold resource endowments. The direct impact of drought is generally classified under four categorized, viz. physical, social, economic and environmental. The relative however, depends on specific regional characteristics. Drought 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.

In the industrial sector, agro-based industries are directly affected. Lower domestic production of agriculture based inputs for agro processing units reduces non-agricultural production and employment opportunities. Availability of water for domestic consumption also diminishes. This has implications for health and household activities, including substantial increase in the time spent on collecting water. As water becomes scarce, competition among and within sector usually increase. Droughts have other important implications for government policies, as it reduces tax revenues through declines in income, employment and exports.

On the expenditure side, the government is faced with increased expenditure on relief, social welfare, health and water supplies, consumption- related subsidies on food distribution, and the logistical costs of drought related imports. The law and order structure is put under greater pressure by a rise in crime, in turn associated with temporary unemployment, migration and increased destitution. Droughts have a range of indirect, secondary effects as well. Generally, the secondary impact is on regional inequality, employment, trade deficits, external debt and inflation. The micro level impact at village and house hold levels are equally important. Drought may result in a considerable intensification of household food insecurity, water related health risks and loss of livelihoods in the agricultural sector.

The impact of drought on day to day human life in rural regions is many a time severe beyond imagination because food availability becomes dismal. Many go hungry, and few have food in stock. Availability of drinking water becomes very poor. Distribution of water by tankers is neither available nor sufficient and equitable. The water needs of cattle are not sufficiently met. Women and children are the worst affected. Productive youths are compelled to migrate to earn livelihood and the children, women, old and sick members of the family are left behind in the drought affected villages without water, food, care and security. Suicide cases in the Marathwada Region, and a number of cases of malnutrition and starvation might be taken as examples of the effects of drought.

#### **EDUCATION AND DROUGHT MANAGEMENT:**

Education can play a significant role in drought management and research on it. Interdisciplinary subjects like Ecology, Capacity Development, Environment Science, Geography and Agricultural Economics which have the characteristics to accommodate the knowledge and skills of various natural, social and agricultural sciences and to promote



specialization modules on drought management should widely be encouraged.

Curriculum development with a focus on dissemination of disaster including drought related information on a sustained basis, covering junior, middle and high school levels have been worked out by the different state education boards in the country. Disaster related curricula have already been introduced in class VIII, IX and X levels in Central Board of Secondary Education (CBSE) schools. The education boards of all the States are also developing similar contents in their curricula. It has been decided that a chapter on drought mitigation will be included in the curricula under the subject of environment science in all classes from 8<sup>th</sup> standard onwards. The development of high quality educational material, textbooks, field training, and a high standard of teaching at all levels is being given due emphasis, now. Education and training programmes are being designed with greater focus on the development of the capacity and skills of trainers and teachers. The central and state governments are encouraging knowledge institutes to undertake research, teaching and training in drought mitigation and management. The UGC strives to promote teaching and research in emerging areas of Sciences including Engineering and Technology, Medical, Pharmacy, Agriculture & Humanities, Social Science Languages, Literature, Arts, Law and allied disciplines by providing financial support to permanent/regular, working /retired teachers in the universities and colleges. From this platform, the UGC can serve well the nation by promoting research and creating knowledge required to deal the calamities of droughts, other environmental issues and sustainability etc. The quantum of studies being funded by University Grants Commission has been very unsatisfactory. Only few research projects are being funded by UGC. It is the ray of hope that number of researches being funded by UGC is constantly increasing but much more importance is expected to be given to the studies on drought.

**Table-3: Major/ Miner Research Projects Funded by UGC and status of research on Issue of Drought or Environment etc.**

<b>Year</b>	<b>Number of ongoing Research Projects in Science, Social Sciences, Humanities &amp; Engg. etc.</b>	<b>Type of Research Projects</b>	<b>Major</b>	<b>Miner</b>	<b>Number of Projects on Drought or on other Environmental Issues</b>
2014-15	1473		993	480	37
2013-14	1878		1452	426	29
2012-13	1527		1150	377	26

2011-12	1300	1033	277	11
2010-11	1805	1631	169	07

**Source: UGC Annual Reports- From 2010-11to 2014-15**

Spreading community awareness and developing community leadership for effective Drought Management is the need of the hour. Investments in education for disaster management, public awareness, community leadership development, should be encouraged. Sensitizing the communities will be the most important activity. Since low income groups are the most vulnerable to drought, the design and content of the educational materials should be based on consideration like alternate livelihoods, supplementing income, creating awareness of government schemes for them. Community should be enabled to understand the importance of drought preparedness and mitigation. The aim of education and research as well, should be to promote an informed, alert and self-confident, motivated community that can cope with the droughts. Government has initiated many programmes for drought management like Drought Prone Area Programme (DPAP), Diesel Subsidy Scheme (for drought/deficit rainfall areas), Crisis Management Programme and National Disaster Response Fund (NDRF) etc. **(India 2012)** but due to inappropriate implementation these programmes we have not achieved expected results. For proper planning and effective implementation of drought relief programmes the collaboration amongst government agencies, educational/research institute and community is necessary.

Present status of researches on the problems of drought, disaster management, sustainable development, environmental education etc. being funded by apex research and education bodies is not satisfactory particularly in the disciplines of humanities and social sciences. Table-3-B shows that status of research on drought and other related areas of studies are not good Researches being funded by apex bodies can be said less satisfactory even in science disciplines.

**Table-3-B: Status Of Research On Drought, Sustainability Or Environmental Education/ Issues In Some Apex Institutions**

FUNDING AGENCY	NIDM#			CRIDA*					TOTAL
	2013	2014	2015	2011	2012	2013	2014	2015	
Major & Miner Researches Funded in	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

**Humanities & Social Sciences Major & Minor Researches Funded in Physical Sciences & Engg. Etc.**

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# National Institute of disaster Management  
Dryland Agriculture

\* National Research Institute for

Mediocrity of research in India is prevalent almost in all disciplines. A cumulative effect of various developments both within and outside of the field of education is the declining availability of talented researchers and teachers in the basic physical sciences, social science and humanities (Shah, 2005). Condition of higher education and researches in the field of drought management, disaster management, sustainability and education for sustainable development etc. is not satisfactory. It is evident from table-3 that the researches being done under the given specific apex institutes like NIDA and CRIDA are directly addressing the problem in their cent percent researches. But when we see the performance of apex education and research institutes like UGC and TISS, we find that the number of researches being done here are not much encouraging as out of 1790 research projects only 59 directly or indirectly related to disaster management including drought management or environment sustainability or education for sustainable development. Thus the need of the hour to save the future of mankind on Planet Earth is to conduct the researches on various aspects of disaster management including drought management, environment sustainability and education for sustainable development. At the same time it should be ensured that the result or finding must go from lab to land.

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