

## 1. Details of Module and its structure

Module Detail	
Subject Name	Geography
Course Name	Geography 02 (Class XI, Semester - 2)
Module Name/Title	Natural Hazards and Disasters: Flood and Drought – Part 4
Module Id	kegy_20704
Pre-requisites	Basic Concept about monsoonal rainfall, retreating monsoon, tropical cyclone, important rivers of India.
Objectives	After reading this lesson, learners will be able to: <ul style="list-style-type: none"><li>• Differentiate between Flood and Drought.</li><li>• Understand the different causes of flood and drought.</li><li>• Acquire knowledge about the different areas affected due to flood and drought.</li><li>• know the different types of droughts.</li><li>• Learn about the precautions and mitigation techniques related to floods and droughts.</li></ul>
Keywords	Inundation, Storm Surge, National Flood Commission, Flash Flood, Evaporation, MNREGA, NDRF, ICRISAT

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## Introduction

In the previous modules of Natural hazards and disaster you read about its meaning and classification, earthquake and Tsunami in India. Now in this module we will discuss about the various aspects of floods and droughts in India in detail. As you know that India is a land of monsoon climate and monsoon is known for its uncertainties. This uncertainty of monsoon is responsible for both the flood and the drought.

The frequency and intensity of tropical depressions, determine the amount and duration of monsoon rains. The depressions follow the axis of the “monsoon trough of low pressure”. The alternation of dry and wet spells varies in intensity, frequency and duration. While it causes heavy floods in one part, it may be responsible for droughts in the other. Now let us begin with the discussion of flood in India.

## Floods

You read in newspapers and watch images of floods on televisions occurring in some regions during rainy seasons. Inundation of land and human settlements by the rise of water in the channels and its spill-over presents the condition of flooding. Unlike other natural disasters, the causes of floods are well established. Floods are relatively slow in occurrences and often, occur in well-identified regions and within expected time in a year. A **flood** is an overflow of water that submerges land.



Image 1: flood

Source: <https://commons.wikimedia.org/wiki/File:Floods.jpg>

## Causes of floods

### Causes of Flood

#### Natural Causes

- overflow of water from water bodies
- storm surge
- high intensity rainfall for a considerably longer time period
- melting of ice and snow
- reduction in the infiltration rate

#### HUMAN CAUSES

- Indiscriminate deforestation
- unscientific agricultural practices
- disturbances along the natural drainage channels
- colonisation of flood-plains and river-beds

Flooding may occur as an overflow of water from water bodies, such as a river, lake, or ocean, in which the water overtops or breaks levees, resulting in some of that water escaping its usual boundaries, or it may occur due to an accumulation of rainwater on saturated ground in an areal flood.

Floods can also occur in rivers when the flow rate exceeds the capacity of the river channel, particularly at bends or meanders in the waterway. Floods occur commonly when water in the form of surface run-off exceeds the carrying capacity of the river channels and streams and flows into the neighbouring low-lying flood plains. At times, this even goes beyond the capacity of lakes and other inland water bodies in which they flow.

Floods can also be caused due to a storm surge (in the coastal areas), high intensity rainfall for a considerably longer time period, melting of ice and snow, reduction in the infiltration rate and presence of eroded material in the water due to higher rate of soil erosion.

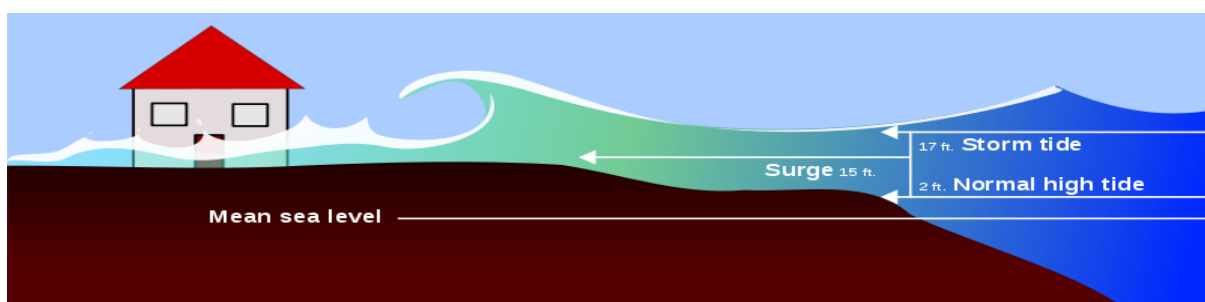


Image 2: Storm Surge

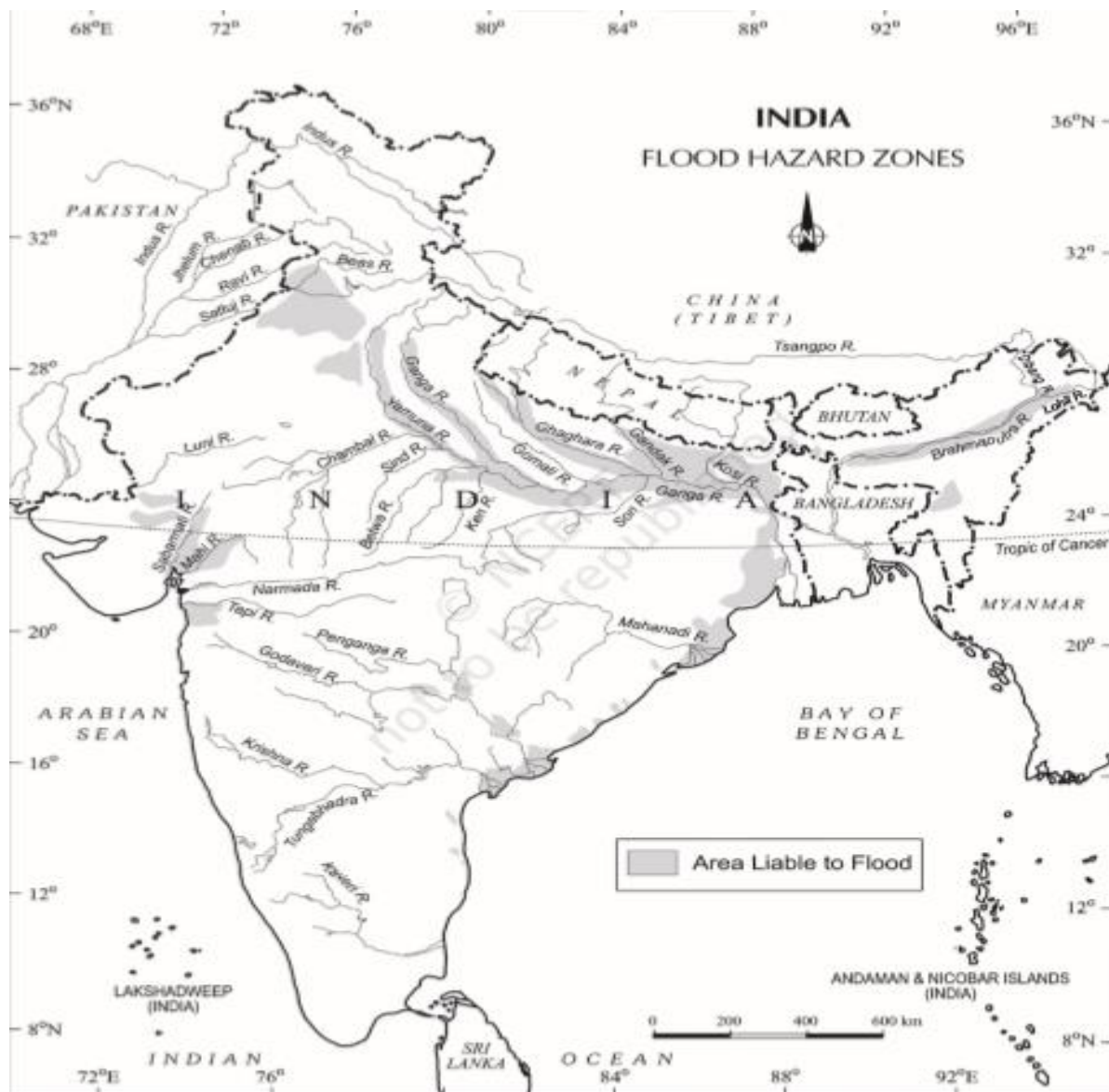
Source: <https://commons.wikimedia.org/wiki/File:Surge-en.svg>

Though floods occur frequently over wide geographical area having disastrous ramifications in many parts of the world, floods in the South, Southeast and East Asian countries, particularly in China, India and Bangladesh, are frequent and equally disastrous.

Once again, unlike other natural disasters, human beings play an important role in the genesis as well as spread of floods. Indiscriminate deforestation, unscientific agricultural practices, disturbances along the natural drainage channels and colonisation of flood-plains and riverbeds are some of the human activities that play an important role in increasing the intensity, magnitude and gravity of floods.

### Areas affected due to flood in India

Various states of India face heavy loss of lives and property due to recurrent floods. *Rashtriya Badh Ayog* (National Flood Commission) identified 40 million hectares of land as flood-prone in India.



Map: India: Flood Hazard Zones

Source: NCERT

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The above map of India shows the flood-affected areas in India. Assam, West Bengal and Bihar are among the high flood-prone states of India. Apart from these, most of the rivers in the northern states like Punjab and Uttar Pradesh, are also vulnerable to occasional floods. It has been noticed that states like Rajasthan, Gujarat, Haryana and Punjab are also getting inundated in recent decades due to flash floods. This is partly because of the pattern of the monsoon and partly because of blocking of most of the streams and river channels by human activities. Sometimes, Tamil Nadu experiences flooding during November- January due to the retreating monsoon.

The Indian monsoon (either the advancing monsoon or the retreating monsoon) is the main source of rainwater in India. The advancing monsoon is causing almost 80 to 90% of the rainfall in India. By early June, the low-pressure condition over the northern plains intensifies. It attracts, the trade winds of the southern hemisphere. These south-east trade winds originate over the warm subtropical areas of the southern oceans. They cross the equator and blow in a south westerly direction entering the Indian peninsula as the south-west monsoon. As these winds blow over warm oceans, they bring abundant moisture to the subcontinent.

The southwest monsoon after gathering enough moisture from the Arabian Sea causes heavy rainfall on to the windward side of the western Ghats which cause a situation of flood in the that region. The windward side of the Western Ghats receives very heavy rainfall, more than 250 cm. When the advancing monsoon (Bay of Bengal branch) crosses over the Bay of Bengal again it gets a large source of water and gather enough moisture from there. These moisture laden wind gets trapped in the Garo, Khasi and Jaintia hills of Meghalaya and cause a heavy downpour there. Mawsynram in the southern ranges of the Khasi Hills (Meghalaya) receives the highest average rainfall in the world.

After that the advancing monsoon turns towards the Ganga plain. Now the winds are moving from land to land. We know that when the winds move from land to land it does not cause enough rainfall as they do not have enough moisture with them. Rainfall in the Ganga valley decreases from the east to the west. For various reasons, the trough and its axis keep on moving northward or southward, which determines the spatial distribution of rainfall.

When the axis of the monsoon trough lies over the plains, rainfall is good in these parts. On the other hand, whenever the axis shifts closer to the Himalayas, there are longer dry spells in the plains, and widespread rain occur in the mountainous catchment areas of the Himalayan Rivers. These heavy rains bring in their wake, devastating floods causing damage to life and property in the plains.

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## Consequence of Floods

Frequent inundation of agricultural land and human settlement, particularly in Assam, West Bengal, Bihar and Eastern Uttar Pradesh (flooding rivers), coastal areas of Odisha, Andhra Pradesh, Tamil Nadu and Gujarat (cyclone) and Punjab, Rajasthan, Northern Gujarat and Haryana (flash floods) have serious consequences on the national economy and society.

Floods do not only destroy valuable crops every year but these also damage physical infrastructure such as roads, rails, bridges and human settlements. Millions of people are rendered homeless and are also washed down along with their cattle in the floods.

The primary effects of flooding include loss of life and damage to buildings and other structures, including bridges, sewerage systems, roadways, and canals. Floods can be local, impacting a neighborhood or community, or very large, affecting entire river basins.



Image 3: Damage Due to Flood

Source:[https://commons.wikimedia.org/wiki/File:Jamestown, Colorado Cut Off by 2013 Colorado Floods.jpg](https://commons.wikimedia.org/wiki/File:Jamestown,_Colorado_Cut_Off_by_2013_Colorado_Floods.jpg)

Floods also frequently damage power transmission and sometimes power generation, which then has knock-on effects caused by the loss of power. This includes loss of drinking water treatment and water supply, which may result in loss of drinking water or severe water contamination. It may also cause the loss of sewage disposal facilities. Lack of clean water combined with human sewage in the flood waters raises the risk of waterborne diseases, which can include typhoid, giardia, cryptosporidium, cholera and many other diseases depending upon the location of the flood.

However, floods also make a few positive contributions. Every year, floods deposit fertile silt over agricultural fields which is good for the crops. Majuli (Assam), the largest riverine island in the world, is the best example of good paddy crops after the annual floods in Brahmaputra. But these are insignificant benefits in comparison to the grave losses.



Image 4: Silt Deposition Due to Flood

Source: [https://en.wikipedia.org/wiki/File:Silt\\_deposition\\_at\\_Kosi\\_embankment\\_at\\_Navbhata\\_near\\_Saharsa.JPG](https://en.wikipedia.org/wiki/File:Silt_deposition_at_Kosi_embankment_at_Navbhata_near_Saharsa.JPG)

### **Preparedness and mitigation**

The Government of India as well as the state governments are well aware of the menace created by floods every year. How do these governments generally respond to the floods? Construction of flood protection embankments in the flood-prone areas, construction of dams, afforestation and discouraging major construction activities in the upper reaches of most of the flood-creating rivers, etc. are some steps that need to be taken up on urgent basis. Removal of human encroachment from the river channels and depopulating the flood plains can be the other steps. This is particularly true in western and northern parts of the country which experience flash-floods.



Image 5: Flood mitigation dam

Source: [https://www.flickr.com/photos/gawler\\_history/29447941463](https://www.flickr.com/photos/gawler_history/29447941463)

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## What to do before a flood

To prepare for a flood, you should:

- Avoid building in flood prone areas unless you elevate and reinforce your home.
- Elevate the furnace, water heater, and electric panel if susceptible to flooding.
- Install "Check Valves" in sewer traps to prevent floodwater from backing up into the drains of your home.
- Contact community officials to find out if they are planning to construct barriers (levees, beams and floodwalls) to stop floodwater from entering the homes in your area.
- Seal the walls in your basement with waterproofing compounds to avoid seepage.

## If a flood is likely to hit your area, you should:

- Listen to the radio or television for information.
- Be aware that flash flooding can occur. If there is any possibility of a flash flood, move immediately to higher ground. Do not wait for instructions to move.
- Be aware of streams, drainage channels, canyons, and other areas known to flood suddenly. Flash floods can occur in these areas with or without such typical warnings as rain clouds or heavy rain.



Image 6: Flash Flood

Source:[https://upload.wikimedia.org/wikipedia/commons/9/9b/Driving\\_through\\_flash\\_flood.jpg](https://upload.wikimedia.org/wikipedia/commons/9/9b/Driving_through_flash_flood.jpg)

## If you must prepare to evacuate, you should:

- Secure your home. If you have time, bring in outdoor furniture. Move essential items to an upper floor.
- Turn off utilities at the main switches or valves if instructed to do so. Disconnect electrical appliances. Do not touch electrical equipment if you are wet or standing in water.





Image 7: turning off electrical switches

Source: <https://www.flickr.com/photos/paulcross/4333070249>

**If you have to leave your home, remember these evacuation tips:**

- Do not walk through moving water. Six inches of moving water can make you fall. If you have to walk in water, walk where the water is not moving. Use a stick to check the firmness of the ground in front of you.
- Do not drive into flooded areas. If floodwaters rise around your car, abandon the car and move to higher ground if you can do so safely. You and the vehicle can be quickly swept away.

**Emergency kits**

- Battery operated torch
- Battery operated radio
- First aid kit and essential medicines
- Emergency food (dry items) and water (packed and sealed)
- Candles and matches in a waterproof container
- Knife
- Chlorine tablets or powdered water
- Thick ropes and cords



Image 8: flood emergency kit

Source: [https://en.wikipedia.org/wiki/Survival\\_kit#/media/File:Moscow\\_Polytechnical\\_Museum\\_cosmonaut's\\_survival\\_kit.jpg](https://en.wikipedia.org/wiki/Survival_kit#/media/File:Moscow_Polytechnical_Museum_cosmonaut's_survival_kit.jpg)

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## Droughts

The term 'drought' is applied to an extended period when there is a shortage of water availability due to inadequate precipitation, excessive rate of evaporation and over-utilization of water from the reservoirs and other storages, including the ground water.

A **drought** is an event of prolonged shortages in the water supply, whether atmospheric (below-average precipitation), surface water or ground water. A drought can last for months or years, or may be declared after as few as 15 days. It can have a substantial impact on the ecosystem and agriculture of the affected region and harm to the local economy. Annual dry seasons in the tropics significantly increase the chances of a drought developing and subsequent bush fires. Periods of heat can significantly worsen drought conditions by hastening evaporation of water vapour.



Image 9: Drought Area

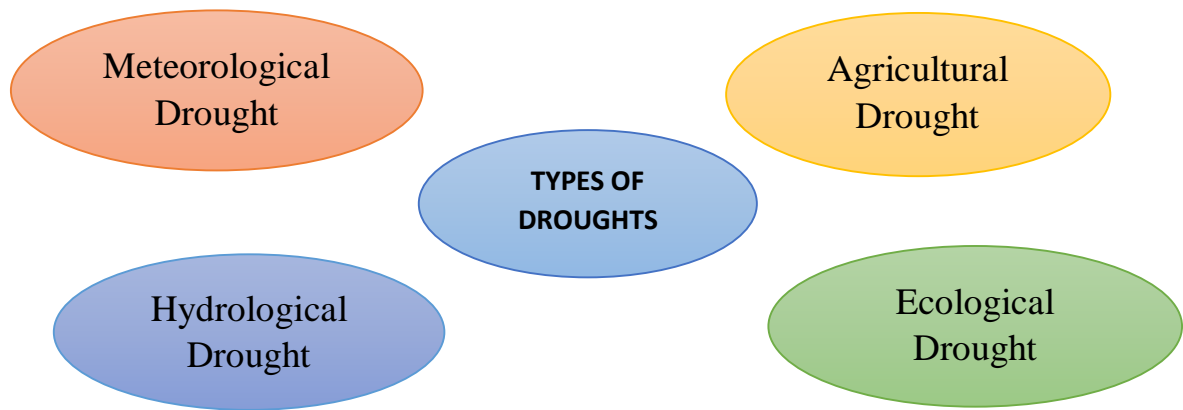
Source:<https://www.wallpaperflare.com/lack-of-rain-dry-season-parched-drought-desert-dehydrated-wallpaper-gachj>

*Drought is a complex phenomenon as it involves elements of meteorology like precipitation, evaporation, evapotranspiration, ground water, soil moisture, storage and surface run-off, agricultural practices, particularly the types of crops grown, socio-economic practices and ecological conditions.*

### Types of Droughts

The different types of droughts are as follows:

1. Meteorological Drought
2. Agricultural Drought
3. Hydrological Drought
4. Ecological Drought



**Meteorological Drought:** It is a situation when there is a prolonged period of inadequate rainfall marked with mal-distribution of the same over time and space.

**Agricultural Drought:** It is also known as soil moisture drought, characterised by low soil moisture that is necessary to support the crops, thereby resulting in crop failures. Moreover, if an area has more than 30 per cent of its gross cropped area under irrigation, the area is excluded from the drought-prone category.

**Hydrological Drought:** It results when the availability of water in different storages and reservoirs like aquifers, lakes, reservoirs, etc. falls below what the precipitation can replenish.

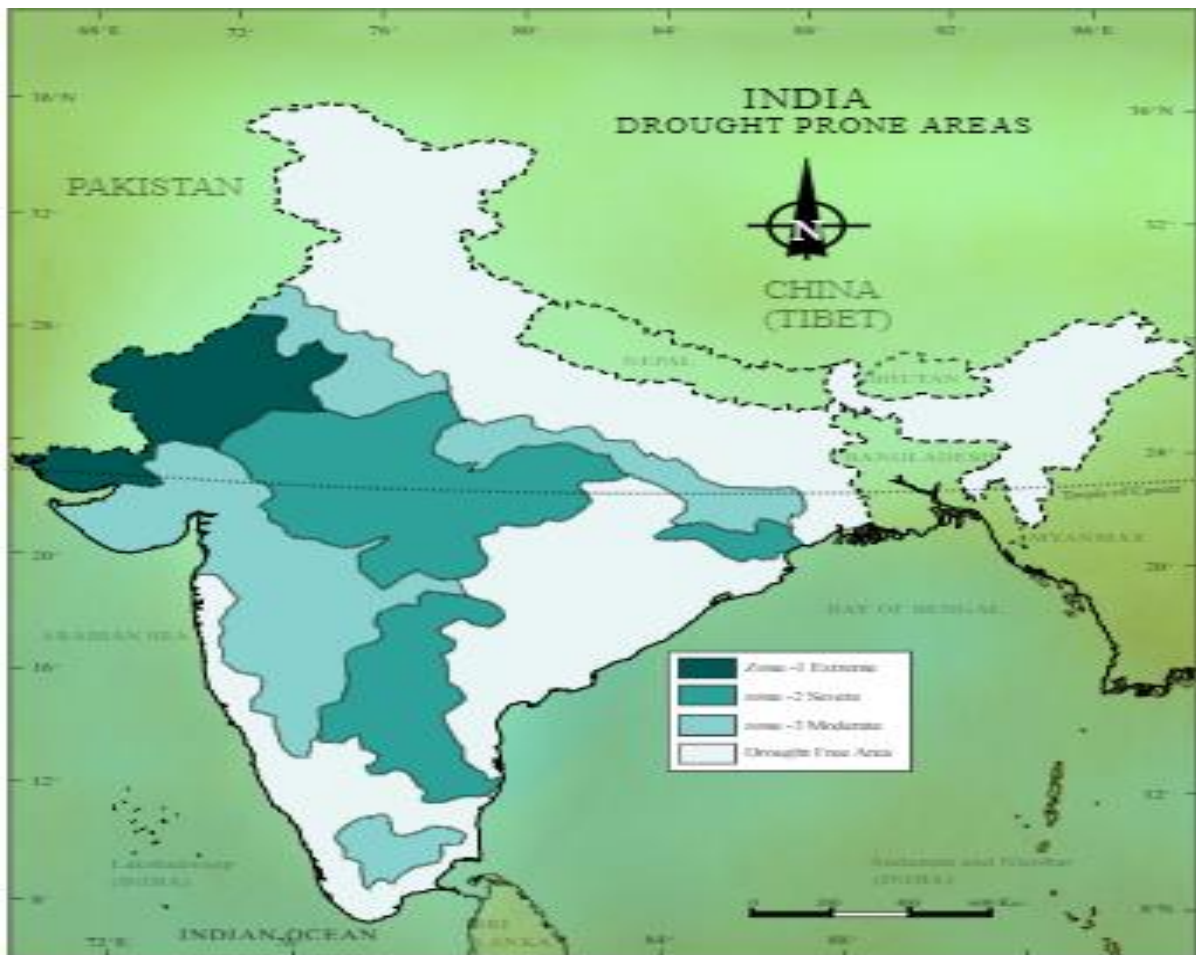
**Ecological Drought:** When the productivity of a natural ecosystem fails due to shortage of water and as a consequence of ecological distress, damages are induced in the ecosystem. Various parts of India experience these droughts recurrently which result in some serious socio-economic and ecological problems.

### **Drought Prone Areas in India**

Indian agriculture has been heavily dependent on the monsoon rainfall. Droughts and floods are the two accompanying features of Indian climate. According to some estimates, nearly 19 per cent of the total geographical area of the country and 12 per cent of its total population suffer due to drought every year. About 30 per cent of the country's total area is identified as drought prone affecting around 50 million people.

It is a common experience that while some parts of the country reel under floods, there are regions that face severe drought during the same period. Moreover, it is also a common sight to witness that one region suffers due to floods in one season and experiences drought in the other. This is mainly because of the large-scale variations and unpredictability in the behaviour of the monsoon in India.

Thus, droughts are widespread and common phenomena in most parts of the country, but these are most recurrent and severe in some and not so in others. On the basis of severity of droughts, India can be divided into the following regions:



Map: India: Drought Prone Zones

Source: <https://nroer.gov.in/55ab34ff81fccb4f1d806025/file/57cff60e16b51c038dedcbad>

**Extreme Drought Affected Areas:** It is evident from the Figure 7.8 that most parts of Rajasthan, particularly areas to the west of the Aravali hills, i.e. Marusthali and Kachchh regions of Gujarat fall in this category. Included here are also the districts like Jaisalmer and Barmer from the Indian desert that receive less than 90 mm average annual rainfall.

**Severe Drought Prone Area:** Parts of eastern Rajasthan, most parts of Madhya Pradesh, eastern parts of Maharashtra, interior parts of Andhra Pradesh and Karnataka Plateau, northern parts of interior Tamil Nadu and southern parts of Jharkhand and interior Odisha are included in this category.

**Moderate Drought Affected Area:** Northern parts of Rajasthan, Haryana, southern districts of Uttar Pradesh, the remaining parts of Gujarat, Maharashtra except Konkan, Jharkhand and Coimbatore plateau of Tamil Nadu and interior Karnataka are included in this category. The remaining parts of India can be considered either free or less prone to the drought.

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## Consequences of Drought

Droughts have cascading effects on various other aspects of environment and society. Crop failure leading to scarcity of food grains (akal), fodder (trinkal), inadequate rainfall, resulting in shortage of water (jalkal), and often shortage in all the three (trikal) is most devastating. Large-scale death of cattle and other animals, migration of humans and livestock are the most common sight to be seen in the drought affected areas. Scarcity of water compels people to consume contaminated water resulting in spread of many waterborne diseases like gastro-enteritis, cholera, hepatitis, etc.

Droughts have both immediate as well as long-term disastrous consequences on the social and physical environments. Consequently, planning for drought has to take both aspects into consideration. Provision for the distribution of safe drinking water, medicines for the victims and availability of fodder and water for the cattle and shifting of the people and their livestock to safer places, etc. are some steps that need to be taken immediately.

Identification of ground water potential in the form of aquifers, transfer of river water from the surplus to the deficit areas, and particularly planning for inter-linking of rivers and construction of reservoirs and dams, etc. should be given a serious thought. Remote sensing and satellite imageries can be useful in identifying the possible river-basins that can be inter-linked and in identifying the ground water potential. Dissemination of knowledge about drought-resistant crops and proper training to practise the same can be some of the long-term measures that will be helpful in drought-mitigation. Rainwater harvesting can also be an effective method in minimizing the effects of drought.

Drought in India has resulted in tens of millions of deaths over the 18th, 19th, and 20th centuries. Indian agriculture is heavily dependent on the country's climate: a favorable southwest summer monsoon is critical to securing water for irrigating India's crops. In parts of India, failure of the monsoons causes water shortages, resulting in below-average crop yields. This is particularly true of major drought-prone regions such as southern and eastern Maharashtra, northern Karnataka, Andhra Pradesh, Odisha, Gujarat, Telangana, and Rajasthan.

In the past, droughts have periodically led to major Indian famines, including the Bengal famine of 1770, in which up to one third of the population in affected areas died; the 1876–1877 famine, in which over five million people died; and the 1899 famine, in which over 4.5 million died. 1972 Maharashtra drought affected 2.5 crore people. In simple words, drought has destroyed India on a large scale.

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## Preparedness and mitigation

Mitigation actions, programs, and policies are implemented during and before drought to reduce the magnitude of risk to human life, property, and productive capacity. Emergency response will always be a part of drought management, because it is unlikely that government and others will anticipate, avoid, or reduce all potential impacts through mitigation programs. A future drought event will also exceed the “drought of record” and the capacity of a region to respond. However, emergency response will be used lesser and only, if it is consistent with the longer-term drought policy goals and objectives. Considering the increase in the frequency of droughts in different parts of the country, it is necessary that there is a shift in public policy from drought relief to drought mitigation measures. These measures are important for adapting to climate change, restoring ecological balance, and bringing development benefits to the people.

The government of India has adopted a three pronged strategy to face droughts:

- a) The drought affected areas will be provided relief under scarcity relief programmes. (Drought Prone Area Development Programme and Desert Development Programme)
- b) Special area development programmes are designed for the drought prone areas and desert areas.
- c) Dry farming agriculture is being promoted by the government in the drought prone areas to overcome the shortage of food grain supply in that areas.
- d)



Image 10: Dryland farming

Source: [https://en.wikipedia.org/wiki/Dryland\\_farming#/media/File:Camposcala.JPG](https://en.wikipedia.org/wiki/Dryland_farming#/media/File:Camposcala.JPG)

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The government of India has also some preparedness programmes and schemes for the drought like condition like:

- a) Integrated Watershed management programmes targeting millions hectare of the rain fed areas.
- b) The green India mission – which aims to restore 10Mha area in 10 years.
- c) MNREGA Scheme- according to this scheme (Mahatma Gandhi National Rural Employment Guarantee Act) a very strong focus is put on land, water and afforestation activities.



Image 11: Mnrega

Source: <https://commons.wikimedia.org/wiki/File:Nregs.jpg>

- d) The National Disaster Response Fund (NDRF) and State Disaster Response Fund (SDRF) constituted under 2005 Disaster Management Act, provide immediate drought relief to the affected people.
- e) For combating the adverse financial impacts of drought, the National Agricultural Insurance Scheme (NAIS) was introduced in 1999 and Weather Based Crop Insurance Scheme in 2007.
- f) The Drought Management Group was constituted to coordinate the efforts to deal with drought in various states. The National Disaster Management Cell monitors the drought situation in different states, National Calamity Contingency Fund from the Government deals with calamities of severe nature.
- g) Drought Prone Area Development Programme and Desert Development Programme use the plans prepared on the basis of the integrated estimation.
- h) Research institutions like the International Crops Research Institute for Semi-arid Tropics (ICRISAT); Central Arid Zone Research Institute; Indian Grassland and Fodder Research Institute; Indian Council of Forestry Research and Training etc. are some of institutes that are involved in drought management.

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In the end of this module it can be concluded that flood and drought are two sides of the same coin that is monsoon. It is the Indian monsoon which is greatly responsible for the situation of both flood and drought in the country. Due to these two natural calamity number of people are getting affected. Both flood and drought causes loss of life and property. Overtime, the Indian government has made a strong strategy to overcome the problems of flood and drought. Now the government is doing a lot for the preparedness and mitigation of flood and drought in the country, various programmes and policies were introduced in this regard.