18CEO307T – DISASTER MITIGATION AND ITS MANAGEMENT

UNIT I - INTRODUCTION TO DISASTER

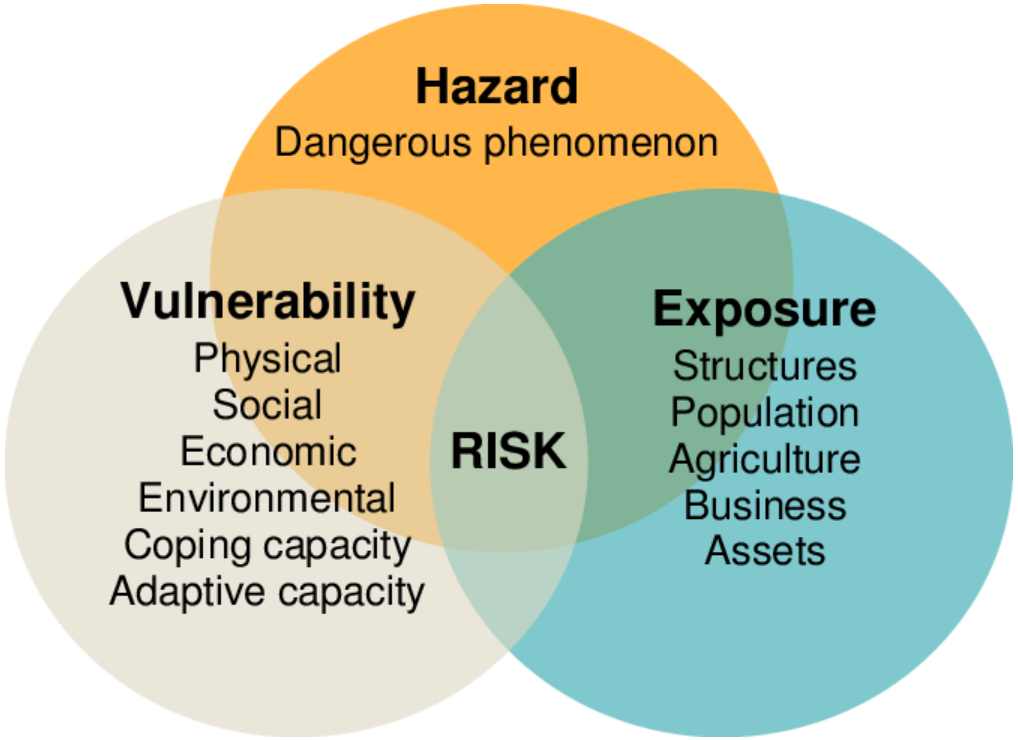
18CEO307T – DISASTER MITIGATION AND ITS MANAGEMENT

Disaster?

A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources.

Hazard, Risk, Vulnerability and Disaster

A hazard can be defined as a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

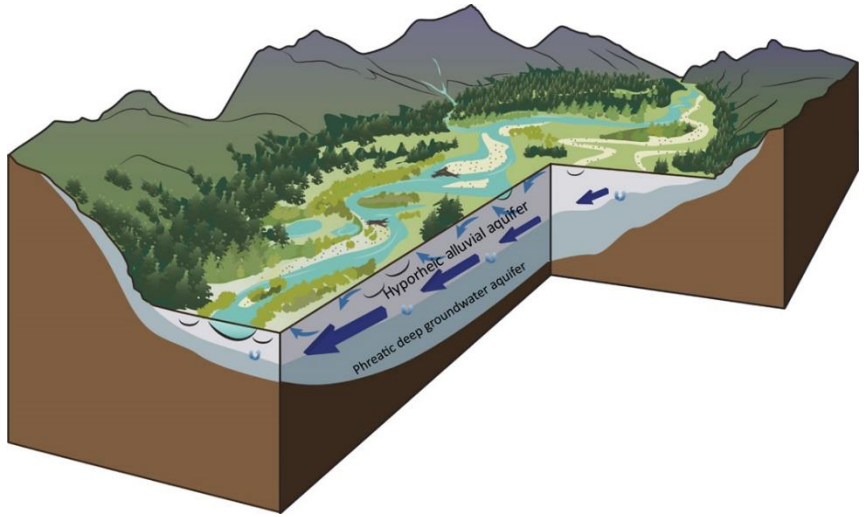


Hazards may be inevitable, but disasters can be prevented.

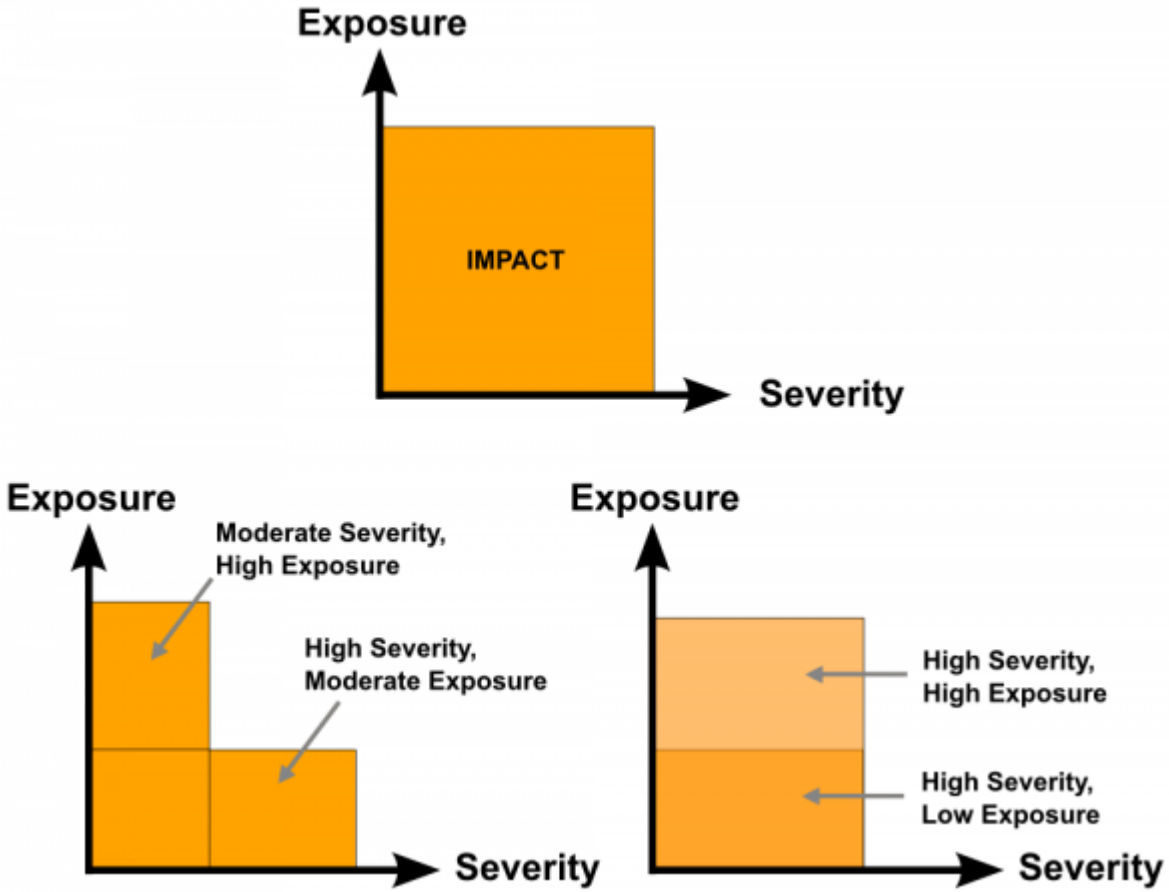
Vulnerability refers to the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

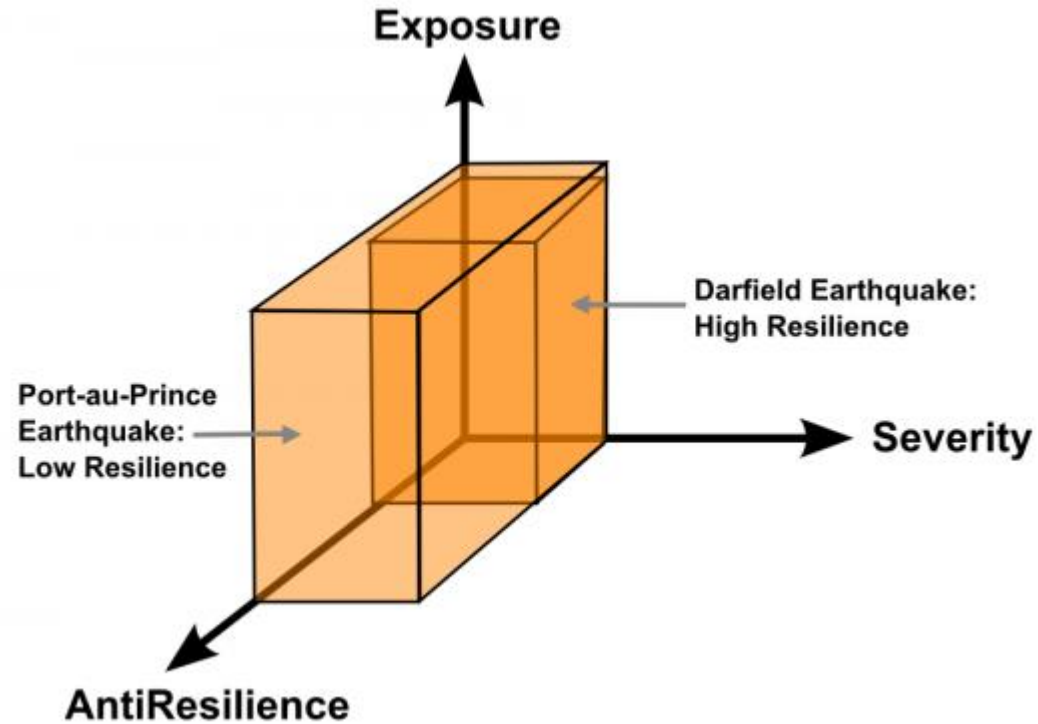
Exposure refers to people, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.

Hazard, Risk, Vulnerability and Disaster



Vulnerability is the inability to resist a hazard or to respond when a **disaster** has occurred





The total human impact of a natural disaster is controlled both by the severity of the event, and how much of our stuff is in the way (exposure). In an area with high exposure, even a moderate severity event can have a large impact.

The resilience of an area to a hazard is also an important control, meaning that events of the same severity can have very different impacts.

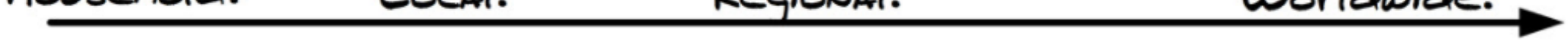
Dimensions of Disaster

- A single word – each beginning with the letter 'v' – represents respectively each of disaster's seven dimensions:
    1. **V**alues – a) Human life b) Social value c) Commercial value and d) Environmental value.
    2. **V**olition – Safety Rules and Regulations.
    3. **V**elocity – Speed of the occurrence and destructions.
    4. **V**icinity- Impact on the Associated areas.
    5. **V**ictims – Affected community.
    6. **V**ulnerability
    7. **V**ision – Goals and Policies

Dimensions of Disaster Management

- Disruption to normal pattern of life, usually severe and may also be sudden, unexpected and widespread
- Human effects like loss of life, injury, hardship and adverse effect on health
- Effect on social infrastructure such as destruction of or damage to government systems, buildings, communications and essential services
- Community needs such shelter, food, clothing, medical assistance and social care.

Geographic Scale of Disasters
(examples)



Household:	Local:	Regional:	Worldwide:
Heating or cooling failure	Water pollution	Tsunami	Gamma ray burst
Leaking roof	Power outage	Tornado	Nuclear war
Internet outage	Cell phone outage	Hurricane/cyclone	Asteroid impact
Water pipe break	Terrorist attack	Ice storm	Alien attack
House fire	Mudslide	Flooding	Sun burnout
	Earthquake	Blizzard	Supervolcano
		Volcanic eruption	

Scope of Disaster

- The term “Disaster Management” encompasses the complete realm of disaster-related activities. Disaster management covers a much broader scope, and many modern disaster managers may find themselves far more involved in pre-disaster activities than in post-disaster response.

Scope of Disaster

1. The refugee field of disaster management is highly specialized and requires not only many development skills but also a broader awareness of political, legal, and humanitarian issues.
2. DM aims and objectives, elements, Natural/man-made Disasters
3. Victims and Relief Systems
4. Phases of Disaster Response/Relief Operations, Government's Role
5. Refugee Assistance Models
6. Prevention and Mitigation Tools, Preparedness Tools
7. Tools of Post-Disaster Management, Mapping, Aerial Photography and Remote Sensing
8. Information Management
9. Epidemiology.

Types of Hazards

There could be many type of hazards:

- Water and Climate Hazards
- Geological Hazards
- Environmental Hazards
- Biological Hazards
- Chemical , Industrial and Nuclear Hazards

Water and Climate related disasters

- Floods and Drainage Management
- Cyclones
- Tornadoes and Hurricanes
- Hailstorm
- Cloud Burst
- Heat Wave and Cold Wave
- Snow Avalanches
- Droughts
- Sea Erosion
- Thunder & Lightning

Geologically related disasters

Earthquake

- Landslides and Mudflows
- Dam Failures/ Dam Bursts.
- Mine Fires

Environmental Disasters

1. Environmental Pollution
2. Deforestation
3. Desertification
4. Pest Infestation
5. Epidemics

Biologically related disasters

- Biological Disasters and Epidemics
- Pest Attacks
- Cattle Epidemics
- Food Poisoning

Chemical, Industrial & Nuclear related disasters

- Chemical and Industrial Disasters
- Nuclear Disasters

Accident related disasters

- Forest Fires
- Urban Fires
- Mine Flooding
- Oil Spill
- Major Building Collapse
- Serial Bomb Blasts
- Festival related disasters
- Electrical Disasters & Fires
- Air, Road and Rail Accidents.
- Boat Capsizing.
- Village Fire

Disasters occur in varied forms

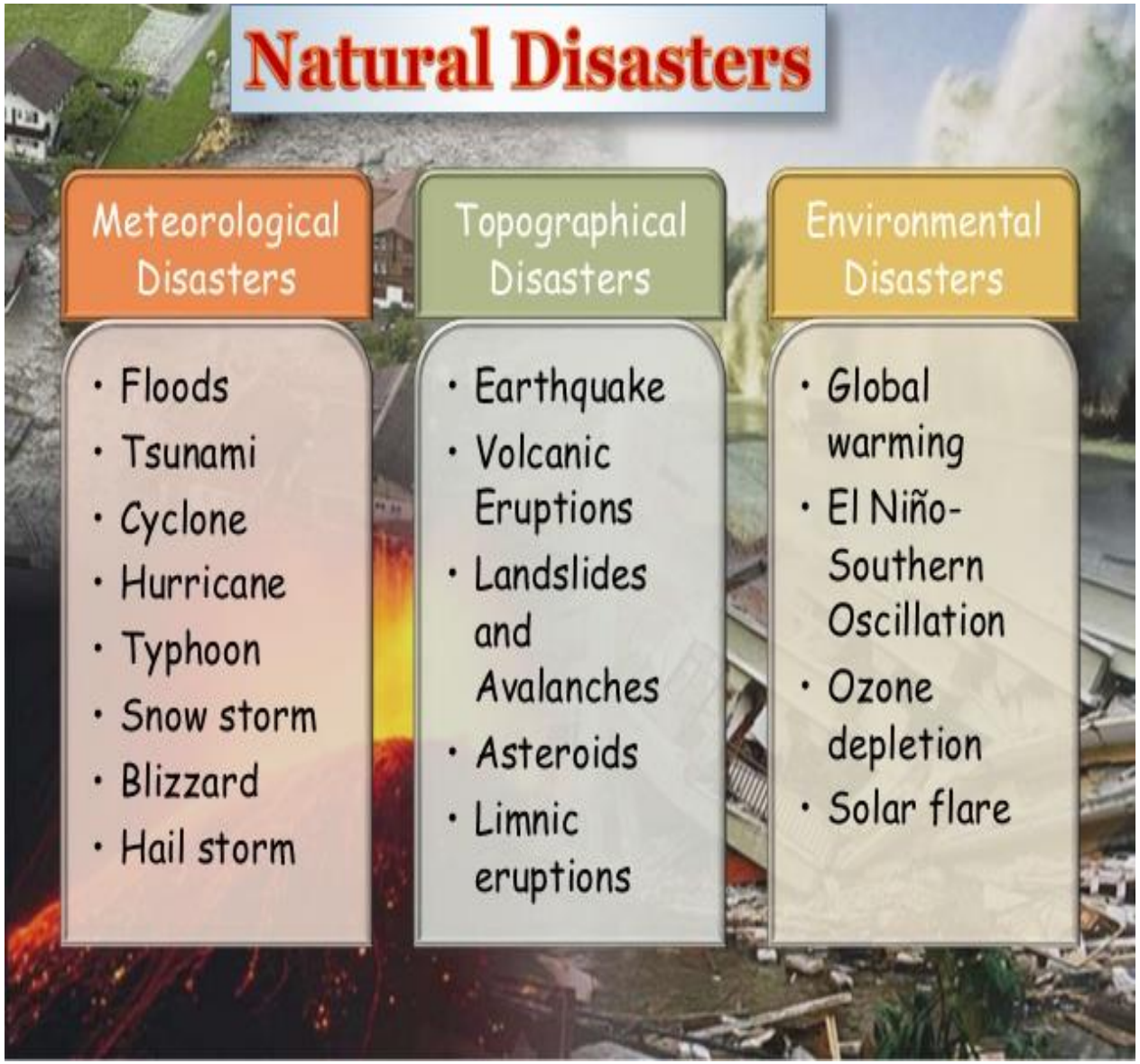
- Some are predictable in advance
- Some are annual or seasonal
- Some are sudden and unpredictable

Events	**Units**
• Floods	Days and weeks
• Earthquakes	Seconds/minutes
• Cyclones	Days
• Droughts	Months

DISASTER-EFFECTS

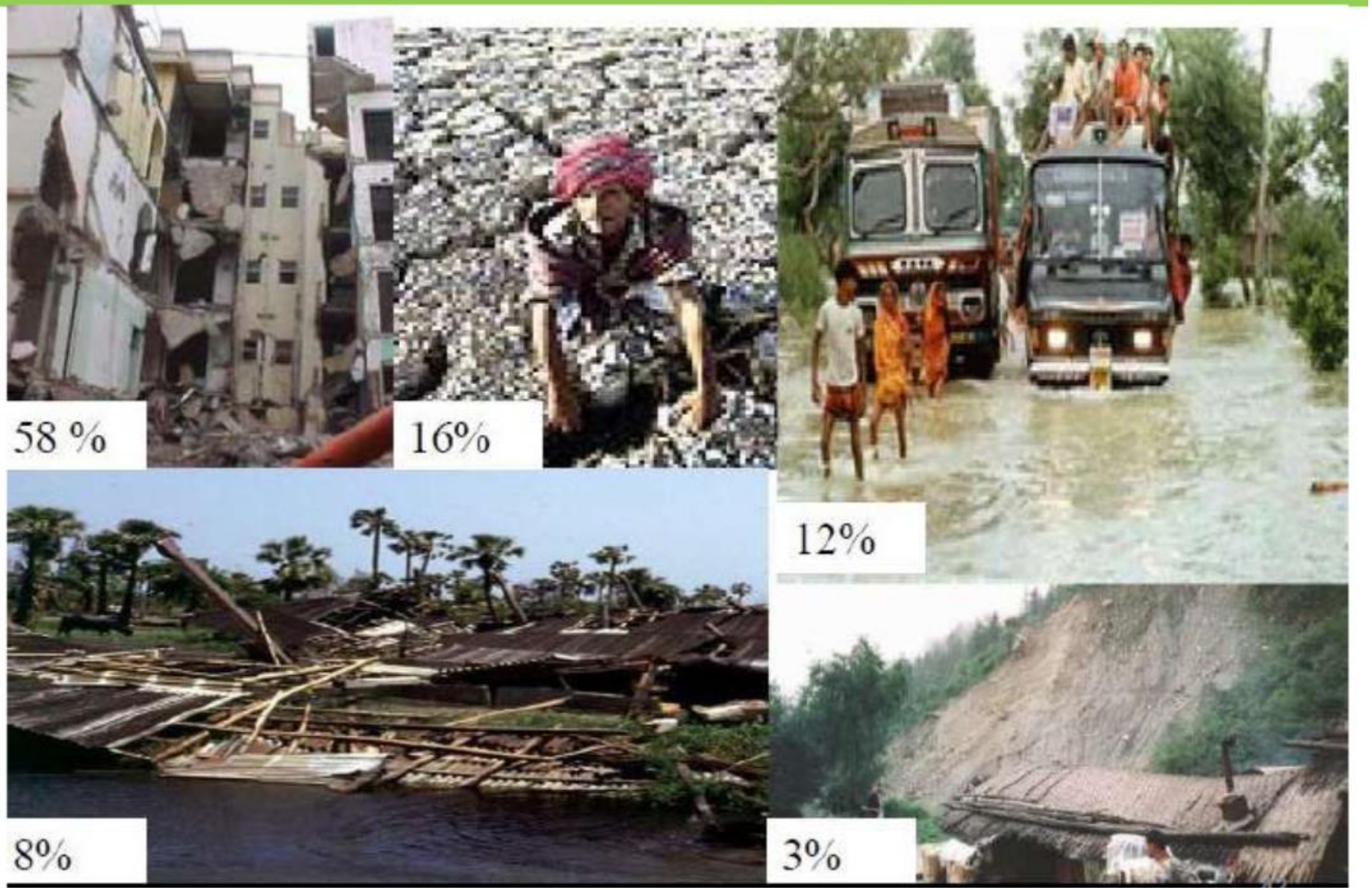
- Deaths
- Disability
- Increase in communicable disease
- Psychological problems
- Food shortage
- Socioeconomic losses
- Shortage of drugs and medical supplies.
- Environmental disruption


TYPES OF DISASTER
Natural Disasters
Meteorological
Topographical
Environmental
Man-made Disasters
Technological
Industrial accidents
Security related


Natural Disasters
Meteorological Disasters
• Floods
• Tsunami
• Cyclone
• Hurricane
• Typhoon
• Snow storm
• Blizzard
• Hail storm
Topographical Disasters
• Earthquake
• Volcanic Eruptions
• Landslides and Avalanches
• Asteroids
• Limnic eruptions
Environmental Disasters
• Global warming
• El Niño-Southern Oscillation
• Ozone depletion
• Solar flare

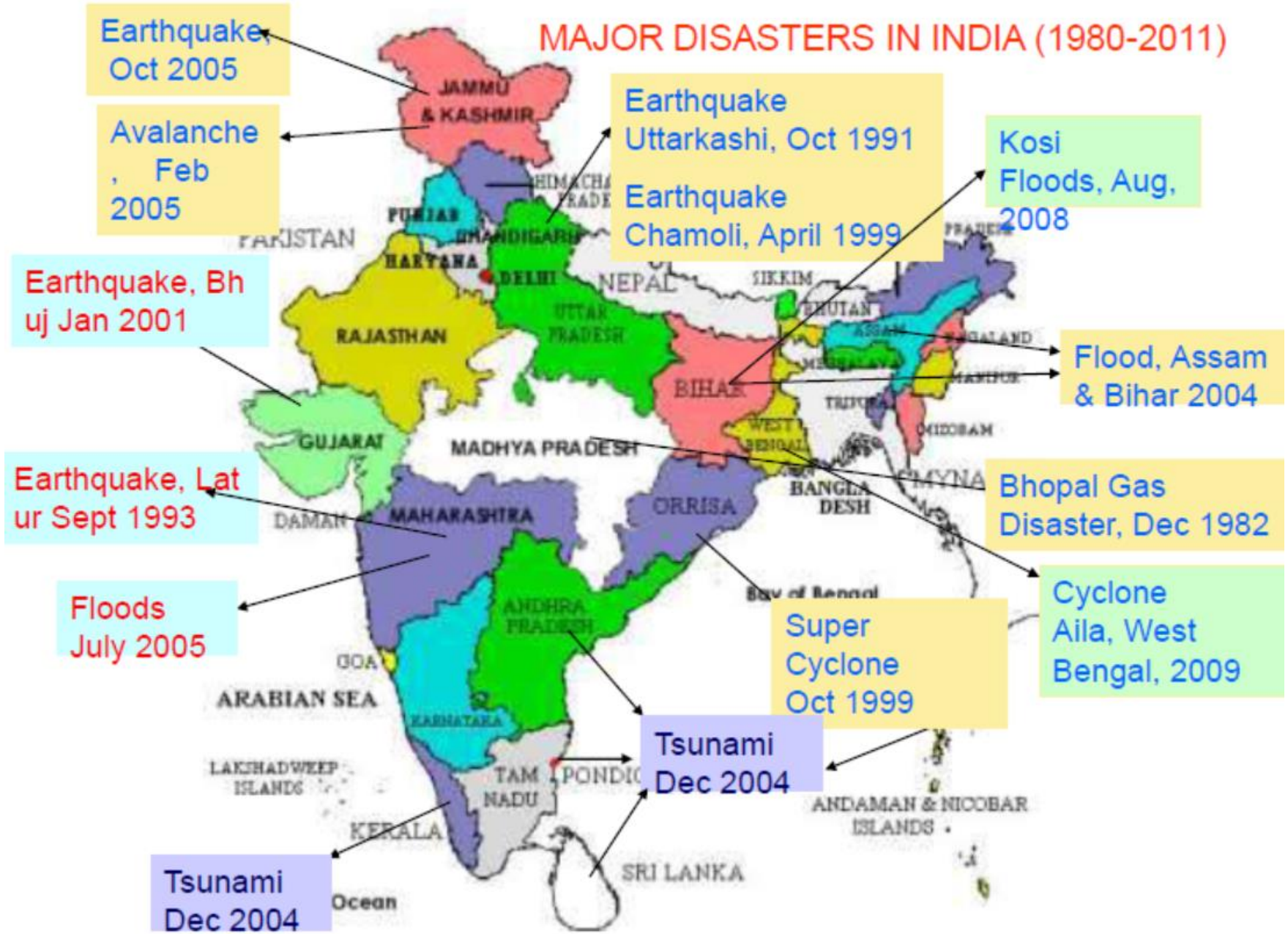

Man made Disasters
Technological
• Transport failure
• Public place failure
• Fire
Industrial
• Chemical spills
• Radioactive spills
Warfare
• War
• Terrorism
• Internal conflicts
• Civil unrest
• CBRNE

VULNERABILITY PROFILE OF INDIA



Major Disasters in India

- 1984 Bhopal Gas Tragedy
- 2001 Gujarat earthquake
- 2004 Indian Ocean tsunami
- 2008 Mumbai attacks

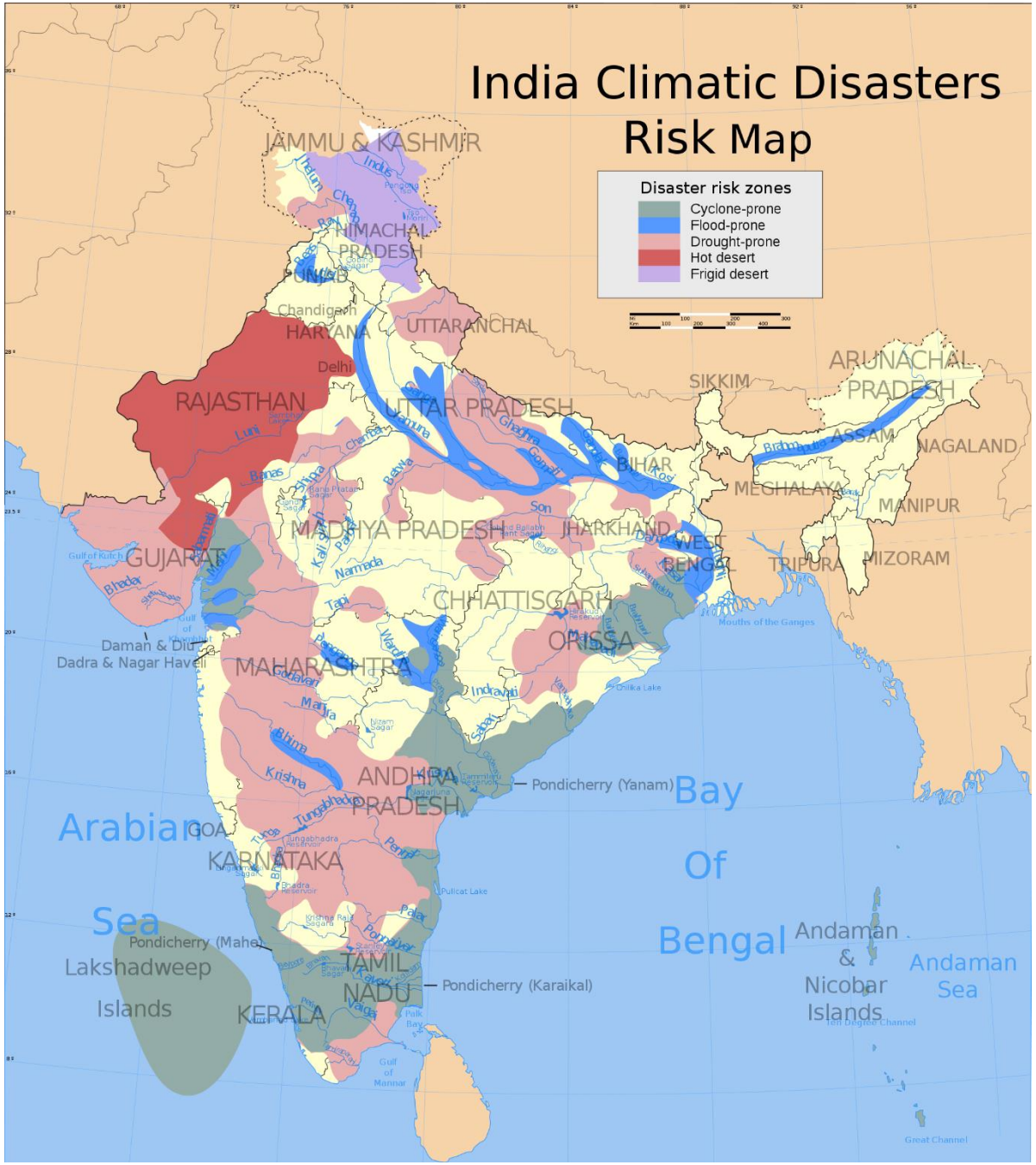

MAJOR DISASTERS IN INDIA (1980-2011)
Earthquake, Oct 2005
Avalanche, Feb 2005
Earthquake Uttarkashi, Oct 1991
Earthquake Chamoli, April 1999
Kosi Floods, Aug, 2008
Earthquake, Bhuj Jan 2001
Flood, Assam & Bihar 2004
Earthquake, Latur Sept 1993
Bhopal Gas Disaster, Dec 1982
Floods July 2005
Cyclone Aila, West Bengal, 2009
Super Cyclone Oct 1999
Tsunami Dec 2004
Tsunami Dec 2004
JAMMU & KASHMIR
PUNJAB
CHANDIGARH
HARYANA
DELHI
RAJASTHAN
UTTAR PRADESH
NEPAL
SIKKIM
BHUTAN
BIHAR
GUJARAT
MADHYA PRADESH
MAHARASHTRA
ORRISA
BANGLA DESH
ANDHRA PRADESH
GOA
ARABIAN SEA
KARNATAKA
LAKSHADWEEP ISLANDS
TAM NADU
KERALA
SRI LANKA
ANDAMAN & NICOBAR ISLANDS
Ocean

Major Disasters in India (last 40 years)

Sl. No.	Event	Year	State & Area	Effects
1	Drought	1972	Large part of country	200 million affected
2	Cyclone	1977	Andhra Pradesh	10,000 people & 40,000 cattle died
3	Drought	1987	15 states	300 million affected
4	Cyclone	1990	Andhra Pradesh	967 died & 435,000 acres land affected
5	Earthquake	1993	Latur, Maharashtra	7,928 people died & 30,000 injured
6	Cyclone	1996	Andhra Pradesh	1000 people died and 5,80,000 houses destroyed
7	Super cyclone	1999	Orissa	Over 10,000 deaths
8	Earthquake	2001	Bhuj,Gujrat	13,805 deaths, 6.3 millions affected

Major Disasters in India (last 40 years)

Sl.No.	Event	Year	State & Area	Effects
9	Tsunami	2004	Coastline TN, Kerala, AP, A&N islands & Puducherry	10,749 deaths and 5,640 missing, 2.79 Millions
10	Floods	July 2005	Maharashtra	1094 deaths 167 injured, 54 missing
11	Earthquake	2008	Kashmir	1400 deaths
12	Kosi floods	2008	North Bihar	527 deaths,19,323 cattle died
13	Cyclone	2008	Tamilnadu	204 deaths
14	Krishna floods	2009	Andhrapradesh & Karnataka	300 died
15	Flash flood	June 2013	Uttarakhand	5,700 deaths, 70,000 affected
16	Phailin Cyclone	Oct 2013	Coastline of Orissa, Jharkhand	27 died, 10,00,000 evacuations


India Climatic Disasters Risk Map
Disaster risk zones
Cyclone-prone
Flood-prone
Drought-prone
Hot desert
Frigid desert
JAMMU & KASHMIR
HIMACHAL PRADESH
UNJAB
Chandigarh
HARYANA
UTTARANCHAL
Delhi
RAJASTHAN
UTTAR PRADESH
SIKKIM
ARUNACHAL PRADESH
ASSAM
NAGALAND
BIHAR
MEGHALAYA
MANIPUR
MADHYA PRADESH
JHARKHAND
WEST BENGAL
TRIPURA
MIZORAM
GUJARAT
CHHATTISGARH
ORISSA
Daman & Diu
Dadra & Nagar Haveli
MAHARASHTRA
ANDHRA PRADESH
Pondicherry (Yanam)
Arabian Sea
GOA
KARNATAKA
Bay Of Bengal
Pondicherry (Mahe)
Lakshadweep Islands
TAMIL NADU
Pondicherry (Karaikal)
KERALA
Andaman & Nicobar Islands
Andaman Sea


Disaster Map
Arabian Sea
Bay of Bengal
Cyclone-prone
Flood-prone
Drought-prone
Hot-Desert
Frigid-Desert
Source 24point0.com/

Elements at Risk

- People
- Livestock
- Rural Housing Stock
- Houses Vulnerable
- Crops, Trees,Telephone, Electric poles
- Boats, Looms, Working Implements
- Personal Property
- Electricity, Water and Food Supplies
- Infrastructure Support

Disaster Management

- Disaster management is the discipline that involves preparing, warning, supporting and rebuilding societies when natural or man-made disasters occur.
- It is the continuous process in an effort to avoid or minimize the impact of disasters resulting from hazards.

DISASTER MANAGEMENT

The body of policy and administration decisions and operational activities that pertain to various stages of a disaster at all levels.

An applied science which seek, by systematic observation and analysis of disasters, to improve measures relating to
prevention, mitigation, preparedness, emergency response and recovery.

Encompass all aspects of planning for and responding to disasters, including both pre and post disaster activities.

AIMS/ GOALS OF DISASTER MANAGEMENT

- Reduce (Avoid, if possible) the potential losses (lives & infrastructure) from hazards.
- Reduce the risks by timely measures, short-term and long-term policies
- Assure prompt and appropriate assistance to victims of disaster when necessary.
- Achieve rapid, effective, sustained & durable recovery & rehabilitation.

Aim of Disaster Management

- Implementing the disaster management cycle (mitigation, preparedness, response and recovery) in the aspects of disaster management.
- Quick and effective communication system in every sector.
- Formulating and implementing disaster management policy, plan, law and regulations in regional, national and global sector.
- Reporting, analysing and monitoring risk performance, intensity etc.
- Planning and executing community, society based CDMP (Comprehensive Disaster Management Programme (CDMP), DRR (Disaster Risk Reduction), CRA (Community Risk Assessment), CCRM (Climate Change Risk Management) and HRD (Human Resource Development), risk assessment, vulnerability analysis and reduction etc.
- Engaging with disaster education, training, research, adaptation and management activities.
- Coordinating and collaborating with all disaster management and related organizations, NGO's, local and international agencies and creating strong network among them.
- Integrating with all other human, resource and development programs.

What is Disaster Management

Preparedness -- activities prior to a disaster.
Examples: preparedness plans; emergency exercises/training; warning systems.

Response -- activities during a disaster.
Examples: public warning systems; emergency operations; search and rescue.

Recovery -- activities following a disaster.
Examples: temporary housing; claims processing and grants; long-term medical care and counseling.

Mitigation - activities that reduce the effects of disasters.
Examples: building codes and zoning; vulnerability analyses; public education.

Disaster Management Cycle

1. **Preparedness:** Measures enabling govt orgs, communities and individuals to respond rapidly and effectively to disaster situations.
2. **Response:** Measures taken immediately prior to and following disaster impact.
3. **Recovery:** Process by which communities and the nation are assisted in returning to their proper level of functioning.
4. **Mitigation:** Measures aimed at reducing the impact of a natural or man-made disaster on a nation or community.

Response

- Includes actions taken to save lives, prevent damage to property, and to preserve the environment during emergencies or disasters.
- It is the implementation of action plans.
- Activities during disaster
- Public warning systems, emergency operations, search and rescue
- The response phase includes the mobilization of the necessary emergency services and first responders in the disaster area.

RECOVERY

Activities following a disaster

- Ex.. Temporary housing, claims processing and grants, long term medical care and counselling
- The aim of the recovery phase is to restore the affected area to its previous state.
- Includes actions that assist a community to return to a sense of normalcy after a disaster.

Mitigation

- Activities that reduces the effects of disaster.
- It reduces either the chance of a hazard taking place or a hazard turning into disaster.
- Mitigation efforts are attempts to prevent hazards from developing into disasters altogether or to reduce the effects of disasters.
- It focuses on long-term measures for reducing or eliminating risk.
- Mitigation measures can be structural or non-structural.
- It includes building codes; zoning and land use management; regulations and safety codes; preventive health care; and public education.

Mitigation

- Risk reduction

Anticipatory measures and actions that seek to avoid future risks as a result of a disaster.

- Prevention

Avoiding a disaster at the eleventh hour.

Includes activities which actually eliminate or reduce the probability of disaster occurrence, or reduce the effects of unavoidable disasters.

DISASTER PREPAREDNESS

Disaster preparedness aims at minimizing the adverse effects of a hazard

1. **Through effective precautionary actions**
2. **Ensure timely, appropriate and efficient organization and delivery of emergency response following the impact of a disaster**.

- Plans made to save lives or property.
- This phase covers implementation/operation, early
- Warning systems and capacity building

Disaster Preparedness Framework

COMPONENTS OF PREPAREDNESS		
Vulnerability Assessment	Planning	Institutional Framework
Information System	Resource Base	Warning Systems
Response Mechanisms	Public Education and Training	Rehearsals

Stages of Disaster Management Cycle

The cycle generally comprises four major stages:

1. **Disaster Prevention, Preparedness and Mitigation**
2. **Disaster Response and Immediate Relief**
3. **Disaster Rehabilitation, Reconstruction and Recovery**
4. **Long-term Development**

Disaster Management Continuum

pre-disaster phase

- Prevention
- Mitigation
- Preparedness

post-disaster phase

- Response
- Rehabilitation
- Reconstruction

Six elements that defines the complete approach to Disaster Management.

Outcomes of the DM

- Appropriate actions at all points in the cycle lead to greater preparedness, better warnings, reduced vulnerability or the prevention of disasters during the next iteration of the cycle.
- The complete disaster management cycle includes the shaping of public policies and plans that either modify the causes of disasters or mitigate their effects on people, property, and infrastructure.
- Capacity to obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.

Presentation on Disaster Management in INDIA

1. Introduction

✓India has been traditionally vulnerable to natural disasters on account of its unique geo-climatic conditions.

✓Floods, droughts, cyclones, earthquakes and landslides have been a recurrent phenomena.

✓The super cyclone in Orissa in October, 1999 & the Bhuj earthquake in Gujarat in January, 2001 was occurred.

✓Over the past couple of years, the Government of India have brought about a paradigm shift in the approach to disaster management.

✓Disaster management occupies an important place in this country's policy framework as it is the poor and the under-privileged who are worst affected on account of calamities/disasters.

2. Definition

The Disaster Management Act, 2005 defines disaster as "*A catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area*".

The United Nations defines disaster as *"The occurrence of sudden or major misfortune which disrupts the basic fabric and normal functioning of the society or community"*.

3. Objectives

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

✓ Capacity building including research & knowledge management.

✓ Prompt response to any threatening disaster situation or disaster.

✓ Assessing the severity or magnitude of effects of any disaster.

4. Approach

✓ Community based DM, including last mile integration of policy.

✓ Plans & execution.

✓ Capacity development in all spheres.

✓ Consolidation of past initiatives & best practice.

✓ Co-operation with agencies at national & international levels.

✓Multi-sectoral synergy

5. Disaster Management Act, 2005

✓This Act provides for the effective management of disaster and for matters connected there with or incidental thereto.

✓ It provides institutional mechanisms for drawing up and monitoring the implementation of the disaster management.

✓The Act also ensures measures by the various wings of the Govt. for prevention and mitigation of disasters and prompt response to any disaster situation.

✓ The Act further provides for the constitution of different Executive Committee at national and state levels.

✓The Act also provides specific roles to local bodies in disaster management.

There are two National Level Institution,

- National Disaster Management Authority (NDMA).
- National Executive committee (NEC).

There are two State Level Institution,

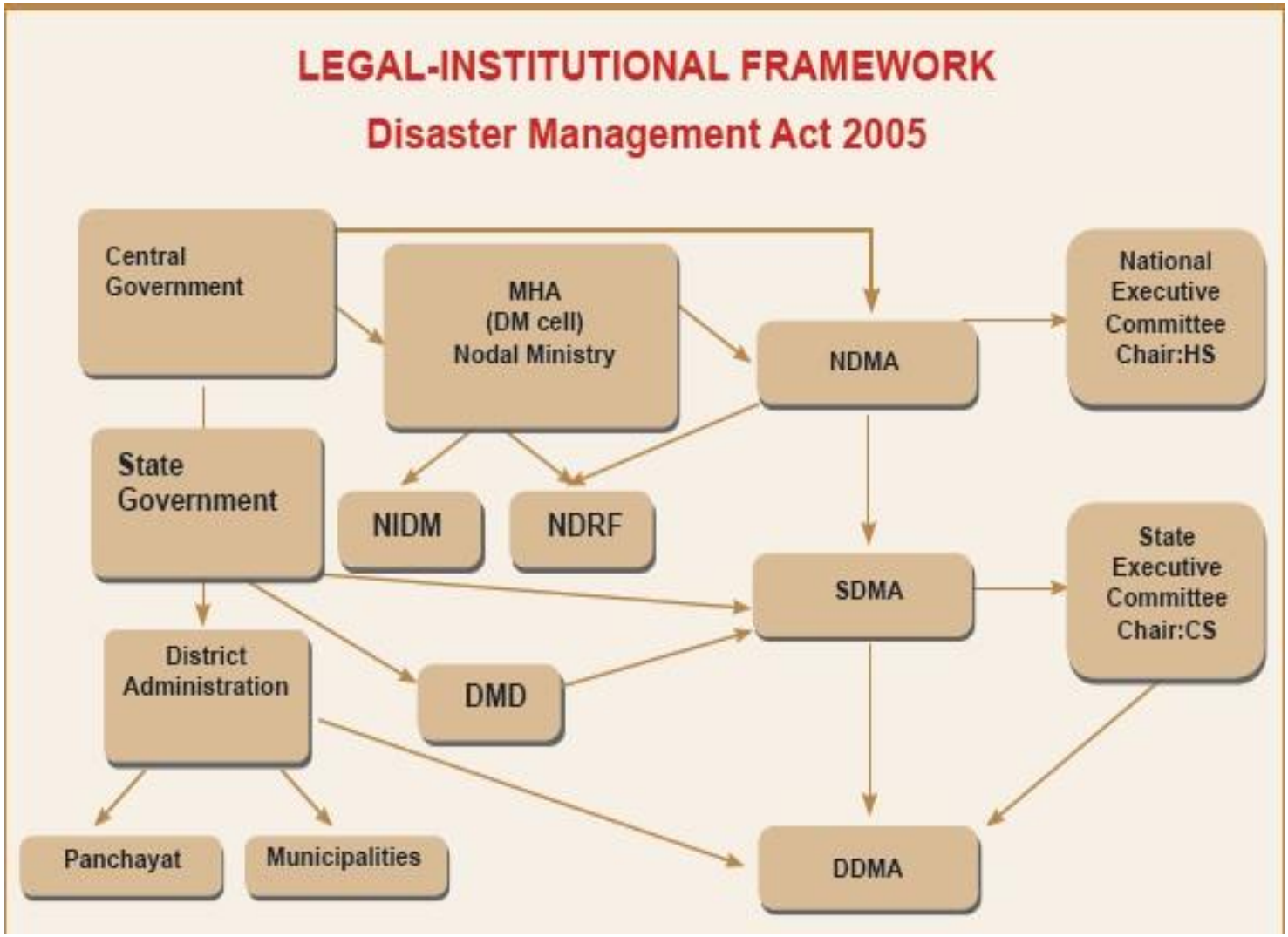
- State Disaster Management Authority (SDMA).
- State Executive Committee (SEC).

There are one District Level Institution,

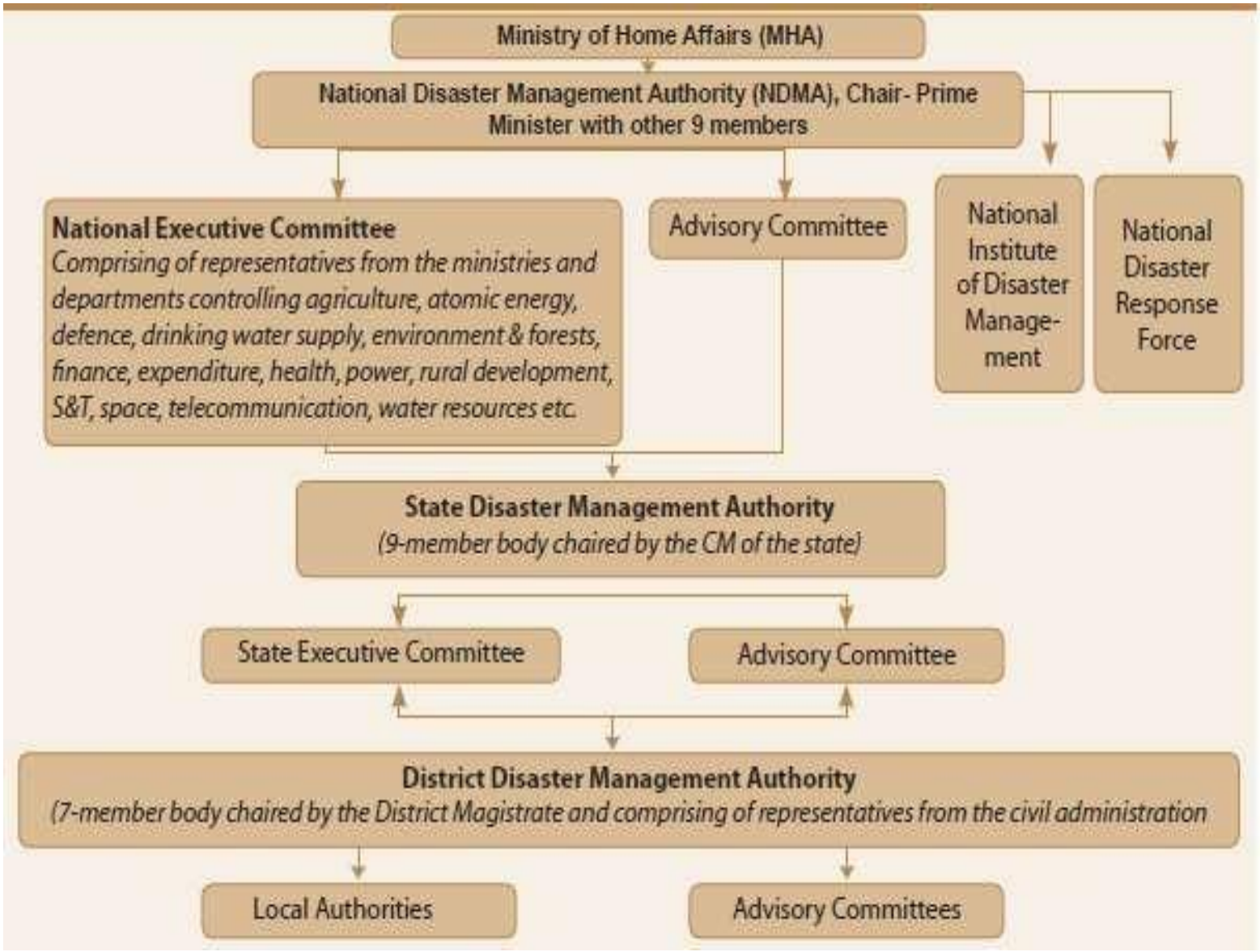
- District Disaster Management Authority (DDMA).

6. National Disaster Management Authority

- ✓ Approve the National Plan.
- ✓Approve plans prepared by the Ministries or Departments of the Government of India in accordance with the National Plan.
- ✓Lay down guidelines to be followed by the State Authorities in drawing up the State Plan.
- ✓Co-ordinate the enforcement and implementation of the policy and plan for disaster management.
- ✓ Recommend provision of funds for the purpose of mitigation.
- ✓Provide such support to other countries affected by major disasters as may be determined by the Central Government.



❑ Legal Institutional Framework



❑ Structure of National Disaster Management

7. Institutional Framework

✓Shifting from relief and response mode, disaster management in India started to address the issues of early warning systems, forecasting and monitoring setup for various weather related hazards.

✓A structure for flow of information, in the form of warnings, alert sand updates about the oncoming hazard, also emerged within this framework.

✓A multi-stakeholder High powered group was setup by involving representatives from different ministries and departments.

✓Some of these ministries were also designated as the nodal authorities for specific disasters.

8. National Policy on Disaster Management

✓The National Policy on Disaster Management (NPDM) has been approved by the central govt. on October 22, 2009 and circulated to all concerned.

✓ The policy covers all aspects of disaster management including institutional and legal arrangements, financial arrangements, disaster prevention, mitigation and preparedness, techno-legal regime, response, relief and rehabilitation, reconstruction and recovery, capacity development, knowledge management, research and development.

✓It focuses on the areas where action is needed and the institutional mechanism through which such action can be channelized.

✓ It aims to bring in transparency and accountability in all aspects of disaster management through involvement of community, community based organisations.

9. National Plan on Disaster Management

✓An institutional mechanism for preparation of the National Plan has been put in place, which is under preparation in three parts namely:-

- National Response Plan,
- National Mitigation Plan &
- National Capacity Building Plan.

✓The National Mitigation Plans are under preparation by the concerned nodal ministries for disasters in respect of which the Nodal Ministries have been identified and designated.

✓The Nodal Officers of the ministries concerned with the disasters are the conveners of the National Mitigation Plan Committees and are required to complete the Mitigation Plan in consultation with the members concerned with the respective disasters in NDMA.

10. Role of Government

a). State Govt.:-

✓In the context of federal set-up of India, the responsibility to formulate the Governments response to a natural calamity is essentially that of the concerned State Government.

✓Most of the States have Relief Commissioners under the Department of Disaster Management, who are in charge of the relief measures in the wake of natural disasters.

✓At the state level, the State Relief Commissioner supervises and controls relief operations through Collectors or Deputy Commissioners, who are the main functionaries to coordinate the relief operation at district level.

b). District Govt.:-

✓A District is sub-divided into sub-divisions and Tehsils or Talukas.

✓The head of a sub-division is called the Sub-Divisional Officer while the head of a Tehsil is generally known as the Tehsildar.

✓Contact with the individual villages is through the village Officer or Patwari who has one or more villages in his charge.

✓The entire hierarchy right from the Central Government to the District level is connected by means of a telecommunication system.

c). National Govt.:-

✓The National in the Ministry of Home Affairs functions 24×7 to monitor the disaster or disaster like situation.

✓During the south west monsoon, daily situation reports are prepared based on the feedback received from the affected States and concerned Central Ministries and organizations, and are sent to all concerned.

✓During the calamities of severe nature, special situation reports are also prepared and issued to all concerned.

✓It also developed a branch called National Disaster Response Force (NDRF).

✓The main task of NDRF is to provide specialist response in case of disasters.

11. Role of Non-Government

✓For large relief agencies & NGOs, the main response is to provide material relief & rescue operation during times of disaster including medical relief.

✓This is followed by a longer period of reconstruction activities of the physical infrastructure like roads, houses, community buildings, drinking water facilities etc. & continuation of medical aid.

✓For small & localized NGOs, initial response is in the form of rescue & material relief.

✓Most of larger India agencies stay back in disaster prone areas for disaster mitigation, long-term development of the people of area & especially for disaster preparedness before next disaster strikes.

✓Local NGOs, who also participate in relief & reconstruction activities during times of disaster, revert back to their usual pre-disaster activities after initial phase.

12. Various Types of Disaster

i.	Water and climate related disasters	a) b) c) d) e) f) g) h) i) j) k)	Floods and drainage management Cyclones Tornadoes and hurricanes Hailstorm Cloud burst Heat wave and cold wave Snow avalanches Droughts Sea erosion Thunder and lightening Tsunami
ii.	Geological related disasters	a) b) c) d)	Landslides and mudflows Earthquakes Dam failures/ Dam bursts Minor fires
iii.	Chemical, industrial and nuclear related disasters	a) b)	Chemical and industrial disasters Nuclear disasters
iv.	Accident related disasters	a) b) c) d) e) f) g) h) i) j) k)	Forest fires Urban fires Mine flooding Oil spills Major building collapse Serial bomb blasts Festival related disasters Electrical disasters and fires Air, road and rail accidents Boat capsizing Village fire
v.	Biological related disasters	a) b) c) d)	Biological disasters and epidemics Pest attacks Cattle epidemics Food poisoning

13. Some Significant Earthquakes in India

Date	Epicenter		Location	Magnitude
	Lat (Deg. N)	Lat (Deg. E)		
16 June 1819	23.6	68.6	Kutch, Gujarat	8.0
10 June 1869	25	93	Near Cachar, Assam	7.5
30 May 1885	34.1	74.6	Sopor, J&K	7.0
12 June 1897	26	91	Shilong Plateau	8.7
04 April 1905	32.3	76.3	Kangra, HP	8.0
08 July 1918	24.5	91.0	Srimangal, Assam	7.6
02 July 1930	25.8	90.2	Dhubri, Assam	7.1
15 Jan 1934	26.6	86.8	Bihar- Nepal Border	8.3
26 June 1941	12.4	92.5	Andaman Island	8.1
23 Oct 1943	26.8	94.0	Assam	7.2
15 Aug 1950	28.5	96.7	Arunachal Pradesh- China Border	8.5
21 July 1956	23.3	70.0	Anjar, Gujarat	7.0
10 Dec 1967	17.37	73.75	Koyna, Maharastra	6.5
19 June 1975	32.38	78.49	Kinnuar, HP	6.2
06 Aug 1988	25.13	95.15	Manipur-Myanmar Border	6.6
21 Aug 1988	26.72	86.63	Bihar- Nepal Border	6.4
20 Oct 1991	30.75	78.86	Uttarkhashi, Uttarakhand	6.6
30 Sept 1993	18.07	76.62	Latur- Osmanabad, Maharshtra	6.3
22 May 1997	23.08	80.06	Jabalpur, MP	6.0
29 Mar 1999	30.41	79.42	Chamoli Dist, UK	6.8
26 Jan 2001	23.40	70.28	Bhuj, Gujarat	7.7
08 Oct 2005	34.49	73.15	Kashmir	7.6

14. Case Study: Floods

- ✓Flood disasters have always brought miseries to numerous people, especially in rural areas.
- ✓Flood results in the outbreak of serious epidemics, specially malaria and cholera.
- ✓ India is one of the most flood prone countries in the world.
- ✓The average rainfall in India is 1150 mm with significant variation across the country.
- ✓ Most of the floods occur during the monsoon period.
- ✓ Floods occur in almost all rivers basins in India.
- ✓The main causes of floods are heavy rainfall, discharge of water from Reservoir, inadequate drainage to carry away the rainwater quickly to rivers.

❑ Floods in Uttarakhand in September2010


Chennai Flood 2015


Fani Cyclone 2019

- Gujarat Earthquake 2001

THANK YOU