

may be elevated by building on raised land. Buildings should be constructed away from water bodies.

**Flood Management** In India, systematic planning for flood management commenced with the Five Year Plans, particularly with the launching of National Programme of Flood Management in 1954. During the last 48 years, different methods of flood protection structural as well as non-structural have been adopted in different states depending upon the nature of the problem and local conditions. Structural measures include storage reservoirs, flood embankments, drainage channels, anti-erosion works, channel improvement works, detention basins etc. and non-structural measures include flood forecasting, flood plain zoning, flood proofing, disaster preparedness etc. The flood management measures undertaken so far have provided reasonable degree of protection to an area of 15.81 million hectares through out the country.

### Web Resources:

- [www.cwc.nic.in](http://www.cwc.nic.in) website of the Central Water Commission of India, (CWC) of India.
- <http://wrmin.nic.in> website of the Ministry of Water Resources, Gol.
- [www.imd.ernet.in](http://www.imd.ernet.in) Indian Meteorological Department (IMD) provides all India weather report, end of monsoon season report, weather charts, satellite images, rainfall maps, earthquake reports and severe weather warnings.
- [www.ndmindia.nic.in](http://www.ndmindia.nic.in) Natural Disaster Management India. Provides current news on Flood, Drought and Cyclones, Weather Links from NIC and weather conditions temperatures on Indian Ocean ([www.weather.nic.in](http://www.weather.nic.in)).

- [www.nih.ernet.in](http://www.nih.ernet.in) India National Institute of Hydrology perform tasks such as Ground water zone mapping, Flood plain mapping, land use, salinity, sedimentation, Soil erosion, water-logging etc.

### Exercise

1. Define Flood. List out some of the causes and adverse effects of floods.
2. Name two basins in India that are frequently affected by flood and explain the warning dissemination system of India in the flood affected areas.
3. Explain in detail atleast five possible risk reduction measures for floods.

## 2.5 DROUGHT

### What is Drought?

Drought is either absence or deficiency of rainfall from its normal pattern in a region for an extended period of time leading to general suffering in the society. It is interplay between demand that people place on natural supply of water and natural event that provides the water in a given geographical region. ***The state of Kerala which receives more than 3000 mm of rainfall every year is declared drought affected as it is insufficient to have two good crops.*** The more the imbalance in supply the higher is the drought. The following will help explaining this general definition of the drought further.

- ◆ It is a slow on-set disaster and it is difficult to demarcate the time of its onset and the end.
- ◆ Any unusual dry period which results in a shortage of useful water.

- ◆ Drought is a normal, recurrent feature of climate. Climate is expected to show some aberrations and drought is just a part of it.
- ◆ Drought can occur by improper distribution of rain in time and space, and not just by its amount.
- ◆ Drought is negative balance between precipitation and water use (through evaporation, transpiration by plants, domestic and industrial uses etc) in a geographical region.

The effects of drought accumulate slowly over a considerable period of time.

### ***Causes of Drought***

#### **Can you think of what causes drought?**

Though drought is basically caused by deficit rainfall, which is a meteorological phenomenon, it manifests into different spheres because of various vulnerability factors associated with them (see the box). Some of these factors are human induced. Though drought is a natural disaster, its effects are made worst in developing countries by over population, over grazing, deforestation, soil erosion, excessive use of ground and surface water for growing crops, loss of biodiversity.

#### ***General Characteristics:***

##### ***– Types of droughts***

Drought proceeds in sequential manner. Its impacts are spread across different domains as listed below.

#### **What on earth do you know about water?**

- **Approximately 80 per cent of earth's surface is covered with water but only 1% of it is fresh water that we can use.**
- **About 2.7 per cent of the total water available on the earth is fresh water of which about 75.2 per cent lies frozen in Polar Regions and another 22.6 per cent is present as ground water. The rest is available in lakes, rivers, atmosphere, moisture, soil and vegetation. This 1% of water is now threatened by pollution!**
- **Today, we have approximately the same amount of water as when the Earth was formed. Earth will not get/generate any more water!**
- **We are using up the fresh water faster than we are recharging our groundwater**

##### ***– Meteorological drought***

Meteorological drought is simple absence/deficit of rainfall from the normal. It is the least severe form of drought and is often identified by sunny days and hot weather.

##### ***– Hydrological drought***

Hydrological drought often leads to reduction of natural stream flows or ground water levels, plus stored water supplies. The main impact is on water resource systems.

**Agricultural drought**

This form of drought occurs when moisture level in soil is insufficient to maintain average crop yields. Initial consequences are in the reduced seasonal output of crops and other related production. An extreme agricultural drought can lead to a famine, which is a prolonged shortage of food in a restricted region causing widespread disease and death from starvation.

Can you think of some more vulnerability factors to drought?

- ◆ Low soil moisture holding capacity
- ◆ Absence of irrigation facilities
- ◆ Livestock without adequate fodder storage facilities
- ◆ Poor water management
- ◆ Deforestation
- ◆ Over grazing
- ◆ Water consuming cropping patterns
- ◆ Excessive ground water draft
- ◆ Soil erosion
- ◆ Population growth and urbanization
- ◆ Industrialization
- ◆ Global warming

**Socio-economic drought**

Socio-economic drought correlates the supply and demand of goods and services with the three above-mentioned types of drought. When the supply of some goods or services such as water and electricity are weather dependant then drought may cause shortages in supply of these economic goods.

Can you believe it!!!

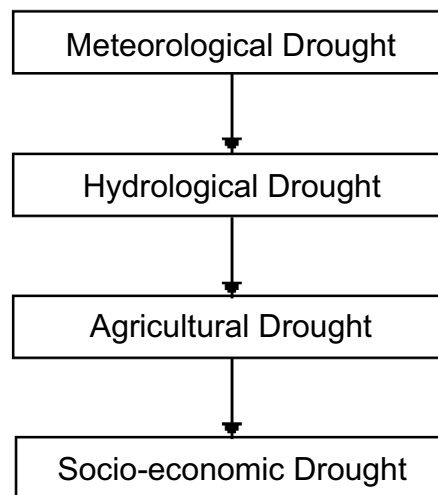
Cherapunji in Meghalaya, which was said to receive highest rainfall in the world, is now reeling under acute drinking water problem. This is because of water runoff, denudation and no storage facilities.

**Measuring Drought :**

**Elements at Risk**

In general, all those elements that are primarily dependent on water are most affected. It affects the rainfed crops and then slowly creeps into the irrigated crops. People who are dependent on agriculture and areas where the other livelihood opportunities are least developed are greatly affected. The herdsman, landless labourer, subsistence farmers, women, children and farm animals are the most vulnerable groups.

Fig 2.5.1



### Drought Mathematics

The following criteria have been set by the Indian Meteorological Division (IMD) for identifying the drought.

- *Onset of drought:* Deficiency of a particular year's rainfall exceeding 25 per cent of normal.
- *Moderate drought:* Deficit of rainfall between 26-50 per cent of normal.
- *Severe drought:* Deficit of rainfall more than 50 per cent of normal.



Fig 2.5.2 Map showing drought prone states in India.

### Typical adverse effects

Drought, different from any other natural disaster, does not cause any structural damages. As the meteorological drought turns into hydrological drought, the impacts start appearing first in agriculture which is most dependant on the soil moisture. Irrigated areas are affected much later than the rainfed areas. However, regions surrounding perennial rivers tend to continue normal life even when drought conditions are prevailing around. The impacts slowly spread into social fabric as the availability of drinking water diminishes, reduction in energy production, ground water depletion, food shortage, health reduction and loss of life, increased poverty, reduced quality of life and social unrest leading to migration.

### Distribution Pattern

- Around 68 per cent of India's total area is drought prone to drought.
- 315 out of a total of 725 Talukas in 99 districts are drought prone.
- 50 million people are annually affected by drought.
- In 2001 more than eight states suffered the impact of severe drought.
- In 2003 most parts of Rajasthan experienced the fourth consecutive year of drought.

### Possible Risk Reduction Measures:

There are various mitigation strategies to cope up with drought.

1. **Public Awareness and education:** If the community is aware of the do's and don'ts, then half of the problem is solved. This includes awareness on

the availability of safe drinking water, water conservation techniques, agricultural drought management strategies like crop contingency plans, construction of rain water harvesting structure. Awareness can be generated by the print, electronic and folk media.

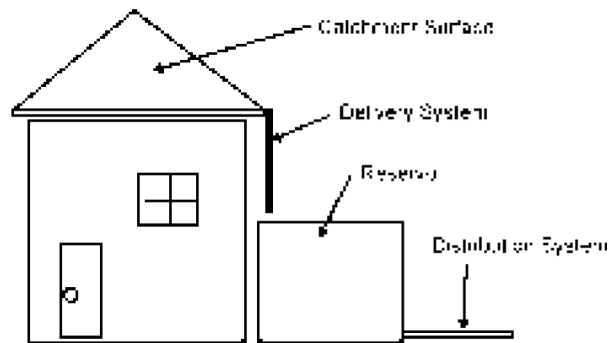


Fig. 2.5.3 Rain Water harvesting

2. **Drought Monitoring:** It is continuous observation of the rainfall situation, availability of water in the reservoirs, lakes, rivers etc and comparing with the existing water needs in various sectors of the society.

3. **Water supply augmentation and conservation** through rainwater harvesting in houses and farmers' fields increases the content of water available. *Water harvesting* by either allowing the runoff water from all the fields to a common point (e.g. Farm ponds, see the picture) or allowing it to infiltrate into the soil where it has fallen (*in situ*) (e.g. contour bunds, contour cultivation, raised bed planting etc) helps increase water availability for sustained agricultural production.

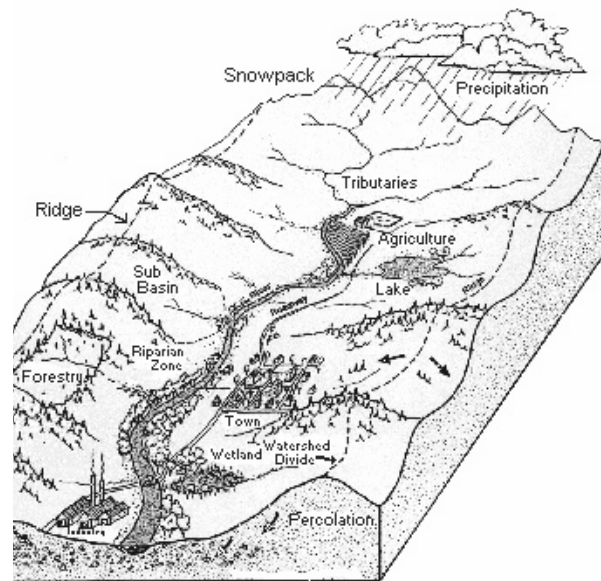


Fig 2.5.4 A watershed showing collection of water to common point.

4. **Expansion of irrigation** facilities reduces the drought vulnerability. **Land use** based on its capability helps in optimum use of land and water and can avoid the undue demand created due to their misuse.
5. **Livelihood planning** identifies those livelihoods which are least affected by the drought. Some of such livelihoods include increased off-farm employment opportunities, collection of non-timber forest produce from the community forests, raising goats, carpentry etc.

6. **Drought planning:** the basic goal of drought planning is to improve the effectiveness of preparedness and response efforts by enhancing monitoring, mitigation and response measures.
7. Planning would help in effective coordination among state and national agencies in dealing with the drought. Components of drought plan include establishing drought taskforce which is a team of specialists who can advise

the government in taking decision to deal with drought situation, establishing coordination mechanism among various agencies which deal with the droughts, providing crop insurance schemes to the farmers to cope with the drought related crop losses, and public awareness generation.



Ralegan, before drought mitigation efforts



Ralegan, after drought mitigation efforts

Fig 2.5.5

**What a mitigation approach can do? A success story**

The people of Ralegan Siddhi in Maharashtra transformed the dire straits to prosperity. Twenty years ago the village showed all traits of abject poverty. It practically had no trees, the topsoil had blown off, there was no agriculture and people were jobless. Anna Hazare, one of the India's most noted social activists,

started his movement concentrating on trapping every drop of rain, which is basically a *drought mitigation practice*. So the villagers built check dams and tanks. To conserve soil they planted trees. The result: from 80 acres of irrigated area two decades ago, Ralegan Siddhi has a massive area of 1300 acres under irrigation. The migration for jobs has stopped and the per capita income has increased ten times from Rs.225 to 2250 in this span of time. The entire effort was only people's enterprise and involved no funds or support from the Government.

**Web Resources:**

- <http://dmc.kar.nic.in/default.htm>
- [www.watershedindia.net](http://www.watershedindia.net)
- [www.rainwaterharvesting.org](http://www.rainwaterharvesting.org)
- [www.drought.unl.edu](http://www.drought.unl.edu)

**Exercise**

1. Why is drought a slow onset disaster? Identify five factors that cause drought.
2. Explain the four different types of drought
3. Identify the elements that are at risk in areas that are prone to drought and identify five risk reduction measures to combat drought.

**2.6 LANDSLIDE**

**What is a landslide?**

The term 'landslide' includes all varieties of mass movements of hill slopes and can be defined as the downward and outward movement of slope forming materials composed of rocks, soils, artificial fills or