Lesson - 11

Natural Disasters and Management (Flood, Drought and Sea Storms)

Flood & Drought

Due to heavy or continued rains, when river water spreads in a large area by breaking levees, it is known as **flood**. When the rains are too scanty, not only for crops but also for the requirements of drinking water, it is termed as **drought**. Flood occurs due to excessive rains. Drought occurs due to lack of or scanty rains. Both type of extremities during rainy season in Bharat become the cause of these natural disasters. Occurrence of floods and droughts are repeated every year in one or the other part of Bharat. About 4 crore hectares area is considered as flood prone, while drought prone area is much larger.

Both the natural disasters affect Bharat due to its large size and monsoon climate. Bhartiya populace have been bearing the blunts of these disasters for centuries with ease due to their modest and contented nature.

Floods (Excessive Rains)

Causes of Floods

When the river water spreads all around by spilling over from its banks, it results into flood. But there are various factors responsible for floods. When it rains heavily in the catchment area of a river, the increased volume of water doesn't find enough space in the valley to flow, it begins to spill over in all directions. In rainy season, the sediments accumulate in the river bed making it shallow. As a result, the increased volume of water spills over to cause floods. Due to deforestation and destruction of pastures, the rain water flows swiftly to join the main stream. When it increases beyond its capacity, it causes floods. Dense forests and pastures hinder the flow of water. It raises the underground water level and checks flooding.

Besides natural factors, man has also increased the possibilities of flooding by his illogical actions, e.g. development of settlements blocking water courses, irrational construction of transportation routes, destruction of traditional water harvesting areas and blocking natural flow of water by illegal constructions.

Flood-prone areas of Bharat

The flood prone areas of Bharat are determined by distribution of rains. More than 90% of the total loss in Bharat due to floods occurs in the northern and north-eastern regions. In northern Bharat, rainfall decreases from east to west. The same pattern emerges in Bharat in flood prone areas. The severity of floods is lesser in the rivers of north-western Bharat, e.g. in Sutlej, Vyas, Ravi, Chinab and Jhelum rivers, while floods are more severe and frequent in the eastern rivers like Ganga, Yamuna, Gomati, Ghaghra and Gandak rivers. The flooding in Kosi and Damodar rivers is very damaging. Hence, Kosi river has been termed as **Sorrow of Bihar** and Damodar river as **Sorrow of Bengal**.

Brahmaputra river flows in the north-eastern Bharat. It causes floods every year. The average annual rainfall is also more than 250 cms. in this region. When it rains heavily in northern and north-eastern Bharat, floods occur in the rivers of the region. If coincidentally it also rains heavily in central Bharat, the severity of floods increases. The

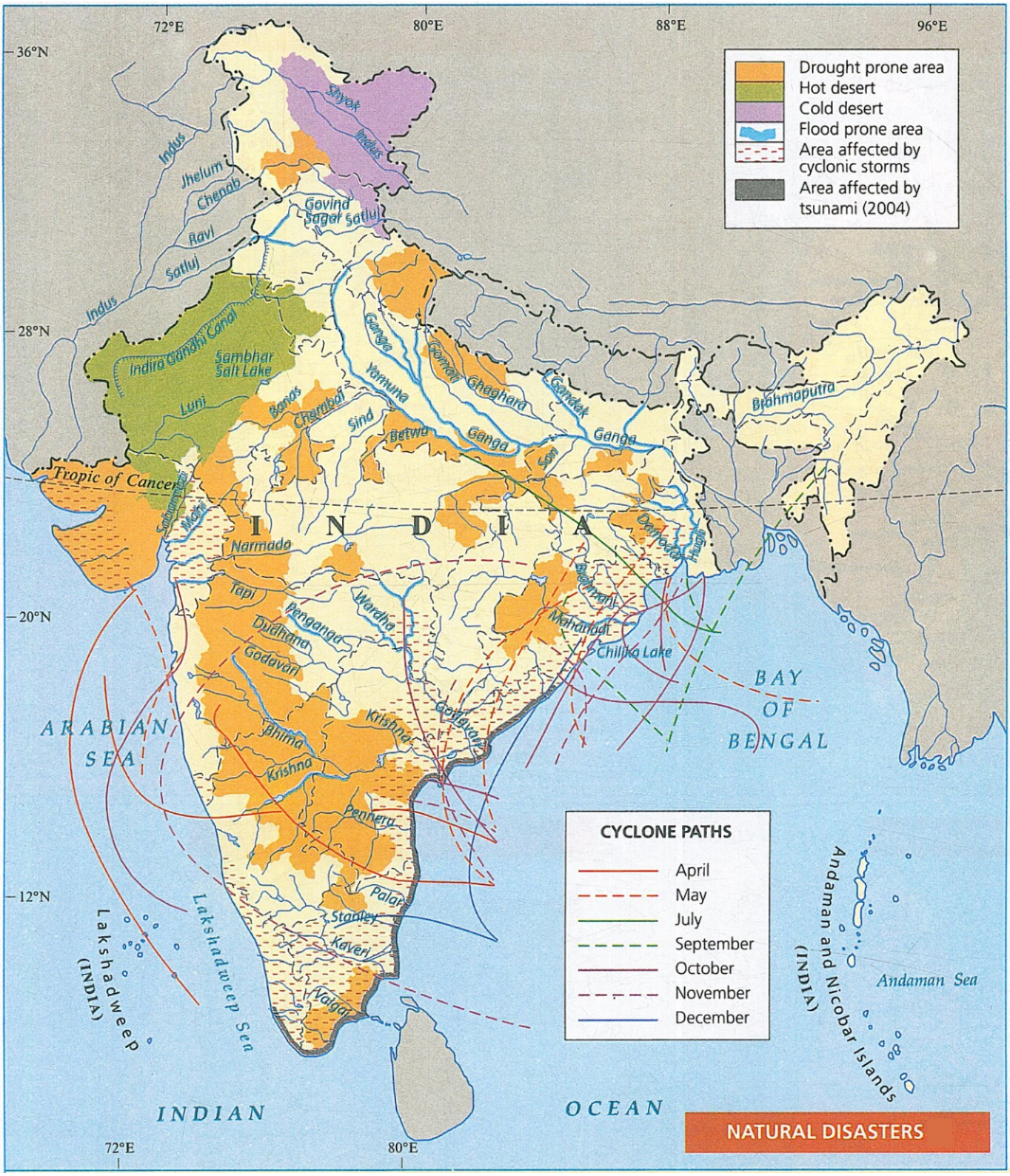


Fig. 11.1 : India : Natural Disasters (Cyclone)

rivers Chambal, Son, Betwa and Damodar drain rain water from central Bharat. Water of these rivers joins with the water brought by the rivers coming from the north, so that it spreads in a huge area and is highly damaging.

In peninsular Bharat, floods are more frequent in the coastal regions of Mahanadi, Godawari, Krishna and Kaveri rivers. Most of the peninsular rivers flow from west to east. These rivers originate in the Western Ghats and drop their waters into Bay of Bengal. The catchment areas of these rivers are smaller than that of the rivers of northern Bharat. Hence the severity of floods of these rivers is lesser than that of the rivers of northern Bharat. The main fact regarding occurrence of floods in Bharat is that the floods are highly damaging if heavy and continuous rains added with the active situations like cloudbursts occur in any part of Bharat. Flood prone areas have been shown in Fig. 11.1.

Major Cyclones of India

Cyclone Phethai – 2018

Cyclone Phethai is part of the ongoing 2018 North Indian Ocean cyclone season over the Bay of Bengal

Cyclone Gaja – 2018

Cyclone Gaja hit the Tamil Nadu, Andhra Pradesh and some parts of coastal Puducherry with heavy rainfall in Cuddalore and Pamban.

Cyclone Titli – 2018

Very severe cyclonic storm Titli was part of the 2018 North Indian Ocean cyclone season and makes landfall in Odisha's Gopalpur and Srikakulam of Andhra Pradesh.

Cyclone Ockhi – 2017

Cyclone Ockhi was the most intense and one of the most strongest tropical cyclone of the 017 North Indian Ocean cyclone season. Ockhi from the Arabian Sea affected mainland India along with coastal areas of Kerala, Tamil Nadu and Gujarat.

Cyclone Vardah – 2016

Cyclone Vardah brought heavy rainfall to Andaman and Nicobar Islands then crossed the eastern coast of India and affected Chennai, Kancheepuram and Visakhapatnam.

Cyclone Hudhud – 2014

Cyclone Hudhud was a strong tropical cyclone, done damage to Visakhapatnam city of Andhra Pradesh. Visakhapatnam or Vizag along with Odisha was mostly affected by Hudhud.

Cyclone Phailin – 2013

Cyclone Phailin was second strongest tropical cyclone in India since the 1999 Odisha cyclone, resulted heavy rainfall in Odisha,Andhra Pradesh, Jharkhand as well as other Indian states.

Cyclone Helen – 2013

Cyclone Helen brought heavy rainfalls in eastern India and became a Severe Cyclonic Storm in India. Cyclonic Storm Helen formed in the Bay of Bengal Region and affected Andhra Pradesh.

Cyclone Nilam – 2012

Cyclone Nilam was the deadliest tropical cyclone in India, Originating from an area of Bay of Bengal in South India. The heavy rains and strong winds by Cyclone Nilam affected Chennai Port of Tamil Nadu and New Port railway station in Kakinada in Andhra Pradesh.

Cyclone Phyan – 2009

Cyclone Phyan emerged into the Arabian Sea and caused heavy rainfall in Tamil Nadu, Maharashtra and Gujarat. Phyan was one of the wettest cyclone in India and brought extremely heavy rainfall of over the coasts of Karnataka, Goa and Maharashtra.

Odisha Cyclone – 1999 – Strongest

The Orissa cyclone in the year of 1999 was the strongest storm to hit the Indian coast and also the strongest tropical cyclones that affected India, Here is the list of strong tropical cyclones that affected India.

India Meteorological Department
Tropical Cyclone Intensity Scale

Category	Sustained winds (3-min average)
Super Cyclonic Storm	≥120 kt ≥221 km/h
Extremely Severe Cyclonic Storm	90–119 kt 166–220 km/h
Very Severe Cyclonic Storm	64–89 kt 118–165 km/h
Severe Cyclonic Storm	48–63 kt 89–117 km/h
Cyclonic Storm	34–47 kt 63–88 km/h
Deep Depression	28–33 kt 51–62 km/h
Depression	17–27 kt 31–50 km/h

Floods - Problems and Adversities

Of all the natural hazards, the floods cause the highest damage annually in Bharat. Despite progressive steps, magnitude of loss due to floods in the country is continuously rising, whether the loss of human life or property. More than 1500 persons are estimated to be dying every year due to floods in Bharat. More than 80 lakh hectares of land is affected by floods. The crops are damaged in 35 lakh hectares of land. Human life is disturbed in 3 crore hectares area. Economically, the country suffers the loss of about Rs. 1000 crores. Floods cause maximum damage to cattle life. About 12 lakh cattle are lost. More than 12 lakh houses are damaged.

Of the total loss by floods in Bharat, more than 60% occurs in Uttar Pradesh and Bihar. West Bengal, Assam and Orissa follow the list of loss by floods.

The problem of flood disturbs the life totally. Transportation routes are blocked and crops are destroyed. The sources of drinking water are damaged and contaminated. The means of communication are affected adversely. There remains a high risk of the spread of epidemics in the flood affected areas due to accumulation of filth. Dams, tanks and canals are damaged. The mean annual losses due to flood in Bharat are shown in Table 11.1.

Table 11.1
Major Flood Damage in India

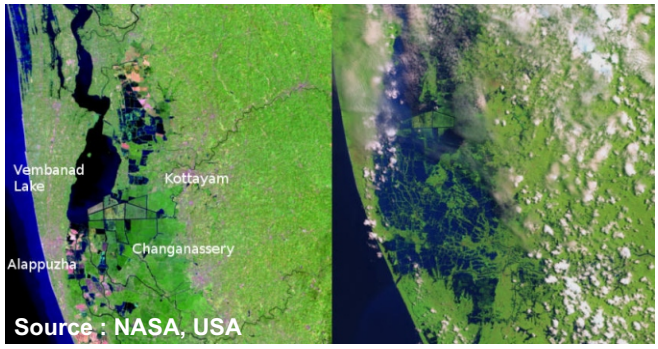
KERALA TOLL AT 387

States	Affected Districts	Lives Lost	In Relief Camps	Total Affected Population
Kerala	14	387	14.5 lakh	54.1 lakh
UP	16	204	10,800	2.4 lakh
W Bengal	23	195	NA	2.3 lakh
Karnataka	11	161	5,800	3.5 lakh
Assam	23	46	2.4 lakh	11.5 lakh

Data as on August 22; Source: Disaster management division, MHA

Management and Responsibilities during Floods

1. At Government and Social Level – Efforts were made initially to control the occurrence of floods. With this objective National Flood



Kerala Flood 2018 Before & After

Control Project was started in 1954. Construction of embankments and water channels was started. Under this scheme, 33630 kms. long embankments and 37904 kms. long water channels were constructed.

In flood affected areas, dams were constructed as part of multipurpose projects. Dams were built on - Mahanadi, Damodar, Sutlej, Vyas, Chambal and Narmada rivers.

Tree plantation in the source region and catchment areas of rivers is essential to check soil erosion and the consequent silt deposition in river beds and to check speedy flow of water in the valleys. Irrational deforestation should be banned, in addition to the plantation efforts.

While constructing transport routes, precautions should be taken so that natural flow of water is not obstructed.

Water accommodating capacity of the rivers should be increased before the rains. The sediments deposited on the river beds should be taken out and be used for embankments. This will not only increase water accommodating capacity of the rivers but embankments will also be higher and sturdy.

An organization was constituted in 1954 for predicting flood and minimizing the loss by floods. At present, flood control cells have been established at all district headquarters. Meteorological and Irrigation Departments closely observe rainfall and water flow during the rainy season. The public should be well informed about the situation through the sources of media.

2. At Individual Level – People should be in touch with radio and television news during rains. If they are residing in flood prone areas, they should abide by the government instructions and advise.

Electric equipments must be switched off. Valuable goods, cloths and food stuffs should be shifted to safer places, so that until the flood water recedes, everybody can receive due care. Pets and vehicles must be moved to safer places. One should shift to a safer place immediately on water level touching the danger mark in the house. Before leaving the house, main entrance should be locked. Unknown depths and flow of water should not be crossed by vehicle or on foot.

Drought (Paucity of Rain)

In the given geographical conditions of an area, if the rainfall is so lower than the mean that it is insufficient for agriculture and household requirements, then that area is termed as drought affected. Drought is a natural disaster related to the paucity or negligible rain. Droughts are very common in some areas of Bharat.

It is essential to understand the difference between drought and aridity. Both signify shortage of water. Aridity is related to climate and geographical conditions whereas drought is temporary phenomena arising from the rainfall lower than the mean. Droughts are seldom in areas having sufficient rainfall. Arid and semi-arid areas are more prone to droughts. The Irrigation Commission of Central Government has designated arid areas where mean annual rainfall is less than 10 cms.

Causes of Drought

Various factors are responsible for the occurrence of droughts. The main reason is insufficient rains. Uneven distribution and uncertainty of rainfall is inherent in monsoonal climatic conditions. The underground water level is also reduced due to scanty and uncertain rains. Hence the availability of underground water is also reduced. Rainfall decreases due to deforestation which also reduces the amount of water seepage. The rain water goes waste by draining away into rivers in the absence of obstacles. Underground water level also decreases due to the destruction of natural sources of water. In the absence of sustainable water policy, there is lack of proper exploitation and utilization of water. Continuous increase in population also affects the sources of water supply and results in its shortage. Hence it is clear that scarcity of water is the main cause of drought. The scarcity may be of rain water or underground water.

Drought Prone areas of Bharat

Western Bharat is the most drought prone area. Droughts are most frequent in Rajasthan and Gujarat. Droughts also occur in Haryana, some parts of Madhya Pradesh, central Maharashtra, central and eastern Karnataka. Occasionally Orissa, Himachal Pradesh and parts of western Uttar Pradesh also experience drought. The main cause for this is insufficient and uncertain rainfall. In some states of Bharat, drought is a permanent feature. These states are Rajasthan and Gujarat.

About 30% of the country's area is affected by drought every year and on an average 5 crore people are affected by drought annually. Irrigation Department of Bharat has classified these areas into two groups – First, areas having more than 25% uncertainty of rainfall which include western Rajasthan and western Gujarat. Second, areas having less than 25% uncertainty of rainfall which include eastern Rajasthan, Punjab, Haryana, Uttaranchal, western Madhya Pradesh, central Maharashtra, interior Karnataka, southern Andhra Pradesh, central Karnataka, north-western Bihar, western Uttar Pradesh and Orissa. About 77 districts of Bharat have been marked as famine prone and most of these districts are situated in western Bharat. More than half districts of Rajasthan and Gujarat are generally drought prone. The drought prone areas of Bharat are shown in Fig. 11.1 & Fig.11.2.

Droughts - Problems and Adversities

The biggest adversity as a result of drought occur in the form of famines. The severity of famine increases with the scarcity of water. There are **three facets of famine**. First, if the crops are destroyed causing unsufficient production of food grains due to paucity of rains, it is known as **food grain famine**. Second, if the rainfall is so scanty that there is insufficient production of food grain and fodder both, it is termed as **food and fodder famine**. It is also known as **dual famine (Dwikal)**. Third, if the rainfall is so less that there is insufficient production of food grains and fodder as well as scarcity of drinking water, it is known as **tri-famine (Trikal)**. In Rajasthan, Trikal of 1987 took the lives of

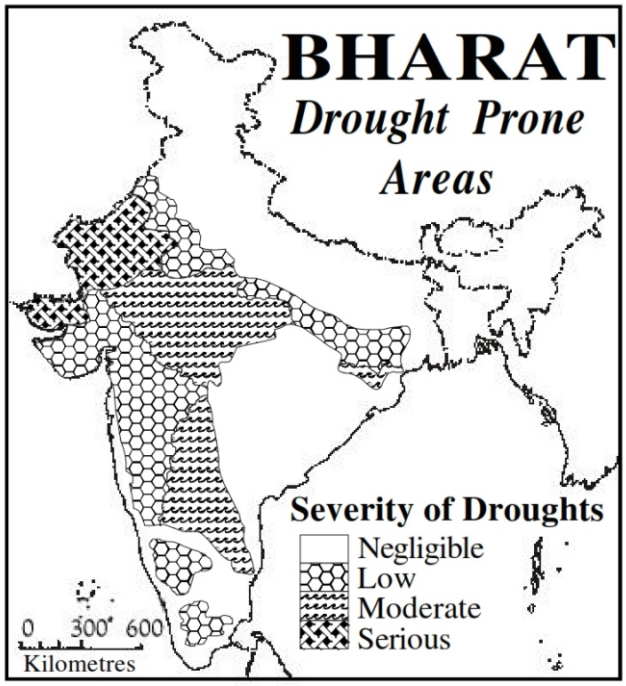


Fig. 11.2 : India : Drought Prone Areas

thousands of cattle. During trikal, relief operations run by central and state governments and by voluntary organizations appear to be insufficient to the public.

The trikal of Vikram Samvat 1956 (1900 A.D.) which is also known as **Famine of fifty six (Chhappaniya Akaal)**, is considered as the worst famine till today. The years of severe droughts and areas affected in Bharat are listed in table 11.2.

Table 11.2
Years of Severe Droughts and Areas Affected in Bharat

S.No.	Year	Affected area (in lakh sq.kms.)
1.	1877	20
2.	1899	19
3.	1918	21
4.	1987	15

Drought results in the scarcity of food grains, water and fodder. People and cattle start migrating from the famine affected areas. Thus several villages are deserted. Continuous famines destroy forests and pastures. Agro-based industries do not get raw materials. Malnutrition increases. Price-hike, hoarding and corruption take steep rise. The debt-burden increases on both the governments and the people of the affected areas. Social homogeneity also suffers.

Drought - Management and Responsibility during the Adversity

1. At Government and Social Level – Drought is associated with scarcity of water. Amount of rainfall depends upon weather conditions. Methods of making water available in a region depends upon the efforts made by the society. Attempts should be made to develop water harvesting areas at village level. The traditional water sources available both at village and town level should be fully utilized. Small annicuts should be constructed to improve the underground water level in villages. Tendency of people's participation in governmental efforts for developing water harvesting areas and traditions of Shramdan should be reinstated.

The severity of drought can be reduced by the availability of underground water. Therefore, new aquifers should be explored through the use of remote sensing satellite mapping and Geographical Information System (G.I.S.)

For long term management of drought, massive task like inter-linking of rivers should be taken up. It will have two fold advantage. Firstly, in areas where ample rain water is available and where floods occur frequently, the problem of flooding will be solved. Secondly, the surplus water of the rivers will be of great use in areas where the underground water and rain water is in scarcity. Proper use of surplus surface flow in this manner will slowly raise the underground water level. The raised underground water level will indirectly help in the growth of greenery in long term.

2. At Individual Level – At this level, it is utmost important to educate people so that they understand the importance of water. They should take interest in the collection and storage of water. They should construct tanks (Tankas) in their houses. Pucca tanks can store the rainwater for its use throughout the year. Kaccha tanks (earthen tanks) will be useful in increasing the underground water level in their area.

In rural areas, people should make earthen

boundary wall all along their fields to store the rainwater. It will increase underground water level in the rural areas through enhanced percolation.

Such seeds should be used which require less water and also take less time in giving the desired production.

People should help each other at the time of drought. This attitude will change the condition of drought into a little comfortable situation.

Sea-Storms

The sea storms are also known as Cyclones in Bharat. These cyclones hover around the tropical zone, therefore, they are called tropical cyclones. In Bharat, the tropical cyclones originate in the oceanic areas and enter into the country through Bay of Bengal and Arabian Sea. Since tropical cyclones originate in the sea, they are laden with moisture. They provide heavy rainfall in coastal areas. Their velocity is also high in coastal regions. Their velocity and the amount of rainfall decreases towards inland areas. Due to high velocity and heavy rainfall, great loss of life and property occurs in coastal areas.

Sea Storms - Causes of Origin

There are difference of opinion regarding the origin of sea storms (Tropical cyclones) in Bharat. Propounders of Frontal Theory believe that these cyclones originate due to frontogenesis like other cyclones. Critiques see a weakness in the theory due to the fact that there is the absence of two air-masses having different characteristics in the equatorial region. More acceptable hypothesis relates origin of cyclones to the convectional process. Under this process, light air rises above the warm oceanic water. The consequent low pressure attracts winds from all directions which result in the genesis of cyclones or sea storms from the atmospheric disturbances. It is important to note that these storms originate in summer only. These are absent in the equatorial regions. These storms originate between 5° to 30° North latitudes.

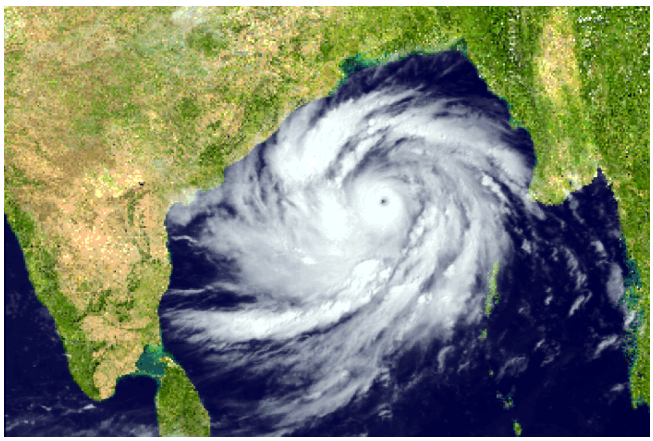


Fig. 11.3 : India : Cyclone in Bay of Bengal

In Arabian sea and Bay of Bengal, these cyclones remain active from April to December, but are more frequent in the month of June, July and August. Their annual average frequency is 2 from the Arabian Sea side and 6 to 7 from the Bay of Bengal side in Bharat. Some cyclones die in the coastal areas only while a few cyclones penetrate in the inner areas and cause heavy loss of life and property. Their inward penetration depends upon the intensity of low pressure in the north-western Bharat due to high temperature. Probable months and tracks of tropical cyclones traversing Bharat have been shown in figure 11.1 and their frequencies given in the table 11.3.

Cyclones also visit north-western Bharat in winter season, but these are temperate cyclones. They enter into Bharat from western and north-western side. They provide **winter rains (Mawat)** in north-western Bharat. It is very useful for the Rabi crop.

Table 11.3
Frequency of Cyclones in Bharat

Month	Arabian Sea	Bay of Bengal
January	02	04
February	00	01
March	00	04
April	05	18
May	13	28
June	13	34
July	03	38
August	01	25
September	04	27
October	17	53
November	21	56
December	03	26

Sea Storms – Affected Areas

Bhartiya western and eastern coastal plains and their adjacent regions are affected by sea storms. Sea storms of Arabian sea generally originate between April and June. Their track remains almost parallel to the coast. These cyclones enter into Bharat through Gujarat coast. Sea storms of Bay of Bengal generally originate between October to December. They travel far more inland. Maximum effect of these cyclones is experienced in Andhra Pradesh, Orissa and West Bengal. Initial period of summer monsoon is favourable for the origin of tropical cyclones. Most of the cyclones in this season originate between 10° to 15° north latitudes and die out between 20° to 25° north latitudes. The loss of life due to sea storms in Bharat has been shown in the table 11.4.

Table 11.4
Loss of Human Life in Bharat due to Sea Storms

S.No.	Year	State	Death toll
1.	May 1833	West Bengal	Approx. 50,000
2.	Oct. 1971	Orissa	Approx. 10,000
3.	Nov. 1977	Andhra Pradesh	Approx. 30,000
4.	Oct. 1999	Orissa	Approx. 1,00,000

Sea Storms – Problems and Adversities

The coverage of tropical cyclones remains confined to a small area but due to steep pressure gradient wind velocity is high. Their size is small at the time of origin, but as they proceed onwards over oceanic areas without any hindrance, their size and velocity increase. They move onwards at a speed ranging between 15 to 25 kms. per hour. The wind speed in the inner side of these storms is 20 to 40 kms. per hour. These are humid winds due to the oceanic source. Heavy rainfall occurs in coastal areas by high velocity winds. It rains so heavily that conditions of flood emerge. Due to high velocity winds the trees are uprooted, and electric and telecommunication poles get damaged. Kuccha houses and huts are destroyed. Chaotic situation arise all around. Standing crops fall down. Due to high speed, the sea waves penetrate far inland in the coastal areas. These are also devastating. Boats are overturned and the lives of sailers are endangered.

Sea Storms – Emergency and Management

1. At Government and Social Level – There must be a sea storm forecasting system. On the basis of pictures of satelite and informations track of the storms, wind velocity and amount of rain should be observed and reviewed regularly. This information must be broadcast through radio and other means of telecommunication repeatedly. People should be notified about safer places so that they can reach there. Thus life can be saved.

In coastal areas people should be advised to construct the houses which can resist the force of the winds. Houses should not be constructed in low - lying areas. Flood water spreads in such areas.

Intense afforestation programmes should be carried out in coastal areas to reduce the force of these storms. The fishermen should be advised to avoid sailing during these storms. Schemes like group insurance must be carried out in storm prone areas.

2. At Individual Level – All arrangements made during these emergencies cannot be successful without integrity and honesty of people. People should take proper steps and necessary precautions according to the available information.

People must move to safer places along with the aged persons, children and women.

The relief goods received from government and other agencies must be shared with all victims.

People residing in storm prone areas must get insured for themselves, their cattle and crops to be able to get appropriate compensation.

Important Points

1. When the rain water spreads in a vast area by breaking levees, it is termed as flood.
2. Torrential rains, accumulation of sediments in river beds and unplanned habitations are the main causes of floods.
3. Floods are more frequent in the eastern and north-eastern Bharat.
4. Kosi river is known as **Sorrow of Bihar** and Damodar river as the **Sorrow of Bengal**.
5. The floods are more frequent in the rivers of north Bharat as compared to the rivers of

southern Bharat.

6. Afforestation, cleaning of river beds and strengthening of river embankments should be done for flood control.
7. Drought is related to low rains or negligible rains.
8. Uncertainty of rains is the main cause of drought.
9. The western parts of Bharat are the most drought affected areas.
10. When food grain and fodder production and drinking water are insufficient, it is termed as tri-famine (Trikal).
11. Development of traditional sources of water and construction of annicuts for raising underground water level should be done in all villages and towns to overcome drought situation.
12. Tropical cyclones enter into Bharat through the Bay of Bengal and the Arabian Sea.
13. Tropical cyclones are more frequent in the months of June, July and August.
14. The coastal areas are more affected by sea-storms.
15. Coastal regions are devastated due to high speed sea storms in a very short time.

Exercise

Multiple Choice Questions

1. The river known as the 'Sorrow of Bengal', is –
   (A) Kosi (B) Damodar
   (C) Ganga (D) Swarnrekha.
2. The cyclones known as sea storms in Bharat, are –
   (A) Temperate cyclones (B) Winter cyclones
   (C) Tropical cyclones (D) Desert cyclones.
3. The maximum drought prone area in Bharat, is–
   (A) Northern plain (B) North-eastern region
   (C) Western region (D) Coastal areas.

Very Short Answer Type

4. What are floods?
5. In which area of Bharat, floods are more frequent?
6. Which river is known as the 'Sorrow of Bihar'?
7. What is the main cause of drought?
8. In which months, sea storms are more frequent in Bharat?

Short Answer Type

9. Which are flood prone areas in Bharat?
10. Explain tri-famine (trikal).
11. Suggest measures to control floods.
12. Explain the origin of sea-storms.

Essay Type

13. Discuss the causes of floods in Bharat.
14. What steps should be taken to control famine?
15. Explain about the sea storms in detail.
16. Throw light on the problems of flood prone areas and suggest remedies to solve the problems.

Skill

17. Show the flood prone areas on an outline map of Bharat.
18. Show the drought prone areas on an outline map of Bharat.
19. Show the tracks of sea storms on an outline map of Bharat.

Answer Key

1. (B), 2. (C), 3. (C).