UNIT-1

Introduction to Disaster Management

Disasters disrupt progress and destroy the hard-earned efforts. Often pushes the nation in quest for progress, back by several decades. Efficient management of disaster has received increased attention rather than mere response to their occurrence. India is vulnerable in varying degrees to a large number of natural as well as man-made disasters. 59% of land mass is prone to earthquake of moderate to very high intensity. Over 40 million hectares (12% of land) is prone to floods and river erosion. 5700 km, out of 7516 km coast line is prone to cyclones and tsunamis. 68% of cultivable area is vulnerable to drought and hilly areas are at land slide risk. Apart from this, we have radiological and nuclear radiation and environmental degradation due to abnormal dumping of greenhouse gases in the atmosphere by the use of fossil fuel for most of energy generation activities and transportation.

Disaster:

A disaster can be defined as **"an event that occurs in most cases suddenly and unexpectedly, causing severe disturbances to people or objects affected by it, and resulting in loss of life and harm to the health of the population, the destruction or loss of community property, and severe damage to the environment"**. This cause a disruption in the normal pattern of life, generating misfortune helplessness and suffering, effects on the socioeconomic structure of a region or a country and the modification of the environment.

Hazard: It is defined as **"a dangerous condition or event, that threat or have the potential for causing injury to life or damage to property or the environment."**

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

Vulnerabilities can be categorized into Physical and socio-economic vulnerability.

Physical Vulnerability: It includes notions of whom and what may be damaged or destroyed by

natural hazard such as earthquakes or floods. It is based on the physical condition of people and elements at risk, such as buildings, infrastructure etc; and their proximity, location and nature of the hazard.

Socio-economic Vulnerability: The degree to which a population is affected by a hazard will not merely lie in the physical components of vulnerability but also on the socioeconomic conditions. The socio-economic condition of the people also determines the intensity of the impact. For example, people who are poor and living in the sea coast don't have the money to construct strong concrete houses.

Risk: Risk is a measure of the expected losses (deaths, injuries, property, economic activity etc.) due to a hazard of a particular magnitude occurring in a given area over a specific time period .It is often expressed as the likelihood of a hazard causing a disaster.

The level of risk depends upon:

1) Nature of the hazard.
2) Vulnerability of the elements which are affected.
3) Economic value of those elements.

Capacity building (or) Resilience: Coping capacity is the ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk or disasters. The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during disasters or adverse conditions. Coping capacities contribute to the reduction of disaster risks.

Interrelation: These concepts are interrelated in disaster management as follows:
A **hazard** becomes a **disaster** when it strikes a **vulnerable** population.
Risk is assessed by understanding the **vulnerability** and the nature of the **hazard**.
Building **resilience** reduces **vulnerability** and therefore minimizes **risk** and the potential impact of **disasters**.
Effective disaster management involves identifying hazards, assessing risks, reducing vulnerability, and enhancing resilience to mitigate the impact of disasters.

Environmental Hazards: The term "Environmental hazards" is defined as the extreme events and substances which are in the earth and its ecological systems that create several consequences.

An environmental hazard can cause numerous effects on the environment and also social nature which mainly creates some different types of consequences. In addition, it has also some effects on the health of people and which involves some natural types of disasters in today's world.

There are numerous categories of environmental hazards such as,

1) **Physical Hazards** - *Noise, Heat, Cold, Fire*
2) **Biological Hazards**- *Corona Virus, H1N1 Virus, Zica Virus, HIV*
3) **Chemical Hazards** - *MIC Gas*
4) **Radiological Hazards** - *Radioactive elements*

All hazards can cause some numerous effects and also some difficult social and environmental problems which can also have some adverse effects on human beings. In addition, it also decreases the well being of human beings

Causes for Environmental Hazards:

- The causes of environmental hazards such as unplanned construction, defective policies of agriculture, deforestation, population exploitation and also transport.
- Unplanned construction can create air pollution in every rural area. It is also caused through trapping the solar radiation and also making all construction areas warmer.
- Deforestation also results negatively in rural areas and the world and it creates more environmental problems such as reducing the balance of Oxygen through cutting trees.
- There has been a tremendous surge in some private vehicles which creates a higher rate of pollution causing smog.

Effects of Environmental Hazards:

- Poor air quality can trigger asthma attacks and other respiratory diseases.
- The effects of environmental hazards create numerous negative ways which mainly derive from cultivation, vehicle population etc.
- They are responsible for extreme harmful weather events.
- Vulnerable groups like the elderly, children and people with a low income or in poor health are most affected.
- It also effects through adding some harmful chemicals for faster growing and creates diseases among human beings.

Disaster and Stress:

After a disaster people use a lot of emotional energy coping with fears, frustrations and other feelings. Eventually, they will begin to feel the effects. This is when normal stress symptoms may begin to show and can affect mind, body, feelings and relationships.

These symptoms can be quite strong and are often at their worst in the first few weeks. They are not signs of weakness. These feelings are a response to a serious traumatic event and are to be expected. In most cases, they will fade over the following weeks or months, although some people may experience them for a longer period. The various stress symptoms given below,

Psychological:

- Trouble thinking clearly, planning or making decisions
- Continually thinking about the problem or other difficult times

Physical:

- Tension, stress or tightness in muscles
- Weakness, tiredness and a loss of energy or enthusiasm
- Feeling tired but unable to sleep, or having disturbed sleep, dreams or nightmares.

Emotional:

- Irritable, bad tempered, impatient or restless
- Feeling sad and hopeless as though the emergency will never end

Relationships:

- Blame others for the stress
- Can't feel happiness, enjoyment or affection for loved ones

These reactions are normal after a traumatic event. But if they continue, it can turn into a stress cycle and eventually it becomes a lifestyle. You need to break the cycle to overcome stress in the following ways,

Step 1: Recognize you are stressed

People don't often recognize they are stressed because they are too focused on the problems. Listen to others who may see you more clearly than you see yourself..

Step 2: Reduce stressful activities

Check your lifestyle and routines to see where you can reduce the stress. Try to stop doing things that keep stress high.

Step 3: Increase relaxation and positive activities

Build activities into your day that are rewarding and give you a good feeling. Take time to enjoy yourself. Doing things you enjoy can be the best cure for stress and there are many things you can do to break the stress cycle.

Disaster Phenomena and events (Global and Regional):

Global event (Floods): floods today are much more influenced by human actions. The frequency and severity of floods have seen a rise due to the global trend of urbanization, industrialization, and the extraction of natural resources.

Floods in Chile: A recent natural disaster in 2023 primarily impacted rural communities in southern and central Chile, affecting over 21 thousand people. Aside from houses and infrastructure, the natural disaster has also severely damaged crops. Water and power supplies have likewise been disrupted. The most tragic part is that the 2023 natural disaster is likely not the last one to strike this area, as climate change continues to contribute to increasingly extreme weather events. Indicatively, the rains in Chile have come shortly after a drought and a devastating period of forest fires that killed scores of people and destroyed hundreds of dwellings.

California Floods: From January to April 2023, California experienced heavy rains brought by atmospheric rivers. More than 200 thousand homes and companies in California suffered from the 2023 natural disaster, leading to the evacuation of around 6 thousand people. In addition to damaging property, the floods claimed the lives of at least 22 people.

Many news outlets in 2023 used this natural disaster to illustrate how climate change is causing more extreme weather events, particularly in terms of the frequency and severity of droughts and floods. Scientists predict that greater rain-to-snow ratios, shorter snowmelt periods, and more fierce storms and other natural disasters will make managing California's water supplies significantly more complex.

Turkey–Syria Earthquakes: On February 6, an earthquake of 7.8 magnitude with an epicenter 23 miles (37 km) northwest of Gaziantep shook southeast Turkey, close to the border with Syria. After a few hours, the 2023 natural disaster in Turkey was exacerbated by a 7.5-magnitude aftershock and several smaller earthquakes. An area of around 86.5 million acres (350 thousand square kilometers) was severely damaged. The already dire humanitarian situation in Syria became even worse because of the natural disaster. Over 55,000 people, primarily of Turkish descent, perished in the earthquake. Even now, one year after this 2023 natural disaster, locals

continue to struggle with its devastating repercussions.

Kerala floods:

The geographic location of Kerala along the coast of the sea and the slopes of the Western Ghats makes it highly vulnerable to hazards with a natural origin and impacts of climate change. The high density of Kerala which is 860 persons per square kilometers makes it more susceptible to disaster losses and damages. Floods and landslides are a recurring phenomenon along the Western Ghats. Landslides occur mostly in Wayanad, Kozhikode, Idukki, and Kottayam districts.

Kerala is highly prone to floods. It is a major and the most frequent hazard in the state. Floods also lead to secondary disasters like landslides as was witnessed in the floods of 2018. Kerala has experienced disasters in the past, resulting in loss of human lives and livestock along with damage to infrastructure including public and private properties.

Kerala is the land of 'rains and rivers'. The floods in Kerala were one of the worst floods experienced by the state in a century. It resulted in the loss of over 400 lives. All the districts in the state were affected. The state government reported that one sixth of the population was directly affected by floods. The central government declared the floods as "calamity of a severe nature". 35 out of 54 dams in the state were opened for the first time in the history. There were heavy rains in the districts of Wayanad and Idukki which triggered severe landslides. Kerala experienced the worst floods in its history between 1 June and 19 August, 2018.

The state that year received 42 % of excess rainfall compared to average rainfall. Due to the rainfall scenario that prevailed till the end of July, 2018, all major 35 reservoirs storage were closed to the full reservoir level (FRL). They had no buffer storage to accommodate the heavy inflows from 8 August onward.

The continued exceptional heavy rainfall in August (with 170% above normal) in the catchment areas compelled the authorities to resort to heavy releases downstream into the rivers. This led to overflowing of all river banks leading to widespread flooding almost all over the state. The disaster resulted in loss of lives, livestock and agriculture, damaged houses and crops, destroyed roads, bridges, school etc.

The four sources of power generation in Kerala include hydro power, thermal power, wind power and solar power. The distribution of power in 300 odd electrical sections in seven districts was shattered. More than 1700 Distribution Transformers were damaged.

The causative factors of the floods are,

- Heavy rainfall
- Dam management
- Overflow of rivers and blockage of water bodies
- Poor resource management
- Lack of awareness
- Unplanned Urbanization

Response and Relief:

Response consists of evacuation of humans, livestock and other animals. Immediately after the floods, the basic amenities of providing food, clothing, shelter and medicines to disaster survivors is of utmost importance. If these needs are fulfilled timely and immediately, the disastrous effects of the disaster to living beings can be reduced. In the wake of Kerala floods, various stakeholders like NDRF, Indian Army, State-led community volunteers, fishermen, women volunteers, Non-state actors and technological interventions responded to the massive deluge in a very effectively manner.

Natural and Man-made disasters/Hazards:

- **Natural Hazards:** The hazards that occur naturally are known as natural disasters. These hazards occur both seasonally and without warning, subjecting the nation to frequent periods of insecurity, disruption, and economic loss.

  Ex: Earthquakes, cyclones, Tsunamis, heat waves, landslides, floods etc.
- **Man-made Hazards:** Hazards that are caused due to human interruption are known as man-made disasters.

  Ex: Industrial disasters, Biological disasters, Nuclear disasters etc.
- **Planetary Hazards**: The hazards that are existing or occurring in inner space of a planet are called as terrestrial or planetary hazards.

  Planetary Hazards are classified into a) Endogenous Hazards b) Exogenous Hazards

  Endogenous Hazards: The hazards which originate inside the surface of the earth are termed as “Endogenous Hazards”

  Ex: Volcanic eruption, Earthquake, Landslides etc.

  Exogenous Hazards: Hazards which originate above the surface of the earth (in the atmosphere) are called exogenous hazards.

Ex: Rainfall, Snowfall, Drought, Winds etc.

Endogenous Hazards: Hazards which originate inside the surface of the earth are termed as 'Endogenous Hazards'. Endogenous hazards are also called as 'Geological Hazards'.

Ex: Volcanic Eruption, Earthquake, Landslides etc.

- **Extra planetary Hazards:** Hazards that are existing or occurring in the outer space Beyond a planet, especially away from the planet Earth are called as extra terrestrial or extra planetary hazards.

  Ex: Collision of the earth with an asteroid, meteoroid, comet etc.

Climate Change Impact: Climate change is a change in the statistical distribution of weather patterns over a long period of time (i.e., decades to millions of years). Climate change is caused by factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions. Certain human activities have been identified as primary causes of ongoing climate change, often referred to as global warming. These changes will have a cascading effect on health, economy and people of the world. Global climate change is a scientifically more accurate term as effects such as changing patterns of rainfall and rising sea levels would probably have more impact than temperatures alone.

1) **Greenhouse effect:** A greenhouse is a house made of glass that can be used to grow plants. The sun's radiations warm the plants and the air inside the greenhouse. The heat trapped inside can't escape out and warms the greenhouse which is essential for the growth of the plants. Same is the case in the earth's atmosphere.

During the day the sun heats up the earth's atmosphere. At night, when the earth cools down, the heat is radiated back into the atmosphere. During this process, the heat is absorbed by the greenhouse gases in the earth's atmosphere. This is what makes the surface of the earth warmer and that makes the survival of living beings on earth possible.

However, due to the increased levels of greenhouse gases, the temperature of the earth has increased considerably. This has led to several drastic effects.

"Greenhouse gases are the gases that absorb the infrared radiations and create a greenhouse effect. For e.g., Carbon dioxide and chlorofluorocarbons."

The major contributors to the greenhouse gases are factories, automobiles, deforestation, etc.

The increased number of factories and automobiles increases the amount of these gases in the atmosphere. The greenhouse gases never let the radiations escape from the earth and increase the

surface temperature of the earth. This then leads to global warming.

Global Warming: It is the phenomenon of a gradual increase in the average temperature of the Earth's atmosphere. The main cause for this environmental issue is the increased volumes of greenhouse gases such as carbon dioxide and methane released by the burning of fossil fuels, emissions from the vehicles, industries and other human activities.

Effects of Global Warming:

1) Rise in the sea level
2) Increase in global temperature
3) Ecological disturbance

Measures to check global warming and climate change:

1. Afforestation: We have to plant more and more trees because plants they not only release oxygen but take carbon dioxide during the process of photosynthesis.

2. Climate-friendly alternatives: Instead of HCFCs and HFCs, Hydrocarbons which are ozone friendly are used in refrigerators, air conditioners, aerosols, fire protection and solvents.

3. Energy-Efficient Appliances: Buying products that are energy efficient. Energy-efficient products can help us save energy, save money and reduce our carbon footprint

4**. Use renewable and clean energy resources:** We should use renewable and clean energy resources like solar, wind, geothermal and many more to reduce the amount of pollution. Electric, smart cars, cars run on vegetable oil, etc. are great examples of using renewable energy. If we cannot afford electric cars, we should at least use cleanest fuel.

5. **Reduce pollution in Industries:** Industries should install tall chimneys, use low sulphur coal, better designed equipment and smokeless fuels to reduce green house gases.

2) **<u>Depletion of Ozone Layer:</u>** Ozone is a pale blue, odorless gas composed of three atoms of oxygen (O_3), mainly present in stratosphere in the form of a thick sheet, called ozonosphere. The thickness of the ozone layer differs as per season and geography. The highest concentrations of ozone occur at altitudes from 26 to 28 km in the tropics and from 12 to 20 km towards the poles. The ozone layer has the capability to absorb almost 97-99% of the harmful ultraviolet radiations that sun emit and which can produce long term devastating effects on humans beings as well as plants and animals. Ozone has the same chemical structure regardless of where it occurs and can be useful or harmful

depending on where it occurs in the atmosphere. When it is present in stratosphere it act as a protective layer but when the same is present in lower atmosphere near earth surface it is a pollutant. The depletion of the ozone layer results in the entry of the harmful UV rays to the earth's surface that might lead to skin cancer and can also change the climate drastically. The major cause of this phenomenon is the accumulation of natural greenhouse gases including chlorofluorocarbons, carbon dioxide, methane, etc.

Causes of Ozone layer Depletion:

- **Chlorofluorocarbons (CFCs):** It is the most extensively utilized ozone-depleting substance because it attributes to more than 80% of overall ozone depletion. It was utilized as a coolant in home appliances like freezers, refrigerators and air conditioners in both buildings and cars that were manufactured prior to 1995. It is usually contained in dry cleaning agents, hospital sterilants, and industrial solvents. It is also utilized in foam products like mattresses and cushions and home insulation.
- **Halons:** It is especially used in selected fire extinguishers in scenarios where the equipment or material could be devastated by water or extinguisher chemicals.
- **Carbon Tetrachloride:** It is also used in selected fire extinguishers and solvents.
- **Methyl Chloroform:** Commonly utilized in industries for cold cleaning, vapor degreasing, Chemical processing, adhesives and some aerosols.

Harmful effects of ozone layer depletion: Ozone layer protects all life forms on Earth from the Sun's harmful UV radiation. Any significant decrease in the amount of ozone in the stratosphere results in the amount of UV radiation reaching the Earth's surface leading to harmful effects on all living organisms.

1) Human health is more prone to UV rays that reach the Earth's surface. Studies suggest that high levels of UV Rays cause non-melanoma skin cancer and play a major role in malignant melanoma development.
2) Certain species of marine life have been greatly affected by overexposure to ultraviolet radiation at their early stage.
3) In animals, particularly domesticated animals, too much Ultraviolet radiation could also lead to skin and eye cancer.
4) Materials like plastics, wood, fabrics, rubber are massively degraded by exposure to too much ultraviolet radiation

Solutions to Ozone Depletion:

- Use natural and environmentally friendly cleaning products which are free from ozone depleting substances.
- Avoid using pesticides and instead use eco-friendly chemicals and other organic methods to check pests and weeds.
- Minimize the usage of vehicles which emits green house gases which is a cause of ozone depletion.

3) **Deforestation:** Deforestation can be defined as the large-scale removal of trees from forests (or other lands) for the facilitation of human activities. It is a serious environmental concern since it can result in the loss of biodiversity, damage to natural habitats, disturbances in the water cycle, and soil erosion. Deforestation is also a contributor to climate change and global warming.

- Forests combat climate change by absorbing greenhouse gases (such as carbon dioxide) and acts as a carbon storehouse.
- They are a source of oxygen, food, clean water, and medicine.
- Forests help mitigate the disastrous effects of floods by acting as a floodwater sink. Therefore, deforestation also increases the vulnerability of the landmass to certain natural calamities.
- They are also a source of raw material for many commercially important products such as paper, wood, and fabric.

Causes for Deforestation:

The primary human activities that contribute to deforestation include,

- Agriculture : small-scale and large-scale farming
- Logging : cutting of trees for use as raw material
- Mining and urban expansion: clearing of forest area for the construction of infrastructure.

Effects of Deforestation:

- Forests play host to a wide spectrum of wildlife. Deforestation can result in the extinction of several desirable species.
- Soil becomes vulnerable to erosion due to deforestation.
- Trees and plants regulate the moisture content in the atmosphere via the process of transpiration.

- Dead plant materials (such as leaves and twigs) that fall to the surface of the ground impart several properties to the soil, such as increased water-holding capacity.
- Deforestation is accompanied by reduced humidity, owing to the absence of transpiring trees.

Steps to control deforestation:

- Implementation of security measures and strict laws to prevent illegal logging.
- Increasing the count and range of forests under government protection.
- Carefully planning the construction of infrastructure (roads, dams, etc.) in order to minimize the loss of forest area.
- Facilitating the production and use of wood alternatives to reduce the demand for timber. For example, bamboo can serve as an alternative to wood fuel.

4) **Forest Fires:** **"Fire is a good servant but a bad master''** Forest fires are wildfires that spread uncontrollably, burning plants, animals, grasslands and brush lands that fall in their path. In reality fire consists of four parts i.e. gas, flame, heat and smoke.

   Forest fires have become a global concern as many countries face significant life and property losses. Moreover, the carbon dioxide released into the air due to forest fires causes lung and skin infections in humans.

   Limited and controlled forest fires have been very useful and essential for healthy forest growth. But uncontrolled forest fire may engulf and destroy healthy thick forest cover within no time. Besides direct loss to forest cover, forest fire also kills wildlife, damages environment, degrade soil quality and retrogrades forest regeneration. Since historical times, forest throughout the world has been adversely affected by fire. Fire always causes many direct or indirect effects on the forest ecosystem. They may merely be beneficial but at most of the times these effects are deteriorating. The damage to a forest by fire depends mainly on size of the fire.

   Causes for forest fires:

- Lightning during thunderstorms may lead to the occurrence of forest fires
- In dry season, friction leading to sparks by rolling stones in the mountainous areas may lead to forest fires.
- Forest fires are also caused intentionally to meet the need of fodder for grazing cattle.
- Careless throwing of cigarettes, bidi stubs, and match sticks by travelers, picnickers or

forest labourers may lead to the forest fires.

- The households residing near the forest use fire wood as fuel for cooking and other purposes. Sparks from such burning may sometime result in fire in the nearby forest.

Effects of Forest Fire:

- Forest fires can impact the economy as many families and communities depend on the forest for food, fodder and fuel.
- It burns down the small shrubs and grasses, leading to landslides and soil erosion.
- Burning of forests causes smoke and poisonous gas emissions that result in significant health issues in humans.
- Loss of trees can disrupt the climatic conditions and break down the carbon chain.
- Wildfires damage the habitat of animals, causing them to wander in cities. Many die in the fires, unable to escape.
- These fires destroy the vegetation, soil quality and overall flora and fauna.

Human Vulnerability to Disasters:

In the context of human vulnerability to disasters, the economically and socially weaker segments of the population are the ones that are most seriously affected. Within the vulnerable groups, elderly persons, women , children-especially women rendered destitute, children orphaned on account of disasters and differently abled persons are expose to high risks.

Indian Scenario:

The scenario in India is no different from the global context. The super cyclone of Orissa (1999), the Gujarat earthquake (2001), Tsunami (2004) and the recent Floods (2019 & 2020) affected millions of people across the country leaving behind a trail of heavy loss of life, property and livelihood.

India is one of the World's most disaster-prone countries because of its unique geo-physical characteristics. Out of 36 states and 7 Union Territories (UTs) of India,25 are Disaster Prone States. One State (West Bengal) is vulnerable to 4 types of Disasters, Seven states are susceptible to 3 types of disasters, 10 states are sensitive to 2 types of disasters, 6 states are prone to 1 type of disaster.

Disasters always bring misfortunes and miseries to humanity. The plans and policies of Central Government cannot be successful unless people are aware and involve in all disaster management activities.

Disaster Management Group:

It is not the whole and sole responsibility of government in disaster management activities, other groups such as local people, communities, panchayaths, NGOs and international agencies such as United Nations, Red Cross society should involve in disaster management activities. Hence, this group is called as 'Disaster Management Group'.

Rehabilitation Centers:

Rehabilitation centers like Schools, Colleges, tall buildings, function halls, government offices etc .help the disaster effected people. When a disaster strikes a particular area, it affects directly and indirectly to the people in the form of loss of life, property damage, loss of valuables etc.

First Responders:

People who have not affected by the disasters should help the disaster effected people by providing basic amenities such as Medicines, water, clothes, food etc. Hence these people are called as 'First Responders'.

Disasters in India:

During past 15 years history of India, the frequency of occurrence of disasters have been increased all over the world, including India due to drastic changes in climatic conditions. On an average, India experiencing one or two disasters every year.

Ex: 1999 – Super Cyclone of Orissa

2001 – Gujarath Earthquake

2004 – Indian Ocean Earthquake (Tsunami)

2007 – Terrorist attack of Hyderabad

2008 – Terrorist attack of Mumbai

2013 – Terrorist Attack in Hyderabad

2013 – Uttarakhand Floods

2014 – Huddudh Cyclone & Kashmir Floods

2015 – Chennai Floods

2016 – Hyderabad – Heavy Rains

2017 – Oki Cyclone of Odisha

2018 – Kerala and Karnataka Floods

2019 – Mumbai and Kearala Floods

2020 – Telanagana, Andhra Pradesh, Maharastra, Assam, Kerala Floods and Covid – 19.