Revision

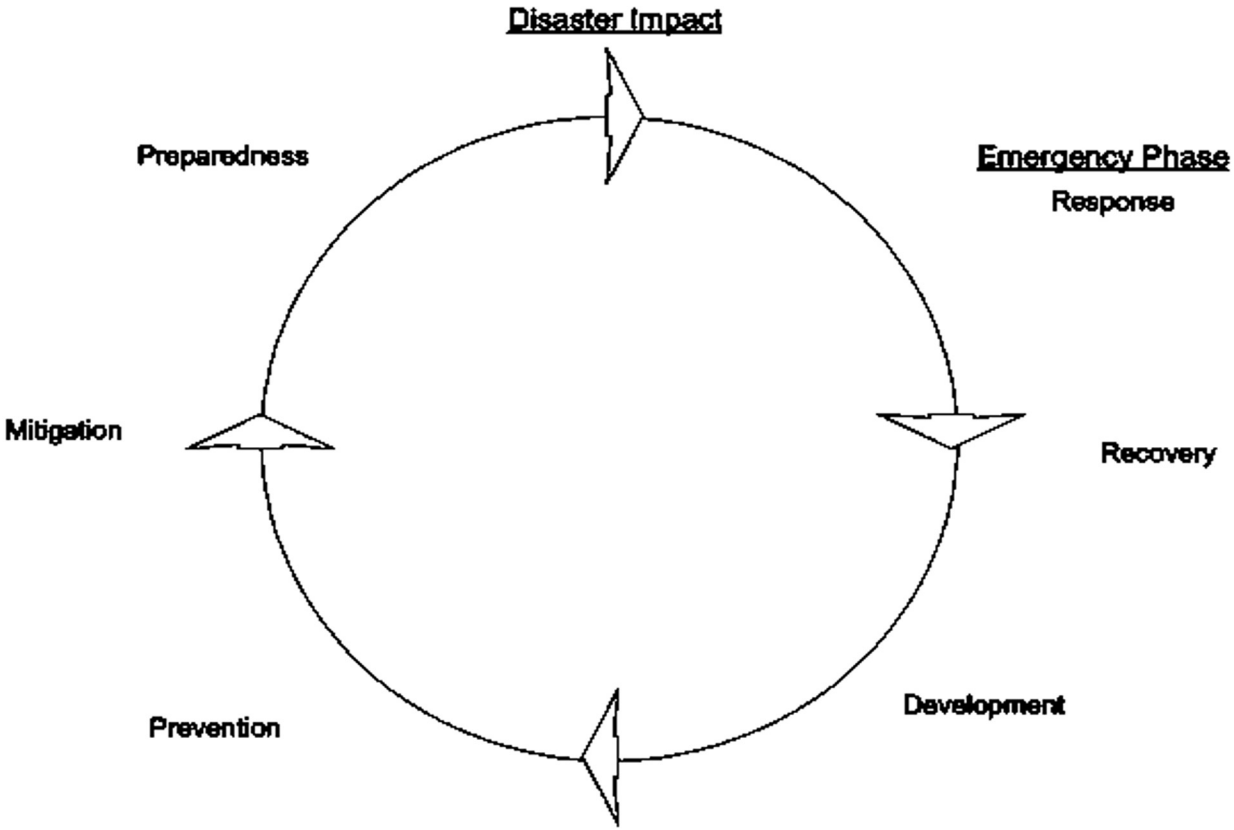
Equation in Brief

$$\text{Disaster} = \frac{\text{Hazard} \times \text{Vulnerability}}{\text{Capacity}}$$

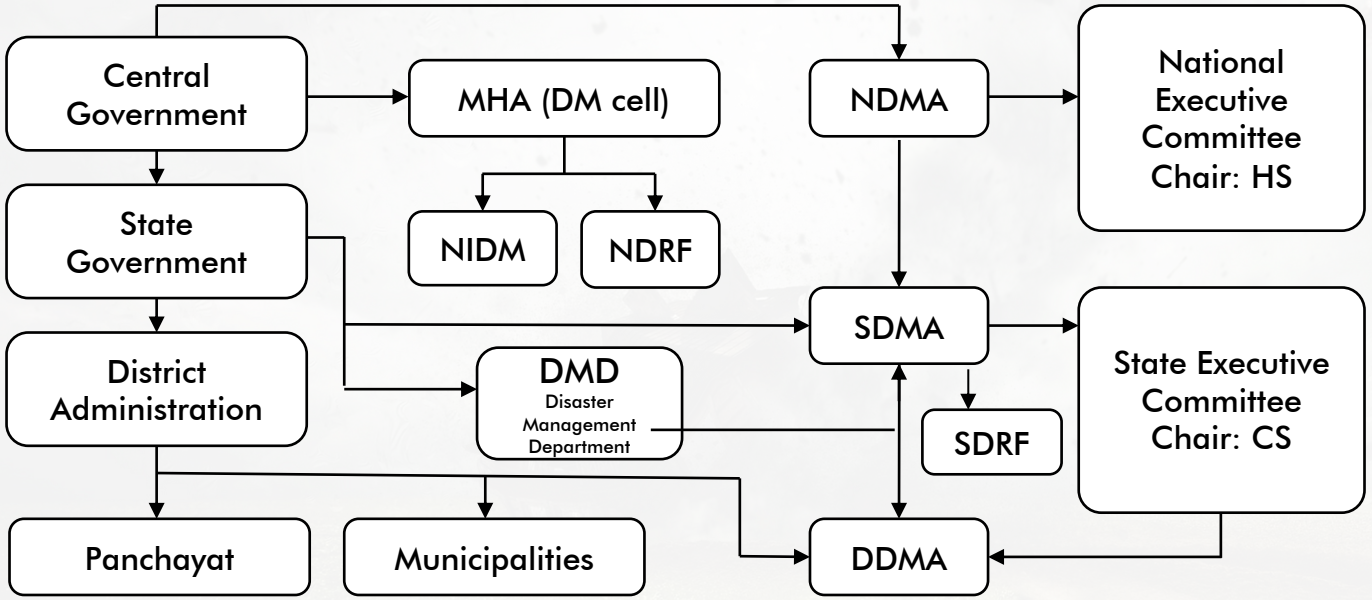
Hazard Vs Disaster

Hazard	Disaster
A hazard is a dangerous physical condition or event that pose threat to life.	Disaster is a consequence of a hazard which causes damages to human life.
Natural hazard are inevitable.	Disasters are preventable.

Holistic Approach in Disaster Management



National Disaster Management Act 2005



LEGAL INSTITUTIONAL FRAMEWORK OF DM act 2005

Sendai Framework for Action (2015-2030)

4 Priority Areas of Sendai Framework:

1. Understanding Risk.
2. Strengthening Risk Governance.
3. Investing in disaster risk reduction for resilience.
4. Improving capacities for disaster response as well as for building back better after disasters.

Flow of this Disaster Management Module

- Basics of DM
- keywords used in DM
- DM policies in India and International Conventions
- Types of Disaster and Ways to Manage them

Types of Disaster and Ways to Manage them

Disaster Management

Geological Disasters

India's Vulnerability Profile

- Highly vulnerable to floods, droughts, cyclones, earthquakes, landslides, avalanches and forest fires.
- Almost 85% of the country is vulnerable to single or multiple disasters.
- 58 % of the landmass is prone to earthquakes of moderate to very high intensity.
- Over 40 million hectares (12%) of its land is prone to floods and river erosion
- Close to 5,700 kms, out of the 7,516 kms long coastline is prone to cyclones and tsunamis.
- 68% of its cultivable area is vulnerable to droughts.

India's Vulnerability Profile : Spatial Approach

- Himalayan Region: Earthquakes and Landslides
- Plain : Floods
- Coastal Zone : Cyclones and Storms
- Western Part & Some Parts of Maharashtra : Drought
- Western Ghats: Landslides and Floods

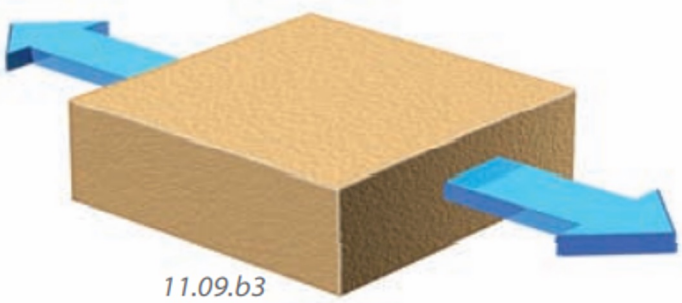
Geological Disasters

Format

- Definition / Basics
- Causes of the Disaster
- Regions Prone to the Disaster
- Impacts of the Disaster
- Management of the Disaster
- Challenges in Managing the Disaster

Earthquakes

Tension



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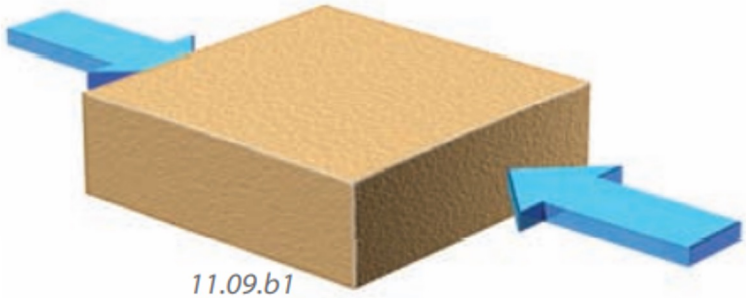
Compression



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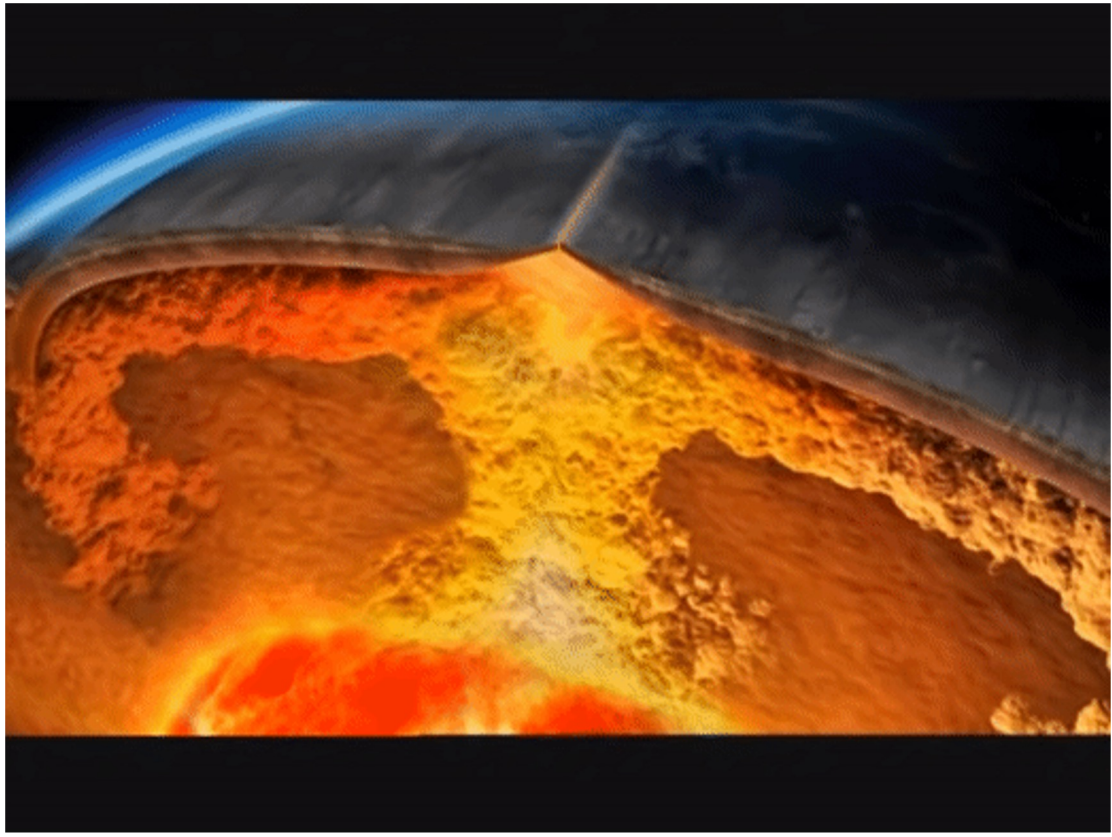
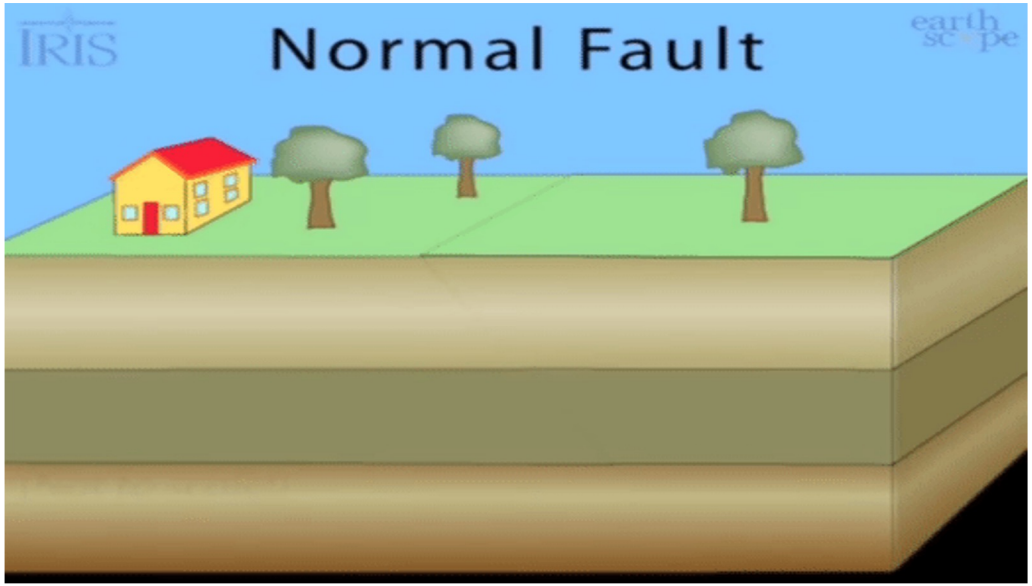
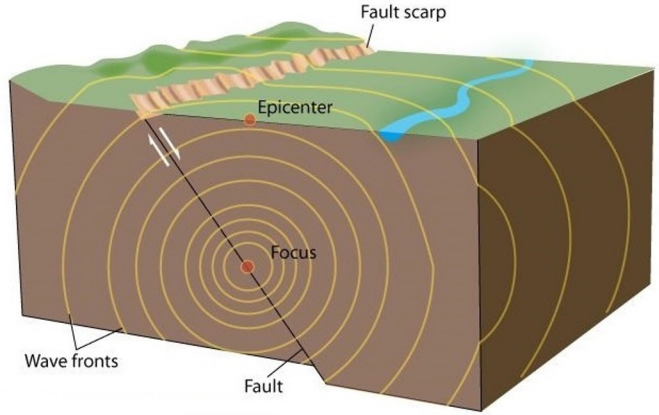


Earthquakes

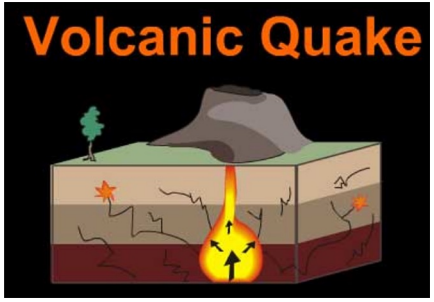
- An earthquake is shaking of the earth's Lithosphere due to sudden release of energy in the Earth's lithosphere that creates seismic waves.

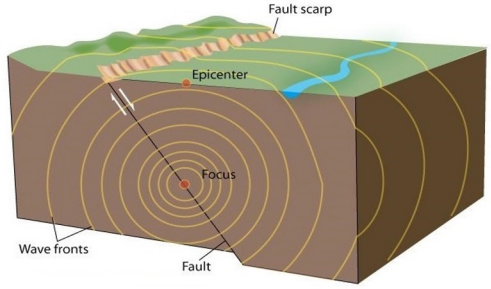




Earthquakes

- Causes of Earthquakes
  - Natural causes:
    i. Tectonic Movement
    ii. Volcanic
    iii. Meteorite





Earthquakes

- Causes of Earthquakes
  - Anthropogenic
    - Dam Induced
    - Nuclear
    - Mining
    - Fracking

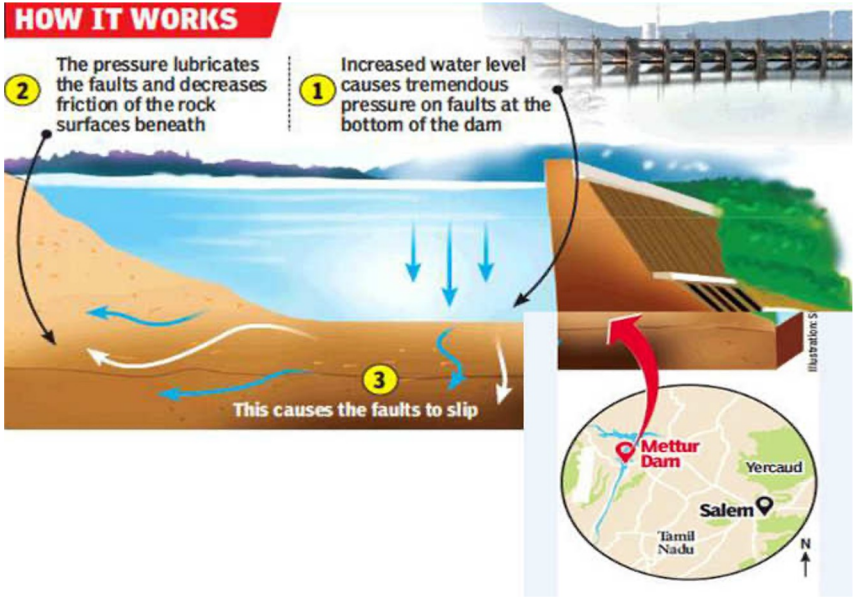
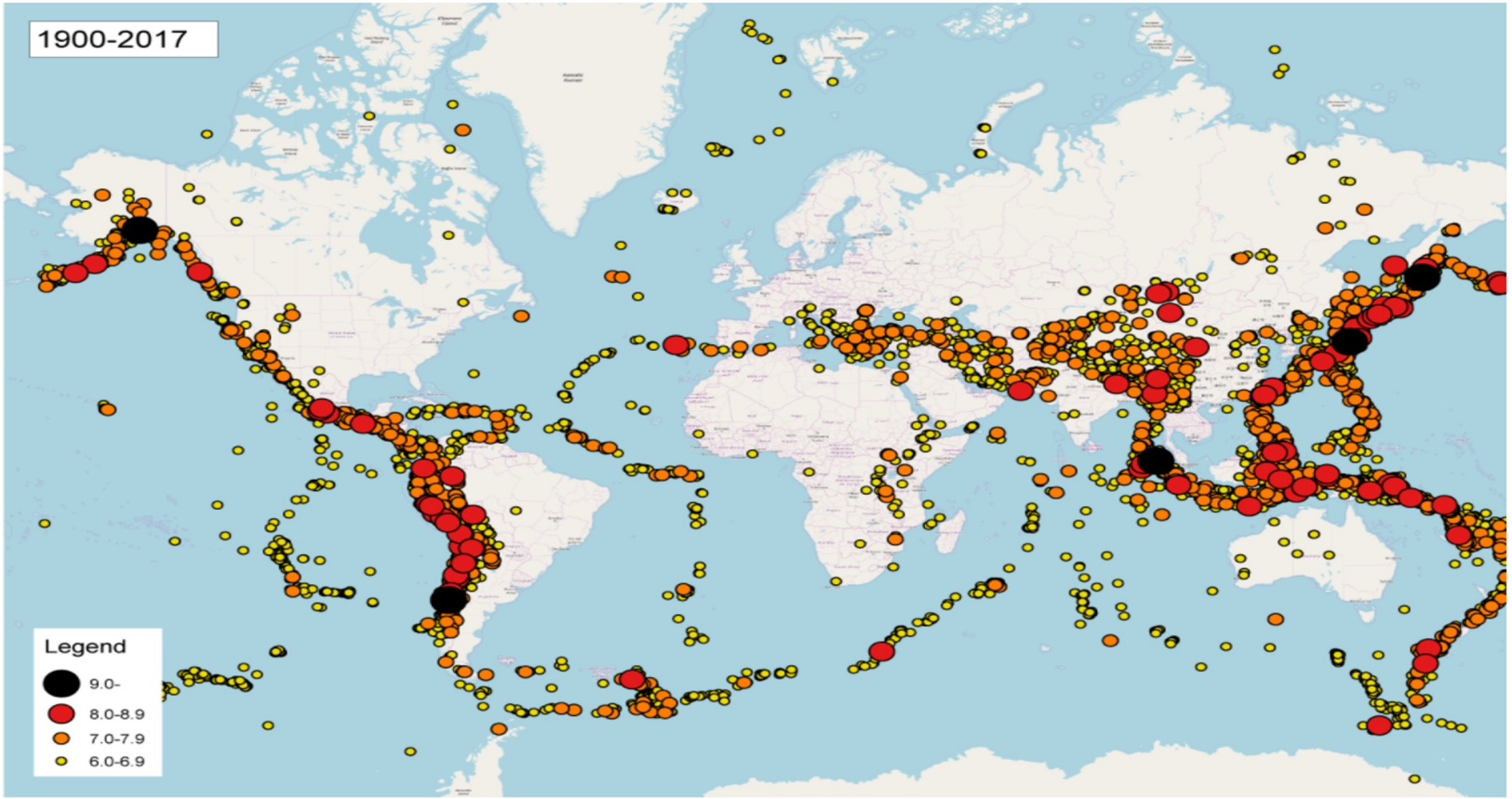
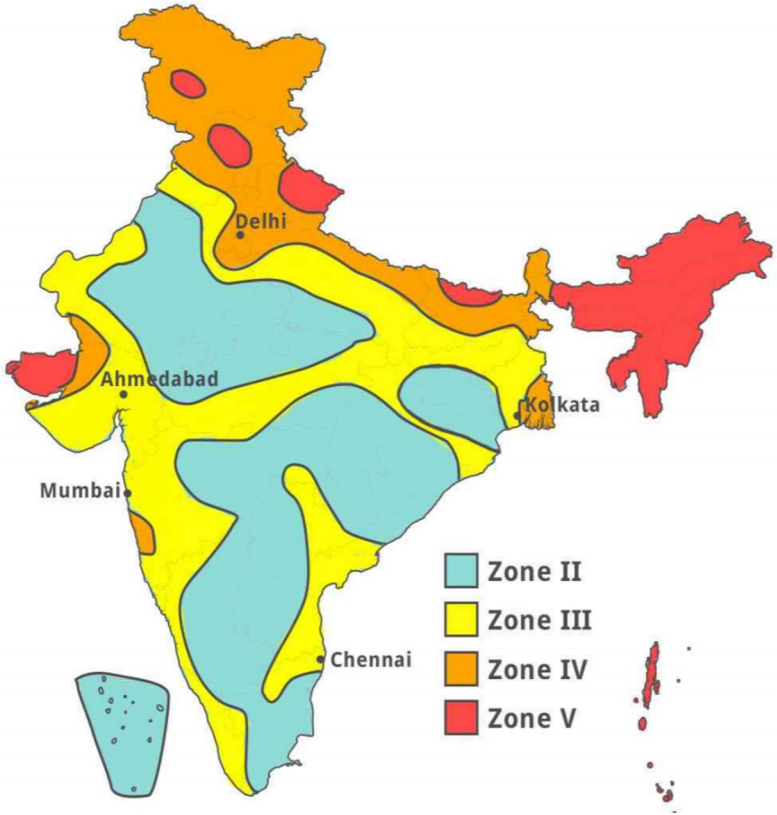


Image Source : Times of India

Distribution of Earthquakes



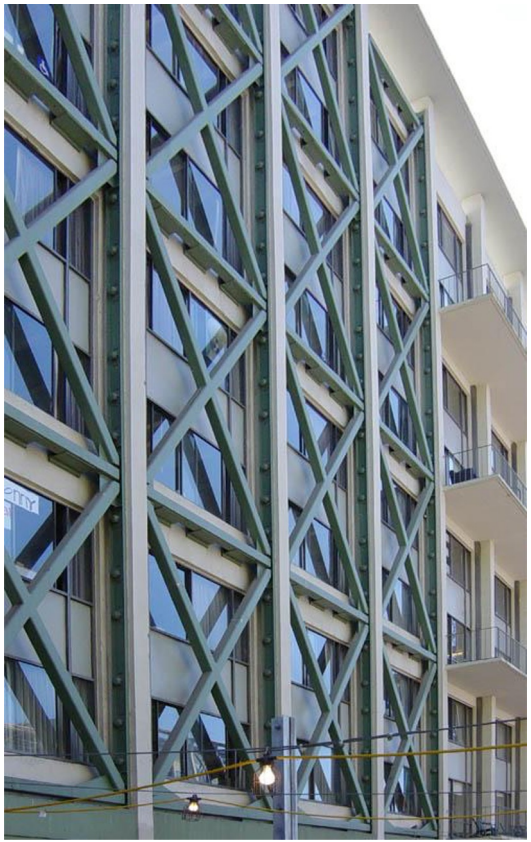
Distribution of Earthquakes



Impacts of Earthquake

- Loss of lives
- Damage to Infrastructure
- Landslides
- Flash Floods
- Tsunamis

Management of Earthquakes



Structural Measures:

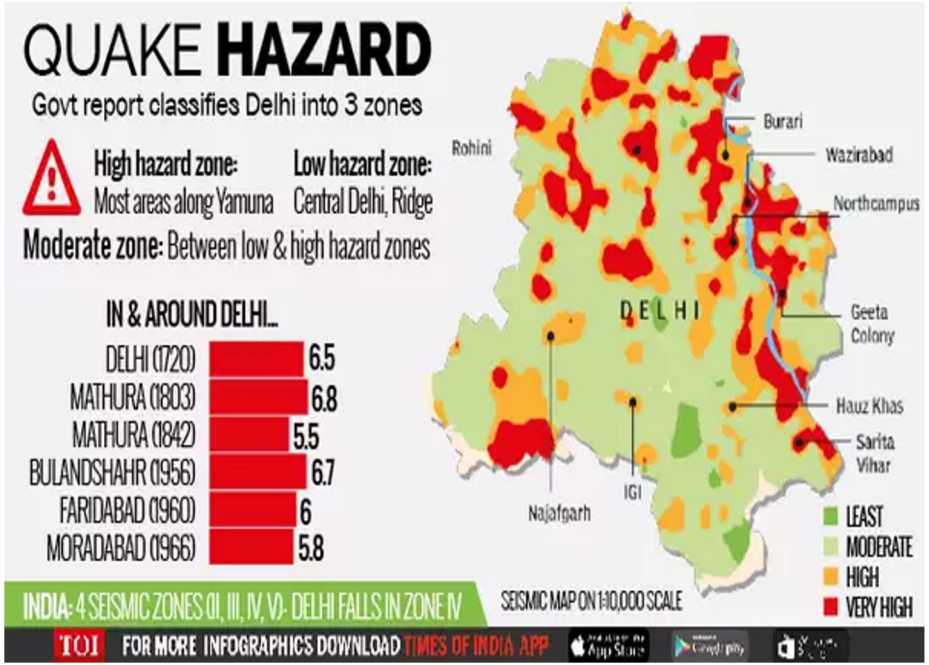
- Earthquake-Resistant design and construction of new structures.

Management of Earthquakes

Structural Measures:

- Seismic strengthening and retrofitting of lifeline and priority structures.

Management of Earthquakes



Non-Structural Measures:

- Hazard & Vulnerability mapping.
- Capacity Development (including Education, Training, R&D).

Management of Earthquakes

Non-Structural Measures:

- Land Use regulation
- National Building Code.
- Effective emergency response.
- Creation of public awareness on seismic safety and risk reduction.

NDMA GUIDELINES

- Earthquake Resistant Construction of New Structures.
- Selective Seismic Strengthening & Retrofitting of existing priority Structures and Lifeline Structured.
- Regulation and Enforcement
- Awareness & Preparedness
- Capacity Development (Education, Training, R & D, Capacity Building and Documentation).
- Emergency Response

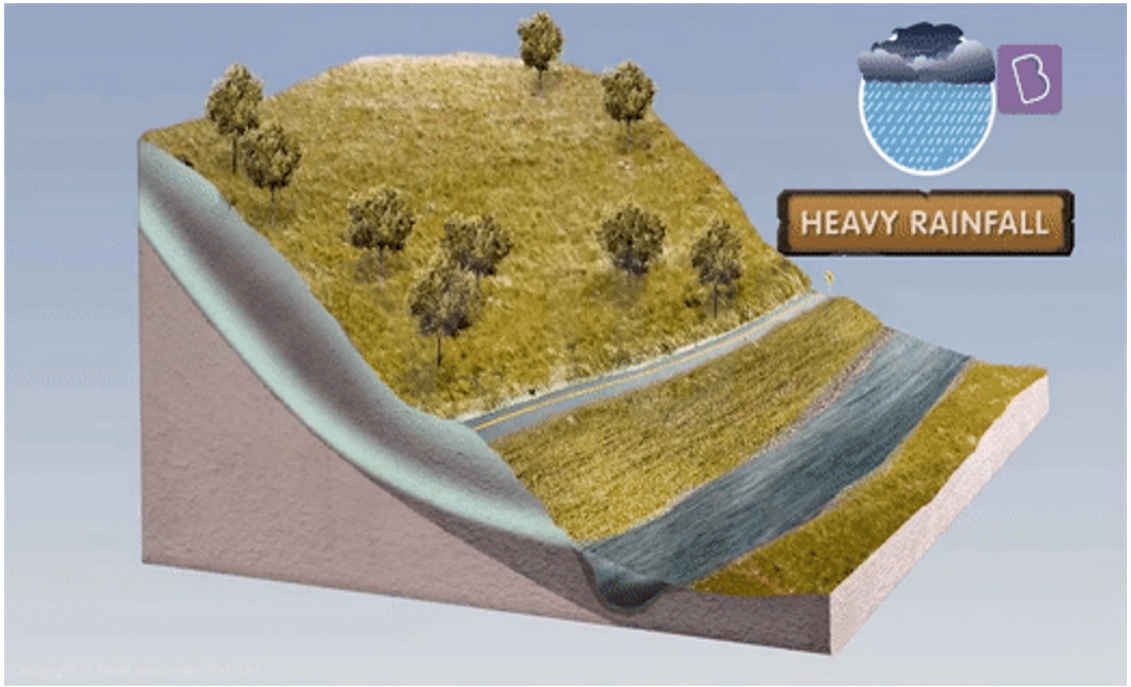
Mains Question

Q. A range of factors increase the risks connected with earthquakes. Can you make a list of these factors? Discuss earthquake mitigation strategies as well.

Landslides

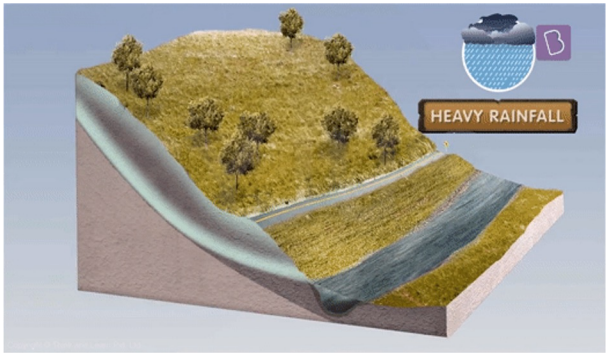
Landslides

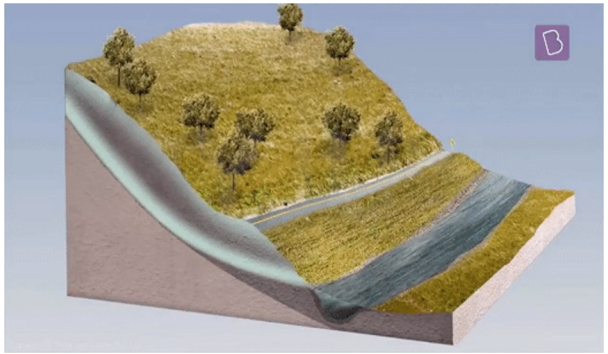
- A landslide is the movement of a mass of rock, debris, or earth down a slope under the influence of gravity.



Causes of Landslide

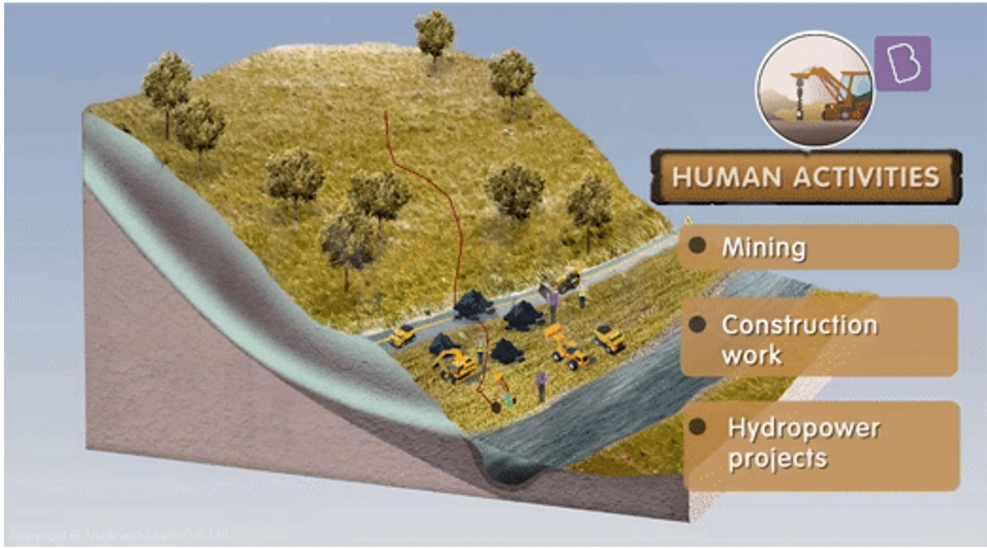
- Natural:
  - Excessive Rainfall
  - Snowfall
  - Volcanic Eruptions
  - Earthquakes





Causes of Landslide

- Manmade :
  - Mining and Quarrying
  - Construction of Roads by Cutting Steep Slopes
  - Unplanned Construction in Slopes
  - Deforestation

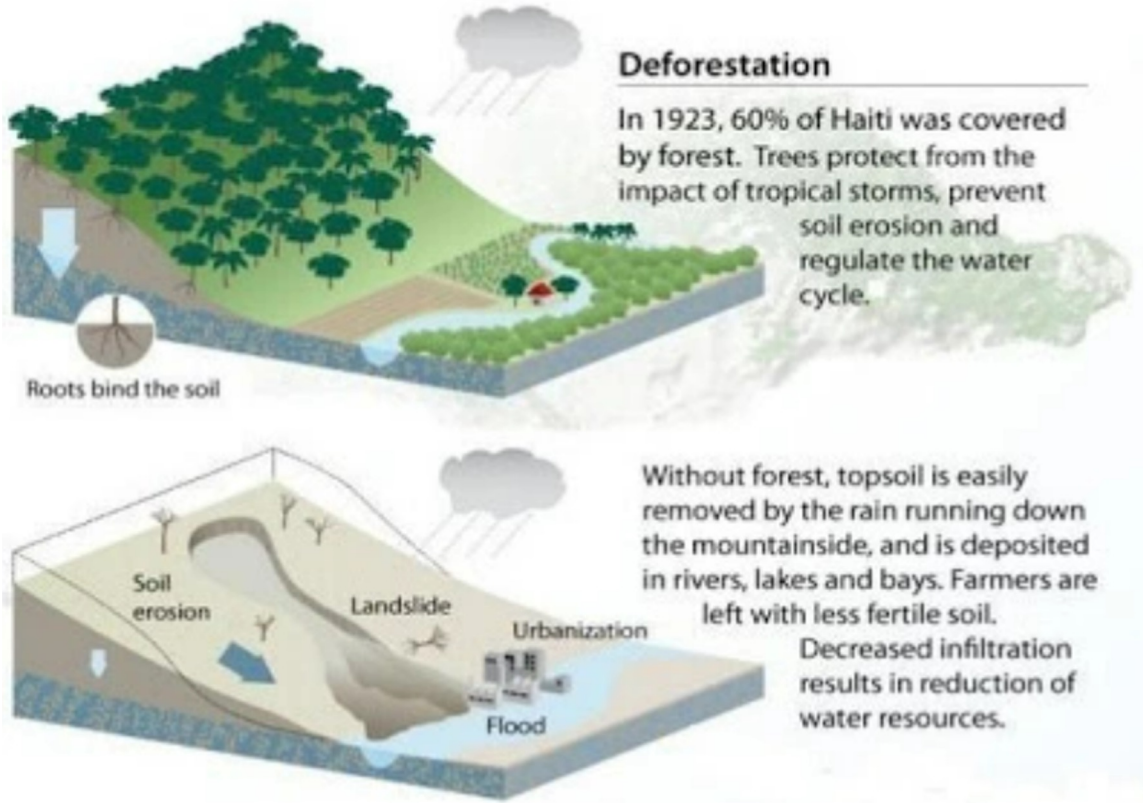


Causes of Landslide

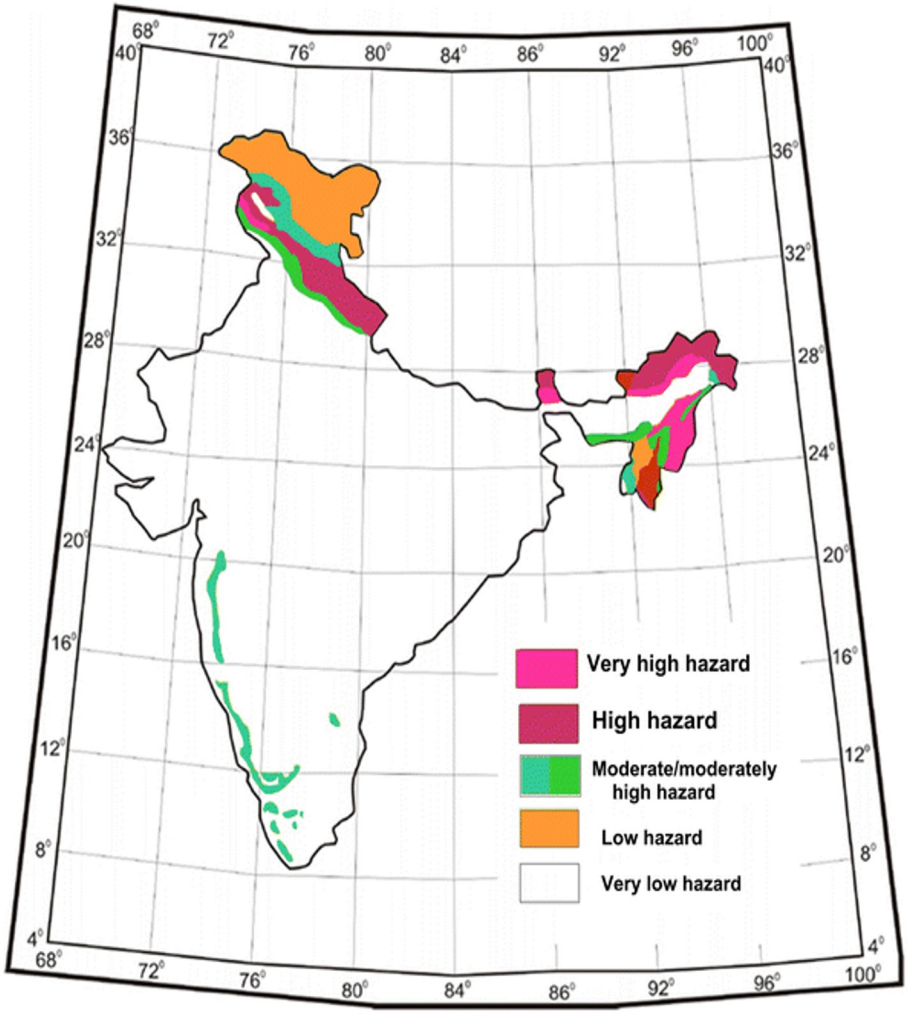
- Manmade :
  - Construction of Roads by Cutting Steep Slopes
  - Unplanned Construction in Slopes

Causes of Landslide

- Manmade :
  - Deforestation



Regions of Landslide



- 15% of the Land Prone to Landslide

Consequences of Landslides

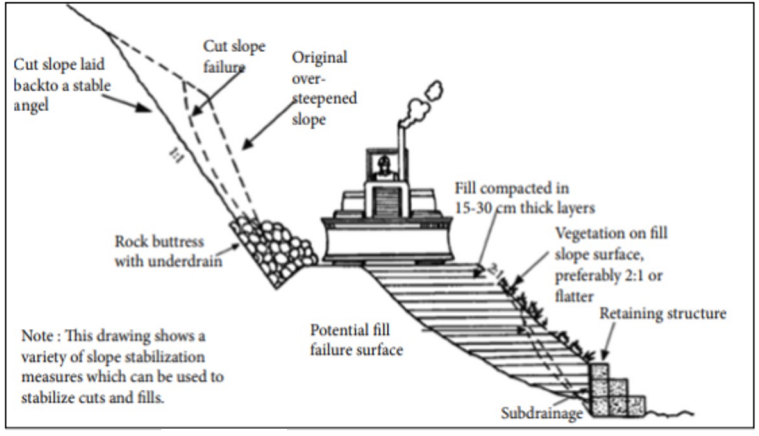
- Loss to Life and Property
- Habitat Fragmentation
- Loss of Cultivable Land
- Floods
- Soil Erosion

Landslide Management

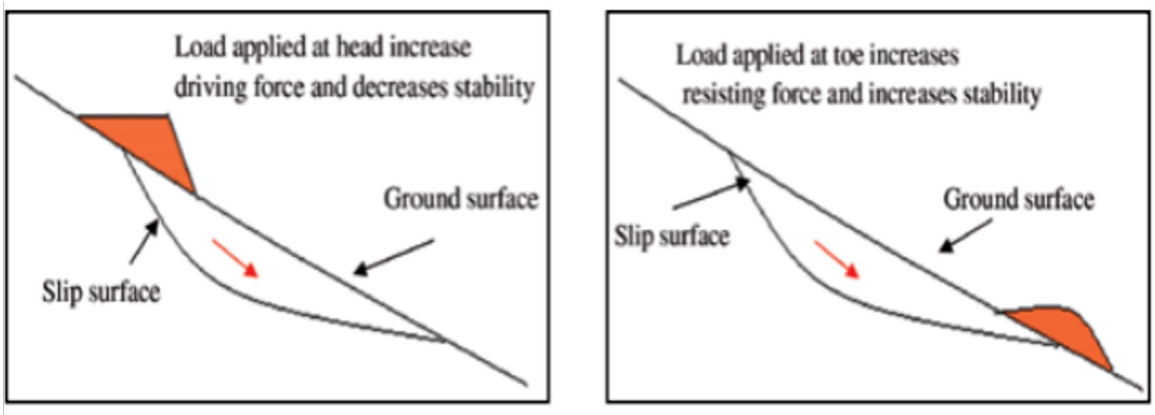
- Structural Measures to be taken in those areas
  - Retaining walls
  - Afforestation

Landslide Management

- Structural Measures to be taken in those areas:
  - Modification of slope Geometry



Solutions for slope failure



Stabilisation of slope

- Structural Measures to be taken in those areas:

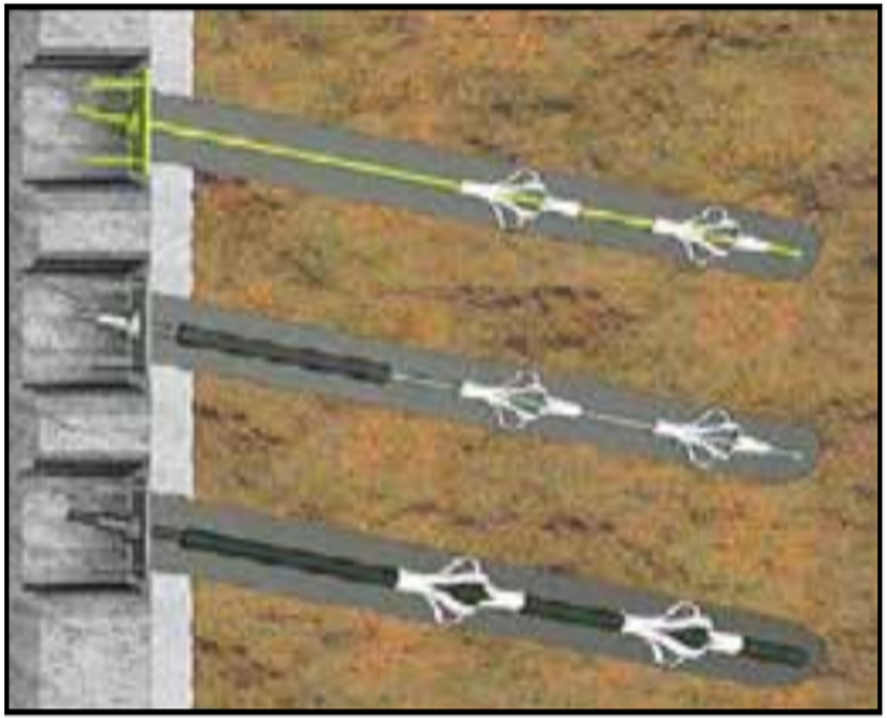


Fig. 3.29: Soil nailing

Fig. 3.30: Rock anchors

Landslide Management

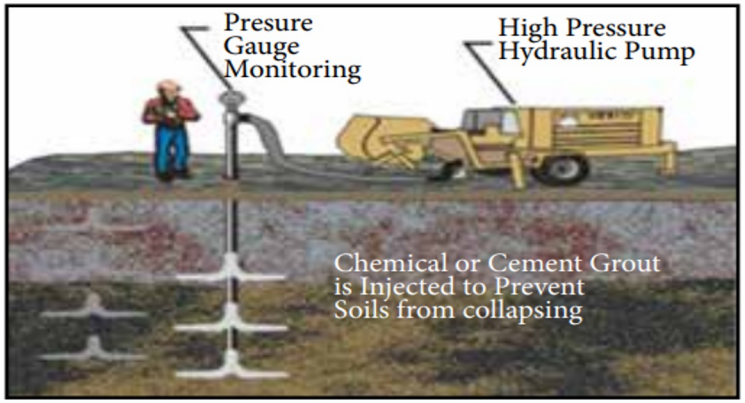


Fig. 3.41: Grouting done by machine
(Source:http://www.geotechnical.com/ulti mo/foundation-repair.htm)

- Structural Measures to be taken in those are:

  - sealing rock joints and fissures with chemical agents.

Landslide Management

- Non-Structural Measures to be taken in those Areas:
  - Landslide Prone Region Mapping
  - Public Awareness and Education
  - Capacity Building and Training
  - Afforestation Policy

NDMA Guidelines on Landslide Management

- Landslide Hazard Zonation
- Landslide Monitoring and Early Warning System
- Awareness Programmes
- Capacity Building and Training of Stakeholders
- Preparation of Mountain Zone Regulations and Policies
- Stabilization and Mitigation of Landslide and Creation of Special Purpose Vehicle (SPV) for Landslide Management

Mains Questions

Q. “Landslides are both natural and anthropogenic phenomena. Elucidate. Also discuss and suggest ways to mitigate it.

Q. Disaster preparedness is the first step in any disaster management process. Explain how hazard zonation mapping will help in disaster mitigation in the case of landslides.

(2019)

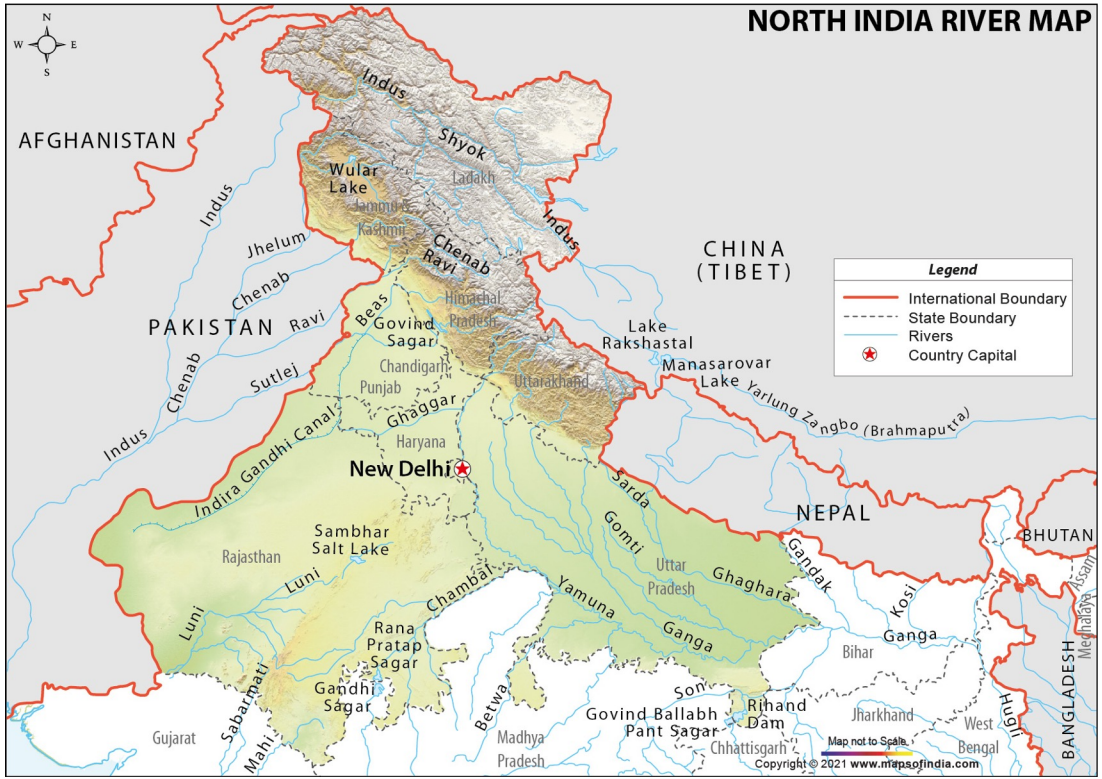
Avalanche

Avalanches

- It is a block of snow or ice descending down from a mountain top.
- Avalanches happen when the gravitational force of snow cover exceeds the resisting force of the slope and the anchoring effect of shrubs.

Avalanches Prone Regions

- Jammu and Kashmir
- Himachal Pradesh
- Uttaranchal



Causes of Avalanches

- Slope of the mountain,
- Depth of snow cover,
- Wind velocity and atmospheric temperature,
- Vibrations caused by human activities and Strength of resisting forces like vegetation cover of trees and shrubs.

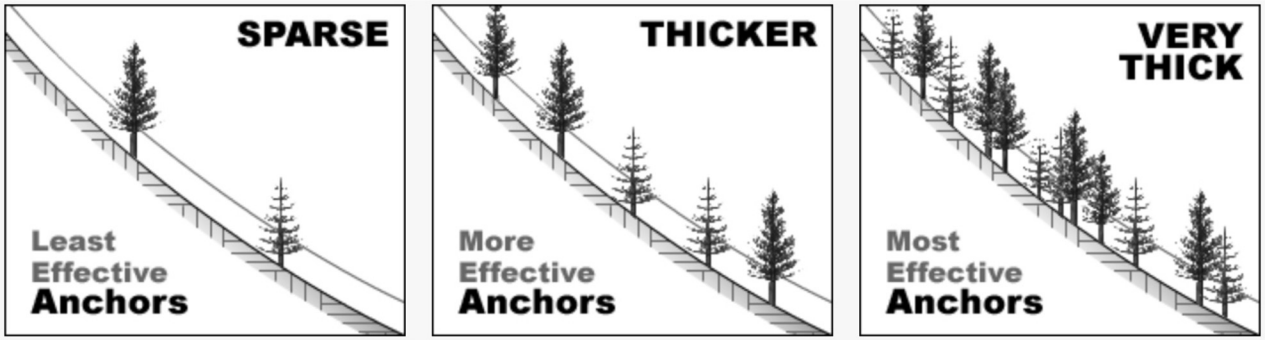
Impacts of Avalanches

- Loss of Lives
- Flooding
- Road Blocked

Mitigation of Avalanches

- Structural Measures :
  - Stepped Terraces
  - Avalanche Control Fences

Mitigation of Avalanches



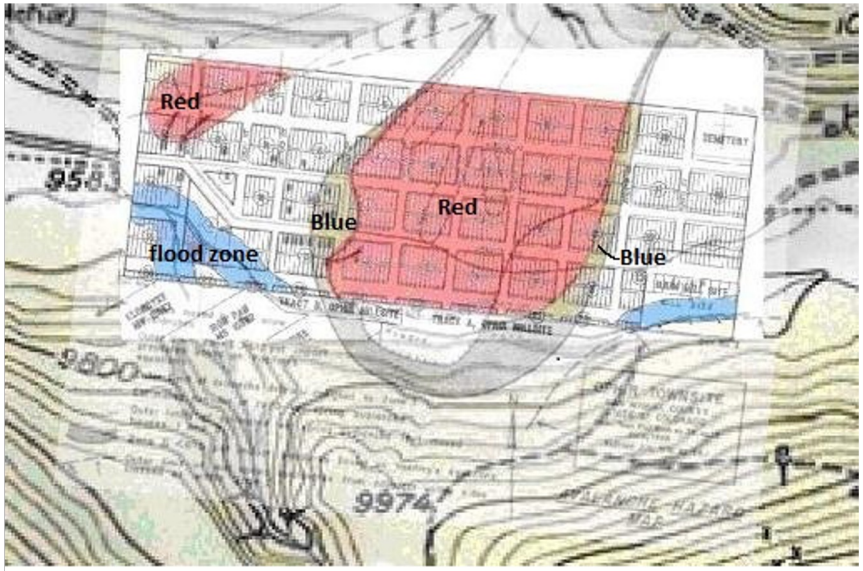
- Structural Measures :
  - Avalanches Prevention Forest

Mitigation of Avalanches

- Structural Measures :

  - Protection structures such as stopping, deflecting and retarding structures.

Mitigation of Avalanches



Avalanche Zoning Map - Ophir, Colorado

- Non-Structural Measures -
  - Avalanche Zoning

Mitigation of Avalanches

- Non-Structural Measures -
  - Removing excess snow deposits on slopes by blasting

Mitigation of Avalanches

- Non-Structural Measures -
    - Evacuation SOP

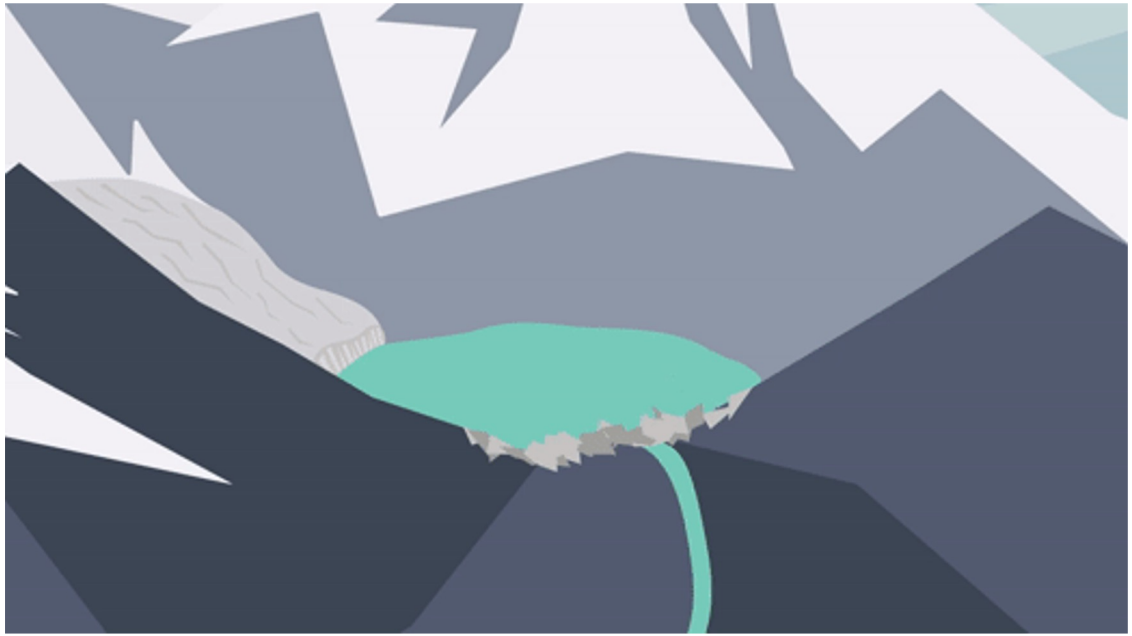
Disaster Management

Hydrological Disasters

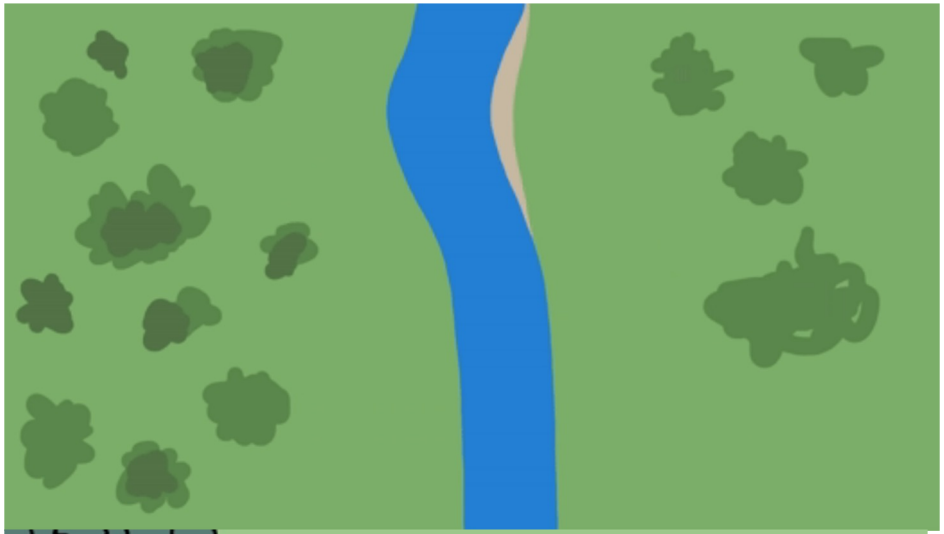
Floods

- Flood is defined as the overflow of large amount of water beyond its normal limits. It is a temporary event.

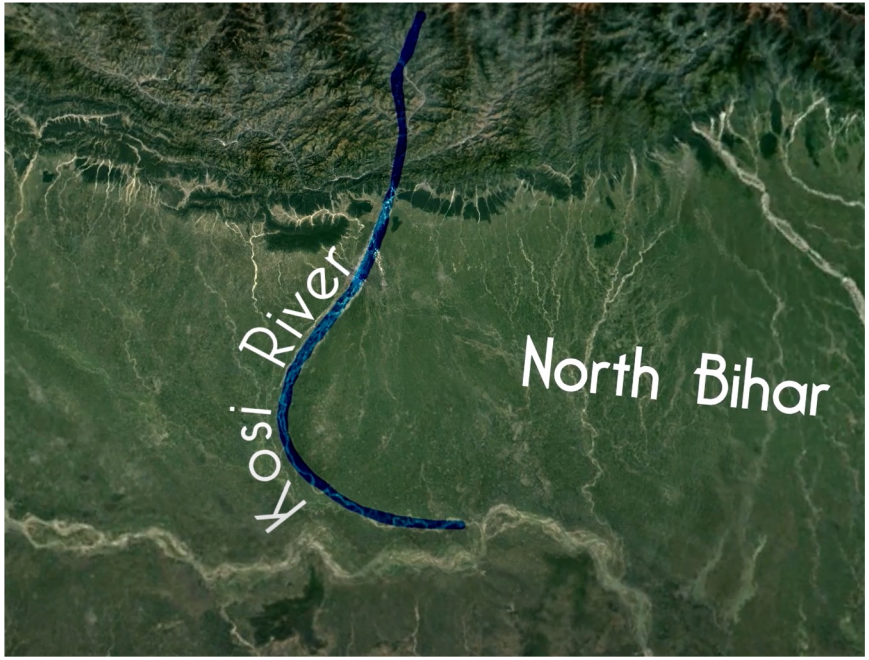
Floods Causes



- Natural Causes:
  - Massive Rainfall
  - GLOF
  - Storm Surge
  - Tsunami
  - Cyclone

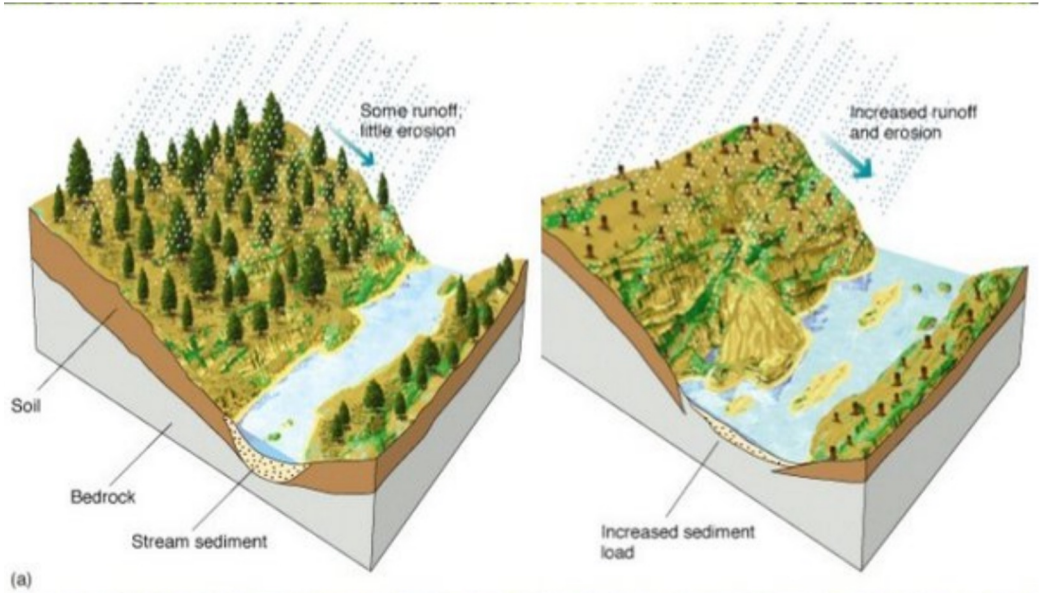


- Natural Causes:
  - Change in the course of the river



Storm Surge

Floods Causes

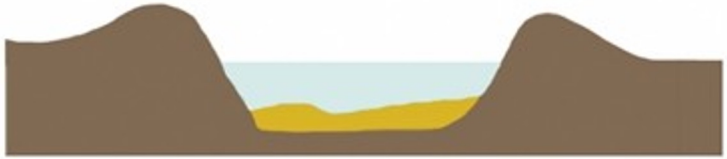


- Anthropogenic Causes:
  - Deforestation

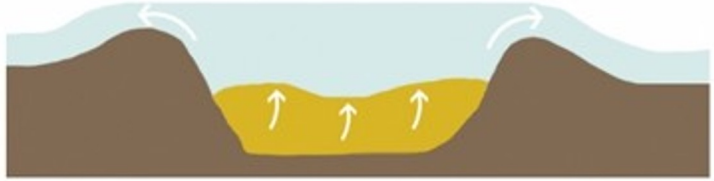
Floods Causes

- Anthropogenic Causes:
  - Collapsed Dams

Floods Causes



1. Sand and silt are constantly washed downstream, gradually filling up channels and canals.



2. As sediments build up, waterways become very shallow. One of the problems caused is flooding.

- Anthropogenic Causes:
  - Silting of River Channels
  - Urbanization

Flash Flood

- Flash floods are defined by the rapid rise and fall of water level due to a high discharge, resulting in significant damage due to the suddenness of the event.

Flash Flood

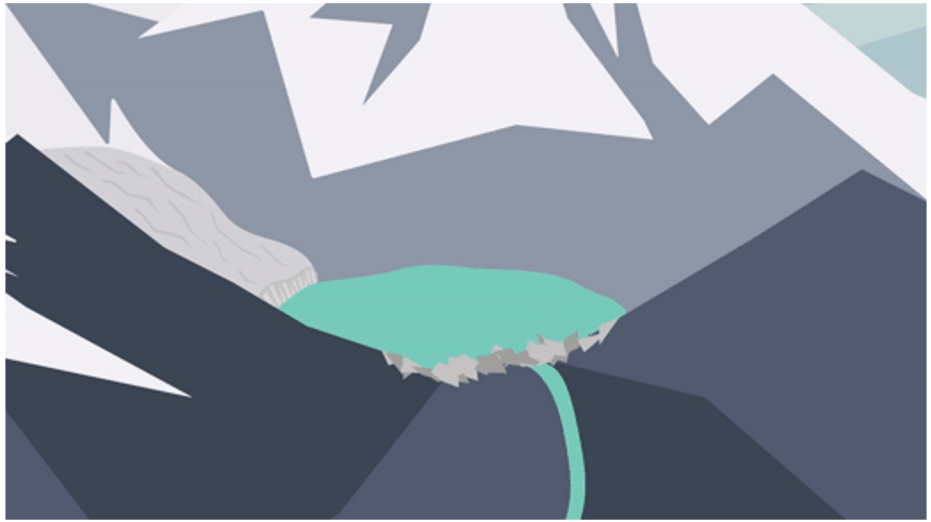
Natural Causes:

- Severe Thunderstorm
- Glacial Lake Outburst Flood
- Cloudburst

Flash Flood

Natural Causes:

- Severe Thunderstorm
- Glacial Lake Outburst Flood
- Cloudburst



Cloudburst

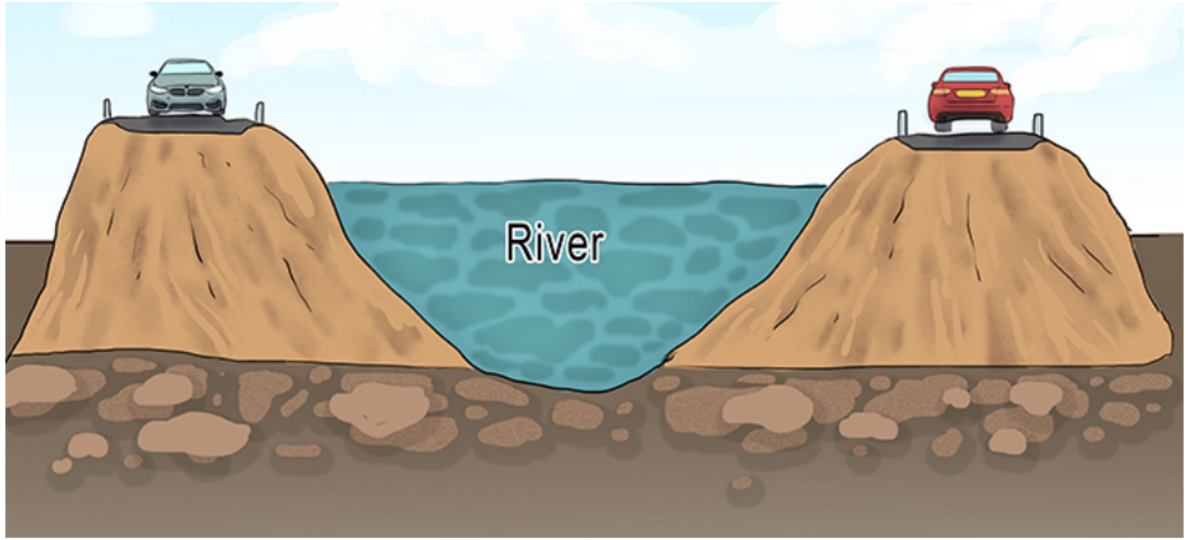
- Cloud bursts are extreme amount of precipitation in a short period of time in a small geographical area.

- IMD → >10cm/Hr

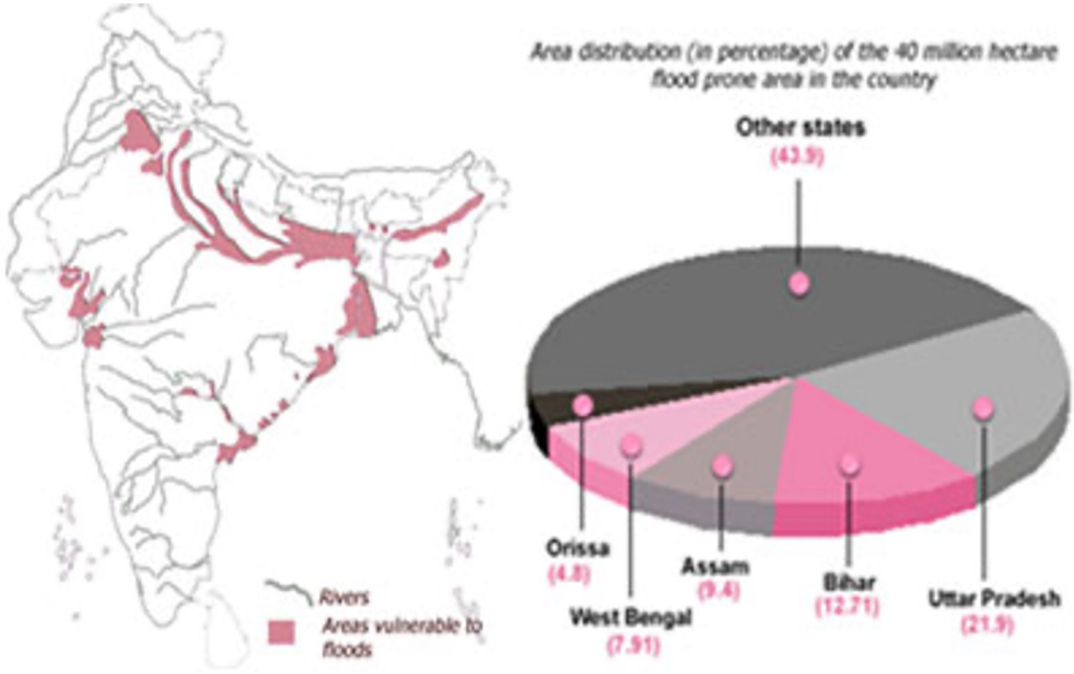
Flash Flood

Anthropogenic Causes:

- Collapse of Dam, Levees and Channels
- Sudden Release of Water from DAM



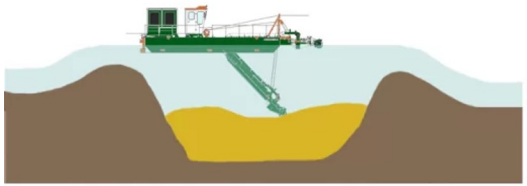
Flood Prone Regions



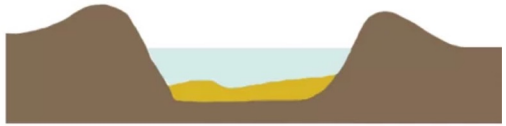
Mitigation Strategies

- Structural Measures:
  - Infrastructure
    - Dams
    - Levees
    - Bridges.

Mitigation Strategies



Sediments can be removed from the bottom of the waterways by dredging.

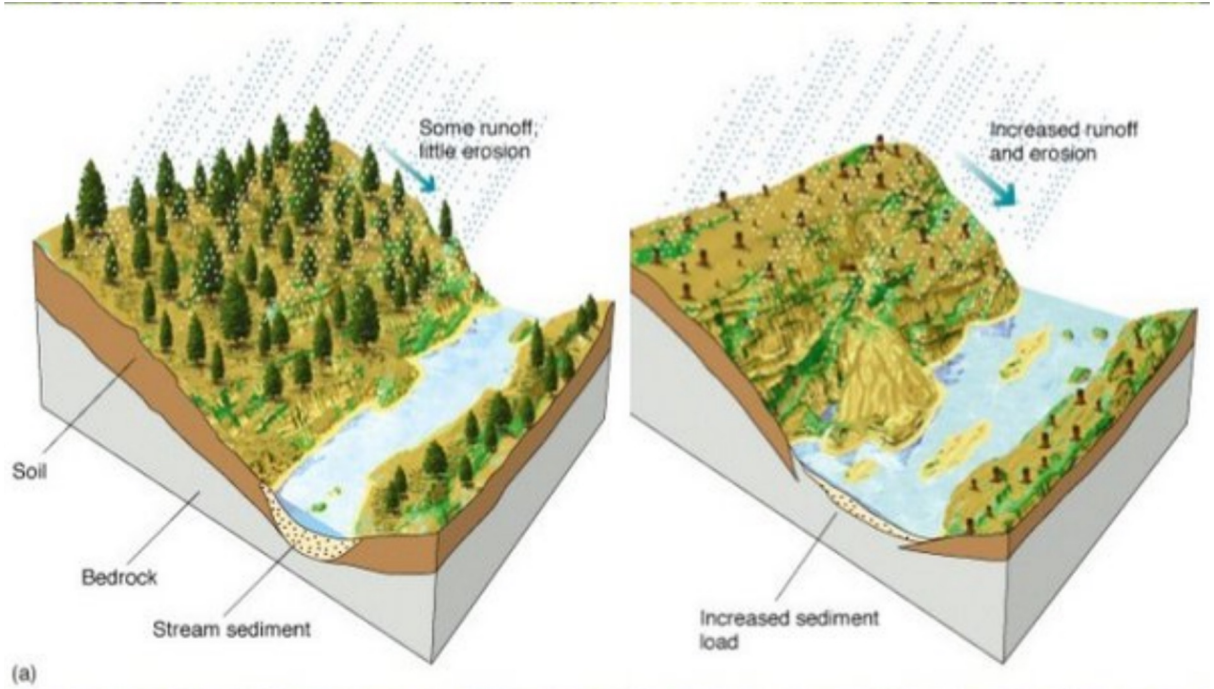


This dredging process maintains waterways accesible and safe.

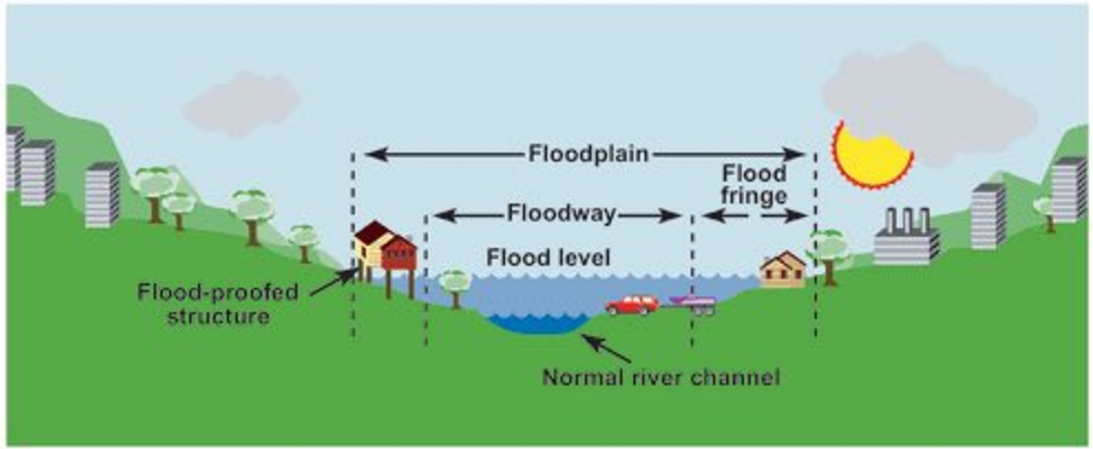
- Structural Measures:
  - Improvement of Channel Capacity.
  - Maintenance of Existing Infrastructure.

Mitigation Strategies

- Structural Measures:
  - Afforestation
  - Flood Resistant Crop



Mitigation Strategies



- Non-Structural Measures:
  - Floodplain Zoning and Mapping
  - Early Warning System: Data sharing.

Mitigation Strategies

- Non-Structural Measures:
  - Evacuation SOP
  - Flood Insurance

Challenges

- Poor Flood Plain Zoning
- Poor Management and Maintenance of Flood Management Systems
- Poor Flood Forecasting
- Poor Infrastructure

Urban Floods

Urban Floods

- Inundation of Land in Urban Areas

Causes of Urban Floods

- Poor Drainage System
- Wetland Encroachment
- Unplanned Urbanisation
- Poor Rain Water Harvesting
- Tsunami

Mitigation Measures

Structural Measures:

- DESILTING OF CHANNELS
- CONSTRUCTION OF EMBANKMENTS
- CLEARANCE OF ILLEGAL ENCROACHMENT IN WATER BODIES
- INCREASING THE INFILTRATION OF WATER THROUGH METHODS SUCH AS RAIN WATER HARVESTING

Mitigation Measures

Non Structural Measures

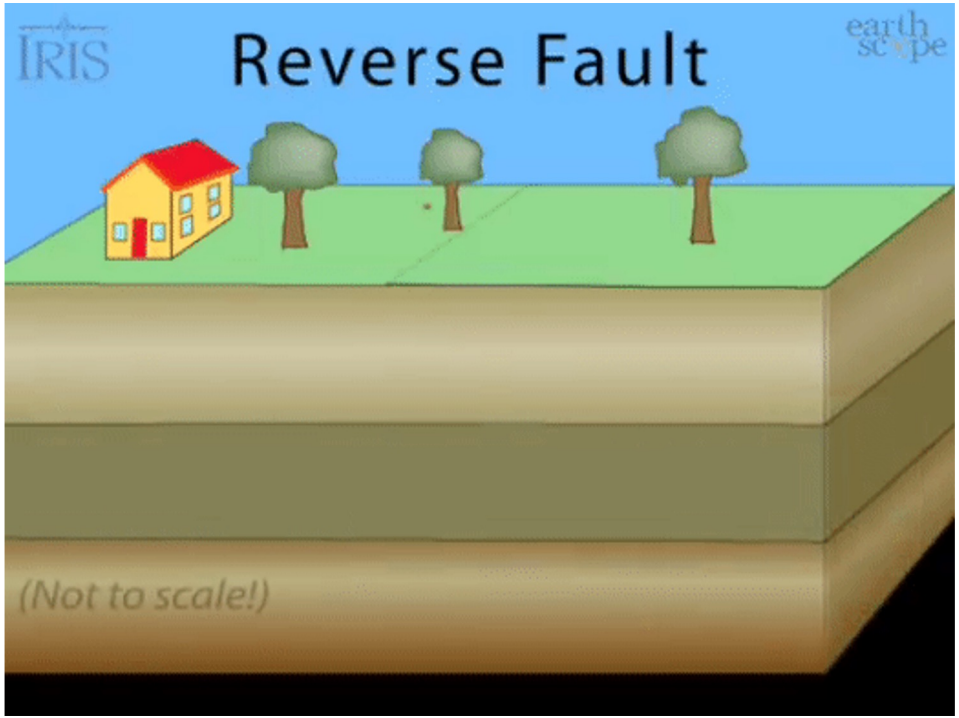
- Flood Forecasting and Warning
- Strengthening ULBs to Streamline Disaster risk Governance.
- Urban Forestry Policy
- Sponge city model:

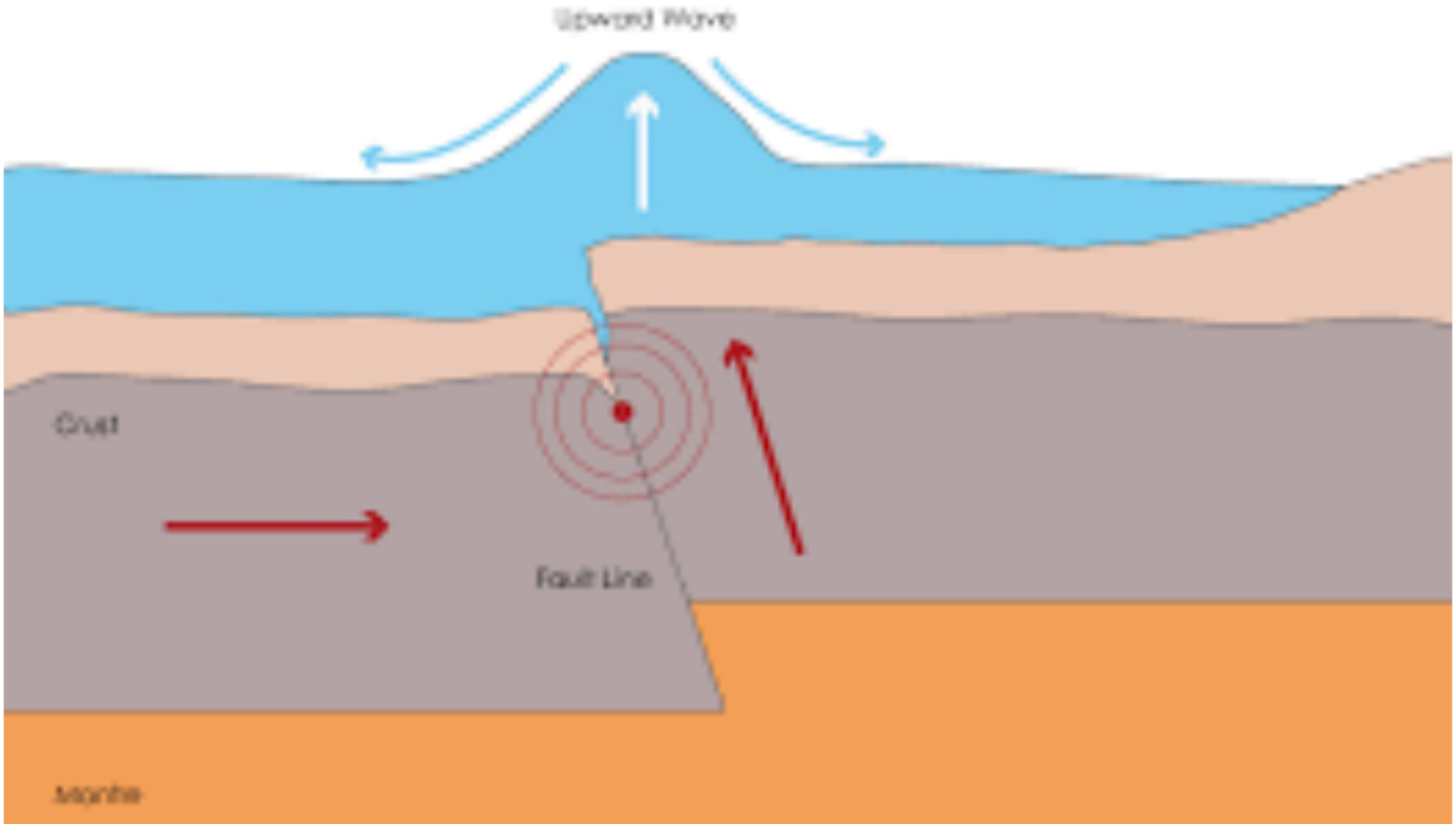
Q. Frequency of urban floods are increasing in India? What solutions that can be taken to address urban flooding in India? Discuss.

Tsunami

- A tsunami is a series of highly destructive waves which causes large scale flooding in the coastal area.

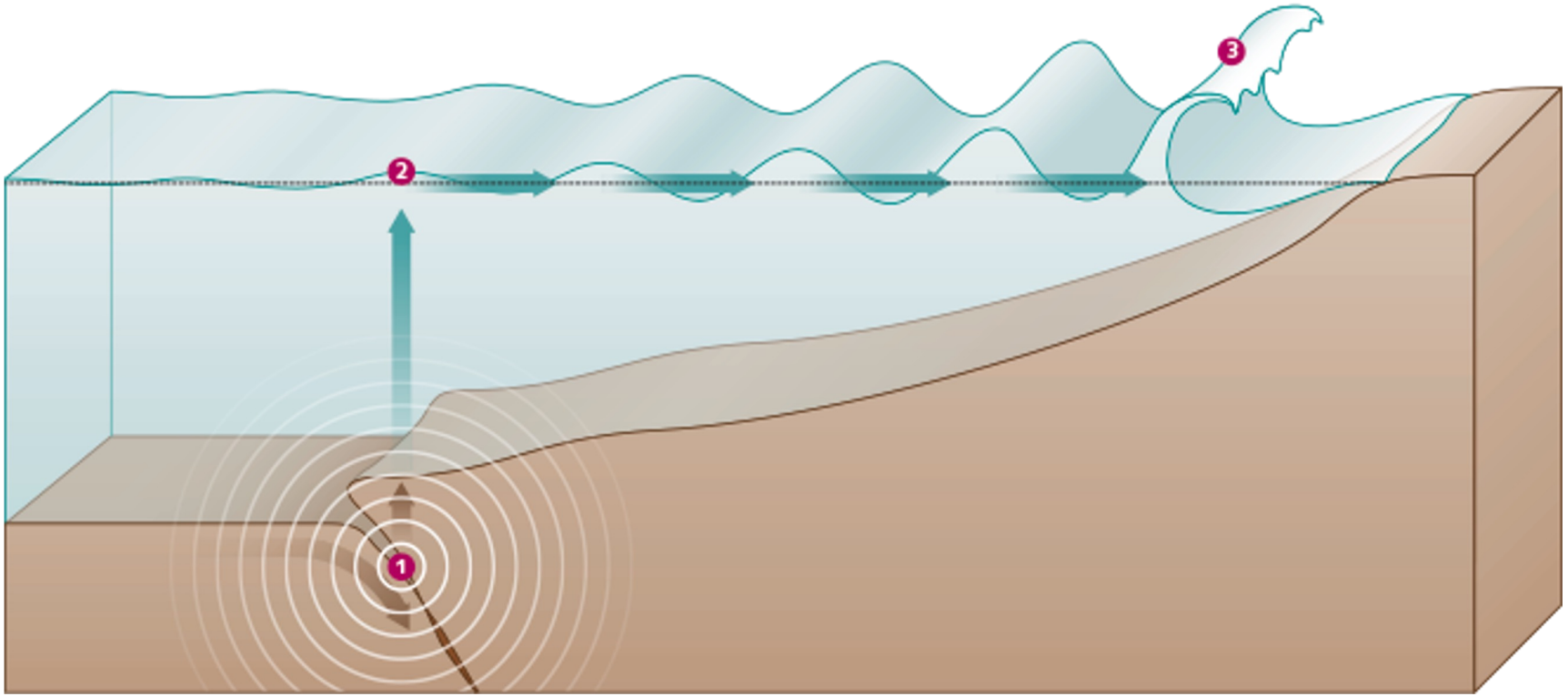
Formation of a Tsunami :





Formation of a Tsunami :

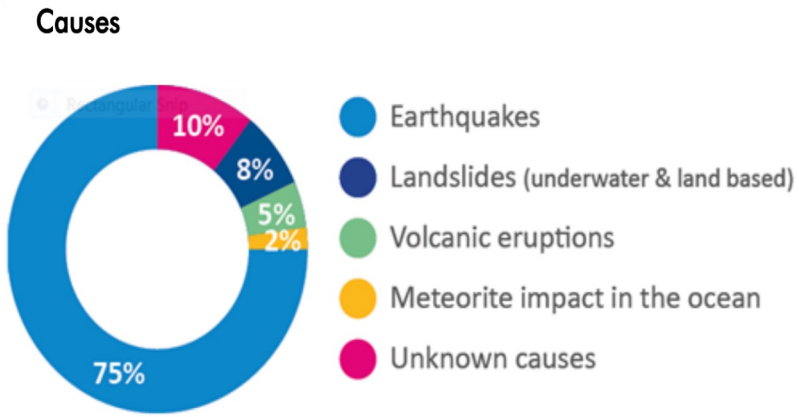
1. Through a vertical motion of the continental plates a pressure impulse is produced in the water column.
2. The impulse propagates as a tsunami through the ocean.
3. When the wave nears the shore, it is slowed down and rises vertically.



Causes of Tsunami

Natural Causes:

- Earthquakes
- Volcanic Eruptions
- Landslides
- Meteorite Impacts

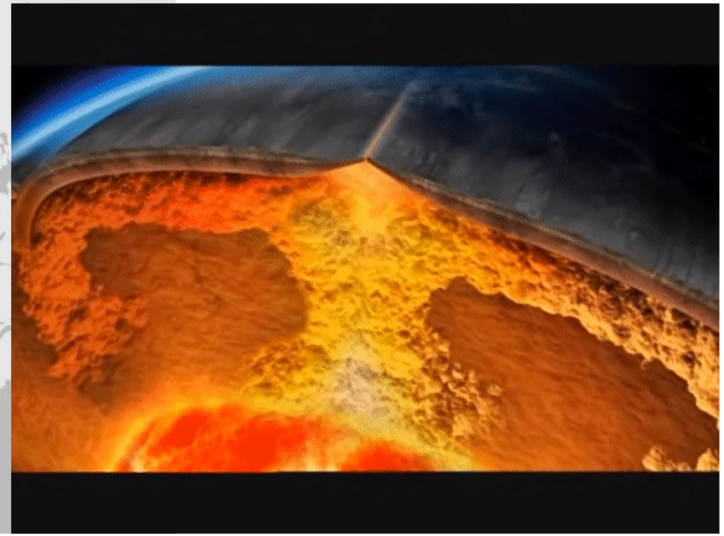


Causes of Tsunami

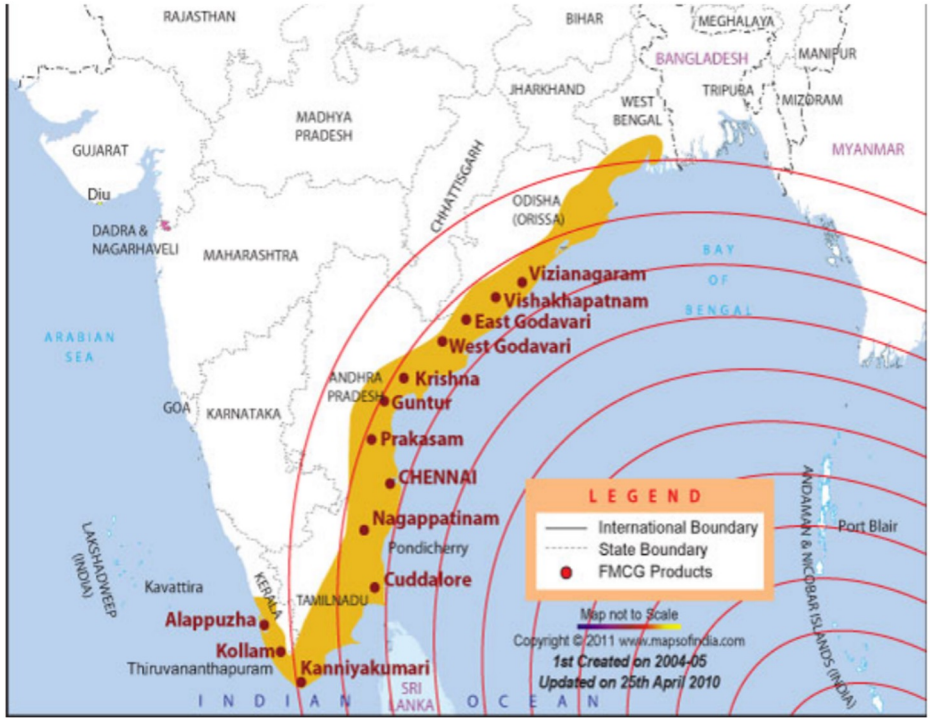
Anthropogenic Causes:

- Underwater Explosions
- Underwater Mining

India's Vulnerability



India's Vulnerability



Impact of Tsunami

- Loss of Lives
- Damage to Infrastructure
- Loss of Livelihood for Farmers and Fishermen

Impact of Tsunami

- Degradation of Natural Resources
- Ecological Impact

Management of Tsunami Risk

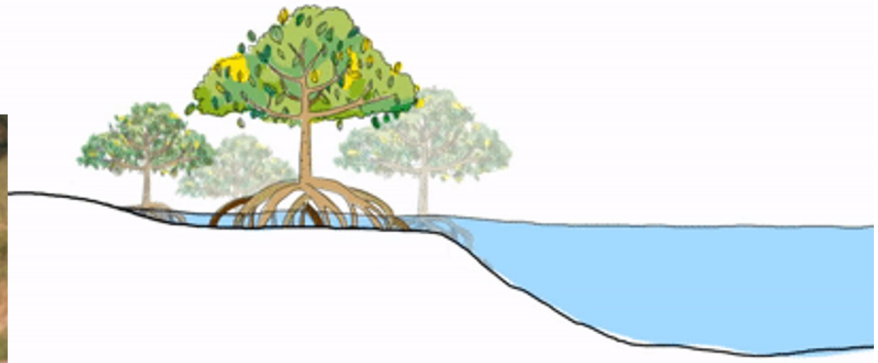
Structural Measures:

- Engineered Structures:
  1. Construction of Tsunami Walls

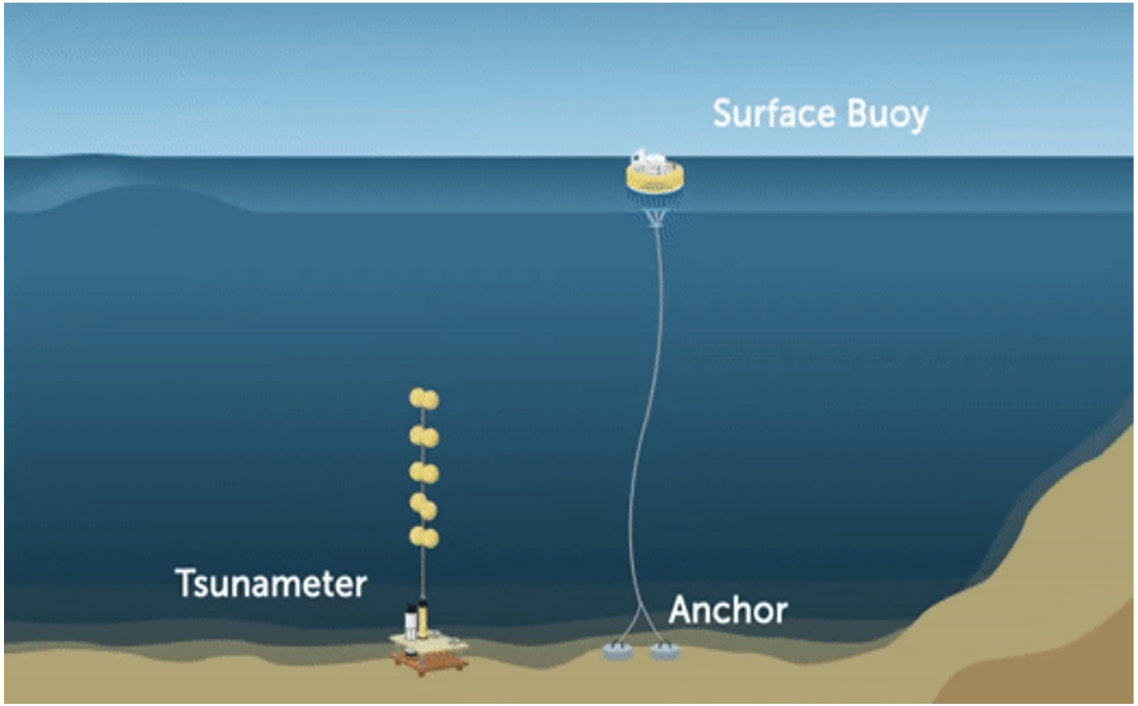
- Natural Structures:
  - Mangroves
  - Coastal Sand Dunes

Management of Tsunami Risk

- Natural Structures:
  - Mangroves
  - Coastal Sand Dunes



Management of Tsunami Risk

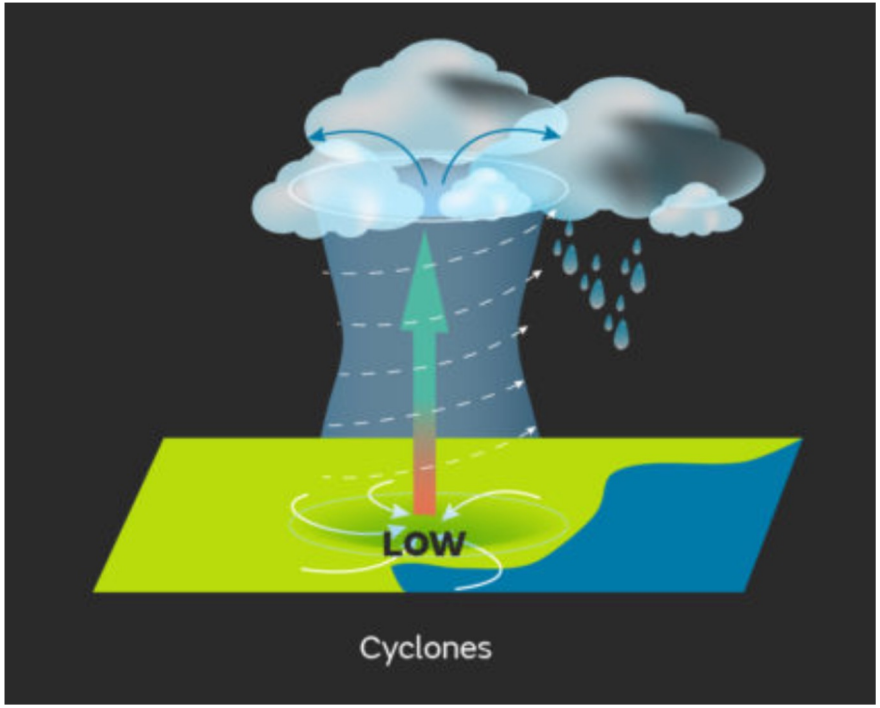


- Tsunami Early Warning System :
  - The Indian Tsunami Early Warning System was established in 2007 and is operated by INCOIS, Hyderabad.

Cyclones

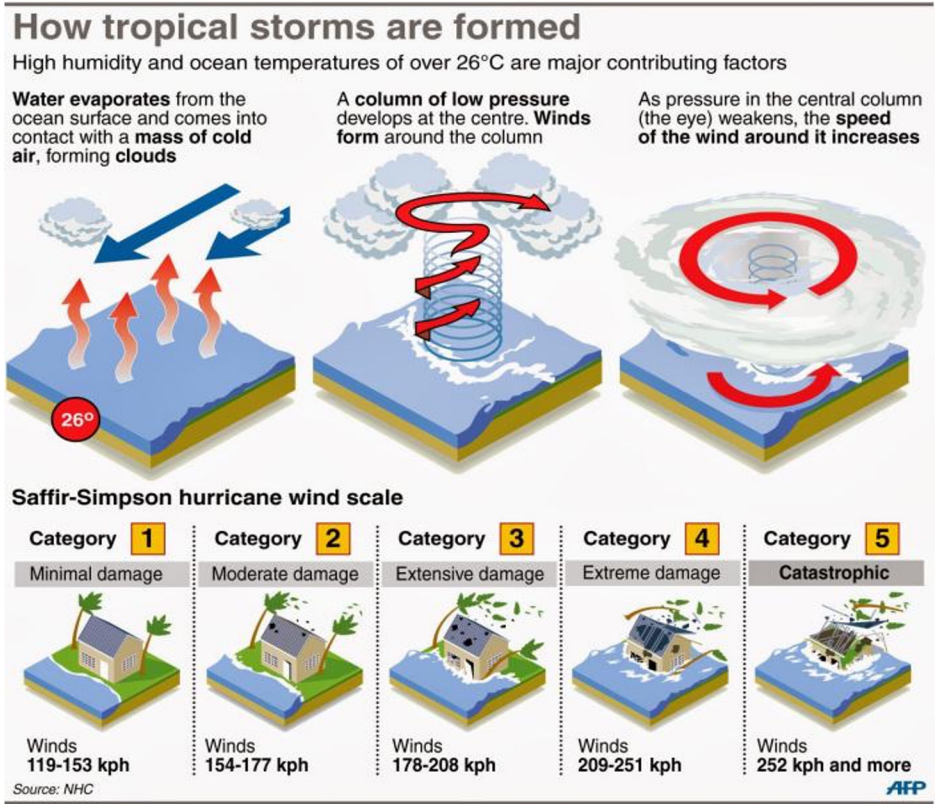
Cyclones

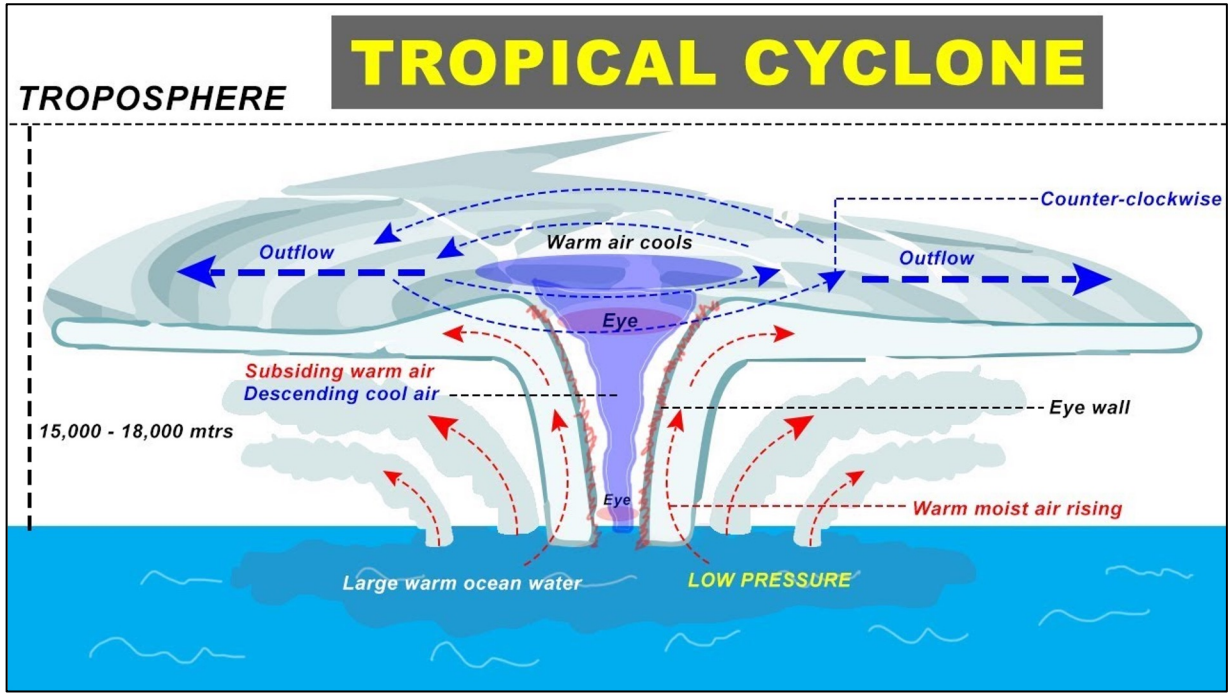
- Cyclone are a of low pressure region resulting in swirling atmospheric winds.



Tropical Cyclones

- They are violent storms that originate over seas and move over to the coastal areas bringing about large scale destruction due to:
  - High Speed Winds
  - Very Heavy Rainfall
  - Storm Surge





Vulnerable Regions of Tropical Cyclone

- Indian Coastal states of Tamil Nadu, Andhra Pradesh, West Bengal, Odisha, Gujarat, Kerala & Maharashtra.

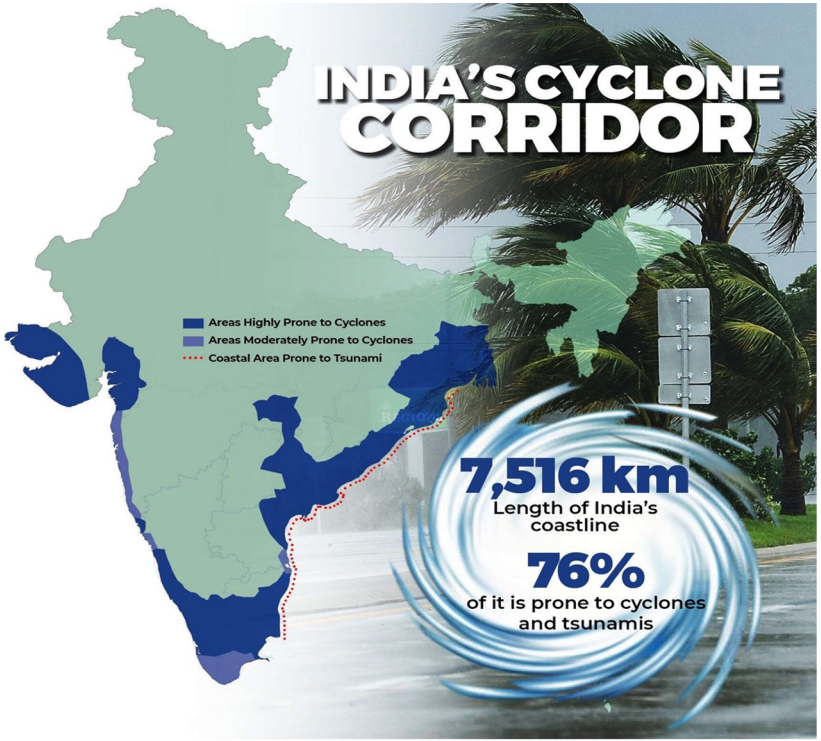


Fig: Cyclone prone areas in India.

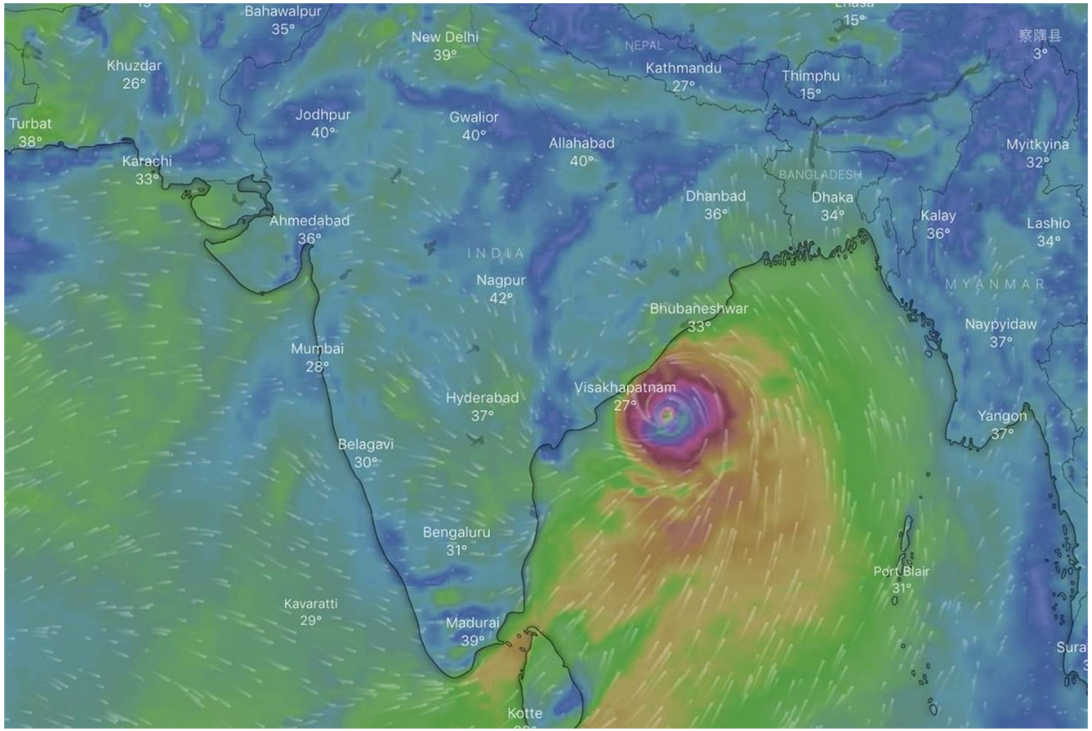
Classification of Tropical Cyclones in India

Type of Disturbances	Wind Speed in Km/h
Low Pressure	Less than 31
Depression	31-49
Deep Depression	49-61
Cyclonic Storm	61-88
Severe Cyclonic Storm	88-117
Super Cyclone	More than 221

Impact of Cyclones

Landfall brings very high speed winds, torrential rains, storm surge & flooding

- Loss of Lives
- Destruction of Property
- Damage to Infrastructure
- Destruction of Crops
- Environmental Damage



Cyclone Risk Management

Structural measures :

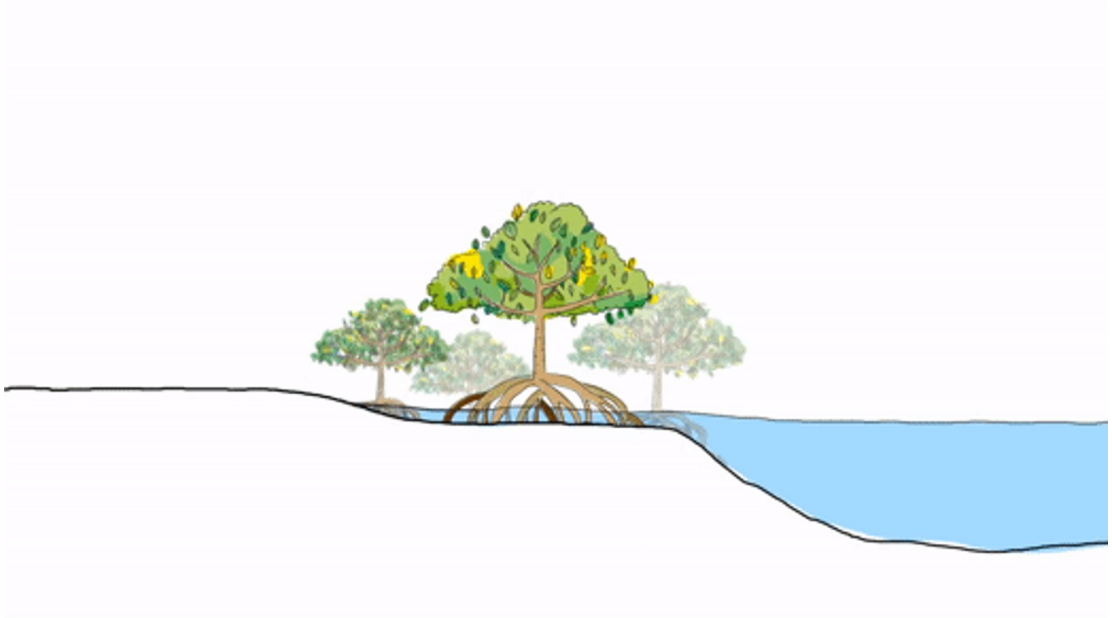
- Cyclone Shelter

Cyclone Risk Manaaement

Structural measures :

Sea-walls

Cyclone Risk Management



Cyclone Risk Management

Non-Structural measures :

- Hazard Mapping
- Efficient Cyclone Forecast and data sharing policies.

Cyclone Risk Management

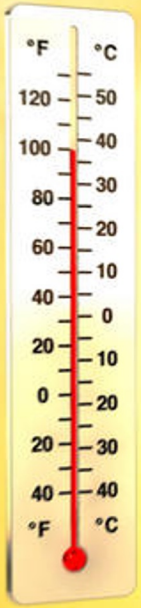
National Cyclone Risk Mitigation Project (NCRMP):

Odisha Government

- What did the Odisha government do to minimize the destruction?
- The Government's "zero casualty" policy for natural disasters and the near accuracy of the India meteorological department's early warning system have helped reduce the possibility of deaths from cyclone Fani.

Build a Relief Infrastructure:

- Odisha State Disaster Management Authority,
- By 2001, Odisha Disaster Rapid Action Force was also set up to conduct rescue operations and distribute relief.
- Accuracy of early warning systems: India Meteorological Department has built an effective service to predict accurate timings of cyclone formation in the Bay of Bengal and when it will make landfall along India's coastline. This early warning system enables the state to be disaster ready and minimize loss of lives.
- Effective co-ordination of groups: Preparations to fight the onslaught of Fani involved a number of government agencies, as well as local community groups and volunteers working together.



HEAT WAVE

Heat Waves

- Qualitatively, heat wave is a condition of air temperature which becomes fatal to human body when exposed.

- Period: March and June, and in some rare cases even extend till July.

Heat Waves

Criteria for declaration of Heat Wave:-

- Heat wave is considered when Maximum Temperatures are ≥ 40°C for plains, ≥ 37°C for coastal stations and ≥ 30°C for Hilly regions.

Based on Maximum Temperature Departure from Normal

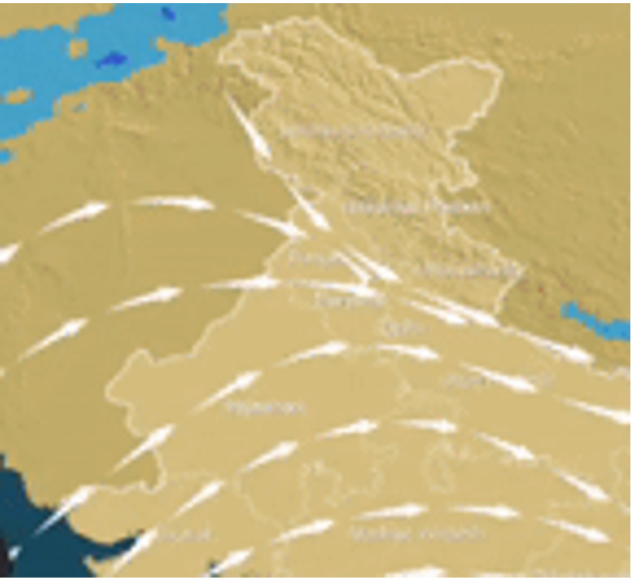
- Heat Wave: Departure between 4.5°C to 6.4°C.
- Severe Heat Wave: Departure > 6.4°C

Based on Maximum Temperature

- Heat Wave: Max. Temperature ≥ 45°C
- Severe Heat Wave: Max. Temperature ≥47°C

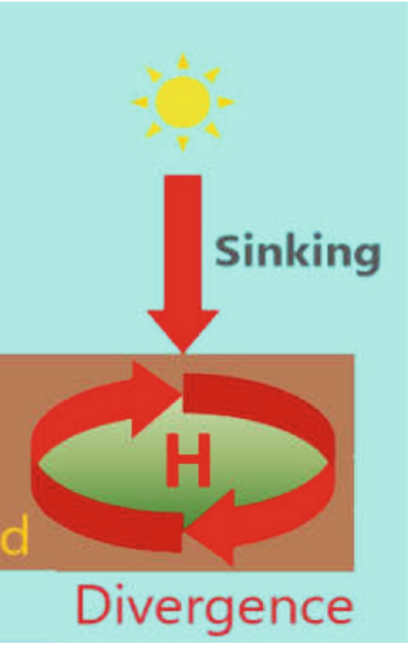
Causes

Causes of Heat Waves

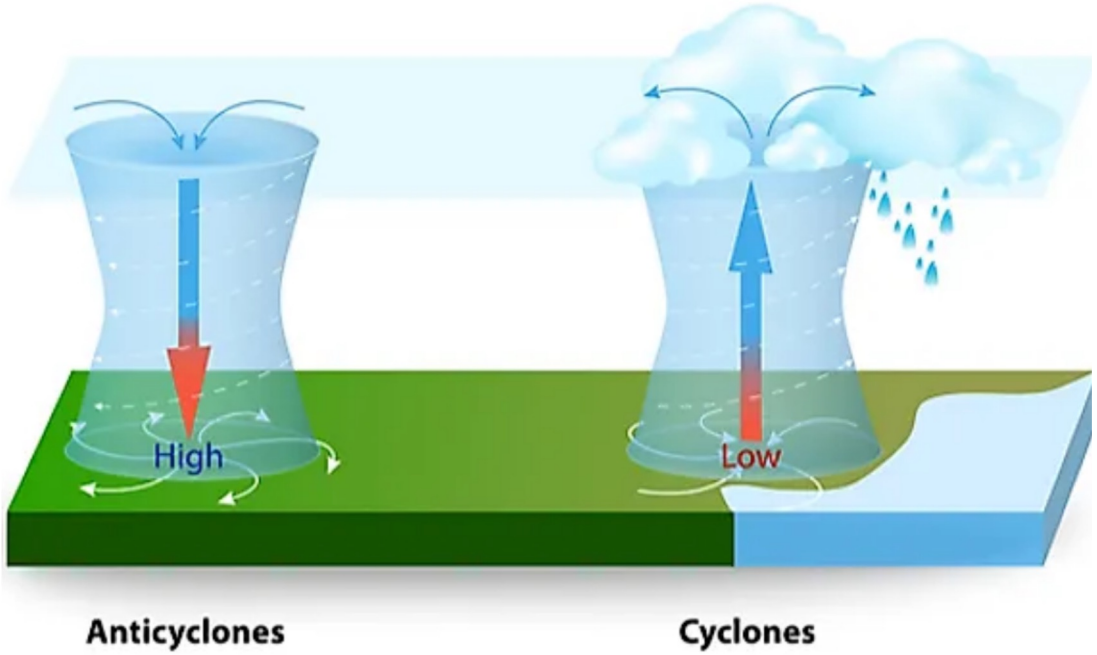


- Hot Local Winds

Causes of Heat Waves



- Anticyclonic Condition



Causes of Heat Waves

- Prolonged Dry Condition

Anthro Causes of Heat Waves

- Deforestation
- Industrial Pollution
- Climate Change

Regions of Heat Waves

Effect of Heat Waves

- On Human Health:

Table 1: Heat Wave Mortality Records

Year	Death Record
2010	1274
2011	798
2012	1247
2013	1216
2014	1677
2015	2422
2016	1111
2017	220
2018	25
2019	94 (till 16.6.19)
	210 (30.6.19)-MHFW

NDMA, Ministry of Home Affairs, GoI, 2019

- Death

Effect of Heat Waves

- On Economy:
  - Disruption in Logistics Management
  - Disruption in Economic Activity
  - Crop Failure

Effect of Heat Waves

- On Ecology:
  - Wildfire
  - Drought Condition

Heat Wave Management

- Preparedness for Heat Wave:
  - Early Warning System
  - Adequate Health Infrastructure
  - Awareness Campaign
  - Green Cover
  - Rejuvenation of Wetlands
  - Strengthening the Fire Fighting Facilities

Heat Wave Management

- During Heat Wave:
  - Working Hours Modification
  - Ensuring Availability of Emergency Ward Beds
  - Public Cooling Places
  - Public Shelters

Challenges in Heat Waves Management

- Haphazard Urbanisation
- Climate Change
- Wetland Encroachment
- Loss of Greenery

Case Study

- Odisha Model:
  - By February-end, the government starts the preparation for fighting heat wave.
  - Schools and colleges shift to early morning sessions- 6.30 am to 12 PM.
  - Examinations are held by March.
  - Public transport does not operate between 12 - 3.30 pm.
  - MGNREGA is halted from 11.30 AM to 3.30 PM.
  - Public health centres keep ice slabs ready to treat heat stroke patients.
  - Panchayats across the state open water booths.

Cold Waves

What is a Cold Wave?

1.7 Definition of Cold Wave and Frost

As per the India Meteorological Departme s criteria, Cold Wave and Cold Day conditions are defined as:

(A) Cold Wave: It should be based on the actual minimum temperature of a station. Cold Wave is considered when the minimum temperature of a station is 10^0C or less for plains and 0°C or less for hilly regions.

Based on Departure

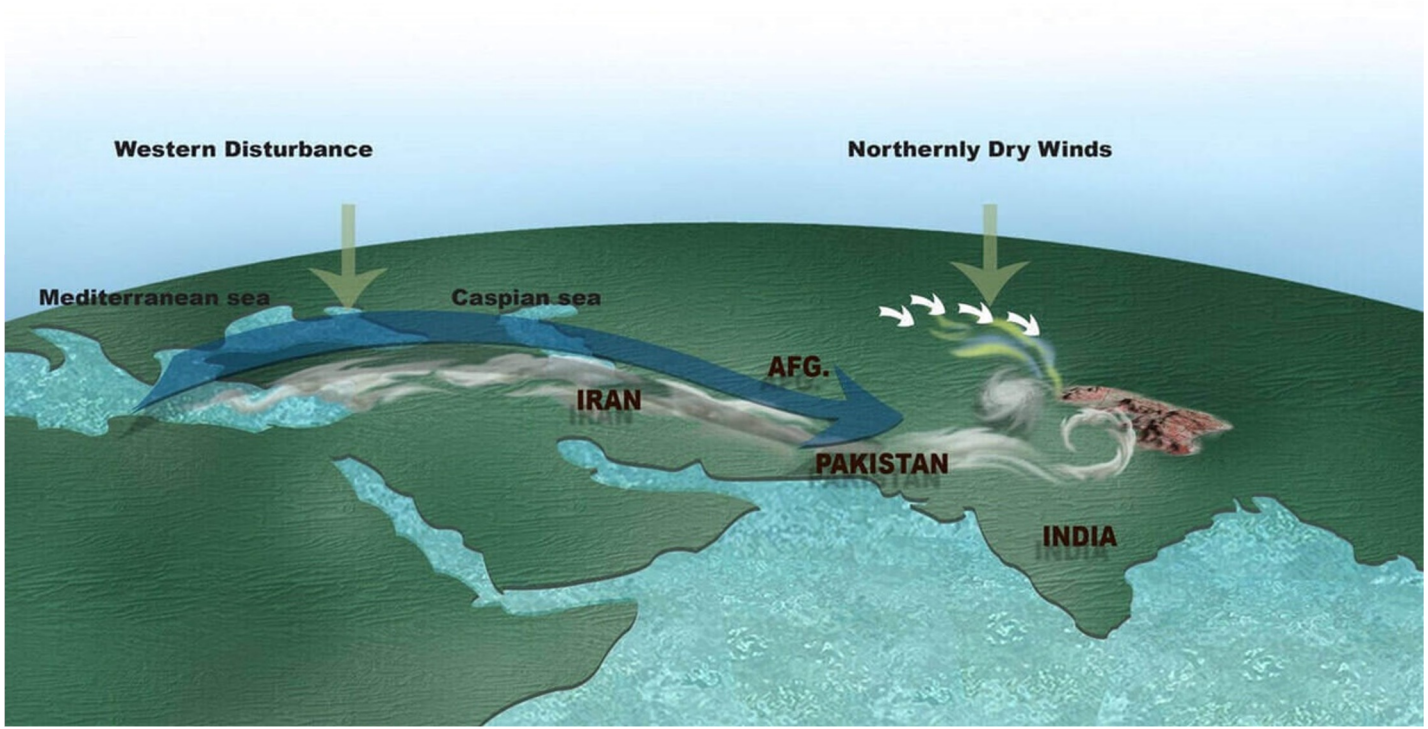
i) Cold Wave (CW): Negative Departure from normal is 4.5°C to 6.4°C
ii) Severe Cold Wave (SCW): Negative Departure from normal is more than 6.4°C

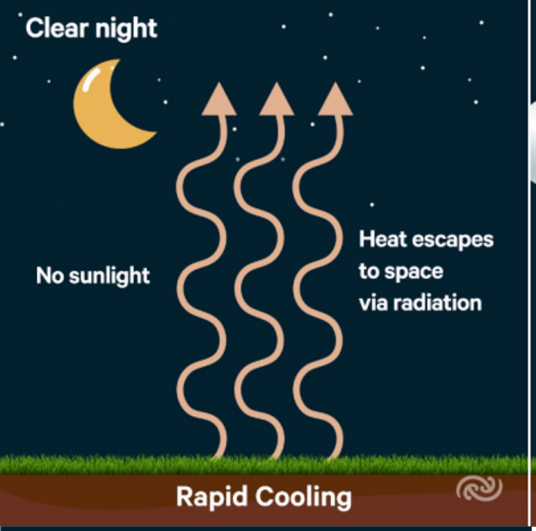
Based on Actual Minimum Temperature (For plain stations only)

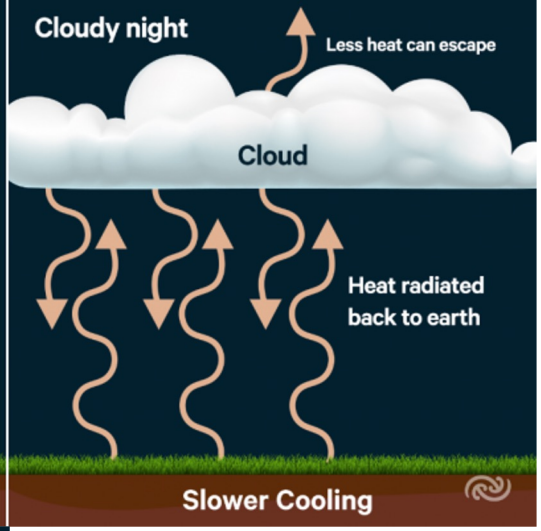
i) Cold Wave: When the minimum temperature is ≤ 04°C
ii) Severe Cold Wave: When the minimum temperature is ≤ 02°C

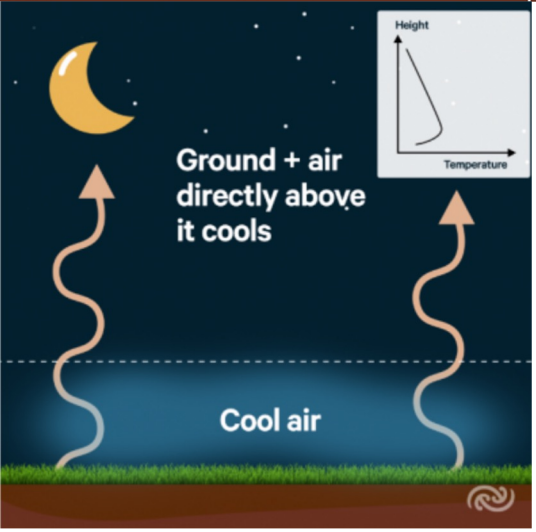
Reasons For Cold Wave?

- Western Disturbances:




Clear night
No sunlight
Heat escapes
to space
via radiation
Rapid Cooling

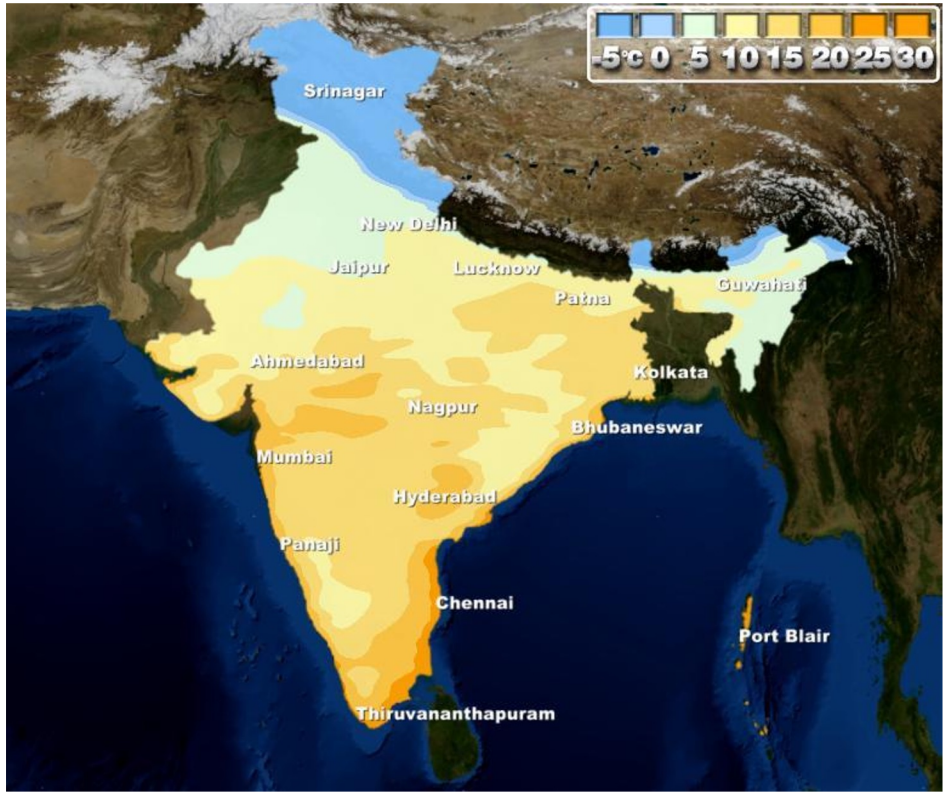

Cloudy night
Less heat can escape
Cloud
Heat radiated
back to earth
Slower Cooling


Height
Temperature
Ground + air
directly above
it cools
Cool air

- Clear Sky:

Cold Waves in India

- Jammu and Kashmir
- Himachal Pradesh
- Punjab
- Bihar
- Haryana
- Uttar Pradesh



Impact of Cold Waves

On Human Health:

Year when more people died due to cold wave	Deaths due to heat wave	Deaths due to cold wave	Proportion between deaths due to cold wave/heat wave
2020	2	152	76.00
2011	12	722	60.17
2018	33	280	8.48
2000	55	425	7.73
2001	70	490	7.00
2004	117	462	3.95
2010	269	450	1.67
2008	111	114	1.03

Impact of Cold Waves

On Economy:

- On Agriculture
- Logistics
- Transportation
- Tourism

Mitigation of Cold Wave

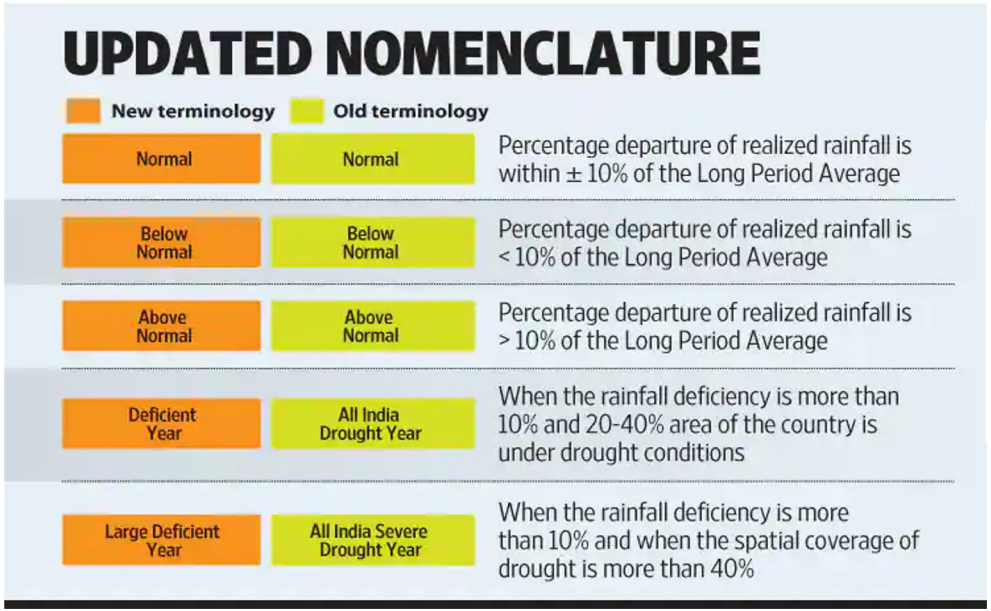
- Early Warning System and Develop A Contingency Plan
- Shelter Homes
- Awareness Generation

Drought

Drought

- Drought is the scarcity of water.
- Drought is a Creeping Phenomenon that Slowly emerges.
- Impacts many sectors of the economy.

Drought



2. What do we mean by long period average (LPA) of rainfall?

LPA of rainfall is the rainfall recorded over a particular region for a given interval (like month or season) average over a long period like 30years, 50-years etc. It acts as a benchmark while forecasting the quantitative rainfall for that region for a specific month or season. For example, LPA of south west monsoon rainfall over Kerala for the months June, July, August and September are 556mm, 659mm, 427mm and 252mm respectively. Current LPA of all India south west monsoon rainfall based on the average rainfall over the period 1961 -2010 is 880.6mm.

Why Drought Is Different From Other Disasters?

- It is difficult to determine the beginning and end of the event.
- Duration may range from months to years.
- No single indicator can identify the onset and severity and its impacts.
- Spatial extent is usually greater than that for other hazards.
- Impacts are difficult to quantify and they usually magnify when the event.
- continues from one season to the next.

Types of Droughts

- Meteorological Drought – Referring to lack of precipitation.
- Agricultural Drought – Referring to lack of moisture in the soil where crops grow.
- Hydrological Drought – Referring to low levels of water in reservoirs.
- Socio-Economic Drought – Referring to water shortages affecting people in society, which impacts availability of foodgrains, fodder, etc.

Types of Drought: Meteorological Drought

- Meteorological drought occurs when dry weather dominates in an area due to Rainfall Deficit.
- Rainfall less than 90% of average is categorized as meteorological drought.

Hydrological Drought

- Hydrological Drought is based on the impact of rainfall deficits on the water supply such as River, reservoir and lake levels, and ground water table decline.

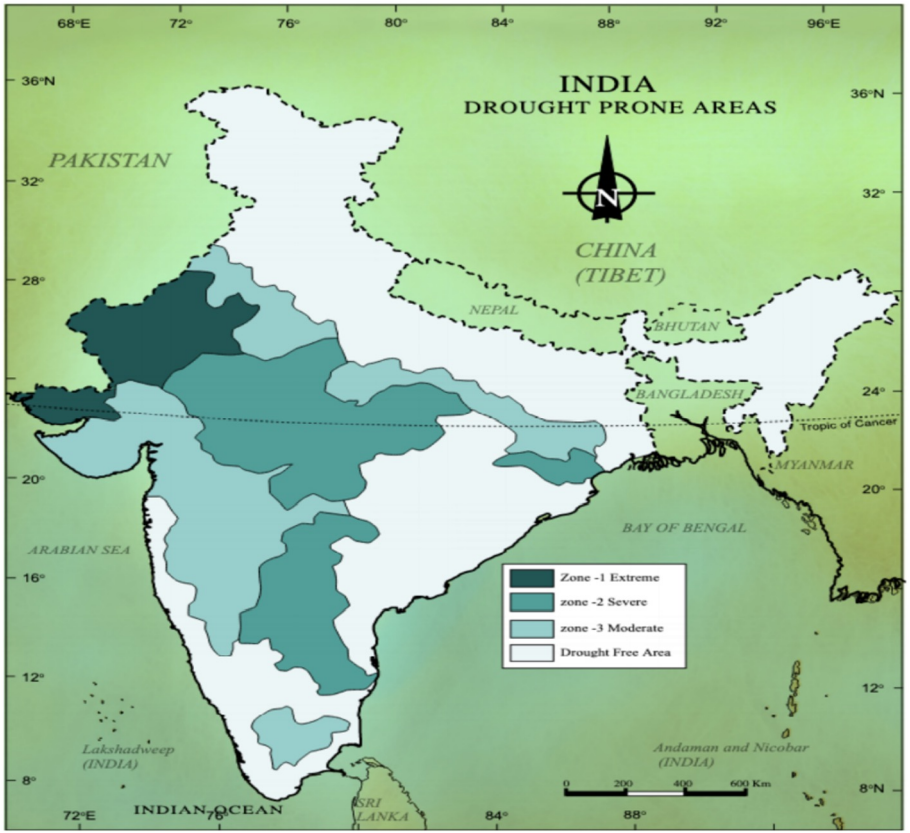
Types of Drought: Agricultural Drought

- Agricultural Drought refers to the impacts on agriculture due to rainfall deficits, soil water deficits, reduced ground-water, or reservoir levels needed for irrigation.

Types of Drought : Socio-Economic Drought

- Socioeconomic Drought considers the impact of drought conditions (meteorological, agricultural, or hydrological drought) on Socio-Economic Conditions in a Region.

Drought Risk in India



Causes of Drought

- The causes for droughts are increasingly attributable to the mismatch between supply and demand, particularly the demand for non-agricultural purposes. While adequate availability of water is crucial to agriculture, it continues to be affected by other variables such as temperature, humidity, solar radiation and wind patterns.

Impact of Drought

- Environmental Impact:
- Economic Impact:

Impact of Drought

- Social Impact:

Drought Risk Management

- Drought Monitoring and Early Warning
- Conservation of Natural Buffers
- Development of Irrigation Infrastructure
- Drought Prone Areas Program
- River Interlinking

Drought Risk Management

- Crop Insurance
- Livelihood Planning
- Land Use Planning
- Strengthening the Welfare Schemes

Flash Drought

Flash Drought

- Flash drought is a critical sub-seasonal phenomenon characterized by a rapid intensification of drought.

Flash Drought

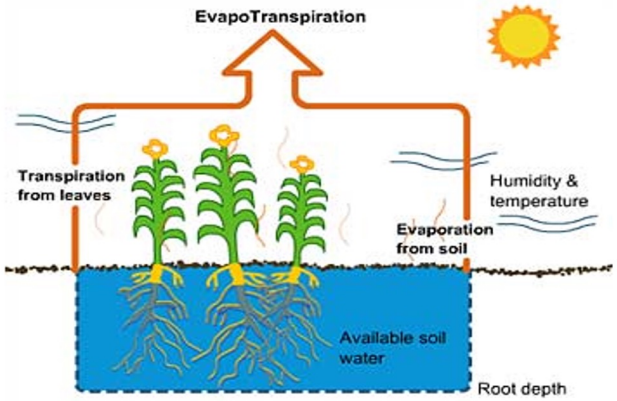
Flash droughts have been defined in two ways:

- Either as a short-lived yet severe event where soil moisture completely depletes.
- A multi-week period of rapid intensification toward drought.

Flash Drought

It is set in Motion by :

- lower-than-normal rates of precipitation.
- accompanied by abnormally high temperatures (heat waves), winds, and radiation.
- Higher temperature increases evapotranspiration.



Differences Between Drought and Flash Drought

- Unlike slow-evolving drought, which is caused by a decline in precipitation,
- flash drought occurs when low precipitation is accompanied by abnormally high temperatures.

  (e.g., heat waves), high winds, and/or changes in radiation.

- conventional drought—which may occur throughout the year at any location—flash drought typically occurs during warm seasons.

Flash Drought

SCIENCE

More flash droughts in India by end of century

Aswathi Pacha

JANUARY 23, 2021 19:52 IST
UPDATED: JANUARY 23, 2021 21:13 IST

SHARE ARTICLE PRINT A A A

Atmospheric anomalies, anthropogenic greenhouse gas emissions play a role

In 1979, India faced a severe flash drought, affecting about 40% of the country and taking a toll on agriculture. An article published that year in the journal

Forest Fires

Forest Fires

- Forest Fire are an large uncontrolled fire in the forest region.

Forest Fires Causes

Natural Causes

- Lightning
- Heat Waves
- Volcanos

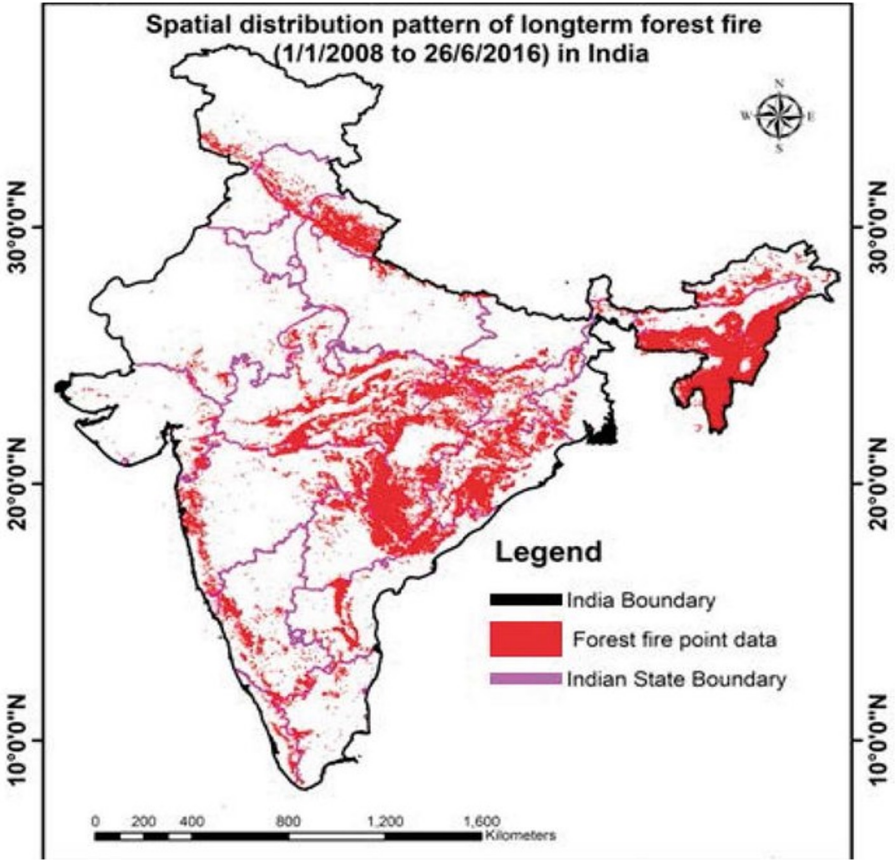
Hawaii volcano causes 75-acre wildfire

Forest Fires Causes

Anthropogenic Causes

- Shifting Cultivation
- Clearing of Land to Collect Minor Forest Produce
- Burning of Crop Residue
- Fires Started Deliberately by Contractors & Industries
- Land Grabbing
- Poaching and Illegal Trade
- Exploitative Tourism

Forest Fire Prone Regions



- About 21% of forest cover in India is prone to fires.
- forests in the North-Eastern region and Central India being the most vulnerable.

Impact of Forest Fires

- Short-Term
  - Loss of Lives And Property
  - Loss of Livelihood
  - Loss of Biodiversity
  - Air Pollution
  - Tourism

Impact of Forest Fires

- Long-Term
  - Soil Erosion, Landslides and Floods
  - Global Warming and Climate Change

Management of Forest Fires

- Before Forest Fire:
  - Early Warning System
  - Creation of Forest Fire Lines
  - Awareness Generation
  - Land Use Planning
  - Natural Buffers
  - Strengthening the Fire Fighting Capabilities

Management of Forest Fires

- India's Initiative to Tackle Forest Fire:
  - National Action Plan on Forest Fires (NAPFF): It was launched in 2018 to minimise forest fires by informing, enabling and empowering forest fringe communities and incentivising them to work with the State Forest Departments.
  - The Forest Fire Prevention and Management Scheme (FPM) is the only centrally funded program specifically dedicated to assist the states in dealing with forest fires.

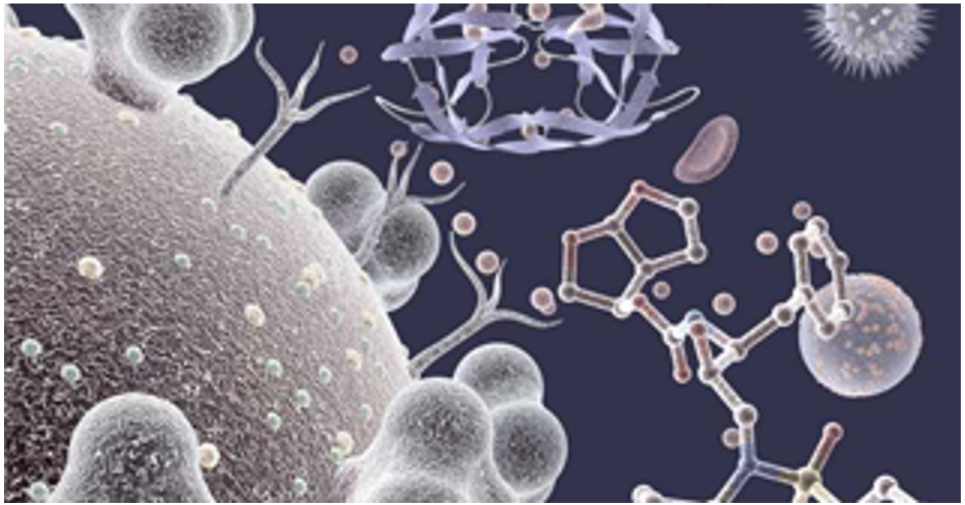
Challenges in Forest Fire Management

- Encroachment
- Poor Research in Forest Fires
- Poor Locals' Participation

Biological Related Disasters

What is Biological Disaster

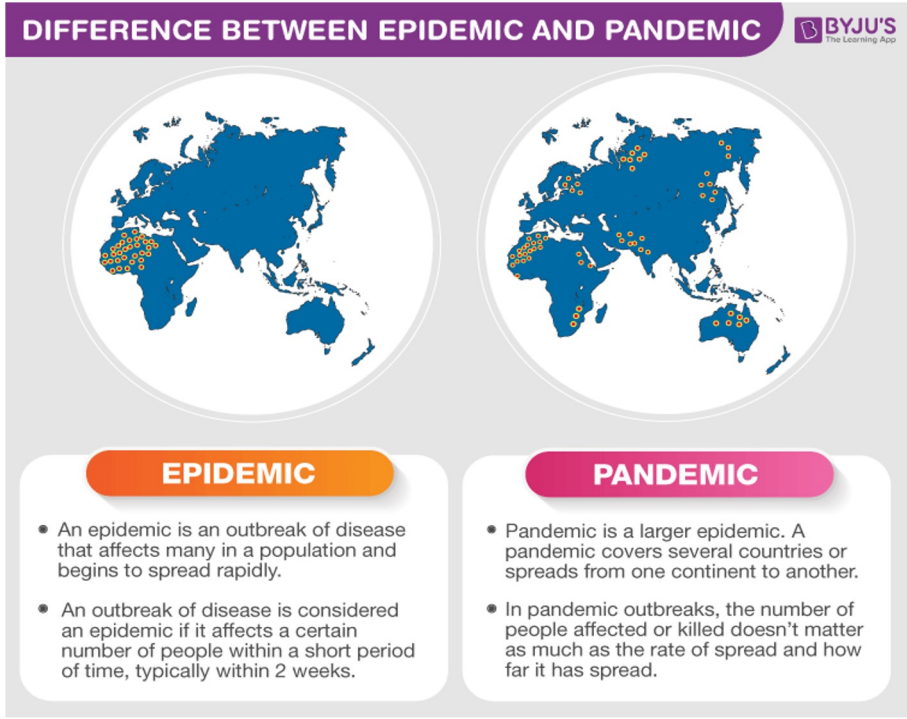
- Disaster that causes widespread illness and death in humans and animals, when they gets in contact with biological hazard in the form of live microorganisms such as bacteria, viruses, fungus, and other microbes.
- Biological disasters can also result in the destruction of crops and plantations.



Biological Disaster Types

Biological disasters may be in the form of:

- Epidemic :
- Pandemic :



Causes of Biological Disaster

- Natural Outbreaks:
- Use of Biological Agents by Terrorists:

  - 1972: Two college students, Allen Schwander and Stephen Pera, were arrested for planning to poison the Chicago water supply with typhoid bacteria.
  - 1979: Anthrax leak from chemical weapons research facility, Sverdlosk, Soviet Union.

Consequence of Biological disaster

- Loss of Lives
- Economic Activities gets disrupted.
- Loss of Biodiversity.

MITIGATION OF BIOLOGICAL DISASTER

- Public Awareness
- Create a Pool of well-Trained Medical Professionals
- Effective Network of Surveillance System to Detect Outbreak of Epidemics
- Mass Immunisation Programs
- Ensure Adequate Stocks and Ready Availability of Diagnostic Re-agents.
- Research of the Vaccines which are Not Available
- Providing Effective and Efficient (timely) Treatment
- International Coordination

Industrial Disasters

What are Industrial Disasters?

- Industrial Disasters are disasters caused by chemical, mechanical, civil, electrical or other process failures due to accident, negligence or incompetence, in an industrial plant which may spill over to the areas outside the plant or with in causing damage to life, property and environment.

What are Industrial Disasters?

- E.g.:
  - Union Carbide Gas Tragedy (1984)
  - Korba Chimney Collapse (2009)
  - Jaipur Oil Depot Fire (2009)
  - Visakhapatnam HPCL Refinery Blast (2013)
  - LG Polymers Visakhapatnam

Causes

- Explosion in a Plant
- Accidents in Storage Facilities of Chemicals
- Accidents During Transportation of Chemicals, Misuse of Chemicals
- Failures of Plant Safety Design
- Sabotage
- Human Error

Prevention and Response

- Role of Industry:
  - Identification of Hazardous Activities/Safety Audits
  - Maintenance of Plant
  - Emergency Preparedness
  - Compliance with Rules and Regulations.
  - Training the Employees.

Prevention and Response

Role of Government:

- Strict Enforcement of Laws
- Regularly Updating of Rules, Norms and Guidelines
- Developing of Specialised Force to Manage Industrial Disaster
- International Collaboration in Sharing of Best Practises

Flow of this Disaster Management Module

- Basics of DM
- keywords used in DM
- DM policies in India and International Conventions
- Types of Disaster and Ways to Manage them

Thank You