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DROUGHT IN KARNATAKA: IMPACT ON SOCIETY AND ENVIRONMENT AND STRATEGIES TO MITIGATE

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ABSTARCT:

Land and water are two most precious and important natural resources for the survival of all living beings and agricultural development. According to survey conducted by Karnataka State Natural Disaster Monitoring Centre (KSNDMC); North Karnataka and Coastal regions have been a declining trend in rainfall. The year 2023 is witnessed for 'Green Drought' which is generally a period when there is limited rainfall due to which there is growth of new plants, but the growth is frail.

Karnataka experiences droughts when the southwest monsoon remains weak. Over last 2 decades Karnataka has faced 11 droughts, Drought causing severe stress to the masses and agriculture. The impact of drought can be grouped as social, ecological, and economic. Drought is a threat to wide range of man and living organisms and has a huge impact on ecology as well. Drought needs prevention and priority for sustainable future and betterment of the farmers. Water conservation is the best way to mitigate the drought and water should be used wisely with utmost care.

KEYWORDS: Concept of drought, its impact on society and environment, strategies for mitigate.

ITRODUCTION:

Among the several natural calamities; drought is most disastrous and its effects on untold varied miseries on the human and environment. Land and water are the two most significant natural resources in the development of agriculture and essential resource for survival of any life. People need water to drink, to grow food, to clean and bath and industrial use etc. The agricultural sector of Karnataka is frequently characterised by drought prone region

Karnataka has been witnessing a drastic change in rainfall pattern and distribution for last two decades. According to survey conducted by Karnataka State Natural Disaster Monitoring Centre (KSNDMC); North Karnataka and Coastal regions have been a declining trend in rainfall. The year 2023 is witnessed for 'Green Drought' which is generally a period when there is limited rainfall due to which there is growth of new plants, but the growth is insubstantial. Failure of rains from South West monsoon results in occurrence of drought.

Karnataka experiences droughts when the South -West monsoon remains weak. The state has the second largest area of dry land in the country, after Rajasthan. Owing to incidents of drought crop loss, cattle deaths, and migration of labour force etc., Thus, drought causing severe stress to the masses and agriculture which resulting in survival struggle for both animals and human beings. In Karnataka; there is a crop loss of 42 lakh ha., and the total loss of crop is of Rs. 33,770.10 crores during the year 2023. Hence, the drought assistance was sought at the tune of Rs. 17,901.73 crore under the National Disaster Relief Fund (NDRF).

Drought is one of those natural events that affects not only the people but specially agriculture of the region and threats to people's livelihood and socio-economic growth. It is a complex phenomenon resulting from interactions between physical and social systems that impacts both societies and ecosystem. Over last 2 decades Karnataka has experienced 11 droughts.

Drought is a climatic anomaly characterised by deficient supply of moisture. It means when the level of rainfall is less than 50 to 75 percent of the normal southwest monsoon. Drought can be defined in terms of moisture deficiency, which is a balance between the water availability and water demand. It is an extended dry period in the natural climate cycle that can occur anywhere and its effects can be seen on various aspects such as vegetation, human, animals, and eco-system of the society.

National Integrated Drought Information System (NIDIS) defines as "It is a deficiency of precipitation over an extended period (generally a season or more) resulting in a water shortage". In simple drought is a prolonged period abnormally low rainfall leading to a storage of water affecting badly on growing and living conditions. There are various reasons for drought such as; deforestation, global warming, low water surface level and flow etc.

OBJECTIVE OF THE STUDY:

- 1) To understand and analyse the concept of drought
- 2) To explore the social impact of drought
- 3) To examine the economic implications of drought
- 4) To investigate environmental effects of drought
- 5) Government measures to mitigate drought
- 6) To suggest the strategies for combating the drought

DATA BASE AND METHODOLOGY:

This research paper is mainly based on secondary source. The data collected from various sources such as; research articles, books, journals, theses, Government reports, website e-mails, newspapers etc.

DROUGHT SCENARIO IN INKARNATAKA:

Being an agrarian economy; large percentage of its population engaged in agriculture and rainfall is a significant element for economic growth of a region. Karnataka state has humid to subhumid monsoonal climate on the waste coast and western ghats and semiarid to arid climate in central and northern districts of plateau region. Karnataka is drought prone being the 2nd driest state in the country after Rajasthan. The Occurrence of drought in Karnataka state is common phenomenon, which is happened owing to spatial and temporal variation in rainfall. For the last four years; Karnataka mostly faced with floods during rainy season.

However; for the year 2023 the South West (SW) monsoon is irregular and scanty; which raised from 56 percent in June to 73 percent in August and this severe drought threatens not only to ruin the kharif crops but also shortage of drinking water sources too. Inter-Ministerial Central Team (IMCT) examined that; the rainfall received in August this year was the lowest between 1901 and 2023 while June rainfall was the 3rd lowest in

the period Oct, 2023. This year, rainfall deficit stands at about 40 percent, receiving lowest rainfall in 123 years.

The state of Karnataka experiences diverse rainfall quantities across its regions. The quantum of rainfall is unequally distributed. Hence, different regions are prone to disasters like floods and drought. The entire rainfed agricultural area in Karnataka is drought prone and it covers about 80 percent of the taluks. The severity of drought is worst in this year; as state has declared drought owing to weak South West (SW) monsoon.

The failure of rains can have an adverse and damaging effect on the rural economy and scanty rain -fall cause for the water crises and there is zero inflow into several reservoirs. Data from Karnataka State Natural Disaster Monitoring Centre (KSNDMC) shows that; Karnataka state received 526 mm. of rain between 1st June 2023 and 4th September 2023; as against the normal of 711 mm. a deficit of 26 percent overall. Out of 31 districts; 15 districts reported deficit rainfall during the period.

Out of 236 taluks from 31 districts of Karnataka; the state Government has declared 195 taluks are drought hit. As per National Disaster Response Fund (NDRF) and the State Disaster Response Fund (SDRF) norms; out of 195 taluks 161 have been declared as severely drought and 34 are moderately drought hit taluks.

DROUGHT HIT NUMBER OF TALUKS OF KARNATAKA FROM 2011 TO 2023:

Srl. No.	Year	No. of Drought hit taluks
1	2011	123
2	2012	157
3	2013	125
4	2014	035
5	2015	136
6	2016	110
7	2017	162
8	2018	156
9	2023	195

Source: The New Indian Express: March, 2019 & The Times of India, Sept, 2023

DROUGHT HIT TALUKS OF KARNATAKA DURING THE YEAR 2023:

Srl No.	Drought hit districts	Number of Drought hit taluks
1	Bangaluru Urban	Bangaluru east, Bangaluru rural, Devanahalli, Hosakote, Nelamangala and Doddaballapur
2	Ramanagara District	Kanakapura Harohalli and Ramanagara
3	Chitradurga District	Molakarmuru, Hosadurga, Hollakere, Hiriuru, Chitrdurga and Challekere
4	Davanagere District	Channageri, Nyamati, Jagaluru, Honnali, Harihar and Davanagere,
5	Mysore District	H.D. Kote, Hunsur, Mysore, Nanjangud, Priyapatna, T. Narasipura, Saraguru, Saligram and K.R.Pete
6	Mandya District	Srirangapattana, Pandavapura, Madduru, Malavalli, Mandya, Nagamangala
7	Bellary District	Bellary, Kampli, Sandur, Shriguppa and Kurugodu
8	Koppal district	Koppal, Kushstagi, Gangavathi, Yelburga, Karatagi, Kukanur and Kanakagiri
9	Raichur District	Sirwar, Lingasagur, Raichur and Manvi
10	Kolar District	Srinivaspur, KGF, Bangarpet, Kolar, Mulbagilu
11	Chikkaballapur District	Sidalghatta, Gudibande, Goribidanur, Chikkaballapur, Chintamani and Bagepalli
12	Tumkur District	Chikanayakanahalli, Gubbi, Koratagere, Kunigal, Madhugiri, pavagada, Shira, Tiptur and Turuvekere
13	Kalaburgi District	Hulasur, Basavakalyan, Balki, Bidar, Shahabad Yadrami, Afjalpur, Alanda, Chincholi, Chitapur, Kalaburgi, Jewargi, Kamalapur, Kalagi and sedam
14	Belagaum District	Athani, Bailahongala, Chikodi, Gokak, Hukkeri, Ramadurga, Raibag, Yaragatti, Mudalgi, Kitturu, Nippani, Kagawad and Savadatti
15	Bagalkot District	Badami, Bagalkot, Baragi, Hunagund, Jamakhandi, Mudhol, Guledagudda, Ilkal, Rabakavi and Banahatti
16	Vijayapura District	Vijayapura, Almera, Devarahippargi, Kolhara, Talikote, Nidagundi, Sindagi, Babaleshwar, Chadachana, Muddebihal, Indi and Basavana Bagewadiu
17	Gadag District	Gadag, Shirahatti, Gajendragad, Lakshmeswar, Naragunda and Ron
18	Haveri District	Haveri, Hirekerur, Rattihalli, Savanur, Ranebennur,
19	Dharwad District	Dharwad, Hubli, Hubli city, Navalagund and Kundgola
20	Hasan District	Arakalagudu, Kadur, Ajjapur, and chikkamagaluru
21	Shimoga District	Bhadravati, Thirthalli, Sorab, Sagara, Shikaripura, Shimoga and Hosanagar
22	Kodagu District	Madakeri, Virajpet, Karkala, Udapi, and Kushalnagar
23	Uttar Kannada Distric	Haliyal, Yallapur, Yadgiri, Shapura, Vadagera, Mundagode and Shirshi
24	Vijayanaga District	Hospet, Hadagali, Hagaribommanahalli, Harapanahalli, Kottur and Kudlgi

25	Moderately Prone Taluks	Drought Anekal, Bengaluru North, Bengaluru South, Yalahanka, Magadi, Malur, Tumkuru, Gundlupete, Kollegal, Hanur, Devadurga, Maski, Beluru, Chennaraypattana, Holenaraseempur, sakaleshpur, Koppa, Narasimharajapura, Sringeri, Kalasa, Somwarpet, Mangalaru, Moodbidre, Hunasagi, Gurmitkal, Yadgiri, Shorapur, Joyda, Kumta, Karwar, Bhatkal, Ankola and Brhamavar
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Source: Karnataka Disaster Management Authority, Published on 9 Dec. 2023(Deccanherald.com) GOK thehindu.com 6th Dec.2023, and varthabharati.in sept.,2023

IMPACT OF DROUGHT ON SOCIETY AND ENVIRONMENT:

Drought affects all parts of our lives and environment in many ways. The impact of drought can be grouped as social, ecological, and economic. Drought is a threat to wide range of man and living organisms and has a huge impact on ecology as well. The drought condition impacts the country's economy drastically and farmers are badly affected. Drought caused decline in crop growth and production has ultimately hampers the food supply and GDP of the nation.

The problem of drought is invariably handled as a crisis and short-term problems. Societal collapses, conflicts and instabilities have happened together due to droughts. Moreover; when we do not have enough water many people and many things of activities will be affected. It is a complex and slow process of ecological challenge, that affects crops failures and cause for decline in agricultural productivity and consequently leads to social problems. The following are the important impacts of drought are as;

Socio- economic impact of drought on family: The agricultural sector is most affected by drought. The depletion of water availability significantly declines in crops and livestock productivity and adversely impacting on farmers income, quality of life and life style. Drought destroys the crop of farmers and this consequently effects on the income of the peasant class. Farmers sell their livestock with low price and this again effects on loss of income generating source of the farmers. There may be shortage of supply of food and fodder for animals and human beings. The social impact such as anxiety, and depression and other effects are due to economic losses. Drought also effects on trade and business and purchasing power of the people.

Impact of drought on poverty, crime, and unemployment: The occurrence of drought creates financial disruptions across farming community and brings huge economic losses and this will ultimately cause for poverty. Drought would have also adverse impact on employment opportunities to the farmers and allied farming communities. The unemployment rate would rise drastically since it would be impossible to engage in agricultural due to drought. The prices of agricultural products would increase immensely due to minimal production and a deficient supply of agricultural products.

Owing to drought most of the people would get unemployed, fumbling their income sources which would reduce their purchasing power and degrade their living standards. When there is poverty and unemployment; there will be well crime rate levels in the society. Poverty has been put forward as a decisive motive for crime. Individuals lacking the basic means of subsistence are more to become involved in criminal activity. Economic theory of crime, originally introduced by Becker and said that; individuals like to become involved in criminal activities, when they experience a poverty and negative income shock.

Impact on fishery culture and fisher man, and tourism: Fisheries have important roles for food supply, food security, income generation and livelihood. Fishermen required profession for their livelihoods. Owing to the climatic changes and drought they face enormous challenges. Drought and climatic changes in the coastal waters affects the productivity of fishermen's eco-system, fish stock and fish migration routes. The drought, cyclones or any other natural disasters influence sustainable livelihood of fishermen's community.

The studies reveal that; disasters have a significant negative effect on tours and travels. Drought decline in tourist arrivals at the major tourist attraction places. This resulted in a loss of business, potential revenue generation and jobs. The hospitality industry is also vulnerable to the effect of drought and climate change.

Drought always threatens livelihood and quality of life: Lively hood is the job or other source of income that gives you the money to buy the things we need. According to Britannica dictionary- livelihood means a way of earning money to live. Hence, farming is the major source of livelihood for all the households. Agriculture contributes 15% of the National GDP, it employs over half the labour force and is the main source of livelihood for more than 2/3 of the population. Hence, due to scanty rainfall or drought affects the livelihood of agricultural and allied activities of many families.

Quality of life (QoL) means aims to capture the well -being; whether of a population or individual. This includes wealth, employment, education, physical and mental health, recreation and entertainment facilities, leisure time, safety and security and social belonging etc. Quality of life is a subjective and measure of our happiness. This is an essential component of many financial decisions.

Migration of the poor and labour class people: There is a positive relation between drought and temporary migration. Drought is a period of drier than normal condition, it often has the large impacts on the ecosystem and cause harm to the total economy. Metrological drought causes serious hydrological imbalance in the affected areas and crops will get spoiled and leads for migration of the labour and poor class population. This is happened owing to deficiencies in crop production and allied farming activities.

Food security is the major problem due to drought: Despite considerable progress in all fields like medicine, industry, finance, and health etc. In spite, many people suffer from hunger and malnutrition. Food security means; when all times have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Drought effecting agriculture and causes for loss of production. Nearly ¼ th of the world's population does not have sufficient food for normal survival and about 1billion people become hungry every year.

Malnutrition and under nutrition are the result of drought: Of all the natural hazards drought results for greatest adverse impact on human population. Malnutrition means poor nutrition; in other words, it is deficiencies or excesses in nutrient or debilitated nutrient utilization. A balanced diet should provide enough nutrients like calories, protein, and vitamins, to keep us healthy. Undernutrition means lack of proper nutrition, caused by not having enough food or not eating enough food containing substances necessary for growth of health. Drought diminishes dietary and reduces overall food consumption, and leads to micronutrient deficiencies.

Health and health related effects of drought: Drought poses many and far- reaching health implications. Droughts are considered as most destructive and challenging climatic hazards. Evidences suggest that health is vulnerable to drought which caused for morbidity and early mortality. Several reviews of the effects of drought on health such as; diarrhoea, scabies, cholera, malaria, chikungunya, dengue etc. Viruses, protozoa and bacteria can pollute both ground and surface water when rainfall decreases. Drought can also cause long term public health problems and shortage of portable and poor quality of water.

Mental health implications are also associated with drought. It is the most severe for farmers and their families, an effect caused by the loss of livelihoods from reduced agricultural activity and loss of crops. The livelihood loss is a risk factor for the increase in anxiety and depression and ultimately this will cause for domestic violence, abuse, and suicide.

Relation between drought and starvation: There is co-relation between drought and starvation. Starvation means it is a severe deficiency in caloric energy intake, below the level needed to maintain an organism's life. Prolonged starvation can cause permanent organ damage and eventually death. It is believed that by using precipitation records; a drought may cause low agricultural yields and as a result food insecurity. Starvation is an extreme deficiency in caloric energy intake which imbalance between energy or nutrient supply and body utilization. Starvation is the deprivation of an exogeneous supply of calories to the energy demands of the body for basic metabolism and other activities

Agricultural drought causes for farmers debt: It is said that; Indian farmer is gambling with monsoon; and is often said that Indian peasant is born in debt, live debt and die in debt. In this background, natural calamities that affects farmers community cause enormous loss and destruction and caused negative impacts on life conditions of a farmer and his economy.

Agricultural drought is a situation where rainfall and soil moisture are inadequate during the crop growing season to support healthy crop growth to maturity causing crop stress. Indian agriculture witness almost every year natural disasters like droughts, floods and pest attacks and climatic variations and which makes the farmers life miserable. The shortfall in the rains causes droughts and drought like situations and farmers were trapped in debt.

Drought causes for suicide and increase in crime rates: In Karnataka agriculture is the major occupation and a total of 1,23,100 km sq. of land is cultivated constituting 64.6 of the total geographical area of the state. And about 25.67 percent are agricultural workers. In 2020 around 500 farmers died, 595 in 2021, 651 in 2022, and 412 in the current year 2023. Rural communities feel impact of drought much more than urban communities. Droughts induce stress disorder, anxiety, and depression among the people in general and farmers in particular and caused in suicide and crimes. The reason behind this is; drought reduce agricultural production, increase financial hardship, and reduce employment opportunities.

The National Crime Records Bureau (NCRB) said the states which are drought hit are reported a greater number of crimes. Thus, the increasing water crises in the country resulting disputes arising out of it are reflected in the latest National Crime Records Bureau. The disputes resulted in crime, clashes and even murders.

Ecological and environmental impact of drought: Drought affects various components of eco-system and environment. Bio-diversity depends on various forms of water, including moisture in soil and atmosphere for their survival. Drought affects the environment in many ways on animals, plants, flora, and fauna etc. There may be water scarcity, shortage of fodder for animals and human beings, this effects on the health conditions of living organisms. Shortage of water can affect soil chemical, physical and biological activities that are essential for plant and soil health. Environmental impacts include; wildfires, wind and soil erosion, destruction of fish and wildlife habitat etc.

IMAGES OF DROUGHT



Figure 1. Crops Drying, farmer in worry



Figure 2. Shortage of fodder to the animals



Figure 3. People in hunt of water



Figure 4. Helpless farmer

DROUGHT MITIGATE STRATEGIES:

At present conditions of climatical change; drought mitigation will have an important role to play for sustained better livelihood of the people. Drought needs prevention and priority for future betterment. Water conservation is the best way to mitigate the drought and water should be used wisely with utmost care. Considering the increase in frequency of droughts, it is necessary to shift in public policy from drought relief to drought preparedness and mitigation measures. There are some of the important strategies to deal with drought are-

- 1.Designing of farming policies for countering droughts
- 2.Water conservation and rain water harvesting is the need of the hour
- 3.Afforestation or planting more and more trees
- 4.Increase in water storage capacity of all sources
- 5.Planned crop rotation system is to be in practice
- 6.Repair and rejuvenate of local water bodies where there is scanty rainfall
- 7.Integrated soil, forest, and water resource management is the need of the hour
- 8.Grow genetically modified crops which gives more yield
- 9.Building and maintaining the dams and reservoirs properly
- 10.To develop genetically modified crops or less water resistance crop
- 11.To practice cloud seeding or artificial precipitation
- 12.Developing water sources like micro dams, wells, and ponds

13. Education and awareness among the public and farmers about water saving, water conservation and water management
14. Promotion of crop diversification and major use of new irrigation technologies such as sprinkler and drip irrigation etc.
15. Shift of cropping system from commercial to food crops
16. To develop agricultural research institutes and drought resistant varieties and less water consumption crops
17. Protecting water against contamination
18. Diversification of agricultural practices
19. Effective and timely co-ordination among various ministries, departments, and organizations can enhance the drought management
20. Desalination and recycling of water i.e. use of sea water for irrigation and consumption

INITIATIVE MEASURES UNDERTAKEN BY GOVERNMENT OF KARNATAKA FOR MITIGATION OF DROUGHT:

Vagaries of monsoon in Karnataka have left farmers in distress, for the current year loss at the tune of Rs. 33,770.10 crores. Drought is declared by State Governments by considering of rainfall and crop growth. The State Disaster Management Authority (SDMA) has released 350 crores for relief measures in 236 drought hit regions. The State Disaster Management Authority has proposed a seeking assistance of Rs. 18,171 crores.

Mitigation Measures Under Taken by Government of Karnataka such as-

- ❖ Helps farmers through existing Krishi Bhagya
- ❖ Works will be under taken up under Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)
- ❖ Requested to central government to increase MGNREGS man day work from 100 to 150 days
- ❖ To boost up dairy farming Government initiated some measures
- ❖ To ensure the availability of fodder during drought situations
- ❖ Seven lakh fodder seed kits have been distributed to ensure fodder to cattle during drought
- ❖ GoK has taken proactive measures i.e. Rs. 324 crores have been released to 31 districts from SDRF in Oct.,2023
- ❖ Ten member Inter Ministerial Central Team (IMCT) visited the drought hit areas of Karnataka
- ❖ Provide input subsidies to the farmers for drinking water, fodder, water for the cattle employment and other relief measures
- ❖ Seeking more drought relief funds to farmers from central to state Government
- ❖ Taken measures to give crop loss compensation to the farmers of Karnataka
- ❖ Government also released Rs. 20 crores to the department of animal husbandry
- ❖ Karnataka Government begin crediting Rs.2000 as partial drought relief to the farmers
- ❖ Drinking water supply through private tankers to 800 Gram Panchayats
- ❖ Launched Jal Amrutha Scheme as a long run drought strategy (it is a community driven movement for supply of water conservation in state)
- ❖ Cloud seeding (artificial rain technique) operation is launched by Karnataka Government in some parts of Karnataka.

(Source: Karnataka Disaster Management Authority, Published on 9 Dec. 2023

and (Deccanherald.com) GOK thehindu.com 6th Dec.2023)

CONCLUSION:

Drought is one of the major threats to people's livelihoods, causes harm to the economic development, plant and species become vulnerable. Droughts are natural disasters that nobody can stop it. But we can prepare for the effects of this natural disaster to make it less impact as well more manageable. However, Mankind is in a continuous struggle with a vast range of natural disaster.

After independence droughts have received more attention of central and State Governments and policy makers than before. In an increasingly vulnerable world, nations, communities, and individuals are suffering and facing loss of lives and livelihood. This calamity is mainly due to natural reasons but nowadays it is observed that increase in drought is due to human interference.

The advance in science and technology enhances drought monitoring capabilities Standardised Precipitation Index (SPI) developed by McKee et al. in 1993. The strategies to mitigate drought are structural and physical such as growing appropriate crops, construction of dams and proper engineering projects and non-structural measures such as; Government policies, natural resource operating practices, awareness among the public, public commitment towards protection and preservation of natural resources, knowledge development etc., may limits the adverse impacts of drought.

Comprehensive drought planning and proactive mitigation measures can lessen the impact of drought on individual, communities, and the eco-system. Proactive mitigation activities such as water conservation, reuse of waste water, scientific forest management, water pricing strategies, de-salination etc., can reduce drought crises at a great level.

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