UNIT - II - Disasters

1. Disasters classification
2. natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.);
3. manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.);
4. hazard and vulnerability profile of India,
5. mountain and coastal areas,
6. ecological fragility.

Disasters classification

- **Natural disasters**

1. Disasters that occur in nature, without human provocation.
2. Natural disasters are those which occur as a natural process of weather patterns or other factors affecting Earth
   - floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires

- **Manmade disasters / Artificial Disasters –**

1. Disasters that occur due to human activities
2. Anthropogenic hazards may adversely affect human, other organisms and biomes and ecosystems The frequency and severity of hazards are key elements in some risk analysis methodologies
   - industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes

FLOODS

- Flood is a state of high water level along a river channel or on the coast that leads to inundation of land, which is not usually submerged. Floods may happen gradually and also may take hours or even happen suddenly without any warning due to breach in the embankment, spill over, heavy rains etc
- Floods are sudden and temporary inundation of a large area as an overflowing of rivers or reservoirs
- A flood occurs when the volume of water in the river becomes greater than bank full stage, the extra water spills over the banks and spreads in sheets all along and away from the banks governed by available slope. This condition is called flood

INTRODUCTION

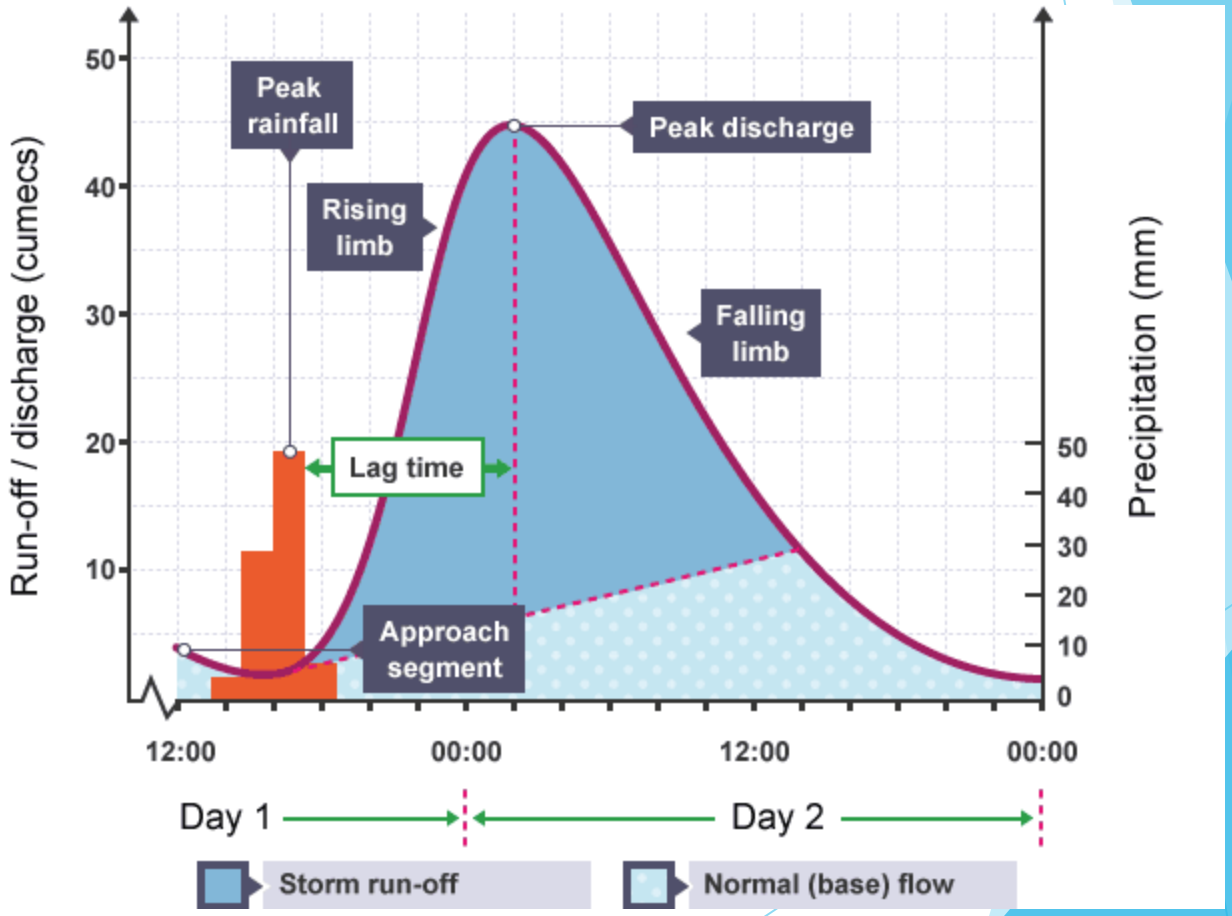
- Floods are relatively slow in occurrences and often, occur in well-identified regions and within expected time in a year.
- Commonly occur when surface run-off exceeds the carrying capacity of river channels & streams and flows into the neighbouring low lying flood plains.
- Also caused due to a storm surge in coastal areas, high intensity rainfall for a considerably longer time period, melting of ice & snow, reduction in the infiltration rate and presence of eroded material in the water due to higher rate of soil erosion
- Though floods occur frequently over wide geographical area having disastrous ramifications in many parts of the world, floods in south, southeast & east Asian countries particularly in China, India, Bangladesh are frequent and equally disastrous

TYPES/ CLASSIFICATION OF FLOODS

- SLOW ONSET FLOODS - these usually last for a relatively longer period, it may last for one or more weeks, or even months
- RAPID ONSET FLOODS - these last for a relatively shorter period, they usually last for one or two days only
- FLASH FLOODS - they may occur with in minutes or a few hours after heavy rainfall, tropical storm, failure of dams or levees or release from dams, and it causes the greatest damages to society

MAGNITUDE & FREQUENCY OF FLOODS

- Magnitude – discharge of water from a channel at a particular point, discharge is commonly indicated by means of hydrograph.
- Hydrograph is a plot between discharge of a stream in cubic meters/ sec or cubic feet / sec over a period of time (day or week or month or year)
- Studying hydrographs of river for long periods will help in predicting the flood duration, intensity and return period



FLOOD HAZARD IN INDIA

- National flood commission identified 40 million hectares of land as flood prone in India
- India receives an annual rainfall of 1200mm , 85% of which is concentrated in 3-4 months i.e June to September.
- Assam, West Bengal & Bihar are highest flood prone states
- Punjab & Uttar Pradesh are vulnerable to occasional floods
- Rajasthan, Gujarat, Haryana & Punjab are inundated to flash floods.
- Southern States experiences floods during monsoon season
- Ganga basin, Brahmaputra basin - north western region

RISK REDUCTION MEASURES

MAPPING OF FLOOD PRONE AREAS

- This is a primary step involved in reducing the risk of the region.
- Historical records gives floods inundation areas & period of occurrence & extent of coverage.
- Warning can be issued looking into earlier marked heights of water levels

LAND USE CONTROL

- This will reduce danger of life & property waters inundate the flood plains & costal areas.
- In areas where people already have built their settlements, measures should be taken to relocate to better sites so as to reduce vulnerability.
- Important facilities like schools, hospitals, should be built in safe area.

RISK REDUCTION MEASURES

CONSTRUCTION OF ENGINEERED STRUCTURES

- Doing this in flood plains & strengthening of structures to withstand flood forces & seepage, buildings should be constructed on an elevated area, if necessary build on stilts or platform.
- Reforestation will decrease the runoff, protection of vegetation,, clearing of debris from streams & other water holding areas, conservation of ponds & lakes
- Improvement of embankments, dams & channels,

FLOOD MANAGEMENT

- Systematic planning for flood management commenced with 5 yr plan launched in 1954 along with NATIONAL PROGRAM OF FLOOD MANAGEMENT
- Last 48 yrs structural & non structural measures have been adopted.
- Important facilities like schools, hospitals, should be built in safe area.

CAUSES OF FLOODS

NATURAL CAUSES

- Heavy rainfall
- Snow melt
- Relief
- Coastal flooding

HUMAN CAUSES

- Deforestration
- Poor farming
- Poor water management
- Population pressure

ADVERSE EFFECTS OF FLOODS

- Casualties - loss of life, livestock, outbreak of epidemics, contamination of water & food
- Structural damage - damage of weak structures, dams, roads,, canals etc
- Material loss - loss of electronics and household goods
- Utilities damage - disruption in power supply, transportation,
- Crop loss - loss of food grains and crops

PRECAUTIONS

- Building houses away from flood prone area
- Keeping updated about weather & flood forecasting
- Evacuating and going to safe shelters immediately after the warnings
- Store extra food, such as rice, pulses etc for emergency
- Do not touch loose electric wire to avoid electrocution
- Don’t spread rumours or listen to them
- Medication for spread diseases

FLOOD BENIFITS

- Recharging ground water, making soil more fertile & increasing nutrients in some soils
- Provides much needed water resources in arid & semi arid regions where precipitation can be very unevenly distributed throughout the year
- Freshwater floods particularly play an important role in maintaining ecosystem in river corridors
- Flooding can spread nutrients to lakes & rivers which can lead to increased biomass & improved fisheries for few years
- Weather fish make use of floods in order to reach new habitats

DROUGHT

- Droughts may be defined as a condition that arises from too little precipitation for an extended period of time for normal farming practices to be conducted
- Drought is an event that results from lower than normal expected rainfall over a season or period. The low rainfall is insufficient to meet the needs of human beings, plants, animals & agriculture. Short fall in rain results in dying of rivers, lakes. Reservoirs & dying of wells due to excessive withdrawal & poor recharge of ground water & loss of crop yield due to shortage of water are some of the main indicators of drought

INTRODUCTION

- 68% of the net area in the country is prone to drought
- Out of this 33% is chronically drought prone, receiving rainfall <750mm per annum
- 35% of drought prone that receive rainfall between 750-1125mm per annum

TYPES & CLASSIFICATIONS

- Metrological Drought : precipitation is < average for an extended period of time, causing a natural shortage of available water
- Agricultural Drought : When soil moisture is not sufficient to support the production of crop
- Hydrological Drought : Occurs when water level in aquifers, lakes & reservoirs fall below the average levels

CAUSES

- Due to shortage of rainfall – if rainfall is <10% of annual average rainfall, the condition is said to be drought
- In the recent past frequency periods of drought have increasing due to deforestation & environmental degradation.

EFFECTS / IMPACTS

- Economic Impacts :
  - Destroy growth of crops, with lower yields & poor quality
  - Livestock of ranches may be lost
  - Fishes & aquatic organisms cant survive
  - Loss to tourism industry
  - Businesses related to food industry will suffer with losses
  - Hydropower will be in short supply
- Environmental Impacts:
  - Due to lack of water, aquatic organisms will be endangered
  - Low water consumption leads to diseases
  - Reduction in wet lands results in soil erosion, and chances of forest fires
  - Loss of biodiversity & extinction of species
- Social Impacts :
  - Revenue loss caused by drought may cause mental & physical stress on people, which tend for suicidal thoughts
  - People migrate to other places
  - Reduction in nutrition due to inflation
  - Increase in poverty leads to changes in lifestyle & quality of life

DROUGHT CONTROL MEASURES

- Rain water harvesting : construction of rain water harvesting pits to store the rain water and recharging the ground water
- Crop rotation : rotation of perennial crops & leguminous plants alternating with cash crops controls soil erosion
- Channelizing the rivers : building canals in drought prone areas is an efficient way to combat the effects of drought
- Cloud seeding : artificial technique to stimulate the precipitation process & form rain, by sprinkling silver iodide aerosols into the upper part of clouds
- Desalination of sea water : desalination plants are set up to convert sea water into portable drinking water
- Risk mitigation efforts by Government : these include
  - Drought prone area program (DPAP)
  - Desert Development Program (DDP)

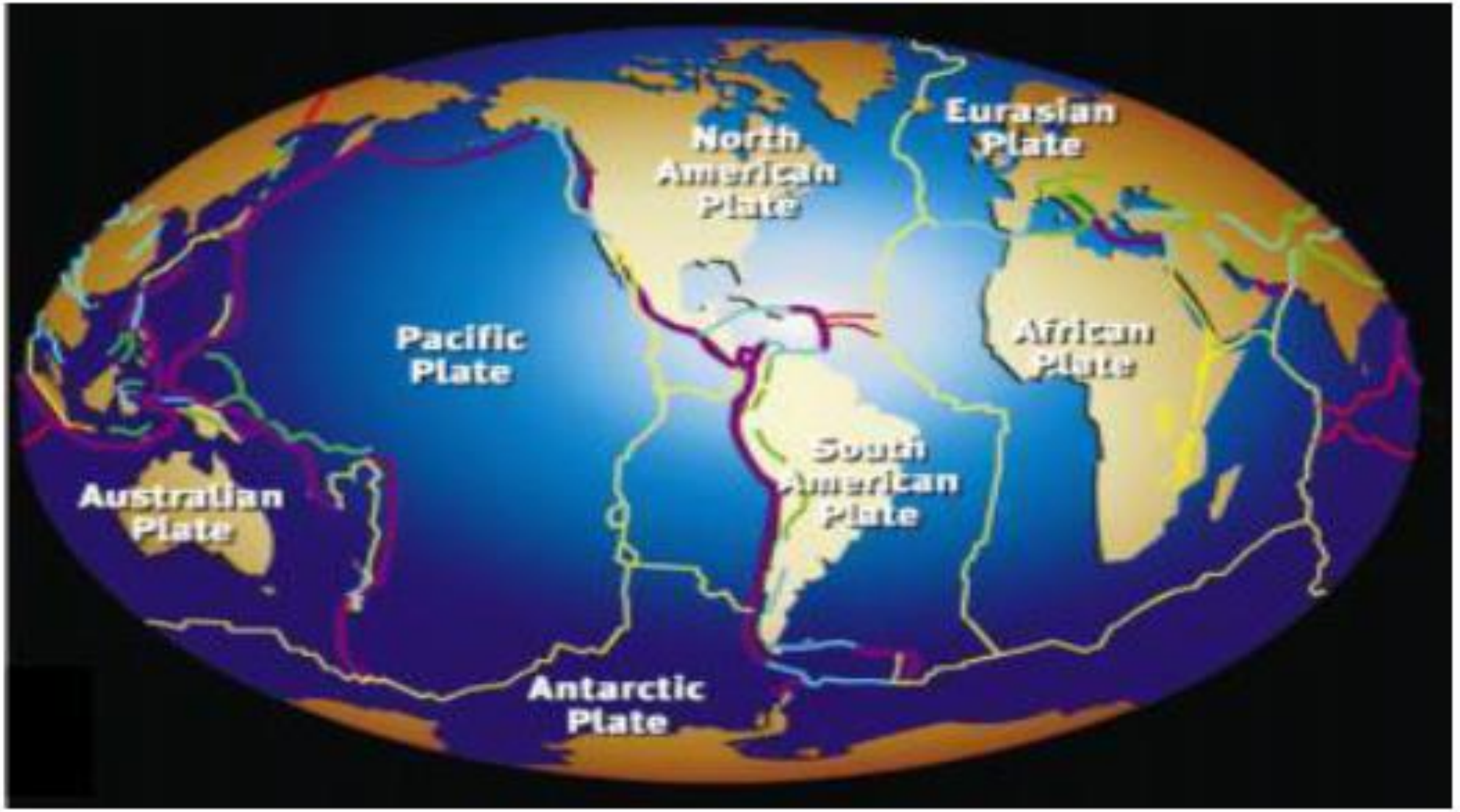
EARTHQUAKE

- It is the sudden shaking of the earth crust. The impact of an earthquake is sudden and there is hardly any warning, making it impossible to predict
- An earthquake is a phenomenon of shaking on the surface of the earth, due to the movement along geological faults present in the earth's lithosphere. It is usually what happens when 2 blocks of the earth suddenly slips past one another or break apart from each other as a result of tension caused by prolonged energy build up. This sudden release of energy from the fault plane will generate seismic waves to travel in all directions. The seismic waves that reach the earth’s surface cause an earthquake
- Earthquake is a sudden release of energy accumulated in deformed rocks of earth crust causing the ground to tremble or shake. Earthquake can occur suddenly any time of the year without any warning causing severe loss of life & property.

CAUSES

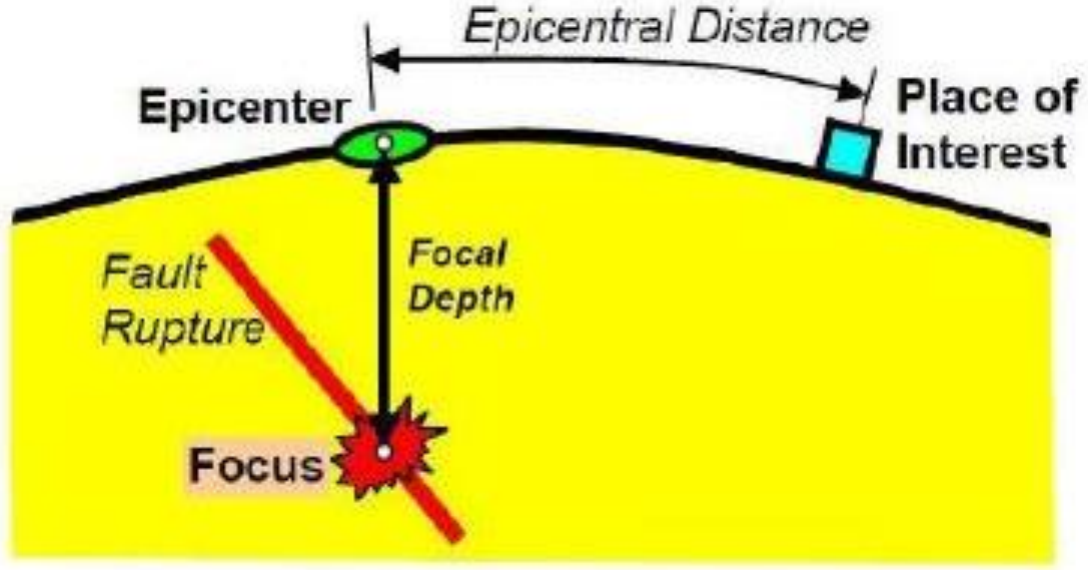
- All these movements are associated with earthquakes.
- The areas of stress at plate boundaries which release accumulated energy by slipping or rupturing are known as *'faults'*.
- The theory of 'elasticity' says that the crust is continuously stressed by the movement of the tectonic plates; it eventually reaches appoint of maximum supportable strain.
- A rupture then occurs along the fault and the rock rebound sunder its own elastic stresses until the strain is relieved.
- The fault rupture generates vibration called seismic (from the Greek 'seismos' meaning shock or earthquake) waves, which radiates from the focus in all directions.

Tectonic Plates



TERMINOLOGY

- Focus or Hypocentre: The point on the fault where slip starts is the focus or hypocentre
- Epicentre: The point vertically above this on the surface of the earth is the epicentre
- Focal Depth: The depth of focus from the epicentre, called as focal depth
- Epicentral distance: Most of the damaging earthquakes have shallow focus with focal depths less than about 70kmm. Distance from epicentre to any point of interest is called epicentral distance



TYPES / CLASSIFICATION OF EARTHQUAKES

- Depth of focus as basis:
  - Shallow : Depth of focus lies up to 60km below the surface
  - Intermediate : Depth of focus lies between 60-300kms below the surface
  - Deep seated : Depth of focus lies between 300 – 700 km below the surface
- Magnitude basis :based on magnitude
- Cause of origin as basis :
  - Tectonic earthquake : caused due to relative displacements of blocks of the crust, of the earth along the rupture planes.
  - Non-tectonic earthquake: Caused due to volcanic eruptions, atomic explosions landslides & subsidence.
- The ground shaking is caused by 'body waves 'and' surfacewave'
  - Bodywaves(PandSwaves): penetrate the body of the earth, vibrating fast. 'P' waves travel about 6kilometers per hour and 'S' waves travel with a speed of 4 kilometers per hour
  - Surfacewaves*:* vibrate the ground horizontally and vertically. These long period waves causes waying of tall buildings and slight waves motion in bodies of water even at great distances from the epicenter.

Measuring Earthquakes

- The scale was developed by a seismologist named *Charles Richter.*
- An earthquake with a magnitude 7.5 on the Richter scale releases 30 times the energy than one with 6.5 magnitudes.
- An earthquake of magnitude 3 is the smallest normally felt by humans. The largest earthquake that has been recorded with this system is 9.25 (Alaska,1969 and Chile,1960).
- The **second type** of scale, the earthquake **intensity** scale measures the effects of an earthquake where it occurs.
- The most widely used scale of this type was developed in 1902 by **Mercalli** an Italian seismologist.
- The scale was extended and modified to suit the modern times. It is called the **Modified Mercalli Scale**, which expresses the intensity of earthquake effect on people, structure and the earth's surface in values from I to XII. With an intensity of VI and below most of the people can feel the shake and there are cracks on the walls, but with an intensity of XII there is general panic with buildings collapsing totally and there is a total disruption in normal life.

GROUP	MAGNITUDE
GREAT	>8
MAJOR	7-7.9
STRONG	6-6.9
MODERATE	5-5.9
LIGHT	4-4.9
MINOR	3-3.9
VERY MINOR	<3

MODIFIED MERCALLI SCLAE		RICHTER SCALE	
1	Felt by almost no one	2.5	Generally not felt but recorded
2	Felt by very few people		
3	Terror noticed by many but they often do not realize it is an earthquake	3.5	Felt by many people
4	Felt indoors by many, feels like a truck has struck the building		
5	Felt by nearly everyone, many people awakened, swaying trees and pole may be observed		
6	Felt by all, many people run outdoors, furniture moved slightly damage occurs	4.5	Some local damage
7	Everyone runs outdoors, poorly built structures considerable damage		
8	Specially designed structures damaged slightly, others collapse	6.0	Destructive earthquake
9	All buildings considerably damaged, many shifts off foundations, noticeable cracks in ground		
10	Many structures destroyed. Ground is badly cracked	7.0	Major earthquake
11	Almost all structures fall very wide cracks in ground	>8.0	Great earthquake
12	Total destruction, waves seen on ground surfaces objects are tumbled and tossed		

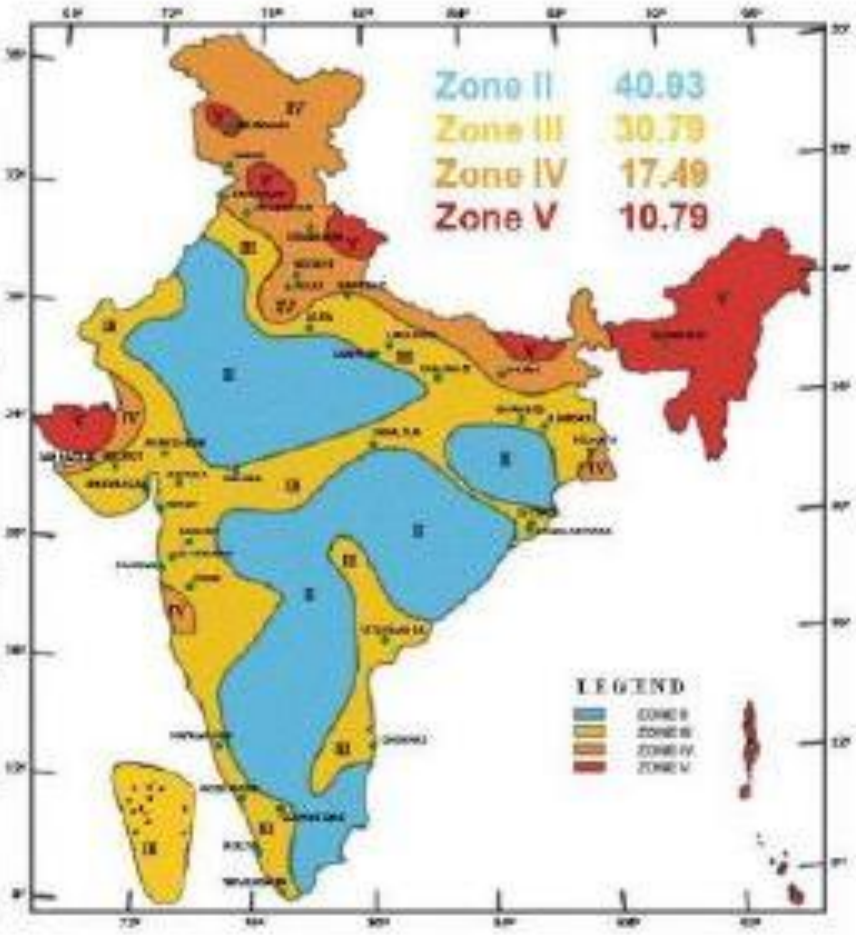
EARTHQUAKE HAZARDS ZONING IN INDIA

- Indian plate is driving into Asia at a rate of 47mm/year.
- 54% of land is vulnerable to earthquakes.
- Seismic zoning map of India given in the earthquake resistant design code of India (IS 1893 PART 1 – 2002)
- As per that India is divided into 3 zones – zone3, zone4, zone5 , where zone 3 is the lowest

Seismic Zone Map of India: -2002

About 59 percent of the land area of India is liable to seismic hazard damage

Zone	Intensity
Zone V	Very High Risk Zone Area liable to shaking Intensity IX (and above)
Zone IV	High Risk Zone Intensity VIII
Zone III	Moderate Risk Zone Intensity VII
Zone II	Low Risk Zone VI (and lower)



Typical adverse effects

- Damage occurs to human settlement, buildings, structures and infrastructure, especially bridges, elevated roads, railways, water towers, pipelines, electrical generating facilities.
- After shocks of an earthquake can cause much greater damage to already weakened structures
- Secondary effects include fires, dam failure and landslides which may block water ways and also cause flooding.
- Damage may occur to facilities using or manufacturing dangerous materials resulting in possible chemical spills.
- There may also be a break-down of communication facilities.
- There are large number of casualties because of the poor engineering design of the buildings and close proximity of the people.
- About 95 percent of the people who are killed or who are affected by the earthquake is because of the building collapse.
- There is also a huge loss to the public health system, transport and communication and water supply in the affected areas.

Year	Location	Magnitude of 6+
1950	Arunachal Pradesh -China Border	8.5
1956	Anjar, Gujarat	7.0
1967	Koyna, Maharashtra	6.5
1975	Kinnaur, Himachal Pradesh	6.2
1988	Manipur -Myanmar Boarder	6.6
1988	Bihar -Nepal Border	6.4
1991	Uttarkashi-Uttar Pradesh Hills	6.0
1993	Latur-Maharashtra	6.3
1997	Jabalpur, Madhya Pradesh	6.0
1999	Chamoli, Uttar Pradesh	6.8
2001	Bhuj, Gujarat	6.9
2005	Muzaffarabad(Pakistan) Impact in Jammu & Kashmir	7.4

RISK REDUCTION MEASURES

- ***Planning:*** The Bureau of Indian Standards has published building codes and guide lines for safe construction of buildings against earth quakes.
- Before the buildings are constructed the building plans have to be checked by the Municipality, according to the laid down **by laws**.
- Many existing life line buildings such as hospitals, schools and fire stations may not be built with earth quake safety measures.
- Their earth quake safety needs to be upgraded by retrofitting techniques
- **Engineered structures:** Buildings need to be designed and constructed as per the building by laws to with stand ground shaking.
- Architectural and engineering inputs need to be put together to improve building design and construction practices.
- The soil type needs to be analysed before construction.
- Building structures on soft soil should be avoided.
- Buildings on soft soil are more likely to get damaged even If the magnitude of the earthquake is not strong.
- Similar problems persist in the buildings constructed on the river banks which have alluvial soil.

CYCLONES

- Cyclone is a region of low atmospheric pressure surrounded by high atmospheric pressure resulting in swirling atmospheric disturbance accompanied by powerful winds blowing in anticlockwise direction in the northern hemisphere and in the clockwise direction in the southern hemisphere. They occur mainly in the tropical & temperature regions of the world.
- Cyclones are violent storms often of vast extent, characterised by strong and high winds rotating about a calm centre of low atmospheric pressure. This centre moves onward often with velocity of around 50km/h cyclones strike suddenly through it takes time for them to build up. Cyclone is generally followed by heavy rains causing floods. Satellite tracking can predict on possible affected areas and inhabitants fore-warned can be made for warning

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 Northeast Pacific Ocean east of the dateline, or the South Pacific Ocean.
- Tropical cyclones : the Southwest Pacific Ocean and Southeast Indian Ocean.
- Severe cyclonic storm" (the North Indian Ocean)
- Tropical cyclone (the Southwest Indian Ocean)
- Willie-Willie : in Australia
- Tornado : in South America

Types of cyclones

- Tropical cyclones:
  - Occur in tropical ocean region
  - Hurricanes and typhoons are the types of tropical cyclones
  - Hurricanes are found in Atlantic & north east pacific, typhoons are found in northwest pacific
  - Tropical cyclones occur in south pacific or Indian ocean
  - They care categorised in 1, 2, 3, 4, 5 increasing intensity & wind speeds from 74-95kmph to 155 kmph
- Polar cyclones :
  - Occur in polar region like Greenland, Siberia & antarctica
- Mesocyclone :
  - Meso means middle, as the mid point between one type of storm and the other tornadoes all come from thunder clouds, but not all thunderstorm clouds make tornadoes.
  - When a thunderstorm cloud starts to spin, which may eventually lead to a tornado.

General Characteristics:

- Strong wind
- Exceptional rain
- Storm surge

Development of cyclones

- Formation & initial development state
- Fully matured
- Weakening or decay

Development of cyclones

- Formation & 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 in to droplets and clouds, releases heat energy and induces drop in pressure.
  - Atmospheric in stability (an above average decrease of temperature with altitude) encourages considerable vertical cumulus cloud convection when condensation of rising air occurs.
  - A location of atleast 4-5 latitude degrees from the Equator allow the influence of the force due to the earth's rotation (Coriol is force) to take effect in inducing cyclonic wind circulation around low pressure centres.

Development of cyclones

Fully matured

- The main feature of a fully mature tropical cyclone is a spiral pattern of highly turbulent giant cumulus thunder cloud bands.
- These bands spiral in wards and form a dense highly active central cloud core which raps around a relatively calm zone. This is called the **“eye”** of a cyclone.
- The eye looks like a black hole or a dot surrounded by thick clouds. The outer circumference of the thick cloud is called the **‘eyewall’.**

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.
- Depending on their track on the warm tropical sea and proximity to land, a cyclone may last for less than 24 hours to more than 3 week.
- On an average the life cycle of a cyclone takes six days.

Cyclones in India

SlNo	Year	Area	Death toll
1	1971	Eastern Coast	9658
2	1972	Andhra Pradesh and Orissa	100
3	1977	Chennai, kerala& Andhra Pradesh	14,204
4	1979	Andhra Pradesh	594
5	1981	Gujarat	470
6	1982	Gujarat & Maharashtra	500
7	1984	Tamil Nadu & Andhra Pradesh	512
8	1985	Andhra Pradesh	5000
9	1990	Andhra Pradesh	957
10	1990	Orissa	250
11	1999	Orissa	8913

Typical Adverse effect:

- *Physical damage*–structures will be damaged or destroyed by the wind force, flooding and storm surge. Light pitched roofs of most structures especially the ones fitted on to industrial buildings will suffer severe damage.
- *Casualties and public heath*–caused by flooding and flying elements, contamination of water supplies may lead to viral out breaks, diarrhea and malaria.
- *Water supplies*–Ground and pipe water supply may get contaminated by flood waters.
- *Crops and food supplies*–high winds and rains ruin the standing crop and food stock lying in low lying areas. Plantation type crops such as banana and coconut are extremely vulnerable. Salt from the sea water may get deposited on the agricultural land and increase the salinity. The loss of the crop may lead to acute food shortage.
- *Communication* –severed is eruption in the communication links as the wind may bring down the electricity and communication towers, telephone poles, telephone lines, antennas and satellite disk and broad casting services.
- Transport lines (road and rail) may be curtailed, lack of proper communication affects effective distribution of relief materials.

Possible Risk Reduction Measures

Hazard mapping

- Meteorological records of the wind speed and the directions give the probability of the winds in the region.
- Cyclones can be predicted several days in advance.
- The onset is extensive and often very destructive.
- Past records and path scan give the pattern of occurrence for particular wind speeds.

Land use control

- **must** designed so that least critical activities are placed invulnerable areas.
- Traditional homes can be improved by building in disaster resistant features.
- Such homes could with stand cyclones with moderate speeds.
- Policies should be in place to regulate land use and building codes should been forced.

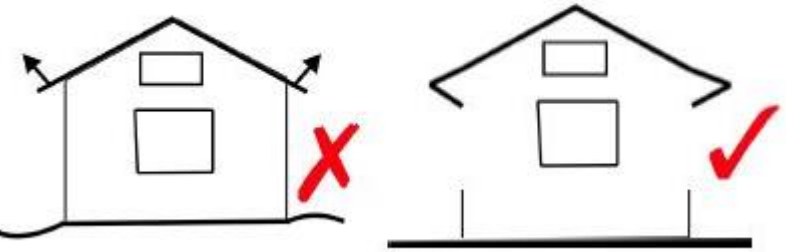
Engineered structures

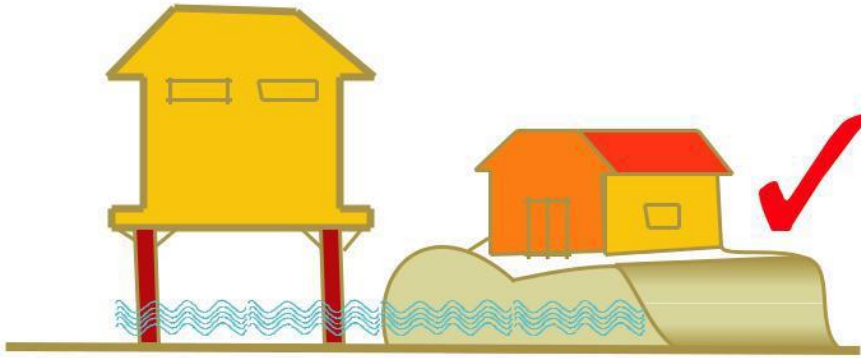
- structures need to be built to with stand wind forces.
- Good site selection is also important.
- Majority of the buildings in coastal areas are built with locally available materials and have no engineering inputs.

Possible Risk Reduction Measures

Good construction practice should be adopted such as:

- Houses can be strengthened to resist wind and flood damage. All elements holding the structures need to be properly anchored to resist the up lift or flying off of the objects. For example, avoid large over hangs of roofs, and the projections should be tied down.
- Arow of planted trees will act as a shield. It reduces the energy.
- Buildings should be wind and water resistant
- Buildings storing food supplies must be protected against the winds and water.
- Protect river embankments. Communication lines should be installed underground.
- Provide strong halls for community shelter





Possible Risk Reduction Measures

- **Flood management**–Torrential rains, strong wind and storm range leads to flooding in the cyclone affected areas. There are possibilities of land slides too. Flood mitigation measures could be in coorporated
- **Improving vegetation cover**–The roots of the plants and trees keep the soil intact and prevent erosion and slow run off to preventor lessen flooding.
- The use of tree planted in rows will act as a wind break. Coastal shelter belt plantations can be developed to break severe wind speeds. It minimizes devastating effects.
- The Orissa calamity has also high lighted the need for urgent measures like shelter belt plantation along cyclone-prone coastal areas.
- Species chosen forth is purpose should not only be able to with stand the impact of strong cyclonic winds, but also check soil erosion

VOLCANOES

- Volcanoes are openings in the earth's crust created when molten material under the crust is propelled upward through the surface. The magma chamber collects the magma that is expelled to the surface in an eruption
- Destructive : with voluminous lava flows or explosive activity. This usually occurs when magma is sticky and contains al lot of gas. Hot debris particles called pyroclastic are expelled during violent explosions. Heavier pieces land near the crater and lighter pieces can be carried by the wind for hundreds of kms
- Non destructive : with little release of solids or magmatic liquid. These eruptions occur when the magma is more fluid and contains less gas. The solids or magma rocks and lava cools on its slope

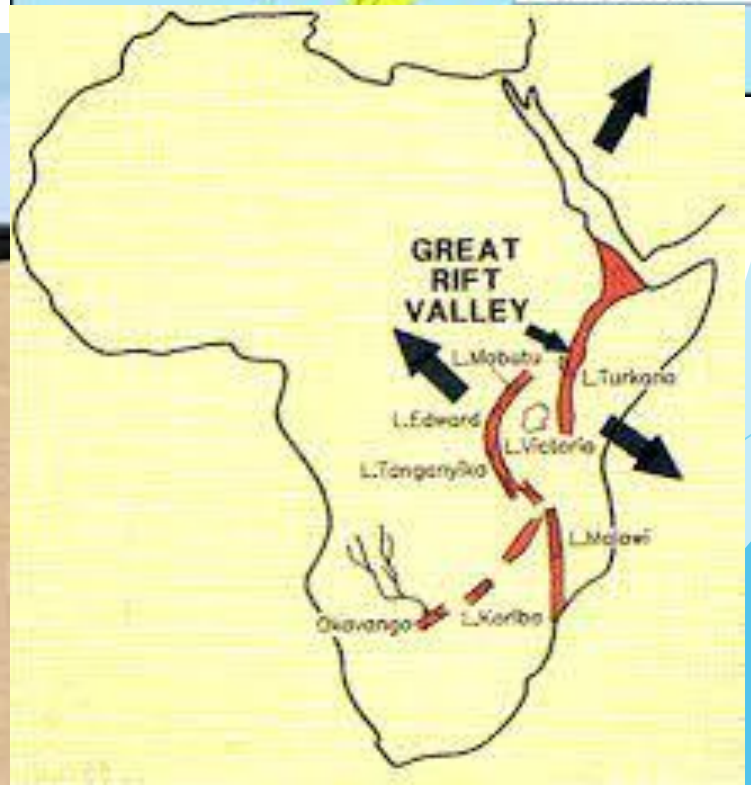
Causes & distribution of volcanoes

- Volcanoes are generally found when tectonic plates are diverging or converging
- **Divergent tectonic plates** - A mid-oceanic ridge, for example the mid-Atlantic ridge has caused by pulling apart
- **Convergent tectonic plates** - The pacific ring of fire has example of volcanoes caused by coming together
- By contrast volcanoes are usually not created when 2 tectonic plates slide past one another
- **Plate hypothesis** - volcanoes can also form where there is stretching & thinning of the earth's crust in the interiors of plates – in east African rift, the wells gray-clearwater volcanic field & the Rio Grande Rift in north America
- **Hotspots** – volacanoes away from plate boundaries has explained as mantle plumes, example Hawaii, are postulated to arise from upwelling diapirs with magma from core-mantle boundary 3000 km deep in the earth


Mid-Atlantic Ridge
Ilike2learn.com


Juan de Fuca
Subduction zone
Middle America
Tonga trench
major earthquake within
the last 50 years


Rio Grande Rift
Cross Section
Albuquerque
Volcanoes
Rio Grande
Inner Valley
10,000 Feet
5,000 Feet
Sea Level
Same Rock
Same Age
Same Fossils
10,000 Feet
Lower Tertiary
Cretaceous
Permian
Pennsylvanian
Pre-Cambrian Granite


GREAT
RIFT
VALLEY
L.Mobutu
L.Turkana
L.Edward
L.Victoria
L.Tanganyika
L.Malawi
Okavango
L.Koriba

List of volcanoes

1. YELLOWSTONE ERUPTION, 640,000 YEARS AGO magnitude-8 eruptions rocked the area as far back as 2.1 million years ago, again 1.2 million years ago and most recently 640,000 years agocrater, measuring 30 by 45 miles across (48 by 72 kilometers).

2. HUAYNAPUTINA, 1600

3. KRAKATOA, 1883 140 feet (40 meters) and killed about 34,000 people

4. SANTA MARIA VOLCANO, 1902large crater, nearly a mile (1.5 km) killed as many as 5,000 people.

5. NOVARUPTA, 1912ash into the air, which fell to cover an area of 3,000 square miles (7,800 square km)

6. MOUNT PINATUBO, 1991eruption ejected more than 1 cubic mile (5 cubic kilometers) of material into the air and created a column of ash that rose up 22 miles (35 km) in the atmosphere.

7. AMBRYM ISLAND, 50 AD 50 times since 1774

8. ILOPANGO VOLCANO, 450 AD

9. MOUNT THERA, APPROX. 1610 B.C

10. Nevado del Ruiz 1985 - 23,000 people died

Environmental Impacts of Volcanic Eruptions

- Releases a no of toxic gases possibly present in pyroclastic material
- Releases Carbon di oxide & sulphur dioxide gas along with hydrogen sulphide, hydrogen chloride
- Carbon di oxide adds to natural greenhouse effects
- sulphur di oxide cause acid rains, and sulphuric aerosols reflect solar radiation and reduce the temperature of earth, also destroy ozone layer

TSUNAMI

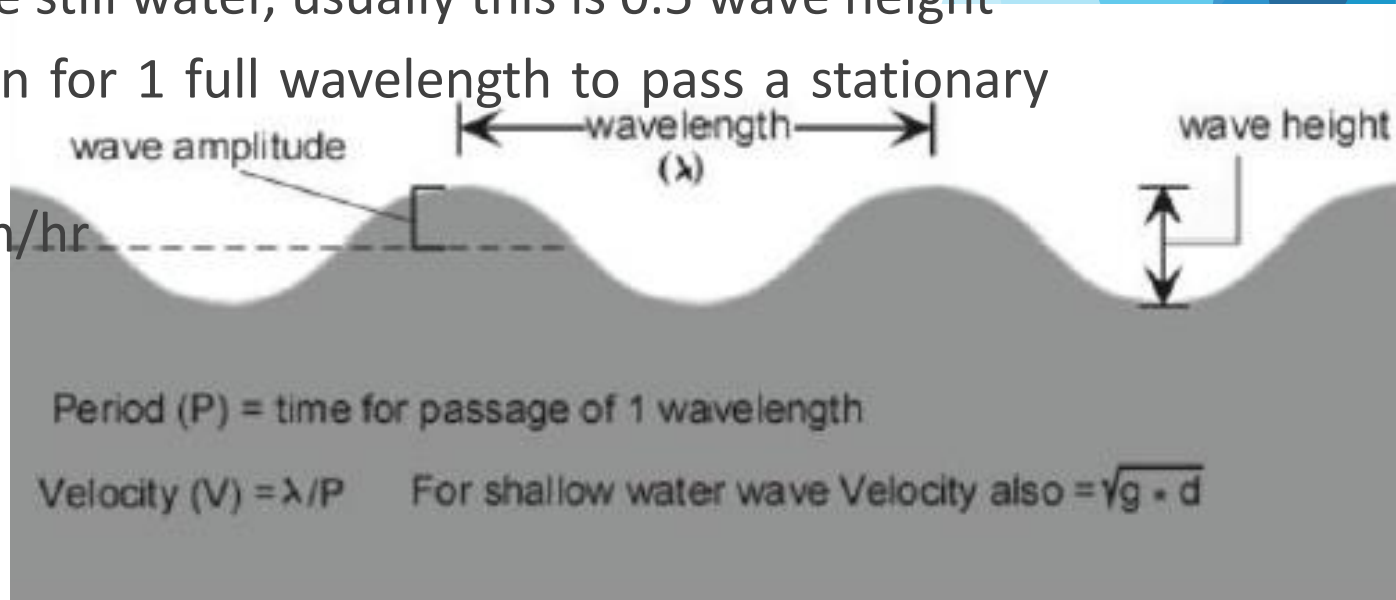
- Tsunami is a very long wave length wave of water that is generated by sudden displacement of the seafloor or disruption of any body of standing water. Tsunami are sometimes called “seismic sea waves”, although they can be generated by mechanisms other than earthquakes. Tsunami have also been called “tidal waves”, but this term should not be used because they are not in any way related to the tides of the earth. Because tsunami occur suddenly often without warning, they are extremely dangerous to coastal communities
- Tsunami is also called seismic sea wave or tidal wave, catastrophic ocean wave usually caused by a submarine earthquake occurring <50km beneath the seafloor, with a magnitude >6.5 on the Richter scale. Underwater or coastal landslides or volcanic eruptions also may cause a tsunami. The term tidal wave is more frequently used for such a wave, but it is a misnomer, for the wave has no connection with the tide

Introduction

- The term Tsunami derived from Japanese word TSU – HARBOR, NAMI – WAVES
- These waves often affect distant shores, originate by rapid displacement of water from the lake or sea either by seismic activity , landslides, volcanic eruption or large meteoroid impacts

Physical characteristics of Tsunami

- Wavelength – distance between 2 identical points – 100 m to 500 m
- Wave height – distance between trough of wave and crest or peak of wave
- Wave amplitude – height of wave above still water, usually this is 0.5 wave height
- Wave frequency or period – time taken for 1 full wavelength to pass a stationary point – 5 to 90 min
- Wave velocity – speed of wave – 100km/hr



Causes of Tsunami

- Geological movements that cause tsunamis are produced in 3 major ways

First reason

- Faults in sea floor, accompanied by an earthquake
- Release of huge amount of energy & have capacity to cross oceans
- Degree of movement depends on how fast the earthquake occurs and how much water is displaced

Second reason

- Landslide either occurring under water or originating above the sea and then plunging into the water
- Massive rock slide produced a wave that reached a high water mark of 50-150m above shore line

Third reason

- Flank of a volcano located near the shore or under water may be uplifted or depressed similar to action of fault or volcano may actually explode

Predictability

- Occurred in all oceans and in Mediterranean sea, but the great majority of them have occurred in pacific ocean
- Since scientists cant exactly predict earthquakes they also cant exactly predict when a tsunami will be generated
- 2 ways to predict

International tsunami warning systems

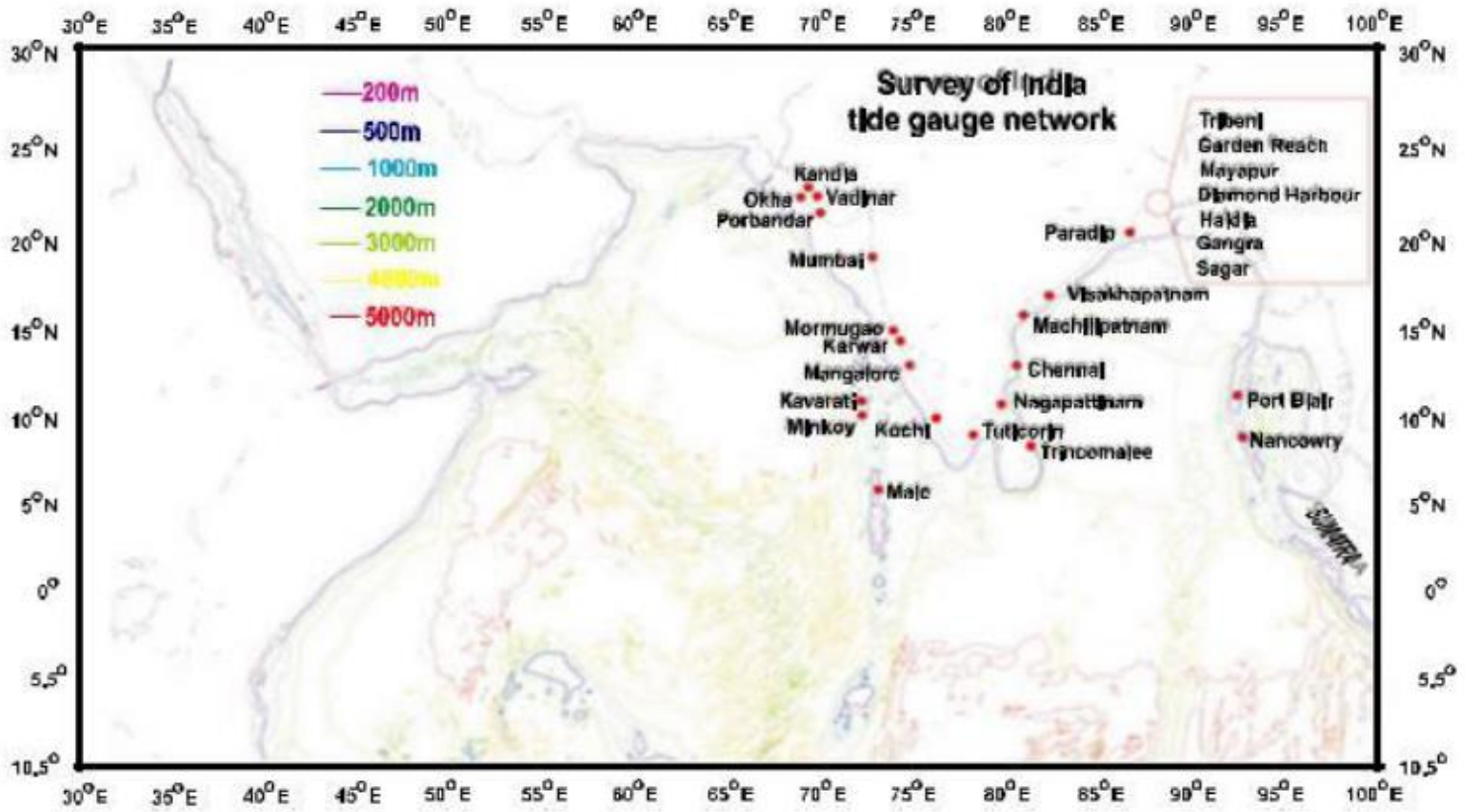
- Shortly after the Hilo tsunami 1946 the pacific tsunami warning system (PTWS) was developed with operational centre at the pacific Tsunami Warning Center near Honolulu, Hawaii
- PTWC is able to alert countries several hours before tsunami strikes
- Warning included predicted arrival time at the selected coastal communities where the tsunami could travel in few hours

Regional warning systems

- Usually use seismic data about nearby earthquakes to determine if there is a possible local threat of a tsunami

Predictability in India

- Survey of India maintains a tide gauge network along the coast of India
- Tsunami can be detected with the help of radars
- 2004 Indian Ocean Tsunami, recorded data from four radars & recorded the height of tsunami waves 2 hours after the earthquake
- Satellites observations of the Indian ocean tsunami would not have been of any use in delivering warnings, as the data took 5 hours to process and it was pure chance that satellites were overhead at that time

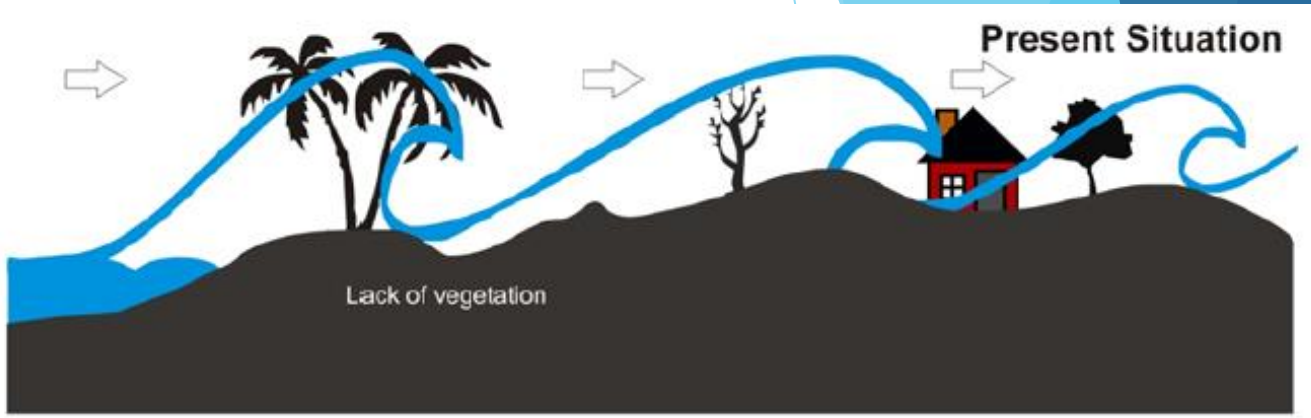


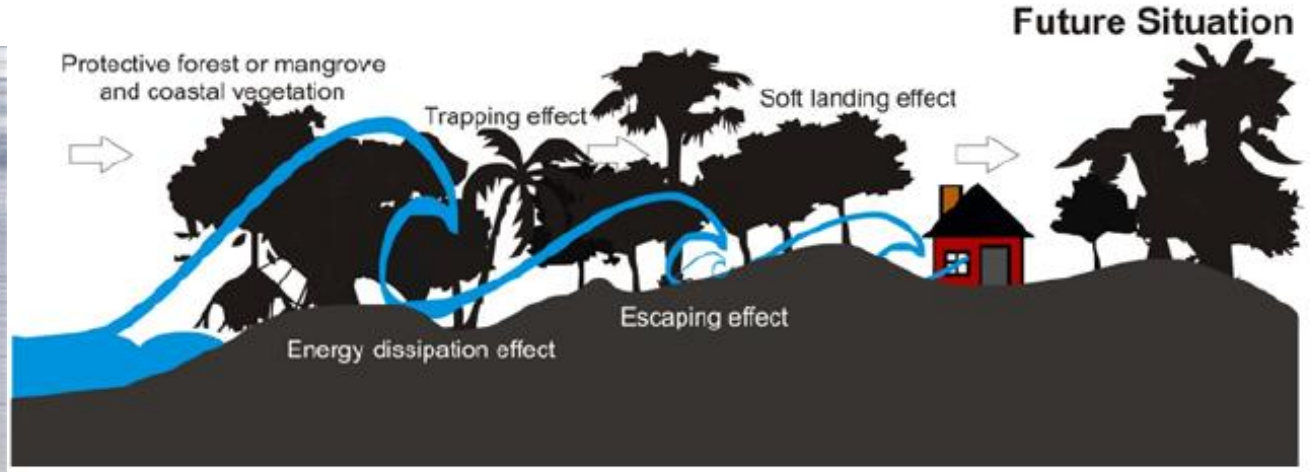
List of Tsunami's in India

Date	Location	Impact
1524	Near Dabhol, Maharashtra	Sufficient data not available
02 April 1762	ArakanCoast, Myanmar	Sufficient data not available
16 June 1819	Rannof Kachchh, Gujarat	Sufficient data not available
31 October 1847	Great Nicobar Island	Sufficient data not available
31 December 1881	An earthquake of 7.9 in the Richter scale in Car Nicobar Island Entire east coast of India and Andaman & Nicobar Islands	1m tsunamis were recorded at Chennai.
26 August 1883	Explosion of the Krakatoa volcano in Indonesian, East coast of India was affected	2m tsunamis were recorded at Chennai.
26 June 1941	An 8.1 Richter scale earthquake in the Andaman archipelago.	East coast of India was affected but no estimates of height of the tsunami is available
27 November 1945	An 8.5 Richter scale earthquake at a distance of about 100km south of KarachiWest coast of India from north to Karwarwas affected;.	12m tsunami was felt at Kandla.
26 December 2004	Banda Aceh, Indonesia; Tamil Nadu, Kerala, Andhra Pradesh, Andaman and Nicobar Islands, India; Sri Lanka; Thailand; Malaysia; Kenya; Tanzania The East cost of India was affected	The waves measured around 10 m high killing

Adverse Effects / Impacts

- Local tsunami events or those < 30 min from the source cause the majority of damage
- It is normally the flooding affect of the tsunami that causes major destruction to the human settlements, roads & infrastructure thereby disrupting the normal functioning of the society
- As the waves withdraw towards the ocean they sweep out the foundations of the buildings, the beaches get destroyed and the houses carried out to sea.
- Damage to ports & airports may prevent importation of needed food and medical supplies
- Deaths mainly occur because of drowning as water inundates homes, many people get washed away or crushed by giant waves & some are crushed by the debris
- Tsunami flooding caused large scale health problem.
- Availability of drinking water has always been a major problem in areas affected by a disaster
- Sewage pipes may be damaged causing major sewage disposal problems.
- Open wells & other ground water may be contaminated by salt water, debris & sewage


Present Situation
Lack of vegetation


Future Situation
Protective forest or mangrove
and coastal vegetation
Trapping effect
Soft landing effect
Escaping effect
Energy dissipation effect

Risk Reduction Measure

- Japan has implemented an extensive programme of building tsunami walls of up to 4.5m high front of populated coastal areas.
- Others built flood gates and channels to redirect the water from incoming tsunami's
- Tsunami which hit the island of Hokkaido on july 12,1993 created waves as much as 30m as tall as 10 story building. The tsunami wall was washed away, but it has slowed down the impact

Site planning & management

- Designation, zoning of tsunami hazard areas for such open-space uses as agriculture, parks & recreation or natural hazard area is recommended as the first land use planning strategy. This strategy is designed to keep development at a minimum in hazard areas

Engineering structures

- Site selection – avoid building or living within several meters from coastline
- Elevated coastal homes – most tsunami waves are <3m in height
- Construction of water breakers to reduce velocity of waves

Flood management

- Flooding will result from tsunami, flood mitigation could be incorporated

LANDSLIDES or MASS MOVEMENT or LANDSLIPS or MUDSLIPS

- Landslide is a geological phenomenon which includes a wide range of ground movements such as rock falls, deep failure of slopes and shallow debris flows, which can occur in offshore, coastal & onshore environments. Although the action of gravity is the primary driving force for a landslide to occur, there are other contributing factors affecting the original slope stability. Typically, pre-conditional factors build up specific sub-surface conditions that make the area/slope prone to failure, whereas the actual landslide often requires a trigger before being released.

Important terminology

Landslide hazard

- Potential of occurrence of a damaging landslide within a given area, such damage could include loss of life or injury, property damage, social & economic disruption or environmental degradation

Landslide vulnerability

- Potential loss to given element within area affected by the hazard, expressed on a scale of 0-1
- Vulnerability is shaped by physical, social, economic & environmental conditions

Landslide risk

- Probability of harmful consequences the expected number of lives lost, persons injured, extent of damage to property or ecological systems or disruption of economic activity – within a landslide prone are.
- The risk may be individual or societal in scope, resulting from an interaction between the hazard and individual or societal vulnerability

Landslide risk evaluation

- Application of analyses & judgement to determine risk management alternatives .

Types of landslides

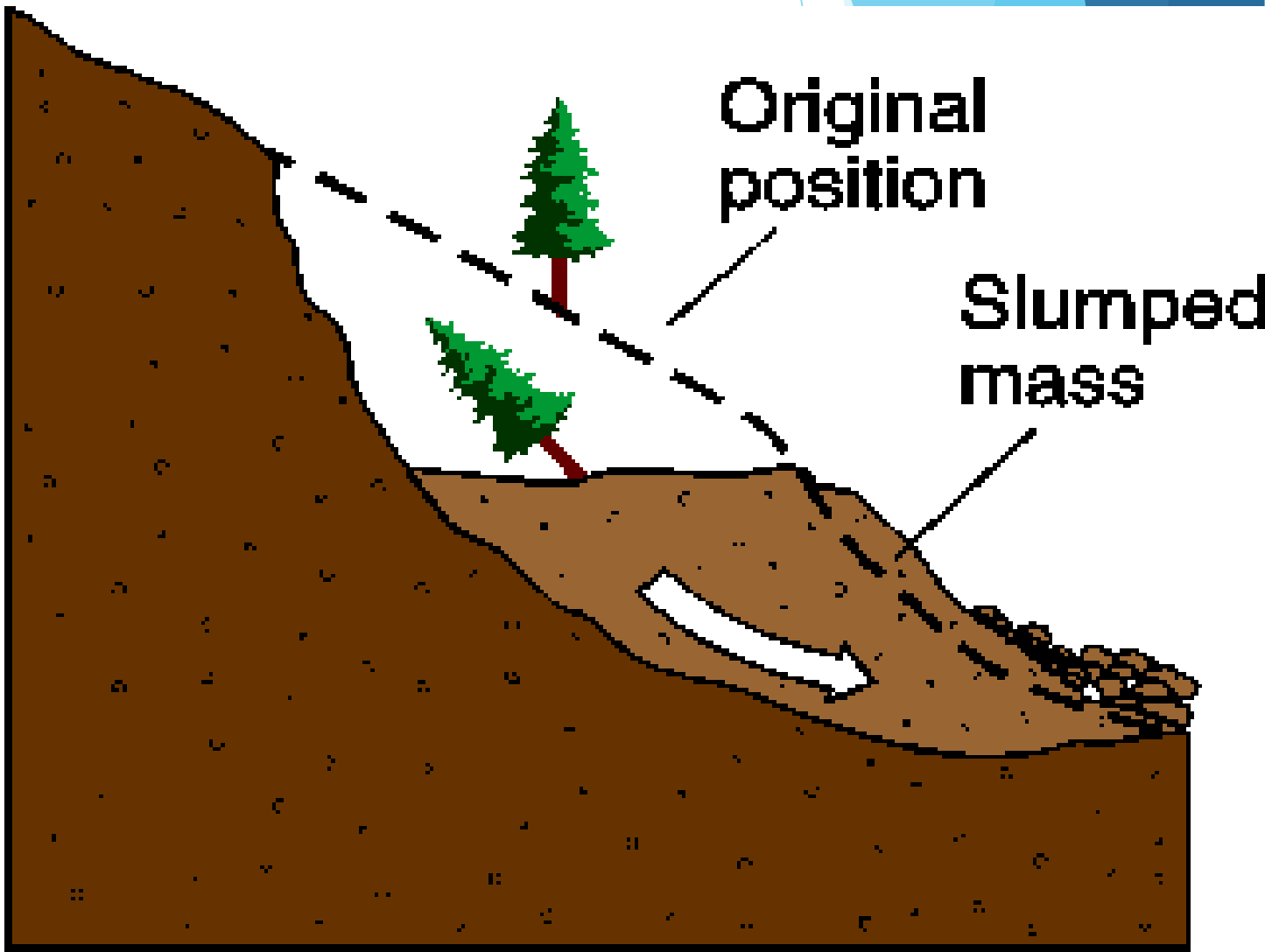
Flowage

- By flowage is understood a downgrade movement of mass along no definite surface of failure
- Mass involved in this type of failure is primarily unconsolidated or loosely packed
- Result is that the movement is distributed throughout the mass, in highly irregular manner

Types of landslides

Sliding

- True landslide is a type of mass failure in which a superficial mass fails by moving as a whole along a definite surface of failure
- Surface of failure may be planar or semi-circular in outline
- Mass above the failure surface is unstable where as the material lying below is stable in general



Types of landslides

subsidence

- Sinking or settling of ground in almost vertically downward direction which may occur because of removal of natural support from the underground or due to compaction of weaker rocks under the load from overlying mass

Causes

Natural causes of landslides include

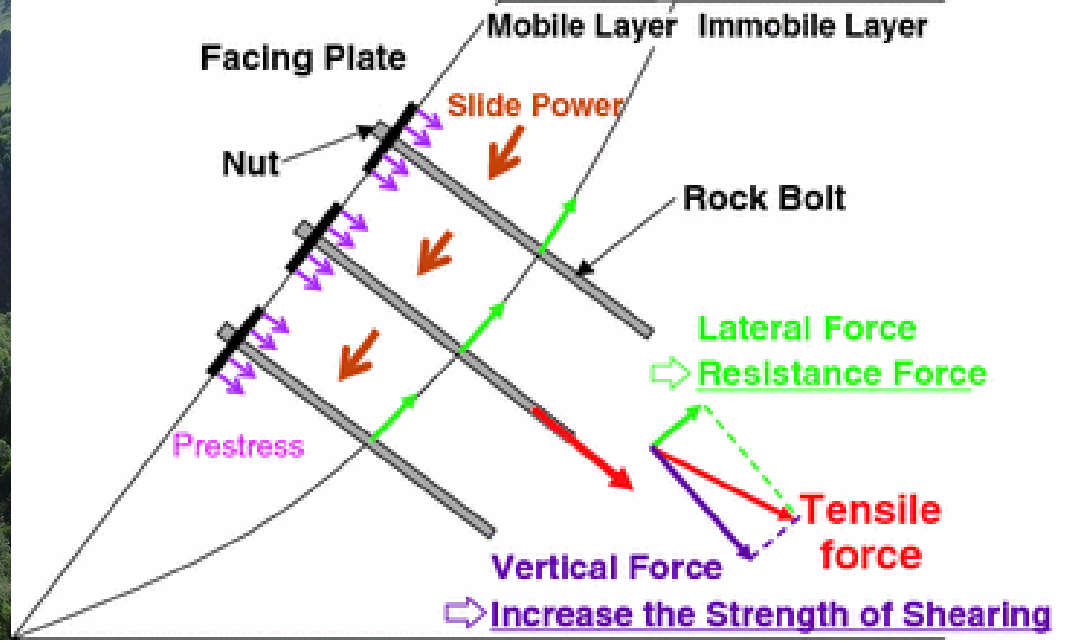
- Groundwater pressure acting to destabilize the slope
- Loss or absence of vertical vegetative structure, soil nutrients, and soil structures
- Erosion of the toe of a slope by rivers or ocean waves
- Weakening of a slope through saturation by snow melt, glaciers melting or heavy rains earthquakes adding loads to barely stable slope earthquake caused liquefaction destabilizing slopes volcanic erosion landslides are aggravated by human activities

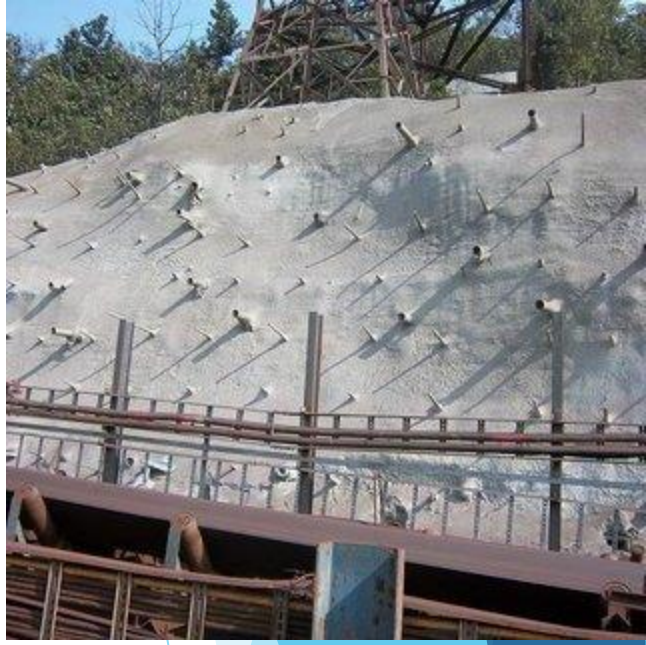
Human causes include:

- Deforestation, cultivation and construction, which destabilize the already fragile slopes
- Earthwork which alters the shape of a slope or which imposes new loads on an existing slope
- In shallow soils, the removal of deep-rooted vegetation that binds colluviums to bedrock
- Construction, agricultural or forestry activities which change the amount of water which infiltrates the soil

Adverse Effects

- Most common elements at risk are the settlements built on the steep slopes, built at the toe and those built at the mouth of the streams emerging from the mountain valley
- All those buildings constructed without appropriate foundation for a given soil and in sloppy areas are also at risk.
- Roads, rails, electricity, telecommunication lines are vulnerable


Mobile Layer
Immobile Layer
Facing Plate
Slide Power
Nut
Rock Bolt
Lateral Force
Resistance Force
Prestress
Tensile force
Vertical Force
Increase the Strength of Shearing



Control of mass movement

Drainage

- Water presence is the one of the factor that leads to mass movement
- Avoid waster content either by surface or sub-surface methods
- Construct series of ditches
- Backfill the pits on the soil surface with concrete or asphalt to prevent the water impounding
- Cover the slope surface with granular material to remove excess rainfall

Retaining structure

- Construct retaining wall and buttresses
- Slope reinforcement by rock bolting - Tie up different rock blocks together
- Rock anchors – structural elements made up of cables, bars. Up to 20-30 m in length
- Slope treatment – treating top layers with cement & sand with 1:3 mix proportion

COASTAL EROSION, SOIL EROSION, FOREST FIRES

- Introduction
- Causes of occurrence
- Process of occurrence
- Primary & secondary hazards (adverse affects)
- Ways to measure
- Past events list
- Control measures (mitigation measures)

Manmade disasters

- industrial pollution,
- artificial flooding in urban areas,
- nuclear radiation,
- chemical spills,
- transportation accidents,
- terrorist strikes, etc.

INDUSTRIAL POLLUTION

- Industrial pollution is which can be directly linked with industry. This form of pollution is one of the leading causes of pollution worldwide. There are a number of forms of industrial pollution. Industrial pollution can also impact air quality, and it can enter the soil, causing widespread environmental problems
- Industrial activities are a major source of air, water, land pollution, leading to illness and loss of life all over the world. The world health organisation (WHO) estimates that outdoor air pollution alone accounts for around 2% of all heart & lung diseases, about 5% off all lung cancers, and about 1% of all chest infections

Causes of Industrial pollution

Industrial growth that is unplanned

- A lot of air & water pollution has occurred from companies who ignored rules or standard practices of facilitate rapid growth.
- Industrial growth has been a frequent culprit for pollution

Lack of Effective Policies

- Many industries have been able to ignore or entirely by pass pollution laws because the policies are either not valid, or not adequately enforced by pollution control boards.
- The result has been significant pollution that has had a direct effect on many people

The Sheer Number of Industries

- Small sectors that have to rely on grants from the government to keep operating are often able to avoid following environmental regulations, releasing significant amount of toxic gas, making pollution an even more substantial issue from those smaller industries

Using Old & Outdated Technology

- Updating technologies is expensive, and there are many companies & plants which are relying on outdated technology to continue operating their business successfully.

Causes of Industrial pollution

Natural Resource Use

- Raw material is necessary for a lot of industries which requires them to pull underground elements.
- One of the most common forms of leaching from natural resources is fracking for oil. When industries pull minerals, the process causes pollution in the soil and also causes oil leaks & spills that are harmful & deadly to people and animals

Improper Disposal of Waster

- One of the most common forms of soil and water pollution are because of companies who do not dispose of their waste correctly.
- This is one of the most significant causes of pollution because the effects include severe and chronic health issues and lower air quality

Effects of Industrial Pollutions

Water Pollution

- Ecosystem has been significantly impacted because of pollution, and the consequence will affect many future generations.
- Big industries & manufacturing plants use significant amounts of water from nearby lakes, rivers & oceans to operate
- During the manufacturing process, the water is exposed to chemicals, heavy metals, organic sludge & radio active waste, & that water is dumped back into its original water source.
- Not only does this process affect the plants, animals & insects in their habitat, farmers also use that water for irrigation causing harmful effects to the food we eat & entered the food chain

Effects of Industrial Pollutions

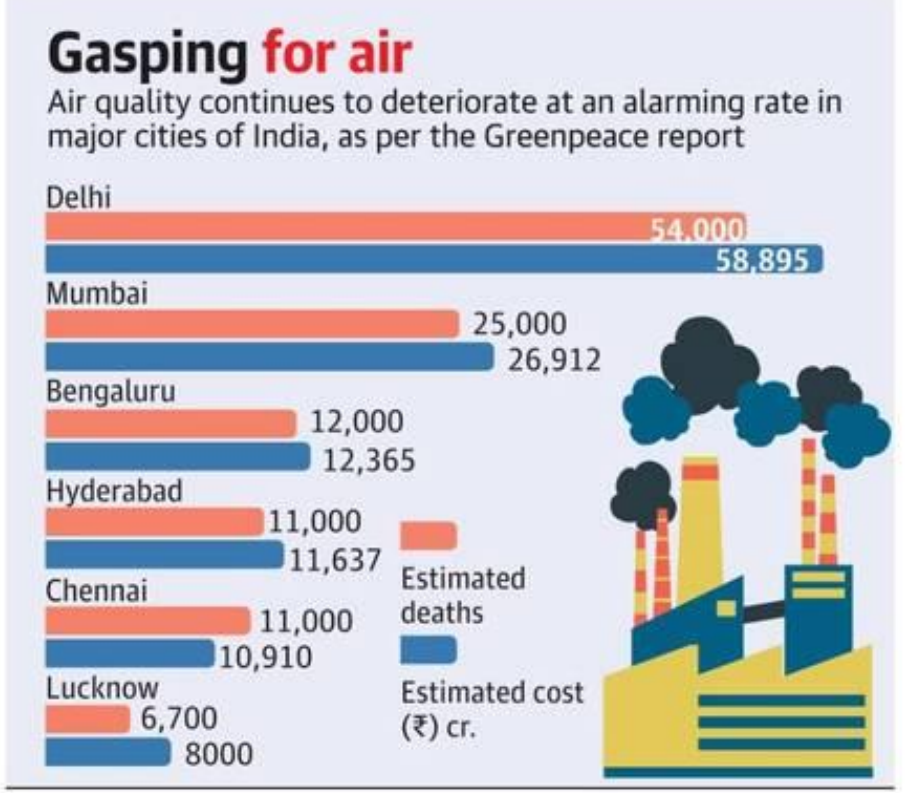
Soil pollution

- Soil pollution is the result of land degradation, and it is caused because of human-made chemicals as a result of industrial activity, the improper disposing of waster & various agricultural chemicals
- Soil pollution poisons agriculture and sometime kills local vegetation
- Result of soil pollution include chronic health concerns for people who work with soil, for farmers & for people who consume the fruits and vegetables from contaminated land

Effects of Industrial Pollutions

Air pollution

- Similar to water & soil pollution , air pollution has been the culprit for many illnesses, increasingly frequent over time,
- The effects of air pollution has an impact on everyone, everyday, it is caused by smoke released by various industries, vehicles etc



Effects of Industrial Pollutions

Animal Extinction

- Pollution is one of the most significant contributors to global warming, there are conspiracy theories & people who believe global warming doesn't exist, but scientists & environmentalists have proven the existence of global warming
- The rapid increase of global warming is of concern to many people. The greenhouse gasses, and the smoke that causes it is released into the air daily & causing consequential problems.
- Glaciers are melting, polar animals are becoming extinct, tsunamis, hurricanes, floods & other natural disasters are increasing because of global warming

Effects of Industrial Pollutions

Natural Resource Use

- Industrial pollution continues to cause significant damage to earth and all of its inhabitants.
- It disrupts natural habitats and rhythms, affecting wildlife and ecosystems.
- Animals are becoming extinct and habitats are being destroyed
- Pollution is the culprit for oil spills and radioactive material leaks, and both of those types of disasters take years to decade to clean up

Control/Reducing Industrial pollution

- Development of better technology for waste disposal
- Increased recycling efforts
- Development of cooling rooms or bins that allow industries to recycle the water they need instead of pushing it back into natural water source it came from
- Adopting organic water and soil cleaning methods, like using microbes that feed off of metal and waste
- Creating policies that prevent land misuse

Other ways

- Source control – adopting new technologies for waste disposal
- Industry site selection
- Proper treatment of industrial waste
- Planting and rebuilding
- Stricter laws and enforcement
- Regular environmental impact assessments

Statistics – air pollution

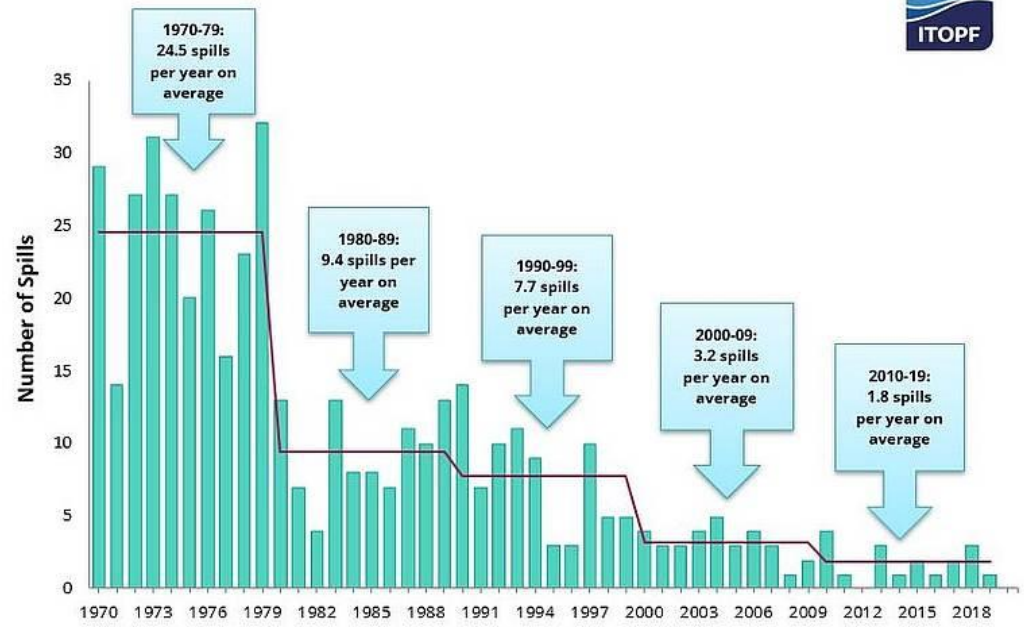
- Air pollution levels remain dangerously high in many parts of the world. New data from WHO shows that **9 out of 10 people** breathe air containing high levels of pollutants.
- WHO estimates that around **7 million people die every year** from exposure to polluted air.
- Ambient air pollution alone caused some **4.2 million deaths** in 2016, while household air pollution from cooking with polluting fuels and technologies caused an estimated **3.8 million deaths** in the same period
- At least 30.7% of **deaths in India** can be attributed to **air pollution** from fossil fuels--that means about 2.5 million people die every year after breathing toxic **air**

Top air pollution cities		
rank	Major city	US AQI
1	Delhi, India	195
2	Kathmandu, Nepal	173
3	Lahore, Pakistan	168
4	Jakarta, Indonesia	167
5	Wuhan, China	160
6	Beijing, China	154
7	Kabul, Afghanistan	153
8	Hangzhou, China	129
9	Mumbai, India	124
10	Kolkata, India	124

www.iqair.com

Statistics – oil spills

- In the 1990s there were 358 spills of 7 tonnes and over, resulting in 1,134,000 tonnes of oil lost; 73% of this amount was spilt in just 10 incidents.
- In the 2000s there were 181 spills of 7 tonnes and over, resulting in 196,000 tonnes of oil lost; 75% of this amount was spilt in just 10 incidents.
- In the 2010s there were 63 spills of 7 tonnes and over, resulting in 164,000 tonnes of oil lost; 91% of this amount was spilt in just 10 incidents. One incident was responsible for about 70% of the quantity of oil spilt.



Statistics – water pollution

- Around 80% of **India's water** is severely **polluted** because people dump raw sewage, silt and garbage into the country's rivers and lakes.
- This has led to **water** being undrinkable and the population having to rely on illegal and expensive sources.
- Each year, more than 1.5 million **Indian** children die from diarrhea

ARTIFICIAL FLOODS IN URBAN AREAS
URBAN FLOODING

- Urban flooding is specific in the fact that the cause is a lack of drainage in an urban area.
- As there is little open soil that can be used for water storage nearly all the precipitation needs to be transport to surface water or the sewage & draining canals do not have the necessary capacity to drain away the amounts of rain that are falling.
- Water may even enter the sewage system in one place and then get deposited somewhere else in the city on the streets.

Causes of urban flooding

- Fast growing urban region
- Construction of houses filling up the water bodies
- Dumping trash into canals, restricting the flow of storm water
- No proper rainwater harvesting pits

Effects of urban flooding

- Contamination of water
- Slow down in economy
- Disruption in power supply
- Loss of house, property and life
- Pandemic situation arises

Control of urban flooding

- Stop dumping plastic waster into canals
- Avoid construction activates filling the lakes
- Construction of rainwater harvesting pits
- Construction of storm water drainage systems

NUCLEAR RADIATION

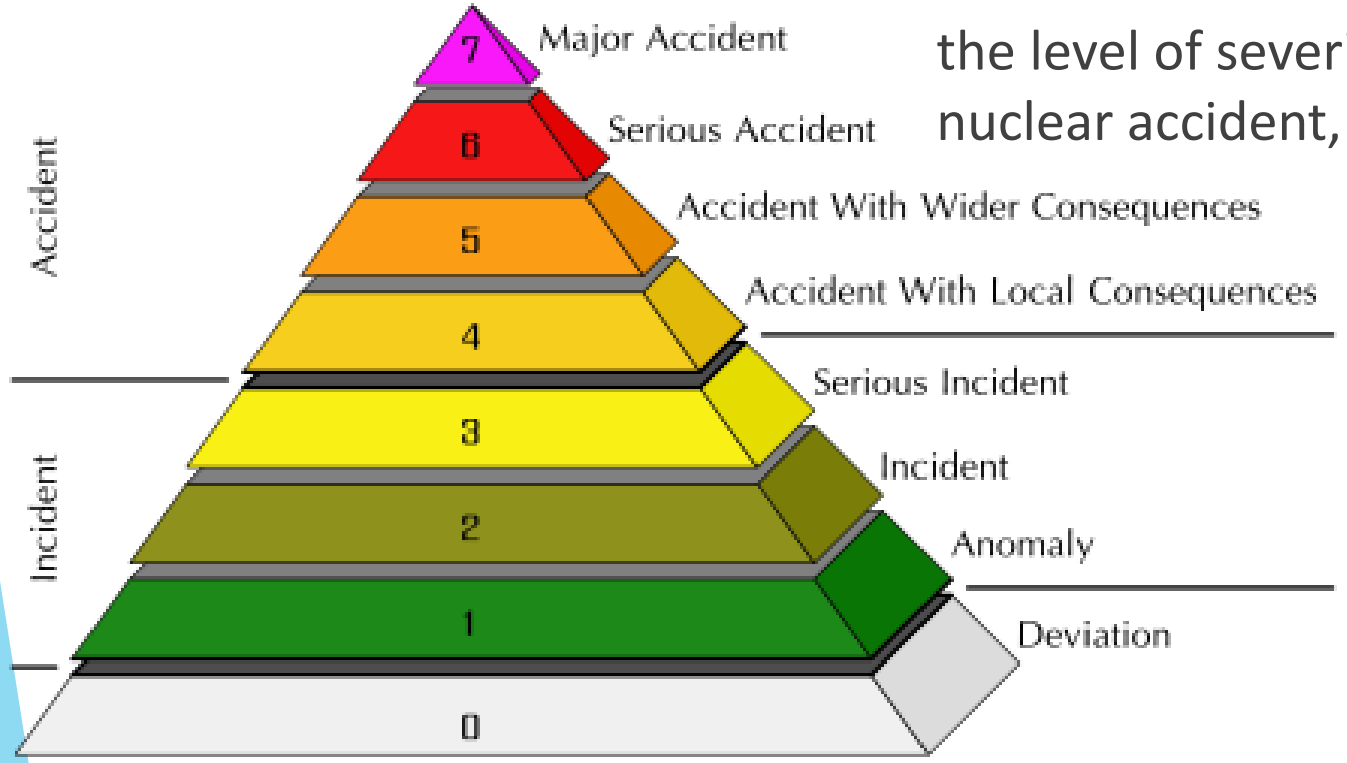
- Sudden release of huge amount of harmful radiation or radioactive materials or both together in environment in a small area either through explosion of a nuclear bomb or in the operation of nuclear reactors and other nuclear related activities

Causes

- International use of nuclear weapons in the event of war
- Accidental explosion of nuclear weapons
- Accidents in nuclear power projects
- Terrorist attacks

International Nuclear Event Scale

- The International Nuclear and Radiological Event Scale (INES) was introduced in 1990[1] by the International Atomic Energy Agency (IAEA) in order to enable prompt communication of safety significant information in case of nuclear accidents.
- The scale is intended to be logarithmic, similar to the moment magnitude scale that is used to describe the comparative magnitude of earthquakes. Each increasing level represents an accident approximately ten times as severe as the previous level. Compared to earthquakes, where the event intensity can be quantitatively evaluated, the level of severity of a man-made disaster, such as a nuclear accident, is more subject to interpretation. Because of this subjectivity the INES level of an incident is assigned well after the fact. The scale is therefore intended to assist in disaster-aid deployment.



Effects of Nuclear Disaster

- Blast. Nuclear explosions produce air-blast effects similar to those produced by conventional explosives. The shock wave can directly injure humans by rupturing eardrums or lungs or by hurling people at high speed, but most casualties occur because of collapsing structures and flying debris.
- Thermal radiation. Unlike conventional explosions, a single nuclear explosion can generate an intense pulse of thermal radiation that can start fires and burn skin over large areas. In some cases, the fires ignited by the explosion can coalesce into a firestorm, preventing the escape of survivors. Though difficult to predict accurately, it is expected that thermal effects from a nuclear explosion would be the cause of significant casualties.
- Initial radiation. Nuclear detonations release large amounts of neutron and gamma radiation. Relative to other effects, initial radiation is an important cause of casualties only for low-yield explosions (less than 10 kilotons).
- Fallout. When a nuclear detonation occurs close to the ground surface, soil mixes with the highly radioactive fission products from the weapon. The debris is carried by the wind and falls back to Earth over a period of minutes to hours.

Statistics

NAME	EXECUTED BY	DATE	EFFECT	REASON	CONTRY EFFECTED	INENSITY
TSAR Bomba	Soviet Union	October 30, 1961		detonating the biggest nuclear warhead	USSR	
Hiroshima & Nagasaki	United States	August 6 & 9, 1945	75,000, 1,20,000	Two nuclear weapons have been exploded	JAPAN	
Chernoby	Ukraine	April 26, 1986	5,00,000 workers and cost an estimated 18 billion rubles	worst nuclear accident	USSR	Level 7
Fukushima	Fukushima Nuclear Power Plant	March 11, 2011	3,00,000 people evacuated the area and around 15,884 (as of February 10, 2014) people died due to the earthquake and tsunami. As of August 2013, approximately 1600 deaths were related to the evacuation or its consequences	magnitude 9.0 earthquake	JAPAN	Level 7
Three Mile Island	Pennsylvania	March 28, 1979	The initial cleanup effort cost nearly a billion dollars.	accident was a partial nuclear meltdown	United States	Level 5
Baneberry Test		1970	buried 900 feet below ground, Eighty-six workers at the site were exposed to radiation.	nuclear weapons tests		

TERRORISM

- The Supreme Court of India quoted definition of terrorism in a 2003
- Whoever with intent to overawe the Government as by law established or to strike terror in the people or any section of the people or to alienate any section of the people or to adversely affect the harmony amongst different sections of the people does any act or thing by using bombs, dynamite or other explosive substances or inflammable substances or lethal weapons or poisons or noxious gases or other chemicals or by any other substances (whether biological or otherwise) of a hazardous nature in such a manner as to cause, or as is likely to cause, death of, or injuries to, any person or persons or loss of, or damage to, or destruction of, property or disruption of any supplies or services essential to the life of the community, or detains any person and threatens to kill or injure such person in order to compel the Government or any other person to do or abstain from doing any act, commits a terrorist act.

Terrorism in india

1.Ethno-nationalist terrorism – This form of terror focuses either (a) on creating a separate State within India or independent of India or in a neighbouring country, or (b) on emphasising the views/response of one ethnic group against another. Violent Tamil Nationalist groups from India to address the condition of Tamils in Sri Lanka, as well as insurgent tribal groups in North East India are examples of ethno-nationalist terrorist activities.

2.Religious terrorism – This form of terror focuses on religious imperatives, a presumed duty or in solidarity for a specific religious group, against one or more religious groups. Mumbai 26/11 terror attack in 2008 from an Islamic group in Pakistan is an example of religious terrorism in India.

3.Left-wing terrorism – This form of terror focuses on economic ideology, where all the existing socio-political structures are seen to be economically exploitative in character and a revolutionary change through violent means is essential. The ideology of Marx, Engel, Mao, Lenin and others are considered as the only valid economic path. Maoist violence in Jharkhand and Chhattisgarh are examples of left wing terrorism in India.

4.Narcoterrorism – This form of terror focuses on creating illegal narcotics traffic zones. Drug violence in northwest India is an example of narco-terrorism in India.

Statistics in India

Source : wikipedia

Terrorist incidents in India			
Year	Number of incidents	Deaths	Injuries
2018	748	350	540
2017	1000	470	702
2016	1025	467	788
2015	884	387	649
2014	860	490	776
2013	694	467	771
2012	611	264	651
2011	645	499	730
2010	663	812	660
2009	672	774	854
2008	534	824	1,759
2007	149	626	1,187
2006	167	722	2,138
2005	146	466	1,216
2004	108	334	949

Steps taken by India

- A total of 42 terrorist organisations like the Lashkar-e-Taiba and the Jaish-e-Mohammed have been banned by the government for their involvement in various acts of terrorism, which is largely been sponsored from across the border
- 635 terrorists were killed by security forces in Jammu and Kashmir between 2018 and 2020, while 115 civilians lost their lives to terror violence in the Union Territory during the period.
- 61 cases of infiltration were reported along the Indo-Pakistan border in last two years, 1,045 infiltrations along the Indo-Bangladesh border and 63 along the Indo-Nepal border.

Source link : https://economictimes.indiatimes.com/news/defence/42-outfits-banned-in-india-for-involvement-in-terror-activities-government/articleshow/81411474.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

Terrorist organisations banned by India

Source : https://www.mha.gov.in/

1	Babbar Khalsa International
2	Khalistan Commando Force
3	Khalistan Zindabad Force
4	International Sikh Youth Federation
5	Lashkar-E-Taiba/Pasban-E-Ahle Hadis
6	Jaish-E-Mohammed/Tahrik-E-Furqan
7	Harkat-Ul-Mujahideen or Harkat-Ul-Ansar or Harkat-Ul-Jehad-E-Islami or Ansar-Ul-Ummah (AUU).
8	Hizb-Ul-Mujahideen/ Hizb-Ul-Mujahideen Pir Panjal Regiment
9	Al-Umar-Mujahideen
10	Jammu and Kashmir Islamic Front
11	United Liberation Front of Assam (ULFA)
12	National Democratic Front of Bodoland (NDFB) in Assam
13	People's Liberation Army (PLA)
14	United National Liberation Front (UNLF)
15	People's Revolutionary Party of Kangleipak (PREPAK)
16	Kangleipak Communist Party (KCP)
17	Kanglei Yaol Kanba Lup (KYKL)
18	Manipur People's Liberation Front (MPLF)
19	All Tripura Tiger Force
20	National Liberation Front of Tripura
21	Liberation Tigers of Tamil Eelam (LTTE)
22	Students Islamic Movement of India
23	Deendar Anjuman
24	Communist Party of India (Marxist-Leninist) -- People's War, all its formations and front organizations
25	Maoist Communist Centre (MCC), all its formations and Front Organisations
26	Al Badr
27	Jamiat-ul-Mujahideen
28	Al-Qaida/Al-Qaida in Indian Sub-continent (AQIS) and all its manifestations.
29	Dukhtaran-E-Millat (DEM)
30	Tamil Nadu Liberation Army (TNLA)
31	Tamil National Retrieval Troops (TNRT)
32	Akhil Bharat Nepali Ekta Samaj (ABNES)
33	Organisations listed in the Schedule to the U.N. Prevention and Suppression of Terrorism (Implementation of Security Council Resolutions) Order, 2007 made under section 2 of the United Nations (Security Council) Act, 1947 and amended from time to time.
34	Communist Party of India (Maoist) all its formations and front organizations.
35	Indian Mujahideen, all its formations and front organizations.
36	Garo National Liberation Army (GNLA), all its formations and front organizations.
37	Kamatapur Liberation Organisation, all its formations and front organizations.
38	Islamic State/Islamic State of Iraq and Levant/Islamic State of Iraq and Syria/Daish/Islamic State in Khorasan Province (ISKP)/ISIS Wilayat Khorasan/Islamic State of Iraq and the Sham-Khorasan (ISIS-K) and all its manifestations.
39	National Socialist Council of Nagaland (Khaplang) [NSCN(K)], all its formations and front organisations
40	Declaring khalistan Liberation Force and all its manifestations as Terrorist Organisation
41	Tehreek-ul-Mujahideen (TuM) and all its manifestations
42	Jamaat-ul-Mujahideen Bangladesh or Jamaat-ul-Mujahideen India or Jamaat-ul-Mujahideen Hindustan and all its manifestations

ACCIDENTS

- An unfortunate incident that happens unexpectedly and unintentionally, typically resulting in damage or injury
- India accounts for the highest number of road accidents globally, with 1.5 lakh people being killed and more than 4.5 lakh crippled annually in 4.5 lakh road accidents with losses amounting to 3.14 per cent of the GDP
- TYPES OF ACCIDENT
  - Road accidents
  - Air accidents
  - Water accidents
  - Train accidents

Road accidents

- Both national & state highways are particularly vulnerable to serious road accidents, a part from these roads in hilly sections and ghat areas are also vulnerable to road accidents due to road vehicles falling into pits, congestion in traffic is inevitable and the consequences are road accidents

Causes of accidents

- In most causes due to human failures and in a few rare cases these are caused by technical failures such as failures of brakes etc, road accidents also occur under conditions of impaired visibility, slippery road surface etc

Safety measures

- Look on either side of the road before crossing
- Use zebra crossing, helmet for 2 wheeler & seat belt for 4 wheelers

Rail accidents

- Railways are confronted with disasters arising out of cyclone, floods, fire bomb blasts, technical errors etc
- While a railway accident can occur at any stretch of railway track experience has show that portion of railway track having double line sections are particularly vulnerable to serious rail accidents

Causes of accidents

- Cyclones, floods, landslides
- Washing away track, human failures, bomb blasts
- Tampering of track, level crossings

Safety measures

- Do not carry inflammable materials, avoid smoking in trains
- Pay attention to signals, swing barriers, fish crossing, level crossings, signals

Air accidents

- 3 types of mid air collisions, forced landing, crash due to technical snags or air crash in mountainous terrains due to poor visibility

Causes of accidents

- Human failure of pilots, air traffic controllers or technical failures
- Landing instruments

Safety measures

- Pay attention to the flight crew safety
- Keep your seatbelt fastened when seated
- Avoid smoking, stay calm and listen to crew members

boat accidents

- Either due to cyclone or floods or over loading of the boat or by tsunamis or poor quality of equipment in the boat, poor maintenance and consequent breakdown and of course human error of judgment

Causes of accidents

- Lack of safety consciousness on the part of crew
- Over loading, over crowding, sailing in adverse weather and collision

Safety measures

- Anchorage of boats during bad weather conditions
- Have safety kits for the no of people in the boat

Statistics

- A total 4,37,396 **road accidents** were recorded across **India** in **2019**, resulting in the death of 1,54,732 people and injuries to another 4,39,262, according to the latest National Crime Records Bureau (NCRB) data

- **Indian** Railways has recorded zero passenger deaths in **rail accidents** in **2019**, making it the national transporter's safest year in history, according to official **data**. ... In 2018-19, railways recorded 16 death, 28 deaths in 2017-2018 and 195 deaths during 2016-2017.

- **Accident** rate per million departures of scheduled commercial flights **India 2019**. For every million departures of scheduled **airlines**, there were 2.4 **accidents** witnessed in **India** during **2019**. ... There were no **accidents** in 2012; it was the safest year in the last ten years.

- In the year 2018, there were 29,696 incidences of **drowning**, resulting in deaths of 30,187 people. ... According to a report published by the Lancet in December **2019**, there were about 62,000 **drowning** deaths in **India** in the year 2017. This was nearly twice of all (30,279) **drowning** deaths reported in ADSI 2017