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Revision on Drought Management Studies in India

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ABSTRACT: Drought is a frequent hazard in India, striking in some part or the other. Drought occurrence results in reduced stream flows, reservoir levels, ground water levels and soil moisture levels. The problem posed by droughts vary from area to area depending upon the amount of precipitation and its variability and on demand of water for the specified user. In India, the problem of droughts is recurrent. Estimates indicate that about one-third of the geographical area of the country (107 m.ha) spread over 99 districts affected by drought. The present report describes that, various impacts of drought on health, Environment, social etc. and how this effects of drought is reduced by taking various planned mitigation actions. Drought is a normal, recurrent feature of climate. It is a temporary aberration; it originates from a deficiency of precipitation over an extended period of time, although its characteristics vary significantly from one region to another. Drought should not be viewed as merely a physical phenomenon or natural event. Its impacts on society result from the interplay between a natural event (less precipitation than expected resulting from natural climatic variability) and the demand people place on water supply. Human beings often exacerbate the impact of drought. Recent droughts in both developing and developed countries and the resulting economic and environmental impacts and personal hardships have underscored the vulnerability of all societies to this "natural" hazard. There are various mitigation techniques such as, focus on water supply instead of water demand (watershed restoration), remove moisture competitive trees, Implement Hay hotline, Implement the emergency grazing of conservation reserve program land in state etc.

KEYWORDS: Drought management, Paper study, Fighting Drought, Modern solutions for drought management.

I. INTRODUCTION

What's a drought? Most of us think of it as "no rainfall", but it's not that simple. Drought is when you have less rainfall than you expected over an extended period of time, usually several months or longer. Drought is a normal part of climate, and it can occur almost anywhere on earth. For example, Arizona and Maine have very different climates, but drought occurs in both states. Drought's features and effects vary from place to place because of different geographical features and cultures, which affect how people use water. A shortage of rainfall can result in major impacts on agriculture, city water supplies, tourism and recreation, energy (power) production, river navigation, and the environment. Drought is one of the major weather related hazards. However, there is no general definition of drought. Perhaps the most general of the proposed definitions is the one formulated by Bernan and rodier (1985); 'drought is a decrease of water availability in a particular period and over a particular area'. A Drought is defined as "a period of abnormally dry weather sufficiently prolonged for the lack of water to cause serious hydrologic imbalance in the affected area".

There are actually four different ways that drought can be defined.

- **Meteorological**-a measure of departure of precipitation from normal. Due to climatic differences, what might be considered a drought in one location of the country may not be a drought in another location.
- **Agricultural**-refers to a situation where the amount of moisture in the soil no longer meets the needs of a particular crop.
- **Hydrological**-occurs when surface and subsurface water supplies are below normal.
- **Socioeconomic**-refers to the situation that occurs when physical water shortages begin to affect people.

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II. RELATED WORK

The focus of the drought management study is to take the actions that we can take before, or at the beginning of, drought to help reduce the impacts of drought. There are many things that people do to prepare for drought, including finding additional water supplies and conserving water that is already available.

The following facilities which are generally performed to manage drought are as follows:

- **a fodder storage facility**—a building or other structure used exclusively to store grain, hay or fodder
- **a water storage facility**—a dam, earth tank, underground tank or above-ground tank or a base, stand or cover for such a tank or any other structure or improvement used under an approved water conservation plan in relation to land to store water predominantly for livestock
- **a water transport facility**—a bore or well, a pump or windmill, a pipe, a water tower or header tank, or any other structure or improvement used under an approved water conservation plan in relation to land to transport water
- **minimum tillage equipment**—for example, trash tillage implements, boom sprays and markers, zero and reduced tillage planters, trash seeders, deep ploughs and seed drills—used in planting and cultivation that involves no tillage of the soil or in which the tillage does not seriously affect soil structure and retains a high degree of organic matter or surface cover.

III. METHODOLOGY

Drought has many causes. It could be a lack of rainfall; it could be a lack of snowfall from mountains far away; or it could be caused when water supplies aren't sufficient to meet everybody's needs. People can also play a big role in drought. All living things, including humans, require a certain amount of water to live. But humans also have developed lifestyles that require additional water. When drought occurs, this additional water can make the difference between having enough water and running out.

Predicting drought depends on our ability to forecast precipitation and temperature. Scientists don't know how to predict drought a month or more in advance for most parts of the world. Scientists are studying how interacting weather events, or teleconnections, can influence the formation of various regional and global weather patterns. Because these patterns tend to be repeated, studying their occurrence can help us improve our ability to predict changes in climate, particularly in the tropics.

Weather is the condition of the earth's atmosphere over a brief period of time. For example, we speak of today's weather or the weather this week. Day-to-day weather over a longer period of time is climate. Climographs can help us understand the climate of various cities or regions. A climograph is a graph that shows monthly average temperature and precipitation for some location. A climatologist studies and tries to explain the impacts of climate so that society will be able plan its activities, design its buildings and infrastructure, and prepare for bad weather conditions. Although climate is not weather, it is defined by the same terms, such as temperature, precipitation, wind, and solar radiation.

IV. PROPOSED SOLUTION

India occupies 2% of world's area but about 16% of its population. The livelihood of almost 70% of the population depends directly on agriculture or agro-industry- 28% of our GNP is derived from agriculture which in turn depends on land and water resource. It has geographical area of 328 m-ha out of which the present net cropped area is about 142.5 m-ha. The present population of country would be 960 million. The present gross cropped area in the country is about 185 m-ha out of which about 67% is under cereals. The average productivity for both irrigated and un-irrigated lands is about 1.7/ha. The productivity on irrigated land is 3 to 5 times that on un-irrigated land. Current total production of cereals in the country is about 195 m tones which includes about 65 m tones of wheat and 85 m tones of rice.

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Water resource availability and requirement :

Table 1: Basin wise water Resources Availability (surface)

sr no	River Basin	Average Annual Availability		
		Water resource Potential(BCM)	Per capita (cubic meter)	Per Ha of cult area (cubic meter)
1	Indus	73.31	1749	7600
2	Ganga Brahamaputra meghna	1110.62	18061	52907
2(a)	Ganga	525.02	1471	8727
2(b)	Brahamaputra &Barak	585.60	16589	44180
3	Godavari	110.54	2048	5837
4	Krishna	78.12	1285	3847
5	Cauvery	21.36	728	3692
6	Mahanadi	66.88	2513	8369
7	Sabarmati	3.81	360	2455
8	Narmada	45.64	3109	7727
9	Tapi	14.88	1007	3285
10	West flowing rivers from Tapi to Tadri	87.41	3383	27900
11	West flowing rivers from Tadri to kanyakumari	113.53	3480	36078
12	East flowing rivers between mahanadi and godavari	22.52	953	5199
13	West flowing rivers of kutch and saurashtra including luni	15.10	683	644
14	Area of inland drainage in Rajasthan	Neglected	-	-
15	Minor rivers draining into Bangaladesh and Myanmar	31	14623	-

Table 2: Percent Development of Ground water in states

Punjab	93.85	West Bengal	24.18
Haryana	83.88	Andhra pradesh	23.64
Tamilnadu	60.40	Bihar	19.19
Rajasthan	50.63	Madhya pradesh	16.49
Gujrat	41.31	Kerala	15.28
Uttar pradesh	37.67	Orissa	8.42
Maharashtra	30.39	Assam	4.48

The percentage development in the major states is given in table 2.

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Evidently there is little scope for additional development in tamilnadu, Rajasthan and Gujarat. There are local areas of over exploitation and falling water tables in these states. There is considerable scope for development in the remaining states ,particular efforts are needed in Madhya Pradesh, orissa,west Bengal, and Assam.

Table 3: A long term projection for 2050

Projections for years	2025	2050
Population	135 cores	164 cores
Cereal requirement @600 GMS /capita/Day plus ancillary requirements	360 m.tones	420 m.tones
Net cropped area	142 m-ha	142 m-ha
Cross cropped area Gross irrigated area (68% of gross cropped area)		216 m-ha (cropping intensity 154 %)
Cereal production on		102 m-ha irrigated 60 m-ha un-irrigated
Average productivity		3.53 t/ha irrigated 1 t/ha un-irrigated

A long term projection for 2050 is shown in tables 3 .It is seen that for the country as a whole ,the water &food requirement can be met till then. After that if the population still continues to grow ,radical measures like inter –Basin transfers and even distillation of sea water may become unavoidable. By the end of 94-95, the Irrigation potential developed was 86.9 m-ha including 32. 34 m-ha from major &medium projects and 54. 67m ha from minor irrigation projects including ground water. The actual utilization was 77. 79 m ha.The ultimate gross irrigation potential from all types of projects is estimated as 145 m-ha.

WATER RESOURCE UTILISATION

Fig below shoes comparison between open well, shallow tube-well and deep tube wells from year 1968-1999. As in the graph we see that the contribution of open wells is maximum over all these years where as the contribution of deep tube wells is the minimum.

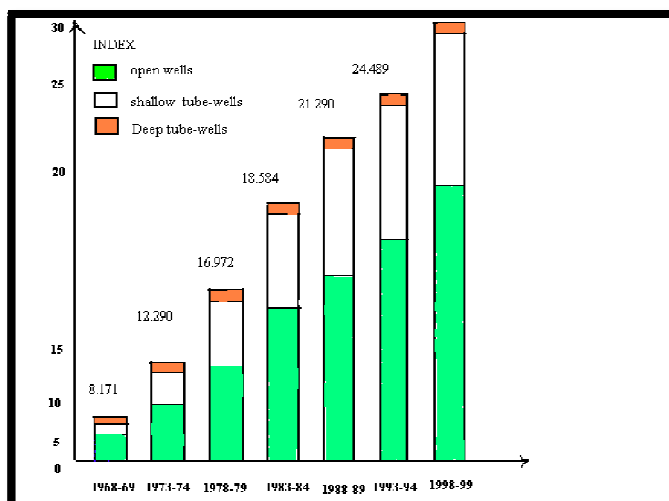


Fig: progressive utilization of ground water through open wells, shallow tube wells and deep tube wells in India.

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Creating, Storing, and Distributing Water Supplies

1 Dams: Many people rely on rain and snowfall to meet their water needs, but these sources of water aren't always available when they're needed. To make sure that they have enough water throughout the year, people sometimes construct dams to store water for times of need. About 75,000 large dams have been built in the United States, and the number is growing. However, building dams can have some unwanted consequences, so there is increasing pressure to find new ways of building up our water supplies.

2 Groundwater and Wells: Aquifers contain large amounts of water under the surface of the earth (groundwater). In other words, an aquifer is like an underground lake. Some aquifers are very large, like the Ogallala Aquifer, which lies under portions of South Dakota, Nebraska, Kansas, Oklahoma, and Texas. The Ogallala contains enough water to cover the United States with one and a half feet of water. People drill wells into aquifers so that they can bring water to the surface for many different purposes, like crop irrigation or drinking water for cities. But there is only a certain amount of water in these aquifers. Many times people pump so much water from these aquifers that they are reduced to levels that threaten the water supply. Human activities can also pollute these underground water supplies so much that it becomes very hard to purify them enough for human use. This is especially troublesome in times of drought when people need as much water as they can get. Many communities are taking steps to make sure that these resources are protected.

3 Canals and Pipelines: Water canals and pipelines have been constructed in many places to make sure that as many people as possible have access to our common water supplies. Canals like the Central Arizona Project and the Los Angeles Aqueduct carry billions of gallons of water each year to areas that do not have enough water. Smaller pipelines also transport water to millions of people living in cities and rural homes. You can contact your local water authority to see where your water comes from and how it gets into your home.

4 Desalination: With recent advances in technology, turning seawater into water that is usable for human needs is becoming easier. Although desalination (removing salt from seawater) is still expensive, some U.S. cities, such as Tampa, Florida, are building desalination plants to help meet their growing water needs. When completed, the Tampa Bay Desalination Project will be the largest desalination plant of its kind in the United States. Several more plants are being planned in states like Texas, California, and Hawaii.

5 Water Conservation: Instead of trying to come up with costly new water sources, another idea is to make better use of the water resources that we already have. Here are a few of the methods that people are using to conserve water.

6 Water Recycling: In the past, people usually let water run back into the ground, down drains, or directly into rivers when they were finished using it. But now many people are trying to find ways of reusing water. For example, some cities are treating their wastewater and reusing it to water golf courses and city parks. Another example is a Denver water park, Water World, which has begun to recycle splash water into other parts of the water park. These and other conservation measures allow businesses to reduce water use or else expand their businesses by using their existing water supply more efficiently.

V. RESULTS

Spatial distribution and quantum of rainfall during south west monsoon mainly determines the incidence of drought in the country, as south west monsoon accounts for more than 70% of annual rainfall. We monitored progress of south west monsoon in the country and kept watch over scarce rainfall regions the plan defines roles and responsibilities of various agencies involved in crisis management during drought. It also reduces the hazardous effect on the agricultural fields which are caused due to insufficient water supply which are not available during the drought seasons for proper growth of agricultural products. As the cultivation of agricultural products is more the number of farmers who used to be jobless are able to earn through there fields or agricultural field as there is no problem of water. Inter linking of

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national water resources is needed to be done. Proper utilization and monitoring of available water resources is to be done. so as to avoid water tax in the future.

VI. CONCLUSION

The science related to groundwater is manifold and deserves careful consideration while planning for its development. Though groundwater is invisible, its occurrence and movement can be visualized through different technical inputs. The study shows that we can plan a strategy for the future i.e. advance planning can be done.

This information may be made available by the end of November. State and district planning commission should collect this type of information so that proper arrangement can be made to face the water scarcity in summer. In order to mitigate these future natural disasters, individuals and government officials must look beyond short-term impacts of drought and consider the long-term issues of water supply management and distribution. Drought is something that cannot be avoided. Some places experience drought more often than others but at some point in time almost everywhere will have a drought. At these points in time it is important how ranchers manage their range land so they do not have as many problems and their grassland is sustained for the future. Drought is not something that can be avoided but something that can be managed. It is not always easy to manage for some it is harder than the others. But proper drought planning is important. Some ranchers have to cut their stocking rate while others provide supplement feed. Drought has been a periodic occurrence in the past and will undoubtedly continue to be in the future. If we properly plan and manage for drought and not overgraze our land the result will be sustainable for the future generations. Proper monitoring of areas that are drought prone needs to be done. The levels of water needed to be updated daily and benchmarks should be set for warning and alarms to trigger. Agriculture and irrigation patterns should be improved and water intensive crops should not be cultivated in the water deficient area. Water transportation channels should be well maintained and leakages should be avoided. Water intensive industries (Alcohol) should be away from water deficit regions. Dams, check dams and other water storage mechanism should be in proper places. Filtration and purification process should not waste water for example the reverse osmosis process (RO) wastes water in the ratio of 1:1. It makes no sense to promote RO. We can use bio sand filters and other similar equipments.

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