

## Unit - 5

# Hazards



## Learning Objectives

- ▶ To learn the meanings of hazard, disaster and catastrophe
- ▶ To describe the major types of hazards, their causes and effects
- ▶ To develop awareness regarding hazards and related prevention measures



## Introduction

- Teacher : Good morning students.
- Students : Good morning teacher.
- Teacher : Are all present today?
- Krithika : No teacher, Shruthi is absent today.
- Teacher : Why is she absent today?
- Pavithra : Teacher, don't you know what happened to her?
- Teacher : No my dear child, what happened to her?
- Theshmitha : Teacher, Yesterday, while returning home, she was struck by a big branch of a tree due to heavy rain and got injured.
- Teacher : Oh my God....what a pity? Students, you all must be very careful while moving around to avoid the problems from hazards.
- Kamalesh : Teacher, what do you mean by hazards? You mean the Belgian football player '**Hazard**'?
- Teacher : No...no, it is an event which can affect the living and non-living things of earth. I think today is the right day to get into the interesting chapter 'hazards'.

## Hazards

In the beginning of twenty-first century, the earth supported a human population that was more numerous and found healthier and wealthier than ever before. At the same time, there were a lack of awareness on the risks that faced by the people. By keeping this in mind, the present lesson of hazards is intended to familiarise the different types of hazards to promote awareness among students regarding hazards.

Hazards are defined as a thing, person, event or factor that poses a threat to people, structures or economic assets and which may cause a disaster. They could be either human-made or naturally occurring in the environment. The word 'hazard' owes its origin to the word 'hasart' in old French meaning a game of dice (in Arabic – az-zahr; in Spanish – azar).

Though the society experiences several types of hazards, it is important for a region to be aware of those threats that are most likely to affect the community most severely.



A natural hazard is a natural process and event that is a potential threat to human life and property. The process and events themselves are not a hazard but become so because of human use of the land.

A disaster is a hazardous event that occurs over a limited time span in a defined area and causes great damage to property/loss of life, also needs assistance from others.

A catastrophe is a massive disaster that requires significant expenditure of money and a long time for recovery.

## Types of Hazards

Some hazards occur frequently and threaten the people. Hazards are classified in different ways.

- I. Based on their causes of occurrence.
- II. Based on their origin.

### I. Based on their causes of occurrence

Hazards can be broadly classified into three types: natural, human-made and socio-natural hazards.

- 1. Natural hazards:** These are the results of natural processes and man has no role to play in such hazards. The main examples of natural hazards are earthquakes, floods, cyclonic storms, droughts, landslides, tsunamis and volcanic eruptions.



Natural hazard

- 2. Human-made hazards:** these are caused by undesirable activities of human. It can be the result of an accident, such as an industrial chemical leak or oil spill, or an intentional act. Such hazards can disturb the safety,

health, welfare of people and cause damage or destruction to property. The following are the examples of human-made hazards. They are explosions, hazardous wastes, pollution of air, water and land, dam failures, wars or civil conflicts and terrorism.



### Human-made hazards

- 3. Socio-natural hazards (Quasi-natural hazards):** these are caused by the combined effect of natural forces and misdeeds of human. Some of the examples are:

- The frequency and intensity of floods and droughts may increase due to indiscriminate felling of trees, particularly in the catchment areas of the rivers.
- Landslides are caused by natural forces and their frequency, and impact may be aggravated as a result of construction of roads, houses etc., in mountainous areas, excavating tunnels and by mining and quarrying.
- Storm surge hazards may be worsened by the destruction of mangroves.
- Smog is a serious problem in most big urban areas. The emissions from vehicles and industries, combustion of wood and coal together combined with fog leads to smog.

### II. Based on their origin

Hazards can be grouped into eight categories

- 1. Atmospheric hazard** – Tropical storms, Thunderstorms, Lightning, Tornadoes, Avalanches, Heat waves, Fog and Forest fire.
- 2. Geologic/Seismic hazard** – Earthquakes, Tsunami, Landslide and Land subsidence.
- 3. Hydrologic hazard** – Floods, Droughts, Coastal erosion and Storm surges.

4. **Volcanic hazard** – Eruptions and Lava flows.
5. **Environmental hazard** – Pollution of soil/air/water, Desertification, Global warming and Deforestation.
6. **Biological hazard** – Chickenpox, Smallpox, AIDS [HIV] and Killer bees.
7. **Technological hazard** – Hazardous material incidents, Fires, Infrastructure failures [Bridges, Tunnels, Dams, Nuclear and Radiological accidents].
8. **Human-induced hazard** – Terrorism, Bomb blast, War, Transportation accidents and Civil disorder.

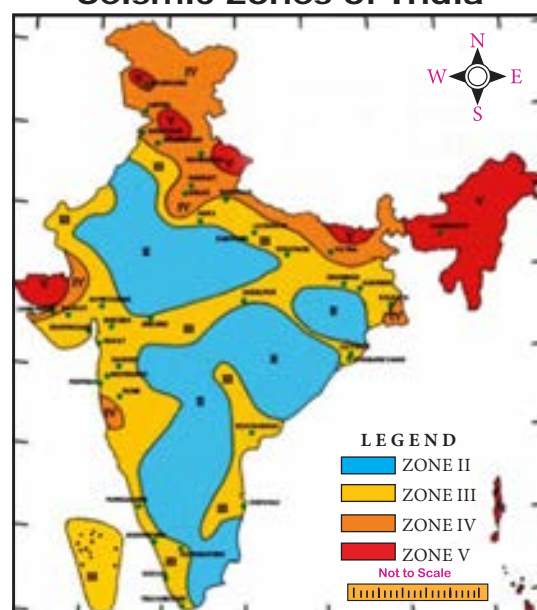
## Major Hazards in India:

### 1) Earthquakes

Earthquake is a violent tremor in the earth's crust, sending out a series of shock waves in all directions from its place of origin.

Earthquake prone regions of the country have been identified on the basis of scientific inputs relating to seismicity, earthquakes occurred in the past and tectonic setup of the region. Based on these inputs, Bureau of Indian Standards has grouped the country into four seismic zones: Zone II, Zone III, Zone IV and Zone V (No area of India is classified as Zone I).

### Seismic Zones of India



(Source: National Institute of Disaster Management, New Delhi)



Earthquakes

### Earthquake-prone Zones of India

Seismic Zones	Level of Risk	Regions
Zone V	Very High	Comprises entire northeastern India, parts of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Rann of Kutch in Gujarat, part of North Bihar and Andaman & Nicobar Islands.
Zone IV	High	Covers remaining parts of Jammu and Kashmir and Himachal Pradesh, National Capital Territory (NCT) of Delhi, Sikkim, northern parts of Uttar Pradesh, Bihar and West Bengal, parts of Gujarat and small portions of Maharashtra near the west coast and Rajasthan.
Zone III	Moderate	Comprises Kerala, Goa, Lakshadweep Islands, remaining parts of Uttar Pradesh, Gujarat and West Bengal, parts of Punjab, Rajasthan, Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh, Maharashtra, Odisha, Andhra Pradesh, Tamil Nadu and Karnataka.
Zone II	Low	Covers remaining parts of country.



## 2) Floods

Flood is an event in which a part of the earth's surface gets inundated. Heavy rainfall and large waves in seas are the common causes of flood.



**Flood**

**The major causes of floods are:**

### A. Meteorological factors

- i) Heavy rainfall
- ii) Tropical cyclones
- iii) Cloud burst

### B. Physical factors

- i) Large catchment area
- ii) Inadequate drainage arrangement

### C. Human factors

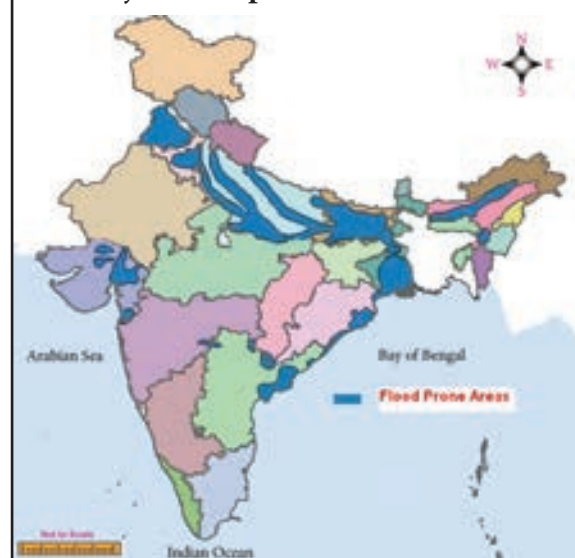
- i) Deforestation
- ii) Siltation
- iii) Faulty agricultural practices
- iv) Faulty irrigation practices
- v) Collapse of dams
- vi) Accelerated urbanisation

### ACTIVITY

Discuss in the classroom about the actions to be taken before, during and after flood.

The following map shows the major flood prone areas in India. Gangetic plains covering the states of Punjab, Haryana, Uttar Pradesh, North Bihar, West Bengal and Brahmaputra valley are the major flood prone areas in north and northeast India. Coastal Andhra Pradesh, Odisha and southern Gujarat are the other regions which are also prone to flood often.

### Major flood prone areas of India



(Source: National Institute of Hydrology, New Delhi)

## 3) Cyclonic Storms

A cyclonic storm is a strong wind circulating around a low pressure area in the atmosphere. It rotates in anti-clockwise direction in Northern Hemisphere and clockwise in the Southern Hemisphere.

Tropical cyclones are characterised by destructive winds, storm surges and exceptional levels of rainfall, which may cause flooding. Wind speed may reach upto 200 km/h and rainfall may record upto 50 cm/day for several consecutive days.

A sudden rise of seawater due to tropical cyclone is called storm surge. It is more common in the regions of shallow coastal water.

### East coastal areas vulnerable to storm surges

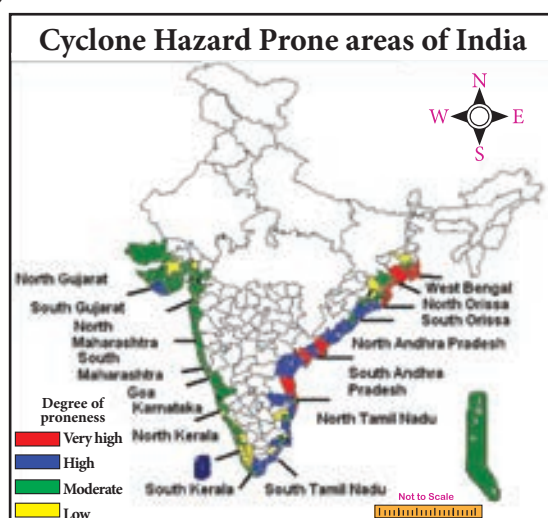
- i) North Odisha and West Bengal coasts.
- ii) Andhra Pradesh coast between Ongole and Machilipatnam.
- iii) Tamil Nadu coast (among 13 coastal districts, Nagapattinam and Cuddalore districts are frequently affected).

### West coastal areas vulnerable to storm surges

The west coast of India is less vulnerable to storm surges than the east coast.

- i) Maharashtra coast, north of Harnai and adjoining south Gujarat coast and the coastal belt around the Gulf of Cambay.

ii) The coastal belt around the Gulf of Kutch.



(Source: Mohapatra et al., 2015)

#### 4) Droughts

Any lack of water to satisfy the normal needs of agriculture, livestock, industry or human population may be termed as a drought. Further, the drought could be classified into three major types as,

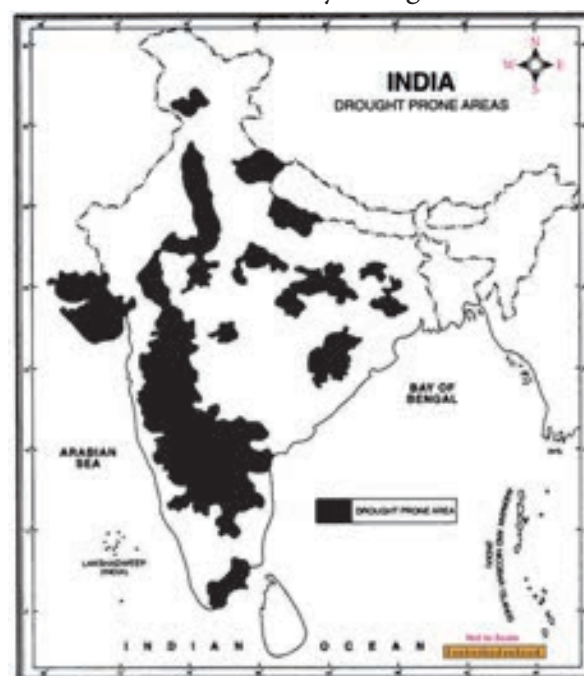
- i) **Meteorological drought:** it is a situation where there is a reduction in rainfall for a specific period below a specific level.
- ii) **Hydrological drought:** it is associated with reduction of water in streams, rivers and reservoirs. It is of two types, a) Surface water drought, and b) Groundwater drought.
- iii) **Agricultural drought:** it refers to the condition in which the agricultural crops get affected due to lack of rainfall.



#### Drought

Droughts in India occur in the event of a failure of monsoon. Generally monsoon rainfall is uneven in India. Some areas receive heavy rainfall while other regions get moderate to low

rainfall. The areas which experience low to very low rainfall are affected by drought.



(Source: Khullar, 2014)

#### Fact

About one third area of the country is affected by drought. It severely affects 16% of the land area and 12% of the total population of India. The areas that receive an annual rainfall of less than 60 cm are the drought prone regions of India.

The major areas highly prone to drought are:

- 1) The arid and semi-arid region from Ahmedabad to Kanpur on one side and from Kanpur to Jalandhar on the other.
- 2) The dry region lying in the leeward side of the Western Ghats.

#### 5) Landslides

Landslide is a rapid downward movement of rock, soil and vegetation down the slope under the influence of gravity. Landslides are generally sudden and infrequent. Presence of steep slope and heavy rainfall are the major causes of landslides. Weak ground structure, deforestation, earthquakes, volcanic eruptions, mining, construction of roads and railways over the mountains are the other causes of landslides.



About 15% of India's landmass is prone to landslide hazard. Landslides are very common along the steep slopes of the Himalayas, the Western Ghats and along the river valleys. In Tamil Nadu, Kodaikanal (Dindigul district) and Ooty (The Nilgiris district) are frequently affected by landslides.

## 6) Tsunami

Tsunami refers to huge ocean waves caused by an earthquake, landslide or volcanic eruption. It is generally noticed in the coastal regions and travel between 640 and 960 km/h. Tsunami pose serious danger to the inhabitants of the coastal areas.



The word 'Tsunami' is derived from Japanese word 'tsu' meaning harbour and 'nami' meaning wave (Harbour wave).

### Indian Ocean Tsunami of 2004

- On December 26, 2004, at 7:59 a.m. local time, an undersea earthquake with a magnitude of 9.1 struck off the coast of the Indonesian island of Sumatra.
- The tsunami killed at least 2,25,000 people across a dozen countries, with Indonesia, Sri Lanka, India, Thailand, Somalia and Maldives, sustaining massive damage.

## 7) Hazardous Wastes

The wastes that may or tend to cause adverse health effects on the ecosystem and human beings are called hazardous wastes.

The following are the major hazardous wastes

- Radioactive substance:** tools and unused fuel pipe of nuclear power plants.
- Chemicals:** synthetic organics, inorganic metals, salts, acids and bases, and flammables and explosives.
- Medical wastes:** hypodermic needles, bandages and outdated drugs.
- Flammable wastes:** organic solvents, oils, plasticisers and organic sludges.

v) **Explosives:** the wastes resulting from ordnance manufacturing and some industrial gases.

vi) **Household hazardous wastes:** pesticides, waste oil, automobile battery and household battery.



hazardous wastes



**Chernobyl nuclear disaster site (near Pripyat) to become an official tourist spot**

### Before:

- Chernobyl (then Soviet Union) nuclear accident was happened on 26th April, 1986.
- The radiation emitted was more than 400 times than that released by the atomic bomb dropped on Hiroshima (Japan) in 1945. This accident remains the largest nuclear accident in history.
- More than 3,50,000 people were evacuated from the area and severe restrictions on permanent human settlement are still in that place.

### Now:

- 33 years after the accident, the Exclusion Zone, which covers an area now in Ukraine and Belarus is inhabited by numerous animals and more than 200 bird species.
- In 2016, the Ukraine part of this zone was declared as a radiological and environmental biosphere reserve by the government.

## 8) Pollution of Air

Air is a mixture of several gases. The main gases are nitrogen (78.09%) for forming products



such as, fertilisers for plants and for making the air inert, oxygen (20.95%) for breathing and carbon dioxide (0.03%) for photosynthesis. Some other gases like argon, neon, helium, krypton, hydrogen, ozone, xenon and methane are also present. Besides, water vapour and dust particles make their presence felt in one way or the other.

Air pollution is the contamination of the indoor or outdoor air by a range of gases and solids that modify its natural characteristics and percentage. Air pollutants can be categorised into primary and secondary pollutants.

A **primary pollutant** is an air pollutant emitted directly from a source. A **secondary pollutant** is not directly emitted as such, but forms when other pollutants (primary pollutants) react in the atmosphere.

#### Primary Pollutants

- i) Oxides of Sulphur
- ii) Oxides of Nitrogen
- iii) Oxides of Carbon
- iv) Particulate Matter
- v) Other Primary Pollutants

#### Secondary Pollutants

- i) Ground Level Ozone
- ii) Smog

### 9) Pollution of Water

Water pollution may be defined as alteration in the physical, chemical and biological characteristics of water, which may cause harmful effects in human and aquatic life.



**Water pollution**

In India, water pollution has been taking place on a large scale and since a long period. Both surface and groundwater bodies are polluted to a great extent. The major causes of water pollution in India are:

- i) Urbanisation
- ii) Industrial effluents
- iii) Sewages
- iv) Agricultural runoff and improper agricultural practices
- v) Seawater intrusion
- vi) Solid wastes

### Need for Prevention Measures

Prevention is defined as the activities taken to prevent a natural calamity or potential hazard from having harmful effects on either people or economic assets.

- Prevention planning consists of i) hazard identification, and ii) vulnerability assessment.
- Delayed actions may increase the economic losses.
- For developing countries like India, prevention is perhaps the most critical components in managing disasters.

### Nature is emerging as a new weapon of mass destruction, do you agree?

Around 22,000 people have died in India in 10 years until 2017 due to major environmental disasters – Indian Meteorology Department.

In the past two decades (1998-2017) over 5,00,000 people have died due to extreme weather events around the world – stated by Global Climate Risk Index Report Published by Germanwatch (German-based non-profit organisation).

## Recap

- Hazards are defined as the phenomena that pose a threat to people, structures or economic assets and which may cause disaster.
- There are three types of hazards namely natural hazards, human-made hazards and Socio-natural hazards
- Natural hazards are earthquakes, floods, cyclonic storms, droughts, landslides, tsunamis, volcanic eruptions etc.
- Human-made hazards are explosions, hazardous wastes, pollution of air, land and water, dam collapses, wars or civil conflicts, terrorism etc.
- Socio-natural hazards are caused by the combined effect of natural forces and misdeeds of human.

## GLOSSARY

Earthquake	It is a violent tremor in the earth's crust.	நிலஅதிர்வு
Floods	It is a state of high water level along a river channel or on coast that leads to inundation of land.	வெள்ளப்பெருக்கு
Drought	Any lack of water to satisfy the normal needs of agriculture, livestock, industry or human population may be termed as a drought.	வறட்சி
Tsunami	It is a series of waves caused by the earth movements under the sea.	ஆழிப் பேரலை



## Evaluation

### I Choose the correct answer

- \_\_\_\_\_ percentage of nitrogen is present in the air.  
a) 78.09%  
b) 74.08%  
c) 80.07%  
d) 76.63%
- Tsunami in Indian Ocean took place in the year \_\_\_\_\_.  
a) 1990                      b) 2004  
c) 2005                      d) 2008
- The word Tsunami is derived from \_\_\_\_\_ language.  
a) Hindi  
b) French  
c) Japanese  
d) German



- The example of surface water is  
a) Artesian well              b) Groundwater  
c) Subsurface water      d) Lake
- Event that occurs due to the failure of monsoons.  
a) Condensation              b) Drought  
c) Evaporation              d) Precipitation

### II Fill in the blanks

- Hazards may lead to\_\_\_\_\_.
- Landslide is an example of \_\_\_\_\_ hazard.
- On the basis of origin, hazard can be grouped into \_\_\_\_\_ categories.
- Terrorism is an example of \_\_\_\_\_ hazard.
- Oxides of Nitrogen are \_\_\_\_\_ pollutants which affects the human beings.
- Chernobyl nuclear accident took place in \_\_\_\_\_ year.



### III Match the following

List I		List II
1. Primary pollutant	-	Terrorism
2. Hazardous waste	-	Tsunami
3. Earthquake	-	Outdated drugs
4. Meteorological drought	-	Oxides of Sulphur
5. Human induced hazard	-	Reduction in rainfall

### IV Answer briefly

1. Define 'hazard'.
2. What are the major types of hazards?
3. Write a brief note on hazardous wastes.
4. List out the major flood prone areas of our country.
5. Mention the types of drought.
6. Why should not we construct houses at foothill areas?

### V Distinguish between

1. Hazards and disasters.
2. Natural hazard and human-made hazard.
3. Flood and drought.
4. Earthquake and Tsunami.

### VI Answer in a paragraph

1. Write an essay on air pollution.
2. Define earthquake and list out its effects.
3. Give a detailed explanation on the causes of landslides.
4. Elaborately discuss the effects of water pollution.

### VII Activities

1. Name the hazards which you have identified.

2. List out the hazards that occur frequently and occasionally in your place.

Frequent Hazards		Occasional Hazards	
1		1	
2		2	
3		3	
4		4	
5		5	

3. On the map of Tamil Nadu shade the 13 coastal districts in different colours.



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4. *Manual on Natural Disasters Management in India* (2001). National Centre for Disaster Management, Ministry of Home Affairs, Government of India, New Delhi.

Item	In and around your school	In your residential environs	On the way to school from home
1. Hazardous factory / Industry			
2. Roads of heavy traffic			
3. Tall buildings			
4. Things which burn easily			
5. Open drainage / Septic tank			
6. Others			



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## INTERNET RESOURCES

- [http://www.amssdelhi.gov.in/tropicle\\_cyclones.htm](http://www.amssdelhi.gov.in/tropicle_cyclones.htm)
- [http://www.searo.who.int/topics/air\\_pollution/what-is-air-pollution.pdf?ua=1](http://www.searo.who.int/topics/air_pollution/what-is-air-pollution.pdf?ua=1)
- <https://germanwatch.org/en/cri>
- <https://ndma.gov.in/en/landslides-zone-map.html>
- [https://nidm.gov.in/safety\\_earthquake.asp](https://nidm.gov.in/safety_earthquake.asp)
- <https://nptel.ac.in/courses/120108005/module9/lecture9.pdf>
- <https://theconversation.com>
- <https://www.downtoearth.org.in>
- <https://www.thehindubusinessline.com/news/national/over-12-of-landmass-in-india-prone-to-landslides/article9728811.ece>