

DISASTER MANAGEMENT -1

What is a Disaster?

- A disaster is a result of natural or man-made causes that leads to sudden disruption of normal life, causing severe damage to life and property.
- It is an undesirable occurrence resulting from forces that are largely outside human control. It strikes quickly with little or no warning.
- **United Nations Office for Disaster Risk Reduction (UNISDR)** defines disaster as “a **serious disruption of the functioning of a community or a society** at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts.”
- **“Disaster” means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence** which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.” (definition by Disaster Management Act 2005)

Classification of Disasters

- Disasters are classified **as per origin**, into **natural and man-made disasters**.
- **As per severity**, disasters are classified as **minor or major** (in impact).
- Natural disasters are sudden ecological disruptions or threats that exceed the adjustment capacity of the affected community and require external assistance.
- Natural disasters can be broadly classified into categories including geophysical such as earthquakes and volcanic eruptions; hydrological such as floods; meteorological such as hurricanes; climatological such as heat and cold waves and droughts; and biological such as epidemics.
- Man-made disasters can include hazardous material spills, fires, groundwater contamination, transportation accidents, structure failures, mining accidents, explosions and acts of terrorism.

Earthquake

- Earthquakes are by far the most unpredictable and highly destructive of all the natural disasters. Earthquakes that are of tectonic origin have proved to be the most devastating and their area of influence is also quite large.

- These earthquakes result from a series of earth movements brought about by a sudden release of energy during the tectonic activities in the earth's crust.

Socio-environmental consequences of earthquakes:

- The idea of earthquakes is often associated with **fear and horror due the scale, magnitude** and suddenness at which it spreads on the surface of the earth without discrimination.
- It becomes a calamity when it strikes the areas of high density of population.
- It not only **damages and destroys the settlement, infrastructure, transport and communication networks, industries and other developmental activities but also robs the population of their material and socio-cultural gains** that they have preserved over generations. It renders them **homeless**, which puts an extra pressure and stress, particularly on the weak economy of developing countries.

Effects of earthquakes:

On Ground:

Fissures:	<ul style="list-style-type: none"> • Earthquakes can create fissures in the crust of the earth which may result into possible chain effects.
Settlements:	<ul style="list-style-type: none"> • Population settlement can be hampered due to earthquakes which may also result into loss of lives, migration of people to safer areas.
Landslides	<ul style="list-style-type: none"> • High sloping areas are most vulnerable zones for landslides. Human activities like intensive grazing, deforestation and natural phenomena like high rainfall can cause landslides. • Example: Himalayan region have high sloping areas which also constitutes 'very high damage risk zone' in India.

On Manmade Structures:

Cracking:	<p>Earthquakes can cause cracking of buildings, roads and other infrastructure. In the long run these cracks can make the structures more vulnerable for further damage.</p>
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Sliding:	Earthquake can develop sliding of structures to the lower strata. A tectonic plate can slide over another which can create unevenness on the ground. This causes sliding of buildings, roads and other infrastructures.
Collapse:	Manmade structures are high risk prone to earthquakes if these are not constructed according to the geological and geomorphological conditions of the area. Thus, buildings collapse is common phenomenon during earthquakes.

On Water:

Waves:	Earthquakes can create waves on water bodies usually higher than normal. Such high waves can intrude human settlements, agriculture, forests etc.
Hydro dynamic pressure:	Water bodies are highly sensitive to pressure changes as creates ripples of pressure. Dams are particularly more vulnerable to such pressure systems. Dam burst can occur if sufficient pressure is generated by earthquakes.
Tsunami:	<ul style="list-style-type: none"> · Earthquakes can cause shift in tectonic plates and it may create waves higher wavelengths. Such waves are more destructive. · Example: 2004 Tsunami, 2018 Tsunami waves in Indonesia.

Earthquake hazard mitigation:

- Establishing **earthquake monitoring centres** for regular monitoring and **dissemination of information** among the people in vulnerable areas
- Preparing a **vulnerability map** of the country and **dissemination of vulnerability risk information among the people** and educating them about the ways and means minimising the adverse impacts of disasters.
- **Modifying the house types and building designs** in the vulnerable areas and discouraging construction of high-rise buildings, large industrial establishments and big urban centres in such areas.
- Making it mandatory to **adopt earthquake resistant designs and use light materials** in major construction activities in the vulnerable areas.

- **India Quake App- Ministry of Earth Sciences launched 'India Quake' app** to enable users receive information about natural hazards on land and water. It has been developed by National centre for Seismology for automatic dissemination of earthquake parameter such as location, time and magnitude after the occurrence of Earthquake and avoid delay of information in the event of earthquake.

Tsunamis:

- Tsunamis (Japanese for “harbour wave”), also **known as a seismic sea wave**, are a series of very **large waves with extremely long wavelength**, in the deep ocean, the length from crest to crest may be 100 km and more.
- It is usually **generated by sudden displacements in the sea floor caused by earthquake, landslides, or volcanic activity**.
- Most tsunamis, including the most destructive ones are **generated by large and shallow earthquakes** which usually occur near geological plate boundaries, or fault-lines, where geological plates collide.
- **The earthquake and resulting tsunami in Indian Ocean on 26 Dec 2004 had devastating effects on India**. Many people died and millions were displaced. The hardest hit areas were on Southern coast and the Andaman and Nicobar Island. Tsunamis have the potential of causing significant casualties, **widespread property damage, massive infrastructure loss and long-term negative economic impacts**. People caught in the path of a tsunami often have little chance of survival. People die from drowning or debris crushing them.
- It is beyond the capacity of individual state or government to mitigate the damage. Hence, combined efforts at the international levels are the possible ways dealing of dealing with these disasters. India has volunteered to join the **International Tsunami Warning System (ITWS)** after the December 2004 tsunami disaster.

Sagar Vani App:

- Sagar Vani app has been **developed by ESSO Indian National Centre for Ocean Information Services (INCOIS) under Ministry of Earth Sciences**.
- It is a software platform which uses state of art technology for dissemination of ocean related information and advisory services such as Potential Fishing Zone (PFZ) advisories, Ocean State Forecast (OSF), High Wave Alerts and Tsunami early warnings.

Tropical cyclones:

- India's long coastline of nearly 7,500 km consists of 5,400 km along the mainland, 132 km in Lakshadweep and 1,900 km in the Andaman and Nicobar Islands. **About 10 per cent of the World's tropical cyclones affect the Indian coast.**
- Of these, the majority has their initial genesis over the Bay of Bengal and strike the east coast of India.
- **On an average, five to six tropical cyclones form every year**, of which two or three could be severe.
- Cyclones occur frequently on both the west coast in the Arabian Sea and the east coast in the Bay of Bengal.
- **More cyclones occur in the Bay of Bengal than in the Arabian Sea.**
- An analysis of the frequencies of cyclones on the East and West coasts of India **during 1891-2000** shows that **nearly 308 cyclones (out of which 103 were severe) affected the East Coast.**

- **The disaster potential is particularly high at the time of landfall in the northern part of Indian Ocean** (Bay of Bengal and the Arabian Sea) due to the accompanying destructive wind, storm surges and torrential rainfall. Of these, storm surges are the greatest killers of a cyclone, by which sea water **inundates low lying areas of coastal regions and causes heavy floods**, erodes beaches and embankments, destroys vegetation and reduces soil fertility.
- The coastal states and union territories (UTs) in the country, encompassing **84 coastal districts which are affected by tropical cyclones.**
- **Four states (Tamil Nadu, Andhra Pradesh, Odisha and West Bengal) and one UT (Puducherry)** on the east coast and one state (Gujarat) on the west coast are highly vulnerable to cyclone disasters.

Mitigation Techniques

- Observation Networks, Information Systems, Monitoring, Research, Forecasting & Early Warning
- Quick, clear, effective dissemination among central and state agencies
- Providing weather information online and offline and interface with mobile network service
- Providing warnings on radio, TV, and cell phones.
- **Hazard resistant** construction

Current Developments:

1st 'National Conference on Coastal Disaster Risk Reduction and Resilience (CDRR&R) – 2020'

- Conference was organized by the **National Institute of Disaster Management (NIDM)**, in New Delhi.
- The conference focused on **enhancing human capacity in terms of better understanding about coastal disaster risks and effective collaborative actions**, by implementing **Prime Minister's 10-point agenda and Sendai Framework for Disaster Risk Reduction**.
- NIDM, under Ministry of Home Affairs was constituted under the Disaster Management Act 2005.
- It has been entrusted with the **nodal national responsibility** for human resource development, capacity building, training, research, documentation and policy advocacy in the field of disaster management.

Cold Waves:

- Cold wave and frost are **seasonal and localized hazards** occurring only in the parts with severe winter. Prolonged frost conditions and cold wave can damage certain frost-sensitive plants causing crops loss. The susceptibility to frost varies widely across crops.
- The extent of damage caused by cold wave **depends on temperature, length of exposure, humidity levels**, and the speed at which freezing temperature is reached. It is difficult to predict a definite temperature level up to which crops can tolerate cold wave/frost because many other factors also affect it.
- Cold wave can **cause death and injury to human beings, livestock and wildlife**. Higher caloric intake is needed for all animals, including humans to withstand exposure to cold and **poor nutritional status can prove deadly** in extreme cold conditions.
- If a cold wave is accompanied by heavy and persistent snow, grazing animals may be unable to get the requisite food. They may die of hypothermia from prolonged exposure or starvation.

IMD definitions for Cold Wave and Cold Day:

- Wind chill factor plays an important role and brings down the actual minimum temperature depending upon the wind speed. The actual minimum temperature of a station should be reduced to "Wind Chill Effective Minimum Temperature (WCTn)" based on wind chill factor using the relevant WMO criteria.

- For declaring “Cold Wave” and “Cold Day” WCTn should only be used. If WCTn is 10°C or less, then only the conditions for cold wave should be considered. There is a Cold Wave:
 1. When normal minimum temperature is equal to 10°C or more; Cold Wave if the **departure from normal is -5°C to -6°C** and ‘Severe Cold Wave’ Departure from normal is -7°C or further.
 2. When normal minimum temperature is less than 10°C; ‘Cold Wave’ – if the **departure from normal is -4°C to -5°C** and ‘Severe Cold Wave’ Departure from normal is -6°C or less.

Cold waves: Mitigation measures

Stay **indoors as much as possible**

- Listen to **local radio stations for weather updates**
- Eat **healthy food to supply heat to the body and drink non-alcoholic beverages to avoid dehydration**
- Wear **several layers of lightweight and warm clothes; rather than one layer of heavy clothing. The outer garments should be tightly woven and water-repellent.**
- Keep **dry. Change wet clothing frequently to prevent loss of body heat.**
- Maintain **proper ventilation when using kerosene, heater or coal oven to avoid toxic fumes.**
- In case of non-availability of heating arrangement, go to **public places where heating arrangements are made by administration.**
- Cover **your head, as most body heat is lost through the top of the head and cover your mouth to protect your lungs.**

Heat waves:

- Heat wave is a **period of abnormally high temperatures** that leads to physiological stress, which sometimes can claim human life.
- The **World Meteorological Organization defines** a heat wave as five or more consecutive days during which the daily maximum temperature exceeds the average maximum temperature by five degrees Celsius.

- Heat Waves typically occur between March and June, and in some rare cases even extend until July. Heat waves are more frequent over the Indo-Gangetic plains of India.
- **On an average, 5-6 heat wave events occur every year** over the northern parts of the country. In the northern plains of the country, dust in suspension occurs in many years for several days, bringing minimum temperature much higher than normal and keeping the maximum temperature around or slightly above normal.
- **According to IMD**, in India, it will be considered as heat wave if the maximum temperature of a met-sub-station reaches **at least 40°C or more in the plains, 37°C or more in coastal areas and at least 30°C or more for hilly regions.**

The signs and symptoms are as follows:

- **Heat Cramps:** Edema (swelling) and Syncope (Fainting) generally accompanied by fever below 39°C
- **Heat Exhaustion:** Fatigue, weakness, dizziness, headache, nausea, vomiting, muscle cramps and sweating
- **Heat Stroke:** Body temperatures of 40°C or more along with delirium, seizures or coma, which is a potentially fatal.

Floods:

- Floods are relatively slow in occurrences and often occur in well identified regions and within expected time in a year.
- Floods occur commonly **when water in the form of surface run-off exceeds the carrying capacity** of the river channels and streams and flows into the neighbouring low-lying flood plains.
- Sometimes this even goes beyond the capacity of lakes and other inland water bodies in which they flow.
- Floods can also be **caused due to a storm surge, high intensity rainfall for a considerably longer time period, melting of ice and snow**, reduction in the infiltration rate and presence of eroded materials in the water due to higher rate of soil erosion.
- Unlike other natural disasters **human beings play important role** in the genesis as well as spread of floods. Indiscriminate **deforestation, unscientific agricultural practices, disturbances along the natural drainage channels and colonisation of**

flood plains and river beds are some of the human activities that play an important role in increasing the intensity, magnitude and gravity of the floods.

- Various states of India face heavy loss of lives and property due to recurrent floods.
- **National Flood Commission has identified 40 million hectares of land as flood prone in India.**
- Assam, West Bengal and Bihar are among the high flood prone states.
- Apart from these, most of the rivers in the northern states like Uttar Pradesh and Punjab are also vulnerable to frequent floods.
- States like Rajasthan, Gujarat, Haryana and Punjab are also getting inundated in recent years due to flash floods. This is partly because of the pattern of monsoon and partly because of blocking of most of the streams and rivers by human activities.

Mitigation:

- **Modernisation** of flood forecasting and warning systems on a river basin basis
- **Monitoring of flood preparedness**, river basin and reservoir management plans
- Studies and **monitoring of rivers flowing from neighbouring countries**
- Implementation of the schemes for **real-time collection of hydro-meteorological data** on important rivers including the relevant rivers flowing from Nepal, Bhutan and China
- **Specialised efforts** for different types of floods and causes of flooding, including cloudburst
- Developing/ improving/ updating forecasting methods and models for quantification of inflows and storage of dams.
- Quick, clear, effective **dissemination** among central and state agencies
- **Facilitate** the distribution of necessary communication equipment, last-mile connectivity and access to disaster risk information
- **International cooperation** to share warnings about rivers flowing from neighbouring countries
- Enhancing the **safety of dams and reservoirs.**
- **Desilting/ dredging** of rivers to improve flow; drainage improvement; floodwater diversion through existing or new channels.

Droughts:

- There is no globally adopted operational definition for drought applicable to all contexts.
- This is the primary reason why policy makers, resource planners, and other decision-makers as well as administrators have considerable difficulty recognising and planning for drought than they do for other disasters.
- Broadly, drought is perceived as sharply felt **water deficit caused by variations in the natural hydro-metrological factors, agro-ecological conditions, moisture requirements of crops under prevailing cropping choices (systems, patterns)**.
- The **WMO considers** drought as a slow creeping natural hazard that occurs in part due to the natural climatic variability.
- In recent years, concern has grown world-wide that droughts may be increasing in frequency due to climate change.
- **A third of the country is drought prone.** Recurrent drought results in widespread adverse impact on people's livelihoods and young children's nutrition status.
- Drought is a phenomenon that is widely considered as a '**creeping disaster**' whose onset, end, and severity are difficult to determine.
- Unlike the suddenly occurring disasters, a drought may develop very slowly over several months affecting very large geographical area without causing little or no structural damage.

The IMD recognizes five drought situations:

- '**Drought Week**' when the weekly rainfall is less than half of the normal
- '**Agricultural Drought**' when four drought weeks occur consecutively during mid-June to September
- '**Seasonal Drought**' when seasonal rainfall is deficient by more than the standard deviation from the normal.
- '**Drought Year**' when annual rainfall is deficient by 20 per cent of normal or more, and
- '**Severe Drought Year**' when annual rainfall is deficient by 25 to 40 per cent of normal or more.

Assessment, Monitoring, Forecasting, Early Warning:

- **Improve the drought forecast**, and assessment of water deficit (likely mismatch between estimates of requirements and availability) in the arid/semi-arid, drought-prone, and dry-land farming areas
- **Prepare detailed advisories** on water conservation and crop management measures based on drought and water deficit in consultation with experts for each State/UT which is likely to face acute water deficit
- **Agricultural research** focussed on drought-prone areas, arid/semi-arid tracts, and dry-land farming areas.
- Research related to **water conservation and management**.
- Promote **water efficient irrigation systems** (sprinklers, drip, etc.)
- Promote **protective irrigation** through micro irrigation systems
- Provide **advice to farmers** to cope with drought, crop management under drought conditions, and efficient water management
- **Training** in water and soil moisture conservation
- **Promote village-level information** systems for natural resource management.

Forest Fires:

- **India is one of the richest areas of biodiversity in the world having nearly seven lakh square kilometres of forest cover.**
- Increasing **human interference** is a major cause for the incidents of the forest fires.
- Despite its natural and essential roles, **fire has negative consequences** when it conflicts with the public interest.
- Examples of negative impacts include **loss of homes, property and critical infrastructure, damage to domestic watersheds** and destruction of commercially valuable timber.
- **Smoke** from forest fires can also interfere with road and air transportation, inhibit tourism, and cause serious public health problems.
- It is also a **threat to human settlements**, dwelling within or adjacent to the forests.
- Forest fires in India are generally ground fires.
- As per **Forest Survey of India (FSI)**, which has been conducting field investigation since 1965, **human activities trigger nearly 95 per cent of the forest fires** in India.

- Forest fire is a **major cause of injury and loss to forests**.
- The **deciduous forest is the most vulnerable to fire** in India.

Reasons for forest fires:

- **Reasons for forest fires**
 - Natural causes
 - Anthropological causes

Natural Causes:

- **Global warming:** Increasing global temperature due to intensive industrialisation and resultant dryness have played havoc on forest. Since 2017, there is 125% surge in forest fire incidents in India.
- **Heat waves, solar flares:** The periodic solar cycle of solar minimum and solar maximum causes abrupt increase in temperature of the earth. Such events cause forest fires.
- **Monoculture growth of forest:** Single strand of forest tree species are more vulnerable to forest fires. Pine forests in Uttarakhand is such an example. According to Forest Survey of India, 50% of forest in Uttarakhand is prone to fires.
- **Deciduous forest:** India's majority of forest cover is deciduous which provides specific seasons for forest fires during dry periods.
- **Climate change:** Climate change is natural phenomenon though during recent years it is highly induced by human activities causes changes in temperature, humidity. This alterations in micro climate give rise to forest fires.

Anthropological Reasons:

- **Human interventions in forest:** Over the years **Urbanisation, industrialisation have come at the cost of forests. Forests were cleared for human settlements, mineral exploration, industrial establishments etc. This has been resulted into degraded forest.**
- **Deforestation:** Human settlements, multipurpose projects like large dams, mines development required clearing of forests. Generally, such clearing were done by setting forests on fires as it is cheapest and easy way to clear the forest.

- **Deliberate act of arson:** Timber mafias indulge into illegal exploitation of timber resources of forests. As they were unable to do it legally, they tend to resort on deliberate forest fires.
- **Unattended camp fires:** Unscientific tourism in forest areas, left over burning camp fires due negligence are also causing fires. Such camps are becoming dumping grounds for discarded cigarettes, beedi buds.
- **Migration:** People are migrating to urban areas for better life opportunities. Villages are deserted because of increased incidences of forest fires. This has resulted into low community participation in forest management.
- **Shifting agriculture:** Small patches of forest land are cleared by setting tress on fires. Though it increases soil fertility for shorter time, it poses dangers of forest fires over the long period.

Effects of forest fires:

- **Migration:** Frequent forest fires compel the people to migrate to safer areas. This causes desertification of villages, pressure on natural resources.
- **Loss of ecosystem and biodiversity:** Forest fires damages the rich flora and fauna. Death of animals, man-animal conflicts are major negative outcomes of forest fires.
- **Human health:** Increased air pollution may damage the respiratory system of humans. It may also cause lung cancer, eye itching, skin cancer etc.
- **Albedo:** Forest fires emit black carbon on large scale. Such small particles of black carbon gets deposited on snow. And snow is best medium of sunlight reflection. Thus melting of snow affects the albedo of snow which in turn causes global warming.
- **Forest degradation:** Forest fires have negative impact on quality of forests. Frequent forest fires not only degrade the forests but also increases the desertification.
- **Climate change:** Climate change is pressing problem humanity facing nowadays. Forest fires can only increase the intensity of climate change.
- **Soil fertility:** Forest fires can increase the soil fertility as it adds black carbon to the soil. But degradation of forests decreases the soil microbial activities. Thus, in the long run forest fires have negative impacts on forest soil.
- **Economic losses:** Less availability of forest wood for pulp industries, firewood, and infrastructure development can result into major economic losses. According to Forest Survey of India, **forest fires costs \$1.5 billion of GDP.**

Mitigation

- Employ a system of **fire risk classification** based on best available methods such as those using satellites
- **Technical support** in mapping forest fire vulnerability areas using satellites
- **Seasonal forest-fire monitoring** and assessment
- **Strengthen coordination** between different ministries
- Strengthen the **early detection and warning**
- **Create awareness** for forest fire prevention as most fires are caused by humans, deliberately or inadvertently
- Training and orientation programs for state govt. staff, and other stakeholders such as: civil society, volunteers, elected representatives.

Chemical (Industrial) Disasters:

- With rapid economic development, there has been spread of industries from small to large across the country.
- There is relatively higher presence of industrial sector along the west coast, largely due to the proximity to raw materials and ports.
- **The states with very large number of chemical industries are Gujarat, Maharashtra, Uttar Pradesh (UP), Tamil Nadu (TN), MP, and Punjab.**
- Due to the regional concentration of chemical companies in certain pockets, the chemical hazard has increased many folds.
- The growth of industries has led to an increase in the risk of occurrence of incidents associated with hazardous chemicals (**HAZCHEM**) and **hazardous materials (HAZMAT)**.
- These events occur due to mishaps or failures in industry and negligence in following international codes and standards for chemical handling which affects the industrial functioning, and productivity.
- While the common causes for chemical accidents are deficiencies in safety management systems or human errors, natural calamities or sabotage may also trigger such accidents.
- Chemical/ industrial accidents are significant and have long term impact on the community and environment. It leads to injuries, pain, suffering, loss of lives, damage to property and environment.

Biological and public health emergencies:

- Disasters related to this sub-group are biological emergencies and epidemics, pest attacks, cane epidemics and food poisoning.
- Biological emergency is one **caused due to natural outbreaks of epidemics or intentional use of biological agents** (viruses and microorganisms) or toxins through dissemination of such agents in ways to harm human population, food crops and livestock to cause outbreaks of diseases.
- This may happen through **natural, accidental, or deliberate dispersal of such harmful agents** into food, water, air, soil or into plants, crops, or livestock.
- Apart from the natural transnational movement of the pathogenic organisms, their **potential use as weapons of biological warfare and bioterrorism** has become far more important now than ever before.
- Along with nuclear and chemical agents, many biological agents are now considered as capable of causing large-scale mortality and morbidity.
- **Pest infestations** have recurred as major disasters for the agrarian economy of India since time immemorial.
- **Locust swarms** coming from Central Asia used to be a major cause for concern.
- As large number of people now travels within and across national boundaries, the likelihood of **fast global spread of epidemics** has increased dramatically making localised outbreaks into national epidemics and global pandemics.
- **The increased interaction between humans and animals** has increased the possibilities of zoonotic diseases emerging in epidemic form.
- **Locust Watch under FAO** monitors the locusts worldwide and issue early warnings to countries about locust swarms. After receiving warning, Government takes urgent measures for monitoring and control