Hazard and vulnerability profile of India

Vulnerability Profile of India

- India is vulnerable, in varying degrees, to a large number of disasters. Around 59% of the landmass is prone to earthquakes of moderate to very high intensity.
- About 12% (over 40 million hectares) 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; and, the hilly areas are at risk from landslides and avalanches.
- Moreover, India is also vulnerable to chemical, biological, radiological and nuclear (CBRN) emergencies and other man-made disasters.
- Disaster risks in India are further compounded by increasing vulnerabilities related to changing demographics and socio-economic conditions, unplanned urbanization, development within high-risk zones, environmental degradation, climate change, geological hazards, epidemics and pandemics.
- Clearly, all these contribute to a situation where disasters seriously threaten India's economy, its population and sustainable development.

Indian sub-continent has unique geo-climatic and socio-political conditions that make it vulnerable to both the natural as well as manmade disasters. *Around 6% of the population of India is impacted annually* by the exposures to disasters. They Key natural disasters in India include floods, droughts, cyclones, earthquakes, landslides and avalanches that have resulted in loss of lives and livelihoods.

According to a Planning Commission report, the key vulnerabilities of India include the following:

- Coastal States, particularly in the East Coast and Gujarat on west coast, are vulnerable 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 of moderate to high density.
- Sub-Himalayan/ Western Ghat are vulnerable to landslides.

Vulnerability to disasters or emergencies of Chemical, Biological Radiological and Nuclear (CBRN) origin has increased on account of socioeconomic development. The changing climate also exasperates the vulnerabilities. The occurrence of heat waves, cold waves, floods, droughts, intense cyclones and flash floods is getting increased due to climate change and global warming.

Further, ***Disaster vulnerability is function of poverty*** *and p*overty is inextricably linked to disaster vulnerability. Poverty compels the people to compromise in matters of shelters and

dwellings and more and more people live at unsafe places. Moreover, the low cost material used in making the dwellings makes them more unsafe to live.

India's Hazard Profile

India is prone to disasters due to a number of factors; both natural and human-induced, including adverse geo-climatic conditions, topographic features, environmental degradation, population growth, urbanisation, industrialisation, non-scientific development practices etc. Various hazards to which India is prone to can be broadly divided into three categories viz. Hydrological or climate related; Geological and Technological hazards. They have been discussed below:

Hydrological and Climate related Hazards

Floods

Floods can be caused by heavy rainfall, inadequate capacity of rivers to carry the high flood discharge, inadequate drainage to carry away the rainwater quickly to streams/ rivers. ice jams or landslides blocking streams, typhoons and cyclones etc. Further, flash floods occur because of high rate of water flow particularly in areas with less permeability of soil.

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 of three to four months from June to September. As a result there is a very heavy discharge from the rivers during this period causing widespread floods. 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 (or winter monsoon). These have caused devesatiing floods in Chennai in 2015. Most devastating floods in recent times have been the 2013 Assam floods, 2013 Uttarakhand Floods, 2012 Brahamputra Floods etc.

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 in the region hit there. 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. from the centre of the cyclones and on either side of the storm track. The principal dangers from a cyclone include the gales and strong winds; torrential rain and high tidal waves (storm surges). Most casualties are caused by coastal inundation by tidal waves and storm surges.

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 of country due to the cold waves include the western and north-western regions and also Bihar, UP directly affected by the western disturbances.

Thunderstorm, Hailstorm, Dust Storm etc

India's central, north-eastern, north-western and northern parts are generally affected by these. The southern coastal areas are less prone to thunderstorms, hailstorms and dust storms. The hailstorms are more frequent in Assam, Uttarakhand and some parts of Maharashtra. Dust storms are common in Rajasthan, MP and Haryana. Tornadoes are rare in India.

Droughts

Drought refers to the situation of less moisture in the soil (which makes the land unproductive) and scarcity of water for drinking, irrigation, industrial uses and other purposes, usually caused by deficient/less than average rainfall over a long period of time. Some states of India feature the perennial drought such as Rajasthan, Odisha, Gujarat, Madhya Pradesh etc.

Sixteen percent of the country's total area is drought-prone and approximately 50 million people are affected annually by droughts. In India about 68 percent of net sown area in the country 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. In the arid and semi-arid zones, very severe droughts occur once in every eight to nine years.

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. More than half of India's total area is vulnerable to seismic activity of varying intensities.

The most vulnerable regions are located in the Himalayan, Sub-Himalayan belt and Andaman & Nicobar Islands. The Himalayan ranges are among world's youngest fold mountains so the subterranean Himalayans are geologically very active. The Himalayan frontal arc, flanked by the **Arakan Yoma** fold belt in the east and the **Chaman fault** in the west make one of the seismically active regions in the world.

Tsunami

Tsunami refers to the displacement of a large volume of a body of water such as Ocean. Most Tsunamis are seismically generated, result of abrupt deformation of sea floor resulting vertical displacement of the overlying water.

The Tsunami waves are small in amplitude and long wavelength (often hundred of kilometers long). The east and west coasts of India and the island regions are likely to be affected by Tsunamis generated mainly by subduction zone related earthquakes from the two potential source regions, viz. the Andaman-Nicobar-Sumatra Island Arc and the Makran subduction zone north of Arabian Sea.

Landslides

Landslides are common in India in Himalayan region as well as Western Ghats. The Himalayan ranges are among the youngest fold mountains of world. They comprise a series of seven curvilinear parallel folds running along a grand arc of around 3400 kilometers. The landslides in this region are probably more frequent than any other areas in the world.

The Western Ghats, particularly Nilgiri hills also are notorious for frequent landslides.

Technologic Disasters

Industrial, Chemical & 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), was released at a Union Carbide pesticides factory.