

**USEFUL FOR IAS/PCS MAINS EXAM**



# मुख्यमंत्री अभ्युदय योजना



**GENERAL STUDIES**

**Disaster Management**

मुख्यमंत्री अभ्युदय योजना प्रकोष्ठ

उत्तर प्रदेश प्रशासन और प्रबंधन अकादमी

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यह अध्ययन-सामग्री मुख्यमंत्री अभ्युदय योजना प्रकोष्ठ (उत्तर प्रदेश प्रशासन और प्रबंधन अकादमी) द्वारा उत्तर प्रदेश सरकार की मुख्यमंत्री अभ्युदय योजना के अंतर्गत सिविल सेवा परीक्षा की तैयारी कर रहे प्रतियोगियों की सहायता के लिए तैयार कराई गई है।

इस पाठ्य-सामग्री को उत्तर प्रदेश प्रशासन एवं प्रबंधन अकादमी, लखनऊ में 65वें आधारभूत प्रशिक्षण कार्यक्रम के अंतर्गत प्रशिक्षण प्राप्त कर रहे प्रशिक्षु डिप्टी कलक्टर (UPPCS-2018) द्वारा प्रोजेक्ट कार्य के रूप में तैयार किया गया है।

इस सामग्री की पूर्णतः शैक्षणिक और जन कल्याणकारी-उद्देश्यों के लिए तैयार किया गया है-इसका एक मात्र उद्देश्य प्रदेश के छात्र/छात्राओं का प्रतियोगी परीक्षाओं की तैयारी में मार्गदर्शन व सहयोग करना है।

**वैधानिक सूचना** - इस अध्ययन सामग्री का किसी भी प्रकार से व्यावसायिक उपयोग प्रतिबंधित है।

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# DISASTER: INTRODUCTION

As per the **Disaster Management Act 2005**, “**Disaster**” means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of property, or damage to, or degradation of environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.

“**Vulnerability**” may be defined as “The extent to which a community, structure, services or geographic area is likely to be damaged or disrupted by the impact of particular hazard, on account of their nature, construction and proximity to hazardous terrains or a disaster prone area.”

“**Capacity**” can be defined as “resources, means and strengths which exist in households and communities and which enable them to cope with, withstand, prepare for, prevent, mitigate or quickly recover from a disaster”.

“**Risk**” is a “measure of the expected losses due to a hazard event occurring in a given area over a specific time period”

## Impact of disasters:

- **Physical Infrastructure:-** Damage to property and destruction of assets.
- **Individual:-** Loss of Life, physical, mental harm
- **Governance:-** Loss of services and administration problems
- **Social:-** disasters weigh heavily against women, children, elderly, marginal and poor sections of society increasing inequality.
- **Environmental:-** Environmental degradation.

### Factors, which aggravate the disasters:

- Poverty
- Dense population
- Lack of awareness and preparedness
- Environmental degradation
- Unplanned urbanisation

### Disasters in India

- India is one of the ten worst disaster prone countries of the world.
- India is vulnerable to both natural and man-made disasters.
- India has a long coastline of nearly **7500 KM**. The coastal regions are vulnerable to tropical cyclones; storms surges; coastal erosion and tsunamis. About **10 percent of the world's tropical cyclones** affect the Indian coast.
- 40 million hectares of land is prone to floods and river erosion
- Nearly **59 percent** of Indian landmass is prone to earthquake.
- Landslides occur in the hilly regions of India such as the Himalaya, North-East India, the Nilgiris, Eastern Ghats and Western Ghats. It is estimated that **30 percent of the World's Landslides occur in the Himalayan ranges**.
- Vulnerability to disasters/emergencies of Chemical, Biological, Radiological and Nuclear (CBRN) origin also exists

### Classification of Disasters:

Disasters are broadly classified into **Natural disasters** and **Man-made Disasters**

1. **Natural Disasters:** are the consequences or effects of natural hazards on humanlife.

**Example:** Earthquake, landslides, cyclones, floods etc.

2. **Man-made disasters:** are also known as anthropogenic disasters and they occur as a result of human intent, error or as a result of failed systems.

**Example:** Urban fire, rail and road accidents, bomb blasts etc.

# EARTHQUAKES

Earthquake is the sudden shaking of the earth crust. It is one of the most destructive natural hazard. They may occur at any time of the year, day or night, with sudden impact and little warning.

## Cause of Earthquake:

It is caused by the sudden release of energy. This can be on account of:

- **Tectonic Plate Movement:**

The earth's crust is not one piece but consists of portions called 'plates' which vary in size from a few hundred to thousands of kilometers. The '*theory of plate tectonics*' holds that the plates ride up on the more mobile mantle, and are driven by some mechanisms like thermal convection currents. When these plates come in contact with each other, stress arises in the crust. These stresses can be classified according to the type of movement along the plate's boundaries:

- a) pulling away from each other or **Divergence**.
- b) pushing against one another or **Convergence**.
- c) sliding sideways relative to each other or **Transform**.

The areas of stress at plate boundaries which release accumulated energy by slipping or rupturing are known as '**faults**'. The fault rupture generates vibration called seismic (from the Greek 'seismos' meaning shock or earthquake) waves, which radiates from the focus in all directions.

The point of rupture is called the **focus/hypocenter** and may be located near the surface or deep below it. The point on the surface directly above the focus is termed as the '**epicenter**' of the earthquake

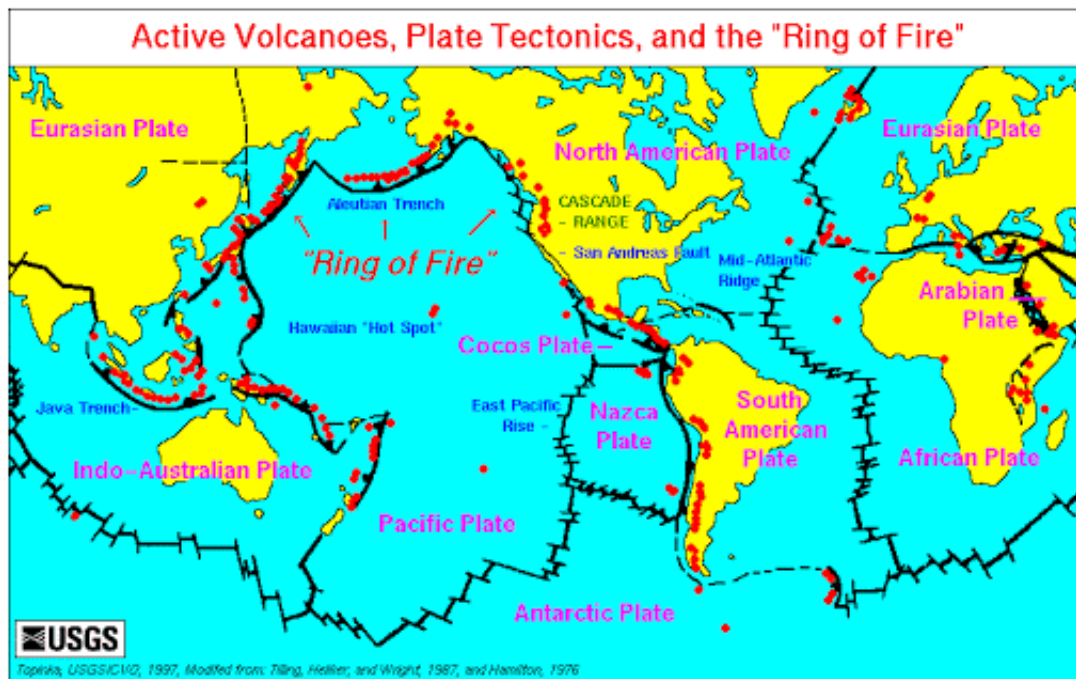


Fig: Tectonic plate boundaries  
Source: [geography.learnoninternet.co.uk](http://geography.learnoninternet.co.uk)

- **Fault zones:** A fault is a sharp break in the crustal rocks. Rocks along a fault tend to move in opposite directions. As a result, the blocks get deformed and eventually, they slide past one another abruptly.

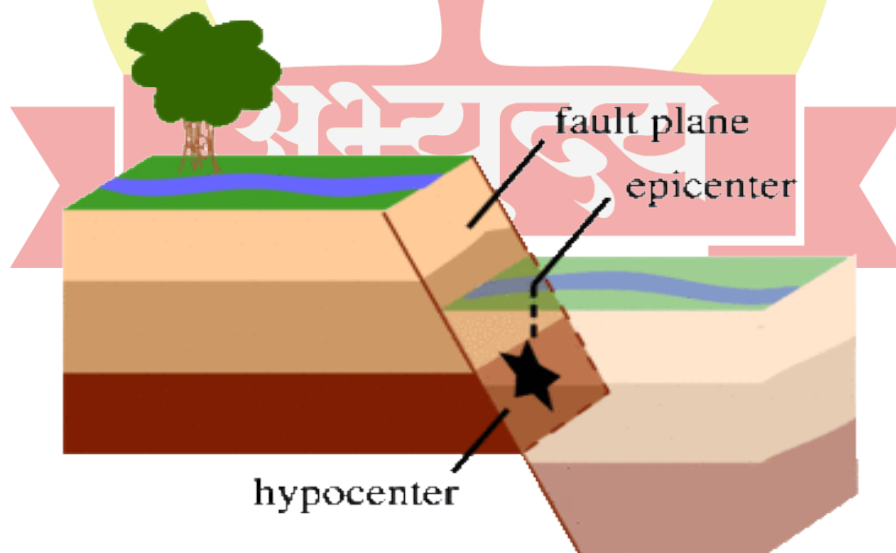


Fig: epicenter and focus  
Source: USGS.gov

- **Volcanic Earthquake:** confined to areas of active volcanoes.
- **Human induced:** like due to intense mining activity, reservoir induced etc.



## Seismic Waves:

The ground shaking is caused by ‘**body waves**’ and ‘**surface wave**’.

**Body waves** (P-and S-waves) penetrate the body of the earth, vibrating fast. ‘P’ waves travel faster than S-waves. Further P-waves travel across both solid crust and liquid core however S-waves travel only across solid crust & mantle.

**Shadow zone of P waves:** 105 degrees to 140 degrees

**Shadow zone of S waves:** beyond 105 degrees

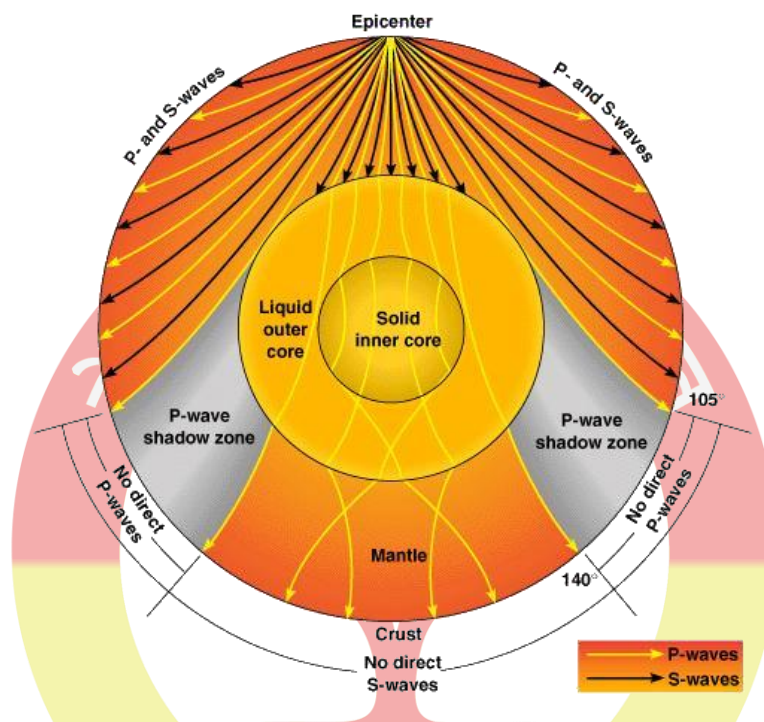


Fig: P & S waves.

Source: cyperphysics.co.uk

**Surface waves** vibrate the ground horizontally and vertically. These long period waves cause swaying of tall buildings and slight waves motion in bodies of water. These are the most destructive waves. Reaches surface the last.

## Measuring Earthquakes

Earthquakes can be described by the use of two distinctively different scales of measurement demonstrating magnitude and intensity.

1. Earthquake **magnitude** or amount of energy released is determined by the use of Richter scale.
2. The earthquake **intensity** scale measures the effects of an earthquake where it occurs. It is called mercalli scale.



The seismic zoning map of India is divided into four zones:

❖ **Zone V (Very high damage risk zone):**

The entire North-east, including the seven sister states, Kutch district, parts of Himachal and Jammu & Kashmir, and the Andaman and Nicobar Islands.

❖ **Zone IV (High damage risk zone):**

Parts of the Northern belt starting from Jammu and Kashmir to Himachal Pradesh. Also including Delhi and parts of Haryana. The Koyna region of Maharashtra is also in this zone.

❖ **Zone III (Moderate damage risk zone):**

A large part of the country stretching from the North, including some parts of Rajasthan to the South through the Konkan coast, and also the Eastern parts of the country.

❖ **Zone II (Low damage risk zone):**

These two zones are contiguous, covering parts of Karnataka, Andhra Pradesh, Orissa, Madhya Pradesh, and Rajasthan, known as low risk earthquake zone.

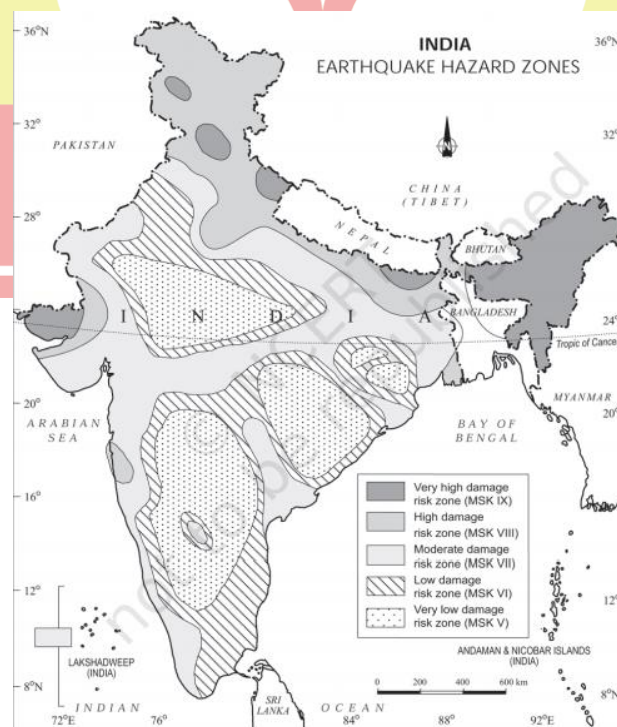


Fig: Earthquake Hazard Zones

Source: NCERT

### **Effects of Earthquakes:**

- Loss of life of humans and animals
- Deformation of the ground surface
- Severe Damage to man-made structures
- Service disruption like that of electricity, telecommunication, water supply etc
- leads to other disasters like tsunami, flashfloods, landslide, avalanches, fires etc

### **Earthquake risk reduction measures:**

- Re-framing buildings' codes, guidelines, manuals and bye-laws and their strict implementation.
- Retrofitting of weak structures in highly seismic zones
- Incorporating earthquake resistant features in all buildings in high-risk areas.
- Community preparedness through training and sensitization programs
- Networking of local NGOs working in the area of disaster management.
- Engineered structures: Buildings need to be designed and constructed as per the building bye-laws to withstand ground shaking. The soil type needs to be analyzed before construction. Building structures on soft soil should be avoided.

### **Earthquake Hazard Mitigation:**

- **National earthquake Risk Mitigation Project:**  
In seismic zones, IV & V in the country to increase awareness of the key stakeholders on the need for adoption of model building bye-laws and earthquake resistant construction and planning standards
- **National Building Code**  
For regulating the building construction activities.
- **Seismic retrofitting:**  
It is the modification of existing structures to make them more resistant to seismic activity, ground motion, or soil failure due to earthquakes.

# DROUGHTS

Droughts refer to a serious shortfall in availability of water, mainly, but not exclusively, due to deficiency of rains, affecting agriculture, drinking water supply and industry. It is a slow onset disaster, which evolves over months or even years and affects a large spatial extent. Drought is any unusual dry period, which results in a shortage of useful water. In India, around 68 percent of the agriculture land country is prone to drought in varying degrees.

## Causes of Drought

- The primary cause of any drought is deficiency of rainfall and in particular, the timing, distribution and intensity of this deficiency in relation to existing reserves.
- Though drought is basically caused by deficit rainfall, which is a meteorological phenomenon, 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.

## Types of Droughts:

- **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

- **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.

#### **Factors that increase vulnerability to drought:**

- Low soil moisture holding capacity
- Absence of irrigation facilities
- Poor water management
- Deforestation
- Over grazing
- Water consuming cropping patterns
- Excessive ground water draft
- Soil erosion
- Population growth and urbanization
- Industrialization
- Global warming & climate change

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

Around 68 per cent of India's total area is drought prone.

- **Extreme Drought Affected Areas:** 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.
- **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.

- **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.

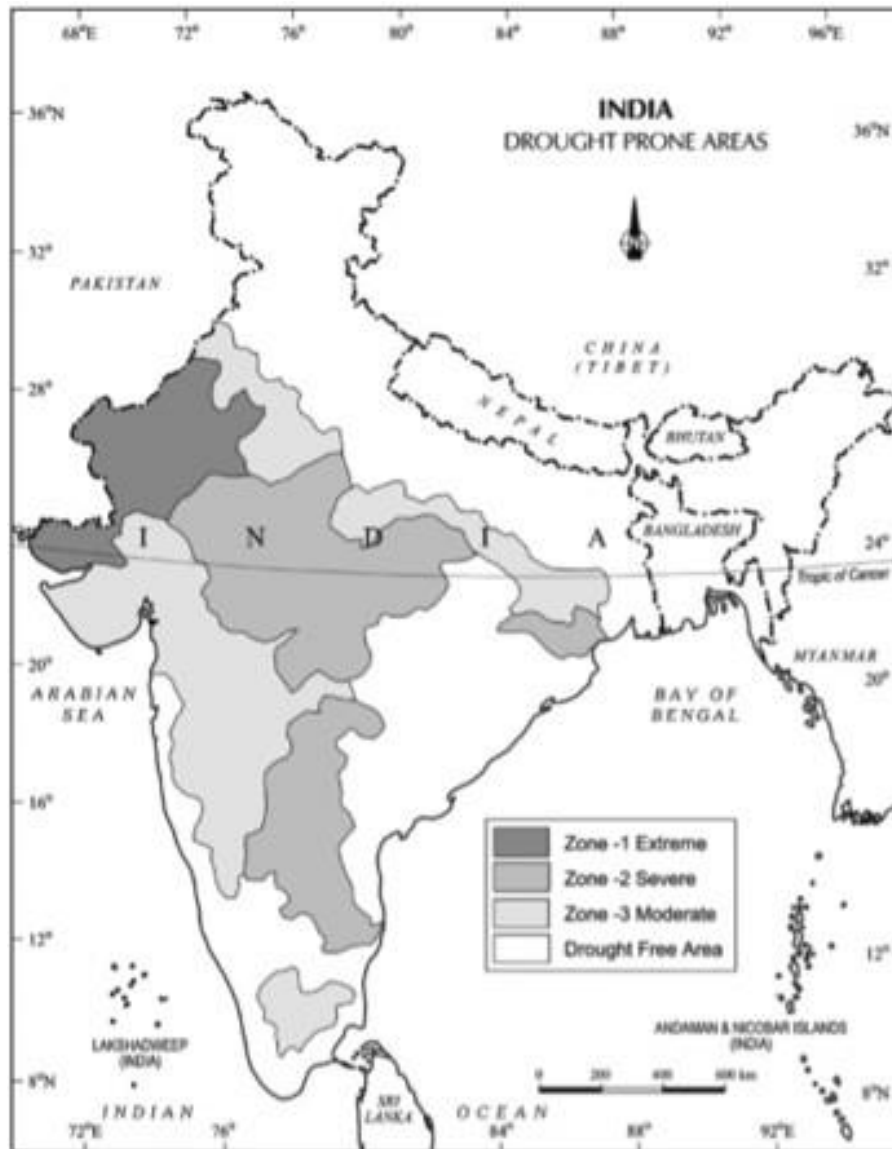


Fig: drought prone areas

Source: NCERT

## Impacts of Drought

### Environmental:

- Drinking Water Shortage.
- Moisture Stress.
- Damage to Natural Vegetation and Various Ecosystems.
- Increased Air and Water Pollution.

### Socio-economic:

- Crop failure.
- Malnutrition.
- Poor Hygiene.
- Bad Health and water borne diseases.
- Migration of human and livestock.
- Increased Stress and Morbidity.
- Social Strife.

### Mitigation of Droughts:

- Provision for the distribution of safe drinking water.
- Availability of fodder and water for the cattle.
- Mapping of aquifers.
- Watershed Development Programs.
- Following NDMA guidelines like:
  - Rainwater harvesting.
  - Interlinking of rivers to transfer of river water from surplus to deficient areas.
  - Remote sensing and satellite imagery can be useful in identifying the possible river basin and in identifying the groundwater potential.
  - Dissemination of knowledge about drought resistant crops at proper training to practice the same can be some of the long-term measures that will be helpful in drought mitigation.

# FLOODS

- Flooding is a condition inundation of land and human settlements by the rise of water in the channels and its spillover is present.
- 20% of deaths caused by floods in the World occur in India. In India, around 40-million-hectare area is flood-prone, which is one eighth of the total area.

## Flood prone Areas in India:

The most flood prone areas are the Brahmaputra, Ganga and Indus basins. Uttar Pradesh, Bihar, West Bengal, Orissa, Assam are the most flood affected states followed by Haryana, Punjab and Andhra Pradesh. Due to climate change, Rajasthan and Gujarat also feel the fury of floods. Karnataka and Maharashtra are every year hit by floods.



Fig: Flood zones

Source: geol-amu.org



## **Causes of Floods:**

### **Natural Causes:**

- Heavy rainfall
- Sediment deposition in river beds
- Cyclones
- Changes in course of rivers
- Tsunamis etc

### **Anthropogenic causes**

- Deforestation: water flows with greater speed into the rivers and causes flood.
- Interference in drainage system: by badly planned construction of bridges, roads, railway tracks, canals etc. hampers the flow of water and results in floods.
- Population pressure
- Poor Water and Sewerage Management in urban areas.

### **Consequences of Floods**

- loss of life & livelihood
- Destroy valuable crops and also damage physical infrastructure such as roads, rails, bridges and human settlements.
- Spread of diseases like cholera, gastro-enteritis, hepatitis and other water-borne diseases spread in the flood affected areas.
- Floods also make a few positive contributions. Every year, floods deposit fertile silt over agricultural fields, which restores fertility of the soil.

### **Possible Risk Reduction Measures**

- Mapping of the flood prone areas
- Land use control with limits on overgrazing and measures like no major development be permitted in the areas which are subjected to high flooding etc
- Flood shelters in areas of frequent occurrences

- Construction of engineered structures in the flood plains and strengthening of structures to withstand flood forces and seepage
- Structural measures like storage reservoirs, flood embankments, drainage channels, anti-erosion works, channel improvement works, detention basins etc.
- Non-structural measures include flood forecasting, flood plain zoning, flood proofing, disaster preparedness etc
- Community preparedness and participation like mapping of drains and local water bodies in pre monsoon season to prepare them for monsoon season.



# CYCLONES

Cyclone is a region of low atmospheric pressure surrounded by high atmospheric pressure resulting in swirling atmospheric disturbance accompanied by powerful winds. They occur mainly in the tropical and temperate regions of the world. The winds in cyclonic system blow in anticlockwise direction in the Northern Hemisphere and in the clockwise direction in the Southern Hemisphere.

**Some of the general characteristics of a cyclone are:**

- 1- Strong winds
- 2- Exceptional rain
- 3- Storm surge

**Development of a cyclone:**

It is a three-stage process viz.:

- **Formation and initial development state:**

Four atmospheric/ oceanic conditions are necessary for the formation of a cyclone namely:

- A warm sea temperature in excess of 26 degree centigrade, to a depth of 60 meters, which provides abundant water vapour in the air by evaporation.
- High relative humidity (degree to which the air is saturated by water vapor) of the atmosphere to a height of about 7000 meters, facilitates condensation of water vapor into droplets and clouds, releases heat energy and induces drop in pressure.
- Atmospheric instability (an above average decrease of temperature with altitude) encourages considerable vertical cumulus cloud convection when condensation of rising air occurs.
- A location of at least 4-5 latitude degrees from the Equator allow the influence

of the force due to the earth's rotation (Coriolis force) to take effect in inducing cyclonic wind circulation around low pressure centers.

- **Fully matured:** The main feature of a fully mature tropical cyclone is a spiral pattern of highly turbulent giant cumulus thundercloud bands. These bands spiral inwards and form a dense highly active central cloud core which raps around a relatively calm zone. This is called the “eye” of acyclone. The eye looks like a black hole or a dot surrounded by thick clouds. The outer circumference of the thick cloud is called the ‘eye wall’.
- **Weakening or decay:** A tropical cyclone begins to weaken as soon as its source of warm moist air is abruptly cut off. This is possible when the cyclone hits the land, or the cyclone moves to a higher altitude or when there is the interference of another low pressure.

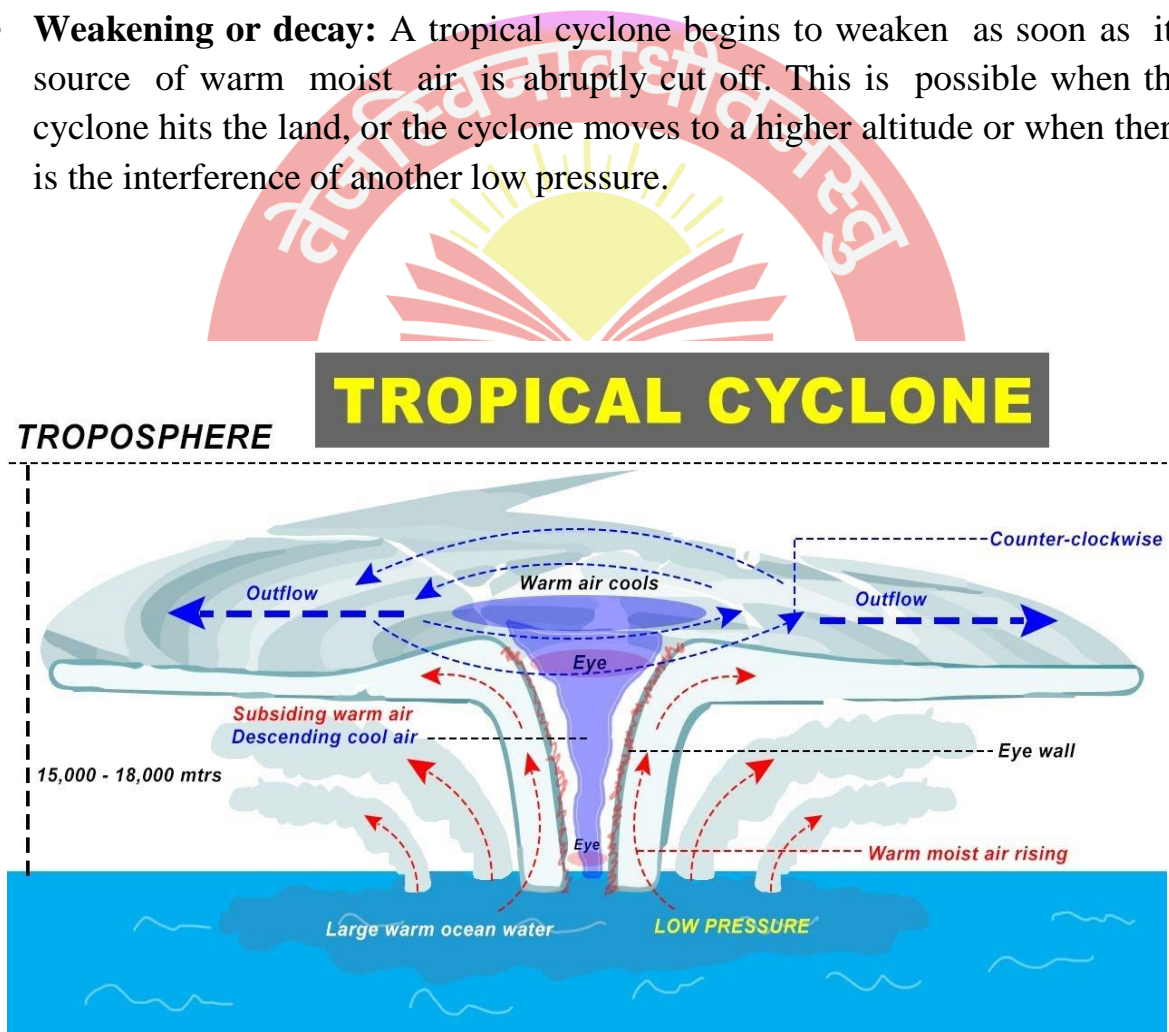


Fig: tropical cyclone

Source: Pinterest.com

## Cyclones in India

About two-third of the cyclones that occur in the Indian coastline occur in the Bay of Bengal. Four states- Tamil Nadu, Andhra Pradesh, Orissa and West Bengal and one UT- Puducherry on the east coast and one state, Gujarat, on the west coast are highly vulnerable to cyclone disasters.

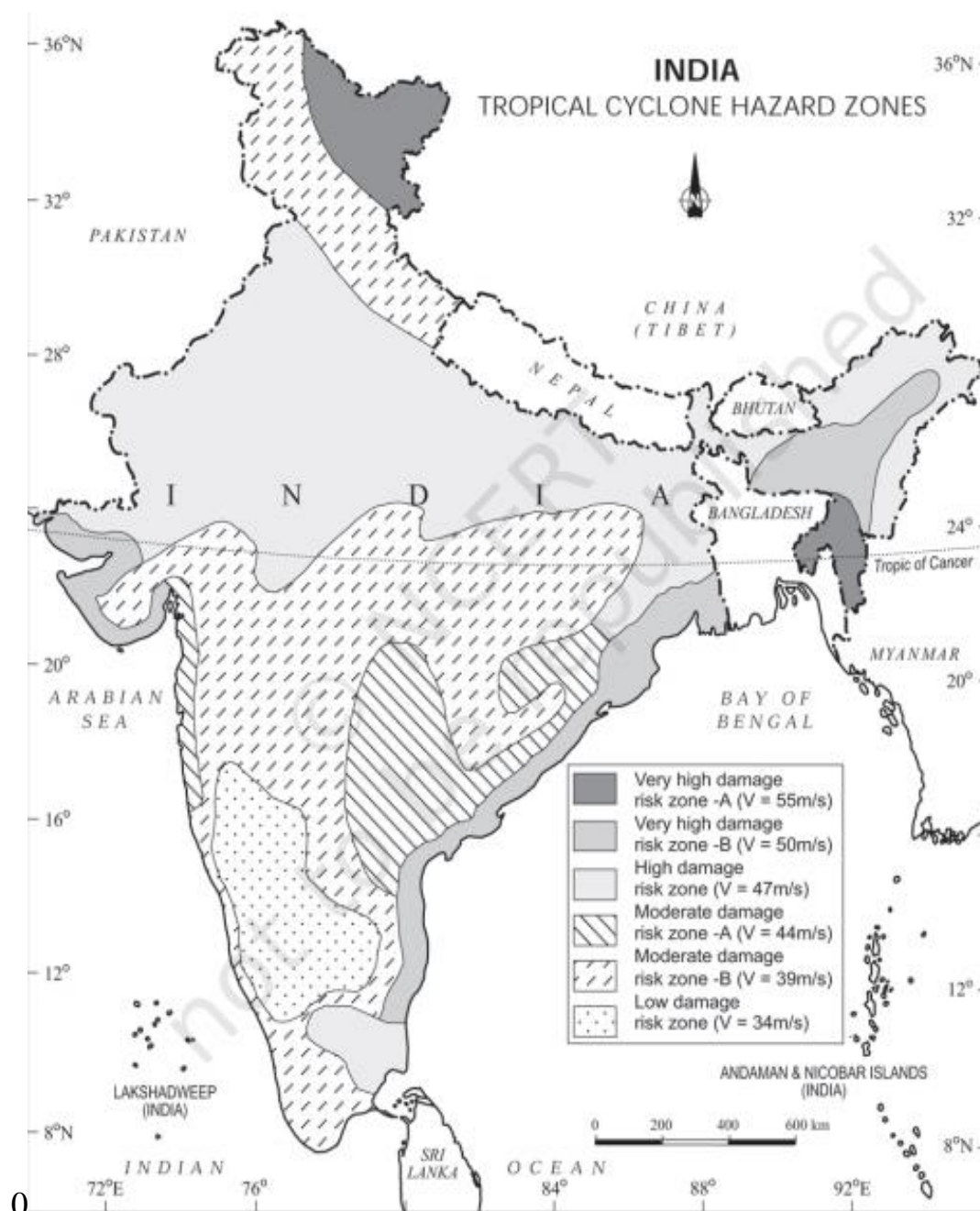


Fig: Tropical Cyclone Hazard Zones

Source: NCER

### **Cyclones are known by different names in different parts of the world:**

- Typhoons in the Northwest Pacific Ocean west of the dateline
- Hurricanes in the North Atlantic Ocean, the North-east Pacific Ocean east of the dateline, or the South Pacific Ocean.
- Tropical cyclones in the South-west Pacific Ocean and South-east Indian Ocean.
- Severe cyclonic storm in the North Indian Ocean
- Tropical cyclone in the South-west Indian Ocean
- Willie-Willie in Australia
- Tornado in South America.

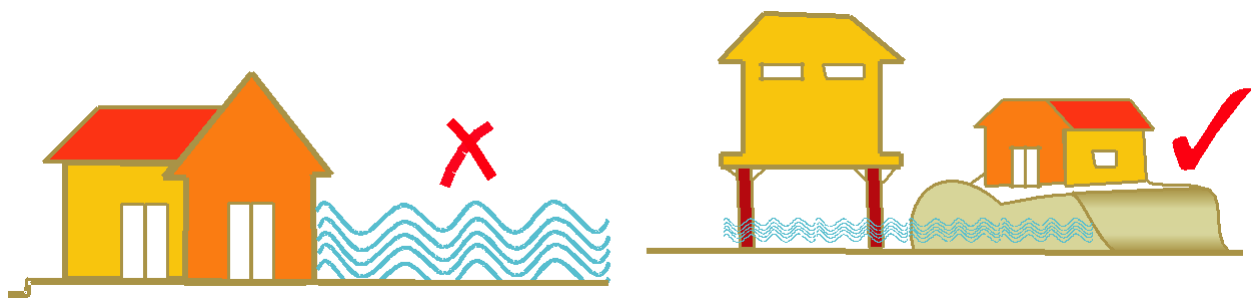
### **Consequences:**

- Loss of life and property
- Damage to physical infrastructure including critical infrastructure
- Abnormal rise in sea level known as storm surge.
- Floods, landslides
- Contamination of water supply
- Ruined standing crop and food stock lying in low lying areas
- Inundation of sea water in low lying areas of coastal regions

### **Cyclone Hazard Mitigation:**

- **Coastal belt plantation:** Green belt plantation along the coastal line in a scientific interweaving pattern can reduce the effect of hazard.
- Land use control should be designed so that least critical activities are placed in vulnerable areas.
- **Engineered structures** need to be built to withstand wind forces.





Source: NCERT

- **Early Warning System:** India has one of the best cyclone warning systems in the world. The India Meteorological Department (IMD) is the nodal department for wind detection, tracking and forecasting cyclones

#### Measures:

- **National Cyclone Risk Mitigation project (NCRMP)** with financial assistance from the World Bank, is envisaged to have four major components
  - Component A: Improvement of early warning dissemination system by strengthening the Last Mile Connectivity (LMC) of cyclone warnings and advisories.
  - Component B: Cyclone Risk Mitigation Investments.



- Component C: Technical assistance for hazard risk management and capacity building.
- Component D: Project management and institutional support.
- **Integrated Coastal Zone Management Project (ICZMP)** to assist the Government in building the national capacity for implementation of a comprehensive coastal management approach in the country.



# TSUNAMI

A tsunami is a series of large waves of extremely long wavelength and period caused by the displacement of a large volume of a body of water, usually an ocean in the form of high vertical waves.

The impact of the tsunami is less over the ocean due to extremely large wavelengths and more near the coast where they cause large-scale devastation as the wave breaks with extremely high amplitude.

## Causes:

- Earthquakes causing abrupt deformation of sea floor resulting vertical displacement of the overlying water.
- landslides into or under the water surface
- volcanic activity

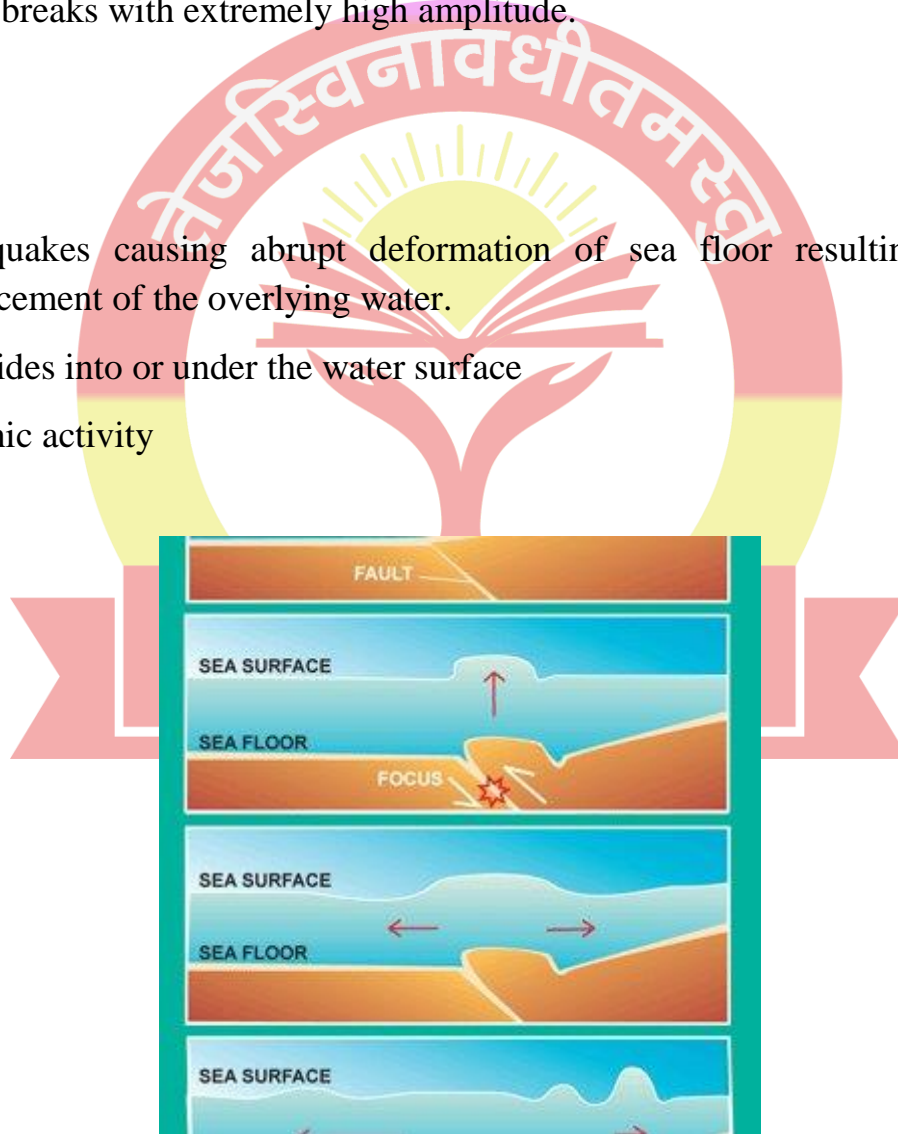


Fig: Tsunami generation due to seismic activity

Source: researchgate.net

**Predictability:**

There are two distinct types of tsunami warning:

- a) International tsunami warning systems and
- b) Regional warning systems.

The Indian Tsunami Early Warning Centre (ITEWC) has been established at Indian National Centre for Ocean Information Sciences, (INCOIS - ESSO) Hyderabad. It has the responsibility to provide tsunami advisories to Indian Mainland and the Island regions

**Effects:**

- Loss of life & property.
- Floods causes major destruction to the human settlements, roads and infrastructure.
- Withdrawal of the tsunami sweep out the foundations of the buildings, the beaches get destroyed and the houses carried out to sea.
- Health problems & diseases due to floods.
- Contaminated water sources.
- Ground water salinization due to intrusion of sea water.
- Crops destroyed, loss of livestock.
- Nutritional deficiency etc.

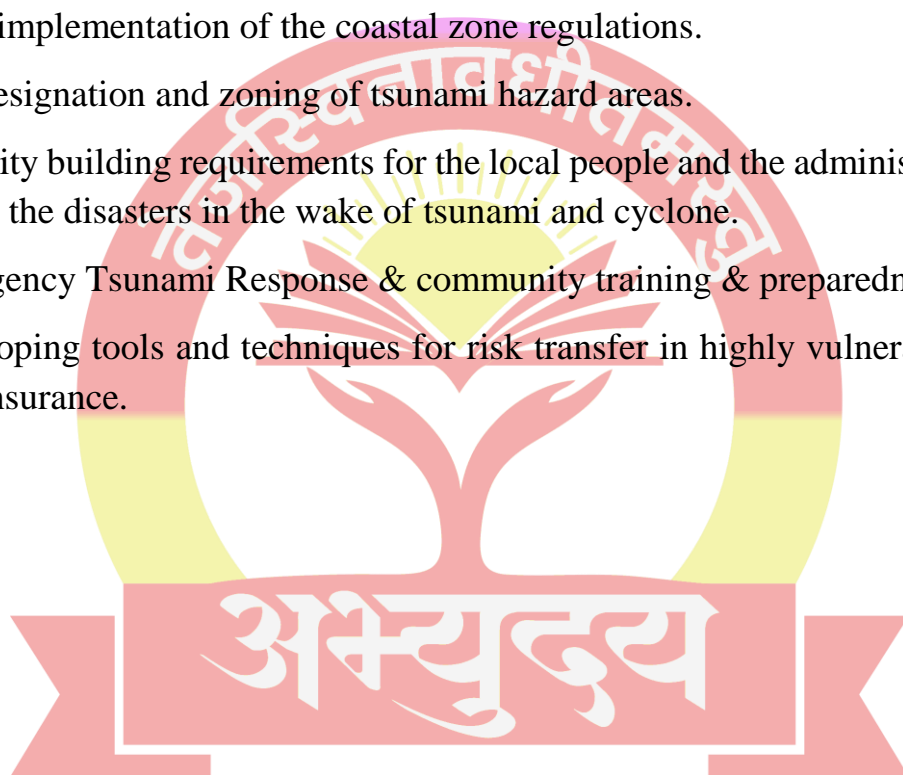
**Possible risk mitigation measures:****Structural measures:**

- Plantation of mangroves and coastal forests along the coast line.
- Construction of location specific sea walls, sand barriers and coral reefs.
- Identification of vulnerable structures and appropriate retrofitting for tsunami/cyclone resistance.

- Development of a network of local knowledge centres (rural/urban) along the coast lines.
- Retrofitting of vulnerable structures

#### **Non-Structural Measures:**

- Tsunami Risk Assessment and Vulnerability Analysis: NDMA recommends assessment of vulnerability and risk mapping in the tsunami hazard based on coastal land use maps and coastal bathymetry.
- Strict implementation of the coastal zone regulations.
- The designation and zoning of tsunami hazard areas.
- Capacity building requirements for the local people and the administration for facing the disasters in the wake of tsunami and cyclone.
- Emergency Tsunami Response & community training & preparedness
- Developing tools and techniques for risk transfer in highly vulnerable areas. E.g. insurance.



# LANDSLIDES

Landslide is a process involving the downward and outward movement of a part of the slope forming material under influence of gravity. Areas with steep slopes, for example mountainous regions, are particularly susceptible to landslide hazards.

Landslides affect at least 15 per cent of the land area of India. The presence of active plate boundaries of Indian and Eurasian plate causes much stress in young Himalayan ranges making them prone to landslides and earthquakes.

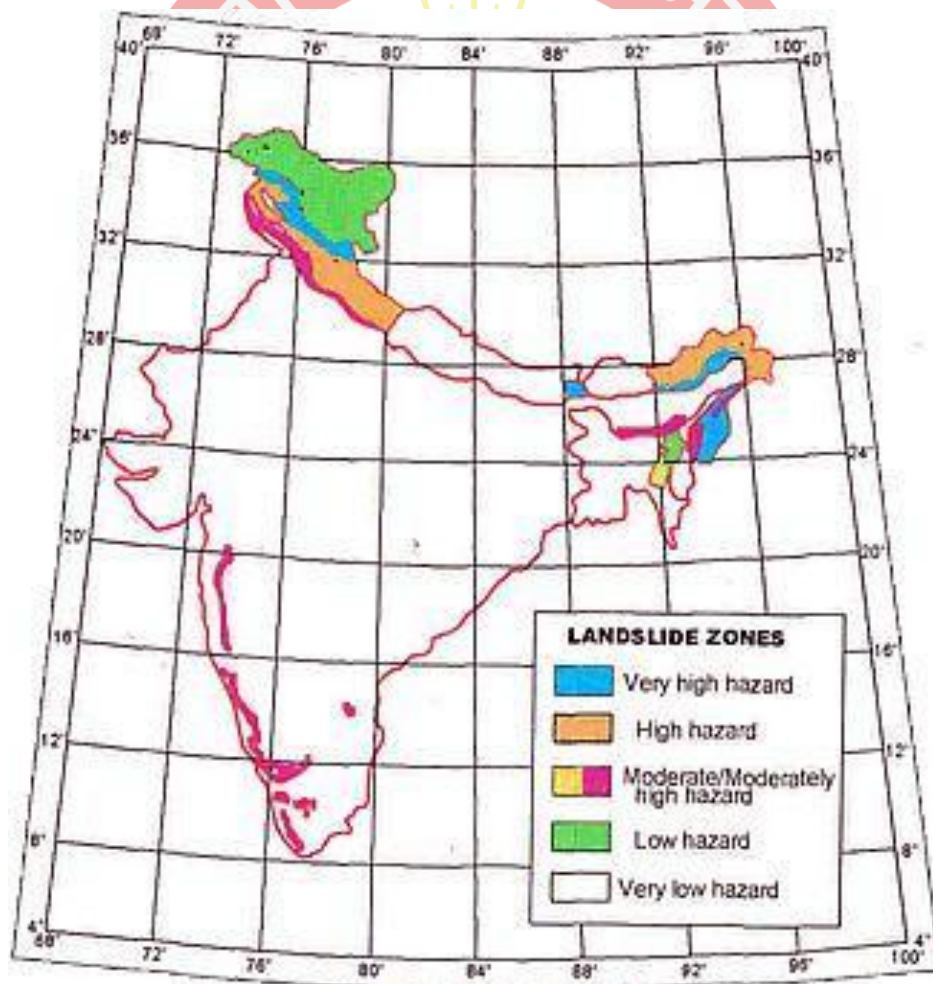


Fig: Landslide zones

Source: Vikaspedia.in

## Type of Landslides:

- **Falls:** Abrupt movements of materials that become detached from steep slopes or cliffs, moving by free-fall, bouncing, and rolling.
- **Rotational landslides:** Rotational landslides occur where more resistant rocks founder over underlying weaker rocks.
- **Translational slides:** Rapid movements along a plane of distinct weakness between the overlying slide material and the more stable underlying material
- **Flows:** General term including many types of mass movement, such as debris flow, debris avalanche, lahar, and mudflow.
- **Creep:** Slow, steady downslope movement of soil or rock, often indicated by curved tree trunks, bent fences or retaining walls, tilted poles or fences.
- **Debris flow** rapid mass movement in which loose soils, rocks, and organic matter combine with entrained air and water to form slurry that then flows down slope, usually associated with steep gullies.
- **Debris avalanche** a variety of very rapid to extremely rapid debris flow.
- **Lahar** originates on the slope of a volcano, usually triggered by heavy rainfall eroding volcanic deposits, sudden melting of snow and ice due to heat from volcanic vents, or the breakout of water from glaciers, crater lakes or lakes dammed by volcanic eruptions
- **Mudflow** rapidly flowing mass of wet material that contains at least 50 per cent sand, silt, and clay-sized particles.
- **Lateral spreads** often occur on very gentle slopes and result in nearly horizontal movement of earth materials. Lateral spreads usually are caused by liquefaction, where saturated sediments (usually sands and silts) are transformed from a solid into a liquefied state, usually triggered by an earthquake.
- **Topple** a block of rock that tilts or rotates forward and falls, bounces, rolls down the slope.



## LANDSLIDE TYPES

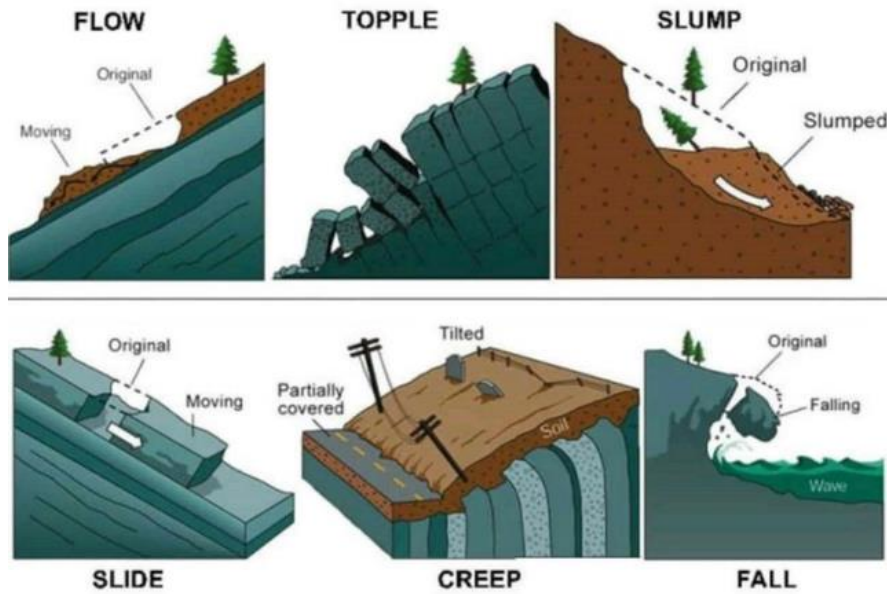


Fig: some types of landslides

Source: [adelaidelandslidesalfa.wordpress.com](http://adelaidelandslidesalfa.wordpress.com)

### Causes of Landslides:

Landslides occur when gravitational and other types of shear stresses within a slope exceed the shear strength (resistance to shearing) of the materials that form the slope.

- Undercutting of a slope by stream erosion, wave action, glaciers, or human activity such as road building
- Intense or prolonged rainfall,
- Shocks or vibrations caused by earthquakes or construction activity,
- Loading on upper slopes,
- Deforestation.



### **Effects of landslide:**

- Loss of life & property
- Changes in landscape
- Loss of cultivable land
- Soil erosion and soil loss
- Relocation of population.
- Diversion of river courses due to landslides

### **Landslide Hazard Mitigation:**

- Hazard mapping
- Afforestation
- Developmental activity initiated in the area should be taken up only after a detailed study of the region has been carried out.
- Avoiding blockage of natural drainage while construction
- Retaining walls to stop land from slipping
- surface drainage control works

# VOLCANO

A volcano is a vent in the earth crust that lets out hot lava, gasses, rocks, volcanic ash and steam from a magma chamber underneath the earth's surface. They are called active if they erupt regularly. Dormant or inactive volcanoes are those that have erupted in the past times but are now quiet while the volcanoes that have not erupted since ages are termed extinct.

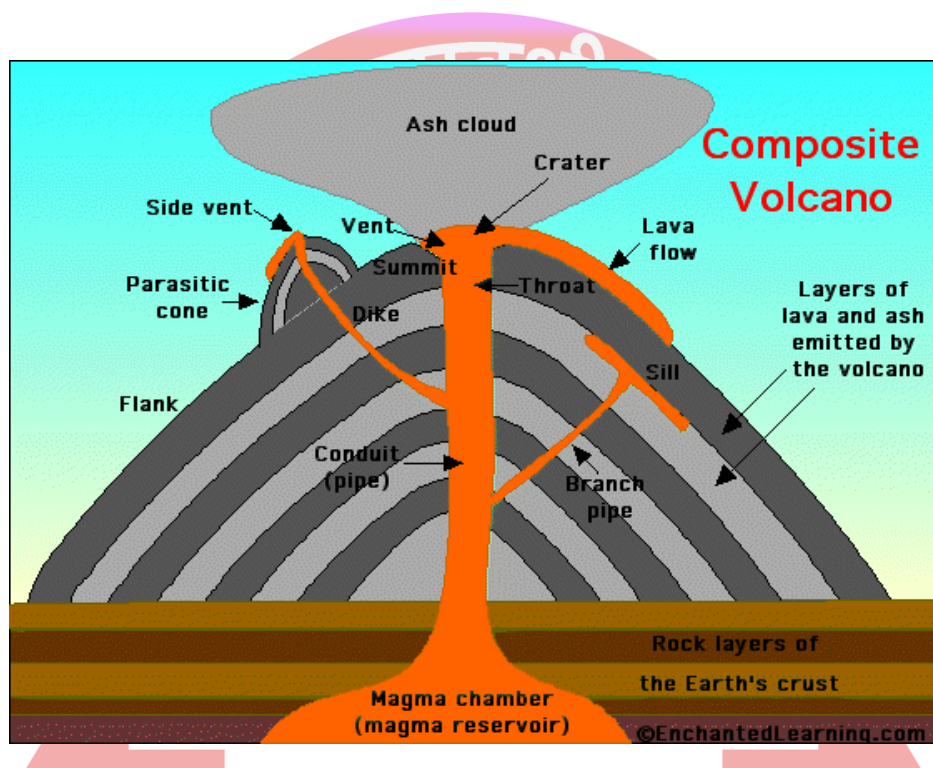


Fig: volcano

Source: enchantedlearning.com

## Types of volcanoes:

### Shield Volcanoes

- They are not very steep but are far and wider. They extend to great height as well as distance.

- They are the largest of all volcanoes in the world as the lava flows to a far distance. Eg. Hawaiian volcanoes.
- These volcanoes are mostly made up of basalt (less viscous), a type of lava that is very fluid when erupted. For this reason, these volcanoes are not steep.
- They are of low explosive in general, but if somehow water gets into the vent they may turn explosive.

### **Cinder Cone Volcanoes:**

- Cinders are extrusive igneous rocks.
- Small volcanoes.
- These volcanoes consist almost entirely of loose, grainy cinders and almost no lava.
- They have very steep sides and usually have a small crater on top.

### **Composite Volcanoes:**

- Cone shaped with moderately steep sides and sometimes have small craters in their summits.
- They consist of layers of solid lava flows mixed with layers of volcanic ash.
- Eruption of a cooler and more viscous lavas than basalt.
- These volcanoes often result in explosive eruptions.
- Along with lava, large quantities of pyroclastic materials and ashes find their way to the ground.

### **Caldera:**

- These are the **most explosive** of the earth's volcanoes.
- They are usually so explosive that when they erupt they tend to collapse on themselves rather than building any tall structure. The collapsed depressions are called calderas.
- Their explosiveness indicates that its magma chamber is large and in close vicinity.

- A caldera differs from a crater in such a way that a caldera is a huge depression caused by a collapse after a large-scale eruption, whereas a crater is a small, steep side, volcanic depression bored out by an eruptive plume.

### **Mid-Ocean Ridge Volcanoes:**

- These volcanoes occur in the oceanic areas.
- There is a system of mid-ocean ridges more than 70,000 km long that stretches through all the ocean basins.
- The central portion of this ridge experiences frequent eruptions.

### **Flood Basalt Provinces:**

- These volcanoes outpour highly fluid lava that flows for long distances.
- The Deccan Traps from India, presently covering most of the Maharashtra plateau, are a much larger flood basalt province.

### **Volcano Risks in India:**

India's only live volcano is the Barren Island volcano in the Andaman and Nicobar Islands which had started showing activity in the year 1991 after being dormant for over 150 years. It has once again started spewing ash in January 2017. The volcanic island is uninhabited and the northern part of the island is barren and devoid of vegetation

# BIOLOGICAL DISASTER

- Biological disasters might be caused by epidemics, accidental release of virulent microorganism(s) or Bioterrorism (BT) with the use of biological agents such as anthrax, smallpox, etc.
- Biological agents are living organisms and their toxic products that can kill or incapacitate people, livestock and plants.
- Recent Covid19 is glaring example of biological disaster. In past Cholera, swine flu, bird flu have been such examples.
- Biological Terrorism (BT) The intentional use of microorganisms, or toxins, derived from living organisms, to produce death or disease in humans, animals or plants.

## Causes

- Poor sanitary conditions leading to contamination of food and water
- due to inadequate disposal of human or animal carcasses in post disaster situations
- Poor solid waste management may create epidemics like plague
- Poor handling of organisms and illegal trade. E.g. Covid19 is expected to have come from illegal Pangolin trade or unregulated bat sale in animal market.
- Increase in transportation has led to easy spread of diseases.

## Challenges:

The essential challenges posed by natural and artificial (bioterrorism) outbreaks of disease include:

- the development of mechanisms for prompt detection of incipient outbreaks.
- isolation of the infected persons and the people they have been in contact with

- mobilization of investigational and therapeutic countermeasures
- international collaboration as epidemics do not respect national borders.
- Absence of standard risk and vulnerability assessment plans.
- Absence of standard treatments and specialized laboratories.

## Effects

- The harmful effects posed to human health by biohazards are mainly of three types:
  - Infection
  - Allergy
  - Poisoning Biohazard Symbol
- It can result into heavy mortalities in the short term.
- drop in economic activity
- leads to diversion of substantial resources of an economy to contain the disaster reversing growth.
- Long term environmental consequences

## Prevention of Biological Disaster

- Vulnerability Assessment and Risk Management
- Environmental management
  - Safe water supply and proper maintenance of sewage pipeline.
  - Awareness about personal hygiene.
  - Vector control.
  - Elimination of breeding places.
  - Regulation of animal trade.
- Pharmaceutical interventions – immunization and other preventive measures

- Biosafety and Biosecurity through legislations that control and govern the nation's health policies.
  - The Water (Prevention and Control of Pollution) Act, 1974
  - The Air (Prevention and Control of Pollution) Act, 1981
  - The Environmental (Protection) Act, 1986,
  - Disaster Management Act of 2005.





# NUCLEAR AND RADIOLOGICAL DISASTERS

Any radiation incident resulting in, or having a potential to result in, exposure to and/or contamination of the workers or the public, in excess of the respective permissible limits can be termed as a nuclear/radiological emergency.

## Sources of Nuclear Hazard:

- **Natural Resources:** Cosmic rays from the outer space, emissions from the radioactive materials from the earth's crust.
- **Man-Made Sources:** Nuclear power plants, X-Rays, nuclear bombs, nuclear accidents, nuclear weapons, mining and processing of radioactive ores.

## Examples:

- The dreadful memory of the use of nuclear weapons in 1945 by the USA on Hiroshima and Nagasaki in Japan.
- Reactor accidents at Three Mile Island (TMI) in USA.
- Chernobyl in erstwhile USSR has strongly influenced the public perception of nuclear emergency.

## Causes:

A nuclear disaster is caused due to:

- An extraordinary or sudden release of radioactive material or radiation in the operation of nuclear reactors.
- Explosion of a nuclear weapon.
- Nuclear emergencies can arise due to factors beyond the control of the operating agencies from human error like system failure, sabotage, extreme natural events like earthquake, cyclone, flood, tsunami, or a combination of these.

## **Risk in India:**

India has a flourishing and largely indigenous nuclear power programme and aims to supply 25% of electricity from nuclear power by 2050. Thus there is a possibility of nuclear/radiological emergency.

## **Impacts of Nuclear Hazards:**

- Death, acute or chronic debilitation, or increased risk of cancer, cataract in eyes etc
- Radiation Sickness which is often fatal
- Damage or destruction of agricultural products – animals and crops
- Degradation of environmental resources.
- Devaluation or loss of use of public and private property
- Genetic changes in the generations to come by mutation

## **Mitigation of Nuclear and Radiological Disaster:**

- Protection of people through
  - Limiting time of exposure
  - Increasing distance with source
  - Shielding
  - Containment
- Preparation of Disaster Management Plans and Financial arrangements.
- Specialists in nuclear science and technology are to be inducted at all levels of administration in the formulation of plans and their effective monitoring during implementation, covering all the activities of disaster continuum.
- **Capacity Development**
  - Specialized response teams specially trained for nuclear/radiological emergency/disasters.

- A reliable and dedicated communication system
- The possible shelters in large metros and vulnerable areas be identified for evacuation in the event of any nuclear/radiological emergency.
- There is a need to enhance the security of radioactive sources at radiation facilities and during their transportation by the concerned facility operator.
- Training of First Responders and Mock Drills by CBRN trained NDRF trainers and NIDM.
- To cope with radiological emergencies, mock-drills emergency preparedness exercises will be conducted by SDMA/DDMA on a regular basis in the public domain.
- Training programmers of medical professionals for treatment of radiation injuries along with maintaining sufficient stock of essential medicines.



# STRUCTURE OF DISASTER MANAGEMENT SYSTEM IN INDIA

The structure of Disaster Management in India has two distinct features:

- The structure is hierarchical and functions at four levels – centre, state, district and local.
- It is a multi-stakeholder setup, i.e., the structure draws involvement of various relevant ministries, government departments and administrative bodies.

## National Level Institutions:

### National Disaster Management Authority (NDMA)

- Initially constituted in 2005 under the Chairmanship of Prime Minister vide an executive order.
- Formally constituted in 2006 in accordance to the National Disaster Management Act, 2005

### Mandate of NDMA:

- It approves the National Disaster Management Plans and plans of the Central Ministries/Departments.
- The general superintendence, direction, and control of the National Disaster Response Force (NDRF) are vested in and are exercised by the NDMA.
- The National Institute of Disaster Management (NIDM) works within the framework of broad policies and guidelines laid down by the NDMA.
- Lay down guidelines to be followed by the State Authorities in drawing up the

State Plan;

- Recommend provision of funds for the purpose of mitigation;
- Take such other measures for the prevention of disaster, or mitigation, or preparedness and capacity building for dealing with the disaster.

### **National Executive Committee (NEC)**

- It acts as the coordinating and monitoring body for disaster management. It is chaired by the Union Home Secretary.
- The NEC will coordinate response in the event of any threatening disaster situation or disaster where central assistance is needed.

### **Cabinet Committee on Security (CCS)**

It deals with issues related to defence of the country, law and order, and internal security, policy matters concerning foreign affairs and economic and political issues impinging on national security.

### **National Crisis Management Committee (NCMC)**

The NCMC deals with major crises that have serious or national ramifications. These include incidents such as those requiring close involvement of the security forces and/or intelligence agencies such as terrorism (counter-insurgency), law and order situations, serial bomb blasts, hijacking, air accidents, CBRN etc

**State Disaster Management Authority (SDMA)** under Chairmanship of the Chief Minister to lay down policies and plans for Disaster Management in the State.

**District Disaster Management Authority (DDMA)** headed by the District Collector/District Magistrate, is responsible for overall coordination of the disaster management efforts and planning in the district.

## **Financial Arrangements:**

### **National Disaster Response Fund**

It is a fund managed by the Central Government for meeting the expenses for emergency response, relief and rehabilitation due to any threatening disaster situation.

### **State Disaster Response Fund**

The SDRF is used only for meeting the expenditure for providing immediate relief to the victims of disasters.

### **National Disaster Response Force (NDRF):**

The NDRF was constituted under the DM Act 2005. It is a specialist response force that can be deployed in a threatening disaster situation or disaster. The general superintendence, direction and control of this force is vested in and exercised by the NDMA

### **Role of NDRF:**

- Provide specialized response for rescue and relief in case of disasters-natural and manmade.
- Deployment in case of impending disasters.
- Assistance to civil authorities in distribution of relief material during/after disaster.
- Co- ordination with other agencies engaged in rescue/relief work.

### **State Disaster Response Force (SDRF)**

(SDRFs) have also been set up across different states on the lines of NDRFs Civil Defence

- The Civil Defence Act of 1968 was amended in 2010 to cater to the needs of disaster management.
- Provisions were made to utilise the services of Civil Defence volunteers effectively for enhancement of public participation in disaster management related activities in the country.

# INTERNATIONAL COOPERATION IN DISASTER MANAGEMENT

- SAARC Disaster Management Centre in New Delhi
- United Nations International Strategy for Disaster Reduction (UNISDR)
- United Nations Disaster Management Team (UNDMT)
- United Nations Disaster Assessment and Coordination (UNDAC)
- International Search and Rescue Advisory Group (INSARAG)
- Global Facility for Disaster Risk Reduction (GFDRR)
- ASEAN Region Forum (ARF)
- Asian Disaster Reduction Centre (ADRC)
- Hyogo Framework of Action
- Sendai Framework 2015

## Three Strategic Goals:

- The more effective integration of disaster risk reduction into sustainable development policies, planning and programming at all levels, with a special emphasis on disaster prevention, mitigation, preparedness and vulnerability reduction.
- The development and strengthening of institutions, mechanisms and capacities at all levels in particular at the community level that can systematically contribute to building resilience to hazards.
- The systematic incorporation of risk reduction approaches into the design and implementation of emergency preparedness, response and recovery programmes in the reconstruction of the affected communities.

## Five Priority Action Areas:

- Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation,



- Identify, assess and monitor disaster risks and enhance early warning,
- Use knowledge, innovation and education to build a culture of safety and resilience at all levels,
- Reduce the underlying risk factors,
- Strengthen disaster preparedness for effective response at all levels.

## SEDAI FRAMEWORK

The Sendai Framework for Disaster Risk Reduction 2015–2030 was adopted at the Third United Nations World Conference on Disaster Risk Reduction to adopt a concise, focused, forward-looking and action-oriented post 2015 framework for disaster risk reduction.

It is a voluntary and non-binding agreement which recognizes that the State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders including local government, the private sector and other stakeholders.

### Four priority areas under framework are:

1. **Understanding Disaster Risk:** collect, analyse, manage, disseminate information and evaluate, record, share the account of disaster losses.
2. **Strengthening disaster risk governance to manage disaster risk:** assessment of the technical, financial and administrative disaster risk management capacity
3. **Investing in disaster risk reduction for resilience:** allocation of necessary resources at all levels of administration for the development and the implementation of disaster risk reduction strategies, policies, plans, laws and regulations in all relevant sectors
4. **Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction.**

## **The Seven Global Target of Sendai Framework**

- Substantially reduce global disaster mortality by 2030.
- Substantially reduce the number of affected people globally by 2030.
- Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.
- Substantially reduce disaster damage to critical infrastructure and disruption of basic services by 2030.
- Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.
- Substantially enhance international cooperation to developing countries
- Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030.

## **India's action on Sendai Framework**

- In June 2016, PM of India launched the National Disaster Management Plan, which aligns with the Sendai Priorities.
- With regards to Target A, India is analyzing the patterns of disaster mortality, both spatially and temporally, for different hazards and taking focused, urgent steps to reduce preventable deaths.
- On 7<sup>th</sup> May 2017, India has launched South Asia Geostationary Communication Satellite with an aim to support and improve communication, weather forecasting, natural resource mapping, disaster information transfer etc. among the South Asian Countries, which demonstrates India's strong sense of commitment towards Target F and G.
- India is also mainstreaming Sendai Principles in the national flagship program.

Disaster Risk Reduction is a work in progress and in this respect, we look for opportunities to collaborate with other countries, learn from their experiences and share what we have learned through our work.