1)Disaster cycle

UNIT - I Introduction to Disasters

A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society (Vulnerability + Hazard) / Capacity = Disaster. Disaster Management :

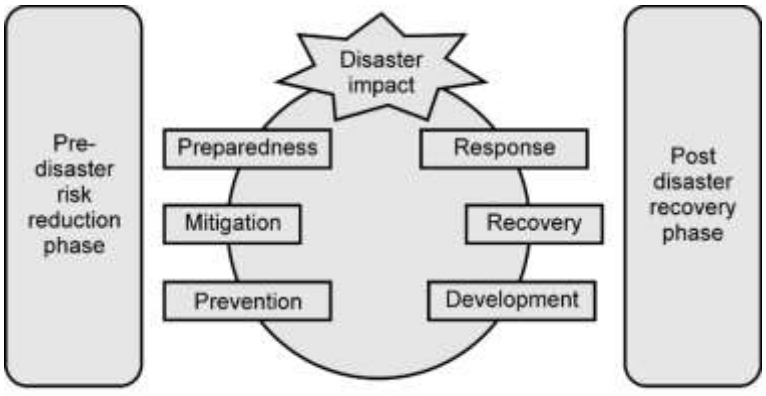
As per Disaster Management Act, 2005, “disaster management” means a continuous and integrated process of planning, organizing, coordinating and implementing measures which are necessary or expedient for

: i. Prevention of danger or threat of any disaster;

ii. Mitigation or reduction of risk of any disaster or its severity or consequences

; iii. Capacity-building;

iv. Preparedness to deal with any disaster; v. Prompt response to any threatening disaster situation or disaster; vi. Assessing the severity or magnitude of effects of any disaster; evacuation, rescue and relief;



Key Phases of Disaster Management

1. Pre - Disaster : Before a disaster to reduce the potential for human, material or environmental losses caused by hazards and to ensure that these losses are minimized when the disaster actually strikes.
2. During Disaster : It is to ensure that the needs and provisions of victims are met to alleviate and minimize suffering

3. Post Disaster : After a disaster to achieve rapid and durable recovery which does not reproduce the original vulnerable conditions.

1. Pre - Disaster Phase
   Prevention and Mitigation-prevention is often used to embrace the wide diversity of measures to protect persons and property
   mitigation should also be aimed at reducing the physical, economic and social vulnerability

   Preparedness
   formulation of viable emergency plans, the development of warning systems, the maintenance of inventories, public awareness and education and the training of personnel
   It may also embrace search and rescue measures as well as evacuation plans
   All preparedness planning needs to be supported by appropriate rules and regulations with clear allocation of responsibilities and budgetary provision.

   Early Warning
   This is the process of monitoring the situation in communities or areas known to be vulnerable to slow onset hazards,

2. During Disaster Phase
   Response -This refers to the first stage response. such as setting up control rooms, putting the contingency plan in action, issue warning, action for evacuation, taking people to safer areas
3. The Post - Disaster Phase
   Recovery-phases of emergency relief, rehabilitation and reconstruction
   Rehabilitation-Rehabilitation includes the provision of temporary public utilities and housing

2) Types of Disasters

*Natural Disasters*Human - Made Disasters

Natural Disasters

A natural disaster is a natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods

Various phenomena like earthquakes, landslides, volcanic eruptions, floods, hurricanes, tornadoes, blizzards, tsunamis, and cyclones are all natural disasters that kill thousands of people and destroy billions of dollars of habitat and property each year

Human - Made Disasters

Human-instigated disasters are the consequence of technological or human hazards. Examples include stampedes, fires, transport accidents, industrial accidents, oil spills, terrorist attacks, nuclear explosions/nuclear radiation

Earthquakes

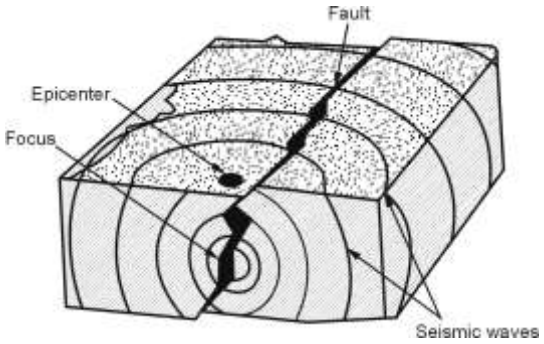
*An earthquake is the shaking of the earth's surface caused by rapid movement of the earth's crust or outer layer

* The earth is primarily composed of three layers : 1. The outer crust, 2. The middle mantle, and 3. The inner core

* The Earth's outer layer or crust is made up of a number of zig-saw pieces like structures that interlock into one another these pieces are called tectonic plates

* Due to this, the rocks are under strain, stress on the rocks exceedscertain limits,

* This sudden rupture of the rocks releases energy in the form of earthquake waves



Grades	Effects
2.5	Generally not felt, but recorded on seismograph
3.5	Felt by many people
4.5	Some local damage may occur
6	A destructive earthquake
7	A major earthquake
8 and above	Massive earthquake

*Thus earthquake is a form of energy, which is transmitted to the surface of theearth in the form of waves called seismic waves

* The exact spot under the earth surface at which an earthquake originates is calledthe focus or hypocenter

Impact of Earthquake on the Environment

In the last 500 years, earthquakes around the world have killed several millionpeople

Massive loss of life and property occurs due to collapse of buildings. Besides,roads, bridges, canals, electric poles, etc

These are places located in the unstable regions of the earth crust, which are subjected to tectonic activities

Dates	Details
Oct, 2005	Jammu & Kashmir, intensity 7.4, about 40000 people died.
26th Jan, 2001	Gujrat, intensity 7.9, about 20000 people died.
29th March, 1999	Chamoli, Uttaranchal, intensity 6.8, about 1000 people died.
22nd May, 1997	Jabalpur and Mandala, M.P. about 50 people died.
30th Sep, 1993	Latur and Osmanabad, Maharashtra, about 10000 people died.
20th Oct, 1991	Uttarkashi, Uttaranchal, intensity 6.6, about 1000 people died.

Prevention and mitigation of earthquake and hazard reduction programs

- Hence, the occurrence of an earthquake cannot be prevented. However, there are certain regions that are earthquakes prone, so the administration must work before hand to minimize the damages due to occurrence of earthquakes in such areas.
- development of critical facilities and proper land useplanning.
- Mapping of faults and weak zones in earthquake prone areas
- Buildings such as schools, hospitals, offices, etc. should be in areas away from active faults

Floods

- Floods occur due to heavy rainfall within a short duration of time in a particular region which causes the rivers and streams to overflow
- In India, states like Assam, Bihar and parts of Gangetic Uttar Pradesh are quite prone to floods during the rainy season
- Flooding, in India, is a major problem and some part or the other is affected by thefury

of floods usually during the months from July to September

- Flood affected areas face acute shortages of food and drinking water

Impact on the Environment

- Though the lives lost in floods may not be as high as in case of earthquakes or cyclones, the damage to the environment is immense
- Floods cause the spread of many epidemic diseases
- Rapid runoff causes soil erosion
- Manmade structures like buildings, bridges, roads, sewer lines, power lines, etc. are damaged

Prevention, Control and Mitigation

- Land Use Planning
- Building of Physical Barriers
- Preventing Human Encroachment

Use of technology for relief

- Advanced communication techniques for flood forecasting and warning
- Fast evacuation of people
- To provide relief in temporary shelters
- Immediate supply of medicines, drinking water, food and clothes
- Epidemic diseases must be controlled through spraying, vaccination, etc.

Drought

*Drought is a condition of abnormally dry weather within a geographic region; Drought refers to the lack or insufficiency of rain for an extended period of time ina specific region.

*During droughts, rainfall is less than normal causing a water imbalance

*Many Indian farmers are still totally dependent on rainfall for irrigation and because of abnormally dry spells there is extensive crop damage

*The main drought prone areas of the country are parts of Rajasthan, Maharashtra, Karna ,Orissa, Tamil Nadu and Chhattisgarh. However, sometimes drought- like conditions also prevail in the Gangetic Plain also

Impact on the Environment

*Water-supply reservoirs become empty, wells dry up and there is acute watershortage.

*Soil degradation and erosion occurs. Soil cracks because of shrinkage duringdesiccatio

*There is extensive crop damage

*People become impoverished and there are diseases due to malnutrition

Prevention, Control and Mitigation

* Though, global warming may have changed the pattern of rainfall in the recent times

* Conservation of water through rainwater harvesting, building check dams,bunds, etc

* Construction of reservoirs to hold emergency water supplies

* Increased use of drought resistant crops

* Proper irrigation techniques, such as drip and trickle irrigation that minimize theuse of water

Cyclones

- Cyclone is an area of low atmospheric pressure surrounded by a wind system blowing in anti-clockwise direction
- In a cyclone, the wind speed must be more than 119 km/hr.
- Cyclones generate in the seas and oceans with a very high speedtowards the land
- It strikes the land with a devastating force

Impact on the Environment

* Cyclones are quite common in the Bay of Bengal and often cause much damage in Bangladesh and coastal areas of West Bengal, Orissa, Andhra Pradesh and Tamil Nadu

*Bangladesh has been devastated by cyclones a number of times. In November 1970, a severe cyclone caused a 6 m rise in sea-level

* Another cyclone in 1971 killed more than one lakh people

* The cyclone that hit Orissa in 1999, is the worst recorded natural disaster in India

* The coastal low lying areas are most affected.

*The affected areas are inundated both with rainfall and the surge of seawater

Prevention, Control and Mitigation

some scientists have speculated that rise in global warming may cause an increased occurrences of cyclones

- The devastating effects of cyclones can only be controlled and mitigated through some effective policies such as use of advanced technology
- Satellites can easily forecast the origin of cyclones in advance
- Installation of early warning systems in the coastal areas
- Increasing public awareness regarding cyclones
- Development of underground shelter belts in the cyclone prone area

Landslides

*Landslides refer to a rapid down-slope movement of rocks or soil mass under the force of gravity

*Landslides may occur when water from rain and melting snow, seeps through the earth on a

sloppy surface

The important factors responsible for landslide

* Stability of slopes

* The type of earth and rock material

* The type of vegetation

Avalanche

*It is a type of landslide involving a large mass of snow, ice and rock debris thatslides and fall rapidly down a mountainside

*It is a type of landslide involving a large mass of snow, ice and rock debris thatslides and fall rapidly down a mountainside

Impact on the Environment

*Malpa landslide in 1999 in the Kumaon hills, took the lives of many pilgrims who were going to Mansarovar in Tibet

*Uprooted trees and degraded soil

*Buried building and settlements

*Damage to crops and plantation

*Injuries and death to humans and animals

*Prevention, Control and Mitigation

*human activities like deforestation, mining, etc. can also induce landslides.

*Landslides can be controlled by providing slope support and minimizing human encroachment

*Plantation of trees should be undertaken on the unstable hilly slopes

Man-Made Disaster

When the disasters are due to carelessness of human or mishandling of dangerousequipment's they are called man-made disasters

Common examples of these disasters are train accidents, aero plane crashes, collapse of buildings, bridges, mines, tunnels, etc

Bhopal Gas Tragedy (BGT)

*The most serious industrial disaster occurred on December 3, 1984 at Bhopal, India, which is known as the Bhopal Gas Tragedy (BGT)

*The Bhopal gas tragedy occurred due to leakage of methyl isocyanide (MIC) gas from the factory

MIC gas is used as an ingredientin pesticides.

*5000 people were killed, half of them due to direct exposure and other half due to after affects

*More than 50,000 people were affected with respiratory, eye, gastric, neurological and gynecological problems

Chernobyl Nuclear Disaster

*This nuclear disaster occurred at the Chernobyl Nuclear Power Plant, which was one of the largest power plants in the Ukrainian on April 26, 1986

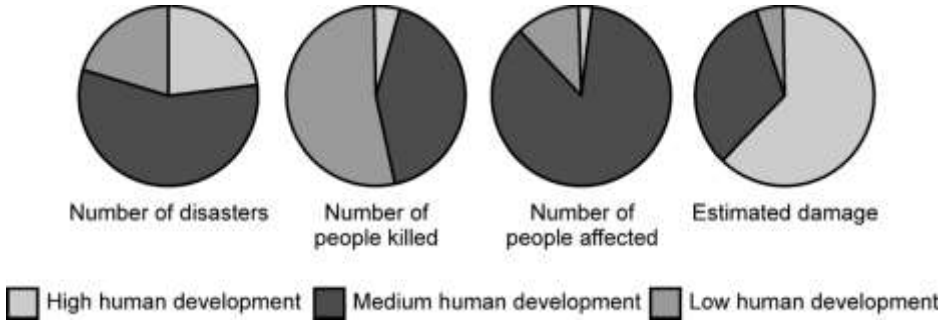
*It is the worst nuclear disaster recorded in a nuclear power plant

*Around 200,000 people had to be evacuated and resettled

*The after affects lasted for many years and a rise in the incidence of thyroid andblood cancer has been observed in a wide group of people

* Other effects on the human health included skin diseases, hair loss, nausea,anemia, respiratory and reproductive disease

Global Trends in Disasters



Urban Disaster

*Disasters cause serious disruption of the functioning of a community or a society

*When disasters affect cities or urban areas, they are referred to as urban disasters

*Urban areas have often expanded into hazard-prone locations, with increasing populations

* Global climate change is shifting hazard levels and increasing disaster risk impacts

Pandemic

* A pandemic is an epidemic of disease that has spread across a large region

* number of pandemics of diseases such as smallpox and tuberculosis.

* The most fatal pandemic recorded in human history was the Black Death (also known as The Plague), which killed an estimated 75-200 million people in the 14^{th}century.

* Other notable pandemics include the 1918 influenza pandemic (Spanish flu) and the 2009

influenza pandemic (H1N1)

Climate Change

* From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding

*deforestation, and large scale agriculture, quantities of greenhouse gases in the atmosphere have risen to record levels not seen in three million year

* The concentration of GHGs in the earth's atmosphere is directly linked to the average global temperature on Earth

* carbondioxide (CO_2), is largely the product of burning fossil fuels.

Dos and Don'ts during Various Types of Disasters

floods

*Avoid building in flood prone areas unless you elevate and reinforce your home

* Elevate the furnace, water heater, and electric panel if susceptible to flooding

Earthquake

* Repair deep plaster cracks in ceilings and foundations

* Place large or heavy objects on lower shelves.

* Repair defective electrical wiring and leaky gas connections

*Identify safe places indoors and outdoors

1) Under strong dining table, bed
2) In the open, away from buildings, trees, telephone and electrical lines, flyoversand bridges

Landslides

*Avoid building houses near steep slopes, close to mountain edges, near drainageways or along natural erosion valleys

* Avoid going to places affected by debris flow

* Avoid river valleys and low-lying areas

* Go to designated public shelter if you have been told to evacuate

Droughts

* Repair dripping taps by replacing washers

* Plant drought-tolerant grasses, shrubs and trees

* Install irrigation devices which are most water efficient for each use, such as microand drip irrigation

* Avoid letting the water run while brushing, washing or bathing.

UNIT II Approaches to DisasterRisk Reduction

Disaster Risk Reduction Strategies in India

*India is leading a global intervention on bringing down disaster losses which is pushing more than 26 million people into abject poverty every year hit by natural calamities.

* India is the only country which has drawn a comprehensive national plan on its roadmap to fully achieve the Sendai framework by 2030 and a short term goal by 2020.

Sendai Framework for Disaster Risk Reduction

* The Sendai Framework for Disaster Risk Reduction 2015- 2030 (hereafter "Sendai Framework") adopted at the Third UN World Conference in Sendai, Japan, on March 18, 2015 (UNISDR 2015a)

* Two other major international agreements followed it in the same year: the Sustainable Development Goals 2015 - 2030 in September, and the UNCOP21 Climate Change agreement

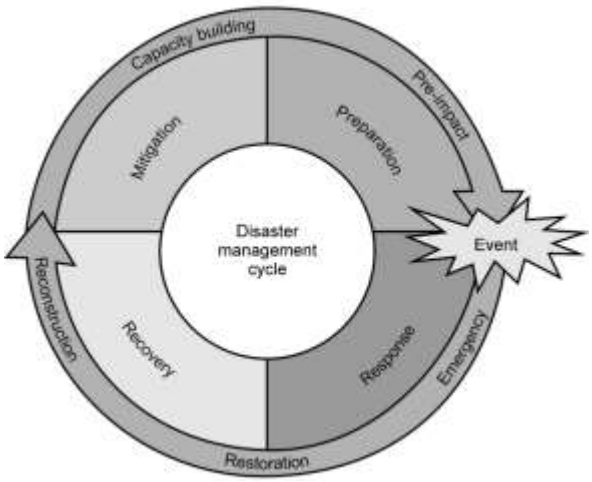
* The Paris Agreement on global climate change points to the importance of averting, minimizing, and addressing loss and damage associated with the adverse effects of climate change

* These three agreements recognize the desired outcomes in DRR

Information Management in Disaster Risk Reduction

* In recent years, researchers and experts have been developing methods to conduct the assessment of hazards

DISASTER MANAGEMENT CYCLE



Disaster Response

* Disaster response work includes any actions taken in the midst of or immediately following an emergency

* establish disaster preparedness plans into motion

* The focus in the response phase is on meeting the basic needs of the victims until sustainable community has been achieved

* Response actions carried out immediately before, during, and after a hazard impact are aimed at saving lives, reducing economic losses

* Increasing security operations

Culture of Safety

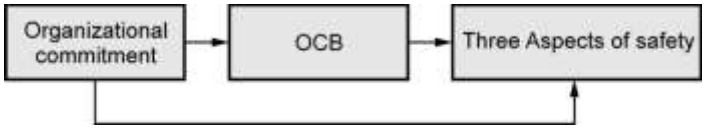
Three Aspects of Safety Culture

The model consists of : psychological aspects, behavioural aspects and situational aspects of the safety culture

***** The behavioural aspect is concerned with "what people do" within the organization which includes the safety-related activities\

* Situational aspects describe, "what the organization has for its policies, operating procedures, management systems, control systems

* The psychological aspects can be described as how employees see and feel their organization in the aspect of safety



Prevention, Mitigation and Preparedness Community Based DRR

* Disaster risk reduction focuses more on reducing underlying risk, encouraging preventive action before a disaster

* focuses on disasterissues, from prevention and mitigation to relief, response, and recovery

*Community-Based Disaster Risk Management (CBDRM) is an approach that reduces vulnerabilities

* Minimize human suffering

* fasten recovery

Structural measures

*Any physical construction to reduce or avoid possible impacts of hazards

Non-structural measures

* Any measure not involving physical construction that uses knowledge, practice oragreement to reduce risks and impacts

* Common structural measures for disaster risk reduction include dams, flood levies, ocean wave barriers

***** Common non-structural measures include building codes, land use planning lawsand their enforcement, research and assessment

Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs)

* As Local Government in Disaster Management In India, after the 73rd Constitution Amendment Act, the Panchayati Raj Institutions (PRIs) have become an opportunity for decision making processes

* PRIs provide a platform to discuss local developmental problems and community needs,

* Gram Panchayats' are known as community based organization

* West Bengal has the longest experience of functioning of three tiers Panchayati Raj Institutions and the structure has been working for flood disaster management.

* gram panchayats had good communication with local officers, doctors, and NGOs for disaster management

* PRIs and community had successfully taken efforts to supply drinking water during drought

* The collaboration and coordination among the Gram Panchayat, Tata Chemical Company and villagers for supplying drinking water effectively met the basic needs during drought

* The main focus of the workshop was on post-disaster reconstruction and rehabilitation

* Gram Sansad Sabha, the members of community share their needsand problems with PRIs

State Disaster Management Authority(SDMA)

***** At the State level, the SDMA, headed by the Chief Minister, will lay down policiesand plans for DM in the State

*It reviews the developmental plans of the different Departments of the State to ensure the integration of prevention, preparedness and mitigation measures

The Environment Protection Act, 1986

***** After the Bhopal Gas Leak Tragedy, the Indian Parliament enacted the Environment (Protection) Act (EPA), 1986 for the purpose of safeguarding and protecting the environment

* It prohibits persons carrying on any industry, operation or process from discharging or emitting any environmental pollutants

* In the year 1994, a notification was issued by the Central Government under Section 3 of EPA making it mandatory on the part of all new industrial units

The 'Manufacture, Storage and Impact of Hazardous Chemical Rules', 1989

***** In the Year 1989, the Central Government framed the "Manufacture, Storage and Import of Hazardous Chemical Rules", 1987 under the EPA.

***** objective is preventing of major accidents arising from industrial activity

The Coastal Regulation Zone (CRZ) Notification, 1991

***** In the year 1991, with a view to protect the fragile ecosystem of the coastal areas in India from unregulated developmental activities

* Government of India issued Coastal Regulation Zone (CRZ) Notification under the EPA to control the developmental activities within 500 meters of High Tide Line (HTL)

Early Warning System

***** It describe the provision of information on an emerging dangerous circumstances

***** Early warning systems exist for natural geophysical and biological hazards, complex socio-political emergencies, industrial hazards, personal health risks

Elements of Early Warning

*** Risk Knowledge :** Risk assessment provides essential information to set priorities for mitigation and prevention strategies and designing early warning systems

* **Monitoring and Predicting :** Systems with monitoring and predicting capabilities provide timely estimates of the potential risk faced by communities, economies and the environment

* **Disseminating Information :** Communication systems are needed for delivering warning messages to the potentially affected locations to alert local and regional governmental agencies.

***Response :** Coordination, good governance and appropriate action plans are a key point in effective early warning

Need of Early Warning System

***** The purpose of early warning systems is to detect, forecast, and when necessary, issue alerts related to impending hazard events

* To ensure public safety, and the protection of human lives

* To ensure long term development and economic growth. Conversely, by reducing the impact of disasters, a government avoids the financial and political- burden of massive

Fire

***** The Government of India in 1956, formed a "Standing Fire Advisory Committee" under the Ministry of Home Affairs

***** India for speedy development and upgradation of Fire Services all over the country

***** This committee had representation from each State Fire Services, as well as the representation from Ministry of Home, Defence, Transport, Communication and Bureau of Indian Standards.

Epidemics

*****The Ministry of Health and Family Welfare is instrumental and responsible for implementation of various programmes on a national scale in the areas of prevention and control of major communicable diseases

* This ministry also assists states in preventing and controlling the spread of seasonal disease outbreaks

* It is actively involved in disease diagnosis during epidemics and outbreaks, operational research, manpower development,

Forecasting and Warning of Cyclones

***** India Meteorological Department is the nodal agency in the country to monitor and predict the cyclonic disturbances and issue the warning and advisory

***** IMD, New Delhi also acts as a Regional Specialized MeteorologicalCentre (RSMC) for providing tropical cyclone advisories to the World Preparedness and Response Meteorological Organization (WMO)

UNIT 3 Inter-relationships betweenDisasters and Development

Effects of disaster on Current Development

Loss of crops

*Standing crops could be seriously damaged

*when the tsunami struck the Indian coasts it destroyed large tracts ofcoconut plantations in Southern parts of Kerala and Tamil Nadu

Loss of livestock

* Loss of livestock due to natural disasters or through outbreak of animal disease

* large number of poultry was lost due to avian flu spread in India in 2013 and 2014

* This led to large scale losses to livestock farmers

Degradation of land

* Land affected by a cyclonic storm or tsunami could be subjected to salinisation.

* This could affect food security of the communities.

* Farm lands in West Bengal that were affected by saline water when the cyclone Ayila .Tamil Nadu when the tsunami struck its coastal areas

* Droughts could also result in degradation of soil, making the fields severelyaffected and making it unsuitable to grow crops

Infrastructure loss

Loss of roads and bridges- Such losses would curb transportation and also delay on going construction and other programs

Loss of buildings and facilities- Losses to buildings, machinery, etc. can hamper developmental activities

Damage to harbours- Such damages will hit the maritime transport

Loss to airport and aircrafts- These losses will also create trouble in air transport

Vulnerability

Inability or incapacity of a community recovers from its impacts.

Vulnerability conditions can be divided into three major groups

Physical / Material Conditions

* It includes high mortality rates, malnutrition,disease

* Financial resource and asset base which includes poverty conditions, marginal income

* Weak infrastructure, such as buildings, sanitation, electricity supply, roads and transportation

* Occupation in a risky area

Constitutional/organizational conditions

*Lack of leadership, initiative, or organizational structure

* Lack of or limited access to political power and representation

* Inadequate skills and educational background

Motivational Conditions

* Lack of awareness of development issues, rights

* Certain beliefs and customs attitudes

* Heavy dependence on external support

Factors Contributing to Vulnerability

Poverty-the widening gap between rich and poor, rural and urban incomes

* Landowners with marginal, degraded land, frequent flooding can decrease the returns from cultivating the land, thus reducing food security

* The rural poor who depend on incomes from farming or other agricultural activities with no reserves to help them get back

Livelihoods

* Communities living in rural flood plains are mainly farming and fishing floods threaten their stability of the their livelihoods owing to the loss of farm products

* The landless poor, working as hired labors, particularly during long flood seasons, have trouble finding jobs to meet their basic needs

Equity

* Unequal distribution of resources and access to human rights can lead to conflicts

2)Impact of Development Projects such as Dams, Embankments, Changesin Land-use

* As a result of dam construction Corrosions may occur

* Archaeological and historical places in company with geological and topographical places

* egg gravel beds can be destructed while the excavation and coating works in the stream beds

* Temperature of water, salt and oxygen distribution may change vertically as a consequence of reservoir formation

* The fishes can be damaged while passing through the floodgates, turbines and pumps of the high bodied dams

* There will be serious changes in the water quality as a result of drainage water returning from irrigation that was done based on the irrigation projects.

* Discharge of toxic matters (pesticides, toxic metals etc.) and their condensation in food chain may affect sensitive animals

* Some increase in earthquakes may occur because of filling of big dam reservoirs

* Microclimatic and even some regional climate changes may be observed related to the changes in air moisture percentage, air temperature,

* Dams may cause increases in water sourced illnesses like typhus, typhoid fever, malaria and cholera

* Dams affect the social, cultural and economical structure Especially forcing people, whose settlement areas and lands remain under water to migrate

Climate Change Adaptation

* The Earth's climate is changing. Some of this change is due to natural variations that have been taking place

* human activities that release heat-trapping gases into the atmosphere are warming the planet by contributing to the "greenhouse effect.

* The Intergovernmental Panel on Climate Change concludes global average surface air warming over the current century ranges from 1.8 °C to 4.0 °C.

* Even after introducing significant measures to reduce greenhouse gas (GHG)emissions climate change is unavoidable and will have significant economic, social and environmental impacts

* There are two main policy responses to climate change : mitigation and adaptation

* Mitigation addresses the root causes, by reducing greenhouse gas emissions, while adaptation seeks to lower the risks posed by the consequences of climatic changes

* Humans have been adapting to their environments throughout history by developing practices, cultures and livelihoods suited to local

* The IPCC describes vulnerability to climate change as reduced rainfall reduced rainfall, economy dominated by rain-fed agriculture and the capacityto adapt to those hazards

* Adaptation measures can help reduce vulnerability

IPCC and it’s Scenarios in the Context of India

* The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP)

* Through the IPCC, thousands of experts from around the world synthesize the most recent developments in climate science, adaptation, vulnerability, and mitigation

* The Intergovernmental Panel on Climate Change (IPCC) is an intergovernmental body of the United Nations

* The IPCC produces reports that contribute to United Nations Framework Convention on Climate Change (UNFCCC)

* The objective of the UNFCCC is to "stabilize greenhouse gas concentrations in the atmosphere

* Within IPCC the National Greenhouse Gas Inventory Program develops methodologies to estimate emissions of greenhouse gases

Effects of Climate Change on Weather

* The largest chunk of the IPCC synthesis report focuses on the changes in weather patterns and projections related to extreme weather events These changes are expected to have a cascading effect on the health of the economy

* The number of monsoon break days has increased while the number of monsoondepressions has declined

* Mean and extreme precipitation during the Indian summer monsoon is expectedto increase

* The Himalayan region will see maximum increase in precipitation

Extreme Weather Events : Cyclones, Floods and Droughts

* The Frequency of cyclones is likely to decrease in 2030s, with increase in cyclonic intensity

*People living in districts along the eastern coast of India are expected to be especially vulnerable to the impact of extreme weather events because of poor infrastructure

* Floods and droughts are likely to increase in India since there will be a decline in seasonal rainfall

* the Mahanadi river basin in India will see an increased possibility of floods in September while an increased possibility of water scarcity in April

* Delhi is one of the world's five most populated cities that are located in areas withhigh risk of floods

Agriculture, Forests and Trade

* Climate change will especially affect the livelihoods of people. Agriculture, the mainstay of the Indian economy

*countrywide agricultural loss in 2030 is over $7 billion. It will severely affect the income of 10 per cent of the population

* A third of forest areas in India are projected to change by 2100, with deciduous forests changing into evergreen ones due to increased precipitation

Health

* Pollution-induced changes in air and water quality, as well as changing weather patterns, are expected to have wide-reaching effects on the health

* In addition to flood deaths, contamination of urban flood waters will increase the risk of water-borne diseases

* High temperatures are associated with mortality rates in India and heat waveswill especially affect outdoor workers

Reducing Material Vulnerability

Vulnerability Conditions	**Cause**	**Strategy**
• Initial well-being.	• Malnutrition, lack of clean water and sanitation, exposure to waterborne diseases, lack of medical facilities and knowledge of how to protect oneself, no food stock saving.	• Raising awareness of flood- related health issues such as the importance of clean water and sanitation and how to achieve it, distribution of water purifiers, pills and food, setting up of emergency health units in floodprone areas.

• Weak infrastructure.	• Unsafe, filmsy houses, lackof flood-proofing knowledge. • Non-compliance with building codes or lack ofbuilding codes. • Lack of sanitation. • Lack of lifelines (electricity,water, roads). • Lack of means of transportation.	• Granting government subsidized building of saferhouses for the poor, creatingawareness of affordable flood-proofing practices. • Enforcing building codes. • Improving of infrastructures. • Promoting transportation Facilities.
• Occupation in a risky area (insecure / risk-prone source of livelihoods).	• Lack of skills, poverty. • Lack of access and controlover means of production. • Lack of market access.	• Providing skill improvementtraining, market access andother means of fighting poverty.
• Degration of the environment.	• Illegal logging and fishing,improper garbage disposal.	• Regulating logging and fishing practices and installing waste treatment systems through incentives and trade-offs, water quality monitoring, raising public awareness of environmental conservation and management (why and how).

Vulnerability Conditions	**Caus e**	**Strateg y**
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• Weak infrastructure.	• Unsafe, filmsy houses, lackof flood-proofing knowledge. • Non-compliance with building codes or lack ofbuilding codes. • Lack of sanitation. • Lack of lifelines (electricity,water, roads). • Lack of means of transportation.	• Granting government subsidized building of saferhouses for the poor, creatingawareness of affordable flood-proofing practices. • Enforcing building codes. • Improving of infrastructures. • Promoting transportation Facilities.
• Occupation in a risky area (insecure / risk-prone source of livelihoods).	• Lack of skills, poverty. • Lack of access and controlover means of production. • Lack of market access.	• Providing skill improvementtraining, market access andother means of fighting poverty.
• Degration of the environment.	• Illegal logging and fishing,improper garbage disposal.	• Regulating logging and fishing practices and installing waste treatment systems through incentives and trade-offs, water quality monitoring, raising public awareness of environmental conservation and management (why and how).

UNIT - IV Disaster Risk Management in India

Hazard and Vulnerability Profile of India

***** Coastal States, particularly in the East Coast and Gujarat on west coast, arevulnerable to cyclones

*4 crore hectare land mass is vulnerable to floods and river erosion

*68 per cent of net sown area is vulnerable to drought.

*55 per cent of total area is in Seismic Zones III-V and vulnerable to earthquakes ofmoderate to high density.

*Sub-Himalayan/ Western Ghat are vulnerable to landslides

Hydrological and Climate Related Hazards

Floods

UNIT - IV Disaster Risk Management in India

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Hydrological and Climate Related Hazards

Floods

- Floods can be caused by heavy rainfall, inadequate capacity of rivers to carry the high flood discharge
- Over 40 million hectare of landmass in India is prone to floods
- Nearly 75 % of the total annual rainfall is concentrated over a short south-west monsoon season
- As a result there is a very heavy discharge from the rivers during this period causing Flood
- Flood problem is chronic in at least 10 states.
- From October to December each year, a very large area of South India, including Tamil Nadu, the coastal regions of Andhra Pradesh and the union territory of Puducherry, receives up to 30 percent of its annual rainfall from the northeast monsoon
- Devesatiing floods in Chennai in 2015. Most devastating floods in recent times have been the 2013 Assam floods, 2013 Uttarakhand Floods, 2012 Brahamputra Floods

Cyclones

- India has a very long coastline which is exposed to tropical cyclones arising in the Bay of Bengal and Arabian Sea
- Indian Ocean is one of the six major cyclone-prone regions in the world
- In India cyclones occur usually in April-May, and also between October and December
- The Eastern coastline is more prone to cyclones as about 80 percent of total cyclones generated
- The worst hitting cyclones have been the Andhra Pradesh cyclone of November 1977 and the super cyclone of Odisha in the year 1999
- The impact of the cyclones is mainly confined to the coastal districts, the maximum destruction being within 100 km

Heat waves, Cold waves and fog

- Heat waves refer to maximumtemperature in summers
- Cold waves occur mainly due to the extreme low temperature coupled with incursion of dry cold winds from north-west
- Most affected areas of country due to the cold waves include the western and north-western regions and also Bihar, UP

Droughts

- Drought refers to the situation of less moisture in the soil
- scarcity of water for drinking, irrigation, industrial uses and other purposes
- Some states of India feature the perennial drought such as Rajasthan, Odisha, Gujarat, Madhya Pradesh
- Sixteen percent of the country's total area is drought-prone
- Most of the drought-prone areas identified by the Government of India lie in arid, semi-arid and sub-humid areas of the country

Geological Disasters

Earthquakes

- Earthquake is almost impossible to be predicted, so it is the most destructive of

all natural disasters.

- It is almost impossible to make arrangements and preparations against damages and collapses of buildings and other man-made structures hit by an earthquake
- The most vulnerable regions are located in the Himalayan, Sub-Himalayan belt and Andaman& Nicobar Islands

Tsunami

- Tsunami refers to the displacement of a large volume of a body of water such as Ocean
- Tsunamis are seismically generated by deformation of sea, vertical displacement ofwater

Landslides

- Landslides are common in India in Himalayan region as well as Western Ghats
- The landslides in this region are probably more frequent than any other areas inthe world
- The Western Ghats, particularly Nilgiri hills also are notorious for frequent landslides

Industrial, Chemical and Nuclear Disasters

- The industrial and chemical disasters can occur due to accident, negligence or incompetence
- They may result in huge loss to lives and property
- The Hazardous industries and the workers in these industries are particularly vulnerable to chemical and industrial disasters
- The most significant chemical accidents in recorded history was the 1984 Bhopal Gas disaster, in which more than 3,000 people were killed after a highly toxic vapour, (methyl isocyanate),

2) **Components of Disaster Relief**

- Disaster relief means first aid provided for disaster victims
- It aims to meet the immediate needs of the victims of a disastrous event

- it includes humanitarian services and transportation, food, clothing, medicine, beds and bedding, temporary shelter and housing, medical materiel, medical

Water

- Global access to safe water, adequate sanitation, and proper hygiene educationcan reduce illness and death from disease
- Community water systemsand water safety plans are important ways to ensure the health of the community
- According to the World Health Organization, the objectives of a water safety plan are to ensure safe drinking water through good water supply practices
- Preventing contamination of source waters
- Treating the water to reduce or remove contamination
- Preventing re-contamination during storage, distribution, and handling of drinking water

Food

- A disaster can easily disturb the food supply at any time

Keep foods that

- Have a long storage life
- Require little or no cooking, water, or refrigeration
- Meet the needs of babies or other family members who are on special diets
- Meet pets' needs
- Avoid salty or spicy, as these foods increase the need for drinking water,which may be in short supply.
- Check the expiration dates on canned foods and dry mixes
- Use and replace food before its expiration date.
- Store foods away from ranges or refrigerator exhausts. Heat causes many foods to spoil more quickly
- Store food away from petroleum products, such as gasoline, oil, paints, and solvents. Some food products absorb their smell

Sanitation and Hygiene

- Sanitation and hygiene are critical to health, survival, and development\

- Throughout the world, an estimated 2.4 billion people lack basic sanitation
- Basic sanitation is described as having access to facilities for the safe disposal of human waste

Absence of basic sanitation facilities can

- Result in an unhealthy environment contaminated by human waste
- waste from infected individuals can contaminate a community's land and water, increasing the risk of infection for other individuals

Handwashing

- Keeping hands clean during an emergency helps prevent the spread of germs.
- Wet your hands with clean, running water
- Rub your hands together to make a lather and scrub them well
- Continue rubbing your hands for at least 20 seconds
- Dry your hands using a clean towel
- If soap and water are not available, use an alcohol-based hand sanitizer that contains at least 60 % alcohol
- Hand sanitizers are not effective when hands are visibly dirty.

When to wash hands

- Before, during, and after preparing food
- Before eating food
- After using the toilet
- Before and after caring for someone who is sick
- After blowing your nose, coughing, or sneezing
- After touching garbage

Health

- Hospitals and health centers may suffer structural damage
- Emergency health kits that contain essential medical supplies and drugs are often provided
- Each kit covers the needs of about 10,000 persons for three months
- The twelve essential drugs in the basic kit include anti-inflammatories, an antacid, a disinfectant, oral dehydration salts, an antimalarial, a basic antibiotic

3**) Institutional Arrangements during disaster**

National level

State level

District level

(Role of Central and State Governments)

- Central and State Governments are jointly responsible for undertaking mitigation,preparedness, response, relief measures
- Central Government supplements the efforts of State Government by providing financial and logistic support
- Involvement of local bodies, NGOs, Self help Involvement of local bodies, Self help groups etc in relief and response

Mitigation, Response and Preparedness

Mitigation: Activities aimed at trying to mitigate the impact of a disaster

if prevention is not possible, such as building schools to be more earthquake resistant.

Response: aimed at understanding needs and responding to provision of food and non-food items, provision of water, sanitation and hygiene services

Preparedness: Activities aimed at trying to prepare communities for a disaster

Includes appropriate land-use planning, flood mitigation works

a continuous cycle of planning, organizing, training, equipping, exercising, evaluating, and taking corrective action

Disaster Management Act and Policy

India : National policy on Disaster Management 2009

This policy aims at :

- Promoting a culture of prevention, preparedness and resilience through knowledge, innovation and education
- Ensuring efficient mechanism for identification, assessment and monitoring of

disaster risks

- Developing forecasting and early warning systems
- Undertaking reconstruction as an opportunity to build disaster resilientstructures
- Ensuring efficient response and relief with a caring approach
- Promoting a productive and proactive partnership with the media for disaster management
- This policy of 2009 replaces the policy of 2005.

The Environment Protection Act, 1986

- After the Bhopal Gas Leak Tragedy, the Indian Parliament enacted the Environment (Protection) Act (EPA), 1986 for the purpose of safeguarding and protecting the environment from industrial or other activities
- It prohibits discharging or emitting any environmental pollutants in excess
- It measures for protecting and improving the quality of the environment and preventing controlling and abating environmental pollution

Environment Impact Assessment Statement

- In the year 1994, a notification was issued by the Central Government under Section 3 of EPA making it mandatory on the part of all new industrial units
- Environment Impact Assessment (EIA) Statement for the purpose of obtaining clearance from the Central Government for setting up industrial projects.

The 'Manufacture, Storage and Impact of Hazardous Chemical Rules', 1989

- In the Year 1989, the Central Government framed the „Manufacture, Storage and Import of Hazardous Chemical Rules", 1987 under the EPA
- The principal objective of the rules is the prevention of major accidents arising from industrial activity

The Coastal Regulation Zone (CRZ) Notification, 1991

- In the year 1991, with a view to protect the fragile ecosystem of the coastal areas inIndia from unregulated developmental activities, the Government of India issued Coastal Regulation Zone (CRZ) Notification under the EPA to control the developmental activities within 500 meters of High Tide Line (HTL)

The Public Liability Insurance Act, 1991

- The parliament also enacted the "Public Liability Insurance Act, 1991" to provide for public liability insurance for the purpose of providing immediate relief to the persons affected by accidents occurring while handling hazardous substances

The National Environment Appellate Authority Act, 1997

- This Act has been enacted to provide for the establishment of a National Environment Appellate Authority with respect to restriction of areas in which any industries, operations or process or class of industries, shall not be carried out

4) **Role of GIS and Information Technology Components in Preparedness,Risk Assessment, Response and Recovery Phases of Disaster**

- Disasters strike at a specific location and influence a particular area.
- Location intelligence plays a critical role in disaster management.
- Through advanced wireless technologies and web-based GIS applications, disaster management by governments and other agencies in enhancing the coordination of response efforts as well as planning for disaster risk reduction.
- understanding of the geography of the impacted area in order to model the hazard intensity and severity and to understand the impact on buildings, infrastructure and population
- Use of GIS and remote sensing, helps conduct all these tasks in a planned an efficient manner.
  - Earlier, when the concept of GIS did not exist, response decisions during disasters were taken mostly on the basis of prior experience rather than any live information.
  - But today, live data on many parameters such as topography, geographic features, population, infrastructure, demographics can be crucial to the response and recovery activities.
- Further, the visualization of this data helps in analyzing a situation and taking quick decisions
- GIS has been successfully utilized to address all phases of disaster management-preparedness, mitigation, response, and recovery.

It helps in many factors

- Awareness and Preparedness

- Risk Assessment
- Planning and Mitigation
- Response and Recovery

Awareness and Preparedness

- GIS and remote sensing techniques can be used to build database of critical facilities such as hospitals, ambulances, fire stations, police stations, schools
- Disaster maps can be prepared to show the risk zones as well as disaster impact zones.
- hazard maps can be created for various natural and manmade hazards such as floods, earthquakes, cyclones, forest fires etc., that help in understanding the risk of a location and planning

Risk Assessment

- To overcome some of the problems thatthe state facrisk due to natural disaster such as earthquakes, hurricanes and flood, is location dependent
- a location which is surrounded by seismic faults and has a weak surface geology has a higher hazard potential than a location for away from faults
- hurricane, hazard at a location near the coast and with a flat, bareterrain is far higher than at a location which is inland
- The worst affected are the rural people who are not adequately warned about the impending disasters.
- Andhra Pradesh State Remote Sensing Applications Centre (APSRC) has developed a remote sensing application

Planning and Mitigation

- GIS is enabling systems capable of reducing risk from natural disasters and helping governments in mitigation and planning

Response and Recovery

- GIS and remote sensing techniques coupled with technologies like satellite imagery, aerial photography using aircraft or drones can help in emergency situations
- Soon after a disaster strikes, use of remote sensing technologies can be used to map the affected locations and compare the data

UNIT - V Disaster Management: Applicationsand Case Studies and Field Works

1) Landslide Hazard Zonation : Case Studies

- Landslide hazard is commonly shown on maps, which display the spatial distribution of hazard classes
- factors causing this are Increased urbanization and development in landslide prone areas
- Continued deforestation of landslide prone areas
- At least 90 % of landslide losses can be avoidable if the problem is recognized before the development or deforestation begins.
- The LHZ maps identify unstable hazard-prone areas
- Discouraging new development in hazard prone areas

Mapping Scale for Landslide Hazard Analysis

- National Scale (<1:1000,000)
- Regional and Synoptic Scale (1:100,000 - 1:1000,000)
- Medium Scale (1:25,000 - 1:50,000)
- Large Scale (1:5,000 - 1:15,000)
- Site investigation Scale (>1:2,000)
- The regional mapping scale is mean for planners in the early phases of regional development projects
- Medium scale hazard maps can be used for the determination of hazard zones in areas affected by large engineering structures, roads and urbanization

Case Study : Landslide Hazard Zonation in Darjeeling Himalayas

- Landslides pose serious threat to human settlements, transportation, natural resources management and tourism in the Himalayan Region in India
- Darjeeling Himalayas in West Bengal affected by landslide every year during the monsoon period (between June and September), loss of human lives ,damage to properties
- Darjeeling region witnessed devastating landslides in July 2003 resulting in the death of tens of people
- Geological Survey of India (GSI) has initiated Landslide Hazard Zonation (LHZ)

mapping of the entire Darjeeling

- The Darjeeling area in West Bengal is bound by Nepal Himalayas in the west, Sikkim Himalayas in the north
- The hill ranges of Darjeeling area are highly rugged , erosional
- A massive landslide wiped out the village of Malin located at 110 km from Pune city, in the Western Ghats on July 30 2014
- mud and debris that came down from a nearby hillock, swallowed up almost the entire tribal village of around 50 families.
- Final death toll was 153 when the rescue operation was stopped and around 100 people were missing

Earthquake Case Studies

- An earthquake is the sudden motion or shaking of the ground due to the rapid release of energy.
- Most earthquakes occur along the boundaries of the tectonic plates, areas close to a plate boundary will experience more earthquakes
- Countries around the Pacific Ocean are often rocked by earthquakes because they are located near the boundary of the Pacific plate.
- Intensity is based on the effects a person experiences during an earthquake, andon the damage caused by the earthquake
- Uttarkashi Township is the district in Uttarakhand is most vulnerable to earthquake
- The natural calamity in the form of floods and landslides
- The town is seismically vulnerable too with the calamity of 1991 earthquake in the region.
- The 2001 Gujarat earthquake, also known as the Bhuj earthquake, occurred on 26 January,
- The death was 12,300. Bhuj, which was situated only 20 km away from the epicentre,
- An underwater earthquake is the most common cause of a tsunami.
- A tsunami is a series of huge waves caused by the shifting of large amounts of ocean water. Tsunamis are also caused by volcanic eruptions and underwater landslides.
- The 2004 Indian Ocean tsunami, also called Asian Tsunami was the most

devasting Tsunami in the history. The wave was the result of an earthquake with the epicentre close to Sumatra.

- The 2004 tsunami killed almost 2,00,000 people, destroyed property and 1000s of miles of coastline, leaving millions of people homeless

Drought Case Studies

- Drought is fundamentally the resultant of reduced rainfall
- National Remote Sensing Agency of India has assessed the drought based on the analysis of vegetation index map and the greenness map

Drought, 2002

- 61 1 1 villages were declared drought - hit in Gujarat in 2002 affecting almost 12 lakh farmer farnilies
- In 2002,13 districts of Gujarat State received less than normal rainfall
- It resulted in reduction in the agriculture production and also slowed down the small and medium industries
- This affected crop production, employment opportunities, hydropower projects
- Eighteen meteorological and 16 hydrological droughts occurred in India between 1870 and 2018
- Andhra Pradesh ranks third in terms of drought prone state after Rajasthan and Karnataka in India
- The Indian Meteorological Department (IMD) officially acknowledged that the year 2002 has been “the first ever all India drought year” since 1987
- Delhi in its climate change adaptation action plan in year 2009–2012 with a Water Mission jacketing water conservation, recycling, and distribution of water

Coastal Flooding

- A flood is an overflow of a large amount of water beyond its normal limits

Gorakhpur Floods, 2000

- Gorakhpur lies in Uttar-Pradesh, the excessive rainfall during the rnonsoon

season (June to September) leads to heavy flood

- Sudden rise in the water level of these rivers as a result of which the whole district of Gorakhpur wasaffected
- It turned out to be a prolonged flood and so became all the more devastating They also damaged the crops of about four hundred villages

Mumbai Floods, 2005

- The southwest monsoon sets over Mumbai where it receives about 90 percent of its annual rainfall
- It received 100cm rain within 24 hours on 26 July 2005
- Lives lost in Mumbai- 435, Loss to industry in Mumbai- 4000 crore
- Suburban trains damaged- 55
- Auto rickshaws damaged- 37000
- Taxis damaged- 4500

2018 Kerala floods

- On 16 August 2018, severe floods affected the south Indian state Kerala, due to unusually high rainfall during the monsoon season
- It was the worst flood in Kerala in nearly a century.[
- Over 483 people died, and 15 are missing
- It is the worst flood in Kerala after the great flood of 99 that took place in 1924.
- All five overflow gates of the Idukki Dam were opened at the same time, and for the first time in 26 years 5 gates of the Malampuzha dam of Palakkad were opened

Fluvial Floods (River Floods)

- A fluvial, or river flood, occurs when the water level in a river, lake or stream risesand overflows onto the surrounding banks,
- In hilly or mountainous areas, floods can occur within minutes after a heavy rain

Pluvial Floods (Flash Floods and Surface Water)

- Surface water floods occur when an urban drainage system is overwhelmed and water flows out into streets and nearby structures
- They can also occur via sudden release of water from a dam

Coastal Flood (Storm Surge)

- Coastal flooding occurs in coast by seawater
- Causes of coastal flooding are intense windstorm events occurring at the same time as high tide

Forest Fire: Case Studies

- During summer, when there is no rain for months the forests is covered with sheded dry senescent leaves and twinges, which could burst into flames ignited by
- Forest fire causes imbalances in nature and endangers biodiversity
- Many forest fires start from natural causes such as lightning which set trees on fire
- Fire is caused when a source of fire like naked flame, cigarette or bidi, electric spark or any source of ignition
- The 2016 Uttarakhand forest fires were a series of widespread, damaging wildfires that took place in Uttarakhand India between April and May.
- The fires were caused by a heatwave that spread across Uttarakhand and were the worst recorded in the region with a reported 4,538 hectares (11,210 acres) of forest burnt down and seven people dead.

A Case Study of Forest Fire in Tamilnadu

- A massive forest fire has happened at Kurangani forest on the Western Ghats in Theni district of Tamil Nadu.
- The Kurangani fire turned into a disaster as 36 trekkers were stuck on the mountains
- Forest fires may be caused by different factors like natural causes, including lightning, but 99% of the fires in the forests are man-made.
- State government need to appoint temporary fire watchers for this purpose

2)Man Made Disasters: Case Studies

Bhopal Gas Tragedy

- The Bhopal disaster is referred as the Bhopal gas tragedy, it was a gas leak incidentin India, considered one of the world's worst industrial disasters
- It occurred on the night of 2-3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, India
- A leak of methyl isocyanate gas and other chemicals from the plant resulted in the exposure of hundreds of thousands of people
- A government official declaration in 2006 stated the leak caused 558,125 injuries
- 170,000 people were treated at hospitals 2,000 buffalo, goats, and other animals were collected and buried
- The early effects were coughing, vomiting, severe eye irritation
- Local governments clearly cannot allow industrial facilities to be placed within urban areas, regardless of the evolution of land use over time.
- We need to introduce a system of laws which will make them liable for higher standards of safety
- Safety management: In 1984 safety management systems were not widely established, although there were recommendations and procedures
- . There were twomajor accidents in 1984 (Bhopal and the explosions of PEMEX in Mexico), which created the need for an organized and systematic approach.
- In Bhopal the main cause of the disaster was unnecessary storage of large quantities of MIC, which ultimately was what caused the mass poisoning.
- 1976: Local trade unions complained of pollution within the plant.
  • 1980: A worker was reported to have accidentally been splashed with phosgene while carrying out a regular maintenance job of the plant's pipes.
  • 1982 (January): A phosgene leak exposed 24 workers, all of whom were admitted to a hospital. Investigation revealed that none of the workers had been ordered to wear protective masks.
  • 1982 (February): An MIC leak affected 18 workers.
  • 1982 (August): A chemical engineer came into contact with liquid MIC, resulting in burns over 30 percent of his body.
  • 1982 (October): In attempting to stop the leak, the MIC supervisor suffered severe chemical burns and two other workers were severely exposed to the gases.

• 1983-1984: There were leaks of MIC, chlorine, monomethylamine, phosgene, and carbon tetrachloride, sometimes in combination

Chernobyl Disaster

- The Chernobyl disaster was caused by a nuclear accident that occurred on Saturday 26 April 1986 in the Chernobyl Nuclear Power Plant in the north of the Ukrainian
- It is considered the worst nuclear disaster in history
- The accident started during a safety test on nuclear reactor
- About 49,000 people were evacuated from the area, primarily from Pripyat
- The exclusion zone was later increased to 30 kilometres (19 mi) radius when a further 68,000 people were evacuated from the wider area
- The reactor explosion killed two of the reactor operating staff
- Of these 134 people, 28 died in the days to months afterward and approximately 14 suspected radiation-induced cancer deaths followed within the next 10 years
- Among the wider population, an excess of 15 childhood thyroid cancer deaths were documented as of 2011.

3) **Space Based Inputs for Disaster Mitigation and Management and FieldWorks Related to Disaster Management**

- ISRO provides the satellite based near real time information support to Central Ministries / Departments and State Ministries / Departments, prior during and after majornatural disasters.
- ISRO is actively involved with various other countries with regard to disaster management, through international frameworks, such as , UNESCAP
- Cyclones- ISRO uses geo-stationary and low earth orbit satellites for providing experimental inputs on cyclogenesis, cyclone track, cyclone intensity
- ISRO provided information to Odisha, Andhra Pradesh States during TITLI, PHETHAI,

Floods- Using hydrological modelling of satellite early warning systems are established for selected river reaches like Andhra Pradesh (Godavari), Odisha (Mahanadi)and Assam (Brahmaputra).

- Landslides- ISRO prepared Landslide Hazard Zonation maps for Himachal Pradesh, Uttarakhand and Meghalaya

- Forest fires- ISRO prepares Forest Fire Regime maps using historical forest fires observed from satellite data.
- ISRO regularly prepares Forest Fire alert maps using satellite data and provides to FSI and other State Forest Department

Role of Media in Disaster Management

- The media is a direct link between the public and emergency organizations and plays a very important role
- It alerts the public before, during and after disasters.
- The media assists in the management of disasters by educating the public about disasters; warning of hazards; gathering and transmitting information about affected areas
- alerting government officials, relief organizations and the public to specific needs , discussions about disaster preparedness and response for continuous improvement.
- People need warnings ahead of the disaster,where In November 1970, for example, a tropical cyclone, combined with a high tide, struck southeastern Bangladesh, leaving more than 300,000 people dead and1.3 million homeless
- When a devastating cyclone struck the same area of Bangladesh in May 1994, fewer than 1,000 people died. 1977 cyclone in Andra Pradesh, India killed 10,000 people, while a similar storm in the same area 13 years later killed only 910
- The dramatic difference -was due to the fact that a new early-warning system connected with radio stations to alert people in low-lying areas
- On the other side, there are many examples where absence of an alert and warning system resulted into huge number of casualties and extensive damage of property
- Media is usually defined as impersonal means of communication by which written, visual or auditory or sometimes a combination of such messages are transmitted directly to the audiences
- It can reach millions of people in short time; even instantaneously.
- It is cost effective and generally user-friendly.
- Television, radio, newspaper, magazines, audio and video as well as movies

are examples of media

- Broadcast media - They comprise radio and television
- Display media- illuminated signs which can be displayed at busy public places like bus stands; railway stations, parks, etc.