



VISION IAS

DISASTER MANAGEMENT

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S.N.	TOPIC	PAGE NO.
1.	Introduction to disaster management	2-4
2.	Disaster Management in India	5-23
3.	Natural Hazards in India	24-76
4.	International Cooperation and Current Development	77 83
5.	Miscellaneous	84-89
6.	Previous Years' Vision's Test Questions	90-105

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DISASTER MANAGEMENT

Contents

CHAPTER-1	2
1. Introduction to Disaster Management.....	2
1.1. What is a Disaster?.....	2
1.2. What is a Hazard?.....	2
1.3. What is Vulnerability?	3
1.4. What is Risk?	4
1.5. What is Capacity?	4
1.6. Classification of Disasters.....	4
1.7. Disaster Management Cycle.....	4
CHAPTER-2	5
2. Disaster Management in India	5
2.1. Background	5
2.2. National Disaster Management Act, 2005	6
2.3. National Policy on Disaster Management, 2009	13
2.4. The National Disaster Management Plan, 2016.....	13
2.5. Disaster Management Cycle in India.....	15
CHAPTER-3	24
3. Natural Hazards in India	24
3.1. India: Vulnerability Profile.....	24
3.2. Natural Disasters	25
3.3. Man Made Disasters	65
CHAPTER-4	77
4. International Cooperation and Current Developments	77
4.1. Global Frameworks for Disaster Risk Reduction	77
4.2. Partnerships with International Agencies	79
4.3. India's Leadership Initiatives	81
4.4. Bilateral Agreements with Countries	83
CHAPTER-5	84
5. Miscellaneous Topics.....	84
5.1. Disaster Insurance.....	84
5.2. Community Based Disaster Management.....	84
5.3. Role of the Media in Disaster Management	85
5.4. Role of Social Media in Disaster Management	86
5.5. Retrofitting of Buildings- The Key is to Let it Swing	86
5.6. Climate Change and Disasters.....	87
5.7. Poverty and Disasters.....	87
5.8. Miscellaneous NDMA Guidelines	88
5.9. National Disaster Plan for Animals.....	89
6. VISION IAS PREVIOUS YEARS TEST SERIES QUESTIONS	90

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CHAPTER-1

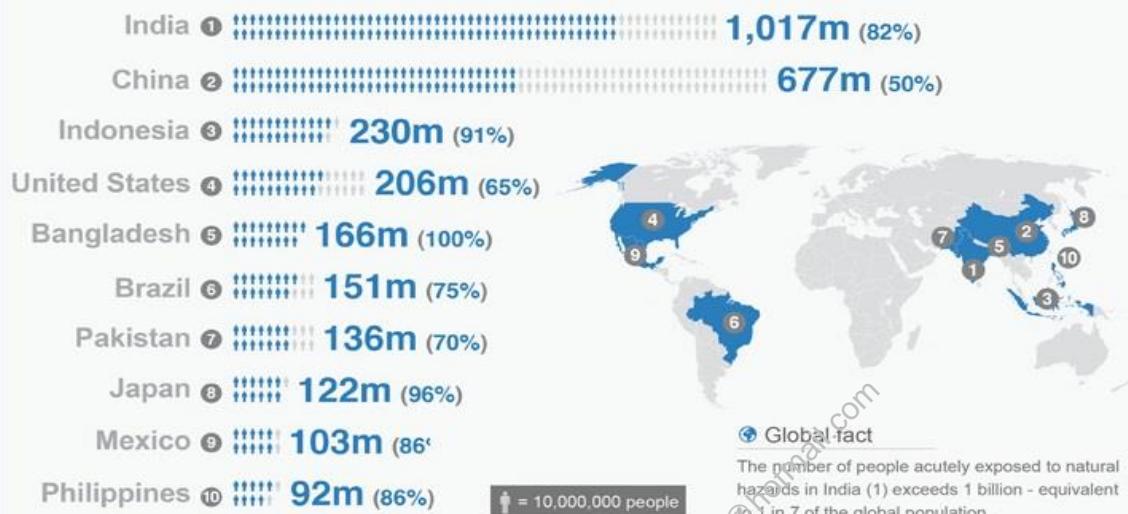
1. Introduction to Disaster Management

Disasters - natural or human-made are common throughout the world. It is believed that in the recent past there is an increase in their magnitude, complexity, frequency and economic impact. India is at the highest risk of exposure to natural hazards in the world.

1.1. What is a Disaster?

The term disaster owes its origin to the French word “**Desastre**” which is a combination of two words ‘**des**’ meaning bad and ‘**aster**’ meaning star. Thus the term refers to ‘Bad or Evil star’. A disaster can be defined as “A serious disruption in the functioning of the community or a society causing widespread material, economic, social or environmental losses which exceed the ability of the affected society to cope using its own resources”.

The 10 populations most exposed to natural hazards



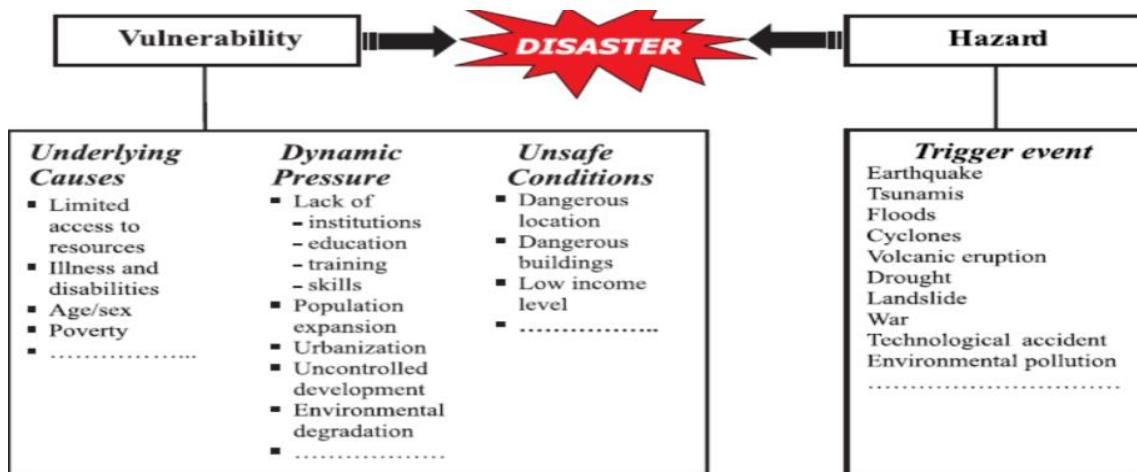
Disaster damage occurs during and immediately after the disaster. This is usually measured in physical units (e.g., square meters of housing, kilometres of roads, etc.), and describes the total or partial destruction of physical assets, the disruption of basic services and damages to sources of livelihood in the affected area.

Disaster impact is the total effect, including negative effects (e.g., economic losses) and positive effects (e.g., economic gains), of a hazardous event or a disaster. The term includes economic, human and environmental impacts, and may include death, injuries, disease and other negative effects on human physical, mental and social well-being.

A disaster is a result of the combination of **hazard, vulnerability and insufficient capacity** to reduce the potential chances of risk.

1.2. What is a Hazard?

The word ‘hazard’ owes its origin to the word ‘*hasard*’ in old French and ‘az-zahr’ in Arabic meaning ‘chance’ or ‘luck’. Hazard may be defined as “a dangerous condition or event, that threat or have the potential for causing injury to life or damage to property or the environment.”



Any hazard – flood, earthquake or cyclone along with greater vulnerability (inadequate access to resources, sick and old people, lack of awareness etc.) would lead to disaster causing greater loss to life and property.

For example; an earthquake in an uninhabited desert cannot be considered a disaster, no matter how strong the intensities produced. An earthquake is disastrous only when it affects people, their properties and activities. Thus, disaster occurs only when hazards and vulnerability meet. Also, with greater capacity of the individual/community and environment to face these disasters, the impact of a hazard reduces.

Difference between Natural Hazard and Disaster

Hazard	Disaster
Hazard is a threat. A hazard is a dangerous physical condition or event.	Disaster is an event. It is a calamity or tragedy or a consequence of a hazard. Natural hazards that cause great loss to human life and economy are called disasters and catastrophes. A disaster disrupts the normal function of the society.
Earthquakes, floods, volcanic eruption, landslides, droughts etc. are called natural hazards before they cause great loss of life and damage to property.	It causes damage to property and loss of life but it also disrupts the opportunities of employment.
Small numbers of people are affected.	A large number of people are affected.
It may cause injury, loss of life or damage of property.	It causes wide spread loss to life and property.
Earthquakes, floods, volcanoes, tsunami, land slide, drought etc. are natural hazards.	It affects the society to such an extent that external aid becomes sate the losses.

1.3. What is Vulnerability?

Vulnerability may be defined as “conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.”

Vulnerability may be of different forms, such as:

- **Economic Vulnerability:** Poorer families may live in squatter settlements because they cannot afford to live in safer (more expensive) areas.

- **Physical Vulnerability:** Wooden homes which are less likely to collapse in an earthquake, but are more vulnerable to fire.
- **Social Vulnerability:** When flooding occurs some citizens, such as children, elderly and differently able, may be unable to protect themselves or evacuate if necessary.

1.4. What is Risk?

Risk is a “measure of the expected losses due to a hazard event occurring in a given area over a specific time period. Risk is a function of the probability of particular hazardous event and the losses each would cause.”

$$\text{Risk} = \text{Hazard} \times \text{Vulnerability}$$

The level of risk depends upon nature of the hazard, vulnerability of the elements which are affected and economic value of those elements.

1.5. What is Capacity?

Capacity can be defined as the combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience. Capacity may include infrastructure, institutions, human knowledge and skills, and collective attributes such as social relationships, leadership and management.

Coping capacity is the ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk or disasters. The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during disasters or adverse conditions. Coping capacities contribute to the reduction of disaster risks.

1.6. Classification of Disasters

Disasters can be grouped into two broad categories namely natural and manmade.

Natural disasters are disasters which are caused because of natural phenomena (meteorological, geological or even biological origin). Examples of natural disasters are cyclones, tsunamis, earthquake and volcanic eruption which are exclusively of natural origin. Landslides, floods, drought, fires are socio-natural disasters since their causes are both natural and manmade. For example flooding may be caused because of heavy rains, landslide or blocking of drains with human waste.

Manmade disasters are disasters which occur due to human negligence. These are associated with industries or energy generation facilities and include explosions, leakage of toxic waste, pollution, dam failure, wars or civil strife etc. Many occur frequently while others take place occasionally. However, on the basis of their genesis, they can be categorized as follows:

1.7. Disaster Management Cycle

Disaster Risk Management includes sum total of all activities, programmes and measures which can be taken up before, during and after a disaster.

A typical disaster management continuum consists of:

- **A Pre-disaster risk management phase** which includes prevention, mitigation and preparedness.
- **Post-disaster crisis management phase** which includes relief, response, rehabilitation, reconstruction and recovery.

The three key stages of activities that are taken up within disaster risk management are:

1. Before a disaster (pre-disaster)

It includes activities taken to reduce human and property losses caused by a potential hazard. For example—carrying out awareness campaigns, strengthening the existing weak structures, preparation of the disaster management plans at household and community level etc. Such risk reduction measures taken under this stage are termed as mitigation and preparedness activities.



2. During a disaster (disaster occurrence)

Initiatives taken to ensure that the needs and provisions of victims are met and suffering is minimized. Activities taken under this stage are called emergency response activities.

3. After a disaster (post-disaster)

Initiatives taken in response to a disaster with a purpose to achieve early recovery and rehabilitation of affected communities, immediately after a disaster strikes. These are called as response and recovery activities.

CHAPTER-2

2. Disaster Management in India

2.1. Background

Disaster management in India has evolved from an **activity-based reactive setup to a proactive institutionalized structure** and from a **relief-based approach to a ‘multi-dimensional pro-active holistic approach for reducing risk’**.

In the pre-Independence era, the policy was relief oriented and relief departments were set up for emergencies during disasters. Activities included designing the relief codes and initialising food for work programmes. Post-Independence, the task for managing disasters continued to rest with the Relief Commissioners in each state, who functioned under the Central Relief Commissioner, with their role limited to delegation of relief material and money in the affected areas.

A permanent and institutionalised setup began in the decade of 1990s with setting up of a disaster management cell under the Ministry of Agriculture, following the declaration of the decade of 1990 as the ‘International Decade for Natural Disaster Reduction’ (IDNDR) by the UN General Assembly. Following a series of disasters such as Latur Earthquake (1993), Malpa Landslide (1994), Orissa Super Cyclone (1999) and Bhuj Earthquake (2001), a **high powered Committee under the Chairmanship of Mr. J.C. Pant**, Secretary, Ministry of Agriculture was constituted. Consequently, the disaster management division was shifted under the Ministry of Home Affairs in 2002 and a hierarchical structure for disaster management evolved in India.

The Tenth Five-Year Plan document also had, for the first time, a detailed chapter on Disaster Management. The Twelfth Finance Commission was also mandated to review the financial arrangements for Disaster Management.

Paradigm Shift in Disaster Management

On 23rd December 2005, the Government of India (GoI) enacted the Disaster Management Act, 2005, which envisaged the creation of the National Disaster Management Authority (NDMA), State Disaster Management Authorities (SDMAs) and District Disaster Management Authorities (DDMAs), to adopt a holistic and integrated approach to Disaster Management. This acted as a paradigm shift, from the erstwhile **relief-centric response to a proactive prevention, mitigation and preparedness-driven approach** to minimise loss of life, livelihood and property.

2.2. National Disaster Management Act, 2005

The National Disaster Management Act, 2005 lays down **institutional, legal, financial and coordination mechanisms** at the National, State, District and Local levels. The Act provides for the setting up of NDMA at national level, and, the SDMA at the state level and the DDMAs at the district level.

The **primary responsibility** for management of disaster rests with the **State Government** concerned. The institutional mechanism put in place at the Centre, State and District levels helps states to manage disasters in an effective manner.

2.2.1. Institutional Framework at National Level

Disaster Management Division, Ministry of Home Affairs: The overall coordination of disaster management vests with the Ministry of Home Affairs (MHA). The Disaster Management Division is responsible for response, relief and preparedness for natural calamities and man-made disasters (except drought and epidemics).

On behalf of the Central Government, DM Division in the Ministry of Home Affairs co-ordinates with disaster affected State Governments, concerned line ministries/departments, National Disaster Management Authority (NDMA), National Disaster Response Force (NDRF), National Institute of Disaster Management (NIDM) and the Directorate General of Fire Services, Home Guards and Civil Defence, and Armed Forces for effective disaster risk reduction.

National Executive Committee

It acts as the coordinating and monitoring body for disaster management. It is **chaired by the Union Home Secretary** and comprises of Secretary level officers from the Ministries and departments having control of agriculture, atomic energy, defence, drinking water supply, environment and forests, finance (expenditure), health, power, rural



development, science and technology, space, telecommunications, urban development and water resources. The Chief of Integrated Defence Staff of the Chiefs of Staff Committee, ex-officio, is also its member.

The NEC will coordinate response in the event of any threatening disaster situation or disaster where central assistance is needed. The NEC may give directions to the relevant Ministries/Departments of the GoI, the State Governments, and the State Authorities regarding measures to be taken by them in response to any specific threatening disaster situation or disaster as per needs of the State.

[UPSC Question: Comment on the following in not more than 50 words: Composition and functions of the National Executive Committee of the National Disaster Management Authority. (2011)]

The **Cabinet Committee on Security (CCS)** and the **National Crisis Management Committee (NCMC)** are the key committees involved in the top-level decision-making with regard to disaster management. The Cabinet Committee on Management of Natural Calamities was discontinued in 2014.

Cabinet Committee on Security (CCS)

The CCS deals with issues related to defence of the country, law and order, and internal security, policy matters concerning foreign affairs that have internal or external security implications, and economic and political issues impinging on national security. CCS will be involved in the decision making if the disaster has serious security implications.

National Crisis Management Committee (NCMC)

The NCMC deals with **major crises** that have serious or **national ramifications**. These include incidents such as those requiring close involvement of the security forces and/or intelligence agencies such as terrorism (counter-insurgency), law and order situations, serial bomb blasts, hijacking, air accidents, CBRN, weapon systems, mine disasters, port and harbour emergencies, forest fires, oilfield fires, and oil spills.

National Platform for Disaster Risk Reduction (NPDRR)

The Government of India recognized the need to evolve a participatory process of decision making with active involvement of the Central & State Governments and other stakeholders including people representing different interests in the field of disaster management. Accordingly, a multi-stakeholder and multi-sectoral National Platform for Disaster Risk Reduction (NPDRR) was constituted.

The NPDRR is chaired by the Union Home Minister and Minister of State in- charge of Disaster Management in the Ministry of Home Affairs and Vice-Chairman, National Disaster Management Authority is Vice-Chairperson of NPDRR. Special Secretary/Additional Secretary in-charge of Disaster Management Division in the Ministry of Home Affairs will be the convener of NPDRR. It performs the following functions:

- To review the progress made in the field of disaster management from time to time
- To appraise the extent and manner in which the Disaster Management Policy has been implemented by the Central and State Governments, and other concerned agencies, and to give appropriate advice in the matter
- To advise regarding coordination between the Central and State Governments/UT Administrations, local Governments and civil society organisations for development of Disaster Risk Reduction
- To advise suo-moto or on a reference made by the Central Government or any State Government or a Union Territory Administration on any question pertaining to disaster management.
- To review the Disaster Management Policy

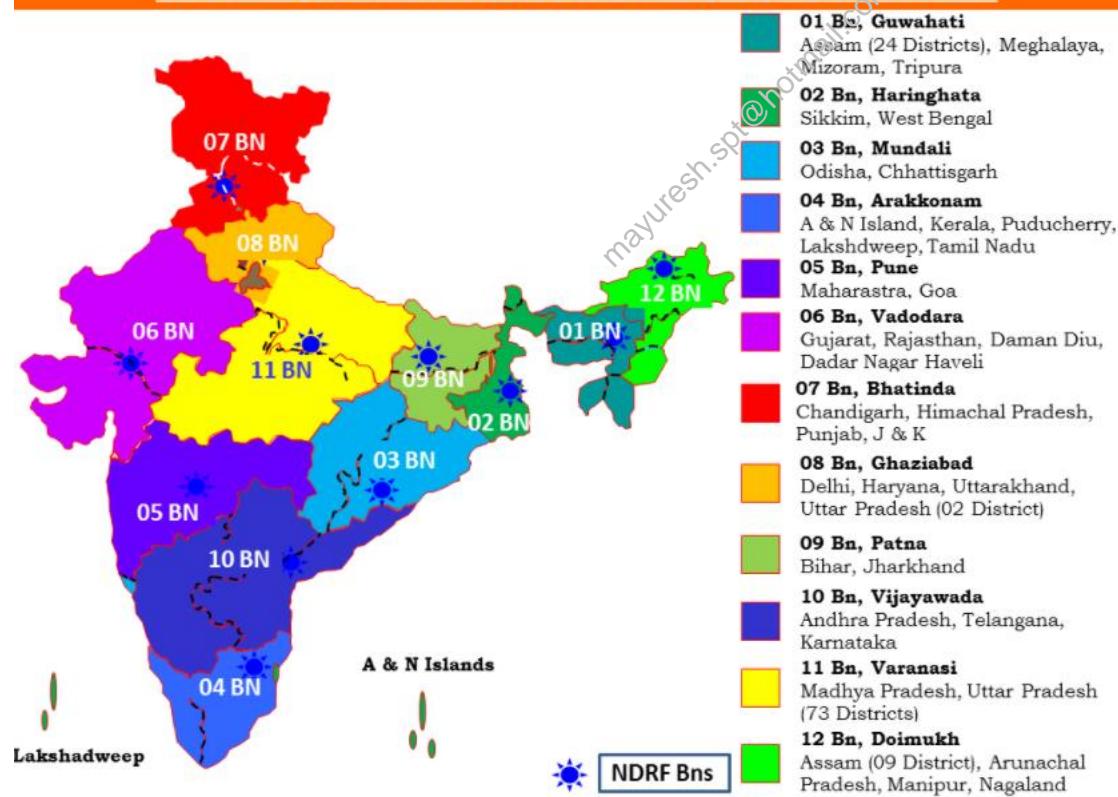
National Disaster Management Authority (NDMA)

The NDMA, is the apex body for disaster management, which has the responsibility for laying down the policies, plans, and guidelines for disaster management. The guidelines of NDMA assist the Central Ministries, Departments, and States to formulate their respective Disaster Management (DM) plans. The NDMA has the mandate to deal with all types of disasters – natural or human-induced.

- It approves the National Disaster Management Plans and plans of the Central Ministries / Departments.
- The general superintendence, direction, and control of the National Disaster Response Force (NDRF) are vested in and are exercised by the NDMA.
- The National Institute of Disaster Management (NIDM) works within the framework of broad policies and guidelines laid down by the NDMA.
- NDMA has the power to authorise the Departments or authorities, to make emergency procurement of materials for rescue and relief in a threatening disaster situation or disaster.
- It takes such other measures, as it may consider necessary, for the prevention of disasters, or mitigation, or preparedness and capacity building, for dealing with a threatening disaster situation or disaster.
- It oversees the provision and application of funds for mitigation and preparedness measures.

Other emergencies such as terrorism (counter-insurgency), law and order situations, hijacking, air accidents, CBRN (Chemical, biological, radiological and nuclear) weapon systems, which require the close involvement of the security forces and/or intelligence agencies, and other incidents such as mine disasters, port and harbour emergencies, forest fires, oilfield fires and oil spills are handled by the **National Crisis Management Committee (NCMC)**.

NDRF BNS WITH AREA OF RESPONSIBILITY



NDMA Advisory Committee

The 15-member Advisory Committee under NDMA consists of experts from various areas of Disaster Management and allied disciplines and has representatives from academia, governments, Non-Governmental Organisations (NGOs) and civil society members.

National Institute of Disaster Management (NIDM)

The National Institute of Disaster Management is the nodal agency responsible for human resource development, capacity building, training, research, documentation and policy advocacy in the field of disaster management.

- The NIDM has built **strategic partnerships** with various ministries and departments of the central, state, and local governments, academic, research and technical organizations in India and abroad and other bi-lateral and multi-lateral international agencies.
- It **provides technical support** to the state governments through the Disaster Management Centres (DMCs) in the Administrative Training Institutes (ATIs) of the States and Union Territories.
- Presently it is supporting as many as 30 such centres. Six of them are being developed as Centres of Excellence in the specialised areas of risk management – flood, earthquake, cyclone, drought, landslides, and industrial disasters.

National Disaster Response Force (NDRF)

The NDRF is a **specialist response force** that can be deployed in a threatening disaster situation or disaster. The **general superintendence, direction and control** of this force is vested in and exercised by the **NDMA** and the command and supervision of the Force vests in the **Director General of National Disaster Response Force**.

At present, National Disaster Response Force consists of **12 battalions**, three each from the BSF and CRPF and two each from CISF, ITBP and SSB. Each battalion has **18 self-contained specialist search and rescue teams of 45 personnel each** including engineers, technicians, electricians, dog squads and medical/paramedics. At present, **each Battalion consists of 1149 personnel**.

The “**proactive availability**” of this Force to the States and its “**pre-positioning**” in threatening disaster situations has immensely helped minimise damage, caused due to calamities in the country.

- The first major test of disaster for NDRF was Kosi Floods in 2008. The situation was handled by the NDRF on a war footing by sending flood rescue trained to the five flood affected districts with utmost promptitude. As a result, over 1,00,000 affected people were rescued during the initial stage itself. The prompt and timely response of NDRF was appreciated by the then Chief Minister of Bihar.
- In the 2015 earthquake in Nepal (magnitude 7.8) India's National Disaster Response Force made the headlines by capitalizing the golden hours' rule of disaster management by being the first on the ground. In the rescue operations, the personnel of NDRF pulled out 11 live victims out of a total figure of 16.
- NDRF has also acquired considerable expertise in facing CBRN (Chemical, Biological, Radiological & Nuclear) challenges. The creditable task of NDRF in retrieving Cobalt-60 radiological material at Mayapuri, Delhi, during April and May 2010 has been an acid test of NDRF's CBRN capability.

2.2.2. Institutional Framework at State Level

As per the DM Act of 2005, **each state in India shall have its own institutional framework** for disaster management and shall prepare its **own Disaster Management Plan**. The DM Act, mandates that each State Government shall take necessary steps for integration of **measures for prevention** of disasters or mitigation into state development plans, **allocation of funds**, and **establish Early Warning Systems**.

Depending on specific situations and needs, the State Government shall also assist the Central Government and central agencies in various aspects of Disaster Management.

The DM Act, 2005 mandates the setting of a **State Disaster Management Authority (SDMA)** with the Chief Minister as the ex officio Chairperson. Similar system will function in each Union Territory with Lieutenant Governor as the Chairperson.

State Disaster Management Authority (SDMA)

As per the DM Act, each State Government shall establish a State Disaster Management Authority (SDMA) with the **Chief Minister as the Chairperson**. In case of other UTs, the Lieutenant Governor or the Administrator shall be the Chairperson of that Authority. For the UT of Delhi, the Lieutenant Governor and the Chief Minister shall be the Chairperson and Vice-Chairperson respectively of the State Authority. Responsibilities of the SDMA include:

- It lays down **policies and plans** for Disaster Management in the State.
- It **approves the State DM Plan** in accordance with the guidelines laid down by the NDMA.
- It **coordinates the implementation** of the state disaster management plan and **recommends provision of funds** for mitigation and preparedness measures.
- It **reviews the developmental plans of the different departments** of the State to ensure the integration of prevention, preparedness and mitigation measures.

State Executive Committee

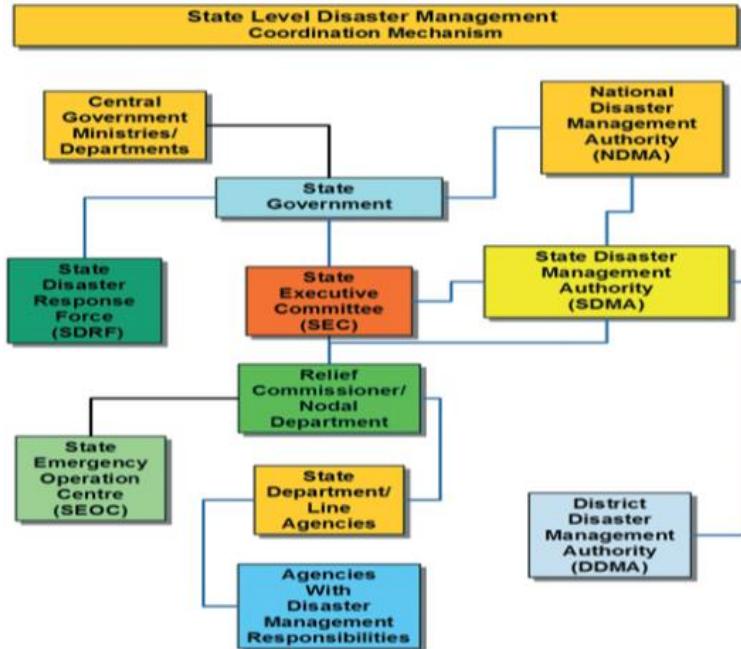
The State Governments constitute a **State Executive Committee (SEC)**, headed by the **Chief Secretary**, to assist the SDMA in the performance of its functions. The SEC will **coordinate and monitor the implementation** of the National Policy, the National Plan, and the State Plans for disaster management. It will also provide information to the NDMA relating to different aspects of disaster management.

2.2.3. Institutional Framework at District Level

District Disaster Management Authority (DDMA)

At the district level, District Disaster Management Authority (DDMA), headed by the District Collector/District Magistrate, is responsible for overall coordination of the disaster management efforts and planning.

- As per provisions of the Act, each State Government establishes a District Disaster Management Authority for every district in the State.
- The DDMA is **headed by the District Collector with the elected representative of the local authority as the Co-Chairperson**.
- The State Government appoints an officer not below the rank of Additional Collector/Additional District Magistrate of the district to be the **Chief Executive Officer of the District Disaster Management Authority**.



- The DDMA prepares the Disaster Management plan for the District and monitors its implementation.
- It also ensures that the guidelines laid down by the NDMA and the SDMA are followed by all the district-level offices.

Local Authorities

Panchayati Raj Institutions (PRI), Municipalities, District and Cantonment Boards, and Town Planning Authorities, which control and manage civic services ensure capacity building of their employees for managing disasters, carrying out relief, rehabilitation and reconstruction activities in the affected areas. They also prepare their disaster management plans as per the national and state guidelines.

Strengthening of State Disaster Management Authorities and District Disaster Management Authorities

Ministry of Home Affairs has sanctioned the scheme to improve the effectiveness of all SDMAs and selected DDMDAs and to make them functionally operational by providing dedicated disaster management professionals. The scheme is implemented by the Scheme Implementation unit (SIU) at NDMA.

2.2.4. Financial Arrangements under NDM Act, 2005

National Disaster Response Fund

It is a fund **managed by the Central Government** for meeting the **expenses for emergency response, relief and rehabilitation** due to any threatening disaster situation. In the event of a calamity, if the requirement of funds for relief operations is beyond the funds available in the State Disaster Response Fund account, additional Central assistance is provided from National Disaster Response Fund. The **National Calamity Contingency Fund (NCCF)** introduced by 11th Finance Commission was **merged with NDRF**.

State Disaster Response Fund

The SDRF is used **only for meeting the expenditure for providing immediate relief** to the victims of disasters. The **state-specific disasters within the local context** in the State, which are not included in the notified list of disasters, **are also eligible** for assistance from State Disaster Response Fund.

National Disaster Response Fund and State Disaster Response Fund have provision for **Gratuitous Relief, Search and Rescue ops**, Relief measures, Air dropping of essential supplies, Emergency supply of drinking water, Clearance of affected area, including management of debris, Agriculture, Animal husbandry, fishery, Handicraft, artisans, Repair/ Restoration (of immediate nature) of damaged Infrastructure and Capacity development.

National Disaster Mitigation Fund

The National Disaster Mitigation Fund (NDMF) **has not been set up**. The Government feels that at present there are **sufficient schemes to take care of mitigation measures** in different projects and the need for creation of separate NDMF has not been felt.

The objective of creation of National Disaster Mitigation Fund (NDMF) is for the projects exclusively for the purpose of mitigation which is being served by the existing Centrally Sponsored Schemes / Central Sector (CS) Schemes such as Pradhan Mantri Krishi Sinchay Yojana, National Mission on Sustainable Agriculture, Namami Gange-National Ganga plan, River Basin Management, National River Conservation Plan and Water Resource Management.

National Disaster Response Reserve

The 13th Finance commission recommended for creation of a National Disaster Response reserve (NDRR) with a corpus of Rs.250 crore to meet the immediate requirement of relief material/equipment after a disaster. The purpose of creating National Disaster Response Reserve (NDRR) is to mitigate the sufferings of the victims of the disaster which are beyond the coping capacity of the States.

14th Finance Commission on Fund Mobilisation for DM

The Finance Commission is required to review the arrangements regarding financing of Disaster Management funds as envisaged in the Disaster Management Act, 2005.

Recommendations of the fourteenth Finance Commission are:

- It recommended that **up to 10 percent of the funds available under the SDRF** can be used by a State for occurrences which State considers to be '**disasters' within its local context**' and which are not in the notified list of disasters of the Ministry of Home Affairs.
- As the financing of NDRF has so far been almost wholly through the levy of cess on select items, it recommended that **Union Government must ensure an assured source of funding** for NDRF once the various **cess and levies were subsumed under the GST**.
- The FFC recommended **an allocation of Rs 55,000 crores** to all states under the Disaster Management head.

2.2.5. Drawbacks of the National Disaster Management Act, 2005

The **implementation** of the **National Disaster Act, 2005** has been **slow, and slack**. There was a seven year **delay**, from 2006 to 2013, in **finalising the National Plan on Disaster Management** which was finally released in 2016. The act has been criticized for **marginalizing Non-governmental organizations (NGOs), elected local representatives, local communities and civic groups**. It has also been accused of fostering a hierarchical, **bureaucratic, command and control, 'top down', approach** that gives the central, state, and district authorities sweeping powers.

A **performance audit** report of the disaster management mechanism in the country by was released by the **Comptroller and Auditor General (CAG) of India in 2013**. The CAG report highlighted several other loopholes in the functioning of NDMA.

- It said **none of the major projects taken up by NDMA was complete**. The projects were either abandoned midway or were being redesigned because of **initial poor planning**.
- As per the CAG report, NDMA has also not been performing several functions such as recommending provision of funds for the purpose of mitigation and recommending relief in repayment of loans.
- It also highlighted **that several critical posts in NDMA were vacant** and consultants were used for day to day working.

The **Public Accounts Committee** submitted its report on '**Disaster Preparedness in India**' in December 2015. It made the following observations:

- Under the Act, the National Executive Committee is required to meet at least once in three months. However, it was found that the committee met infrequently even when there had been disasters, such as the 2007 floods in West Bengal and the 2008 stampede in Rajasthan.
- The centre, states and districts had not constituted Mitigation Funds which could be utilised for disaster preparedness, restoration, etc.

- Various projects undertaken for strengthening the communications network for disaster management were either at the planning stage, or were delayed. The CAG report summary suggested that against a target of installing 219 telemetry stations (flood forecasting instrument) between 2012 and 2017, only 56 had been installed as of August 2016 and 59% of the existing telemetry stations were non-functional.
- 27% posts in the National Disaster Response Force (NDRF) were vacant. The NDRF's training institute, **the National Institute of Disaster Response**, had not been established, though it had been approved in 2006.

2.3. National Policy on Disaster Management, 2009

NDMA came up with a '**National Policy on Disaster Management**' (NPDM) in 2009. It is prepared with the vision "**To build a safe and disaster resilient India** by developing a holistic, proactive, multi-disaster oriented and technology driven strategy **through a culture of prevention, mitigation, preparedness and response**".

Disaster Management is a multidisciplinary activity which is to be performed with **cohesive synergy among all stakeholders**. The National Policy on Disaster Management provides for an **integrated approach for management** with emphasis on building strategic partnerships at various levels.

Objectives of the National Policy on Disaster Management, 2009

- Promoting a culture of prevention, preparedness and resilience at all levels through knowledge, innovation and education.
- Encouraging mitigation measures based on technology, traditional wisdom and environmental sustainability.
- Mainstreaming disaster management into the developmental planning process.
- Establishing institutional and techno-legal frameworks to create an enabling regulatory environment and a compliance regime.
- Ensuring efficient mechanism for identification, assessment and monitoring of disaster risks.
- Developing contemporary forecasting and early warning systems backed by responsive and fail-safe communication with information technology support.
- Ensuring efficient response and relief with a caring approach towards the needs of the vulnerable sections of the society.
- Undertaking reconstruction as an opportunity to build disaster-resilient structures and habitat for ensuring safer living.
- Promoting a productive and proactive partnership with the media for disaster management.

It places an **enabling environment** for all and addresses the concerns of all the sections of the society including differently abled persons, women, children and other disadvantaged groups.

It also aims to bring in transparency and accountability in all aspects of disaster management through involvement of community, community based organizations, Panchayati Raj Institutions (PRIs), local bodies and civil society.

2.4. The National Disaster Management Plan, 2016

The Government of India, for the first time, released its first **National Disaster Management Plan in 2016**. The Vision of the Plan is to "Make India disaster resilient, achieve substantial disaster risk reduction, and significantly decrease the losses of life, livelihoods, and assets – economic, physical, social, cultural and environmental – by maximizing the ability to cope with disasters at all levels of administration as well as among communities."

It has been aligned broadly with the goals and priorities set out in the **Sendai Framework for Disaster Risk Reduction, the Sustainable Development Goals 2015-2030 and the Paris Agreement on Climate Change at COP-21**. While Sendai framework is the first international agreement adopted within the context of post 2015 development agenda, the Sustainable

Development Goals also recognize the importance of disaster risk reduction as integral to sustainable development. The Paris Agreement notes the urgent need to take into account the increasing frequency of extreme weather events due to global climate change.

Major highlights of the Plan

- For each hazard, the approach used in this national plan incorporates the four priorities enunciated in the Sendai Framework into the planning framework for Disaster Risk Reduction under the five Thematic Areas for Actions:
 - ✓ Understanding Risk
 - ✓ Inter-Agency Coordination
 - ✓ Investing in DRR – Structural Measures
 - ✓ Investing in DRR – Non-Structural Measures
 - ✓ Capacity Development
- It covers all phases of disaster management: Prevention, Mitigation, Response and Recovery and covers human induced disasters like chemical, nuclear etc. It plans for short medium and long run respectively 5, 10, and 15 years to deal with disasters.
- **Integrating approach with role clarity**
 - ✓ It provides for horizontal and vertical integration among all the agencies and departments of the Government and also spells out the roles and responsibilities of all levels of Government right up to Panchayat and Urban local body level in a matrix format.
 - ✓ Ministries are given role for specific disasters e.g. Ministry of Earth Sciences is responsible for Cyclones
 - ✓ The plan has a regional approach, which will be beneficial not only for disaster management but also for development planning.
 - ✓ It is designed in such a way that it can be implemented in a scalable manner in all phases of disaster management.
- **Major activities**
 - ✓ It identifies major activities such as early warning, information dissemination, medical care, fuel, transportation, search and rescue, evacuation, etc. to serve as a checklist for agencies responding to a disaster.
 - ✓ It also provides a generalised framework for recovery and offers flexibility to assess a situation and build back better.
- **Information & media regulation**
 - ✓ To prepare communities to cope with disasters, it emphasises on a greater need for Information, Education and Communication activities.
 - ✓ It calls for ethical guidelines for the media for coverage of disasters as well as self-regulation.
 - ✓ The plan wants the media to respect the dignity and privacy of affected people.
 - ✓ Also, in a move aimed to stop rumours and spread of panic, the plan directed the authorities to schedule regular media briefing (depending on the severity of the disaster) and designate a nodal officer for interacting with the media on behalf of the government
- It lays focus on training, capacity building and incorporating best international practices.

Significance of the NDMP

- It provides a framework and direction to the government agencies for all phases of disaster management cycle.
- It recognizes the need to minimize, if not eliminate, any ambiguity in the responsibility framework. It, therefore, specifies who is responsible for what at different stages of managing disasters.

- It is envisaged as ready for activation at all times in response to an emergency in any part of the country.
- It is designed in such a way that it can be implemented as needed on a flexible and scalable manner in all phases of disaster management:
 - ✓ Mitigation (prevention and risk reduction),
 - ✓ Preparedness,
 - ✓ Response and
 - ✓ Recovery (immediate restoration to build-back better).

Shortcomings of National Disaster Management Plan, 2006

The National Disaster Management Plan, 2006 is devoid of many important elements that make a good and robust action plan.

Drawbacks

- It fails to lay down a clear and practical roadmap. It is **too generic** in its identification of the activities to be undertaken by the central and states governments for disaster risk mitigation, preparedness, response, recovery, reconstruction, and governance.
- The plan **refrains from providing a time frame** for undertaking these activities beyond vaguely prescribing that these must be taken up in short, medium, mid- and long-term basis.
- The plan does not project the requirement of funds needed for undertaking these activities, nor does it provide any clue as to **how funds shall be mobilised** for this purpose.
- The plan further does **not provide any framework for monitoring and evaluation** of the plan.
- The plan is aligned with the Sendai Framework for Disaster Risk Reduction and Sustainable Development Goals, but **unlike in the Sendai Framework or the SDGs, the plan does not set any goals or targets**, nor does it spell out how the Sendai goals and targets shall be achieved.

Therefore, the national plan needs to be supplemented by national roadmaps for disaster resilience with clear goals, targets, timeframe, and ideas about how resources shall be mobilised for its implementation.

2.5. Disaster Management Cycle in India

2.5.1. Reducing Risk and Enhancing Resilience

In the terminology adopted by the UNISDR, the concept and practice of reducing disaster risks involve systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events. The DM Act 2005 defines "Mitigation" as measures aimed at reducing the risk, impact, or effects of a disaster or threatening disaster situation. Following Picture depicts **Prime Minister's ten point agenda on Disaster Risk Reduction**.

10- POINT AGENDA FOR DISASTER RISK REDUCTION	
1	All development sectors must imbibe the principle of disaster risk management
3	Work towards risk coverage for all
5	Encourage greater participation and leadership of women in Disaster Risk Management
7	Invest in risk mapping globally
9	Leverage technology to enhance the efficiency of our disaster risk management efforts
2	Develop a network of universities to work on disaster
4	Utilise the opportunities provided by social media and mobile technologies
6	Build on local capacity and initiative
8	Ensure that the opportunity to learn from a disaster is not wasted
10	Bring about a greater cohesion in international response to disasters

The National Policy suggests a multipronged approach for disaster risk reduction and mitigation consisting of the following:

- Integrating risk reduction measures into all development projects.
- Initiating mitigation projects in identified high priority areas through joint efforts of the Central and State Governments.
- Encouraging and assisting State level mitigation projects.
- Paying attention to indigenous knowledge on disaster and coping mechanisms.
- Giving due weightage to the protection of heritage structures.

The guiding principles of Sendai Framework state that disaster risk reduction requires responsibilities to be shared by different divisions of governments and various agencies. The effectiveness in disaster risk reduction will depend on coordination mechanisms within and across sectors and with relevant stakeholders at all levels. For each hazard, the approach used in the national plan incorporates the four priorities enunciated in the Sendai Framework into the planning framework for Disaster Risk Reduction under the five thematic areas for action:

- 1. Understanding Risk:** It focuses on understanding risk and is a priority 1 under Sendai Framework. It involves a) Observation Networks, Research, Forecasting, b) Zoning / Mapping, c) Monitoring and Warning Systems, d) Hazard Risk and Vulnerability Assessment (HRVA), and e) Dissemination of Warnings, Data, and Information. Having adequate systems to provide warnings, disseminate information are an integral part of improving the understanding of risk.
- 2. Inter-Agency Coordination:** Inter-agency coordination is a key component of strengthening the disaster risk governance. The major areas where improvement in top level interagency coordination is required are: a) Overall disaster governance b) Response c) Providing warnings, information, and data and d) Non-structural measures.
- 3. Investing in DRR – Structural Measures:** Undertaking necessary structural measures is one of the major areas for action for disaster risk reduction and enhancing resilience. These consist of various physical infrastructure and facilities required to help communities cope with disasters.
- 4. Investing in DRR – Non-Structural Measures:** Sets of appropriate laws, mechanisms, and techno-legal regimes are crucial components in strengthening the disaster risk governance to manage disaster risk. These non-structural measures comprise of laws, norms, rules, guidelines, and techno-legal regime (e.g., building codes) etc. and empower the authorities to mainstream disaster risk reduction and disaster resilience into development activities.
- 5. Capacity Development:** The capacity development includes training programs, curriculum development, large-scale awareness creation efforts, and carrying out regular mock drills and disaster response exercises.

Hazard-wise Responsibility Matrices for Disaster Risk Mitigation have been developed and relevant stakeholders have been identified.

Sustainable Reduction in Disaster Risk in 10 Multi-Hazard Districts

To build the capacity of the most hazardous districts in the most vulnerable states, the Government of India has launched a project on sustainably reducing disaster risks in two districts each in five identified states (Uttarakhand, Assam, Bihar, Himachal Pradesh and Jammu and Kashmir)

2.5.2. Disaster Preparedness and Response

Response measures are those taken immediately after receiving early warning from the relevant authority or immediately after the occurrence of an event. It is considered as the most visible phase amongst various phases of disaster management. Response includes not only

those activities that directly address the immediate needs, such as search and rescue, first aid and temporary shelters, but also rapid mobilization of various systems necessary to coordinate and support the efforts.

Preparedness, as defined by UNISDR, consist of “the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.” Based on the preparedness, the response process begins as soon as it becomes apparent that a disastrous event is imminent and lasts until the disaster is declared to be over.

No single agency or department can handle a disaster situation of any scale alone. There are specific tasks, roles and responsibilities in the domain of response, which is the most critical and time-sensitive aspect of disaster management.

The institutional arrangements for the response system consist of the following elements:

- Nodal Central Ministries with disaster-specific responsibilities for national-level coordination of the response and mobilization of all the necessary resources.
- Central agencies with disaster-specific responsibilities for Early Warning Systems and alerts.
- National Disaster Response Force (NDRF).
- State Disaster Response Force (SDRF).

National Early Warning System

The GoI has designated specific agencies to monitor the onset of different natural disasters, set up adequate Early Warning Systems (EWS), and disseminate necessary warnings/ alerts regarding any impending hazard. These agencies provide inputs to the MHA, which will issue alerts and warnings through various communication channels.

Table : Central Agencies Designated for Natural Hazard-Specific Early Warnings

	Hazard	Agencies
1	Avalanches	Snow and Avalanche Study Establishment (SASE)
2	Cyclone	India Meteorological Department (IMD)
3	Drought	Ministry of Agriculture and Farmers Welfare (MoAFW)
4	Earthquake	India Meteorological Department (IMD)
5	Epidemics	Ministry of Health and Family Welfare (MoHFW)
6	Floods	Central Water Commission (CWC)
7	Landslides	Geological Survey of India (GSI)
8	Tsunami	India National Centre for Oceanic Information Services (INCOIS)

Role of Central Agencies/Departments

The National Emergency Operations Centre (NEOC) will act as the communication and coordination hub during this phase and it will maintain constant touch with early warning agencies for updated inputs. It will inform State Emergency Operations Centre (SEOC) and District Emergency Operations Centre (DEOC). The DM Division of the MHA will communicate and coordinate with designated early warning agencies, various nodal Ministries, and State Governments.

Coordination of Response at National Level

At the national level, the Central Government has assigned nodal responsibilities to specific Ministries for coordinating disaster-specific responses. At the national level, the Central Government has assigned nodal responsibilities to specific Ministries for coordinating disaster-specific responses. The NEC will coordinate response in the event of any threatening disaster situation or disaster.

Table : Central Ministries for Coordination of Response at National level

Disaster	Nodal Ministry/ Dept./ Agency
1 Biological Disasters	Min. of Health and Family Welfare (MoHFW)
2 Chemical Disasters and Industrial Accidents	Min. of Environment, Forests and Climate Change (MoEFCC)
3 Civil Aviation Accidents	Min. of Civil Aviation (MoCA)
4 Cyclone, Tornado, and Tsunami	Min. of Home Affairs (MHA)
5 Disasters in Mines	Min. of Coal; Min. of Mines (MoC, MoM)
6 Drought, Hailstorm, Cold Wave and Frost, Pest Attack	Min. of Agriculture and Farmers Welfare (MoAFW)
7 Earthquake	Min. of Home Affairs (MHA)
8 Flood	Min. of Home Affairs (MHA)
9 Forest Fire	Min. of Environment, Forests and Climate Change (MoEFCC)
10 Landslides and Avalanche	Min. of Home Affairs (MHA)
11 Nuclear and Radiological Emergencies	Dept. of Atomic Energy, Min. of Home Affairs (DAE,MHA)
12 Oil Spills	Min. of Defence/Indian Coast Guard (MoD/ICG)
13 Rail Accidents	Min. of Railways (MoR)
14 Road Accidents	Min. of Road Transport and Highways (MoRTH)
15 Urban Floods	Min. of Urban Development (MoUD)

Relief Measures

It is essential that the first responders and relief reach the affected areas in the shortest possible time. Often, there are inordinate delays due to real constraints imposed by the location, nature of disaster and, most regrettably, due to inadequate preparedness. Relief tends to arrive in a highly fragmented or uncoordinated form with multiple organisations acting independently of each other without a cohesive plan or mechanism to avoid overlaps and without proper prioritization of different aspects of relief such as shelter, clothing, food, or medicine.

NDMA guidelines on Minimum Standards of Relief

NDMA has prescribed guidelines on minimum standard of relief, which include the following:

1. State/District Administration must **pre-identify locations and buildings** like schools, anganwadi centres which can be used as relief shelters. Advance MoUs can be made with suppliers for provision of tents/toilets/urinals etc.
2. Special care and arrangements must be made for women, children, old and differently abled persons. A minimum area of **3.5 sq. m/person** with lighting facilities must be made available.
3. Men and women must be supplied food with minimum calorie intake of **2,400 Kcal/day**. Minimum supply of **3 litres water per person per day** must be ensured.
4. **Maintenance of Hygiene** must be ensured at camps with provision of sufficient water for personal cleanliness. Drainage from toilets should not run towards any surface water source.
5. **Mobile medical teams** should visit the camps regularly and arrangements for **safe delivery** should be made for **pregnant women**.
6. **Death certificate** of spouse for widows should be issued within 15 days of the disaster by the district administration and **necessary financial assistance must be arranged within 45 days**.
7. Relief centres should be **temporary** and closed as soon as normalcy returns in the area.

Fire and Emergency Services

FES is one of the first responders during the Golden Hour after a disaster and plays a vital role in saving lives and property. The primary role of Fire and Emergency Service (FES) is of responding to fire incidents. However, besides fire fighting, FES attends to other emergencies such as building collapse, road traffic accidents, human and animal rescue, and several other emergency calls.

At present, States and UTs, and ULBs are managing the FES. However, there is no standardization with regard to the scaling of equipment, the type of equipment, or the training of their staff. Each State it has own standards according to the initiatives taken by the States and the funds provided for the FES.

2.5.3. Disaster Risk Governance

From the mid-2000s onwards, governance was commonly accepted as the crux of Disaster Risk Reduction. Disaster risk governance is the way in which public authorities, civil servants, media, private sector, and civil society cooperate at various levels in order to manage and reduce disaster related risks.

This requires ensuring sufficient levels of capacity and resources available to prevent and prepare for disasters. It also entails institutions and processes for citizens to articulate their interests, exercise their legal rights and obligations, and mediate their differences.

The Sendai Framework states that disaster risk governance at different levels is of great importance for an effective and efficient management of disaster risk. The Sendai Framework lays emphasis on the following to strengthen disaster risk governance:

- a) Mainstream and integrate disaster risk reduction within and across all sectors. It must guide both the public and private sectors and clearly spell out the roles and responsibilities. Mechanisms and initiatives for increasing disaster risk transparency must be encouraged.
- b) Adopt and implement disaster risk reduction strategies and plans, across different levels (local to national) and timescales to the strengthen resilience – economic, social, health and environmental.
- c) Carry out assessment of disaster risk management capacity to deal with the identified risks at different levels
- d) Promote necessary mechanisms and incentives to ensure high levels of compliance with the safety-enhancing provisions.
- e) Periodically review and assess the progress on various DM plans as well as encourage institutional debates, including by parliamentarians and relevant officials, on DRR plans. Also establish grievance redress mechanisms.
- f) Assign clear roles and tasks to community representatives within disaster risk management
- g) Establish and strengthen government coordination forums composed of relevant stakeholders at the national and local levels, such as national and local platforms for disaster risk reduction.
- h) Work with parliamentarians and other elected representatives for disaster risk reduction by developing or amending relevant legislation and setting budget allocations
- i) Promote the development of quality standards, such as certifications and awards for disaster risk management.

2.5.4. Recovery and Build Back Better (BBB)

Globally, the approach towards post-disaster restoration and rehabilitation has shifted to one of betterment reconstruction. The recovery, rehabilitation and reconstruction phase is seen as an opportunity to “Build Back Better” (BBB) and integrate disaster risk reduction into development measures, making communities resilient to disasters.

The approach to re-construction and recovery in India is guided by the National Policy on Disaster Management 2009. It states that:

- the reconstruction process has to be comprehensive. Incorporating disaster resilient features to 'build back better' will be the guiding principle.
- Reconstruction plans and designing of houses need to be a participatory process involving the government, affected community, NGOs and the corporate sector. While owner driven construction is a preferred option, participation of the NGOs and corporate sector will be encouraged.
- Essential services, social infrastructure and intermediate shelters/camps will be established in the shortest possible time.
- the plans for reconstruction in highly disaster prone areas need to be drawn out during the period of normalcy, which may include architectural and structural designs in consultation with the various stakeholders.

Recovery Process

According to UNISDR (2009), recovery is the restoration, and improvement of facilities, livelihoods and living conditions of disaster-affected communities. It includes efforts to reduce disaster risk factors.

Three recovery stages, in which appropriate policies and programmes tend to be planned and implemented are: a) Early, b) Mid-Term, and c) Long-Term.

Recovery Stages

Recovery Stage	Duration	Brief Description
Early	3 – 18 Months	Cash for work, resumption of markets, commerce and trade, restoration of social services, transitional and temporary shelters
Mid-Term	Up to 5 Years (concurrent with early recovery)	Recovery plans for assets and livelihoods, reconstruction plans for housing, infrastructure, public buildings and cultural heritage buildings
Long-Term	Within 10 Years	Implemented alongwith developmental plans: infrastructure strengthening, environmental, urban and regional planning

Major Steps of the recovery

The major steps of the recovery process and the key steps involved are as follows:

- Post-Disaster Needs Assessment: It includes credible damage assessment led by government and assisted by humanitarian response agencies. A qualitative and quantitative baseline assessment is made for damage, loss and needs across sectors.
- Developing a vision for Build-Back Better: Wider consultations with experts, civil society and key stakeholders are done and consensus is arrived at.
- Ensure Coherence of BBB with the development goals: Discussions at the top level must be done to align the recovery vision with government's broader longer term development goals.
- Incorporating resilience in recovery vision: It involves consultations on disaster resistant physical recovery, addressing gender and equity concerns, vulnerability reduction etc.
- Balancing recovery across sectors: Public and private sector programs should be balanced. Infrastructure reconstruction should be prioritized while showing sensitivity to affected population.
- Prioritising Sectors for recovery: Determine relative importance of various sectors such as housing, water and sanitation, governance, transport, power, communications, infrastructure, environment, livelihoods, tourism, social protection, health, and education.

Reconstruction

Long term recovery efforts must focus on redeveloping and restoring the socio-economic viability of the disaster area(s). The reconstruction phase requires a substantial commitment of time and resources by the Governments (State and Central) and other agencies. These reconstruction efforts include:

- Reconstruction of public infrastructures and social services damaged by the disaster, which can be completed over the long-term
- Re-establishment of adequate housing to replace that has been destroyed
- Restoration of jobs/ livelihood that was lost
- Restoration of the economic base of the disaster areas

Rehabilitation

Rehabilitation is defined as a strategy of institutional reform and improvement of infrastructure and services aimed towards supporting the affected populations. Generally, rehabilitation package includes total reconstruction of damaged physical and psychological infrastructure, as well as economic and social rehabilitation of the people in the affected region. The rehabilitation is classified into the following:

Physical Rehabilitation

Physical rehabilitation is a very important facet of rehabilitation. It includes:

- Reconstruction of physical infrastructure such as buildings, railways, roads, communication network, water supply, electricity etc.
- Short-term and long-term strategies towards watershed management, canal irrigation, social forestry, crop stabilization, alternative cropping techniques, job creation, employment generation and environmental protection.
- Rehabilitation of agriculture, artisan work and animal husbandry.
- Adequate provision for subsidies, adherence to land-use planning, flood plain zoning, retrofitting or strengthening of undamaged houses, and construction of model houses.

Relocation is a very sensitive part of the physical rehabilitation process and it must be ensured that need based considerations and not extraneous factors should drive the relocation policy. Relocation efforts should consider the following:

- Avoid secondary displacement as far as possible.
- Gain consent of the affected communities.
- Clearly define land acquisition process.
- Take into consideration urban/ rural land use planning before moving ahead.
- Provide customized relocation packages.
- As far as possible, ensure relocation site is near to their sources of livelihood,

[UPSC Question: Rehabilitation of human settlements is one of the important environmental impacts which always attract controversy while planning major projects. Discuss the measures suggested for mitigation of this impact while proposing major developmental projects. (2016)]

Social Rehabilitation

Social rehabilitation is also an important part of disaster rehabilitation. The vulnerable groups such as the artisans, elderly, orphans, single women and young children would need special social support to survive the impact of disasters. The rehabilitation plan must have components that do not lose sight of the fact that the victims have to undergo the entire process of re-socialization and adjustments in a completely unfamiliar social milieu. Thus, this type of rehabilitation would include various activities such as:

1. Revival of Educational Activities: Educational facilities may suffer greatly in a major disaster placing considerable stress on children. Therefore, the following steps will be helpful in helping children to recover and cope with the situation:
 - Give regular counselling to teachers and children.
 - Encourage children to attend the schools regularly.
 - Provide writing material, and work books to children.
 - Make children participate in all activities pertaining to resurrection of normalcy in the school.
 - Try to inculcate conducive attitudes to enable the students to play a positive role in self-development.
 - Establish village level education committees.
 - Identify local groups that could conduct smooth functioning of education activities
2. Rehabilitation of the Elderly, Women and Children: The elderly, women, and children are more vulnerable after a major disaster. Hence the following measures will help in their rehabilitation:
 - Identify familiar environs to rehabilitate elderly, women and children.
 - Make efforts to attach destitute, widows and orphans with their extended family, if that is not possible then identify foster families.
 - Organize regular counselling to strengthen the mental health of women and children.
 - Initiate various training programmes to make the women economically self-sufficient.
 - Give due attention to health, nutrition and hygiene in the long-term rehabilitation package for women and children.
 - Activate/reactivate the anganwadis (day-care centres), and old-age homes within the shortest possible time.
 - Set up at least one multi-purpose community centre per village.
 - Make efforts to build residential female children homes at the block level.
 - Set up vocational training camps to improve the skills of orphans and children
 - Promote self-help groups.

Economic Rehabilitation

The major components of economic rehabilitation are livelihood restoration and ensuring the continuity of trade and commerce. Livelihood opportunities are severely disrupted by the destruction or loss of essential assets; with the result that people are unable to engage in normal income generating activities; become demoralized and dependent on humanitarian aid. Economic recovery should be based on:

- Analysis of existing livelihood strategies and sustainability of businesses.
- A comprehensive analysis of existing and future risks.
- The vulnerabilities of the affected families.
- The accessibility of linkages to external influences and institutions including skills and knowledge.
- Access to functioning markets.

Psychological Rehabilitation

Another crucial dimension of disaster rehabilitation is psychological rehabilitation. Dealing with victim's psychology is a very sensitive issue and must be dealt with caution and concern. The psychological trauma of losing relatives and friends, and the scars of the shock of disaster event can take much longer to heal than the stakeholders in disaster management often realize. Thus, counselling for stress management should form a continuous part of a disaster rehabilitation plan. Efforts should be made to focus more on:

- Psycho-therapeutic health programmes
- Occupational therapy

- Debriefing and trauma care
- Tradition, values, norms, beliefs, and practices of disaster-affected people

2.5.5. Capacity Development

Capacity development covers strengthening of institutions, mechanisms, and capacities at all levels of all stakeholders. In the domain of disaster risk management, the Sendai Framework emphasizes the need for enhancing the technical, financial, and administrative capabilities of institutions, governments, and communities to deal with the identified risks at different levels.

Institutions involved in CD

The National Institute for Disaster Management, in partnership with other research institutions has capacity development as one of its major responsibilities. There are a number of renowned institutes in various States, which are imparting training in DM. Also, the Disaster Management cells in all **Administrative Training Institutes, Police Academies, State Institutes of Rural Development**, Training centres of five CAPFs from where NDRF is drawn up (BSF, CRPF, CISF, ITBP, and SSB) and the **NDRF Academy, Nagpur** will contribute most significantly in developing DM related skills. The capacity of existing institutes needs to be upgraded in accordance with regional and local requirements and greater financial assistance is required.

National Disaster Response Force Academy, Nagpur

National Disaster Response Force (NDRF) Academy at Nagpur is a premier institute to impart high class training to NDRF and SDRF Battalions, Civil Defence Volunteers and disaster response personnel of SAARC countries in disaster management. The existing National Civil Defence College, Nagpur will be merged into the NDRF Academy. The Academy will conduct courses for Training of Trainers (ToT) and Master Trainers (MoT) in the areas of Collapsed Structure Search & Rescue (CSSR), Medical First Responder (MFR), Flood Rescue, Deep Diving, Landslide, Mountain Rescue and Chemical, Biological, Radiological and Nuclear (CBRN) Emergencies to the personnel of NDRF, State Disaster Response Force (SDRF) and other stakeholders

Capacity Development of Local Bodies

The local leadership can play a big role in disaster management in all stages. The elected leaders and officials of Panchayats and ULBs should be trained to handle different types of crises, contribute to disaster preparedness, make proper use of available warnings, organize operations such as search, rescue, relief, medical assistance, and carry out damage assessment. They should also have sound understanding of the needs of proper post-disaster rehabilitation.

The capabilities of the local bodies have to be developed in financial, technical, and managerial spheres. The state level training institutes (ATI, SIDM, and others) will develop need-based training programs for the capacity development of rural and urban local bodies.

Training Communities

Enhancing the capacity of communities, as they are the first responders to disasters, is a significant part of the capacity development process. The Sendai Framework notes the need to build the knowledge of civil society, communities, and volunteers on disaster risk reduction. Capacity building has to include awareness, sensitisation, orientation, and developing skills of communities and community leaders.

[UPSC Question: How important are vulnerability and risk assessment for pre-disaster management? As an administrator, what are key areas that you would focus on in a Disaster Management System? (2013)]

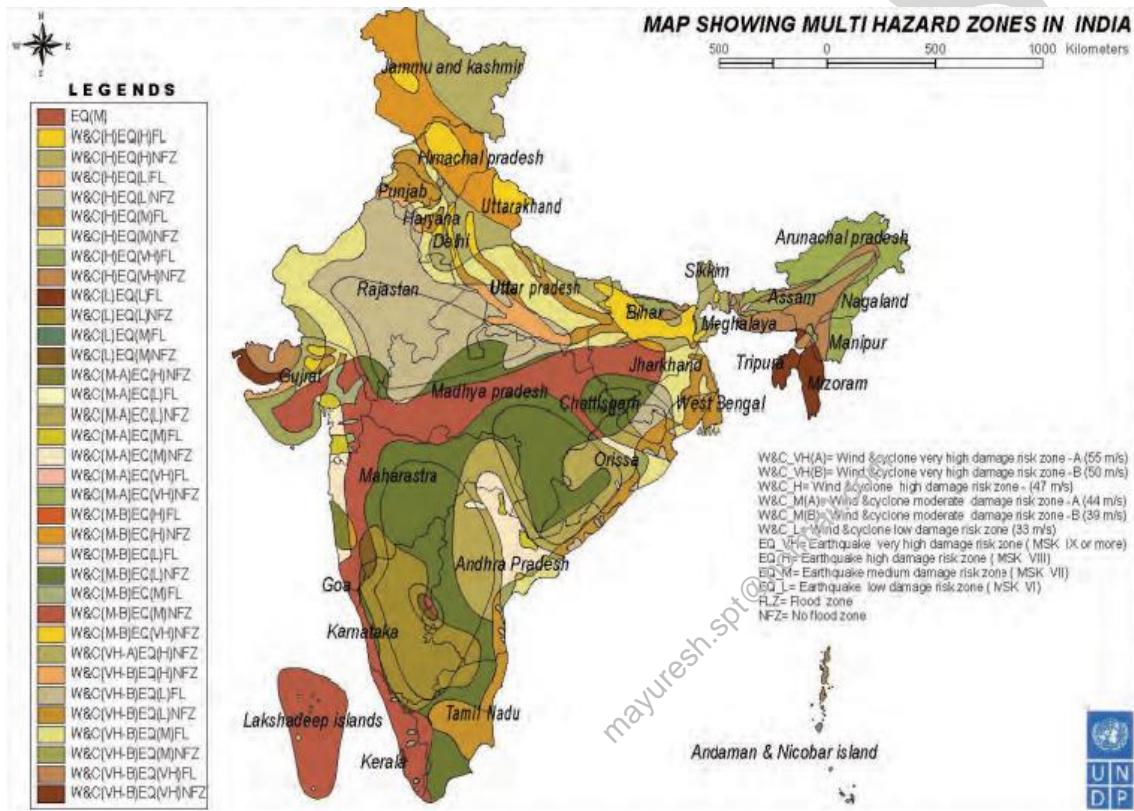
CHAPTER-3

3. Natural Hazards in India

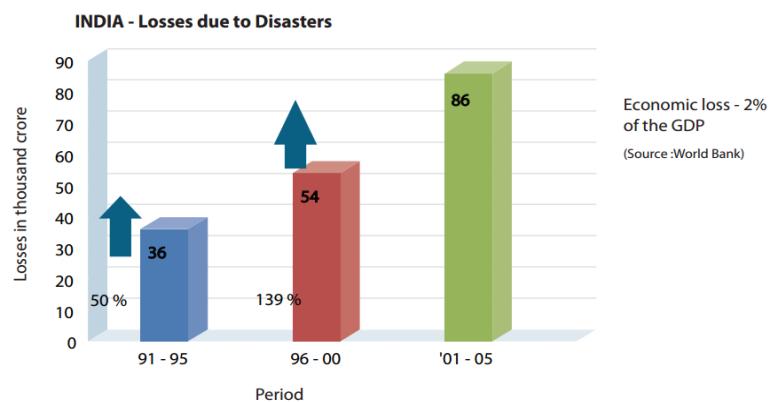
3.1. India: Vulnerability Profile

India is one of the ten worst disaster prone countries of the world. It is vulnerable to a large number of natural, as well as, human-made disasters on account of its **unique geo-climatic and socio-economic conditions**. Out of 35 states and union territories in the country, **27 of them are disaster prone**.

The five distinctive regions of the country i.e. Himalayan region, the alluvial plains, the hilly part of the peninsula, and the coastal zone have their own specific problems. While on one hand the Himalayan region is prone to disasters like earthquakes and landslides, the plain is affected by floods almost every year. The desert part of the country is affected by droughts and famine while the coastal zone susceptible to cyclones and storms.



- **58.6 per cent 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**
- Its hilly areas are at risk from **landslides** and **avalanches**.



- Vulnerability to disasters/emergencies of **Chemical, Biological, Radiological and Nuclear (CBRN)** origin also exists.

Within the **vulnerable groups**, elderly persons, women, children— especially women rendered destitute, children orphaned on account of disasters and differently-abled persons are exposed to higher risks.

Besides the natural factors, various **human-induced activities** like increasing demographic pressure, deteriorating environmental conditions, deforestation, unscientific development, faulty agricultural practices and grazing, unplanned urbanisation, construction of large dams on river channels etc. are also responsible for accelerated impact and increase in frequency of disasters in the country. Building Material and Technology Promotion Council (BMTPC) has come out with Vulnerability Atlas of India.

Economic loss due to disasters

As per World Bank, economic loss accounted for 2% of the GDP due to disasters.

3.2. Natural Disasters

3.2.1. Earthquake

What is an Earthquake?

An earthquake is the sudden shaking of the earth crust. The impact of an earthquake is sudden and there is hardly any warning, making it impossible to predict.

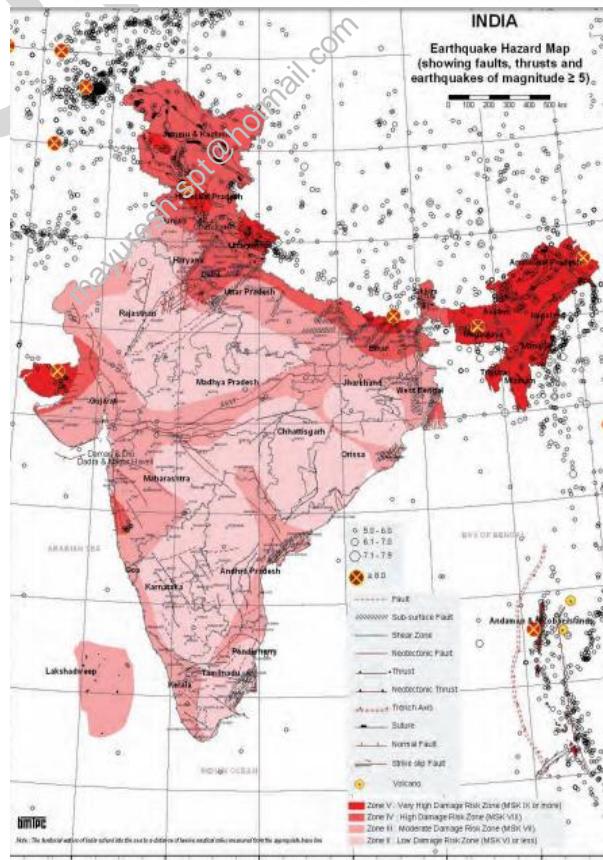
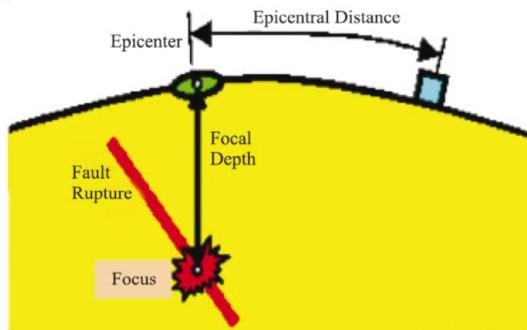
Cause of Earthquake

It happens due to movements along the plates' boundaries when the plates ride up over the mobile mantle. When these plates contact each other, stress arises in the crust. These stresses are classified according to the type of movement along the plate's boundaries:

- Pulling away from each other (Divergent),
- Pushing against one another (Convergent) and
- Sliding sideways relative to each other (Transform)

The areas of stress at plate boundaries which release accumulated energy by slipping or rupturing are known as 'faults'. A rupture then occurs along the fault and the rock rebounds under its own elastic stresses until the strain is relieved. The fault rupture generates vibration called seismic waves.

Earthquakes can be measured by the use of two distinctively different scales of



measurement demonstrating **magnitude (by Richter scale) and intensity (by Mercalli Scale)**. Although some scientists claim ability to predict earthquakes, accurate and exact predictions of such sudden incidents are still not possible.

Earthquake Risk in India

Six major earthquakes have struck different parts of India over a span of the last 15 years.

The increase in earthquake risk is due to a spurt in developmental activities driven by urbanization, economic development and the globalization of India's economy. India has highly populous cities and the constructions in these cities are not earthquake resistant. Regulatory mechanisms are weak, thus any earthquake striking in one of these cities would turn into a major disaster.

Distribution Pattern of Earthquakes in India

India falls prominently on the 'Alpine - Himalayan Belt'. This belt is the line along which the Indian plate meets the Eurasian plate. Being a convergent plate, the Indian plate is thrusting underneath the Eurasian plate at a speed of 5 cm per year. The movement gives rise to tremendous stress which keeps accumulating in the rocks and is released from time to time in the form of earthquakes.

India has been divided into four seismic zones according to the maximum intensity of earthquake expected. Of these, zone V is the most active which comprises of whole of Northeast India, the northern portion of Bihar, Uttarakhand, Himachal Pradesh, J&K, Gujarat and Andaman & Nicobar Islands. The entire Himalayan Region is considered to be vulnerable to high intensity earthquakes of a magnitude exceeding 8.0 on the Richter scale. Much of India lies in zone III and zone II.

Geographic Areas in Seismic Zones

Seismic Zones	% of Geographical Area
II	41.40
III	30.40
IV	17.30
V	10.90
	58.6%

Consequences of an Earthquake

Primary damage: Damage occurs to human settlement, buildings, structures and infrastructure, especially bridges, elevated roads, railways, water towers, pipelines, electrical generating facilities. Aftershocks of an earthquake can cause much greater damage to already weakened structures.

Secondary effects include fires, dam failure and landslides which may block water ways and also cause flooding, landslides, Tsunami, chemical spills, breakdown of communication facilities, human loss. There is also a huge loss to the public health system, transport and water supply in the affected areas.

Tertiary impact of earthquake includes Post Trauma Stress Disorder (PTSD), long term psychological issues, loss of livelihood, disruption of social capital due to relocation related issues, etc.

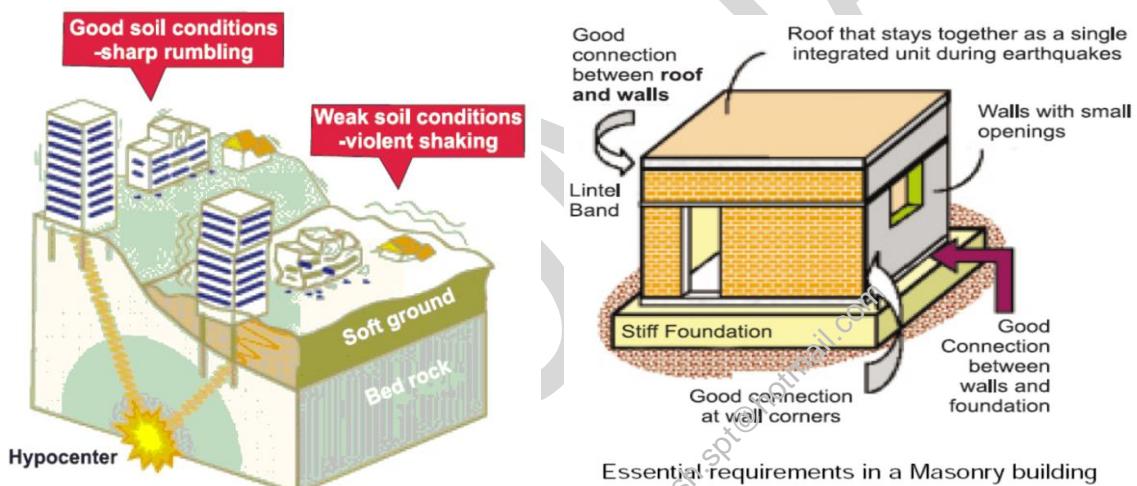
Earthquake Hazard Mitigation

Since earthquake also destroys most of the transport and communication links, providing timely relief to the victims becomes difficult. It is not possible to prevent the occurrence of an earthquake; hence, the next **best option is to lay emphasis on disaster preparedness and mitigation rather than curative measures**.

- Earthquake monitoring centres (**seismological centres**) for regular monitoring and fast dissemination of information among the people in the vulnerable areas should be

established. Currently, **Centre for Seismology** (CS) is the nodal agency of Government of India responsible for monitoring seismic activity in and around the country.

- A **vulnerability map** of the country along with dissemination of vulnerability risk information among the people can be done to minimize the adverse impacts.
- **Planning:** The Bureau of Indian Standards has published building codes and guidelines for safe construction of buildings against earthquakes. Before the buildings are constructed the building plans have to be checked by the Municipality, according to the laid down **by-laws**.
- Important buildings such as hospitals, schools and fire stations need to be upgraded by **retrofitting techniques**.
- **Community preparedness and public education** on causes and characteristics of an earthquake and preparedness measures is important. It can be created through sensitization and training programme for community, by preparation of disaster management plans by schools, malls, hospitals etc. and carrying out mock drills, by preparing documentation on lessons from previous earthquakes and widely disseminating it.
- **Engineered structures:** The **soil type should be analysed before construction**. Building structures on soft soil should be avoided. Similar problems persist in the buildings constructed on the river banks which have alluvial soil.



- **Encouraging use of Indigenous methods** – Indigenous earthquake-resistant houses like the **bhongas in the Kutch Region of Gujarat**, **dhajji diwari buildings in Jammu & Kashmir**, **brick-nogged wood frame constructions in Himachal Pradesh** and **ekra constructions made of bamboo in Assam** are increasingly being replaced with modern Reinforced Cement Concrete (RCC) buildings, often without incorporating earthquake resistant features and without compliance to building codes and bye-laws. It is thus necessary to make use of indigenous technical knowledge and locally available materials in the construction of earthquake-resistant buildings in suburban and rural areas.
- **Quick and effective response** – Experience has shown that over 80% search and rescue is carried out by communities itself before the intervention of specialized rescue and relief forces. Thus there is a need to give basic training to the community members as it is always the first responder after any disaster.
- **Early Earthquake Warning and Security System** -Chennai-based Structural Engineering Research Centre (CSIR-SERC), a pioneer advanced seismic testing and research laboratory under the Council of Scientific & Industrial Research (CSIR), has completed the testing of the German-developed “Early Earthquake Warning and Security System”, which was launched for the first time in India recently.

- A pilot project on Earthquake Early Warning (EEW) system is under implementation for northern India (Uttarakhand) by Indian Institute of Technology (IIT) Roorkee which is funded by the Ministry of Earth Sciences (MoES).
- **Insurance & Risk transfer instruments** – These should be developed in collaboration with the insurance companies and financial institutions.

National Earthquake Risk Mitigation Project

A National Earthquake Risk Mitigation (Preparatory phase) was approved as a Centrally Sponsored Plan Scheme in 2013. The project is to be implemented by NDMA in coordination with the State Governments/UT that lie in seismic zones IV & V in the country. It aims to increase awareness of the key stakeholders on the need for adoption of model building bye-laws and earthquake resistant construction and planning standards.

National Building Code

The National Building Code of India (NBC) provides guidelines for regulating the building construction activities on different materials, planning, design and construction practices of buildings. It lays down provisions designed to protect the safety of the public with regard to structural sufficiency, fire hazards and health aspect of buildings.

 A building collapsed in Lalita Park, Laxmi Nagar, East Delhi in November 2010 in which 71 people lost their lives. It was reported that builders in the area were violating building laws by **adding extra floors** for additional rental incomes and **encroaching road space**. An inquiry commission, headed by retired **justice Lokeshwar Prasad** reported that most of the buildings in East Delhi were unsafe due to the **inferior construction material** used. Recently, again in July 2017 another four-storey building collapsed in the same Lakshmi Nagar area hinting at **poor enforcement of the National Building Code**.

Critical Existing Challenges for Earthquake Mitigation in India

- Inadequate **enforcement of earthquake-resistant building codes** and town planning bye-laws;
- Absence of earthquake-resistant features in constructions in urban and rural areas.
- **Lack of formal training among professionals** in earthquake-resistant construction practices.
- **Lack of adequate preparedness** and **poor response capacity** of various stakeholder groups.
- **Lack of awareness** among various stakeholders about the seismic risk;
- Absence of systems of licensing of engineers and masons.

[UPSC Question: The frequency of earthquakes appears to have increased in the Indian subcontinent. However, India's preparedness for mitigating their impact has significant gaps. Discuss various aspects. (2015)]

NDMA Guidelines on Earthquake Management

Guidelines issued by NDMA rest on six pillars of seismic safety for improving the effectiveness of earthquake management in India:

1. **Earthquake Resistant Construction of New Structures:** All central ministries and departments and state governments will facilitate the implementation of relevant standards for seismically safe design and construction of buildings and other lifeline and commercially important structures falling within their administrative control such as bridges, flyovers, ports, harbours etc.
2. **Selective Seismic strengthening & Retrofitting of existing Priority structures and Lifeline Structures:** All central ministries and state governments are required to draw up programs

for seismic strengthening of priority structures through ULBs and PRIs. **Buildings of national importance** such as Raj Bhavans, Legislatures, Courts, **critical buildings** like academic institutions, **public utility structures** like reservoirs, dams and **multi-storeyed buildings** with five or more floors. The responsibility to identify these structures rests with the State Governments.

3. **Regulation and Enforcement:** State Governments are responsible for establishing mechanisms to implement Building Codes and other safety codes to ensure that all stakeholders like builders, architects, engineers, government departments adhere to seismic safety in all design and construction activities. The Home Ministry had constituted a **national level expert group** which recommended modifications to the town and country planning Acts, land use and zoning regulations, DCRs and building bye-laws which are technically rigorous and conform to globally accepted norms.
4. **Awareness & Preparedness:** NDMA acknowledges that sensitization of all stakeholders is one of the most challenging tasks in earthquake preparedness and mitigation. It recommends preparation of **handbooks on earthquake safety, homeowner's seismic safety manuals, a manual on structural safety audit** and video films for the general public. It also highlights the need to create vulnerability maps of land areas and streamlining of NGOs and Volunteer Groups.
5. **Capacity Development (Education, Training, R&D, Capacity Building and Documentation):** The target groups for capacity development include elected representatives and government officials, professionals in visual and print media, urban planners, engineers, architects and builders, NGOs, Community Based Organisations (CBOs), social activists, social scientists, schoolteachers, and schoolchildren.
6. **Emergency Response:** All response activities are undertaken through **Incident Command System** coordinated by the local administration. It includes involvement of community, corporate sector and specialized teams.

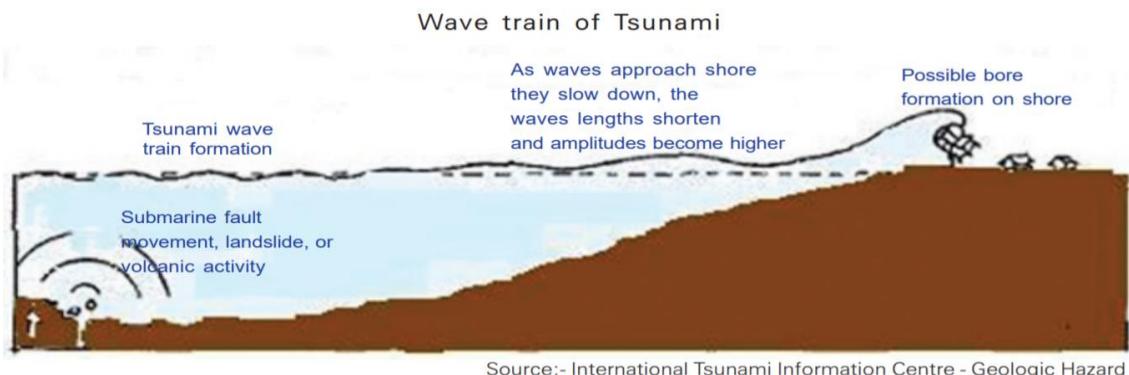
3.2.2. Tsunami

What is a Tsunami?

Tsunami (soo-NAH-mee) is a Japanese word meaning 'harbour' wave. A tsunami is a series of large waves of extremely **long wavelength and period** usually generated by an undersea disturbance or activity near the coast or in the ocean.

How Tsunami is generated?

Tsunamis are generated by a **large, impulsive displacement of the sea bed level**. Earthquakes generate tsunamis by **vertical movement** of the sea floor. Tsunamis can also be triggered by landslides into or under the water surface, volcanic activity and meteorite impacts. Landslide triggered tsunamis can be a possible scenario in the Bay of Bengal and the Arabian Sea due to the huge sediment deposition by the Ganges and Indus Rivers.



Tsunami Risks in India

In the past, a few devastating tsunamis have occurred in the Indian Ocean and in the Mediterranean Sea. The most significant tsunami in the region of the Indian Ocean was the one associated with the violent explosion of the volcanic island of Krakatoa in August 1883. Even though tsunamis occur very rarely in the Indian Ocean region, in the last 300 years, this region recorded 13 tsunamis and 3 of them occurred in the Andaman and Nicobar region. The Indian Ocean Tsunami of 26th December 2004 is one of the most destructive Tsunamis known to have hit India.

Distribution Pattern of Tsunami in India

Both East and West Indian shorelines are vulnerable to tsunami wave action. It has more than 2200 km shoreline which is heavily populated. For a tsunami to hit Indian coastline, it is necessary that a tsunamigenic earthquake of magnitude greater than 6.5 should occur. Actual tsunami hazard of a coastline depends on its bathymetry and coastal topography.

Consequences of Tsunami Disaster

The effects of the tsunami can range from destruction and damage, death, diseases, injury, millions of dollars in financial loss, and long lasting psychological problems for the inhabitants of the region.

The effects of a tsunami depend on the following factors:

- Characteristics of the seismic event that generated the tsunami.
- Distance from its point of origin, its size (magnitude)
- Configuration of the bathymetry (that is the depth of water in oceans).

Indian Ocean tsunami of December 2004 along the Indian coast highlighted that the maximum damage had occurred in low-lying areas near the coast and high casualties were found in thickly populated areas. Mangroves, forests, sand dunes and coastal cliffs provided the best natural barriers to reduce the impact of the tsunami and heavy damage was reported in areas where sand dunes were heavily mined.

Table : History of tsunami's in India

Date	Location	Impact
1524	Near Dabhol, Maharashtra	Sufficient data not available
02 April 1762	Arakan Coast, Myanmar	Sufficient data not available
16 June 1819	Rann of Kachchh, Gujarat	Sufficient data not available
31 October 1847	Great Nicobar Island	Sufficient data not available
31 December 1881	An earthquake of 7.9 in the Richter scale in Car Nicobar Island	Entire east coast of India and Andaman & Nicobar Islands; 1m tsunamis were recorded at Chennai.
26 August 1883	Explosion of the Krakatoa volcano in Indonesian.	East coast of India was affected; 2m tsunamis were recorded at Chennai.
26 June 1941	An 8.1 Richter scale earthquake in the Andaman archipelago.	East coast of India was affected but no estimates of height of the tsunami is available
27 November 1945	An 8.5 Richter scale earthquake at a distance of about 100km south of Karachi	West coast of India from north to Karwar was affected; 12m tsunami was felt at Kandla.
26 December 2004	Banda Aceh, Indonesia; Tamil Nadu, Kerala, Andhra Pradesh, Andaman and Nicobar Islands, India; Sri Lanka; high killing more than 10,000 precious Thailand; Malaysia; Kenya; Tanzania	The East cost of India was affected. The waves measured around 10 m lives.

Tsunami Predictability

Since scientists cannot exactly predict earthquakes, they also cannot exactly predict when a tsunami will be generated. There are two distinct types of tsunami warning:

- International tsunami warning systems and
- Regional warning systems.

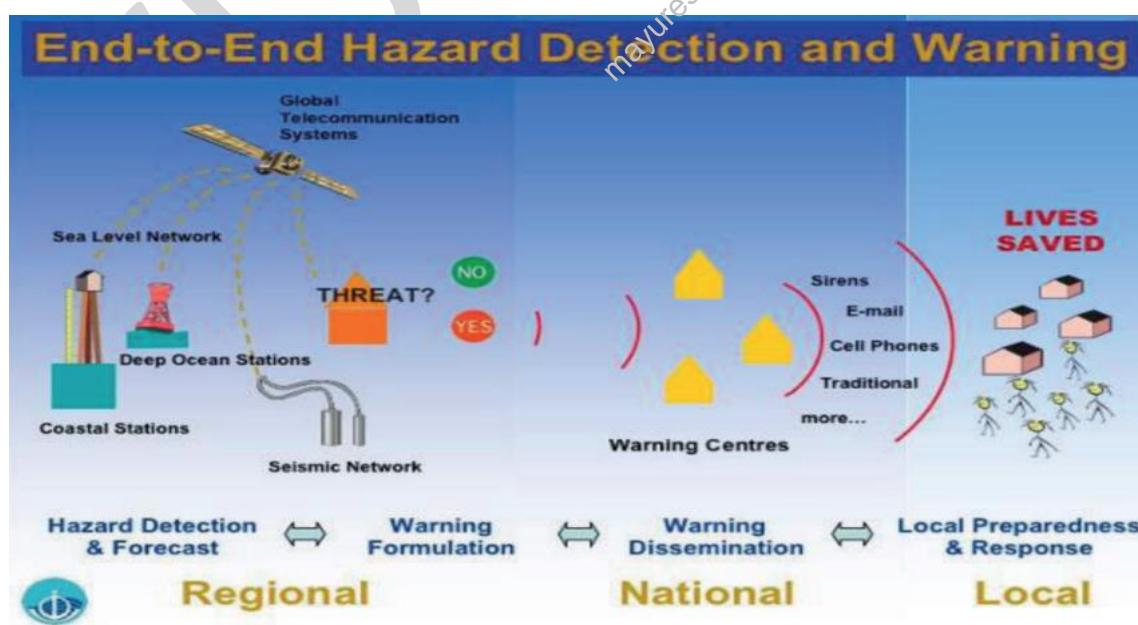
Present status of Tsunami Warnings in India:

The Indian Tsunami Early Warning Centre (ITEWC), which is based at and operated by **Indian National Centre for Ocean Information Services (INCOIS), Hyderabad** has all necessary infrastructure and capabilities to give tsunami advisories to India as well as to Indian Ocean countries. Towards early warning of tsunamis, real-time continuous seismic waveform data of **three IMD stations, viz., Portblair, Minicoy and Shillong**, is also shared with global community by the Centre for Seismology (CS), IMD.

ITEWC has been designated as one of the **Regional Tsunami Service Providers for the entire Indian Ocean Region** by the **Intergovernmental Oceanographic Commission (IOC)** of United Nations Educational, Scientific and Cultural Organization (**UNESCO**). It is providing tsunami warnings and related services to all countries in the Indian Ocean Rim (24 Countries) beyond fully serving the India's coastline / Islands.

The centre is capable of detecting tsunami-genic earthquakes occurring in the Indian Ocean as well as in the Global Oceans within 10 minutes of their occurrence and disseminates the advisories to the concerned authorities within 20 minutes through email, fax, SMS, Global Telecommunication System (GTS) and website.

The ITEWC consists of national and international observational network of **seismic stations, sea level gauge stations** and **tsunami buoys** around the Indian and Pacific Oceans. Data from approximately **400 seismometers** is being received in real-time and processed **automatically to detect an earthquake of magnitude 4.0 and above** anywhere on the globe. As soon as the earthquake is detected, warning centre transmits the first bulletin based on seismic data describing the location of earthquake, its magnitude, depth and other characters of the event. After issuing the first bulletin, seismic data are further analysed to improve the accuracy of earthquake parameters (magnitude, depth and location). The processing of seismic data is optimized to detect and characterize large earthquakes within earliest possible time.



NDMA Guidelines on management of Tsunamis

1. **Tsunami Risk Assessment and Vulnerability Analysis:** NDMA recommends assessment of vulnerability and risk mapping in the tsunami hazard based on coastal land use maps and coastal bathymetry. It suggests development of models to estimate the arrival and wave run up height of tsunami waves. In India, the Indian Naval Hydrographic Department (INHD) functions under the Chief Hydrographer to the Government of India. It regularly provides bathymetry information to authorized agencies for drawing the inundation maps.
2. **Tsunami Preparedness:** A 17-station **Real Time Seismic Monitoring Network (RTSMN)** is envisaged to be established by IMD and Bottom Pressure Recorders (BPRs) are used to detect the propagation of Tsunami waves in the Open Ocean. A major concern is that the unattended ocean observation platforms in sea are being vandalized either accidentally. The **National Institute of Ocean Technology (NIOT)** has implemented the **National Data Buoy Programme** for the protection of surface buoys. Tsunami Bulletins and warning systems are an important part of preparedness. "**Tsunami Escape**" direction sign boards must be set up in coastal areas. Visual and radio media also play an important role in alert and warning and Public awareness campaigns must be held more frequently.
3. **Structural Mitigation Measures:** Following are the various structural measures recommended:
 - Construction of **cyclone shelters, submerged sand barriers/dykes, sand dunes with sea weeds** and plantation of **mangroves and coastal forests** along the coast line.
 - Development of a network of **local knowledge centres** (rural/urban) along the coast lines to provide necessary training and emergency communication during crisis time (e.g. centres developed by M.S. Swaminathan Foundation in Pondicherry).
 - Construction of **location specific sea walls and coral reefs** in consultation with experts.
 - Development of **break waters** along the coast to provide necessary cushion,
 - Development of a "**Bio-Shield**" - a narrow strip of land along coastline. It can be developed as coastal zone disaster management sanctuary, which must have thick plantation and public spaces for public awareness, dissemination and demonstration.
 - Identification of vulnerable structures and appropriate retrofitting for tsunami/cyclone resistance of all such buildings along with identification of Tsunami shelters.
4. **Regulation and Enforcement of Techno-Legal Regime:** Following measures can be taken:
 - Strict implementation of the **coastal zone regulations** (within 500 m of the high tide line with elevation of less than 10 m above mean sea level)
 - Adoption the model techno-legal framework, developed by MHA, for ensuring compliance of tsunami-safe zoning, planning, design and construction practices and encourage optimum land use.
5. **Emergency Tsunami Response:** As community is the first responder, launching a series of public awareness campaign throughout the coastal area by various means can be undertaken. SHGs, NGOs, CBOs can be involved in search and rescue operations. Inflatable motorized boats, helicopters and search & rescue equipment are required immediately after a tsunami to carry out search and rescue of people trapped in inundated areas, on tree tops and hanging on to structures.

The Indian Naval Hydrographic Department plays a crucial role in disasters affecting coastal areas. During the Indian Ocean Tsunami of 26th December 2004, seven survey ships were deployed to open the sea lines of communication apart from providing the medical aid. They were engaged to urgently re-chart the area and bring out the latest bathymetry information.

6. Ensuring Implementation: Aggressive capacity building requirements for the local people and the administration for facing the disasters in wake of tsunami and cyclone, 'based on cutting edge level'.

- Awareness generation and training among the fishermen, coast guards, officials from fisheries department and port authorities and local district officials etc., in connection with evacuation and post tsunami storm surge management activities. Regular drills should be conducted to test the efficacy of the DM plans.

Existing Challenges

The critical areas of concern, with respect to Tsunami Risk management in India are:

- Lack of easily accessible tsunami documentation and paleo-tsunami studies for better understanding of past tsunami events for improved risk assessment;
- Lack of high resolution near-shore bathymetric and topographic data will prove to be a limiting factor for inundation models;
- Inadequate community awareness on tsunami risk and vulnerability.
- Lack of people's participation in strengthening disaster preparedness, mitigation and emergency response in the coastal areas.
- Lack of documentation of traditional knowledge for tsunami risk management.

 Tree plantation is a cost-effective long-lasting means of tsunami mitigation in comparison to the artificial barriers. Some locations of Indian Ocean where Tsunami struck in 2004 remained almost intact because the existing coconut palms and mangroves trees absorbed the tsunami's energy. Similarly, the village of Naluvvedapathy in Tamil Nadu region faced minimal damage and few deaths because of the forest of 80, 244 trees planted along the shoreline in 2002.

3.2.3. Volcano

What is a Volcano?

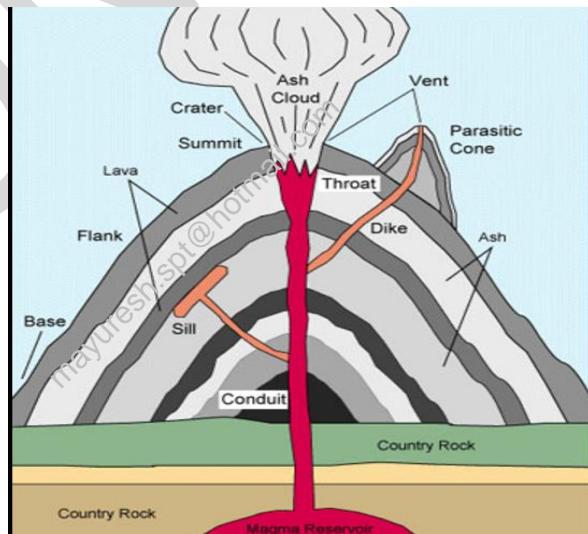
A volcano is a vent in the earth crust that lets out hot lava, gasses, rocks, volcanic ash and steam from a magma chamber underneath the earth's surface. They are called active if they erupt regularly. Dormant or inactive volcanoes are those that have erupted in the past times but are now quiet while the volcanoes that have not erupted since ages are termed extinct.

Causes of Volcano

Volcanic eruptions predominantly occur in areas with vibration activities or weak zones, for example, where the continental plates of the earth pull apart or collide. It also occurs where the earth crust constantly melts.

Volcano Risks in India

India's only live volcano is the Barren Island volcano in the Andaman and Nicobar Islands, which had started



List of all Volcanoes in India

Sr. No.	Volcano Name	State
1.	Barren Island	(Active)
2.	Narcondam	(Extinct)
3.	Baratang	(Extinct)
4.	Deccan Traps	(Extinct)
5.	Dhinodhar Hills	(Extinct)
6.	Dhos Hill	(Extinct)

showing activity in the year 1991 after being dormant for over 150 years. It has once again started spewing ash in January 2017. The volcanic island is **uninhabited** and the northern part of the island is barren and devoid of vegetation.

3.2.4. Floods

What is Flood?

Flood is a state of high water level along a river channel or on the coast that leads to inundation of land. India is highly vulnerable to floods. Out of the total geographical area of 329 million hectares, Rashtriya Barh Ayog (RBA) has assessed that **more than 40 million hectare area is flood prone**.

Causes of Floods

Inadequate capacity of the rivers to contain within their banks the high flows brought down from the upper catchment areas following heavy rainfall, leads to flooding.

Indiscriminate deforestation, unscientific agricultural practices, disturbances along the natural drainage channels and colonisation of flood-plains and river-beds are some of the human activities that play an important role in increasing the intensity, magnitude and gravity of floods. Some of the causes of flood are as follows:

What are Flash Floods?

- Flash floods are characterized by very fast rise and recession of flow of small volume and high discharge, which causes high damages because of suddenness.
- This occurs in hilly and sloping lands where heavy rainfall and thunderstorms or cloudbursts are common.
- Depression and cyclonic storms in the eastern coastal areas may also cause flash floods.
- Sudden release of waters from upstream reservoirs, breaches in dams and embankments on the banks of the rivers also leads to floods.
- Flash floods warning systems and forecasting is done using Doppler radars.

Natural causes

- **Heavy rainfall:** Heavy rain in the catchment area of a river causes water to over flow its banks, which results in the flooding of nearby areas.
- **Sediment deposition:** River beds become shallow due to sedimentation. The water carrying capacity of such river is reduced. As a result the heavy rainwater over flow the river banks.
- **Cyclone:** Cyclone generated sea waves of abnormal height spreads the water in the adjoining coastal areas. In October 1994 Orissa cyclone generated severe floods and caused unprecedented loss of life and property.
- **Change in the course of the river:** Meanders, erosion of river beds and banka, and obstruction of flow due to landslides also lead to changes in river courses.
- **Tsunami:** Large coastal areas are flooded by rising sea water, when a tsunami strikes the coast.
- **Lack of Lakes** - Lakes can store the excess water and regulate the flow of water. When lakes become smaller, their ability to regulate the flow become less and hence flooding.

Snowmelt and glacial melt are gradual processes and usually does not cause major floods. But sometimes glaciers hold large quantity of bounded water, which may be suddenly released with melting of ice block resulting into Glacial Lake Outburst Floods (GLOFs).

Anthropogenic causes

- **Deforestation:** Vegetation facilitates percolation of water in the ground. As a result of deforestation, the land becomes obstruction free and water flows with greater speed into the rivers and causes flood.

- **Interference in drainage system:** Drainage congestion caused by badly planned construction of bridges, roads, railway tracks, canals etc. hampers the flow of water and results in floods.
- **International dimension** - The rivers originating in China, Nepal and Bhutan cause severe floods in the states of Uttar Pradesh, Bihar, West Bengal, Arunachal Pradesh and Assam. For flood management (FM), cooperation with the neighbouring countries viz. China, Nepal and Bhutan is essential.
- **Population pressure** - Because of large amount of people, more materials are needed, like wood, land, food, etc. This aggravates overgrazing, land encroachment, over cultivation and soil erosion which increases the risk of flooding.
- **Poor Water and Sewerage Management** - Old drainage and sewerage systems in urban areas have not been overhauled. During the rainy seasons every year, the drainage and sewer system collapse resulting in urban flooding.

Flood Hazard Vulnerability of India

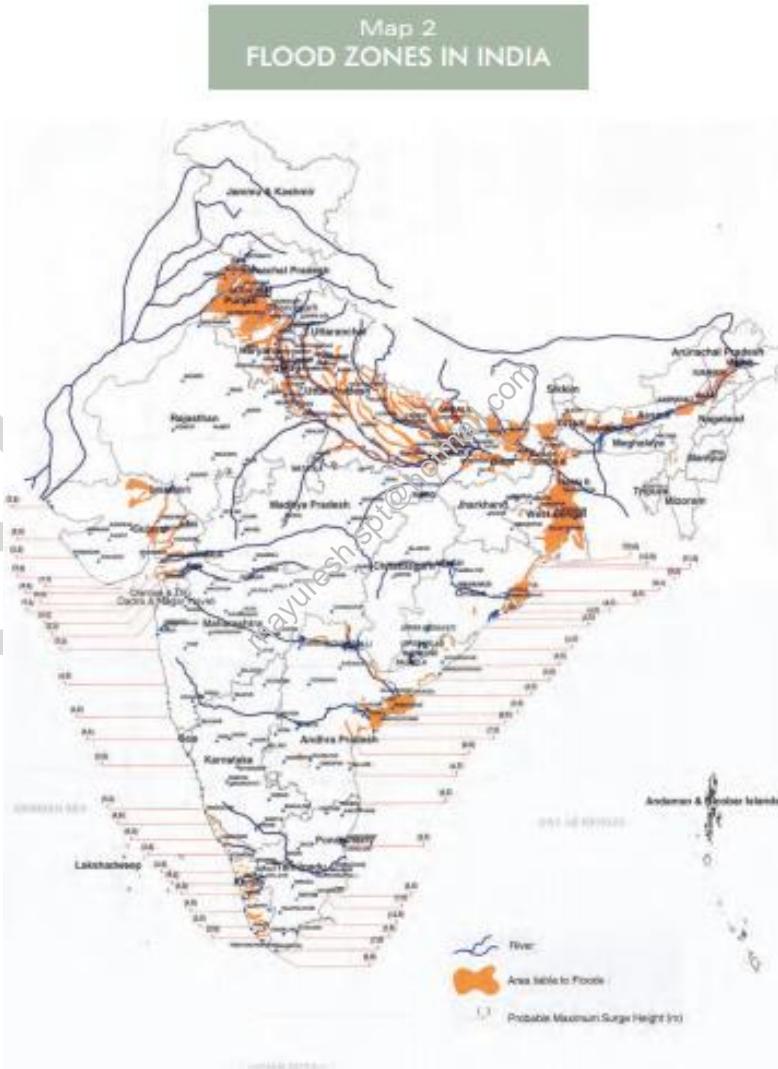
Floods occur in almost all the river basins of the country. Around **12 per cent (40 million hectare) of land** in India is prone to floods. Our country receives an annual rainfall of 1200 mm, **85% of which is concentrated in 3-4 months i.e. June to September**. Due to the intense and periodic rain, most of the rivers of the country are fed with huge quantity of water, much beyond their carrying capacity leading to mild to severe flood situations in the region.

Distribution Pattern of Flood Areas in India

The Brahmaputra River Region

This region consists of the rivers Brahmaputra and Barak and their tributaries, and covers the states of Assam, Arunachal Pradesh, Meghalaya, Mizoram, Manipur, Tripura, Nagaland, Sikkim and the northern parts of West Bengal.

- The catchments of these rivers receive heavy rainfall during monsoons.
- These rivers originate in fragile hills susceptible to erosion leading to high silt discharge.



Source: BMTPC Vulnerability Atlas

- The region is subject to severe and frequent earthquakes, which cause numerous landslides and upset river regime.
- Cloud bursts followed by flash floods and heavy soil erosion are also prevalent.

The Ganga River Region

The river Ganga has many tributaries, the important ones being Yamuna, Sone, Ghaghra, Raphti, Gandak, Burhi Gandak, Bagmati, Kamla Balan, Adhwara group of rivers, Kosi and the Mahananda. It covers the states of Uttarakhand, Uttar Pradesh, Jharkhand, Bihar, south and central parts of West Bengal, Punjab, parts of Haryana, Himachal Pradesh, Rajasthan, Madhya Pradesh and Delhi.

- The flood problem is mostly confined to the areas on the northern bank of the river Ganga as most of the damage is caused by the northern tributaries of the Ganga.
- In general, the flood problem increases from the west to the east and from south to north.
- In recent years, the states of Rajasthan and Madhya Pradesh have also experienced some incidents of heavy floods.
- Large-scale encroachment of flood plains of the rivers for habitation and various developmental activities is one of the main causes in this region.

The North-West River Region

The main rivers in this region are the Indus, Sutlej, Beas, Ravi, Chenab and Jhelum. This region covers the states of Jammu and Kashmir, Punjab and parts of Himachal Pradesh, Haryana and Rajasthan. Compared to the Ganga and the Brahmaputra river regions, the flood problem is relatively less in this region.

- The major problem is that of inadequate surface drainage which causes inundation and water-logging over vast areas.
- Indiscriminate use of water for irrigation and development of low-lying areas and depressions has created problem of drainage congestion and water logging.
- These rivers change their courses frequently and leave behind vast tracts of sandy waste.

The Central and Deccan India

Important rivers in this region are the Narmada, Tapi, Mahanadi, Godavari, Krishna and Cauvery. These rivers have mostly well-defined and stable courses. They have adequate capacities within the natural banks to carry the flood discharge except in the delta area. The region does not have serious flood problem except that some of the rivers in Orissa State namely Mahanadi, Brahmini, Baitarni, and Subarnarekha are prone to floods every year. The delta and coastal areas of the states on the east coast periodically face flood and drainage problems in the wake of monsoon depression and cyclonic storms.

Consequences of Floods

- Frequent inundation of agricultural land and human settlement has serious consequences on the national economy and society.
- Floods destroy valuable crops and also damage physical infrastructure such as roads, rails, bridges and human settlements.
- Millions of people are rendered homeless and are also washed down along with their cattle in the floods.
- Spread of diseases like cholera, gastro-enteritis, hepatitis and other water-borne diseases spread in the flood-affected areas.
- Floods also make a few positive contributions. Every year, **flood deposit fertile silt over agricultural fields** which restores fertility of the soil.

NDMA Guidelines on Flood Management

The main thrust of the flood protection programme undertaken in India so far has been on structural measures.

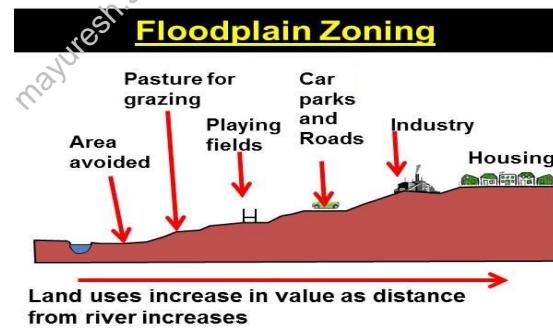
Flood Prevention, Preparedness and Mitigation

Structural Measures

- Reservoirs, Dams, Other Water Storages:** By constructing reservoirs in the courses of rivers could stores extra water at the time of flood. Such measures adopted till now however, have not been successful. Dams built to control floods of Damodar could not control the flood.
 - Embankments/Flood Levees/Flood Walls:** By building flood protection embankments, floods water can be controlled from overflowing the banks and spreading in nearby areas. Building of embankments on Yamuna, near Delhi, has been successful in controlling the flood.
 - Drainage improvement:** Drainage system is generally choked by the construction of roads, canals railway tracks etc. Floods could be checked if the original form of drainage system is restored.
 - Channel Improvement/Desilting/Dredging of Rivers:** A channel can be made to carry flood discharge at levels lower than its prevailing high flood level by improving its discharge carrying capacity. It aims at increasing the area of flow or the velocity of flow (or both) to increase its carrying capacity. Selective desilting/dredging at outfalls/confluences or local reaches can, however, be adopted as a measure to tackle the problem locally.
 - Diversion of Flood Water:** Diverting all or a part of the discharge into a natural or artificially constructed channel, lying within or in some cases outside the flood plains is a useful means of lowering water levels in the river.
-  The flood spill channel skirting Srinagar city and the supplementary drain in Delhi are examples of diverting excess water to prevent flooding of the urbanised areas.
- Catchment Area Treatment/Afforestation:** Watershed management measures such as developing the vegetative cover i.e. afforestation and conservation of soil cover in conjunction with structural works like check dams, detention basins etc. serve as an effective measure in reducing flood peaks and controlling the suddenness of the runoff.

Non-Structural Measures

- Flood Plain Zoning:** It is to regulate land use in the flood plains in order to restrict the damage due to floods, while deriving maximum benefits from the same.
- Flood Proofing:** It helps in the mitigation of distress and provides immediate relief to the population in flood prone areas. It is a **combination of structural change and emergency action, not involving any evacuation**. It includes providing raised platforms for flood shelter for men and cattle, raising the public utility installation especially the platforms for drinking water hand pumps and bore wells above flood level, promoting construction of double-storey buildings wherein the first floor can be used for taking shelter during floods.
- Flood Management Plans:** All government departments and agencies must prepare their own FMPs.
- Integrated Water Resources Management** aiming at integrating management of water resources at the basin or watershed scale.



Flood Forecasting and Warning in India: Real time discharge and rainfall data is the basic requirements for the formulation of a flood forecast. Most of the hydro-meteorological data are observed and collected by the field formations of Central Water Commission; IMD supplies the daily rainfall data.

Aapada Mitra Scheme

The NDMA has approved a Centrally Sponsored Scheme focusing on training community volunteers in disaster response in the 30 most flood-prone districts of 25 states in India. It aims to train community volunteers with the skills that they would need to respond to their community's immediate needs and to undertake basic relief and rescue tasks from emergency situations such as floods, flash floods, and urban flooding, when emergency services are not readily available.

[Why are floods such a recurrent feature in India? Discuss the measures taken by the Government for flood control. (85/I16c/20)]

3.2.5. Urban Floods

What is Urban Flood?

Area under urban settlements (7933 towns) in India has increased from 77,000 sq. km in 2001 to 1,00,000 sq. km in 2011 showing 25,000 sq.km of additional land area being brought under urban uses. Unplanned development and encroachments of sprawling habitations alongside rivers and watercourses have meddled with the natural flow of streams. As a result of this, the runoff has increased in proportion to urbanization of the watersheds causing urban floods.

Causes of Urban Floods

Flooding in the cities and the towns is a recent phenomenon caused by increasing incidence of heavy rainfall in a short period of time, indiscriminate encroachment of waterways, inadequate capacity of drains and lack of maintenance of the drainage infrastructure. There is wide variation of rainfall amongst the cities and, even within the city, rainfall shows large spatial and temporal variation; for example, in Mumbai, on 26th July 2005, Colaba recorded only 72 mm of rainfall while Santa Cruz, which is 22 km away, recorded 944 mm in 24 hours.

Urban Flood Risks in India

Urban flooding is significantly different from rural flooding as urbanization leads to developed catchments, which increases the flood peaks from 1.8 to 8 times and flood volumes by up to 6 times. These areas are densely populated centers of economic activities with vital infrastructure which needs to be protected 24x7. Floods of Chennai (December 2015), the Kashmir Floods (2014), the Surat Floods (2006) and the Mumbai Floods (2005 & 2017) reflect the vulnerability of our Cities.

Impact and Mitigation Strategies for Urban Flood

Urban Flooding has localized impacts on commercial, industrial, business, residential and institutional locations. Disruption of water supply, sewerage, power supply and

Losses due to urban flooding

Direct losses: Losses resulting from direct contact with flood water, to buildings and infrastructure, human and animal lives.

Indirect losses: Losses resulting from the event but not from its direct impact, for example, transport disruption, business losses that can't be made up, losses of family income, etc.

In both loss categories, there are two clear sub-categories of loss:

Tangible losses: Loss of things that have a monetary (replacement) value, for example, buildings, infrastructure, etc.

Intangible losses: Loss of things that cannot be bought and sold, for example, lives and injuries, heritage items, memorabilia, etc.

communications is common. Shutdown of commercial, industrial and business activity and loss to property and assets is often observed. Disruption of traffic – road, rail and air is frequent. New slums come up in areas which are not approved.

In order to check the threat of urban flooding, each city should have their Flood mitigation plans (floodplain, river basin, surface water, etc.) strongly integrated with the overall land use policy and master plan of a city. The following three phases of disaster management for effective and efficient response to urban flooding include:

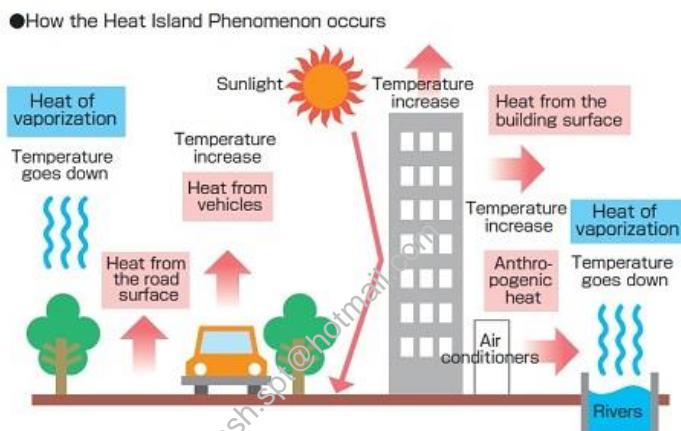
Pre-Monsoon Phase (Preparedness): It involves an estimation of emergency needs, familiarization of the stakeholders, particularly the communities through training and simulation exercises, identification of Teams for maintaining the drains and roads and conducting exercises for prevention of water logging/ inundation.

During Monsoon Phase (Early Warning & Effective Response): It includes timely, qualitative and quantitative warnings based on the intensity of rainfall to various agencies to take preventive measures. The Response phase focuses primarily on emergency relief: saving lives, providing first aid, minimizing and restoring damaged systems (communications and transportation), meeting the basic life requirements of those impacted by disaster (food, water, and shelter), and providing mental health and spiritual support and comfort care.

Post-Monsoon Phase: Restoration and Re-habilitation phase includes establishment of a programme to restore both the disaster site and the damaged materials to a stable and usable condition.

Urbanization leads to an increase in rainfall:

As early as 1921, scientists noted thunderstorm formation over large cities while there were none over rural areas. This can be very well explained by the Urban Heat Island Effect – the rising heat induces cloud formation while the winds interact with urban induced convection to produce downwind rainfall.



Brief points on NDMA Guidelines on Urban Flood

- **Early Warning System and Communication:** National Hydro-meteorological Network and Doppler Weather Radars can provide a lead time of 3 to 6 hours. Once flood warning is generated, it must be communicated to public in an effective manner.
- **Design and Management of Urban Drainage:** Rapid urbanisation has resulted in increased impermeable surfaces in the form of pavements, roads and built-up areas, thereby reducing the infiltration and natural storage.
 - **Drainage System:** A proper inventory of water supply system with details of all pumping, storage etc. must be maintained, particularly of the minor drainage systems.
 - **Catchment as a basis of design:** As run off processes are independent of states and city administrative boundaries outlines of drainage divides must be depend on watershed delineation.
 - **Contour Data:** Accurate contours are necessary for determining the boundaries of a watershed/ catchment and for computing directions of flow.
 - **Design Flow:** Estimation of peak flow rates for adequate sizing and quantity control facilities.

- **Removal of Solid Waste:** Most towns and cities have open surface drains besides the road, into which there is unauthorized public disposal of waste. Solid waste increases hydraulic roughness, causes blockage and generally reduces flow capacity.
- **Drain Inlet Connectivity:** It is seen that the inlets to drain the water from the roads into the roadside drains are either not properly aligned or non-existent leading to severe waterlogging on the roads.
- **Rain Gardens:** Rain gardens consist of a porous soil covered with a thin layer of mulch. Stormwater runoff is directed into the facility, allowed to pond and infiltrates through the plant/mulch/soil environment.
- **Vulnerability Analysis and Risk Assessment:** Identification of areas at risk, classification of structures according to function and estimation of risk for each structure and function using Hazard Risk Zoning.
- **Urban Flooding Cells:** A separate Urban Flooding Cell (UFC) will be constituted within MoUD which will coordinate all UFDM activities at the national level. ULBs will be responsible for the management of urban flooding at the local level.
- **Response:** Emergency Operation Centres, Incident Response System, flood shelters, search and rescue operations, emergency logistics are some key action areas of flood response mechanism.
- **Sanitation:** Diseases like malaria, dengue and cholera can spread if adequate sanitation and disinfection are not carried out.
- **Capacity Development, Awareness Generation and Documentation:** Participatory urban flood planning and management involving both local government and the community.

Existing Challenges

- Less importance to **comprehensive risk assessment** of urban flooding. It includes understanding, analysis and assessment of urban flood risks, before flood mitigation measures are planned and implemented.
- **Ignorance of mapping** of different factors and risks in different cities and non-inclusion of the same in development planning
- Unsatisfactory coordination among different institutions for experience sharing for the purpose of public awareness and imparting professional training of disaster managers.
- Lack of information sharing,
- Disintegrated investment decisions, and
- Lack of consultation with stakeholders.

[UPSC Question: The frequency of urban floods due to high intensity rainfall is increasing over the years. Discussing the reasons for urban floods, highlight the mechanisms for preparedness to reduce the risk during such events. (2016)]

3.2.6. Landslides

What is a Landslide?

A landslide is defined as the movement of a mass of rock, debris, or earth down a slope. Landslides are a type of "mass wasting," which denotes any down-slope movement of soil and rock under the direct influence of gravity.

Landslides are one of the natural hazards that affect at least 15 per cent of the land area of our country. The Himalayas are formed due to collision of Indian and Eurasian plate. The northward movement of the Indian plate (@5cm/year) towards Eurasian plate causes continuous stress on the rocks rendering them friable, weak and prone to landslides and earthquakes.



Landslide Vulnerability Zones of India

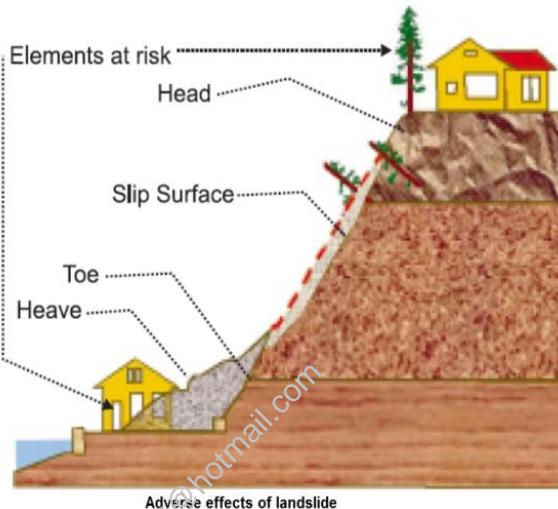
On the basis of frequency and other controlling factors like geology, geomorphic agents, slope, land-use, vegetation cover and human activities, **India has been divided into a number of vulnerability zones** as shown in table below:

Very High Vulnerability Zone	<ul style="list-style-type: none"> Highly unstable, relatively young mountainous areas in the Himalayas and Andaman and Nicobar, High rainfall regions with steep slopes in the Western Ghats and Nilgiris, the north-eastern regions, Areas that experience frequent ground-shaking due to earthquakes, etc. and Areas of intense human activities, particularly those related to construction of roads, dams, etc.
High Vulnerability Zone	<ul style="list-style-type: none"> Very high vulnerability zone are included in this category. (except the plains of Assam) The only difference between these two is the combination, intensity and frequency of the controlling factors.
Moderate to Low Vulnerability Zone	<ul style="list-style-type: none"> Areas that receive less precipitation such as- <ul style="list-style-type: none"> - TransHimalayan areas of Ladakh and Spiti (Himachal Pradesh), - undulated yet stable relief and low precipitation areas in the Aravali,

	<ul style="list-style-type: none"> - rain shadow areas in the Western and Eastern Ghats and - Deccan plateau • Landslides due to mining and subsidence are most common in states like Jharkhand, Orissa, Chhattisgarh, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Goa and Kerala.
Other Areas	The remaining parts of India, particularly states like Rajasthan, Haryana, Uttar Pradesh, Bihar, West Bengal (except district Darjiling), Assam (except district KarbiAnglong) and Coastal regions of the southern States are safe as far as landslides are concerned.

Causes of Landslides

- **Heavy rain:** Heavy rain is the main cause of landslides.
- **Deforestation:** Deforestation is another major cause of landslides. Tree, brushes and grasses keep the soil particles compact. Mountain slope loses their protective cover by felling of trees. The rain water flows on such slopes with unimpeded speed.
- **Earthquakes and volcanic explosions:** Earthquake is a common feature in the Himalaya. Tremors destabilize the mountains and the rocks tumble downwards. Volcanic explosions also trigger landslides in the mountainous areas.
- **Building of roads:** Roads are built in mountainous areas for development. During the process of the construction of road, a large amount of rocks and debris has to be removed. This process dislodges the rock structure and changes the angle of slopes. Consequently landslides are triggered.
- **Shifting agriculture:** In the North Eastern part of India, the number and frequency of landslides has increased due to the practice of shifting agriculture.
- **Construction of houses and other buildings:** For giving shelter to the ever-increasing population and promotion of tourism more and more house and hotels are being built. In building processes large amount of debris created. This causes the landslides.



Consequences of Landslide Hazard

Landslide disasters have both short-term and long-term impact on society causing an imbalance in economic and social life and the environment.

- **Short term impacts:**
 - ✓ Loss of natural beauty
 - ✓ Roadblocks, destruction of railway lines
 - ✓ channel blocking due to rock-falls
 - ✓ diversion of river courses due to landslides causing **flood** and
 - ✓ Loss of life and property
- **Long term impacts:**
 - ✓ Changes in the landscape that can be permanent,
 - ✓ the loss of cultivable land
 - ✓ the environmental impact in terms of erosion and soil loss,
 - ✓ population shift and relocation of populations and establishments
 - ✓ drying up of sources of water



Landslide Hazard Mitigation

- Hazard zones have to be identified and specific slides to be stabilized and managed in addition to monitoring and early warning systems to be placed at selected sites.
- It is always advisable to adopt **area-specific measures** to deal with landslides.
- **Hazard mapping** should be done to locate areas commonly prone to landslides.
- **Restriction on the construction** and other developmental activities such as roads and dams, limiting agriculture to valleys and areas with moderate slopes, and control on the development of large settlements in the high vulnerability zones, should be enforced.
- Promote large-scale **afforestation programmes** and construction of bunds to reduce the flow of water.
- **Terrace farming** should be encouraged in the north-eastern hill states replacing Jhumming or shifting cultivation.
- **Retaining walls** can be built of mountain slopes to stop land from slipping.
- Treating vulnerable slopes and existing hazardous landslides.
- Restricting development in landslide-prone areas.
- Preparing codes for excavation, construction and grading.
- Protecting existing developments.
- Putting in place arrangements for landslide insurance and compensation for losses.

Existing Challenges

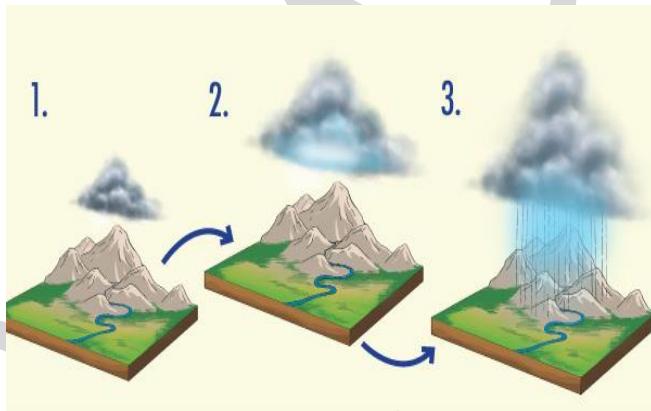
- Integrating landslide concerns in the development of disaster management plans at different levels i.e., national, state, district, municipal/panchayat.
- Switch-over from piecemeal remediation of landslides to simultaneous and holistic implementation of control measures.

- Techno-legal regime for introduction of sound slope protection, planned urbanisation, regulated land use and environment friendly land management practices.
- Zero tolerance against deliberate environmental violence and unhealthy construction practices.
- Laws governing new constructions and alteration of existing land use on problematic slopes and in landslide prone areas.
- Innovation in the management of multi-institutional and multi-disciplinary teams.
- Establishment of a disaster knowledge network and a mechanism for dissemination of information at the national level, mechanism for international linkages, cooperation and joint initiatives.

3.2.7. Cloudburst

What is a Cloudburst?

A cloudburst is a sudden downpour within a radius of few kilometres. It usually lasts no longer than few minutes but is capable of flooding the area. Rainfall from a cloudburst is usually over 100 mm per hour.



How are cloudbursts formed?

1. Monsoon clouds filled with water droplets move across the plains. Warm air currents keep pushing the clouds up not allowing them to shed rain.
2. More and more water droplets get collected and the clouds get bigger as they move up a mountain or hill. The clouds soon stop moving since there is barely any wind up in the mountains.
3. The warm air holding up the water drops in the clouds cools. The cloud bursts like a soggy paper bag and the rain comes gushing down.

Cloudburst risks in India

As per the specific definition of Cloudburst, if rainfall of about 10 cm or above per hour is recorded over a place that is roughly 10 km x 10 km in area, it is classified as a cloudburst event. This means, 5 cm of rainfall in half an hour would also be classified as a cloudburst. India, in a normal year, gets about 116 cm of rain in the entire year i.e. every area in the country, on an average, should expect to get only this amount during the course of the year.

August 2, 2010	Leh, Ladakh	25 cm of rainfall in just 1 hour!
September 29, 2010	National Defence Academy	14.4 cm of rainfall in just 1 hour!
October 4, 2010	Pashan, Pune	18.2 cm of rainfall in just 1.5 hours!
July 26, 2005	Mumbai	144.8 cm of rainfall in 10 hours!

Record cloudbursts in India

The events of extreme precipitation have been on the rise in the last few decades due to global warming; it is expected that cloudburst events might be on the increase as well.

Distribution Pattern of Cloudbursts

Cloudbursts do happen in plains as well, but there is a greater probability of them occurring in mountainous zones; as it has to do with the terrain of the region. For example- like steep hills favour the formation of these clouds. Cloudbursts get counted only when they result in large

scale destruction of life and property, which happens mainly in mountainous regions.

Predictability about Cloudbursts

There is no satisfactory technique for anticipating

Consequences of Cloudburst

- ✓ flash floods/ landslides
- ✓ house collapse, property loss
- ✓ dislocation of traffic
- ✓ human casualties on large scale

the occurrence of cloud bursts because of their small scale. A very fine network of radars is required to be able to detect the likelihood of a cloud burst about six hours in advance, sometimes even 12-14 hours in advance. This would be prohibitively expensive. Only the areas likely to receive heavy rainfall can be identified on a short range scale. Much of the damage can be avoided by way of identifying the areas and the meteorological situations that favour the occurrence of cloud bursts.

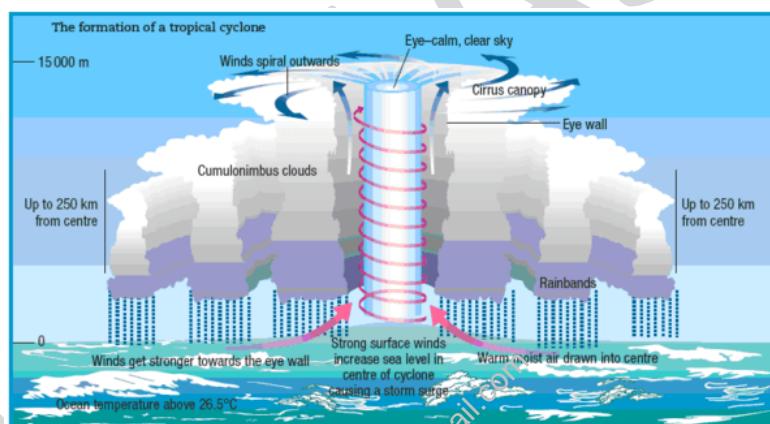
Note: *Cloudburst Hazard Mitigation, Challenges, Do's and Dont's before-during-after disaster go hand in hand with Flash/Urban floods and landslides.*

[UPSC Question: With reference to National Disaster Management Authority (NDMA) guidelines, discuss the measures to be adopted to mitigate the impact of recent incidents of cloudbursts in many places of Uttarakhand. (2016)]

3.2.8. Cyclone

What is Cyclone?

Cyclone is a region of low atmospheric pressure surrounded by high atmospheric pressure resulting in swirling atmospheric disturbance accompanied by powerful winds. They occur mainly in the tropical and temperate regions of the world.



Formation of Tropical Cyclone

Favourable Conditions: Cyclones are atmospheric and oceanic phenomena. Listed below are some of the favourable identified conditions:

- A warm sea surface (temperature in excess of 26°–27°C) and associated warming extending up to a depth of 60m with abundant water vapour in the overlying air (by evaporation),
- High relative humidity in the atmosphere up to a height of about 5,000 metres,
- Atmospheric instability that encourages the formation of massive vertical cumulus clouds due to condensation of rising moist air,
- Low vertical wind shear between the lower and higher levels of the atmosphere that do not allow the heat generated and released by the clouds to get transported from the area (vertical wind shear is the rate of change of wind between the higher and lower levels of the atmosphere),

Cyclones are known by different names in different parts of the world:

- ◆ Typhoons in the Northwest Pacific Ocean west of the dateline
- ◆ Hurricanes in the North Atlantic Ocean, the Northeast Pacific Ocean east of the dateline, or the South Pacific Ocean.
- ◆ Tropical cyclones - the Southwest Pacific Ocean and Southeast Indian Ocean.
- ◆ Severe cyclonic storm" (the North Indian Ocean)
- ◆ Tropical cyclone (the Southwest Indian Ocean)
- ◆ Willie-Willie in Australia
- ◆ Tornado in South America

- The presence of cyclonic vorticity (rate of rotation of air) that initiates and favours rotation of the air cyclonically, and
- Location over the ocean, at least 4–5° latitude away from the equator.

Within the cyclone field, strong winds blow around the low pressure centre in an anticlockwise direction in the Northern Hemisphere and clockwise in Southern Hemisphere, though the wind at the centre (known as eye of the cyclone) is very little and generally free from cloud and rain. Winds increase rapidly to its peak (often exceeding 150 km/h) at about 20 to 30 km from the centre and thereafter decrease gradually to become normal around 300 to 500 km away. Cyclones vary in diameter from 100 to 1,000 km but their effect dominates over thousands of square kilometres over the ocean as well as along the coast. The powerhouse is located within a 100 km radius of the eye of the cyclone where very strong winds, sometimes more than 250 km per hour, can be generated in a narrow zone beyond the eye diameter.

Cyclone Risks in India

India has a coastline of about 7,516 km, 5,400 km along the mainland, 132 km in Lakshadweep and 1,900 km in the Andaman and Nicobar Islands. Although the North Indian Ocean (NIO) Basin (including the Indian coast) generates only about 7% of the world's cyclones, their impact is comparatively high and devastating, especially when they strike the coasts bordering the North Bay of Bengal. On an average, five to six tropical cyclones form every year, of which two or three could be severe. More cyclones occur in the Bay of Bengal than the Arabian Sea and the ratio is approximately 4:1.

Tropical cyclones occur in the months of May-June and October-November.

Cyclones of severe intensity and frequency in the North Indian Ocean are bi-modal in character, with their primary peak in November and secondary peak in May. The disaster potential is particularly high during landfall in the



North Indian Ocean (Bay of Bengal and the Arabian Sea) due to the accompanying destructive wind, storm surges and torrential rainfall.

Cyclone Prone Areas in India

There are 13 coastal states and union territories (UTs) in the country, encompassing 84 coastal districts which are affected by tropical cyclones. Four states (Tamil Nadu, Andhra Pradesh, Orissa and West Bengal) and one UT (Puducherry) on the east coast and one state (Gujarat) on the west coast are highly vulnerable to cyclone disasters.

Cyclone Warning System in India

Low pressure and the development can be detected hours or days before it causes damage. The satellites track the movement of these cyclones based on which the people are evacuated from areas likely to be affected. It is difficult to predict the accuracy. Accurate landfall predictions can give only a few hours' notice to threatened population.

India has one of the best cyclone warning systems in the world. The India Meteorological Department (IMD) is the nodal department for wind detection, tracking and forecasting cyclones. Cyclone tracking is done through INSAT satellite. Cyclone warning is disseminated by several means such as satellite based disaster warning systems, radio, television, telephone, fax, high priority telegram, public announcements and bulletins in press. These warnings are disseminated to the general public, the fishing community especially those in the sea, port authorities, commercial aviation and the government machinery.

Consequences of Cyclone Hazard

- ✓ Inundation of sea water in low lying areas of coastal regions,
- ✓ Heavy floods, landslides
- ✓ Erodes beaches and embankments,
- ✓ Destruction of vegetation, infrastructure and loss of life
- ✓ Loss of crops and food supplies along with loss of soil fertility
- ✓ Contamination of ground and pipe water supply
- ✓ Severe disruption in the communication links

Cyclone Shelters

One of the most successful ways of reducing loss of human lives during cyclones is the provision of cyclone shelters. In densely populated coastal areas, where large scale evacuations are not always feasible, public buildings can be used as cyclone shelters. These buildings can be so designed, so as to provide a blank façade with a minimum number of apertures in the direction of the prevailing winds. The shorter side of the building should face the storm, so as to impart least wind resistance. Earth berms and green belts can be used in front of these buildings to reduce the impact of the storm.

Cyclone Hazard Mitigation

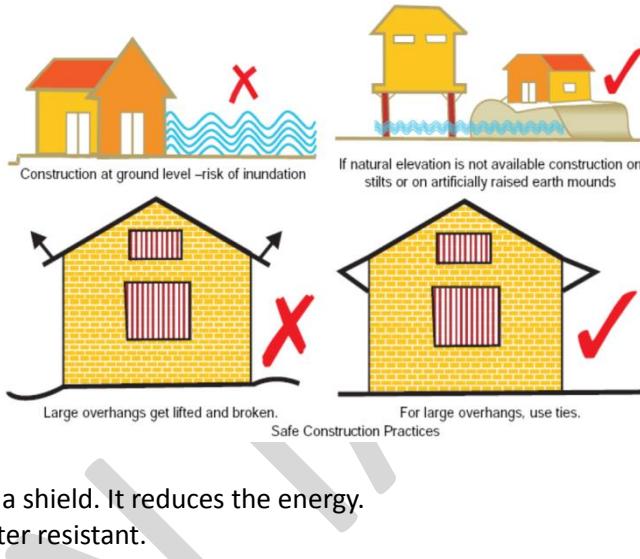
An effective cyclone disaster prevention and mitigation plan requires:

- Efficient cyclone forecast - and warning services;
- Rapid dissemination of warnings to the government agencies, particularly marine interests like ports, fisheries and shipping and to the general public and
- Construction of cyclone shelters in vulnerable areas, a ready machinery for evacuation of people to safer areas and community preparedness at all levels to meet the exigencies.

Considering above points possible risk mitigation measures can be:

- **Coastal belt plantation** - Providing a cover through green belt sustains less damage as forests act as a wide buffer zone against strong winds and flash floods. Without the forest the cyclone travel freely inland.
- **Hazard mapping** – Meteorological records of the wind speed and the directions give the pattern of occurrence of cyclone for particular wind speeds. A hazard map will illustrate the areas vulnerable to cyclone in any given year and estimate the severity of the cyclone and various damage intensities in the region.

- Land use control**- can be designed so that least critical activities are placed in vulnerable areas. Location of settlements in the flood plains is at utmost risk. Citing of key facilities must be marked in the land use. Policies should be in place to regulate land use and building codes should be enforced.
- Engineered structures** – need to be built to withstand wind forces. Good site selection is also important. Majority of the buildings in coastal areas are built with locally available materials and have no engineering inputs. Good construction practices should be adopted such as:
 - ✓ Cyclonic wind storms inundate the coastal areas. It is advised to construct on stilts or on earth mound.
 - ✓ Houses can be strengthened to resist wind and flood damage. All elements holding the structures need to be properly anchored to resist the uplift or flying off of the objects. For example, avoid large overhangs of roofs, and the projections should be tied down.
 - ✓ A row of planted trees will act as a shield. It reduces the energy.
 - ✓ Buildings should be wind and water resistant.
 - ✓ Buildings storing food supplies must be protected against the winds and water.
 - ✓ Protect river embankments.
 - ✓ Communication lines should be installed underground.
 - ✓ Provide strong halls for community shelter in vulnerable locations.



Flood management – Torrential rains, strong wind and storm range leads to flooding in the cyclone affected areas. There are possibilities of landslides too. Flood mitigation measures can be incorporated.

Improving vegetation cover – The roots of the plants and trees keep the soil intact and prevent erosion and slow runoff to prevent or lessen flooding. The use of tree planted in rows will act as a windbreak.

Coastal shelterbelt plantations can be developed to break severe wind speeds. It minimizes devastating effects.

National Cyclone Risk Mitigation Project (NCRMP)

The Government of India approved NCRMP Phase-I for Andhra Pradesh & Odisha in January 2011 to address the vulnerability of the coastal community to cyclones, who are generally poor and are from the weaker section of the society. The NCRMP Phase-II was approved as Centrally Sponsored Scheme for implementation in the States of Goa, Gujarat, Karnataka, Kerala, Maharashtra and West Bengal by Union Cabinet in July 2015.

The project has four principal components namely:

- ✓ Component A- Last Mile Connectivity.
- ✓ Component B- Structural and Non-Structural Measures.
- ✓ Component C- Technical Assistance for Cyclone Hazard Risk Mitigation, Capacity Building and Knowledge Creation.
- ✓ Component D- Project Management and Implementation Support.

The project aims at minimizing the vulnerability to the cyclone and making people and infrastructure disaster resilient.

The broad outcome of the project is a provision of cyclone forecasting, cyclone risk mitigation and capacity building in multi-hazard risk management. The major infrastructure, which is being constructed under the project includes multipurpose cyclone shelters (including shelter-cum-go-down) and approach roads/bridges to habitations and saline embankments.

Existing Challenges

- The failure to adequately respond to warnings stemming from lack of planning and coordination at the national and local levels, as well as a lack of understanding by people of their risks.
- Bare minimum the terminal-end equipment and communication back-up equipment support.
- Lack of grass root level participation in disaster management to build up effective resilience to disasters.
- Lack of a fully automated and state-of-the-art OC at NDMA and MHA with all terminal-end facilities and communication connectivity both for routine activities and also during disasters.
- The need for integration of networks set up by various agencies to establish various types of networks in the country for disaster management.
- Failure of even well-engineered structures such as communication and transmission towers past cyclones.

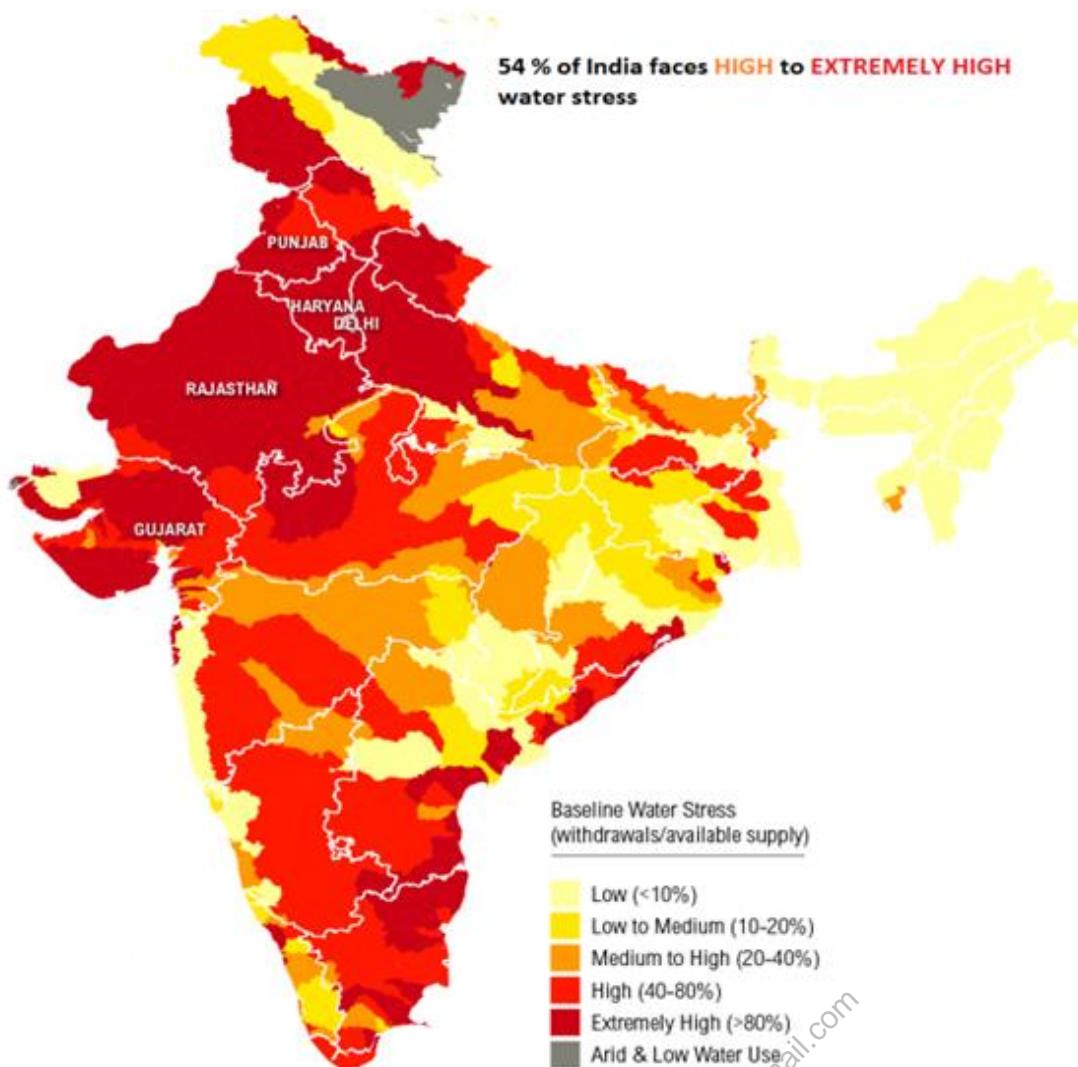
3.2.9. Drought

What is Drought?

Droughts refer to a serious shortfall in availability of water, mainly, but not exclusively, due to deficiency of rains, affecting agriculture, drinking water supply and industry. It is a slow onset disaster which evolves over months or even years and affects a large spatial extent.

Drought is a complex phenomenon as it involves elements like

- precipitation, evaporation, evapotranspiration
- ground water, soil moisture, storage and surface run-off
- agricultural practices, particularly the types of crops grown
- Socio-economic practices and ecological conditions.



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.

Types of Droughts

Meteorological Drought	<ul style="list-style-type: none"> • When there is a prolonged period of inadequate rainfall marked with mal-distribution of the same over time and space. • Rainfall less than 90 per cent of average is categorized as meteorological drought.
Agricultural Drought	<ul style="list-style-type: none"> • It is characterised by low soil moisture that is necessary to support the crops, thereby resulting in crop failures • If an area has more than 30 per cent of its gross cropped area under irrigation, the area is excluded from the drought-prone category. • An extreme agricultural drought can lead to a famine, which is a prolonged shortage of food in a restricted region causing widespread disease and death from starvation. This is why sometimes in Hindi language famine Akal and Anavritshy are also used for drought. • The government also declares an area affected by drought, if more than 50 percent crop loss happens in an area due to meteorological condition.

Hydrological Drought	<ul style="list-style-type: none"> When the availability of water in different storages and reservoirs like aquifers, lakes, reservoirs, etc. falls below what the precipitation can replenish.
Ecological Drought	<ul style="list-style-type: none"> When the productivity of a natural ecosystem fails due to shortage of water and as a consequence of ecological distress, damages are induced in the ecosystem.

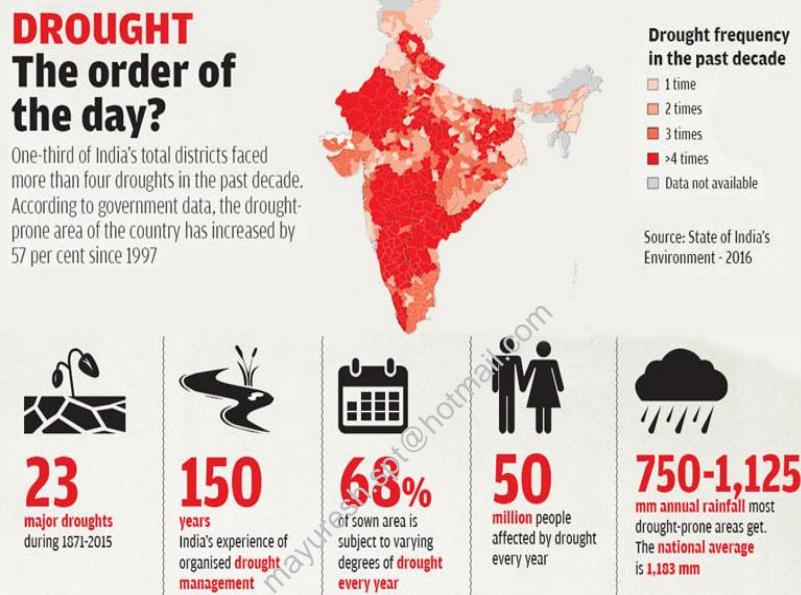
The IMD recognizes five drought situations:

- 'Drought Week' when the weekly rainfall is less than half of the normal.
- 'Agricultural Drought' when four drought weeks occur consecutively during mid-June to September.
- 'Seasonal Drought' when seasonal rainfall is deficient by more than the standard deviation from the normal.
- 'Drought Year' when annual rainfall is deficient by 20 per cent of normal or more.
- 'Severe Drought Year' when annual rainfall is deficient by 25 to 40 per cent of normal or more.

Drought Risks in India

Droughts in India have their own peculiarities requiring appreciation of some basic facts. These are:

- India has an average annual rainfall of around 1150 mm; no other country has such a high annual average, however, there is considerable annual variation.
- More than 80% of rainfall is received in less than 100 days during the Southwest monsoon and the geographic spread is uneven.
- 21% area receives less than 700 mm rains annually making such areas the hot spots of drought.
- Inadequacy of rains coupled with adverse land-man ratio compels the farmers to practice rain-fed agriculture in large parts of the country.
- Irrigation, using groundwater aggravates the situation in the long run as ground-water withdrawal exceeds replenishment; in the peninsular region availability of surface water itself becomes scarce in years of rainfall insufficiency.
- Per capita water availability in the country is steadily declining.
- As against total annual availability 1953 km³, approximately 690 km³ of surface water and 396 km³ of ground water resources can be put to use. So far, a quantum of about 600 km³ has been put to use.
- The traditional water harvesting systems have been largely abandoned.

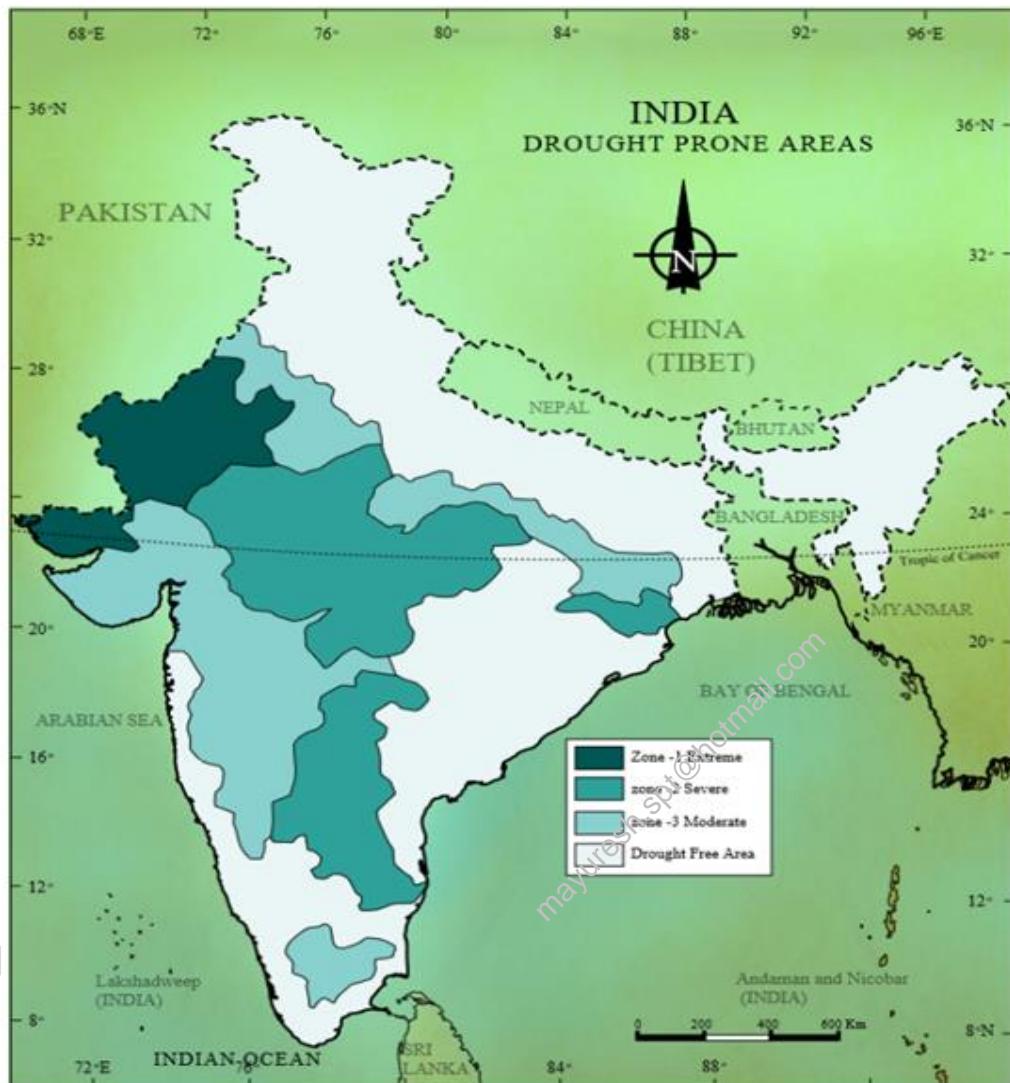


Distribution of Drought Prone Areas in India

Droughts and floods are the two accompanying features of Indian climate. According to some estimates, nearly 19 per cent of the total geographical area of the country and 12 per cent of

its total population suffer due to drought every year. About 30 per cent of the country's total area is identified as drought prone. It is common to see flood and drought at same time in different region. It is also common that same region faces drought in one season and flood in another season. This is attributed to spatial and temporal unpredictability in the monsoon behaviour.

Recently IMD has decided to drop the word 'drought' and replace it with 'deficient' to describe the bad monsoon. It said that it was never the mandate of IMD to declare drought and it is on the state government to decide as droughts are of various types – hydrological, agricultural etc. On the basis of severity of droughts, India can be divided into the 3 regions:



Extreme Drought Affected Areas	<ul style="list-style-type: none"> Most parts of Rajasthan, particularly areas to the west of the Aravali hills, i.e. Marusthali and Kachchh regions of Gujarat fall in this category. The districts like Jaisalmer and Barmer from the Indian desert that receive less than 90 mm average annual rainfall.
Severe Drought Affected Areas	<ul style="list-style-type: none"> Parts of eastern Rajasthan, most parts of Madhya Pradesh, eastern parts of Maharashtra, interior parts of Andhra Pradesh and Karnataka Plateau, northern parts of interior Tamil Nadu and southern parts of Jharkhand and interior Odisha.
Moderate Drought Affected Areas	<ul style="list-style-type: none"> Northern parts of Rajasthan, Haryana, southern districts of Uttar Pradesh, the remaining parts of Gujarat, Maharashtra except Konkan, Jharkhand and Coimbatore plateau of Tamil Nadu and interior Karnataka.

UPDATED NOMENCLATURE

New terminology	Old terminology	
Normal	Normal	Percentage departure of realized rainfall is within $\pm 10\%$ of the Long Period Average
Below Normal	Below Normal	Percentage departure of realized rainfall is $< 10\%$ of the Long Period Average
Above Normal	Above Normal	Percentage departure of realized rainfall is $> 10\%$ of the Long Period Average
Deficient Year	All India Drought Year	When the rainfall deficiency is more than 10% and 20-40% area of the country is under drought conditions
Large Deficient Year	All India Severe Drought Year	When the rainfall deficiency is more than 10% and when the spatial coverage of drought is more than 40%

Early Indicators of Drought

Since the nature of drought as a disaster is slow on set, it is very necessary to know about the early warning indicators of drought. These are:

- Delay in onset / Deficiency in closing figures for South-West Monsoon
- Long 'break' during the of South-West Monsoon season.
- Insufficient rains and skewed spatial distribution, particularly during the months of June and July.
- Rise in price of fodder.
- Absence of rising trend in reservoir levels and / or reduction in stream flows and depletion rate of groundwater.
- Drying up of sources of rural drinking water supply.
- Declining trend in the progress of sowing as compared to total normal sown areas.
- Out migration of rural population
- Serious depletion in level of Ground Water compared to figures for "normal years"
- Indication of marked soil moisture stress.
- Increased deployment of water through tankers

Impact of Drought as a Hazard

The impact of droughts on societies varies depending on coping capabilities and the general health of the national economies concerned. Few inevitable impacts of drought are:

- **Economical:**
 - ✓ production losses in agriculture and related sectors, especially animal husbandry, dairy, poultry, horticulture and fisheries
 - ✓ affects livelihoods and quality of life of the population in that is dependent on agriculture a dampening impact by constricting employment avenues
 - ✓ All industries dependent upon the primary sector for raw materials suffer on account of reduced supplies and hardening prices.
- **Environmental:**
 - ✓ low water levels in ground water and surface reservoirs, lakes and ponds, reduced flows in springs, streams and rivers, loss of forest cover,
 - ✓ migration of wildlife, sharpening man-animal conflicts and general stress on biodiversity
 - ✓ Reduced stream flow and loss of wetlands may affect levels of salinity
 - ✓ Increased groundwater depletion rates, and reduced recharge may damage aquifers and adversely affect the quality of water (e.g., salt concentration, acidity, dissolved oxygen, turbidity) which in turn may lead to a permanent loss of biological productivity of soils

- ✓ Crops failure leading to scarcity of food grains, inadequate rainfall, resulting in shortage of water, and often shortage in all the three is most devastating.
- **Social:**
 - ✓ Out-migration of the population from drought affected areas, rise in school dropout rates and indebtedness,
 - ✓ alienation of land and livestock assets, malnutrition, starvation and loss of social status among the most vulnerable sections
 - ✓ Scarcity of water compels people to consume contaminated water resulting in spread of many waterborne diseases like gastro-enteritis, cholera, hepatitis, etc.
 - ✓ The situation of scarcity in some cases may exacerbate social tensions and lead to erosion of social capital.

How drought as a disaster is different from other disasters?

Unlike floods, earthquakes, and cyclones, droughts have certain distinct features –

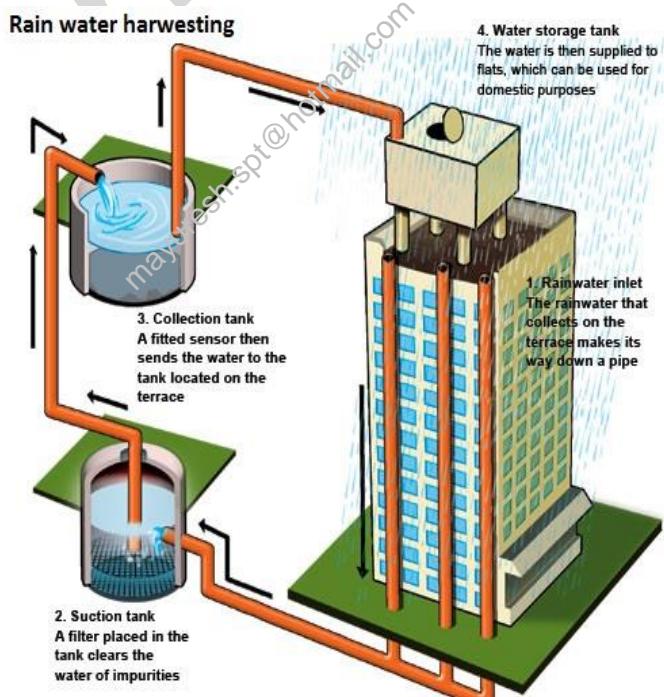
- the onset is slow giving adequate warning,
- it affects livelihoods of people over a large area,
- the duration of the disaster is much longer and so the relief efforts have to be sustained over this stretched time period,
- it remains basically a rural phenomenon except that very severe drought may also impact on urban water supply by drying up sources and drastically reducing water table in regions with aquifers, and
- There is a possibility that drought management efforts could reduce vulnerability by improving moisture conservation and vegetal cover etc.

This does not hold true of other natural disasters. In other words, droughts lend themselves to being managed in a manner not possible in most other disasters. All these factors necessitate ‘independent consideration’ drought management.

Drought Hazard Mitigation

The objectives of mitigation measures are to reduce soil erosion, augment soil moisture, restrict surface run-off of rainwater and improve the efficiency of water use. It involves a wide range of soil and water conservation measures and farm practices.

- **Water Harvesting and Conservation:** processes and structures of rainfall and run-off collection from large catchments area and channelling them for human consumption by using traditional methods or artificial recharge of groundwater. It helps to rejuvenate depleted high-capacity aquifers by adopting integrated groundwater recharge techniques, such as dams, tanks, anicuts, and percolation tanks, could improve water availability and create a water buffer for dealing with successive droughts.



- **Drought Monitoring:** It is continuous observation of the rainfall situation, availability of water in the reservoirs, lakes, rivers etc. and comparing with the existing water needs in various sectors of the society.
- **Sowing drought resistant crops:** By sowing drought resistant crops of cotton, Moong, pearl millet, wheat etc., the impact of drought could be mitigated to a certain extent.
- **Livelihood planning** identifies those livelihoods which are least affected by the drought. Some of such livelihoods include increased off-farm employment opportunities, collection of non-timber forest produce from the community forests, raising goats, carpentry etc.
- **Suitable farming methods for arid areas:** By adopting the following methods it is possible to mitigate the intensity of drought. The methods are: Production of coarse and hardy cereals; conservation of soil moisture by deep ploughing, storing water behind small dams, collecting water in ponds and tanks and use of sprinklers for irrigation.
- **Drought planning:** the basic goal of drought planning is to improve the effectiveness of preparedness and response efforts by enhancing monitoring, mitigation and response measures.
- Small quantity of water can irrigate comparatively larger area by using **drip irrigation and sprinkler methods**.
- **Identification of ground water potential** in the form of aquifers, transfer of river water from the surplus to the deficit areas, and particularly planning for inter-linking of rivers and construction of reservoirs and dams.
- **Cloud Seeding** to assess the aerosol characteristics, suitability of nuclides for cloud seeding and alternative types of cloud seeding – (ground based or aerial, warm or cold cloud seeding etc.). A cloud seeding policy needs to be formulated at National level and State level for creating required environment to regulate these measures.

Drought Crisis Management Plan, 2015

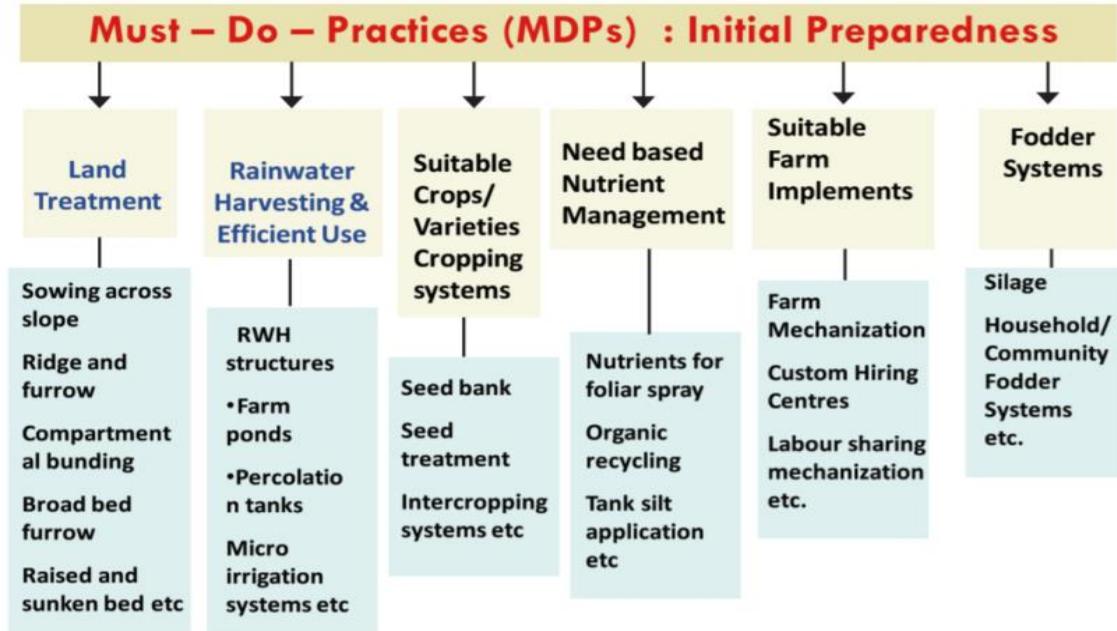
The NDMA manual sets out four important measures that a State government should take at the time of a drought, with the Union government's help.

- **MGNREGA to provide immediate employment** to drought-affected people.
- The **public distribution mechanism** should be strengthened to provide food and fodder
- initiate actions to **recharge the groundwater table** by building check dams and providing pipeline water and other irrigation facilities
- The government should either **waive off or defer farmer loans** and arrange for crop loss compensation.

Existing Challenges in Drought Management

- Drought management encompasses three vital components namely,
 - ✓ drought intensity assessment and monitoring;
 - ✓ drought declaration and prioritization of areas for drought management and
 - ✓ development and implementation of drought management strategies
 Each step in drought management lacks holistic approach to ensure effective end result.
- Development of standard procedures for drought vulnerability assessment and generation of vulnerability maps in each state needs to be done.
- Absence of Crisis Management Authority for drought to manage the various phases of drought.
- Ineffective dissemination of credible and verified information on relevant aspects of drought to the people and media.
- Ineffective monitoring and early warning system to provide accurate and timely information on rainfall, crop sown area, data on soil moisture, stream flow, groundwater, lake and reservoir storage.

- Half hearted attempts to detect drought conditions as early as possible in order to implement District Agriculture Contingency Plans and the Crisis Management Plan.
- Lack of community participation.



Slow onset Disasters

Disasters can also be classified as 'slow onset' disasters and 'rapid onset' disasters. Earthquakes, cyclones, floods, tsunamis would fall under the category of rapid onset disasters; climate change (global warming), desertification, soil degradation, and droughts, would fall under the category of slow onset disasters.

Slow onset disasters are also termed as 'Creeping Emergencies'. It may be added that with 'prevention' forming an integral part of the 'management cycle', slow onset disasters like global warming, and desertification must find adequate reflection in disaster preparedness - these phenomena gradually erode the 'health' of ecosystems and expose societies to the vagaries of nature. Unlike the rapid onset disasters, their impact is not felt immediately; however societies lose their ability to derive sustenance from their surroundings, over a period of time. Development policies and the manner in which they are implemented are some of the main reasons for the slow onset disasters.

[UPSC Question: Which parts of India were mainly affected by the severe drought of 1987-88? What were its main consequences? (88/II/6b/20)]

[UPSC Question: Write note on Causes of droughts in India. (2005)]

[UPSC Question: Drought has been recognized as a disaster in view of its spatial expanse, temporal duration, slow onset and lasting effects on vulnerable sections. With a focus on the September 2010 guidelines from the National Disaster Management Authority (NDMA), discuss the mechanisms for preparedness to deal with likely El Nino and La Nina fallouts in India. (2014)]

3.2.10. Heat Wave

What is a Heat Wave?

A Heat Wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the summer season in the North-Western parts of India. Heat Waves typically occur between March and June, and in some rare cases even extend till July.

Causes of Heat Waves

- Hot winds blowing from deserts with the dry winds on surface
- Anticyclone formations leading to no cloud formation and thunderstorm activity which fails to balance the temperature
- Rising global temperatures due to climate change and global warming
- Shifts in air currents and weather patterns due to shifting of pressure belts
- Depletion of Ozone layer
- Jet streams

How do heat waves occur?

Heat waves occur when a ridge of high pressure sits over a region for an extended period of time, bringing down dry, hot air to the ground. As the air sinks, it warms and compresses and it becomes very hot by the time it reaches the surface.

This hot air quickly heats up the ground, which raises the air temperature. Since the centre of high pressure areas are usually cloud free, the direct sunlight further raises the day time temperature creating a heat wave.

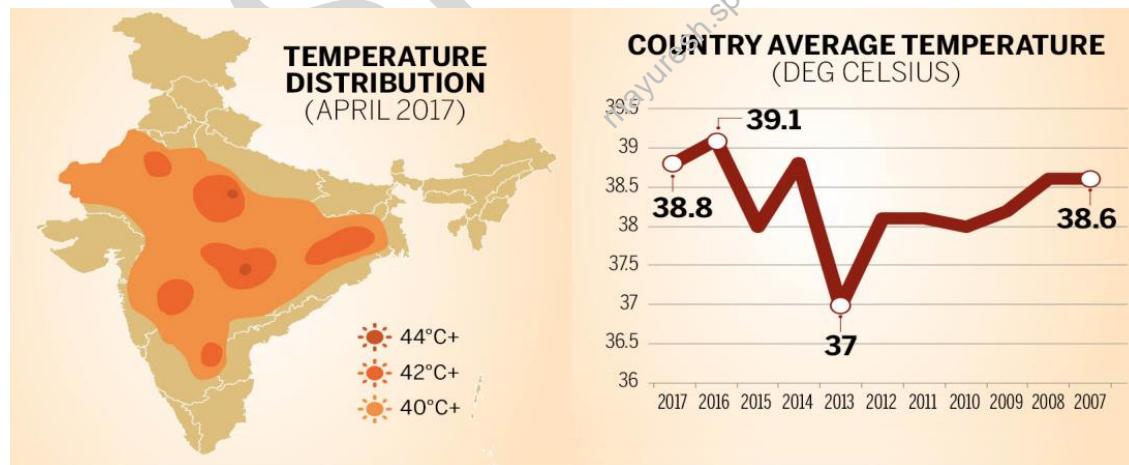
Signs of Heat Waves

- Unreasonable Warmth- at least 9 degrees Celsius higher temperature than the average temperature of the region.
- Humidity- presence of high moisture in the air at higher temperatures can be extremely uncomfortable.
- Duration of heat in the region for a minimum time interval of five days.
- Lack of moisture in soil

Heat Wave Risks in India

Higher daily peak temperatures and longer, more intense heat waves are becomingly increasingly frequent globally due to climate change. India too is feeling the impact of climate change in terms of increased instances of heat waves which are more intense in nature with each passing year and have a devastating impact on human health thereby increasing the number of heat wave casualties.

In India, April to June is a typical heat wave season. June is the onset month of Southwest Monsoon when summer-like conditions leave Peninsular and Central India but remains in North India. Cities are hotter than rural areas due to population density, pollution from industrial activities and presence of buildings.



The combination of exceptional heat stress and a predominantly rural population makes India vulnerable to heat waves. Heat wave per say is more prominent in the interiors of the country. Hilly regions, Northeast India and coastal stations generally do not witness heatwave conditions. Heat waves prevail in pockets of Haryana, Delhi, Maharashtra, Telangana, Andhra Pradesh, Odisha, West Bengal, Bihar, Jharkhand, Chhattisgarh and Karnataka.

Consequences of Heat Waves

• Effects on Human Health

- ✓ High moisture at high temperature doesn't let body sweat to evaporate easily to cool itself and body temperature raises eventually causing sickness.
- ✓ Heat stroke, Heat exhaustion, Heat cramps
- ✓ Dehydration, nausea, dizziness, headaches
- ✓ Diseases transmitted by chemical air
- ✓ Heat waves is one of the biggest killers amongst all natural calamities

• Effects on Nature

- ✓ Heat waves can lead to droughts with decrease in moisture in the air and soil. Moisture in soil helps in cooling down the temperature by evaporation
- ✓ Some species may disappear. Few new species may appear which are heat resistant.
- ✓ Adaptations in lifestyle and behaviour of few organisms
- ✓ Wildfires in open areas or forests become frequent due to heat waves.
- ✓ Coral bleaching in oceans can rise
- ✓ Huge damage to crops leading to food shortage

• Effects on Infrastructure and Economy

- ✓ Heat tests the ability of infrastructure to withstand the pressure created by increased energy demand. Electricity transmission line expands due to heat
- ✓ Transport services gets impacted
- ✓ Loss of labour efficiency

Criteria for Heat Wave in India

The Indian Meteorological Department (IMD) has given the following criteria for Heat Waves:

Heat wave need not be considered till maximum temperature of a station reaches at least 40°C for Plains and at least 30°C for Hilly regions.

- When normal maximum temperature of a station is less than or equal to 40°C
 - ✓ Heat Wave Departure from normal is 5° C to 6° C
 - ✓ Severe Heat Wave Departure from normal is 7° C or more
- When normal maximum temperature of a station is more than 40° C
 - ✓ Heat Wave Departure from normal is 4° C to 5° C
 - ✓ Severe Heat Wave Departure from normal is 6° C or more
- When actual maximum temperature remains 45°C or more irrespective of normal maximum temperature, heat wave should be declared.

Heat Wave Hazard Mitigation

- Four criteria are important for prevention and mitigation of heat waves:
 - ✓ forecasting heat waves and enabling an early warning system;
 - ✓ building capacity of healthcare professionals to deal with heat wave-related emergencies;
 - ✓ community outreach through various media; and
 - ✓ inter-agency cooperation as well as engagement with other civil society organizations in the region
- Create a list of the high-risk areas of the city vulnerable to heat waves for more focused activities on heat prevention. For example- Adoption of a 'Heat Action Plan' (HAP)
- Build on the "Green Cover" activity to establish tree-plantation campaign in hotspot areas such as roadsides and during plantation festival in June.
- Discuss establishing cooling centre facilities in high-risk areas around city.
- Public awareness- Conduct training workshops and outreach sessions with community groups and mobilizers such as Mahila Arogya Samiti, Self-Employed Women's Association

(SEWA), ASHA workers, aanganwadis, and municipal councils to help inform and get vulnerable communities more actively involved, including women. Incorporate other sectors such as higher education, non-profits, and community leaders to increase reach to communities.

- Protect environment. Adopt sustainable environment practices.

Existing Challenges in Heat Wave Management

- Lack of research using sub-district level data to provide separate indices for urban and rural areas to enable more targeted geographical interventions.
- Narrow analysis of urban ward-level data to provide intra-city vulnerability patterns.
- Less active usage of available provisions of public messaging (radio, TV), mobile phone-based text messages, automated phone calls and alerts.
- Lack of Public awareness like promotion of traditional adaptation practices, such as staying indoors and wearing comfortable clothes.
- Half-hearted attempts for popularization of simple design features such as shaded windows, underground water storage tanks and insulating housing materials.
- Unavailability of provision of drinking water within housing premises and indoor toilets.

3.2.11. Cold Waves

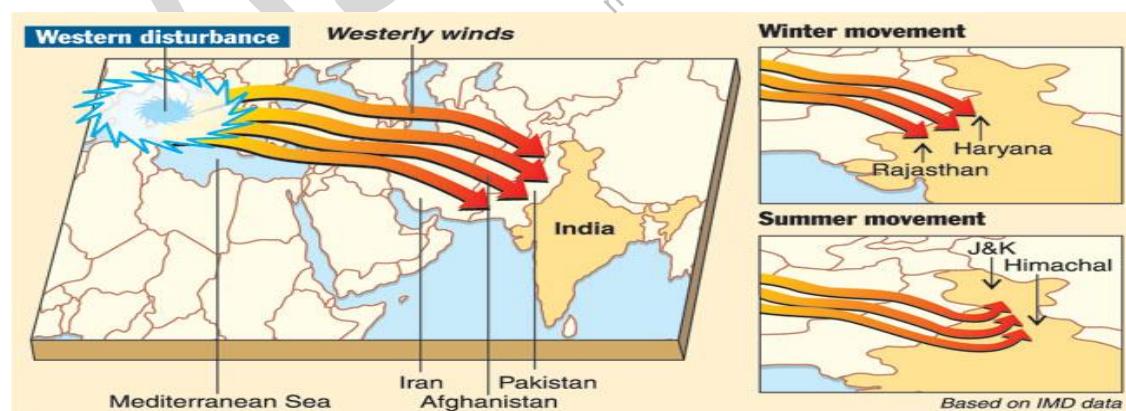
What is a Cold Wave?

A cold wave is a weather phenomenon that is distinguished by marked cooling of air, or the invasion of very cold air, over a large area. It can also be a prolonged period of the excessively cold weather, which may be accompanied by high winds that cause excessive wind chills. Cold waves can be preceded or accompanied by significant winter weather events, such as blizzards or ice storms.

Causes of Cold Waves

Cold waves over India are primarily due to transport of cold air from higher latitudes. It is usually associated with El-Nino, cyclonic activities and Jet streams (western disturbances).

Western disturbances manifest as eastward moving well marked troughs in the upper tropospheric westerlies north of 20° N and often extend to the lower troposphere. It transports cold air from northern latitudes into India. There are also few instances of occurrence of cold waves due to a low pressure system over the North Arabian Sea. In these cases, the easterlies to the north of the low pressure system transport cold air from higher latitudes.



Cold waves Risks in India

Cold waves that occur during winter months from November to February exert considerable stress to the people of northern India. During cold wave episodes, a drop of more than 4°C is

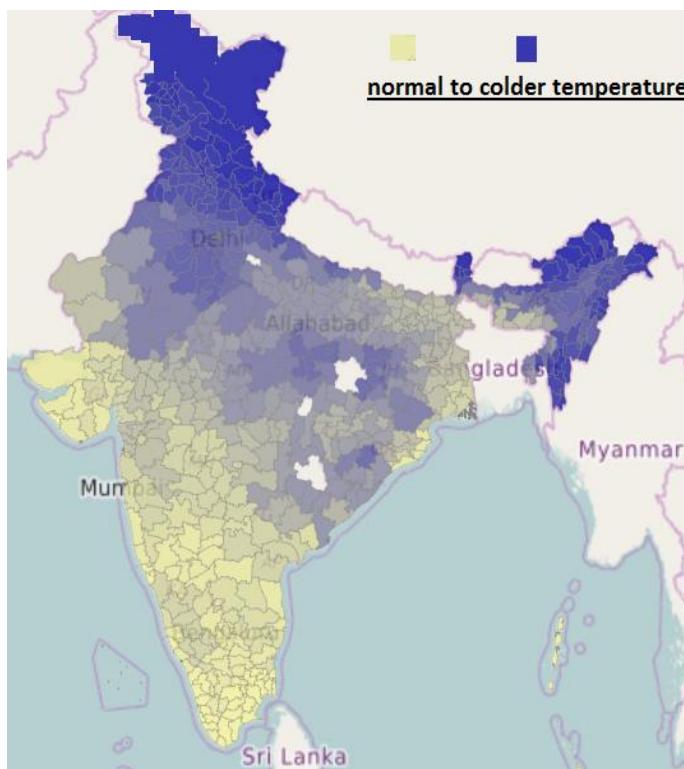
observed in minimum temperatures, and these episodes generally persist for 3–5 days and their occurrence peaks in the month of January.

Distribution pattern for Cold waves in India

Northern India:

December and January are the coldest months in the northern plain. The night temperature may go below freezing point in Punjab and Rajasthan. Reasons for the excessive cold in north India can be:

- States like Punjab, Haryana and Rajasthan being far away from the moderating influence of sea experience continental climate.
- The snowfall in the nearby Himalayan ranges creates cold wave situation; and
- Around February, the cold winds coming from the Caspian Sea and Turkmenistan bring cold wave along with frost and fog over the north western parts of India.



The peninsular region:

The Peninsular region of India does not have any well-defined cold weather season. There is hardly any seasonal change in the distribution pattern of the temperature in coastal areas because of moderating influence of the sea, and proximity to the equator.

Impacts of Cold waves

- Along with frost it can cause damage to agriculture, infrastructure, property
- heavy snowfall and extreme cold can immobilize an entire region
- snowstorm resulting into flooding, storm surge, closed highways, blocked roads, downed power lines and hypothermia
- economic and human losses

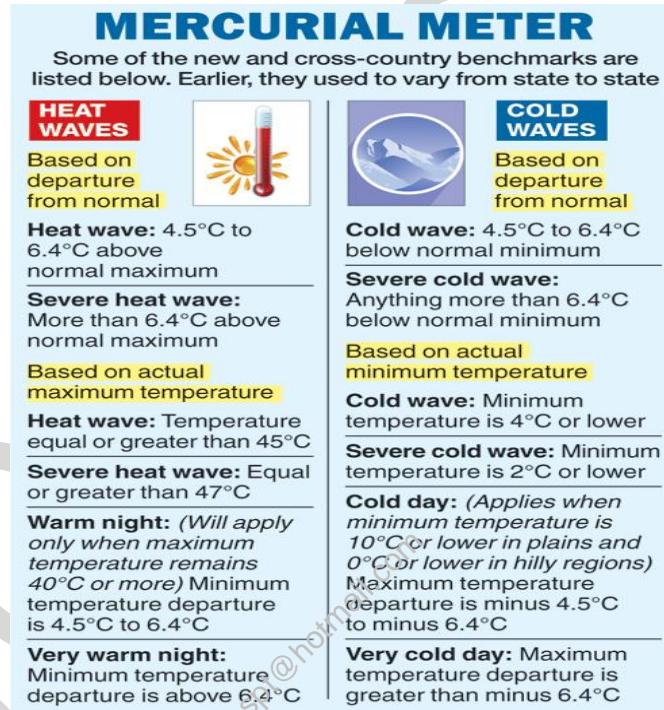
Wind Chill	Is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature. Animals are also affected by wind chill; however, cars, plants and other objects are not.
Frostbite	Is damage to body tissue caused by extreme cold. A wind chill of -20 degrees Fahrenheit (F) will cause frostbite in just 30 minutes. Frostbite causes a loss of feeling and a white or pale appearance in extremities, such as fingers, toes, ear lobes or the tip of the nose. If symptoms are detected, get medical help immediately! If you must wait for help, slowly re-warm affected areas. However, if the person is also showing signs of hypothermia, warm the body core before the extremities.
Hypothermia	Is a condition brought on when the body temperature drops to less than 95 degrees Fahrenheit (F). It can kill. For those who survive, there are likely to be lasting kidney, liver and pancreas problems. Warning signs include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness and apparent exhaustion. Take the person's temperature. If below 95 degrees F, seek medical care immediately!

Cold Wave Hazard Mitigation

- In case of cold wave/frost situation, States needs to initiate location specific measures as outlined in District Crop Contingency Plans and in consultation with respective State Agricultural Universities to minimise its impact.
- Farmers are to provide light irrigation as per need, immediately prune damaged tips of branches or shoot, burn leave/waste material in the orchard to create smoke and manage rejuvenation of damaged crops through pruning of dead material, application of extra doses of fertilizer through foliar sprays.
- Plan for the potential to convert schools and other public buildings into shelters to keep vulnerable citizens out of the cold.
- Remain aware of the effects that exposure to extreme cold has on children, the elderly, as well as those already ill, and promote outreach and preparedness efforts.
- Insulate any water lines running along exterior walls so your water supply will be less likely to freeze.
- Adequate preparedness of the community and local governments can prevent deaths due to cold waves.

Existing Challenges in Cold Wave Hazard Management

- As Cold Wave/Frost is a localised disaster event, location specific mitigation plans should be drawn up by the concerned State Governments instead of a National level plan.
- Lack of participation at community level like SHGs, PRIs.
- Lack of preparedness in advance.



3.2.12. Wild Fires

What is Wild fire?

A wildfire is simply an uncontrolled fire that is wiping out large fields and areas of land. These fires sometimes burn for days and weeks. They can wipe out an entire forest and destroy almost every organic matter in it.

Causes of Wild fires

Wild land fire spread is influenced by three primary factors – weather, topography, and fuel. Wild fires are caused by Natural causes as well as Manmade causes.

- Natural causes-** such as lightning which set trees on fire. However, rain extinguishes such fires without causing much damage. High atmospheric temperatures and dryness (low humidity) offer favourable circumstance for a fire to start.
- Man made causes-** for example- when a source of fire like naked flame, cigarette or bidi, electric spark or any source of ignition comes into contact with inflammable material. More than 95% forest fires in India are manmade.

Types of Forest Fire

There are two types of forest fire:

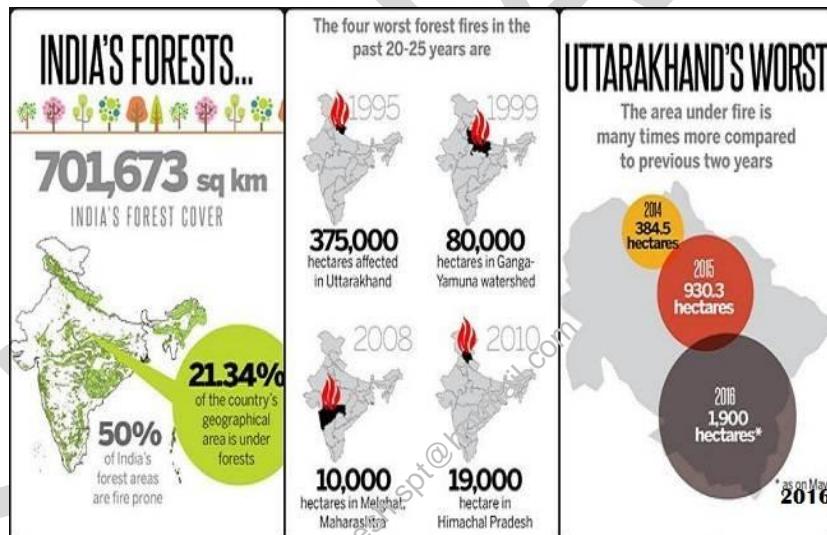
- **Surface Fire-** A forest fire may burn primarily as a surface fire, spreading along the ground as the surface litter (senescent leaves and twigs and dry grasses etc.) on the forest floor and is engulfed by the spreading flames.
- **Crown Fire-** The other type of forest fire is a crown fire in which the crown of trees and shrubs burn, often sustained by a surface fire. A crown fire is particularly very dangerous in a coniferous forest because resinous material given off burning logs burn furiously. On hill slopes, if the fire starts downhill, it spreads up fast as heated air adjacent to a slope tends to flow up the slope spreading flames along with it. If the fire starts uphill, there is less likelihood of it spreading downwards.

Indicators of Wild Fires

- Visible flames and smoke column
- Reduced visibility due to the smoke obscuring the sun
- The sound of burning and the increased movement of air
- The smell of burning vegetation

Wild fires Risks in India

India, with a forest cover of 76.4 million hectares, contains a variety of climate zones, including the tropical south, north western deserts, Himalayan mountains, and the wet north-east. Forests are widely distributed in the country. The forest vegetation in the country varies from tropical evergreen



forests in the West Coast and in the Northeast to alpine forests in the Himalayas in the North. In between the two extremes, there are semi-evergreen forests, deciduous forests, sub-tropical broad-leaved hill forests, sub-tropical pine forests, and sub-tropical montane temperate forests.

With increasing population pressure, the forest cover of the country is deteriorating at an alarming rate. Along with various factors, forest fires are a major cause of degradation of Indian forests. According to a Forest Survey of India Report, about 50 percent of forest areas in the country are fire-prone (ranging from 50 percent in some states to 90 percent in the others). About 6 percent of the forests are prone to severe fire damage.

Distribution pattern for Wild fires in India

Various regions of the country have different normal and peak fire seasons, which normally vary from January to June. In the plains of northern and central India, most of the forest fires occur between February and June. In the hills of northern India fire season starts later and most of the fires are reported between April and June. In the southern part of the country, fire season extends from January to May. In the Himalayan region, fires are common in May and June.

The vulnerability of the Indian forests to fire varies from place to place depending upon the type of vegetation and the climate. The coniferous forest in the Himalayan region is very prone to fire. Every year there are one or two major incidences of forest fire in this region. The other parts of the country dominated by deciduous forests are also damaged by fire.

Forests on FIRE

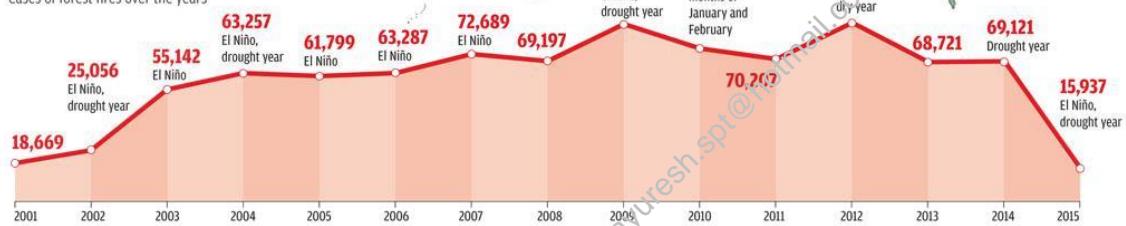
Over 10,634 incidents of forest fire have been reported between April 1 and May 2, 2016. This is five times more than what was reported during the same period last year

● Number of forest fires between April 1 and May 2, 2016
■ Forest areas in India

50 per cent
of forests in India are
vulnerable to fire

₹440 cr
is India's annual loss due
to forest fires

Burning red
Cases of forest fires over the years

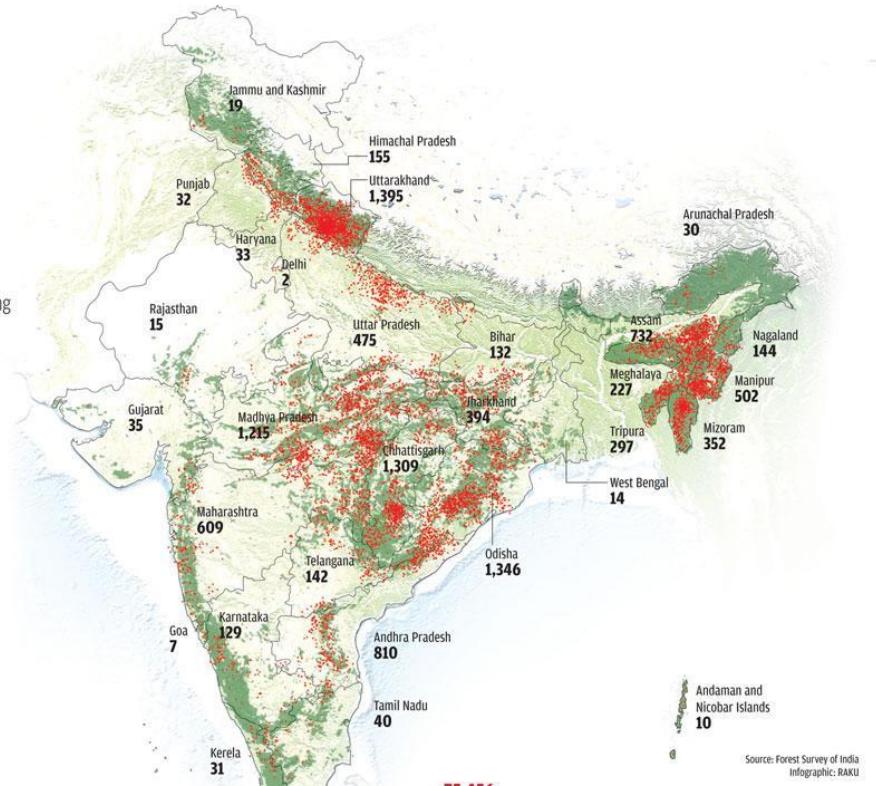


Impacts of Wild fires

- Huge investment by the government to suppress wildfires.
- Increase the potential for flooding, debris flows, and landslides.
- Smoke and other emissions contain pollutants that can cause significant health problems.
- Losses in productivity of the land, impacts on regeneration of species, and deleterious impacts on water shed
- Global warming, soil erosion, loss of fuel, wood and fodder, damage to water
- **Short-term effects:** destruction of timber, forage, wildlife habitats, scenic vistas, and watersheds
- **Long-term effects:** reduced access to recreational areas; destruction of community infrastructure and cultural and economic resources

Benefits of forest fires

- Wild fires are sometimes a natural process, and help forests by promoting flowering, branching and seedling establishment. Fires that are limited to the surface may help in the



Source: Forest Survey of India
Infographic: RAKU

natural regeneration of forests. The heating of the soil may result in helpful microbial activity, and hasten decaying processes that are useful for the vegetation.

- Recent research on the ecology and bio-geographical origin of these forests indicates that fire occurrence and light availability are important factors that maintain the ecosystem.
- Also, frequent, low-intensity forest fires possibly prevent the proliferation of many invasive species which act as fuel for the spread of forest fires.

Wild fires Hazard Mitigation

During the British period, fire was prevented in the summer through removal of forest litter all along the forest boundary. This was called Forest Fire Line, and was used to prevent fire breaking into the forest from one compartment to another.

- A full spectrum of strategies that can be used to reduce wildland fire risks in the unincorporated area are as follows:
 - ✓ Vegetation Management – Investigate methods of vegetation management including fuel breaks, prescribed burning, mechanical clearing, biological brush control, and chemical brush control.
 - ✓ Codes and Ordinances – Review the existing codes relating to wildfires including building codes and vegetation clearance requirements around structures located in wild land-urban interface areas.
 - ✓ Bark Beetle Management – Investigate methods for bark beetle eradication or control.
 - ✓ Public Education – Expand strategies to educate the public on the essential steps for and the benefits of reducing fire risks.
- Initiate research in the fields of fire detection, suppression, and fire ecology for better management of forest fires.
- The fire spreads only if there is continuous supply of fuel (Dry vegetation) along its path. The best way to control a forest fire is therefore, to prevent it from spreading, which can be done by creating firebreaks in the shape of small clearings of ditches in the forests.
- Participation of the volunteers not only for fire fighting but also to keep watch on the start of forest and sound an alert.
- Arrange fire fighting drills frequently.
- Proper utilisation of media and available technologies for dissemination of exact information to the people and the government.

Existing Challenges in Wild fires Hazard Management

The incidence of forest fires in the country is on the increase and more area is burned each year. The major cause of this failure is the piecemeal approach to the problem. Both the national focus and the technical resources required for sustaining a systematic forest fire management programme are lacking in the country.

- Inadequate research on previous wildfires, including ignition sources, burn severity patterns, season of burning, and fire size
- Half hearted attempts to study the effects of post fire runoff and erosion on aquatic ecosystems and species
- Narrow spatial reach to monitor and provide early warnings using new technology, sensor webs, and satellite technology
- Need to develop tools and methods to minimize impacts on human life and property, especially in the wild land urban interface
- We never ask village communities to participate in managing forest resources, but expect their support at times of crisis. Such attitude and approach should be changed by making them aware of the situation and teach them what to do in case of such emergencies.

Tech no help (year 2016)

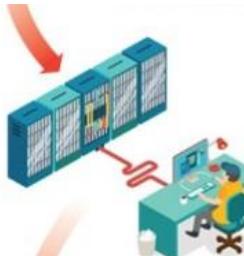
Despite regular monitoring and pre-warnings, Uttarakhand failed to control forest fires

1 The National Remote Sensing Centre, Hyderabad, receives data from two US satellites—TERA and AQUA—that track all the countries in the world every six hours. The satellites are fitted with heat-sensitive sensors that detect fire and capture the exact locations



2 Data is emailed to the Forest Survey of India (FSI) within 25 minutes. FSI then filters the data using forest cover maps to identify forest fires. Further filtration is done using specific data such as state, district names, longitudinal and latitudinal details

3 Besides monitoring, FSI also has a pre-warning alert system, which has over 90 per cent accuracy. The warning data is based on several parameters, including forest cover, forest type, current temperature in the forest, and recent fires signals. The data gives forest officials information at least 48 hours before the fire. FSI had sent at least two such warnings to Uttarakhand in the last week of April, when forest fires peaked in the state



4 The monitoring data is notified through emails and SMSes in a KML format (which supports Google maps) to the state forest fire nodal officer. The notifications are sent everyday at about 3 am, 12 pm, 5 pm and 11 pm



- There is a need to establish a *National Institute of Forest Fire Management* with satellite centres in different parts of the country.
- Important forest fire management elements like strategic fire centres, coordination among Ministries, funding, human resource development, fire research, fire management, and extension programmes are missing.

Way ahead

Instead of viewing forest fires as being purely destructive in nature, forest managers should perhaps expand their worldview and be more inclusive to information from ecological and local knowledge systems that view fires as being both rejuvenating and revitalising.

3.3. Man Made Disasters

3.3.1. Biological Disaster

What is Biological Disaster?

Biological disasters might be caused by epidemics, accidental release of virulent microorganism(s) or Bioterrorism (BT) with the use of biological agents such as anthrax, smallpox, etc. In recent times travelling has become easier. More and more people are travelling all over the world which exposes the whole world to epidemics.

Types of Biological Disasters

Biological disasters may be in the form of:

- **Epidemic** affecting a disproportionately large number of individuals within a population, community, or region at the same time, examples being Cholera, Plague, Japanese Encephalitis (JE)/Acute Encephalitis Syndrome (AES); or,
- **Pandemic** is an epidemic that spreads across a large region, that is, a continent, or even worldwide of existing, emerging or re-emerging diseases and pestilences, example being Influenza H1N1 (Swine Flu).

Causes of Epidemics

- Poor sanitary conditions leading to contamination of food and water or
- due to inadequate disposal of human or animal carcasses in post disaster situations
- They become real dangers during floods and earthquakes.
- Poor solid waste management may create epidemics like plague.

Incidence of plague is quite uncommon now but it can still occur claiming many human lives and disrupting normal life as it did in Surat in 1994.

Methods of Dissemination Used by Bio-terrorists

- **Aerosols**- biological agents are dispersed into the air forming a fine mist that may drift for miles.
- **Animals**- fleas, mice, flies, mosquitoes and livestock
- **Food and Water contamination**- some pathogenic organisms and toxins may persist in food and water supplies.
- **Person to person**- small pox, plague and the Lassa viruses.

Major sources of Epidemics in India

In India, the major sources of epidemics can be broadly categorized as follows:

- **Water-borne diseases** like cholera (and forms of gastroenteritis), typhoid, Hepatitis A, Hepatitis B etc. - major epidemics of such diseases have been recorded in the past and continue to occur;
- **Vector-borne** (often mosquito-borne) epidemics like dengue fever, chikungunya fever, Japanese encephalitis, malaria, kala-azar etc., which usually occur in certain regions of the country;
- **Person to person transmission of diseases** e.g. AIDS and other venereal diseases; and
- **Air-borne diseases** like influenza and measles that can also be transmitted through fomites (used clothes etc.).

In addition to the above, there are certain types of emerging infectious diseases such as epidemic of Severe Acute Respiratory Syndrome (SARS), which had occurred in China or the recent outbreak of avian flu in poultry in certain parts of the country and which has the potential of being transmitted to human beings. Epidemics due to the Dengue virus have occurred in many metropolitan cities of India and outbreak of various other types of viral diseases is also a recurring phenomena.

Trends Favouring Biological Disaster

- Low cost and wide spread availability
- More efficient in terms of coverage per kilogram of payload
- Advances in biotechnology has made production easy
- Used agents are largely natural pathogens to simulate existing diseases
- Have unmatched destructive potential
- Lethal biological agents can be produced easily and cheaply
- The lag time between infection and appearance of symptoms are longer than with chemical exposure.

Consequences of Biological Disaster

- It can result into heavy mortalities in the short term leading to a depletion of population with a corresponding drop in economic activity
- It leads to diversion of substantial resources of an economy to contain the disaster.
- Bio weapons of mass destruction

Prevention and Mitigation Measures

- The general population should be educated and made aware of the threats and risks associated with it.
- Only cooked food and boiled/chlorinated/filtered water should be consumed.
- Insects and rodent control measures must be initiated immediately.

- Clinical isolation of suspected and confirmed cases is essential.
- A network of laboratories should be established for proper laboratory diagnosis.
- Existing diseases surveillance system as well as vector control measures have to be pursued more rigorously.
- Mass immunisation programs in suspected areas have to be followed more rigorously.
- More focus should be given on the research of the vaccines which are not available.

Existing Challenges

The essential challenges posed by natural and artificial outbreaks of disease (bioterrorism) include:

- The development of mechanisms for prompt detection of incipient outbreaks
- Mobilisation of investigational and therapeutic countermeasures
- International collaboration as epidemics do not respect national borders
- No plan for prevention of post-disaster epidemics
- Yet to be devised an integrated disease surveillance system
- Absence of standard risk and vulnerability assessment plans.
- Lack of indicators and field-tested variables for various locations vulnerable to acts of biological terrorism.
- Non-availability of risk-zonation maps, especially for computing the trans-frontier spread.
- No comprehensive studies have been performed to assess the linkages between various global attacks and enhanced risk potential in the Indian context.
- A multi-dimensional information network and flow of information on various biological agents amongst stakeholders is lacking.
- Detailing the role of the emergency functionaries, vis-à-vis the intelligence gathering agencies is also grossly inadequate.
- Lack of capability for collection of samples and proper dispatch to laboratories.
- Inadequate facilities for early detection and characterisation of biological agents at an incident site.

Steps Required for Biological Disaster Management

- **Legal framework** - The Epidemic Diseases Act was enacted in 1897 and needs to be repealed. This Act does not provide any power to the centre to intervene in biological emergencies. It has to be substituted by an Act which takes care of the prevailing and foreseeable public health needs including emergencies such as BT attacks and use of biological weapons by an adversary, cross-border issues, and international spread of diseases
- **Operational framework** - At the national level, there is no policy on biological disasters. The existing contingency plan of MoH&FW is about 10 years old and needs extensive revision. All components related to public health, namely apex institutions, field epidemiology, surveillance, teaching, training, research, etc., need to be strengthened.
- **Command, control and coordination** - One of the lessons learned during the plague outbreak in Surat in 1994 and avian influenza in 2006 is the need to strengthen coordination with other sectors like animal health, home department, communication, media, etc., on a continuous basis for the management of outbreaks of this nature
- **Augmentation in human resource** - There is a shortage of medical and paramedical staff at the district and sub-district levels. There is also an acute shortage of public health specialists, epidemiologists, clinical microbiologists and virologists. There have been limited efforts in the past to establish teaching/training institutions for these purposes.

- Basic infrastructural setup** – Biosafety laboratories for prompt diagnosis, network of sub centres, PHCs and CHCs, dispensaries with stockpile of essential vaccines and medicines need to be expanded to handle epidemic.

3.3.2. Industrial Disasters

What are Industrial Disasters?

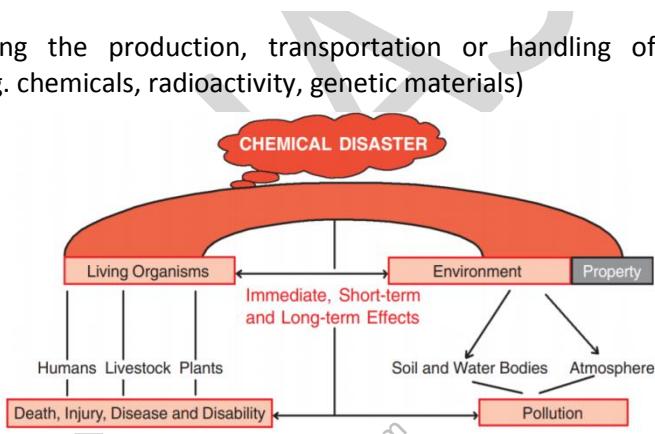
Industrial hazards are threats to people and life-support systems that arise from the mass production of goods and services. When these threats exceed human coping capabilities or the absorptive capacities of environmental systems they give rise to industrial disasters. Industrial hazards can occur at any stage in the production process, including extraction, processing, manufacture, transportation, storage, use, and disposal.

- The Bhopal Gas Tragedy, 1984
- Chasnala Mining Disaster, 1975
- Jaipur Oil Depot Fire, 2009
- Korba Chimney Collapse, 2009
- Mayapuri Radiological Incident, 2010
- Bombay Docks Explosion, 1944

[Few Major Industrial Disasters](#)

Forms of Industrial Disasters

- Accident release**- Occurring during the production, transportation or handling of hazardous chemical substances. (e.g. chemicals, radioactivity, genetic materials)
- Explosions**- Disasters will only be classified as explosions when the explosions are the actual disaster. If the explosion is the cause of another disaster, the event will be classified as the resulting disaster.
- Chemical explosion**- Violent destruction caused by explosion of combustible material, nearly always of chemical origin.
- Nuclear explosion/Radiation**- Accidental release of radiation occurring in civil facilities, exceeding the internationally established safety levels.
- Mine explosion**- Accidents which occur when natural gas or coal dust reacts with the air.
- Pollution**- Degradation of one or more aspects in the environment by noxious industrial, chemical or biological wastes, from debris or man-made products and from mismanagement of natural and environmental resources.
- Acid rain**- A washout of an excessive concentration of acidic compounds in the atmosphere, resulting from chemical pollutants such as sulphur and nitrogen compounds. When deposited these increase the acidity of the soil and water causing agricultural and ecological damage.
- Chemical pollution**- A sudden pollution of water or air near industrial areas, leading to internal body disorders with permanent damage of the skin.
- Atmosphere pollution**- Contamination of the atmosphere by large quantities of gases, solids and radiation produced by the burning of natural and artificial fuels, chemicals and other industrial processes and nuclear explosions.



Consequences of Industrial Disaster include- the loss of lives or injury, pain, suffering, property damage, social and economic disruption and environmental degradation.

Bhopal-like disasters in the making

Sites contaminated by hazardous waste identified by the Central Pollution Control Board

1 Eloor-Edyar area, Kochi, Kerala: Sits over 200,000 tonnes of highly hazardous chemicals, pesticides waste

2 Ranipet chromium-contaminated area, Tamil Nadu: About 220,000 tonnes of chromium waste piles 2-4 metres high over 3 hectares

3 Ratlam Industrial area, Ratlam, Madhya Pradesh: Contaminated with effluents from pharma industry manufacturing H-Acid

4 Chromium-contaminated area, Sundargarh, Odisha: 50,000 tonnes of chromium waste dumped in the open

5 Talcher chromium contaminated area, Talcher, Odisha: 60,000 tonnes of waste from closed chrome salt-manufacturing unit dumped in the open

6 Ganjam mercury-contaminated area, Ganjam, Odisha: Over 50,000 tonnes of mercury waste from closed caustic soda plants at different locations

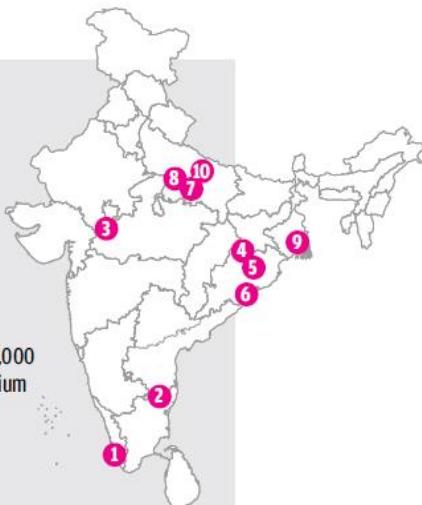
7 Juhi-Baburaiya-Rakhi-Mandi, Kanpur, Uttar Pradesh:

About 2 hectares of soil contaminated by roughly 10,000 tonnes of hexavalent chromium within densely populated settlement; owners not known

8 Rania, Kanpur Dehat, Uttar Pradesh: About 45,000 tonnes of hexavalent chromium waste piles up on 200 hectares of private land

9 Nibra Village, West Bengal: 4,440 tonnes of chromium waste dumped; owners not known

10 Persistent organic pollutants-contaminated area, Lucknow: Indian Pesticide Ltd generated 36,432 tonnes of hexachlorocyclohexane (HCH) waste



Industrial Disaster Risk in India

India has witnessed the world's worst chemical (industrial) disaster "Bhopal Gas Tragedy" in the year 1984. It was most devastating chemical accident in history, where over thousands of people died due to accidental release of toxic gas Methyl Iso Cyanate (MIC).

India continued to witness a series of chemical accidents even after Bhopal had demonstrated the vulnerability of the country. Only in last decade, 130 significant chemical accidents reported in India, which resulted into 259 deaths and 563 number of major injured.

There are about 1861 Major Accident Hazard (MAH) units, spread across 301 districts and 25 states & 3 Union Territories, in all zones of country. Besides, there are thousands of registered and hazardous factories (below MAH criteria) and un-organized sectors dealing with numerous range of hazardous material posing serious and complex levels of disaster risks. With rapid industrialization, the threat of industrial disasters has increased.

Industrial Disaster Prevention and Mitigation Strategies

- **Design and Pre-modification review:** this involves proper layout, facilities and material selection. Research should be done try to substitute extremely toxic chemicals with safer ones. Less chemicals should be stored; a reduction in inventory will automatically mean less damage if an accident is to occur.
- **Chemical Risk Assessment:** Chemicals are assessed based on compatibility, flammability, toxicity, explosion hazards and storage.
- **Process Safety Management:** reliability assessment of process equipment, incorporating safety trips and interlocks, scrubbing system, etc. should be done before effecting major process changes. Management should try to develop a culture of safety in industrial organizations
- **Safety Audits:** Periodical assessment of safety procedures and practices, performance of safety systems and gadgets along with follow up measures should be carried out.

- **Emergency Planning:** A comprehensive risk analysis indicating the impact of consequences and specific written down and practiced emergency procedures along with suitable facilities should be done. This can be done by communities as well as national or regional corporation authorities
- **Training:** Proper training of employees and protective services should be done.
- Special times and escorts for dangerous vehicles
- **Public Cooperation on the road:** the public should cooperate with the police and any tankers and heavy duty vehicles to avoid accidents and allow for the shortest possible on road time for dangerous vehicles.
- **Public awareness:** Everyone should be aware of potential disasters and informed of protective and safety measures. Cautions must be placed to standout on dangerous household and car care products.
- **Proper storage of hazardous Materials:** All chemicals and hazardous materials should be kept at proper storage temperature and in locked cupboards away from children and animals. Also, if reactive substances are stored, it should be stored in a watertight container.
- Proper and safe disposal of hazardous waste to be ensured as per existing regulations.
- Transition towards the use of safer alternatives and adoption of safer, affordable and sustainable technologies and processes
- Strict implementation of land use policy should be there. A legislation on the buffer zone (or to be referred as 'no man's' zone) should be introduced so that residential/ slum colonies are not established in proximity to industries. The already settled residential colonies need to be relocated.
- A scheme for giving good performance awards to industries for achieving exemplary safety standards and statutory compliance shall be developed and implemented.

Existing Challenges

- In spite of the existence of a large number of laws, their enforcement has left much to be desired.
- Lack of understanding and research towards devising a sustainable solution to the issue of industrial disasters
- No adequate separation of parameters, awareness and preparedness for such disasters.
- Absence of national regulations on occupational safety and health and medical emergency management.
- Harmonisation of classification and definitions in existing regulations including petroleum and petroleum products.
- Absence of regulations on storage and transportation of cryogenics.
- Lack of legislation on risk assessment requirements and classification, labeling and packaging for industrial chemicals.
- Non-availability of statutes for grant of compensation to chemical accident victims.
- Harmonisation and incorporation of international laws in chemical management.

Steps Required to be Taken

- Need to identify technical competent authorities and standardisation of reporting mechanisms for the status of implementation of various chemical disaster-related activities.
- Greater focus on need to understand industrial disaster. These are not simply safety problems that need to be resolved. They also have wider significance because they offer important opportunities to learn about the "goodness of fit" between society, technology, and environment and about how that fit can be strengthened or weakened by unexpected

events. This is the kind of information that will be invaluable to humanity during an era of deep and far-reaching societal and environmental change.

- It is time to make a clear distinction between **two types of industrial disasters - "routine" disasters and "surprises"**. **Routine disasters** are well understood by experts and susceptible to management using long established principles and practices. **Surprises** are quite different and much less understood. They include disasters like Bhopal and Chernobyl and Minamata events or their consequences or both - that lie outside the realm of previous experience. It will help in better preparation of mitigation strategies and policies.

3.3.3. Nuclear Hazards

What is a Nuclear Hazard?

It is a risk or danger to human health or the environment posed by radiation emanating from atomic nuclei of a given substance, or the possibility of an uncontrolled explosion originating from a fusion or fission reaction of atomic nuclei. The phenomenon is known as Radioactivity and the emission of energy released from the radioactive substance is called as “Radioactive Pollution”.

Sources of Nuclear Hazard

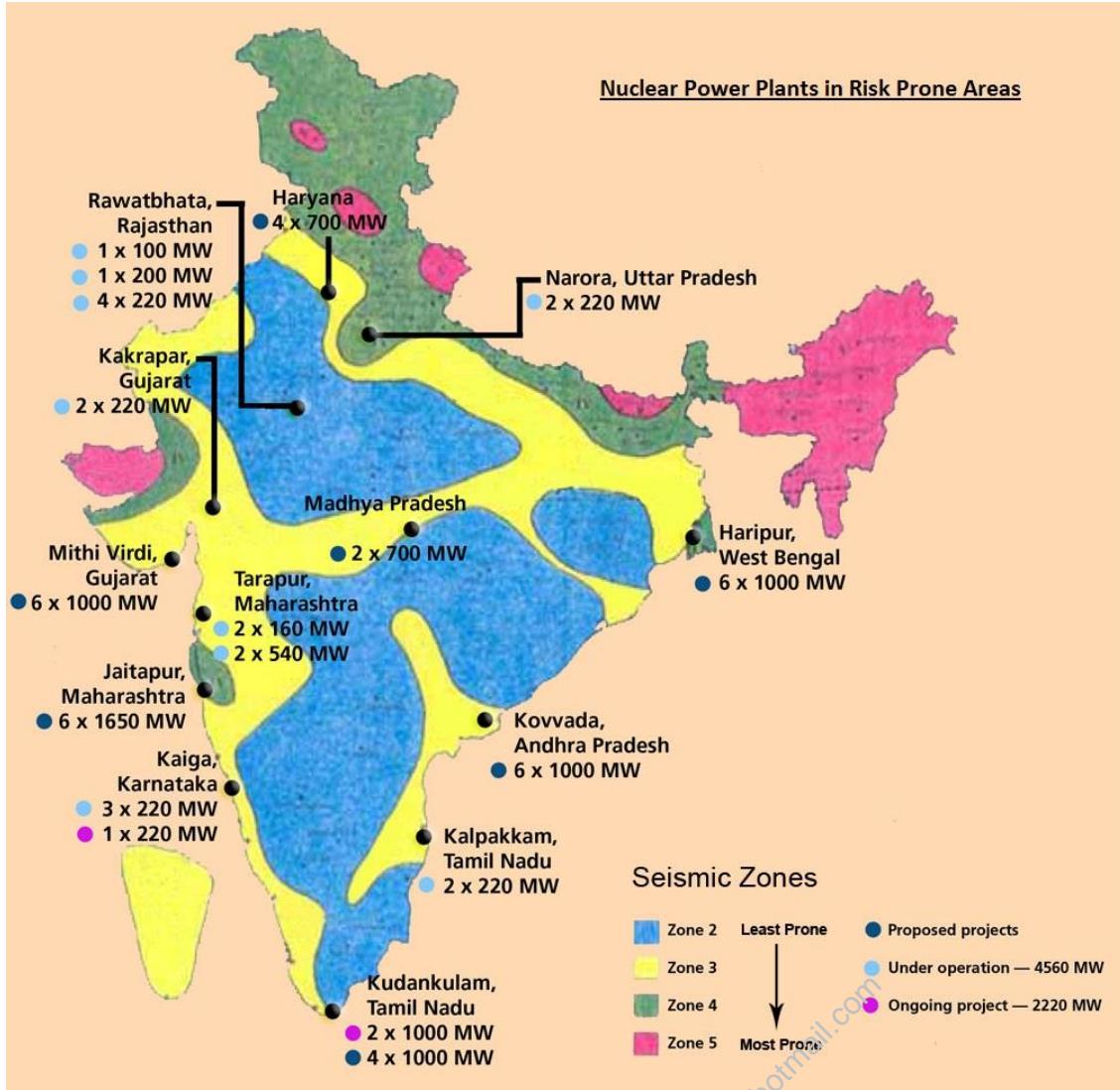
- Natural Resources:** Cosmic rays from the outer space, emissions from the radioactive materials from the earth's crust.
- Man-Made Sources:** Nuclear power plants, X-Rays, nuclear bombs, nuclear accidents, nuclear weapons, mining and processing of radioactive ores.

Nuclear emergencies can also arise due to factors beyond the control of the operating agencies; e.g., human error, system failure, sabotage, earthquake, cyclone, flood, etc. Such failures, even though of very low probability, may lead to an on-site or off-site emergency. It can also take place while using radiation sources, either at Hospitals, Industries, Agriculture or Research Institutions due to loss or misplacement or due to faulty handling.

Nuclear Hazard risk in India

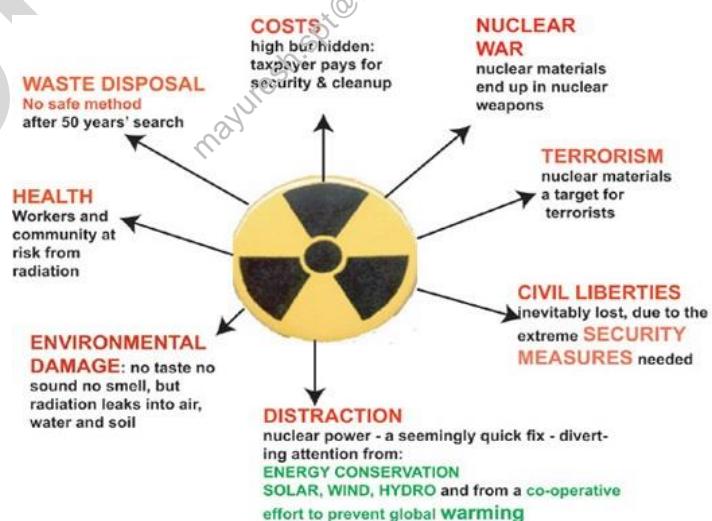
India has traditionally been vulnerable to natural disasters on account of its unique geo climatic conditions and it has, of late, like all other countries in the world, become equally vulnerable to various man-made disasters.

Nuclear power is one of the biggest sources of electricity in India. India has a flourishing and largely indigenous nuclear power programme and expects to have 14.6 GWe nuclear capacity on line by 2024 and 63 GWe by 2032. It aims to supply 25% of electricity from nuclear power by 2050. Nuclear and Radiological Emergency can arise in a nuclear facility at plant level leading to plant/ site or offsite emergency depending upon the extent of its impact on the surroundings.



Impacts of Nuclear Hazard

- Death, acute or chronic debilitation, or increased risk of cancer, cataract in eyes, hair loss
- Radiation Sickness: A person's risk of getting sick depends on how much radiation the body absorbs. Radiation sickness is often fatal and can produce such symptoms as bleeding and shedding of the lining on the gastrointestinal tract.
- Damage or destruction of agricultural products – animals and crops
- Degradation of environmental resources
- Devaluation or loss of use of public and private property
- Genetic changes in the generations to come by mutation



Nuclear Hazard Mitigation Strategies

- There are four ways in which people are protected from identified radiation sources:
 - ✓ **Limiting time.** In occupational situations, dose is reduced by limiting exposure time.
 - ✓ **Distance.** The intensity of radiation decreases with distance from its source.
 - ✓ **Shielding.** Barriers of lead, concrete or water give good protection from high levels of penetrating radiation such as gamma rays. Intensely radioactive materials are therefore often stored or handled under water, or by remote control in rooms constructed of thick concrete or lined with lead.
 - ✓ **Containment.** Highly radioactive materials are confined and kept out of the workplace and environment. Nuclear reactors operate within closed systems with multiple barriers which keep the radioactive materials contained.
- Promoting flexibility in management of emergencies, for efficient use of resources.
- Maintenance of full-time capability for immediate response
- Ensuring the responders, plans, facilities, and any necessary inter-organizational coordination are sufficient to provide the desired protection.
- Appropriate steps and measures to be taken against occupational exposure and safety measures for nuclear accidents.

Steps Taken by Govt

- With increased emphasis on power generation through nuclear technology, the threat of nuclear hazards has also increased. The Department of Atomic Energy (DAE) has been identified as the nodal agency in the country in respect of manmade radiological emergencies in the public domain.
- Nuclear facilities in India have adopted internationally accepted guidelines for ensuring safety to the public and environment.
- A crisis management system is also in place to take care of any nuclear hazard.
- Other types of emergency response plans in place within the facility to handle local emergencies, response plans have also been drawn up for handling such emergencies in the public domain, which are called as “offsite Emergencies”.
- These plans, drawn up separately in detail for each site - which are under the jurisdiction of the local district administration, cover an area of about 16 km radius around the plant or the offsite Emergency Planning Zone.

Mobile Radiation Detection System (MRDS)

NDMA, as part of a pilot project on national level preparedness to cope with Radiological Emergencies, has taken an initiative to equip police and NDRF personnel for management of radiological emergencies in public domain.

3.3.4. Crowd Management

What do you mean by Crowd Management?

It encompasses law enforcement, management, intervention, and control strategies while responding to all forms of public assemblies and gatherings. It also refers specifically to strategies and tactics employed before, during, and after a gathering for the purpose of maintaining the event's lawful activities where as, **crowd control** is restriction or limitation of group behaviour.

Need for Managing Crowd

Large crowds create annoyances and difficulties to a section of society leading to severe traffic delays, pollution, stampede, fights among people, riots, alteration in landscape and ultimately become source of medical emergencies and disasters. In recent years India has witnessed many such events which resulted into great causalities.

Difference between Crowd Management and Crowd Control

Crowd management

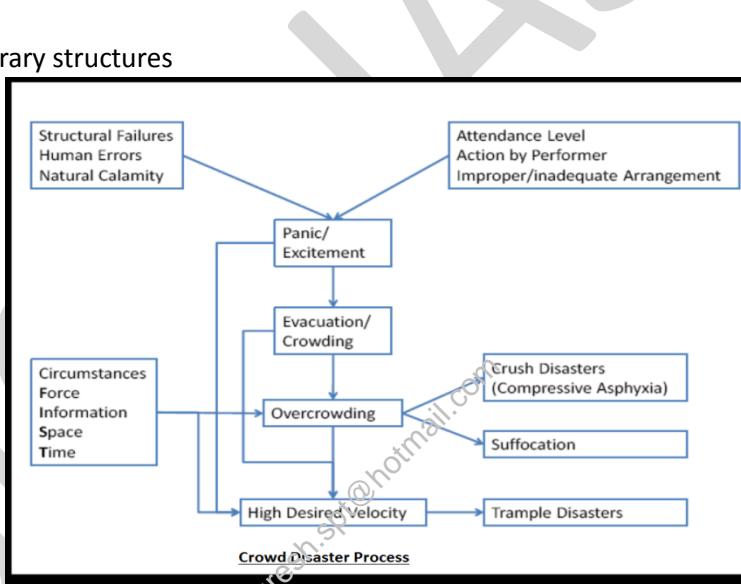
- involves the assessment of the people handling capabilities of a space prior to use.
- It includes evaluation of projected levels of occupancy, adequacy of means of ingress and egress, processing procedures such as ticket collection, and expected types of activities and group behaviour.

Crowd control

- may be part of a crowd management plan, or occur as an unplanned reaction to a group problem.
- It can include extreme measures to enforce order, such as the use of force, arrest, or threat of personal injury.
- It may employ barriers that alter the space available for occupancy and patterns of group movement.
- Inappropriate or poorly managed control procedures have precipitated crowd incidents rather than preventing them. For example, police reacting to a group of unruly persons at a rock concert, herded spectators into areas where there were no means of egress.

Causes and Triggers for Crowd Disasters

- Structural Collapse
 - ✓ of the barriers or temporary structures
 - ✓ Barriers on the way
 - ✓ Poor guard railings
 - ✓ Poorly lit stairway, narrow staircase
 - ✓ Absence of emergency exits
- Fire/Electricity
 - ✓ Wooden structure catching fire
 - ✓ Electricity supply failures
 - ✓ Short circuits
- Crowd Control
 - ✓ Lack of sectoral partition to segregate crowd
 - ✓ Lack of proper public address systems
 - ✓ Uncontrolled parking and movement of vehicles
 - ✓ Reliance on one major exit route
- Crowd Behaviour
 - ✓ A wild rush towards entrance or exits
 - ✓ Rush during distribution of something
 - ✓ Sudden mass evacuation
 - ✓ Last minute change in platforms of trains
 - ✓ Crowd in anger due to delay in start of a program
- Security
 - ✓ Lack of CCTV surveillance of the crowd
 - ✓ Absence of walky-talkies with security staff
 - ✓ Lack of metal detector door frames
 - ✓ Under development of security personnel to regulate crowd control
- Lack of Coordination between stakeholders

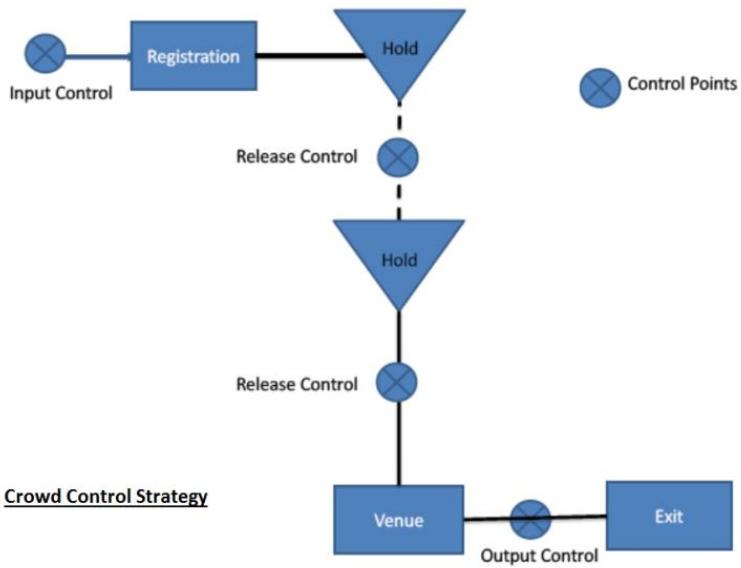


- ✓ coordination gap between agencies
- ✓ communication delays
- ✓ poor infrastructure
- ✓ Plans on paper and no implementation due to lack of funds

Prevention and Mitigation Strategies for Crowd Disaster

Crowd management, intervention, and control strategies and tactical considerations may include:

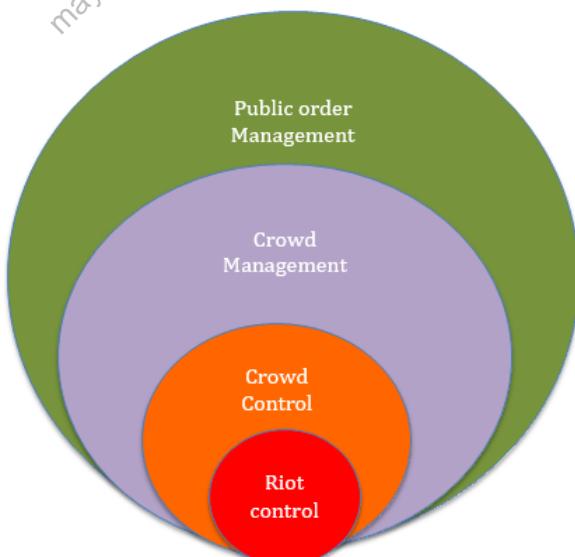
- Establishing contact with the crowd, understand crowd behaviour
- Gaining verbal compliance
- Capacity Planning
- Supporting and facilitating First Amendment activities
- Developing a traffic management and/or control plan
- Using **crowd control strategy** and dispersal methods
- Protecting critical facilities
- Providing a high-visibility law enforcement presence
- Proper transmission of information



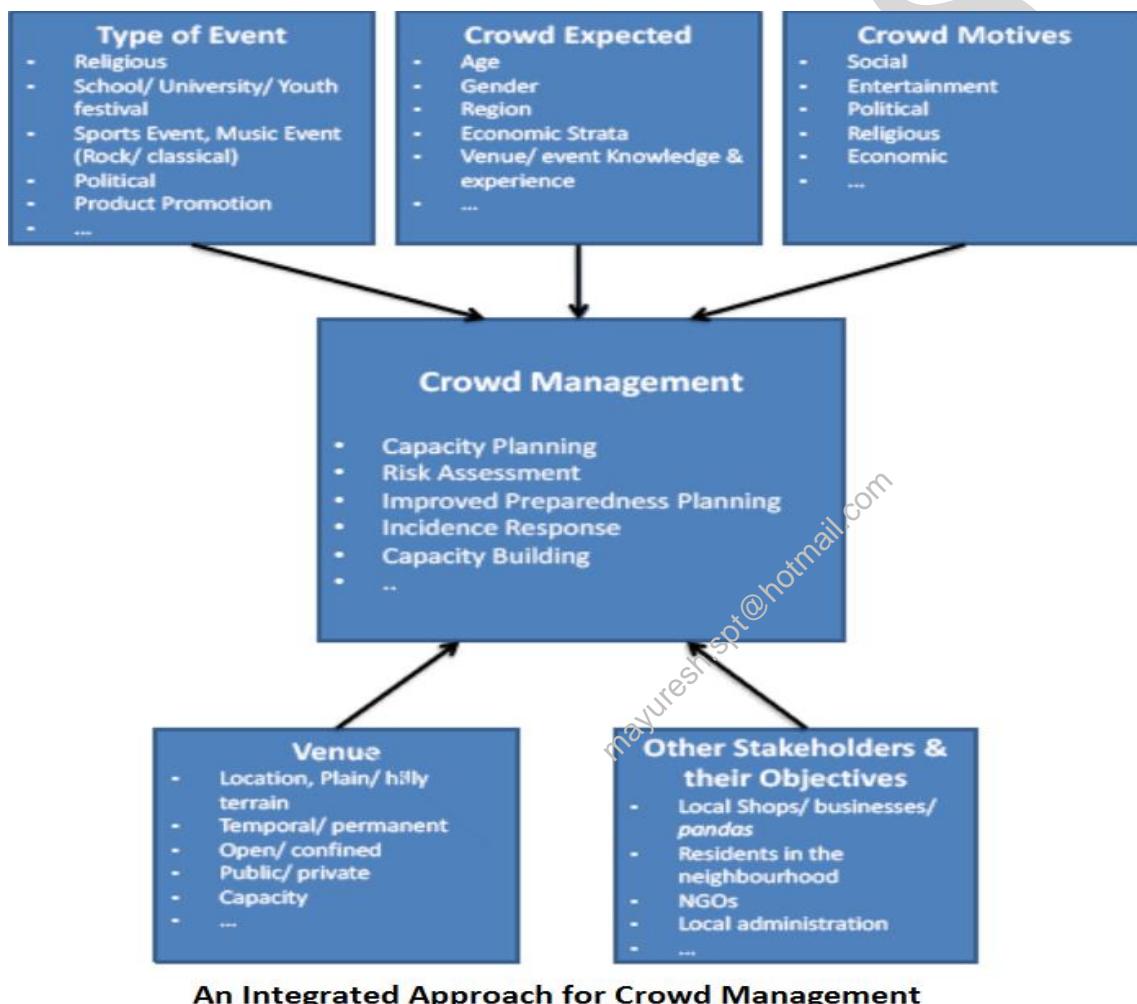
NDMA Guidelines

Recently in 2017 NDMA has released crowd management guidelines to 'Reduce risks this festive season'.

- **Free movement:** The first step is to regulate traffic in areas surrounding the pandals and Dussehra grounds.
 - ✓ For pedestrians, route maps for reaching the venue and emergency exit route should be put up at strategic points.
 - ✓ Barricading to ensure the movement of people in a queue is key to control a burgeoning crowd.
 - ✓ Unauthorised parking and makeshift stalls eating into pedestrian space also need to be taken care of.
- **Monitoring:** CCTV cameras to monitor movement and police presence to reduce the risk of snatching and other petty crimes should also be on the organisers' agenda.
- Medical emergencies can occur in claustrophobic spaces. An ambulance and health care professionals on stand-by can save lives in exigencies.



- **For participants:**
 - ✓ Familiarizing with exit routes, staying calm and following instructions will help prevent stampede-like situations.
 - ✓ In case a stampede breaks out, protect chest by placing your hands like a boxer and keep moving in the direction of the crowd.
 - ✓ Stay alert to open spaces and move sideways wherever the crowd gets thinner. Stay away from walls, barricades or bottlenecks such as doorways.
 - ✓ Stay on your feet and get up quickly if you fall. If you can't get up, use your arms to cover your head and curl up like a foetus so that your exposure area is reduced.
- **Fire related:** Unplanned and unauthorised electrical wiring at pandals, LPG cylinders at food stalls and crackers hidden in the Ravana effigies pose the danger of a fire breaking out.
 - ✓ Organisers should ensure authorised use of electricity, fire safety extinguishers and other arrangements meeting safety guidelines. A list of neighbourhood hospitals would come in handy.



CHAPTER-4

4. International Cooperation and Current Developments

4.1. Global Frameworks for Disaster Risk Reduction

4.1.1. Hyogo Framework for Action (HFA): Building the Resilience of Nations and Communities 2005-2015

India is a signatory of the Hyogo Framework for Action, which was adopted globally to work towards the reduction of disaster losses in lives and economic and environmental assets of communities and countries. The framework has set three strategic goals and five priority action areas regarding the integration of disaster risk reduction (DRR) into sustainable development policies, capacity building and preparedness and vulnerability reduction.

Five Priority Actions under the Hyogo Framework

1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation.
2. Identify, assess and monitor disaster risks and enhance early warning.
3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels.
4. Reduce the underlying risk factors.
5. Strengthen disaster preparedness for effective response at all levels.

The three strategic goals of the Hyogo Framework for Action along with steps taken by India towards its implementation:

(a) **Goal 1: "The more effective integration of disaster risk considerations into sustainable development policies, planning and programming at all levels, with a special emphasis on disaster prevention, mitigation, preparedness and vulnerability reduction;"**

- With the enactment of the DM Act, 2005, and preparation of the disaster management plan, 2016, the present focus of the government is to implement the various provisions under them.
- All the government programs are being designed following the principle of "do no harm".

(b) **Goal 2: "The development and strengthening of institutions, mechanisms and capacities at all levels, in particular at the community level, that can systematically contribute to building resilience to hazards;"**

- Strategies have been adopted to strengthen SDMAs and DDMAs.
- Comprehensive Human Resource Development Program is being prepared for the entire country.
- Partnerships with Civil Society are being strengthened.

(c) **Goal 3: "The systematic incorporation of risk reduction approaches into the design and implementation of emergency preparedness, response and recovery programmes in the reconstruction of affected communities."**

- "Build Back Better" is the underlining principle adopted by the Government for all post reconstruction and recovery activities.

4.1.2. Sendai Framework for Disaster Risk Reduction (SFDRR)

The Sendai Framework is a **15-year, voluntary, non-binding agreement** which recognizes that the State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders including local government, the private sector and other stakeholders.

The Sendai Framework for Disaster Risk Reduction 2015–2030 was adopted at the Third United Nations World Conference on Disaster Risk Reduction, held in March 2015 in Sendai (Miyagi, Japan). It is the successor instrument to the *Hyogo Framework for Action (HFA) 2005-2015: Building the Resilience of Nations and Communities to Disasters*.

India is committed to achieving the 7 goals set under the framework through systematic and sustainable efforts.

The Four Priorities for Action under the Sendai Framework

1. Understanding disaster risk: Disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment.

2. Strengthening disaster risk governance to manage disaster risk: Disaster risk governance at the national, regional and global levels is very important for prevention, mitigation, preparedness, response, recovery, and rehabilitation. It fosters collaboration and partnership.

3. Investing in disaster risk reduction for resilience: Public and private investment in disaster risk prevention and reduction through structural and non-structural measures are essential to enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets, as well as the environment.

4. Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction: The recovery, rehabilitation and reconstruction phase is a critical opportunity to build back better, including through integrating disaster risk reduction into development measures.

India has been designated as the champion for Disaster Risk Reduction (DRR) for its efforts to facilitate regional support towards enabling community resilience in the Asia-Pacific region. United Nations Office for Disaster Risk Reduction (UNISDR) has declared India first regional champion after the **Sendai Agreement**.

The Sendai Framework Readiness Review, UNISDR 2017

Critical data gaps exist in specific areas of disaster loss, in all areas of international cooperation, and for many aspects of early warning, risk information and disaster risk reduction strategies. The Review confirms that unless gaps in data availability, quality and accessibility are addressed, countries' ability to assure accurate, timely and high quality monitoring and reporting of implementation across all Targets and Priorities of the Sendai Framework will be severely impaired.

Sendai Framework's Seven Global Targets

1. Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortalities between 2020-2030 compared to 2005-2015;
2. Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015;
3. Reduce direct disaster economic loss in relation to global gross domestic product by 2030;
4. Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030;
5. Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020;
6. Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of the framework by 2030;
7. Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030.

A **Global Partnership for Disaster-related Data for Sustainable Development** would facilitate a collaborative, multi-stakeholder effort (bringing together governments, international organizations, the private sector, civil society groups, and the statistics and data communities), to optimize and operationalize existing and future disaster-related data in support of national and sub-national disaster risk reduction efforts.

2030 Agenda for Sustainable Development

In the 2030 Agenda for Sustainable Development, ten of the seventeen Sustainable Development Goals (SDGs) have targets related to disaster risk, firmly establishing the role of disaster risk reduction in realizing the 2030 Agenda for Sustainable Development.

Paris Agreement at CoP 21

In the Paris Agreement, adopted at the 21st Conference of Parties to United Nations Framework Convention on Climate Change in 2015, Member States committed to holding the global average temperature increase to well below 2°C above pre-industrial levels and to pursue efforts to limit the increase to 1.5°C, with the aim to “significantly reduce the risks and impacts of climate change”

4.2. Partnerships with International Agencies

4.2.1. United Nations Office for Disaster Risk Reduction

The United Nations Office for Disaster Risk Reduction (UNISDR) serves as the focal point for coordination among all stakeholders involved in disaster reduction activities. The Government of India has contributed US\$ 1 million in November, 2016 in 7th Asian Ministerial Conference for Disaster Risk Reduction and signed a Statement of Cooperation to promote regional capacity buildings for the Asia Pacific Region in the field of Disaster Risk Reduction (DRR). UNISDR has established following mechanism/ vehicles to achieve its objectives:

The World Conference on Disaster Risk Reduction (WCDRR)

It is a series of United Nations conferences focusing on disaster risk reduction and climate risk management in the context of sustainable development. The conferences bring together government officials and other stakeholders to discuss **how to strengthen the sustainability of development by managing disaster and climate risks**. The conferences have been hosted by Japan: in Yokohama in 1994, in Kobe in 2005 and in Sendai in 2015.

Global Platform for Disaster Risk Reduction (GPDRR)

It acts as the main global forum for emphasis on disaster risk reduction. **It assesses the progress made in the implementation of the Sendai Framework for Disaster Risk Reduction (SFDRR)**. It meets biannually and Indian delegation participated in it in Cancun, Mexico in 2017 where NDMA Guidelines on Museums was also launched during the summit.

Asian Ministerial Conference for Disaster Risk Reduction (AMCDRR)

To monitor and **share the country's progress at a regional platform** for Asian-Pacific region, AMCDRR was conceptualized. It provides a platform for engagement of Ministers of about 61 countries, dealing with Disaster Management for plan and policy making at regional level in line with the global framework on disaster risk reduction. It meets biannually. The 2nd and 7th AMCDRR were hosted by Government of India in 2007 and 2016 respectively.

4.2.2. United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA)

The United Nations office for the Coordination of Humanitarian Affairs (UNOCHA) was formed in December 1991 by the General Assembly to **strengthen the response of United Nations Organizations to complex emergencies and natural disasters**. UNOCHA has established following mechanism/ vehicles to achieve its objectives:

United Nations Disaster Assessment and Coordination (UNDAC): It is a stand by team of disaster management professionals which are nominated and funded by member governments, UNOCHA, UNDP and operational humanitarian UN Agencies such as WFP, UNICEF and WHO. The Government of India joined the membership of UNDAC in 2001.

International Search and Rescue Advisory Group (INSARAG): It is a global network of more than 80 countries and disaster response organizations under the United Nations umbrella. It deals with urban search and rescue (USAR) related issues. Members of INSARAG are both earthquake-prone and responding countries and organisations. Instructors from India participate in the mock exercises organized by the INSARAG. India was the Chairman of INSARAG Asia Pacific Regional Group in 2005-06.

4.2.3. Global Facility for Disaster Reduction and Recovery (GFDRR)

The Global Facility for Disaster Reduction and Recovery (GFDRR) is a global partnership program administered by the World Bank Group. It helps developing countries - particularly those identified as the most vulnerable natural disaster "hotspots" - enhance their capacity for disaster prevention, emergency preparedness, response, and recovery. It also supports developing countries to:

- mainstream disaster risk management and climate change adaptation in development strategies and investment programs, and
- Improve the quality and timeliness of resilient recovery and reconstruction following a disaster.

It was launched in September 2006 to support implementation of the Hyogo Framework for Action 2005-2015 (HFA). India became a member in 2013.

4.2.4. SAARC Disaster Management Centre (SDMC)

The 13th SAARC Summit at Dhaka in November 2005 considered the issues of regional cooperation for preparedness and mitigation of national disasters and approved the offer of India to set up a SAARC Disaster Management Centre (SDMC) in New Delhi.

South Asia Disaster Knowledge Network (SADKN)

SADKN web portal is a platform for networking and knowledge sharing for the region. It brings together various agencies and creates an extensive knowledge network on disasters for the region to share information, data and research in the field of DRR. It is a network of networks with one regional and eight national portals.

4.2.5. Asian Disaster Reduction Center (ADRC)

A resolution was adopted at the United Nations General Assembly in 1997 to reduce damage from natural disasters substantially by designating the 1990s as the International Decade for Natural Disaster Reduction. Following a series of national conferences held during the period of 1994-1997 to discuss the cooperation for disaster reduction, a ministerial level conference was held in Kobe, Japan in 1995 in which 28 countries from Asia and other regions participated. It adopted the Kobe declaration which includes an agreement to consider the creation of a system, which has the functions of a disaster reduction centre for the Asia region. The Asia Disaster Reduction Centre (ADRC) was thus established in Kobe in 1998 following an agreement from the participating countries with the Japanese government.

4.2.6. Asian Disaster Preparedness Center (ADPC)

Asian Disaster Preparedness Center (ADPC) is established in 1986 at Bangkok, Thailand. It is a non-profit, non-political, autonomous, regional organization serving as a regional centre in Asia-Pacific for promoting disaster preparedness, disaster mitigation, awareness generation,

exchange of information, community participation etc. In 2004, the ADPC became an international body (inter-governmental organization).

4.2.7. ASEAN Regional Forum (ARF)

The ASEAN Regional Forum (ARF) was established in 1994. The ARF membership including India, which joined in 1996, is 25 countries. It is the Principle Forum for Security Dialogue in Asia and complements the various bilateral alliances and dialogues, which underpin the region's security architecture. The ARF is premised on the idea drawn from the ASEAN experience that a process of dialogue can produce qualitative improvements in political relationships. It provides a platform for members to discuss current regional security issues and develop cooperative measures to enhance peace and security in the region.

As all ASEAN members are automatically ARF members, India is actively participating in the ARF meetings and disaster relief exercises.

4.3. India's Leadership Initiatives

4.3.1. First International Workshop on Disaster Resilient Infrastructure, 2018

In pursuance with 1st point of Hon'ble Prime Minister's 10 point agenda on Disaster Risk Reduction, National Disaster Management Authority (NDMA) in collaboration with United Nations Office for Disaster Risk Reduction (UNISDR), organized first of its kind International Workshop on Disaster Resilient Infrastructure (IWDRI) on 15-16 January, 2018 in New Delhi.

The Workshop emphasized the role of risk resilient infrastructure. It identified best global practices prevailing in the resilient infrastructure, as well as key challenges and gaps in existing practices and ways to address them. Potential areas for collaboration among the stakeholders on disaster resilient infrastructure were also identified.

4.3.2. First Joint Disaster Management Exercise for BIMSTEC Countries, 2017 (BIMSTEC DMEx-2017)

The Government of India hosted the first Annual Disaster Management Exercise for 'Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation' (BIMSTEC) countries (BIMSTEC DMEx-2017) in October, 2017 in the National Capital Region (NCR). About 200 disaster professionals from all seven BIMSTEC countries participated for the first time in table top and field exercises.

4.3.3. Asian Ministerial Conference for Disaster Risk Reduction, 2016

AMCDRR was established in 2005. It is a biennial conference jointly organized by different Asian countries and the United Nations Office for Disaster. The November 2016, Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR) came up with the adoption of the 'New Delhi Declaration' and the 'Asian Regional Plan for Implementation of the Sendai Framework'. It was the first Asian Ministerial Conference for Disaster Risk Reduction (AMCDRR) after the advent of the Sendai Framework for DRR. The Conference also commemorated the first World Tsunami Awareness Day to spread awareness on Tsunami.

The theme of AMCDRR 2016 was "Risk Sensitive Development for Community Resilience". The Conference concluded with:

- (i) **A New Delhi Declaration**, reaffirming the government and stakeholders' commitment to Disaster Risk Reduction and strengthening the resilience of communities, nations and the Asian region. It commits to a people-centred and whole-of-society approach towards DRR.
- (ii) Adoption of **Asia Regional Plan for implementation of the Sendai Framework for Disaster Risk Reduction**. It arrived at a longer term road map of cooperation spanning the 15-year

horizon of the Sendai Framework, as well as a two-year action plan to further disaster risk reduction with specific, actionable activities.

4.3.4. Cooperation with UNISDR, 2016

The Government of India and United Nations Office for Disaster Risk Reduction (UNISDR) signed a Statement of Cooperation in November 2016 underlining the guiding principles and areas of cooperation between India and UNISDR towards the effective implementation and monitoring of the Sendai Framework on Disaster Risk Reduction (SFDRR).

India has partnered with UNISDR to strengthen the capacity of Asian countries in ensuring risk resilient development. It will also share knowledge and experiences towards addressing critical regional challenges. The cooperation aims to ensure effective implementation and monitoring of the Sendai Framework through training and capacity building for Asian countries.

4.3.5. Meeting of BRICS Ministers for Disaster Management, 2016

The Meeting of BRICS Ministers for Disaster Management was held in August, 2016 in Udaipur, Rajasthan. **The Udaipur Declaration** agreed for **setting up a Joint Task Force on Disaster Risk Management (DRM)** for regular dialogue and collaboration among BRICS countries. The joint Task Force is expected to initiate the actions as agreed in the Roadmap for implementation of the **Joint Action Plan** signed by the BRICS countries at the Udaipur Meet.

4.3.6. First Disaster Management Exercise with SAARC Countries in 2015

The Government of India organized the first South Asian Annual Disaster Management Exercise (SAADMEx) in 2015. All the SAARC member countries participated in first ever joint exercise conducted by the National Disaster Response Force (NDRF) of India. The focus was to test the inter-governmental coordination and create synergy to synchronize efforts to institutionalize regional cooperation on disaster response among the member countries of the SAARC region. It was followed by the SAARC Regional Workshop on sharing best practices.

4.3.7. India-Pacific Sustainable Development Conference

India organised an India Pacific Islands Sustainable Development Conference in Suva, Fiji on 25-26 May, 2017 to strengthen the resilience of Pacific nations by collaborating with them on DRR activities.

4.3.8. Other Planned Initiatives

Japan-Indo Workshop on Disaster Risk Reduction, 2018

As a part of agreement of Japan and India on Disaster Risk Reduction (DRR), a workshop on DRR would be organised on 19-20 March 2018.

Joint Urban Earthquake Search and Rescue exercise of SCO member states in 2019

India became a member of Shanghai Cooperation Organisation (SCO) in 2017. Apart from India, SCO has seven other member States (China, Kazakhstan, Kyrgyzstan, Pakistan, Russia, Tajikistan and Uzbekistan) and 4 observer States (Afghanistan, Belarus, Iran and Mongolia).

During the 9th Meeting of Heads of Government authorities of Shanghai Cooperation Organization (SCO) in Kyrgyzstan in August, 2017, the Government of India announced that it will organise a Joint Urban Earthquake Search and Rescue exercise of SCO member states to improve collective preparedness and also host the next meeting of SCO head of departments dealing with disaster prevention in 2019.

4.4. Bilateral Agreements with Countries

4.4.1. Japan

A Memorandum of Cooperation (MoC) was signed between India and Japan in 2017 on Cooperation in the field of Disaster Management. Both sides will exchange information and collaborate on disaster risk reduction and policies in the areas of prevention, response and recovery and reconstruction for "build back better". They will also collaborate to share information, lessons and policies for tsunami risk reduction, including tsunami awareness, early warning and preparedness. Recently, first India-Japan Workshop on Disaster Risk Reduction was inaugurated in March 2018 for cooperation in disaster risk reduction with particular emphasis on earthquake safety.

4.4.2. Shanghai Cooperation Organisation (SCO) Countries

SCO Member States, inter-alia, have agreement on Disaster Relief Mutual Assistance, which calls for mutual assistance among the SCO countries in disaster response.

4.4.3. Germany

A **Joint Declaration of Intent** on Cooperation in the field of Disaster Management between India and Germany on cooperation in the field of disaster management was signed in October 2015. It seeks to exchange information and other Scientific/Technological expertise in the field of Disaster Management. It also aims to provide training and capacity building of First Responders in Civil Defence, urban search and rescue, Fire services and medical field.

4.4.4. Indonesia

A MoU was signed in 2013 between the National Disaster Management Authority (NDMA), of India and the National Agency for Disaster Management of Indonesia with an aim to develop cooperation in the field of disaster management. The areas of cooperation between the countries include exchange of information in the field of disaster management, training and capacity building; exchange of experts and human resources on disaster management etc.

4.4.5. SAARC Countries

SAARC Agreement on Rapid Response to Natural Disasters was signed at the Ministerial level at the 17th SAARC Summit held at Addu city, Maldives in November, 2011.

The objective of the agreement is "to provide effective regional mechanisms for rapid response to disasters to achieve a substantial reduction of disaster losses in lives and in the social, economic and environmental assets of the Parties, and to jointly respond to disaster emergencies through concerted national efforts and intensified regional cooperation."

4.4.6. Russia

The Government of India and the Government of Russian Federation had signed the Agreement for cooperation in the field of **Emergency Management** during the 11th Indo-Russian Annual Summit held in December 2010 in New Delhi. The main areas and forms of co-operation are: exchange of information, early warning, assessment of risks, joint conferences, seminars, workshops, training of specialists, mutual assistance in providing technical facilities and equipment etc.

The first meeting of the **Indo-Russian Joint Commission for cooperation in Prevention and Elimination of Consequences of Emergencies** was held on 22nd March, 2016 in New Delhi. During this meeting the Joint Implementation Plan on cooperation in the field of prevention and elimination of emergencies for 2016-2017 was signed.

4.4.7. Switzerland

India and Switzerland signed an agreement for extending cooperation in the prevention preparedness for handling natural disasters and assistance in the event of disasters or major emergencies.

CHAPTER-5

5. Miscellaneous Topics

5.1. Disaster Insurance

Excessive dependence on relief and rehabilitation packages creates a regime where there are **no incentives for adoption of risk reduction**. Insurance is a potentially important mitigation measure in disaster-prone areas as it brings quality in the infrastructure & consciousness and a **culture of safety** and **culture of prevention**. Disaster insurance mostly works under the premise of 'higher the risk higher the premium', thus creating awareness towards vulnerable areas and motivating people to settle in relatively safe areas.

Following the success of micro-credit for rural development, micro-insurance has started emerging as a tool for ex ante risk management. In fact, micro-credit and micro-insurance support each other. The tool of insurance should be made attractive through a set of policy measures and fiscal incentives. Catastrophic Insurance: Examples from Japan - Seismic Hazard Maps have been put to use and have been found appropriate for modelling financial risk, including time-dependent and time-independent rates of earthquake recurrence.

5.2. Community Based Disaster Management

Disaster management can be effective only if the communities participate in it. As a community is the repository of knowledge and skills which have evolved traditionally, these needs to be integrated in the management strategy. Community is the first line of responders, thus, it is necessary to educate the community and impart skills and assign specific roles regarding disaster management to ensure a coordinated response while disaster. This can be achieved by:

- **Undertaking location specific training programmes for the community:** Cascading approach should be used to impart training as the number of people to be imparted skills is very large. Thus this responsibility can be entrusted at the local level, say, to the village panchayats.
- **Disaster management education** needs to be integrated within the formal and informal systems of education.
- The leaders and **personnel in critical sectors** should be given disaster management training as well.
- A **proper safety plan** including all pre-disaster planning to reduce risk should be made to enhance community preparedness.
- The entire process of **damage assessment** and **distribution of the relief packages** can be conducted very smoothly with the active involvement of local community leaders and SHGs.

Community also plays an important role in recovery process including the **socio-psychological rehabilitation** of the victims of the disaster. During the recent past, it has been experienced that the capacity building of the community has been very helpful even in situations when isolated instances of drowning, burns etc. take place. With the creation of awareness generation on disaster mitigation and carrying out mock drills from time to time under the close supervision of Disaster Management Committees the community will be able to function as a well-knit unit in case of any emergency.

-  In recent floods in Chennai, local people were able to help army and other forces in locating the routes as roads were all filled and army was not acquainted with the area as much as locals.

5.3. Role of the Media in Disaster Management

The role of the media is very important. They are often not provided with the correct information, resulting in the spread of incorrect information which adds to the panic.

Pre-disaster

- The media can influence the government to prioritize Disaster Risk Issues. For example, it may expose excessive and inefficient expenditure on disaster preparedness in a particular region.
- It can help disaster mitigation experts create early warning systems. Emergency alerts using TV, radio, cable services across the country can be very effective.
- To educate the community in recognising symptoms and reporting them early if found.
- Ensuring cooperation of the community in risk reduction by forewarning the people about the consequences of their dangerous actions and operations.

During disaster

During the onslaught of the disaster, what is of utmost importance is to keep the morale of the people high, to create self-confidence in them and to prevent panic. The media can help, in many ways in ensuring these conditions.

- Continuous and factual coverage, particularly by local media, can assist the authorities, voluntary organizations and volunteers in reaching the affected with assistance and relief.
- Cautioning the affected or to be affected people about the Dos and Don'ts, of scotching rumours and preventing panic and confusion.
- Identifying the needy spots and focusing attention on them, giving details on impassable roadways and downed utility lines.
- Communicating the information to the people and the concerned authorities sufficiently in advance to enable them to take the necessary steps to minimize the losses of lives and property.
- It provides the outside world with a glimpse of what that affected community is dealing with.

Post-disaster

- Collection of material resources and the enlisting of man-power by appealing to the people to come forward to render help.
- Helping the affected in establishing contacts with their closed ones
- Keeping a watch and report on some anti-social elements who try to take advantage of such situations
- Contributing by countering the damaging, exaggerated and negative reporting and propaganda in the foreign media on the occurrence of the disasters.

Negative Effects of Media

- The media may exaggerate some elements of the disaster and create unnecessary panic.
- Inaccurate portrayal of human behaviour during and after a disaster may create a very dramatic and exciting picture but it is only partially truthful.
- Influential politicians may manipulate the media for personal and political gains.
- Biased coverage for the purposes of sensationalism by choosing to capture only small incidents of horrific devastations leads to misreporting.

- Convergence of media representatives on a high-profile event can create tremendous "congestion" in the affected area.
- Live coverage of critical operations can disrupt the counter-terrorism strategy of the forces, as was observed in Mumbai 26/11 attacks.

A prompt presentation of the real state of affairs by our media, and the correction of the misrepresentations by them will go a long way in dispelling the wrong impressions created abroad which may otherwise have adverse effect on the administration, the economy and the polity of the country.

5.4. Role of Social Media in Disaster Management

Social media is different from conventional media in that it allows for one-to-one, one-to-many and many-to-many communications. It enables communication to take place in real time or asynchronously over time. It is also device indifferent and can take place via a computer, tablets and smartphones which are relatively mobile and easy to carry around. It also allows participants to create or comment on social media networks.

During disasters all the conventional communications generally stop functioning at the time while social media or networking services stay active. Its role as a news source is invaluable with instantaneous information available with power outages shutting down TV stations and landlines. Emergency service agencies are utilising the power of social media and SMS to instantly broadcast and amplify emergency warnings to the public. Critical tasks that can be implemented by social media are:

- Prepare citizens in areas likely to be affected by a disaster;
- Broadcast real-time information both for affected areas and interested people;
- Receive real-time data from affected areas;
- Mobilize and coordinating immediate relief efforts; and
- Optimize recovery activities.

☞ During the devastating Hudhud cyclone that struck Visakhapatnam, PWD officials created a WhatsApp group that acted as the main tool of communication for sharing information. No meetings and discussions were organised at the district level as the WhatsApp group helped identify and access required resources.

Online social networking services and social media like Facebook, Twitter, Google+, Etc. try to solve many problems during natural disasters by establishing link with closed ones. Concerns such as the threat of technology failure, hackers, stalkers, viruses will have to be addressed in the development of emergency online networks. Also, the spread of rumours can be quick leading to spread of panic. Therefore, social media cannot and should not supersede current approaches to disaster management communication or replace existing infrastructure, but if managed strategically, they can be used to bolster current systems.

5.5. Retrofitting of Buildings- The Key is to Let it Swing

Parameters for earthquake-resistant construction have been laid down in Indian Standards Code, 2002. It entails studying a building's design and assessing its construction material by non-destructive radiological tests. The key idea of making a building earthquake-resistant is to make it ductile, i.e. to give it a certain flexibility to shake horizontally. It helps soften the impact of the earthquake and lets the building absorb its energy.

To make a building earthquake resistant, its base is strengthened in a way that during an earthquake, the building's load is borne by the base alone, and upper stories do not experience much quaking. The part of the base that is above the ground is cut and rested on bearings, exactly like how a jack is used to lift a car to change wheels. The bearings act as shock

absorbers, similar to those in cars. Adding rubber material such as used tyres to the foundation of a building under construction can also be done. For a building under construction, the cost is estimated to increase by about 10% and for retrofitting, it is estimated to be around 15-20% of the total cost of the structure.

 Only two schools were left standing in Grenada after the passage of Hurricane Ivan (September 2004). Both had been subject to retrofitting through a World Bank initiative. One of the schools was used to house displaced persons after the event.

In India, the Building Materials & Technology Promotion Council (BMTPC) has undertaken projects for retrofitting of life-line structures. The Council has initiated retrofitting of MCD school buildings in Delhi and other structures in Jammu and Kashmir.

5.6. Climate Change and Disasters

There is considerable evidence that economic damage caused by extreme weather events has increased substantially over the last few decades. For a country like India, with over 70 percent of its population relying directly or indirectly on agriculture for their livelihoods, the impact of extreme weather events is critical.

People often live in areas of high ecological vulnerability and relatively low levels of resource productivity and have limited and insecure rights over productive natural resources.

Changes in the precipitation patterns and any intensification of the monsoons will contribute to flood disasters and land degradation. India's water supply depends not only on monsoon rains but also on glacial melt water from the Hindu Kush and the Himalayas. Rising temperatures will cause snowlines to retreat further, increasing the risk of floods during the summer monsoon season.

 The state of Odisha has experienced floods in 49 of the last 100 years, droughts in 30 and cyclones in 11 years. The occurrence of droughts, floods and cyclones in a single year is not unusual

Disaster Risk Reduction and climate change mitigation and adaptation share common goals, both aim to reduce the vulnerability of communities and achieve sustainable development. While emphasis of DRR is on prevention, mitigation, preparedness and recovery from geological hazards such as earthquakes, landslides etc. as well as hydro-meteorological disasters such as floods, cyclones, Climate Change Adaptation is mainly linked with hydro-meteorological disasters and aims at reducing vulnerability due to climate change/variability risk through adaptation to gradual changes in climate over a long period.

5.7. Poverty and Disasters

Poverty and vulnerability to natural hazards are closely linked and mutually reinforcing. Disasters are a source of hardship and distress, potentially temporarily forcing certain groups below the poverty threshold and also contributing to more persistent, chronic poverty.

Poverty and risk to disasters are inextricably linked and mutually reinforcing. The poor section of the society is worst affected in case of disaster. Due to the compulsion of the poor to exploit environmental resources for their survival, the risk and exposure of the society to disasters increases. Poverty also compels the poor to migrate and live at physically more vulnerable locations, often on unsafe land and in unsafe shelters.

Disasters can also disrupt ongoing poverty reduction activities and force a diversion of related financial resources into relief and rehabilitation efforts. Poverty can be further reinforced by deliberate risk-averting, ex-ante livelihood choices that poorer households may make. For

example, poorer households may choose to forego the potential benefits of higher yielding or more profitable crops in favour of more hazard-tolerant ones.

The substandard quality and often, dangerous location of housing (e.g., on flood plains, riverbanks or steep slopes); lower levels of access to basic services, particularly for the rural poor and illegal squatters; uncertain ownership rights, reducing incentives to manage resources sustainably or invest in structural mitigation measures; often more vulnerable livelihoods; and limited access to financial resources, constraining their ability to diversify livelihoods and recover post disaster.

The poor can also exacerbate their own risk where limited livelihood opportunities force over-exploitation of the local environment. Meanwhile, the covariate nature of natural hazards implies that there is limited scope for formal and informal community-based support systems in the aftermath of a disaster.

5.8. Miscellaneous NDMA Guidelines

5.8.1. Museums

Indian museums show a great range and diversity of collections and themes. Loss of collections and building structures also leads to loss of income and cultural values associated with the objects. Some specific challenges of disaster risk management in museums are listed below.

- Museums contain a diversity of individual objects, ranging from archaeological to organic materials which are vulnerable.
- In the aftermath of a disaster, aspects of cultural heritage take a backseat as priority is given to infrastructure and rehabilitation of communities.
- Collections in a museum require specialized planning approaches.
- Museums are often housed in historic buildings which are structurally more vulnerable and located in hard-to-access regions.
- In general, museum staff is not well equipped and unaware of basic measures for disaster risk reduction.
- Lack of assigned areas for temporary storage further adds to post-disaster losses.
- Post-disaster recovery plans often do not include museums and they are not assigned funds for reconstruction.

The museums should be divided into public, semi-public, private and service areas. Value assessment, documentation and prioritization of objects and collections must be done. Authenticity and uniqueness of objects should be taken into account. Hazards and risk identification both inside and outside the building must be done and steps for disaster risk reduction taken accordingly.

5.8.2. Cultural Heritage Sites and Precincts

Cultural heritage has only recently been recognized as a key aspect within overall frameworks of disaster risk reduction. A general lack of awareness and a lack of prioritization of heritage is one of the key challenges in this area. Some critical aspects of disaster risk management for built cultural heritage are:

- Due to the diversity in age, scale and physical conditions of built heritage it is difficult to apply standardised approaches for disaster risk reduction
- Disasters pose a risk not just to the lives of people living, visiting or managing cultural heritage sites and precincts but also to heritage values embodied in the physical fabric.
- Poor management, neglect, lack of awareness further complicate disaster risk reduction for built heritage as often the structural integrity of such buildings gets compromised over time.

- Interventions that would reduce risk to such sites may sometimes pose a threat to the heritage value and aesthetics.
- Built heritage may also offer the opportunity to act as refuge space or as examples of structural resilience using traditional technologies and this aspect may be useful while developing larger scale risk reduction strategies.

 The Bhuj City Palace, the commemorative chattris(cenotaphs), suffered extensive damage due to the earthquake. Similarly, in 2011, the Sikkim Earthquake destroyed many Buddhist monasteries and temples. Flash-floods in the lower Himalayas in 2013 and the Kashmir Floods in 2014 caused wide-spread damage to temples, palaces, historic gardens and museums.

5.8.3 Psycho-Social Support and Mental Health Services in Disasters

Psycho-social support in the context of disasters refers to comprehensive interventions aimed at addressing a wide range of psychosocial and mental health problems arising in the aftermath of disasters. These interventions help individuals, families and groups to build human capacities, restore social cohesion and infrastructure along with maintaining their independence, dignity and cultural integrity. Psycho-social support helps in reducing the level of actual and perceived stress and in preventing adverse psychological and social consequences amongst disaster-affected community. Emotional reactions such as guilt, fear, shock, grief, Hyper-vigilance, numbness, intrusive memories, and despair are universal responses in people experiencing unforeseen disastrous events beyond their coping capacity. Emotional reactions reported by the people are normal responses to an abnormal event. It is estimated that nearly 90% of survivors undergo these emotional reactions immediately after the disaster. However, it reduces to 30% over a period of time with psychological reactions to stress, leading to a change in behaviour, relationships and physical or psycho-social situations.

Indian experience in Orissa super cyclone, Gujarat earthquake, riots and tsunami has demonstrated that appropriate psycho-social intervention during the rescue, relief, rehabilitation and rebuilding period significantly decreases the distress and disability among survivors, leading to an overall improvement in the quality of life.

5.9. National Disaster Plan for Animals

Disaster Management Plan for Animals aims at protecting animals and preventing and mitigating loss of livestock resources during various disasters. It is divided into a) Pre-disaster preparedness, b) Disaster response and c) Post-Disaster Plan.

Pre-disaster preparedness includes detailed action plan relating to dissemination of early warning, identification of vulnerability amongst livestock, animal vaccination, feed and fodder supply and capacity building of different stake-holders in disaster management etc. Disaster response component includes strategy/action plan relating to effective and prompt response, rescue of livestock, feed & fodder supply, measures against epidemics and diseases and maintenance of Sanitation etc. Post disaster component includes strategy for treatment of sick animals, disease surveillance, disposal of carcass, restoration and restocking of livestock population.

6. VISION IAS PREVIOUS YEARS TEST SERIES QUESTIONS

- Explain National Disaster Communication Network and India Disaster Resource Network. Do you think that both the terms are merely proverbs in India's approach towards disaster management?*

Approach:

Briefly explain the need and concept of NDCN and IDRН. Then point out the deficiency in their working and conclude that indeed they are not upto the mark. There is no need to give suggestions for improvements regarding these systems as it is NOT the concern of question.

Answer: [Student Note: Answer is kept long to provide a full analysis of the issue. Use a summary for your answer]

National Disaster Communication Network (NDCN)

During a disaster, the existing terrestrial communication networks are prone to failure. To address this risk, NDMA decided to set up the National Disaster Communication Network (NDCN). NDCN was planned as a network of networks by providing appropriate connectivity to the existing communication networks viz. NICNET, State Wide Area Networks (SWANS) and POLNET, etc., to various Emergency Operation Centres. For this an additional overlay network segment utilizing satellite communication will be established as VSAT network of NDMA. This VSAT Network will consists of a HUB and VSATs distributed all over the country. In Addition to the Emergency operation centres at National, State and District Levels, NDCN will be equipped with mobile/transportable communication systems to establish graded communication capability at the disaster sites.

Issues-

The concept paper for the project was sent by NDMA to MHA in October 2007. However there were delays at various stages involved in the preparatory work of the project, since the submission of the concept note. As a result, the ambitious project of NDMA to provide networking for integration of various disaster management tools in the country was still at the preparation stage even after a lapse of more than four years. MHA stated (December 2012) that NDCN Project was very comprehensive and important, detailed consultations with various stake holders had to be held and accordingly the project was formulated to bring about effective coordination among various communication networks presently working in the field of Disaster Management. So it seems it will still take a long time before actually materializing. CAG report on disaster preparedness has also recommended that NDMA should ensure the implementation of NDCN at the earliest.

India Disaster Resource Network (IDRN)

MHA developed India Disaster Resource Network (IDRN) portal with the support of UNDP and launched it in 2004 through National Informatics Centre (NIC). IDRN is a web portal designed to systematically build up an organised information system of specialist equipment and expertise for disaster response. This is to enable disaster managers to identify the location of the resources and access it for disaster response with the minimum loss of time. The nodal authorities (District Collector or DDMA) are responsible for updating the inventory data.

Issues -

MHA entrusted (June 2008) NIDM with the responsibility of updating and maintaining the portal. CAG in its report on disaster preparedness noted that the portal was being managed without any dedicated staff. Data is monitored and maintained at the central level by National Institute of Disaster Management (NIDM). Besides NIDM is responsible for the overall administration of the portal. At the same time; NIDM is not responsible for collection, updation & validation of data. Only district level authority is responsible for updating the data. Thus there are issues of coordination.

There is also no regular monitoring and emphasis of the data updation. It was mandatory to carry out a security audit of the portal periodically by a specialised external agency. But there is no such audit had taken place after 2004, despite repeated warnings by NIC. The inventory of resources is thus vulnerable and its reliability in a disaster situation is uncertain.

There are also challenges of poor connectivity between and within knowledge generating communities and user communities at various levels and there is a lack of a systemic institutional mechanism for collating, synthesizing and delivering knowledge products for decision making.

Therefore, owing to the issues related to the respective networks, it seems that presently these are merely symbolic platforms for disaster management and a lot needs to be done before we can take full advantage of these.

2. *Discuss the weaknesses of Civil Defence in the context of Disaster Management and suggest measures for its improvement.*

Approach:

First we have to define the core concept and then straight forward can tell problems and their solution.

Answer:

'Civil Defence' means the performance of humanitarian tasks intended to protect the civilian population against hostilities or disasters and also to provide the conditions necessary for its survival. These tasks are: warning; evacuation; management of shelters; management of blackout measures; rescue; medical services, including first-aid, and fire fighting etc.

Problems in India

- The lacuna inherent in the definition of legislation related to the civil defence, that it cannot be made applicable to natural disasters, thereby depriving it of a wider role in the administrative set-up for crisis management.
- Excessive centralization is there in Civil Defence mechanism as union has entire control.
- The number of volunteers is grossly inadequate for a vast country like India.
- The financial allocation for civil defense activities is very inadequate.

Solutions:

- The term 'disasters' should be inserted in the Civil Defense Act to give a wider meaning to the definition of 'civil defence'.

- The whole structure of 'civil defence' may be left at the disposal of the State Governments.
- India should pursue people to enroll as volunteers to 1% of the population in time bound manner.
- The financial allocation should be increased and donations from corporate sector should be permitted for civil defence activities.

3. *The national policy should reflect a paradigm shift in disaster management from a short term to long term perspective. Discuss.*

Approach:

Presently, India's policy framework does not encompass the necessary requirements of disaster management. The desired direction, in which the national policy should shift – short term to long term perspective- has been mentioned.

Answer:

The recent Uttarakhand disaster and its management has exposed the weaknesses in the disaster management capabilities of India. Given such a situation, India needs to move from a short term towards long perspective. The desired National policy, giving effect to this, should reflect the following characteristics:

- Disaster management needs to be professionalized.
- Risk management should be brought to the center stage in all disaster mitigation plans.
- All efforts for disaster management to be based on hazard and vulnerability analysis.
- Communities and local governments to be made aware of the possible hazards and vulnerabilities.
- Communities and local governments to be involved in formulating disaster management plans.
- The primary responsibility for disaster management to be that of the State Governments, with the Union Government playing a supportive role.
- Effective implementation of land use laws, building byelaws, safety laws and environmental laws.
- Setting up a framework to coordinate the responses from different sections like donors, voluntary organizations, corporate bodies etc.
- Special needs of women, children, elderly and physically challenged persons to be addressed.

4. *Analyze the difference in approach to Disaster Management of the 1999 Orissa supercyclone and the 2013 Phailin cyclone.*

Approach:

By taking the examples of both the disasters mentioned in the question, try to highlight how the approach to manage disasters has changed over the years. This also involves outlining the traditional as well as current approach to Disaster Management briefly.

Answer:

- India is vulnerable to many natural hazards like cyclones, droughts, earthquakes and floods. Such natural disasters have caused heavy loss to life and property.

However, Disaster Management has historically been ignored, with the focus being only on post-facto relief operations. This approach changed with the International Decade for Natural Disaster Reduction in the 1990s.

- The 1999 super-cyclone that struck the coast of Odisha caused havoc, with tens of thousands of people displaced and a loss of around \$4.5 billion. Such widespread destruction was the result of not only severity of the storm but also the unpreparedness of the authorities to tackle such a hazard.
- The coming decade saw a change in perspective with Disaster Management being seen as a constituent of strategy of sustainable development. The Yokahama Declaration laid emphasis on preparedness for a disaster, its mitigation, prevention and an efficient response with adequate relief and rehabilitation.
- Therefore the approach to Disaster Management is now much more holistic involving forethought to its prevention and capacity building of the community for being prepared for the disaster. After a disaster strikes, reconstruction and rehabilitation plans would include measures for prevention of future disasters. A National Disaster Management Authority has been institutionalized, which would lay down policy guidelines to effectively handle any future disasters.
- The difference can be seen from the successful handling of Phailin cyclone that struck the Odisha coast in 2013. Early Warning Systems informed about the impending storm. Unlike in 1999, people were prepared this time and cooperated with the authorities in evacuation plans. This was possible because sufficient trust and capacity had been built in the community to realize the coming danger. The result was that less than 100 lives were lost.
- Much can still be done to reduce the impact of disasters. Use of native knowledge to tackle disasters and knowledge dissemination are necessary for an effective approach to disaster management.

5. Illustrate the role of 'Crisis Mapping' in Disaster Management.

Approach:

Following needs to be brought about:

- Defining crisis mapping
- At what specific stage of Disaster Management does it becomes relevant
- It's functioning and few examples

Answer:

Crisis mapping is the real-time gathering, display and analysis of data during a crisis, usually a natural disaster or social/political conflict (violence, elections, etc.).

Crisis mapping projects usually allows large numbers of people, including the public and crisis responders, to contribute information either remotely or from the site of the crisis. One benefit of the crisis mapping method over others is that it can increase situational awareness, since the public can report information and improve data management.

Role of Crisis Mapping

The role of crisis mapping is to bridge the gap that existed between information-seekers and providers, particularly when it came to providing insights into the situation on the ground and the action that needed to be taken.

Crisis Mapping is an apt tool to cater to 'Emergency Response', the second stage of Crisis Management or the second of 3R's (Reduction, Response and Recovery).

Methodology

Crisis mapping leverage the following tools and methods to power effective early warning for rapid response to complex humanitarian emergencies:

- Mobile and web-based applications,
- Participatory maps and crowd-sourced event data,
- Aerial and satellite imagery,
- Geospatial platforms,
- Advanced visualization,
- Live simulation, and
- Computational and statistical models

Example: It was used to great effect during Haiti Earthquake, 2011 and closer home, during Uttarakhand Floods, 2013.

6. *Environmental degradation has acted as a catalyst in increasing the severity of disaster events. Illustrate. Also suggest measures for their mitigation.*

Approach:

Briefly define environmental degradation and its causes. Discuss with examples, environmental degradation increasing the severity of disaster events and suggest measures to mitigate the causes of Environmental degradation.

Answer:

Environmental degradation is the deterioration of the environment through depletion of resources such as air, water, soil and forest; the destruction of eco-systems and the extinction of wildlife.

IMPLICATIONS OF ENVIRONMENTAL DEGRADATION

About 50 percent of geographical area of India suffers from varying degrees of degradation caused by deforestation, overgrazing, agricultural mismanagement, shifting cultivation, soil erosion, soil salination, water logging, alkalinity, and acid rains.

Over 5.3 billion tonnes of top soil is lost every year due to soil erosion. The average soil loss is estimated to be over 16 tonnes per hectares per year which translates into approximately 1 millimetre (mm) each year or 1 centimetre (cm) every decade.

The terrible floods in Uttarakhand killed more than 1,000 people, left 70,000 stranded for days and destroyed livelihoods. The true causes of the epic tragedy lie in the grievous damage recently wrought on the region's ecology by the runaway growth of tourism, unchecked proliferation of roads, hotels, shops and multistory housing in ecologically fragile areas, and above all mushrooming hydroelectricity dams that disrupt water balances. Underlying the disaster are multiple governance failures, too.

A landslide in Pune that has killed more than 100 people and left scores missing may have been a man-made disaster caused by deforestation to make way for farming. The Relentless rain naturally was the trigger. But the use of heavy machinery to flatten land for agriculture may have aggravated the crumbling of the hill top.

Recent Jammu and Kashmir Floods, while the level of rainfall was unprecedented, Ecological degradation caused by unplanned development and urbanisation, and failure to preserve wetlands, had severely added to havoc.

Solutions to Environmental Degradation

- Massive information campaign should be carried out using mass media and multi-media both. Individuals, community of concerned citizens, legislators, government leaders, school authorities and all, should make efforts to teach people about environmental concerns toward sustainable development.
- Protest excessive development. Show to the people that too much urbanization extremely causes harm to the flora, chases away wildlife and increasingly pollutes rivers and sources of water.
- Environmental concerns should be a mandatory part of urbanization and development planning. There should be no obstruction to the flow of rivers, no huge constructions on their banks and techniques like flood plain zoning should be adopted.
- Prohibit contamination of rivers, lakes and seas. Leaders and well-to-do families should take the most initiative and lead by example.
- Tourism must be culturally and environmentally friendly and sustainable. Tourists should be encouraged to live in the homes of local people where they can experience their unique culture and life styles. In this way, building of new structures can be lessened
- Encourage recycling activities and maintain proper waste disposal by teaching people how to do it and by giving them awareness of the benefits it could give them, both financially, healthfully, and spiritually;
- Start planting trees now and do backyard gardening. Even with less space, one can grow plants in small recyclable containers. They could even hang it in small spaces so the breath of oxygen is present all around to fight greenhouse effects.

7. Community based disaster management, which seeks to empower community directly to enhance their indigenous coping mechanisms, is a must. Elaborate.

Approach:

- Explain CBDM and importance of CBDM
 - Ways to achieve CBDM – mock drills, capacity building etc.
 - Benefits of CBDM – use of traditional knowledge etc.
 - Government steps – legal, budgetary allocation etc.
 - Give examples where communities succeeded or failed

Answer:

Community Based Disaster Management (CBDM) is a process, which leads to a **locally appropriate and locally "owned" strategy** for disaster preparedness and risk reduction. The first responder to any disaster is invariably the disaster-hit community itself which is also a **repository of traditional knowledge**. This approach should work in harmony with the top-down approach.

It is necessary to **educate the community** about the entire disaster risk reduction and even to impart skills and assign specific roles to the members of the community, so that the first response from the community is a well coordinated one. This could be **achieved by**:

- Undertaking location specific training programmes for the community – **Village panchayats**, should be entrusted this responsibility.
- Mainstreaming crisis management in **education** – through textbooks, training exercises, conducting workshops and mock drills.

CBDM empowers community to actively engage in supporting each other by giving them the knowledge and resources they need. It **helps the community to**

1. Become effective first responders
 2. To evaluate their own situation based on local experiences
 3. Community becomes part of planning and implementation
- Integration of traditional knowledge and skills

Community can also be empowered to run **Public address system (PAS)** which is crucial for raising alarm. For example, in the coastal villages of Puducherry, a PAS installed saved thousands of life during Tsunami, 2004.

The government also recognizes that CBDM is a key to effective disaster risk reduction. DMA2005 and National Policy on disaster management (2009) mandate strong association of the communities through awareness, capacity building and training. Odisha government had conducted several **mock drill** exercises and its benefit was evident during the recent cyclone Phailin. Government ran a programme in multi-hazard districts to train volunteers. States like Odisha and Assam have undertaken significant community capacity building interventions. Other states must implement CBDM effectively.

In conclusion, different regions of India suffer from different types of disasters. Community participation is the key to handle it as seen in various disasters. Role of community must be integral to all the phases of disaster management from risk reduction to recovery.

8. What are Tsunamigenic zones? Give examples of such zones in the vicinity of Indian Coastal regions. Examine the preparedness level of India to minimize the impact of Tsunamis.

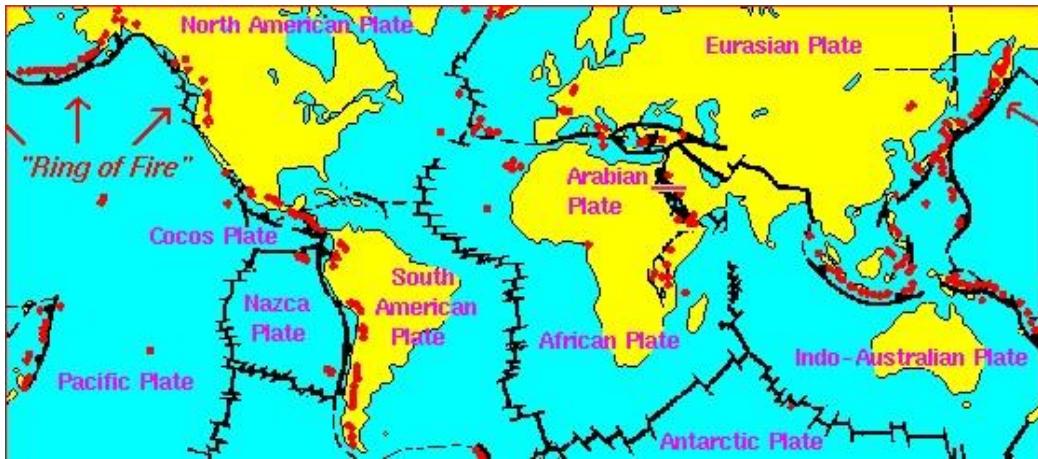
Approach:

There are three parts of the question as follows:

- Tsunamigenic zones – earthquake zones commonly along major subduction zone plate boundaries that can generate Tsunamis
- Mention zones along with their approximate distances from mainland and islands of India.
- Assess the Preparedness level in today's time. Focus on the steps taken after 2004 Tsunami. Talk about the issues in the present system.
- Conclusion – final statement on preparedness and then can suggest some measures in a line or two.

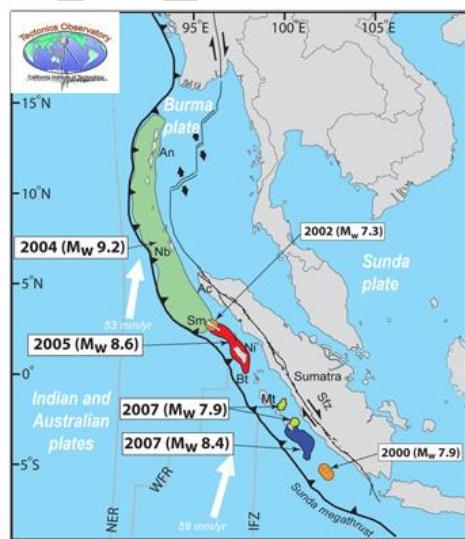
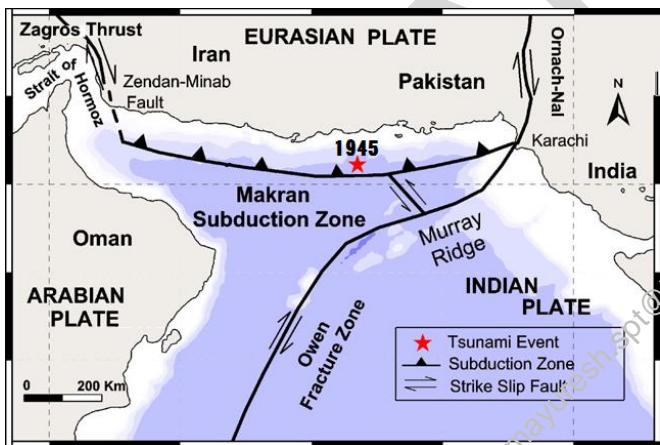
Answer:

Tsunamigenic zones are the regions in the sea where vertical shifting of water mass can cause Tsunami waves. Tsunami can be created by earthquakes and volcanoes etc. Region of convergent tectonic plate boundaries are the most likely sources for Tsunami. Therefore, these zones are not randomly distributed as shown in the map below.



Tsunamigenic zones along the converging plate boundaries in the sea regions

Two main Indian Ocean Tsunamigenic zones are Makran subduction zone (MSZ) in the Northern Arabian Sea and Indonesian subduction zone (ISZ) in the Bay of Bengal near Indonesian Islands. These zones are result of the active tectonic collision process that is taking place along the southern boundary of the Eurasian plate as it collides with the India plate and adjacent micro-plates. MSZ is not far from India's coast and a major earthquake can be disastrous for India. 2004 Tsunami was generated in the ISZ, which is very near to the Andaman and Nicobar Islands and about 1300km from the mainland India.



Makran subduction zone and Indonesian subduction zone

India had some lessons to learn from the Tsunami of 2004. Government installed “Indian Tsunami early warning system” was developed which is integrated with the system of other Asian countries. It has a network of seismometers, tidal gauges and ocean buoys.

Other measures include mapping of vulnerable coastal areas, awareness and community preparedness activities. Yet critical gaps remain. While the system can send out warnings quickly, dissemination of the alerts to people on the ground takes time. Coastal infrastructure is still poor.

Tribes of A&N Islands moved to higher places in the interiors in advance with the help of tradition knowledge during the Tsunami of 2004. There is a need to integrate such knowledge in the system. Mangroves require special attention from government. Only a very handful of scientists are working on Tsunami research today.

9. *Technology is an indispensable tool in disaster management. Explain the role of GIS in context of the above statement giving recent examples from India.*

Approach:

In the introduction, discuss about increasing usage of technology in disaster management. Then, discuss how GIS can assist in different types of disaster and in different stages of disaster management. Include examples from India only. Example: cyclone management in Odisha.

Answer:

Technology has considerably enhanced the potential of mankind to manage the disasters. For instance, exact prediction of Phailin cyclone considerably reduced the loss of life and property. Similarly technologies are today extensively used in prediction and protection from other disasters like tsunami, earthquakes. In this regard Geographic Information System (GIS) is turning out to be an excellent tool for disaster management. GIS is an effective, economic and efficient tool for storing, manipulating, and presenting spatial and geographic data in an integrated manner.

It can assist in Disaster Management in following ways:

PRE DISASTER PHASE

- It can assist the disaster managers in vulnerability mapping. For example it can be used to map the areas vulnerable to earthquakes and classify them under various zones. For example it is used to Indian ocean region to identify the areas vulnerable to earthquake and tsunami.
- It can also assist in developing alternate routes to shelters, camps, and important locations in the event of disruption of normal surface communication
- In case of disasters like floods and tsunamis, GIS can help in identifying locations likely to remain unaffected or remain comparatively safe. Then routes and signboards can be placed guiding the public to such safe locations in the event of hazards. . For Example: GIS has been used in Odisha against cyclones. For example: it has been used in the identification of location for construction of multipurpose cyclone shelters.
- Locations suitable for construction of shelters, godowns, housing colonies, etc. can be scientifically identified by using information regarding landforms, nature of disasters, etc.

- Areas where no construction should be taken up or existing habitations require relocation, could be identified by using vulnerability data which can be created using GIS.

DURING DISASTER

- It can be used for planning of rescue and evacuation operations. In Sikkim GIS was useful in search and rescue operations in areas affected by landslides.
- GIS can also be used to identify the areas where the disaster is likely to spread. It can act as a warning system and thus it can help in controlling the further spread of disaster.

POST DISASTER

- Accessibility of data through GIS can assist in rehabilitation by identifying the most damaged area. For example, it was used in earthquake region of Gujarat.
- It is also useful in post-disaster reconstruction works. New houses can be constructed in the less vulnerable areas.

10. The first ever SAARC disaster management exercise, named SAADMEx, was recently hosted by India whose theme was "one SAARC, one response". Discuss the need for cooperation among SAARC countries for 'Disaster Risk Reduction'. How can India contribute to the same?

Approach:

- Briefly describe SAADMEx.
- Mention the vulnerability of SAARC countries to disasters and discuss the benefits of a coordinated response.
- Explain centrality of India's role in coordinating and in providing information and resources.

Answer:

India hosted the first-ever joint disaster management exercise with SAARC nations in November 2015, to learn best practices and skills in urban search and rescue operations called the South Asian Annual Disaster Management Exercise (SAADMEx).

Regional collaboration for DRR is essential because of cross-boundary nature of causes as well as effects of the disasters. Cooperation helps identify a common security agenda since the security of one state is contingent on others'. It may also work as an ice-breaker in difficult relations.

Need for collaboration among SAARC countries for DRR

- Geographical unity of SAARC countries makes it imperative for them to act and plan together for disasters.
- In a poor region, it is best that a collective system of DRR be developed rather than each one spending in silos. The best way the smaller countries (with less resources) could overcome gaps in capacities and capabilities is through concerted coordination with each other.
- "One SAARC, one response", the underlying theme of the exercise also facilitates sharing of best practices among the member countries to deal with climate related disasters. It also brings best regional practices on the table.
- EQs affect the entire Himalayan belt as these countries lie on active fault zones.

- International nature of almost all Himalayan rivers makes downstream countries vulnerable to actions of upstream countries. Collective understanding of threats such as flash floods, dam breach, etc. can prepare the countries to act swiftly in case of exigencies.
- Cyclones in both the BoB and in Arabian Sea.
- Proximity to active faults in Indian Ocean makes need for collaboration in Tsunami response imperative.

The collective damage by disasters such as Indian Ocean Tsunami (2004), Kashmir EQ (2005), string of cyclones, floods (such as in Kosi) and landslides could have been contained to minimum levels had the rescue, relief and rehabilitation (DRR) been undertaken in a collaborative manner.

Role of India

India's central location ensures that any disaster that affects any country will probably have impact on India too. Besides coordinating the effort, it can play the following role:

- Since it is better resourced in terms of technology and manpower, it can provide access to these to the SAARC countries to deal with disasters. E.g. during Nepal EQ, Indian forces not only provided rescue and relief, but also helped re-establishing communication systems.
- We can help improve their entire disaster response cycle (Prevention, Mitigation, Preparedness, Rescue, Relief, and Rehabilitation) through our own experiences, and also improve up on our own.
- SAARC disaster bonds can be floated in Indian Stock Markets. Insurance companies can collaborate to provide disaster insurance, as is being done in Sri Lanka.
- SAARC satellite, as is being developed, can provide basis for cross-country Geographical information Systems.

- 11. "Rising accidents involving merchant ships leading to oil spills in Indian waters is a growing concern that needs to be addressed." Discuss the impact of oil spills on marine environment. Also, suggest measures to prevent such disasters.**

Approach:

- Briefly explain the given statement citing recent examples and other facts.
- Discuss its impact on marine environment
- Suggest measures to prevent oil spills and turning it into disaster.

Answer:

There has been a considerable increase in shipping through the Indian waters and is expected to increase further by four times by 2020. With the increasing transit, the accidents involving merchant ships have been increasing. The recent examples are oil spills near Sundarbans, collision of merchant ship near Mumbai harbor etc.

Effects of oil spills on marine environment

- Ingestion of oil may impair the ability of animals to digest and absorb foods.
- Absorption of oil through the skin can damage the liver and kidneys, cause anaemia, suppress the immune system, induce reproductive failure, and in extreme cases kill an animal.

- Oil destroys the insulating ability of fur-bearing mammals, such as sea otters, and the water repellence of a bird's feathers, thus exposing these creatures to the harsh elements.
- Inhalation of these harmful materials can cause respiratory inflammation, irritation, emphysema, or pneumonia. Manatees, dolphins, whales, and sea turtles all come to the surface to breathe periodically, and all are susceptible to this risk.
- If a spill causes direct mortality to the food resources of a particular species, many individuals of this species will need to relocate their foraging activities to regions unaffected by the spill. This leads to increased competition for remaining food sources in more localized areas.

Following steps can be taken to prevent oil spills

- The cargo transit during difficult weather conditions such as monsoons should be restricted along with safer ship designs and better systems to provide navigation information to prevent collisions.
- Effective implementation of frameworks like the National Oil Spill Disaster Contingency Plan of 1996 and Merchant Shipping Act, 1958 and international conventions such as International Convention on Civil Liability for Bunker Oil Pollution Damage, 2001.
- The oil spills could be prevented from spreading by using various methods such as burning of oil, spraying chemical dispersants, bio remediation with the help of bacteria such as oil zapper and plants like corchorus depresuss, using activated carbon and bentonite clay.

12. India's commitment to Disaster Risk Reduction (DRR) is evident from the fact that it became one of the first countries to align its National Disaster Management Plan (NDMP) with the Sendai Framework. What are the salient features of India's first National Disaster Management Plan (NDMP)? How can this plan help in effective disaster management?

Approach:

- Briefly mention about the Sendai Framework.
- Salient Features of National Disaster Management Plan
- Identify the strengths and weakness of the Plan

Answer:

NDMP aims to make India disaster resilient and significantly reduce the loss of lives and assets. The plan is based on four priority themes of "Sendai Framework for Disaster Risk Reduction 2015-30" namely:

- Understanding disaster risk.
- Improving disaster risk governance.
- Investing in disaster risk reduction (through structural and non-structural measures) and disaster preparedness.
- Early warning and building back better in the aftermath of a disaster.

Salient Features of NDMP

Vision of the Plan is to "Make India disaster resilient, achieve substantial disaster risk reduction, and significantly decrease the losses of life, livelihoods, and assets – economic, physical, social, cultural and environmental – by maximizing the ability to cope with disasters at all levels of administration as well as among communities."

- It covers all phases of disaster management: prevention, mitigation, response and recovery.
- It provides for horizontal and vertical integration among all agencies and departments of Government.
- It also spells out roles and responsibilities of all levels of Government right up to Panchayat and Urban Local Body level in a matrix format.
- It has a regional approach, which will be beneficial not only for disaster management but also for development planning.

Evaluation of the Plan

- NDMP provides a framework and direction to government agencies for all phases of disaster management cycle.
- It is designed in such a way that it can be implemented in a scalable manner in all phases of disaster management.
- It also identifies major activities such as early warning, information dissemination, medical care, fuel, transportation, search and rescue, evacuation, etc. to serve as a checklist for agencies responding to a disaster.
- It also provides a generalized framework for recovery and offers flexibility to assess a situation and build back better.
- To prepare communities to cope with disasters, it emphasizes on a greater need for Information, Education and Communication activities.
- Globally, the approach towards post-disaster restoration and rehabilitation has shifted to one of betterment reconstruction. NDMP provides a generalized framework for recovery since it is not possible to anticipate all possible alternatives of betterment reconstruction.
- The Plan also highlights that disaster risk reduction will be achieved by mainstreaming the requirements into the developmental plans.
- It incorporates provisions for strengthening disaster risk governance through six themes i.e. integrated and mainstream disaster risk reduction, promoting participatory approach, capacity development, working with elected representatives, grievance redress mechanism and promoting quality standards, certification and awards for disaster risk management.

13. A new disease emerging in any part of the world is a global threat. In the context of “zoonoses” and “emerging infectious diseases”, analyse the risks for India. Also, identify the structures in place and measures required to combat these risks.

Approach:

- Introduce in brief the meaning of emerging infectious diseases (EIDs) and zoonosis.
- Discuss the factors which put India at risk of these EIDs and zoonosis.
- Mention the changes needed in health system and strategy to combat the above problem.

Answer:

In an increasingly interconnected world, emergence and spread of infectious diseases constitute grave health, economic, developmental and security challenges globally. Notably, Emerging Infectious Diseases (EIDs) are diseases of infectious origin whose incidence in humans has increased within the recent past or threatens to increase in the near future. These include new, previously undefined diseases as well as old diseases with new features e.g. Avian influenza, chikungunya, Nipah virus etc.

Over 30 new infectious agents have been detected worldwide in the last three decades; 60 per cent of these are linked to zoonoses i.e capable of being transmitted to humans from animals. In the recent past, India has seen outbreaks of at least eight organisms of emerging and re-emerging diseases in various parts of the country, six of these are of zoonotic origin.

The Indian subcontinent is a ‘hotspot’ for zoonotic, drug-resistant and vector-borne pathogens. India is especially vulnerable because of:

- **High population density:** With 1.34 billion people, 512 million livestock and 729 million poultry, the density and rates of human-animal, animal-animal and human-human contacts are high.
- **Inadequacy of research:** Threats from EIDs are inadequately understood because of poor domestic research and lack of international collaborations due to restrictive policies on sharing clinical and research materials. E.g. There are 460 medical colleges and 46 veterinary colleges in India, but most do little or no research.
- **Coordination issues:** The bureaucratic approach and lack of inter-sectoral coordination leads to fragmented response.
- **Lack of policy focus:** Recently approved National Health Policy has not mentioned “zoonosis” and “emerging infectious diseases”, thus, missing the opportunity to have a comprehensive strategy for it.
- **Anthropogenic changes:** Deforestation brings wildlife into direct contact with humans and domesticated animals, increasing the risk of zoonosis along with changed weather patterns which further escalates the spread of EIDs.
- **Diverse animal population:** For instance, India has an incredibly diverse bat population which harbours 10% of corona viruses. Further, little is known about the viruses in Indian bats and their disease potential.
- **Changing lifestyles,** patterns of behavior etc., for example, improper food handling and preparation in order to save time and for convenience.
- **Lower latitudes:** areas that lie in lower latitudes are at a greater risk of new and emerging EIDs.
- **Poverty and social inequality;** e.g. tuberculosis is primarily a problem in low-income areas.

Structures in Place

- National Apical Advisory Committee for National Disease Surveillance and Response System (NAAC) created in 1996
- National Surveillance Programme on Communicable Diseases (NSPCD) in 1997
- Integrated Disease Surveillance Programme (IDSP) established in 2004, as project, in 101 districts and later expanded to cover all States and districts. It involves Central Surveillance Unit (CSU), State Surveillance Units (SSUs) District Surveillance Units (DSUs) a surveillance unit and peripheral reporting units at block level.
- IT connectivity has been established with all the States, districts and medical colleges through 776 sites for rapid data transfer, video conferencing and distance learning activities.
- Commitment to International Health Regulations (IHR) 2005 of the WHO. This requires all countries to have the ability to detect, assess, report and respond to public health events and disease outbreaks.
- National Vector Borne Disease Control Programme (NVBDCP)
- National Surveillance Programme for Communicable Diseases

- National Centre for Disease Control (NCDC) has initiatives such as Division of Zoonosis dedicated to the control of zoonoses and Epidemic Intelligence Service (EIS)
- Indian Council of Medical Research (ICMR) signed MoU with Indian Council of Agricultural Research (ICAR) for cooperation in the area of zoonoses.
- First SAARC Epidemiology Networking Forum Meeting held primarily to operationalize a sustainable and functioning veterinary epidemiology network.

Structures and Measures required to combat these risks are:

- There is a need to move from being reactive to proactively understanding zoonotic pathogens before they cause human disease.
- Identifying the animal source of infection and intervene to stop further transmission. For example, setting up a district level emergency response team which acts swiftly on such incidents.
- Culture of safe health care practices for timely infection control to stop transmission within hospitals and healthcare facilities. Capacity augmentation in hospitals (medical staff, supplies & equipments) to cope up with epidemics.
- Developing robust early warning, communication & surveillance system at ports, airports etc.
- A strategy should be evolved for the law enforcement/national defence structure as EID etc. promotes regional tension, mistrust and distort productive economic growth.
- An inter-ministerial task force should prepare a policy framework that enables preparedness by strengthening inter-sectoral research on zoonosis and health systems. There needs to be regular collection of data for unusual occurrences and of their origins. Also the National Health Policy should include specific section on how to deal with EIDs.

14. Why are women particularly vulnerable to the impact of natural disasters? Also analyse, with adequate examples, how women can play a more effective role in disaster risk management cycle.

Approach:

- List the reasons for vulnerability of women to natural disasters.
- Also discuss the role women can play in disaster risk management, with suitable examples.

Answer:

India is vulnerable to a number of natural disasters such as earthquakes, floods, cyclones etc. which not only lead to economic loss but also claim precious human lives. In past disasters, more than half of the victims have been women.

Reasons for vulnerability of women to natural disasters

- Lack of access to technical knowledge and information about disaster occurrence in general.
- Less participation of women in the planning, designing, implementing and monitoring emergency programs and rehabilitation projects.
- Less resources under their control, low socio-economic and political status make them more vulnerable.

- Special health needs in terms of sanitation, nutrition or in the case of pregnancy or lactating mothers.
- Post-disaster, they are more vulnerable to depression or post-traumatic stress disorder.
- Culture and beliefs such as traditional taboo of not letting them enter the sea prevents them from learning how to swim.
- Difficulty in applying and qualifying for aid after a disaster because of illiteracy or limited literacy, lack of knowledge on how to apply and navigate bureaucracy.
- Women are mostly employed within the agricultural and informal sectors, which are often the worst affected by disasters.
- Vulnerable to physical and sexual violence especially post disaster.

Generally, women in disasters are looked at only as victims, but their role in risk management and facing the aftermath of disaster should not be neglected. They can play effective role in it, as can be seen from the following instances:

- In 1993, Latur, Maharashtra earthquake where they contributed in repairing and strengthening of damaged houses and in 2001 Bhuj, Gujarat earthquake where the grassroots women's groups from Maharashtra traveled to this neighboring state to share experiences and pledge long-term assistance. Thus, proving their capability when they are skilled and trained through an NGO or other government schemes.
- In 1998 Hurricane Mitch, the second deadliest Atlantic hurricane on record, the only village to register no deaths was given gender-sensitive community education on early warning systems and hazard management which made women take on abandoned task of continuously monitoring the warning system. Thus, helping to evacuate the area promptly when the hurricane struck.
- Securing food, water and fuel are key community concerns especially post disaster, which are predominantly taken care of by women. Thus, including women in disaster risk reduction as well as relief and rescue operations such as management of refugee camps, distribution of food, etc. could prove to be an asset.
- Traditional knowledge and skills of women can be used to manage natural resources, aid the injured and sick, prepare community meals, and nurse displaced infants and children during reconstruction and recovery processes.
- In a country like India, where women are apprehensive of being touched by a male relief worker even in the time of disaster, there is need to include female volunteers.

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