Multi Hazard and Disaster Vulnerability of India
Introduction

In relation to hazards and disasters, vulnerability is a concept that links the relationship that people have with their environment to social forces and institutions and the cultural values that sustain and contest them. It's also the extent to which changes could harm a system or to which a community can be affected by the impact of a hazard. A natural disaster is a consequence when a natural calamity affects humans and/or the built environment.

Human vulnerability, and often a lack of appropriate emergency management, leads to financial, environmental, or human impact. The resulting loss depends on the capacity of the population to support or resist the disaster; their
Hazard meet with vulnerability & disaster happened

Hazard:
- Past Recurrence Intervals
- Future Probability
- Speed of Onset
- Magnitude
- Duration
- Spatial Extent
- Intensity

Vulnerability:
- People
- Property
- Essential Services
- Environment
- Economy

Risk
‘multi-hazard’ to describe the independent analysis of multiple different hazards (e.g., landslides, earthquakes, volcanic eruptions, flooding) relevant to a given area.
India’s Vulnerability to Disasters

- 57% land is vulnerable to earthquakes. Of these, 12% is vulnerable to severe earthquakes.
- 68% land is vulnerable to drought.
- 12% land is vulnerable to floods.
- 8% land is vulnerable to cyclones.
- Apart from natural disasters, some cities in India are also vulnerable to chemical and industrial disasters and man-made disasters.
Earthquakes

- Of the earthquake prone areas, 12% is prone to very severe earthquakes, 18% to severe earthquakes and 25% to damageable earthquakes.

- The biggest quakes occur in the Andaman and Nicobar Islands, Kutch, Himachal and the NorthEast. The Himalayan regions are particularly prone to earthquakes.

- The last two major earthquakes shook Gujarat and Jammu and Kashmir. Many smaller scale quakes occurred in other parts of India in 2006.

- All 7 North East states of India – Assam, Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and Megalaya; Andaman & Nicobar Islands; and parts of 6 other states in the North/NorthWest (Jammu and Kashmir, Uttarakhand, Bihar) and West (Gujarat), are in Seismic Zone V.
Earthquake Zones of India indicating 60 cities with population exceeding half a million.
About 30 million people are affected annually. Floods in the Indo–Gangetic–Brahmaputra plains are an annual feature. On an average, a few hundred lives are lost, millions are rendered homeless and several hectares of crops are damaged every year.

Nearly 75% of the total rainfall occurs over a short monsoon season (June – September). 40 million hectares, or 12% of Indian land, is considered prone to floods.

Floods are a perennial phenomenon in at least 5 states – Assam, Bihar, Orissa, Uttar Pradesh and West Bengal. On account of climate change, floods have also occurred in recent years in areas that are normal not flood prone. In 2006, drought prone parts of Rajasthan experienced floods.
Droughts

- About 50 million people are affected annually by drought. Of approximately 90 million hectares of rain-fed areas, about 40 million hectares are prone to scanty or no rain.
- Rainfall is poor in nine meteorological subdivisions out of 36 subdivision (each meteorological sub division covers a geographic area of more than ten revenue districts in India)
- In India annually 33% area receive rainfall less than 750 mm (low rainfall area) and 35 % area receive between 750 to 1125 mm rainfall Medium rainfall) and only 32percent falls in the high rainfall (>1126 mm) zone.
About 8% of the land is vulnerable to cyclones of which coastal areas experience two or three tropical cyclones of varying intensity each year. Cyclonic activities on the east coast are more severe than on the west coast.

The Indian subcontinent is considered to be the worst cyclone affected part of the world, as a result of low depth ocean bed topography and coastal configuration. The principal threat from a cyclone are in the form of gales and strong winds; torrential rain and high tidal waves/storm surges. Most casualties are caused due to coastal inundation by tidal waves and storm surges.

Cyclones typically strike the East Coast of India, along the Bay of Bengal, ie. the states of West Bengal, Orissa, Andhra Pradesh and Tamil Nadu, but also parts of Maharashtra and Gujarat at the Arabian Sea West Coast.
Landslides

Landslides occur in the hilly regions such as the Himalayas, NorthEast India, the Nilgiris, and Eastern and Western Ghats.

Landslides in India are another recurrent phenomenon. Landslide prone areas largely correspond to earthquake prone areas, i.e. Northwest and NorthEast, where the incidence of landslides is the highest.
MAP SHOWING LANDSLIDE AFFECTED STATES

Legend
- **Highly Affected**
- **Moderately Affected**
- **Marginally Affected**
Avalanche

- Avalanches are river like speedy flow of snow or ice descending from the mountain tops. Avalanches are very damaging and cause huge loss to life and property. In Himalayas, avalanches are common in Drass, Pir Panijat, Lahaul-Spiti and Badrinath areas. On an average around 30 people are killed every year due to this disaster in various zones of the Himalayas. Beside killing people, avalanches also damage the roads and others properties and settlements falling in its way.

**Area Prone to Avalanches**

- Avalanches are common in Himalayan region above 3500m elevation.
- Very frequent on slopes of 3045°.
- Convex slopes more prone to this disaster.
- North facing slope have avalanches in winter and south facing slopes during spring.
- Slopes covered with grass more prone to this hazard.
Forest Fire

- Forest or bush fire, though not causing much loss to human life, is a major hazard for forest cover in the country. As per FSI report, 50 per cent of the forest cover of the country is fire prone, out of which 6.17 per cent is prone to severe fire damage causing extensive loss to forest vegetation and environment.

- The major loss due to forest fire is caused to the environment which gets adversely affected by this calamity. The degradation of climate, soil and water quality, loss of wildlife and its habitat, deterioration of human health, depletion of ozone layer, etc.

- Along with direct loss to timber are the major adverse impact of forest fires. The coniferous forests in the Himalayan region are very susceptible to fire and every year there are one or more major fire incidences in these areas.

- The other parts of the country dominated by deciduous forest are also damaged by fire up to an extent. It is worth mentioning that in India 90 per cent of the forest fires are man made (intentionally or unintentionally).
Heat Waves, Cold waves and Fog

Heat waves refer to the extreme positive departure from the maximum temperature in summers. The fatalities caused by heat waves have increased in recent decades. The problem of heat wave is compounded by a decrease in diurnal temperature Range (DTR). In urban areas, the heat wave is increasing gaining notoriety for more and more fatalities.

Cold waves occur mainly due to the extreme low temperature coupled with incursion of dry cold winds from north-west. Most affected areas country due to the cold waves include the western and north-western regions and also Bihar, UP directly affected by the western disturbances.
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), was released at a Union Carbide pesticides factory.
### Epidemics in India

- Infectious diseases are a major public health problem in India. While many infectious diseases like tuberculosis and malaria are endemic, some of them occasionally attain epidemic Proportion.

- Epidemics are public health emergencies which disrupt routine health services and are major drain on resources. Epidemics include viral infections disease (meningitis, measles, dengue, polio, typhoid fever etc.) and Bacterial infectious diseases (cholera, diarrhoea etc.)

- The main causes for epidemic are non availability of clean and hygienic drinking water contamination of drinking water sources, lack of awareness about sanitation, unhygienic food, overcrowding, biological conditions in addition to ecological factors.
The table shows major disasters in the known history of India.

<table>
<thead>
<tr>
<th>SR. NO.</th>
<th>Name of Event</th>
<th>Year</th>
<th>Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Maharashtra Earthquake</td>
<td>1618</td>
<td>2,000</td>
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<tr>
<td>2.</td>
<td>Bengal Earthquake</td>
<td>1737</td>
<td>300,000</td>
</tr>
<tr>
<td>3.</td>
<td>Bengal Cyclone</td>
<td>1864</td>
<td>60,000</td>
</tr>
<tr>
<td>4.</td>
<td>The Great Famine of Southern India</td>
<td>1876-1878</td>
<td>5.5 million</td>
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<td>5.</td>
<td>Maharashtra Cyclone</td>
<td>1882</td>
<td>100,000</td>
</tr>
<tr>
<td>6.</td>
<td>The Great Indian famine</td>
<td>1896-1897</td>
<td>1.25 million to 10 million</td>
</tr>
<tr>
<td>7.</td>
<td>Kangra earthquake</td>
<td>1905</td>
<td>20,000</td>
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<tr>
<td>8.</td>
<td>Bihar Earthquake</td>
<td>1934</td>
<td>6,000</td>
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<tr>
<td>9.</td>
<td>Bengal Cyclone</td>
<td>1970</td>
<td>500,000 (include Pakistan and Bangladesh also)</td>
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<td>10.</td>
<td>Drought</td>
<td>1972</td>
<td>200 million people affected</td>
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<td>11.</td>
<td>Andhra Pradesh Cyclone</td>
<td>1977</td>
<td>10,000</td>
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<td>12.</td>
<td>Drought in Haryana &amp; Punjab</td>
<td>1987</td>
<td>300 million people affected</td>
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<td>13.</td>
<td>Latur Earthquake</td>
<td>1993</td>
<td>7,928 death and 30,000 injured</td>
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<tr>
<td>14.</td>
<td>Orissa Super Cyclone</td>
<td>1999</td>
<td>10,000</td>
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<td>15.</td>
<td>Gujarat Earthquake</td>
<td>2001</td>
<td>25,000</td>
</tr>
<tr>
<td>16.</td>
<td>Indian Ocean Tsunami</td>
<td>2004</td>
<td>10,749 deaths 5,640 persons missing</td>
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<tr>
<td>17.</td>
<td>Kashmir Earthquake</td>
<td>2005</td>
<td>86000 deaths (include Kashmir &amp; Pakistan)</td>
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<td>18.</td>
<td>Kosi Floods</td>
<td>2008</td>
<td>527</td>
</tr>
<tr>
<td>19.</td>
<td>Cyclone Nisha of Tamil Nadu</td>
<td>2008</td>
<td>204</td>
</tr>
</tbody>
</table>
Vulnerability Assessment

- Investigation of -

  a) causes of differential consequences and
  b) responses to offset, lessen or prevent potential adverse consequences.

- Seeks answers to questions such as -

  a) Who (or what) is vulnerable?
  b) To what are they vulnerable?
  c) Why are they vulnerable?
  d) What responses can lessen
Natural causes

Natural hazard

Human causes

Technological hazard

Vulnerability
(physical, economic, environmental and social factors)

Disaster risk on ...

Human beings

Fauna

Flora

Soil

Water Climate

Cultural Goods

Feedback
Vulnerability can be lessened by interventions at a number of points:

- Lessen exposure to perturbations and stresses
- Lessen sensitivities to exposures
- Increase capacities to cope or adapt
- Increase resilience and recovery potential
conclusion

♦ In order to tackle and reduce to risk of hazard ending up into disaster, we have to carry out disaster management in systematic way.

♦ Preparedness for any situation is a key actor.

♦ Mitigation measures should be carried out in a proper way.

♦ Response to any hazard should be well organized.