DPPM

(203104346)

Prof. Akshay Rathod, Assistant Professor
Civil Engineering

Parul®
University

DIGITAL LEARNING CONTENT

CHAPTER-2

Disasters

Parul®
University

DIGITAL LEARNING CONTENT

CONTENTS

- Disasters – Disaster Classification:
- Disasters classification;
- Natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.);
- Manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.);
- Hazard and Vulnerability profile of India,
- Mountain and coastal areas,
- Ecological fragility.

NATURAL DISASTERS

- It is defined as a quick, catastrophic event that seriously disrupts the functioning of a civic or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources.
- Types of natural disaster:

1. Earthquakes
2. Volcanic eruptions
3. Cyclones
4. Floods
5. Droughts

Image Source Google

NATURAL DISASTERS

6. Tornadoes
7. Tsunami
8. Landslides
9. coastal erosion
10. Soil erosion
11. Forest fires

Image Source Google

Earthquake Disaster

- An earthquake is a trembling of the ground caused by the quick breaking and movement of tectonic plates of the earth's rocky outermost crust. The edges of the tectonic plates are marked by faults. Mostly earthquakes occur along the fault lines when the plates slide past each other or strike against each other.
- The instable masses send out shock waves that may be powerful enough to alter the surface of the Earth, thrusting up cliffs and opening great cracks in the ground and cause great damage, collapse of buildings and other man-made structures, broken power and gas lines, landslides, snow avalanches, tsunamis.

Image Source Google

Earthquake Disaster

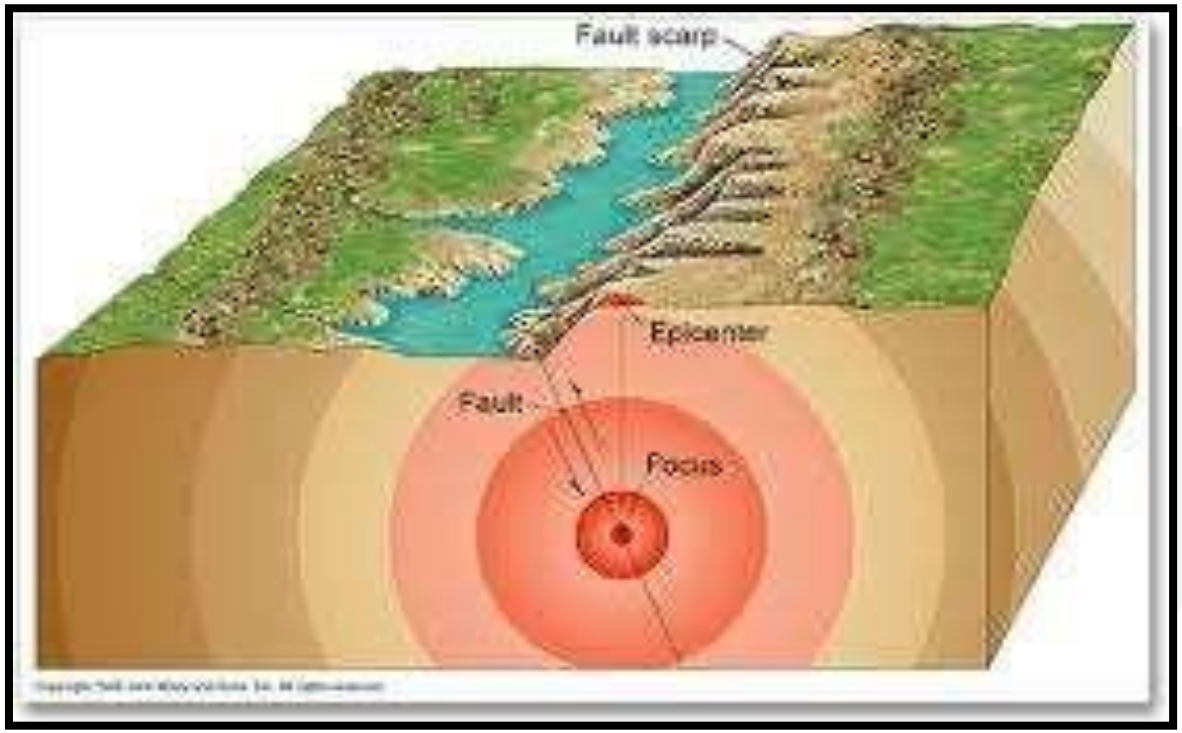


Image Source Google

Volcanic Eruption

- It can cause widespread destruction and consequent disaster in several ways. The effects include the volcanic eruption itself that may cause harm following the explosion of the volcano or the fall of rock. Second, lava may be produced during the eruption of a volcano.
- As it leaves the volcano, the lava destroys so many buildings and plants it meetings. Third thing, volcanic ash may form a cloud, and settle thickly in nearby locations. In sufficient quantity ash may cause roofs to collapse under its weight but even small quantities will harm humans if breathe in. One of specific type of volcano is the super volcano.
- The main hazard from a super volcano is the huge cloud of ash which has a disastrous global effect on climate and temperature for many years.

Volcanic Eruption

Cyclone

- Cyclone in weather forecasting refers to any low pressure area with winds spiralling inwards. Cyclones always rotate clockwise in the Southern Hemisphere and anti-clockwise in the Northern Hemisphere. Cyclone is the general term for a variety of low pressure system types, such as tropical cyclones, extra tropical cyclones and tornadoes.
- The largest of the low-pressure systems are the extra tropical cyclones and the cold-core polar cyclones which lie on the synoptic scale which in weather forecasting is a horizontal length of 1000 km or more. The Warm-core cyclones are the tropical cyclones, mesocyclones, and the polar lows that lie within the smaller mesoscale. The Subtropical cyclones are in-between in size. Cyclones have also been on other planets outside of the Earth, such as Mars and Neptune. For example the Great Red Spot of Jupiter and the Great Black Spot of Neptune.

Cyclone

Floods Disaster

- It is an overspill of an expanse of water that sinks land. It is defined as a flood as a short-term covering by water of land not usually covered by water. In the sense of "flowing water", the word may also be applied to the inflow of the tide.
- Flooding results in the volume of water within a body of water, like a river or lake, which overflows or breaks levees, with the consequence that some of the water escapes its usual boundaries.
- Although the size of a lake or other body of water will differ with seasonal changes in precipitation and snow melt, it is not a major flood unless the water covers land used by man like a village, city or other colonized area, roads, expanses of farmland, etc.

Floods Disaster

Drought Disaster

- It occurs in virtually all climates. Of all the weather-related phenomena that can cause severe financial impacts in the United States, droughts come in second only to hurricanes, according to the National Climatic Data Center.
- But if hurricanes, which are easily identified and straightforward to classify in terms of wind speeds, droughts are much tougher to define. Most people think of a drought as a period of unusually dry weather that persists long enough to cause problems such as crop damage and water supply shortages.

Tsunami Disaster

- It waves do not look like normal sea waves, because their wavelength is far longer. Rather than looking as a breaking wave, a tsunami may instead initially look like a rapidly rising tide. It generally contain of a series of waves with periods ranging from minutes to hours, arriving in a so-called "wave train".
- It is a series of water waves caused by the displacement of a large volume of a body of water, usually an ocean or a large lake. Earthquakes, volcanic eruptions and other underwater explosions landslides, glacier carvings, meteorite impacts and other disturbances above or below water all have the potential to generate a tsunami.

Tsunami Disaster

Landslides

- **Landslides**, also known as **landslips**, are several forms of mass wasting that may include a wide range of ground movements, such as rockfalls, deep-seated slope failures, mudflows, and debris flows.
- Landslides occur in a variety of environments, characterized by either steep or gentle slope gradients, from mountain ranges to coastal cliffs or even underwater, in which case they are called *submarine landslides*.
- Gravity is the primary driving force for a landslide to occur, but there are other factors affecting slope stability that produce specific conditions that make a slope prone to failure.
- In many cases, the landslide is triggered by a specific event (such as a heavy rainfall, an earthquake, a slope cut to build a road, and many others), although this is not always identifiable.

Landslides

- Landslides occur when the slope (or a portion of it) undergoes some processes that change its condition from stable to unstable. This is essentially due to a decrease in the shear strength of the slope material, an increase in the shear stress borne by the material, or a combination of the two. A change in the stability of a slope can be caused by a number of factors, acting together or alone. Natural causes of landslides include:
- saturation by rain water infiltration, snow melting, or glaciers melting;
- rising of groundwater or increase of pore water pressure (e.g. due to aquifer recharge in rainy seasons, or by rain water infiltration);
- increase of hydrostatic pressure in cracks and fractures;
- loss or absence of vertical vegetative structure, soil nutrients, and soil structure (e.g. after a wildfire – a fire in forests lasting for 3–4 days);

Landslides

- erosion of the top of a slope by rivers or sea waves;
- physical and chemical weathering (e.g. by repeated freezing and thawing, heating and cooling, salt leaking in the groundwater or mineral dissolution);
- ground shaking caused by earthquakes, which can destabilize the slope directly (e.g., by inducing soil liquefaction) or weaken the material and cause cracks that will eventually produce a landslide;
- volcanic eruptions

Landslides

Coastal Erosion

- **Coastal erosion** is the loss or displacement of land, or the long-term removal of sediment and rocks along the coastline due to the action of waves, currents, tides, wind-driven water, waterborne ice, or other impacts of storms.
- The landward retreat of the shoreline can be measured and described over a temporal scale of tides, seasons, and other short-term cyclic processes.
- Coastal erosion may be caused by hydraulic action, abrasion, impact and corrosion by wind and water, and other forces, natural or unnatural.

Coastal Erosion

Soil Erosion

- **Soil erosion** is the displacement of the upper layer of soil; it is a form of soil degradation.
- This natural process is caused by the dynamic activity of erosive agents, that is, water, ice (glaciers), snow, air (wind), plants, and animals (including humans).
- In accordance with these agents, erosion is sometimes divided into water erosion, glacial erosion, snow erosion, wind (aeolean) erosion, zoogenic erosion and anthropogenic erosion such as tillage erosion.
- Soil erosion may be a slow process that continues relatively unnoticed, or it may occur at an alarming rate causing a serious loss of topsoil.
- The loss of soil from farmland may be reflected in reduced crop production potential, lower surface water quality and damaged drainage networks. Soil erosion could also cause sinkholes.

Soil Erosion

Forest Fire

- A **wildfire**, **forest fire**, **bushfire**, **wildland fire** or **rural fire** is an unplanned, unwanted, uncontrolled fire in an area of combustible vegetation starting in rural areas and urban areas.
- Depending on the type of vegetation present, a wildfire can also be classified more specifically as a forest fire, brush fire, bushfire (in Australia), desert fire, grass fire, hill fire, peat fire, prairie fire, vegetation fire, or veld fire.
- Fossil charcoal indicates that wildfires began soon after the appearance of terrestrial plants 420 million years ago.
- The occurrence of wildfires throughout the history of terrestrial life invites conjecture that fire must have had pronounced evolutionary effects on most ecosystems' flora and fauna.

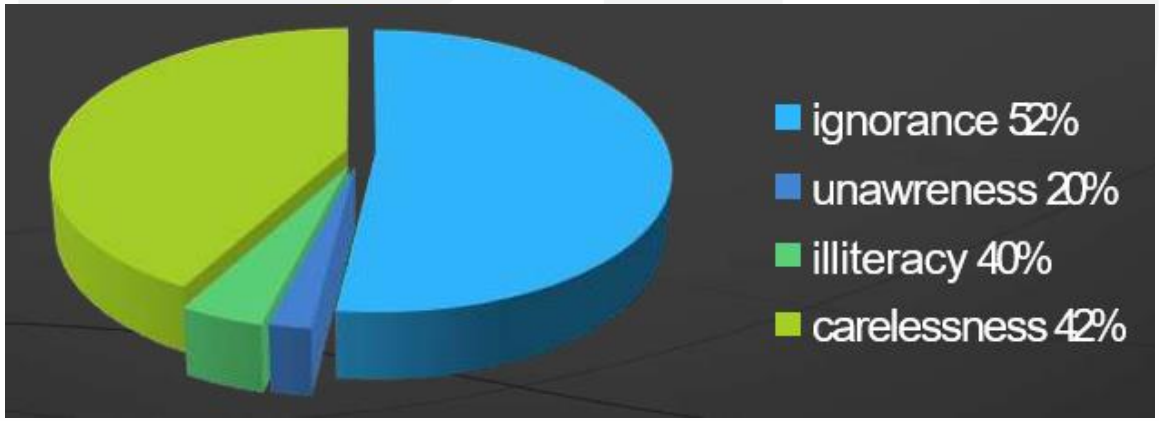
Forest Fire

- Earth is an intrinsically flammable planet owing to its cover of carbon-rich vegetation, seasonally dry climates, atmospheric oxygen, and widespread lightning and volcanic ignitions.
- Wildfires can be characterized in terms of the cause of ignition, their physical properties, the combustible material present, and the effect of weather on the fire.
- Wildfires can cause damage to property and human life, although naturally occurring wildfires may have beneficial effects on native vegetation, animals, and ecosystems that have evolved with fire.
- Wildfire behavior and severity result from a combination of factors such as available fuels, physical setting, and weather.

Forest Fire

MAN-MADE DISASTERS

- A man-made disasters is a disaster resulting from human intent, negligence, orerror.
- Manmade disasters can be both intentional and unintentional. It results in huge loss of life and property. It further affects a person's mental, physical and social well-being.
- The causes of man made disasters are:
  - **Reasons**



Industrial Pollution

- Industrial pollution is the pollution which can be directly linked with industry.
- This form of pollution is one of the leading causes of pollution worldwide.
- Industrial activities are a major source of air, water and land pollution, leading to illness and loss of life all over the world.

Industrial Pollution

The activities causing pollution include:-

- Burning coal
- Burning fossil fuels like oil, natural gas, and petroleum
- Chemical solvents used in dyeing and tanning industries
- Untreated gas and liquid waste being released into the environment
- Improper disposal of radioactive material.

Artificial Flooding in urban areas

- 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 system.
- Urban floods are a great disturbance of daily life in the city.
- High intensity rainfall can cause flooding when the city sewage system and 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. Sometimes you see dancing drain covers.

Artificial Flooding in urban areas

Nuclear Radiation

- A Nuclear Explosion is an accident taking place in the nuclear fuel cycle of the nuclear reactor , or in a facility using radioactive sources, leading to a large scale release of radioactivity in the environment.
- The growth in the application of nuclear science and technology in the fields of power generation, medicine, industry, agriculture, research and defence has led to an increase in the risk of occurrence of Nuclear and Radiological emergencies.
- CAUSES :

➢ Loss of pressure control
➢ A loss-of-coolant accident (LOCA)
➢ Uncontrolled power excursion
➢ A fire within the reactor core
➢ Failures in control systems

Nuclear Radiation

Major Nuclear Attacks :

Hiroshima, Japan, (6 AUG 1945)
Nagasaki, Japan, (9 AUG 1945)

Nuclear Radiation

- Fukushima Daiichi nuclear disaster (2011)
- The Chernobyl disaster (1986)
- The Three Mile Island accident (1979)
- The SL-1 accident (1961)

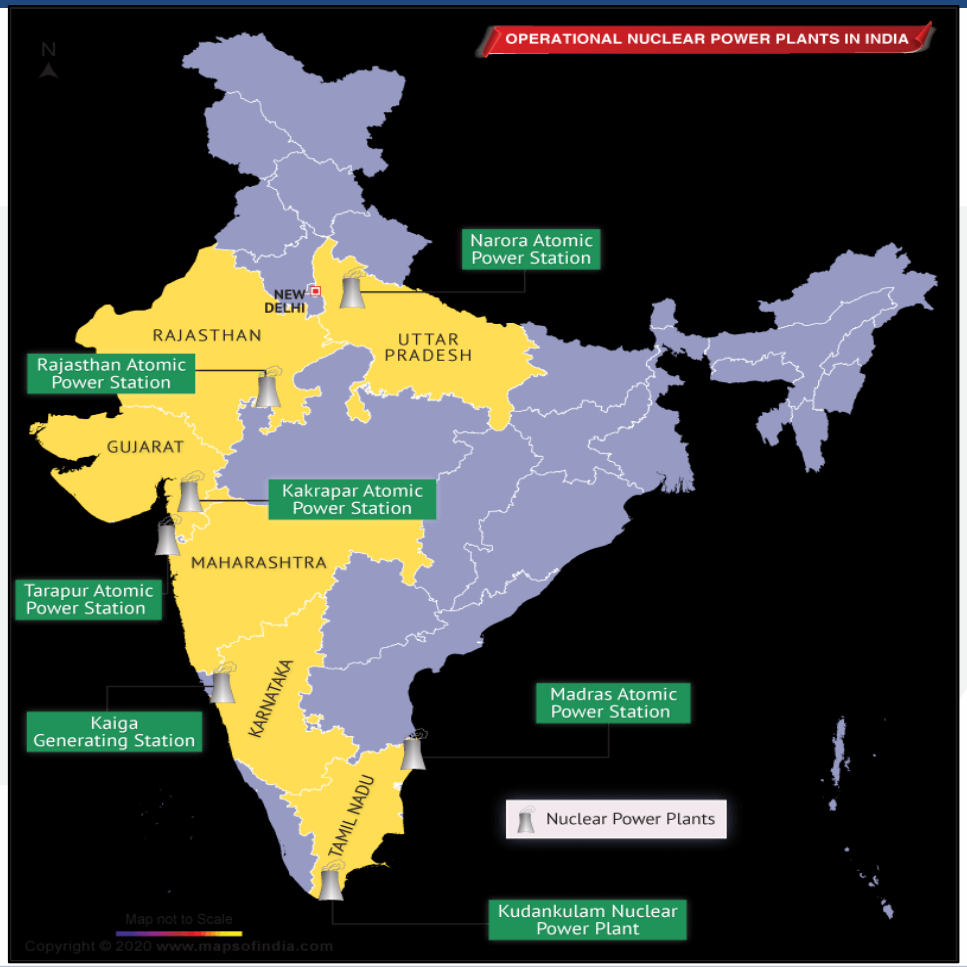
Major Nuclear Attacks :

- Hiroshima, Japan, (6 AUG 1945)
- Nagasaki, Japan, (9 AUG 1945) Fukushima Daiichi nuclear disaster (2011)
- The Chernobyl disaster (1986)
- The Three Mile Island accident (1979)
- The SL-1 accident (1961)

Parul®
University

DIGITAL LEARNING CONTENT

Nuclear Radiation



Chemical Spills

A Chemical accident is the unintentional release of one or more hazardous substances which could harm human health and environment.

These include fires, explosions, leakages or release of toxic or hazardous materials that can cause people illness, injury, disability or death.

CAUSES :

- Process and safety system failures
- Hazardous waste processing/disposal
- Accidents during chemical transportation

MAJOR CHEMICAL DISASTERS :

- Kanpur Ammonia Gas Leak (15 MAR 2017)
- Bhopal Gas Tragedy (3 DEC 1984)

Chemical Spills

- Chemical spills are the uncontrolled release of a hazardous chemical, either as a solid, liquid or a gas.
- These spills need to be minimized as much as possible.
- If a chemical spill should occur, a quick response with a stocked chemical spill kit will help minimize potential harm to personnel, equipment and laboratory space.
- Another thing to take into account is the safety of the individual handling the chemicals and how to react if something would occur.

Chemical Spills

Transportation Accidents

A **transport accident** is any accident (or incident) that occurs during any type of transportation.

It can refer to:

- Road traffic accident (including vehicle collision)
- A marine accident (sailing ship accident)
- Railroad accidents (including train wreck)
- An aviation accident (including crashing)

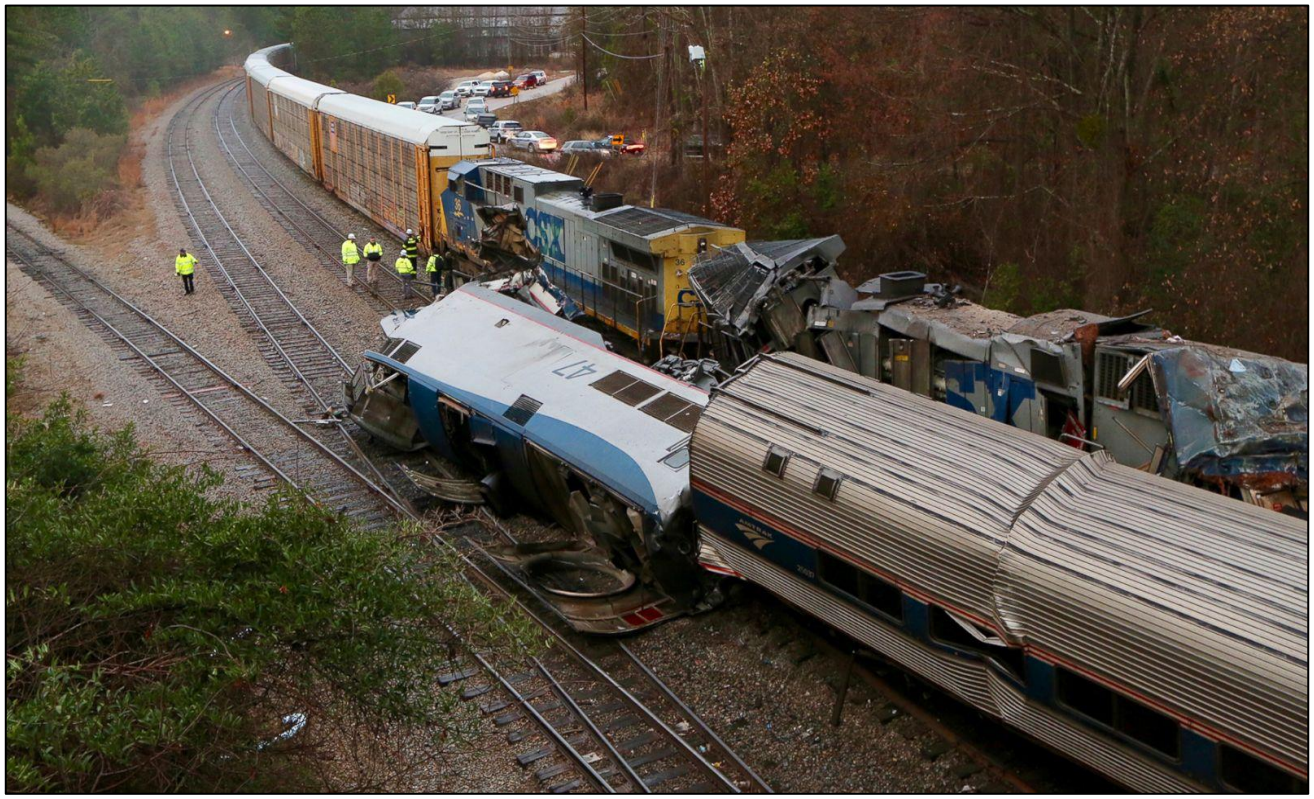
Causes :

- Over speeding, Distraction to drivers
- Drunk Driving
- Non-adherence to lane driving
- Overtaking in a wrong manner

Parul®
University

DIGITAL LEARNING CONTENT

Transportation Accidents



Terrorist Strikes

- Terrorism is defined as an act that is violent or dangerous to human life, with the intent of furthering political or social objectives.
- Terrorism may be domestic, international or transnational.

CAUSES :

- Independence or separatist movements
- Irredentist movements
- Adoption of a particular political philosophy

MAJOR TERRORIST ATTACKS :

- Pulwama Attack (14 FEB 2019)
- Uri Attack (18 SEP 2016)
- Mumbai Attack (26 NOV 2008)
- Jaipur Bombing (13 MAY 2008)
- Parliament Attack (13 DEC 2001)

Terrorist Strikes

- Terrorism is the use of fear and acts of violence in order to intimidate societies or governments. Many different types of social or political organizations might use terrorism to try to achieve their goals. People who do terrorism are called terrorists.

- It is difficult to explain terrorism. Terrorism has no official criminal law definition at the international level. Common definitions of terrorism refer to violent acts which are intended to create fear (terror); are done for a religious, political, or ideological goal; and which target civilians.

- Some definitions now include acts of unlawful violence and war. The use of similar tactics by criminal gangs is not usually called terrorism, though these same actions may be called terrorism when done by a politically motivated group.

Terrorist Strikes

Hazard and Vulnerability profile of India

- India is the 7th largest country by area and the 2nd most populated country with over 1.37 billion people and due to its physiographic and climatic conditions , it is one of the most disaster prone areas of the world.
- Nearly 59% of the landmass is prone to earthquakes of moderate to very high intensity.
- More than 40 million hectares (12% land) is prone to floods and river erosion.
- Nearly 7,500 km long coastline is prone to cyclones and tsunamis.
- Nearly 68% of the cultivable area is vulnerable to drought.
- Large tracts in hilly regions are at risk from landslides and some are prone to snow avalanches.
- Further, the vulnerability to Chemical, Biological, Radiological and Nuclear (CBRN) disasters and terrorism has also increased manifold.
- According to a report, out of 905 natural disasters worldwide, nearly 10% occur in India

Mountain and Coastal areas

- India's Himalayan region is geologically very active and sensitive. In this region, every year, one or other types of disasters such as earthquakes, landslides, floods, forest fires etc. occur very frequently. Though at the time of disaster, various rescue and relief operations are carried out and plans for long term strategies are formed, yet the long term strategies are easily forgotten as memory fades.
- It is observed that disaster management in the area is just like fire fighting and very negligible or conscious attempt is made for long term strategies.
- Partial failure of the administration and other agencies to counter the situation results in further deterioration of the condition.

Mountain and Coastal areas

- Unemployment, diseases, scarcity of livelihood, food and water shortage, shelter housing problem, failure of communication and other infrastructures, environmental degradation etc. are some major problems which are being faced due to one or the other form of disasters in the area.
- In the recent past, mainly due to increasing population pressure and various other man made/natural factors, the intensity and severity of disasters have increased many times and subsequently the problem of rehabilitation has become more tenuous, particularly in this region of the country.
- Realizing the seriousness of the problem and its adverse impact on the socio-economic status of the people of the region, it is high time that some appropriate strategic approach is applied for proper disaster management in the area.

Ecological Fragility

- Fragile ecosystems are important ecosystems, with unique features and resources. Fragile ecosystems include deserts, semi–arid lands, mountains, wetlands, small islands and certain coastal areas. Most of these ecosystems are regional in scope, as they transcend national boundaries.
- **Desert**: The Thar Desert or the Great Indian Desert is a large, arid region in the north-western part of the Indian subcontinent, is the world's 17th largest desert, and the world's 9th largest subtropical desert. About 85% of the Thar Desert is in India, and the remaining part in Pakistan. In India, it covers about 320,000 km^2, of which 60% is in Rajasthan and extends into the states of Gujarat, Punjab, and Haryana.

Ecological Fragility

- **Wetlands**: India, with its varying topography and climatic regimes, supports diverse and unique wetland habitats. The available estimates about the areal extent of wetlands in India vary widely from a lowest of 1% to a highest of 5% of geographical area, but do support nearly fifth of the known biodiversity. These wetlands are distributed in different geographical regions ranging from Himalayas to Deccan plateau.
- **Mountains**: The major mountain ranges in India are the Himalayas and the Western Ghats.The Himalayas are the highest mountainous range in theworld that traverses an arc of about 2500 km between the Indus and theBrahmaputra rivers with an average width ranging from 100 to 400 km. TheHimalayas pass through eight countries, namely Afghanistan, Pakistan, India, China,Nepal, Bhutan, Bangladesh and Myanmar. In India, this mountain ecosystem isspread over 11 states, viz.

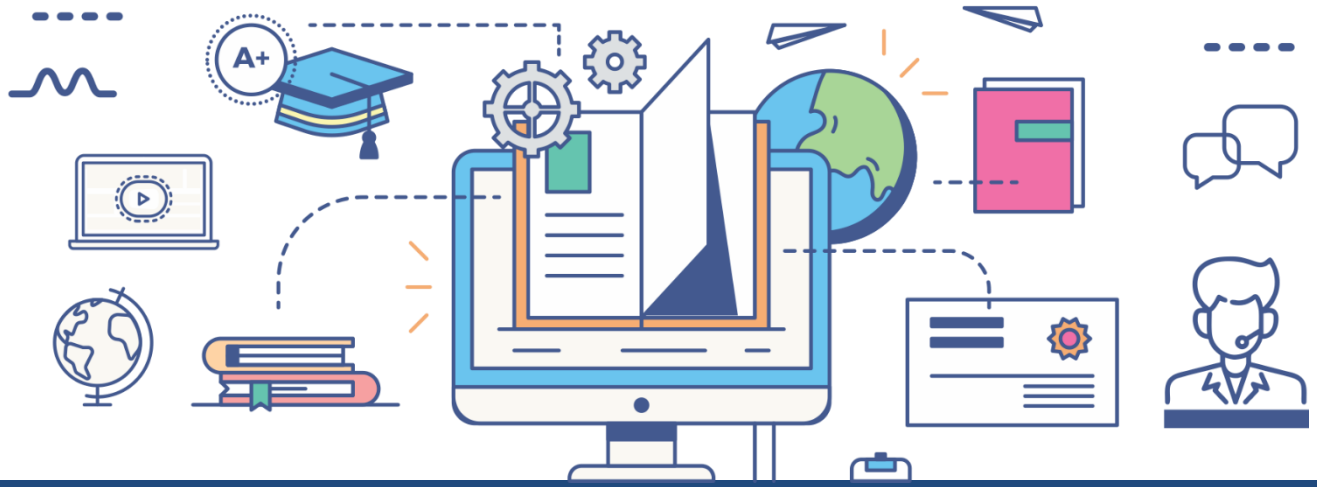
Ecological Fragility

- Jammu and Kashmir, Himachal Pradesh, Uttaranchal,Sikkim, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland,Tripura and West Bengal. These two mountainous ranges are recognised as two hottest biodiversity hotspots of the world, exhibit high level of endemism.
- **Islands**: There are a total of 1,208 islands, including uninhabited ones in India. The Andaman and Nicobar Islands Union Territory is a tropical archipelago of 572 islands in the Bay of Bengal, situated between 6°45'–13°41' N and 92°12'–93°57' E, and covering a total geographical area of 8,249 km^2 with a coastline of 1,962 km. These islands have unique flora and fauna, and exhibits high level of endemism.
- **Coastal areas**: India has a coastline of 7516.6 km, nine states and two union territories of the country have coastal areas. These coastal areas have 97 major estuaries, 34 major lagoons, 31 mangrove areas and 5 coral reef areas, and these various habitats support unique flora and fauna.

REFERNCES

1. https://joint-research-centre.ec.europa.eu/scientific-activities/natural-and-man-made-hazards_en
2. https://en.wikipedia.org/wiki/Disaster
3. https://sdma-arunachal.in/manmade-disasters/
4. https://www.dhs.gov/natural-disasters
5. https://emergency.fsu.edu/hazards/chemical-spills
6. https://nidm.gov.in/easindia2014/err/pdf/country_profile/India.pdf

DIGITAL LEARNING CONTENT



Parul® University

www.paruluniversity.ac.in