Disaster:

- Dis means bad and aster means star. i.e stars are in bad position
- Negatively affects society and environment

WHO definition

- Any occurrence that causes damage, ecological disruption, loss of human life, deterioration of health and health services, on a scale sufficient to warrant and extraordinary response from outside that affected community or area.

DISASTER MANAGEMENT

Aim:

- **To protect or preserve maximum number of lives during a natural disaster like floods, fires, hurricanes etc.**

Disaster management plans

- **seeks to provide a framework and direction to government agencies for prevention and management of disasters.**
- PM NARENDRA MODI released the 1st DM plan in India on June 1st 2016.

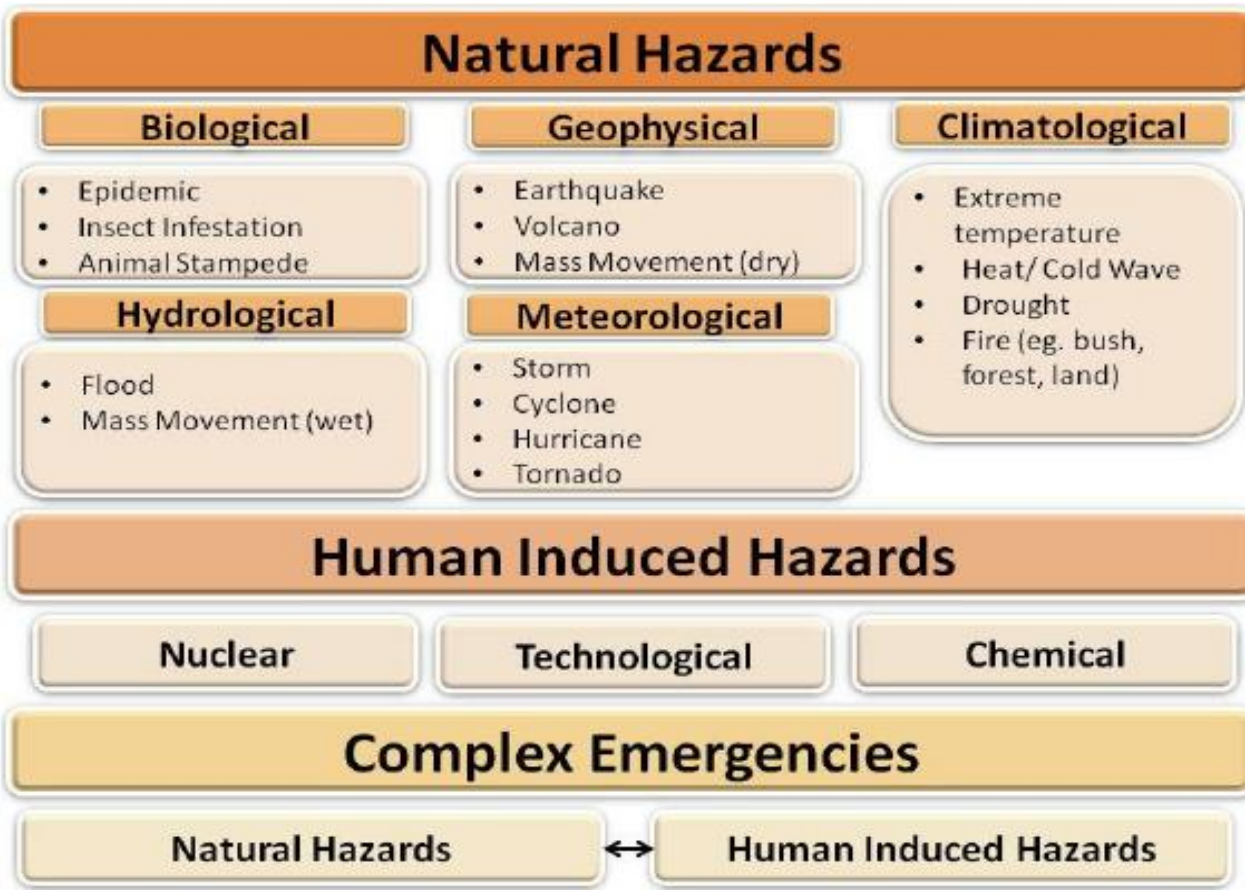
Hazard:

- originated from the word 'hasard' in French and 'az-zahr' in Arabic meaning 'chance' or 'luck' .
- A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage,

loss of livelihoods and services, social and economic disruption, or environmental damage.

-

two broad categories, namely natural and manmade.



Risk

- a measure of expected loses due to a hazard event occurring in a given area over a specific time period.
- The level of risk depends upon the nature of the hazard.
- **Risk = Probability of Hazard x Degree of Vulnerability**

- Total Risk = (Sum of the elements at risk) X (Hazard X Vulnerability)

Vulnerability

- The extent to which a community, infrastructure, services or geographic area is likely to be damaged by the impact of particular hazard or disaster, on account of their nature, construction etc..
- Affected by physical, social, economic, and environmental factors.

Physical vulnerability:

- Includes loss of lives and materials by natural hazard such as earth-quakes or floods.
- based on the physical condition of people and elements at risk, such as buildings, infrastructure etc; and their proximity, location and nature of the hazard.
- In case of an earth-quake or landslide the ground may fail and the houses on the top may topple or slide and affect the settlements at the lower level even if they are designed well for earthquake forces

Economic vulnerability

- is dependent upon the economic status of individuals, communities and nations
- The poor are usually more vulnerable to disasters because they lack the resources to build strong structures
- *Example*: Poorer families may live in squatter settlements

Social vulnerability

- inability of people, organizations and societies to withstand adverse impacts to hazards due to characteristics inherent in social interactions, institutions and systems of cultural values.

Environmental vulnerability

- Natural resource depletion and resource degradation are key aspects of environmental vulnerability
- *Example*: Wetlands, such as the Caroni Swamp, are sensitive to increasing salinity from sea water, and pollution from stormwater runoff containing agricultural chemicals, eroded soils, etc.

RESILIENCE

- ability of individuals, communities, organizations and states to adapt to and recover from hazards, shocks or stresses without compromising long-term prospects for development.
- "Add mid 1 Natural and Manmade disasters"

Disasters

Natural Disaster

- → Tsunami
- → earthquake
- → Volcanic eruption
- → Flood
- → Drought
- → Tornado
- → heat waves
- → Cyclones
- → Typhoon
- → land slide
- → snow avalanche
- → Hail storm
- ~~→ Coldwave & Flog~~

Manmade Disaster

- → Accident
- → Nuclear
- → Industrial
- → oil spill.

*Natural disaster: It is defined as any catastrophic event that caused by natural or the natural processes of the earth.

→ Tsunami:

Tsunamis are giant waves caused by earthquakes, volcanic erruptions or landslide under the sea.

→ Earthquakes

large vibrations that move through rock or other earth material (shear forces).

→ Volcanic eruption:

A volcano is a mountain where lava (hot, liquid rock) comes from under the ground. So hot that it can even melt anything.

→ Flood

A water related disaster refers to overflow of water.

→ Drought: Opposite of flood.
It is defined as a period in which a region has deficit in its water supply whether surface or underground water

→ Tornado: The hot and cold air mix & twist around each other form a tube it is tornado.

→ heat wave: caused due to high atmospheric pressure.

→ Cyclone: It is the storm system fueled by the heat released when moist air rises & the water vapour in it condenses.

→ land slide: A wide range of ground movements such as rock falls deep failure of slopes.

→ snow avalanche rapid movement of snow down a slope.

→ Hail storm Water droplets freeze in to an ice balls.

* Man Made Disasters

Disasters which are caused by human negligence or errors.

→ Accidents Un expected, unplanned occurence of an event which may involve injury which we do see them frequently

→ Nuclear Due to nuclear reactor which causes huge damage for future.

→ Industrial Causing huge pollution

→ Oil spill huge pollution & wastage of natural resources

Review of past disasters in India

Kashmir Floods:

- Year: 2014
- Areas affected: Srinagar, Bandipur, Rajouri etc.
- Death toll: 500 plus

Uttarakhand Flash Floods

- Year 2013
- Areas affected: Gobindghat, Kedar Dome, Rudraprayag district, Uttarakhand, Himachal Pradesh, Western Nepal
- Death Toll: 5000 plus

The Indian ocean tsunami

- Year: 2004
- Areas affected: Parts of southern India and Andaman Nicobar Islands, Sri Lanka, Indonesia etc.
- Death toll: 2 lakh plus

Gujarat earthquake

- Year 2001
- Areas affected: Bhuj, Ahmedabad, Gandhinagar, Kutch, Surat, Surendranagar district, Rajkot district, Jamnagar and Jodia
- Death toll – 20,000 plus

Odisha super cyclone

- Year 1999

- Areas affected: The coastal districts of Bhadrak, Kendrapara, Balasore, Jagatsinghpur, Puri, Ganjam etc.
- Death toll: 10,000 plus

Latur Earthquake

- Year: 1993
- Areas affected: Districts of Latur and Osmanabad
- Death toll: 20,000 plus

The great famine

- Year: 1876-1878
- Areas affected: Madras, Mysore, Hyderabad, and Bombay
- Death toll: 3 crore

Coringa cyclone

- Year: 1839
- Areas affected: Coringa district
- Death toll: 3.2 lakh people

Calcutta cyclone:

- Year - 1737
- Areas affected: Low-lying areas of Calcutta
- Death toll: 3 lakh plus

Bengal Famine

- Year 1770, 1943
- Areas affected: Bengal, Odhisa, Bihar
- Death toll: 1 crore

“about DROUGHTS we have already written in EVS”

→ lowering of water table is due to mining, rapid industrialization etc..,

Water logging :-

Water logging refers to the the saturation of soil with water.

✱Floods :-

→ Floods are water related Disaster
→ It refers to the overflow of water.

→ Due to heavy rainfall
→ Heavy Snow-melting
→ Due to tsunami, storms, cyclones etc..,

→ Due to Deforestation
→ Breakage of Dams.

causes of floods :-

→ Heavy rainfall
→ Breakage of dams
→ Excess water dvd's.

→ Human loss
→ Property loss
→ Communication Breakdown.
→ electricity supply cut off.
→ Increase in air/water pollution.

Steps taken to prevent floods:

→ Afforestation.
→ Construction of dams in a proper way.
→ Introduce better flood warning systems.
→ Construct building above flood level
→ Introduce water storage areas.
→ Put up more flood barriers.

☆ Drought: → Opposite of floods.

It is defined as a period in which a region has deficit in its water supply whether surface or underground water.

Causes of Drought :-

- → high temperature
- → rate of evaporation is more
- → Due to deforestation.

Types of Drought :-

i) Agricultural Drought :- This type of drought occurs when the soil moisture is not sufficient to support the production of crop

ii) Hydrological Drought :- This type of drought occurs when the water levels in lakes & reservoirs fall below the average level.

Anthropogenic factors :-

- → Deforestation
- → Usage of non-decomposable materials
- → Greenhous effect
- → Global warming.
- → Useage of fertilizers.

To prevent Drought :-

→ Afforestation
→ Try root irrigation
→ Irriage slowly (min amount)
→ Build water storage plant reservors & dams.
→ Follow watershead management.

✱ Dams :-

A solid barrier constructed at a suitable location across a river valley to store flowing water.

These dams serve two major function

i) To store water to compensate for the fluctuation in the discharge by rivers.

ii)
→ Generate electricity
→ Supply water to irrigation, industrial & household activities
→ Control flood water
→ For fishing, swimming, boating etc..,

IMPACTS OF DROUGHTS

ECONOMIC IMPACTS:

□ The economic impacts of drought on a community can mount up after just one season of drought. Farms may lose value due to crop failures and an inability to feed and water livestock during drought.

□ Agriculture–dependent businesses conduct less business

□ Tourists may be reluctant to visit drought-effected areas, reducing another source of community income

ENVIRONMENTAL IMPACT

- It can degrade the habitation of a region

□ Rivers and lakes drop to low levels and turbidity and salinity increases, affecting fish habitat

□ Animals have less water to drink and migrate to wetter areas or to places of water concentration

□ The potential for catastrophic wildfires increases

SOCIAL IMPACTS

□ It affects human health, both physically and emotionally, in both rural and urban areas

□ People loss their peace of mind if they are not certain they'll have enough water

They may also change their habits in response to animals that come into communities in search of food and water, or to the increased risk of fire caused by dry landscaping around their homes.

“Any thing else its just about droughts so we can write in our own words”

DROUGHT

There are mainly three types of droughts reported, namely

- Hydrological drought
- Agricultural drought
- Metrological drought

Hydrological drought

- the condition when precipitation is low than the usual rainfall for prolonged period.
- A marked depletion of surface water causing very low stream flow and drying of lakes, rivers and reservoirs

Metrological drought

- This happens when the actual rainfall in an area is significantly less than the climatological mean of that area.

Agricultural drought:

- due to inadequate rainfall, soil moisture falls to short to meet the water demands of the crop during growth.

Earthquake

Characteristics

• Usually no warning.

However, following a major earthquake, secondary shocks may warn of a further earthquake.

• Speed of onset usually sudden.

• Major effects (see also paragraph 4) is due to

- land movement, fracture,
- or slippage;

result;

- damage (usually very severe) to structures and systems and considerable casualties due to lack of warning.

General countermeasures

- Developing possible warning indicators,
- Land-use regulations,

- Building regulations,
- Relocating communities, and
- Public awareness and education programs.

Special problem areas for disaster management

- Severe and extensive damage,
- creating the need for urgent countermeasures
- Difficulty of access and movement;
- Widespread loss of or damage to infrastructure, essential services, and life-support systems;
- Recovery requirements e.g., restoration and rebuilding) may be very extensive and costly; and
- Rarity of occurrence in some areas may cause problems for economies of countermeasures and public awareness.

Volcanic Eruption

Characteristics

- Volcanic blast can destroy structures and environmental surrounds
- Lava flow can bury buildings and crops. It may also cause fires and render land unusable.
- Ash, in its airborne form, can affect aircraft by ingestion into engines.
- Ash may also cause respiratory problems.

General countermeasures

- Land-use regulations,
- Lava control systems,

- Developing a monitoring and warning system,
- Relocating the population

Special problems areas for disaster management

- Access during eruption.
- Timely and accurate evacuation decision(s).
- Public apathy, especially if there is a history of false alarms or small eruptions
- Control of incoming sightseers

Tsunami (Seismic Sea Wave)

Characteristics

- The velocity of the wave depends on the depth of water where the seismic disturbance occurs.
- Warning time depends on the distance from the point of wave origin.
- Speed of onset varies .

Effect

- flooding;
- saltwater contamination of crops, soil, and water supplies;
- destruction of or damage to buildings, structures, and shoreline vegetation.

General countermeasures

- Optimum arrangements for receipt and dissemination of warning;
- Evacuating threatened communities from sea level/low-level areas to high ground

- Land-use regulations
- Public awareness and education programs.

Special problem areas for disaster management

- Timely dissemination of warning
- Effective evacuation time-scale;
- Search and rescue; and
- Recovery problem may be extensive and costly because of severe destruction and damage.

Tropical Cyclone (Typhoon, Hurricane)

Characteristics

- Usually long warning, derived from systematic international meteorological observation
- Speed of onset gradual;
- Tends to conform to seasonal pattern;

• Major effects

- Destruction and/or severe damage to buildings and other structures, roads, essential services, crops, and the environment generally. Major loss of life and livestock may occur.

General countermeasures

- Effective warning arrangements;

- Precautionary measures during warning period
- Moving people to safe shelters;
- General readiness and cleanup measures prior to an expected cyclone season
- Building regulations, and
- Public education and awareness.

Special problem areas for disaster management

- Assessing effects and needs may be difficult
- Widespread destruction or loss of counter-disaster resources
- Difficulty of access and movement in carrying out urgent relief operations
- Search and rescue;
- Widespread destruction/disruption of essential services;
- Evacuating; and
- Rehabilitating agriculture, especially tree crops.

Flood

Characteristics

- Long, short, or no warning, depending on the type of flood
- Speed of onset may be gradual or sudden;
- There may be seasonal patterns to flooding; and
- Major effects arise mainly from inundation and erosion;

Effect;

- isolation of communities or areas, and involve the need for large-scale evacuation.

General countermeasures

- Flood control (e.g., by walls, gates, dams, dikes, and levees);
- Land-use regulations;
- Building regulations;
- Forecasting, monitoring, and warning system(s);
- Relocating population;
- Planning and arranging evacuation;
- Emergency equipment, facilities, and materials
- Public awareness and education programs.

Special problem areas for disaster management

- Difficulties of access and movement;
- Rescue;
- Medical and health difficulties (e.g., arising from sanitation problems);
- Evacuating;
- Loss of relief supplies; and
- Large-scale relief may be required until next crop harvest.

Landslide

Characteristics

- Warning period may vary. Little or no warning may be available if the cause is an earthquake.
- Speed of onset is mostly rapid.
- Damage to structures and systems can be severe
- Rivers may be blocked, causing flooding.
- Crops may be affected
- When landslides are combined with very heavy rain and flooding, the movement of debris (e.g., remains of buildings, uprooted trees) may cause high levels of damage and destruction.

General countermeasures

- Land-use and building regulations;
- Monitoring systems, where applicable;
- Evacuating and/or relocating communities
- Public awareness programs.

Special problem areas for disaster management

- Difficulties of access and movement in affected areas;
- Search and rescue;

Risk of follow-up landslides may hamper response operations;

- Relocation
- Rehabilitation and recovery may be complex and costly; and

Bushfire (or Wildfire)

Characteristics

- Bushfire threat tends to be seasonal.
- Speed of onset may vary
- fragments of fire from a main front may be carried forward by the wind, starting new fires further ahead. This is sometimes known as “spotting.”
- Effects can be very destructive, especially in loss of buildings, timber, and livestock
- Recovery from effects on the environment may take several years.

General countermeasures

- Accurate risk assessment;
- Effective monitoring and warning systems, including remote sensing to define “curing” or dryingout of vegetation;
- Fire prevention regulations;
- Seasonal mitigation measures
- Building regulations; and
- Public awareness and education programs,

Special problem areas for disaster management

- Maintaining adequate community awareness and preparedness;
- Establishing and maintaining adequate fire-fighting resources
- Establishing an adequate warning system,
- Timely dissemination of warning and, if applicable, decision to evacuate;
- Long-term recovery may be prolonged

- Evacuation movements, either out of affected areas or to safe havens within such areas.

15. ***Epidemic***

Characteristics

- Disaster-related epidemic arises generally from the disrupted living conditions
- Epidemic may arise from: food sources; water sources; inadequate medical and health facilities/standards; malnutrition; and vector-borne sources (e.g., mosquitoes).
- Types of disease include:
    - hepatitis,
    - typhoid,
    - diptheria,
    - malaria,
    - cholera,
    - influenza,
    - enteritis,
    - diarrhea,
    - skin diseases, and food poisoning.
- Warning (i.e., risk) is self-evident in most post-impact circumstances.
- Speed of onset is mostly rapid.

General countermeasures

- An effective medical and health sub-plan

- Close post-disaster monitoring of medical and health aspects;
- Reinforcement of medical resources and supplies in anticipation of epidemic outbreak; and
- Public awareness and education, both before and after disaster impact.

Special problem areas for disaster management

- Loss of medical and health resources
- In-country shortage of special equipment (e.g., water purifying plant).
- Integrating outside (international) medical and health assistance with local systems
- Containing and controlling common diseases (e.g., enteritis and diarrhea

16. ***Major Accident***

Characteristics

- Usually violent in nature
- Can have limited or widespread effect
  - Mostly limited or no warning,
- Speed of onset usually rapid.

General countermeasures

- Good physical planning
- Special building regulations, if applicable;
- Good in-house safety and management standards/procedures
- Effective organizational emergency services (e.g., fire services and rescue teams)
- Effective community or area disaster plans

- Training in handling the effects of specific hazards.

Special problem areas for disaster management

- problems of reaction and response time;
- Response problems may be severe, extensive, and difficult
- Identifying victim may be difficult in some cases.

Civil Unrest

Characteristics

- Usually the responsibility of police, paramilitary, and armed forces.
- Violent and disruptive activities occur
- difficult to predict
- Eg: strikes, bombings

General countermeasures

- Firmly applying law and order regulations and requirements;
- Imposing special emergency measures and regulations
- Positive information programs aimed at maintaining majority public support for government action against disruptive elements/factions.

Special problem areas for disaster management

- Overloading of resource organizations
- Difficulty of integrating “peacetime” resource organizations (noncombatant in nature) with “military type” operations

Heat waves:

- Prolonged period of excessive heat with humidity

- Develops slowly and kills and injure more animal and people
- Silent disaster

Effects:

- Heat stress
- Sunstroke
- Severe dehydration with vomiting and high fever

- More severe in may and June in india

Causes:

- Higher atmospheric pressure, air from upper levels of atmosphere descends and rotates and compresses. Thus raising the temperature
- Occurs in elderly, babies < 4yrs, outdoor workers, pregnant women, infants

Heat stress on livestock:

- Animals change their behaviour

Effect of heat waves on Agriculture and crop

- No precipitation
- Dryness or drought
- Enormous damage, crop failure and harvest loss

Psychological and sociological effects due to heat waves:

- power outages
- Wildfire
- Physical damage – roads, water lines burst

Heat disorders

- Sun burn → skin redness and pain, fever, headache.
  Take a shower using soap as first aid
- Heat cramps in legs and abdominal muscles
  Gentle massage is done as first aid
- Heat exhaustion – heavy seating, weakness, skin cold pale, weak pulse, fatigue, vomiting
- Heat stroke – high body temperature, hot dry skin

Cold waves:

- Influx of unusually cold air into middle or lower latitudes

Formation of cold waves

- When cold air masses transport only little moisture.
- Precipitation occurs as snow or sleet
- Cold waves accompanied by strong wind is called as winter storm

Effect on person and economic activity

- Hypothermia and frostbite
- Injury and death to livestock and wild life

- Mandates greater calorie intake
- Causes famines, droughts, forest fires
- Water supply may become unreliable
- People can stock up on food, water

Effect of cold wave on other sectors

- Demand for electrical power and fuels rises dramatically
- Some metals may become brittle at low temperature
- Antifreeze

Coal weather injuries

- Non freezing – hypothermia, chilblains, trench/ Immersion foot
- Freezing – frost nip, frost bite

Frost bite

- True freezing of tissues
- Painess, blanching of skin
- Treatment is rewarming

Snow blindness

- Light reflection of snow causes red, itchy eyes
- Treatment: rest eyes or bandage

Dehydration

- Loss of body moisture, dry air causes dry lips and moutch, fatigue
- Treatment – drink frequently

Hypothermia

- Less than 40 F causes shivering, slow speech

Chilblain

- Repeated, chronic exposure of bare skin appear as swollen, tender papules
- Treatment – passive warming at room temperature

Trench foot/ immersion foot

- Prolonged contact with moisture causes swelling, tingling and itching

Cold weather injury prevention tips

- Keep clothing clean
- Avoid overheating
- Wear clothing in layers

Unit – 3 Approaches to disaster risk reduction

Disaster management cycle

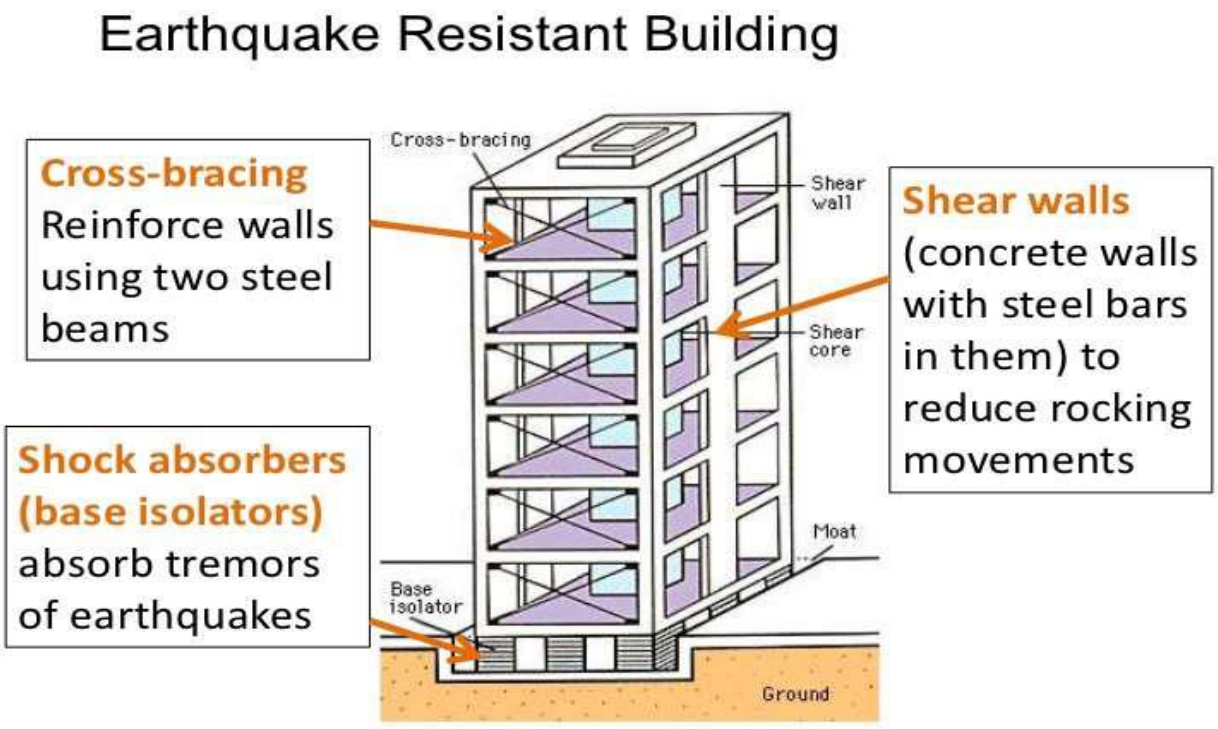
- Mitigation
  - Measures put in place to minimize the results from a disaster
  - Eg: public education
- Preparedness
  - Planning how to respond
  - Eg: emergency exercises or training
- Response
  - Initial actions taken

- To minimize the hazards created by a disaster
- Eg: evacuation, emergency relief

- Recovery
  - Returning the community to normal
  - Eg: temporary housing

Disaster mitigation

- Structural mitigation
  - Construction projects which reduce economic and social impacts i.e dams
- Non structural mitigation
  - Policies and practices which raise awareness of hazards or encourage developments



Mitigation includes

- Reviewing building codes
- Vulnerability analysis updates
- Zoning and land use management and planning
- Reviewing of building use regulations and safety codes
- Implementing preventative heath measures
- Political intervention and commitment
- Public awareness

Disaster mitigation and infrastructure

- Investment in infrasturture for reconstruction and sustainable socioeconomic development
- Back up generator for power and backup copy for critical information
- Strengthening vulnerable areas like roofs, exterior doors, windows

Disaster and development

- Destroy development initiatives
- Development programmes designed to decrease susceptibility to disasters

Development initiatives countries faced with disaster

- Partnership – close collaboration among donors, governments
- Flexibility – development agencies must be efficient and flexible, adaptable to local environment
- Selectivity – resources are the public asset

Unit 5

Disease mitigation and management:

History of disasters during last 3 decades

- 431 disasters in india in last 30 years

Vulnerability profile of india:

- India is highly vulnerable to floods, droughts, cyclones, earthquakes, landslides, avalanches and forest fires due to its unique geo-climatic and socio-economic econditions
- 58.6% landmass is prone to earthquake, 12% landmass to floods and river erosions, 68% to drought and hilly areas to landslides

Human induced factors responsible for increased disasters:

- Demographic pressure
- Deteriorating environmental conditions
- Deforestation
- Unscientific development
- Faulty agricultural practices and grazing
- Unplanned urbanization

Disaster Type	**Damage caused**
Floods	32%
Tropical Cyclones	30%

Droughts	22%
Earthquakes	10%
Other disasters	6%

Disaster management: = 4 phases

- Mitigation
- Preparedness
- Response
- Recovery

1. Mitigation
   - To prevent hazards from developing into disasters
   - Structural measures – technological solutions like flood leaves, earthquake resistant structures
   - Non structural measures – legislation, land use planning and insurance
   - Also includes providing mandatory evacuations, communication of potential risks to public
   - Hazard specific risk (R_h) is calculated by

     $$R_h = H \times V_h$$

     Where H is Hazard and V is Vulnerability
2. Preparedness:
   - Include
     - Communication plans
     - Proper maintenance and training of emergency services

        - Development and exercise of emergency population warning methods
        - Stockpiling, inventory and maintain disaster supplies
        - Develop organizations of trained volunteers
        - Casualty prediction
    - Done to ensure effective coordination, enhancement of capabilities to prevent, protect against, respond to, recover from and mitigate effects of disasters
3. Response:
    - Includes mobilization of necessary emergency services
    - Services include
        - Fire fighters
        - Police
        - Ambulance
        - Disaster relief operation (military)
        - Special rescue teans
4. Recovery:
    - Aim = to restore affected area to its previous state
    - Involves rebuilding destroyed property, re-employment and repair of essential infrastructure

Disaster mitigation and management:

Institutional arrangements:

Evolution of disaster management in India:

- Changed from activity based reactive setup to institutionalized structure
- Changed from single faculty domain to multi stakeholder setup
- Changed from a relief based approach to multi – dimensional pro-active holistic approach for reducing risk

Disaster management during British administration and post independence:

- Relief department set up for emergencies
- Relief oriented activities includes designing relief codes, initializing food for work programmes
- Post independence
  - Management of disasters is by relief commissioners in each state under central relief commissioner

Emergence of institutional arrangement in india:

- Disaster management cell under the ministry of agriculture was set up in decade of 1990.
- 1990 decade was declared as international decade for natural disaster reduction by UN general assembly
- A committee under chairmanship of Mr. J.C.Pant, secretary of ministry of agriculture was constituted for drawing up a holistic approach to disasters
- The disaster management division was shifted under the Ministry of Home Affairs in 2002 vide Cabinet Secretariat's Notification No. DOC.CD-108/2002 dated 27/02/2002

Organisation and structure of disaster management:

- Disaster management division is headed by = Joint secretary
  - Three directors

- Under secretaries
- Section officers
- Technical officers
- Senior economic investigator
- Consultant
- Supporting staff

Disaster Management Act 2005

Vision

- To build a safe and disaster resilient India by developing a holistic strategy through a prevention, mitigation, preparedness and efficient response

Strategy:

- Pre disaster phase:
  - Prevention
  - Mitigation
  - Preparedness
  - Capacity building
  - Community based disaster management
- Post disaster phase
  - Prompt and efficient response
  - Reconstruction and recovery

Approach:

- Paradigm shift from response centric to a holistic and integrated approach
- Backed by institutional frame work
- Supported by financial mechanism

Disaster management structure

- NMDA is apex body with honorable PM as chairperson
- Disaster management structure = at 3 levels = national, state, district
- National executive committee = secretaries of 14 ministries and chief of integrated defence staff function as Executive committee of NDMA

Changing approach to disaster management:

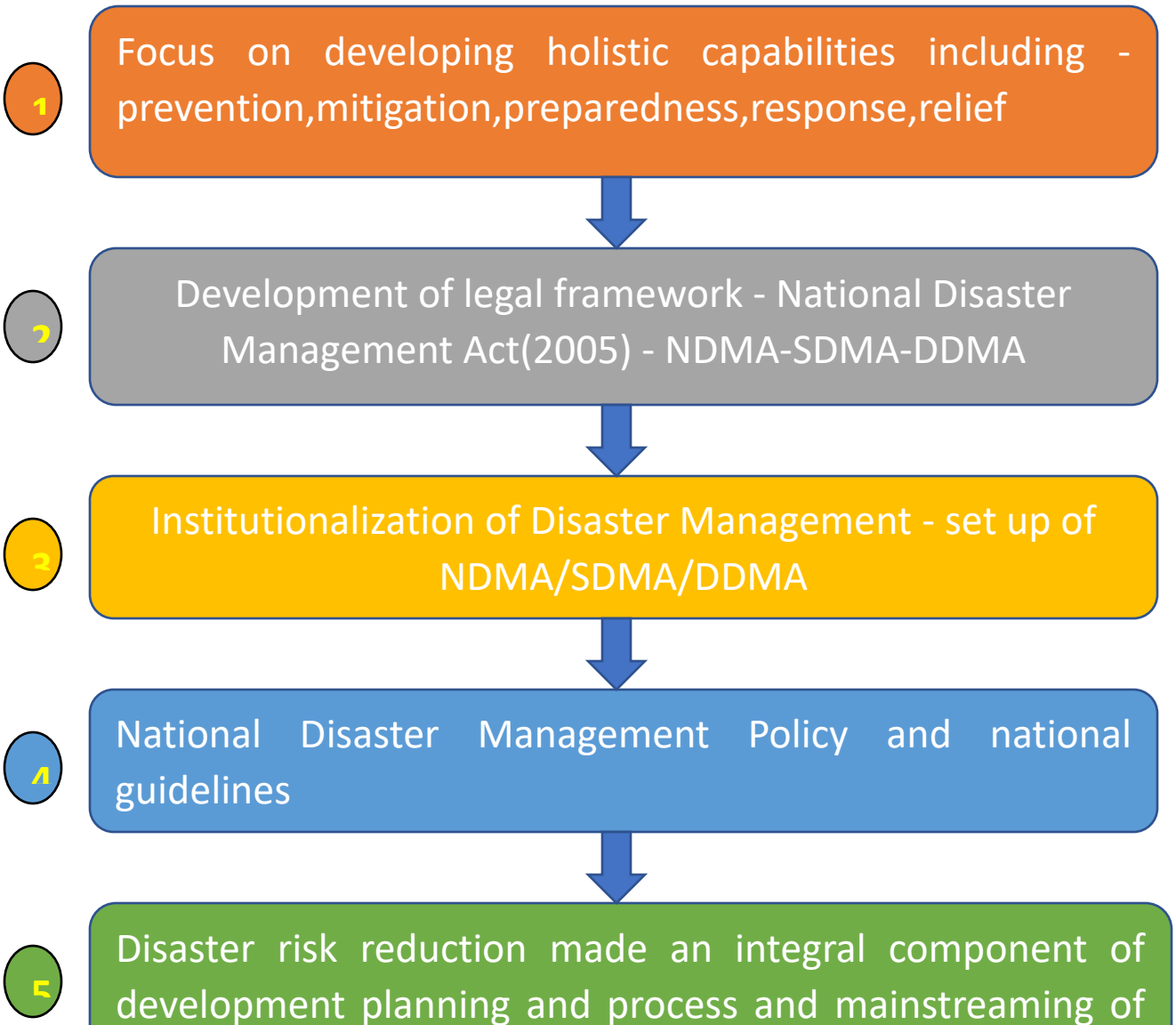
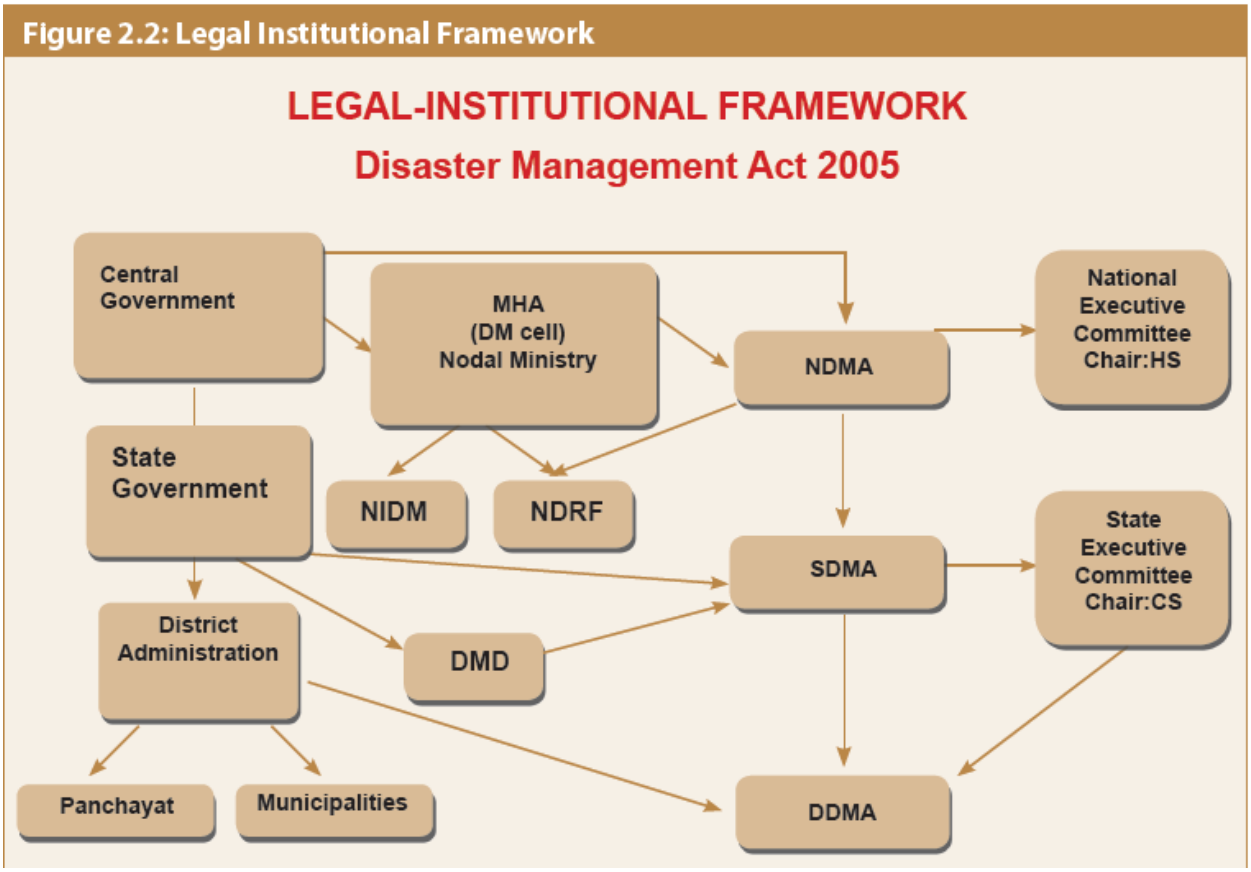
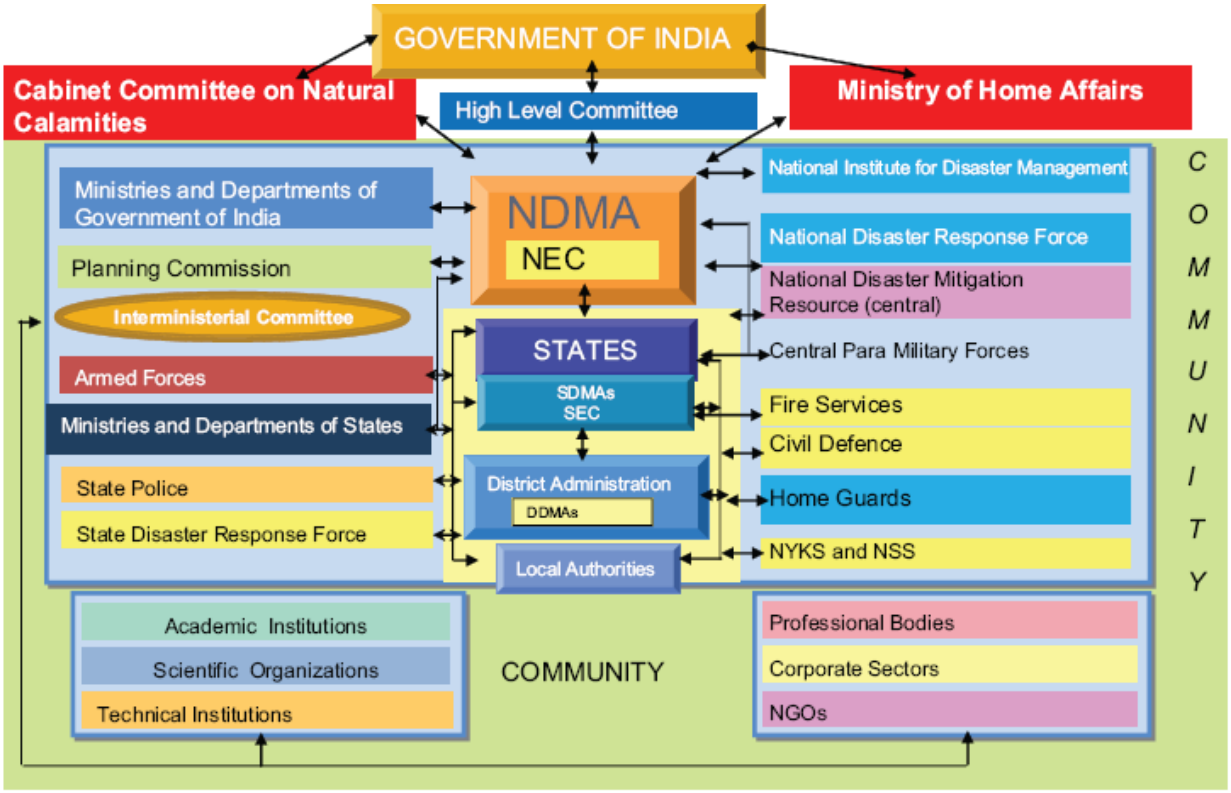


Figure 2.2: Legal Institutional Framework



Disaster management framework:



National level institutions:

- National disaster management authority
- National executive committee
- National institute of disaster management
- National disaster response force
- National civil defence college
- National fire service college

National disaster management authority:

- Constituted with section 3(1) of act on 27th September 2006
- Prime minister = chair person

- Responsibilities:
  - Lay down policies on disaster management
  - Approve national plan
  - Approve plans prepared by ministries or department of government of India
  - Co-ordinate enforcement and implementation of policy and plan for disaster management
  - Provide support to other countries
  - Take measures for the prevention of disaster, mitigation or preparedness
  - Recommend provision of funds for purpose of mitigation

Composition of NDMA

- 9 members nominated by prime minister
- One secretary
- 5 joint secretaries including 1 financial advisor
- 10 posts of joint advisors and directors
- 14 assistant advisors
- Under secretaries
- Assistant financial advisor
- Duty officer along with supporting staff

National executive committee

- Formed under section 8 of Disaster management act 2005
  To assist national authority in performance of its functions
- Chair person= home secretary
- Secretaries to government have administrative control of agriculture, atomic energy, defence, drinking water supply, environment and forest, finance, health, power

State level institutions:

1. State disaster management authority
   - Present in all states as per Disaster management act 2005
2. State Executive Committee
   - Section 20 of disaster management
   - Head = chief secretary of state government

District Disaster Management Authority

- Section 25 under disaster management
- District magistrate/ district collector/ deputy commissioner = chairperson
- Chairperson of zila perishad = co- chairperson
- Other members
  - CEO of district authority
  - Superintendent of police
  - Chief medical officer of district
  - Two district level officers

National institute of Disaster management:

- National centre of disaster management is established at Indian Institute for Public Administration in 1995
- It was upgraded as national institute of disaster management on 2003
- Section 42 of disaster management act 2005 provides following responsibilities
  - Developing training modules
  - Undertake research and documentation in disaster management
  - Organize training programmes
  - Undertake and organize study courses, conferences
- Government constituted a 14 member governing body in 2007

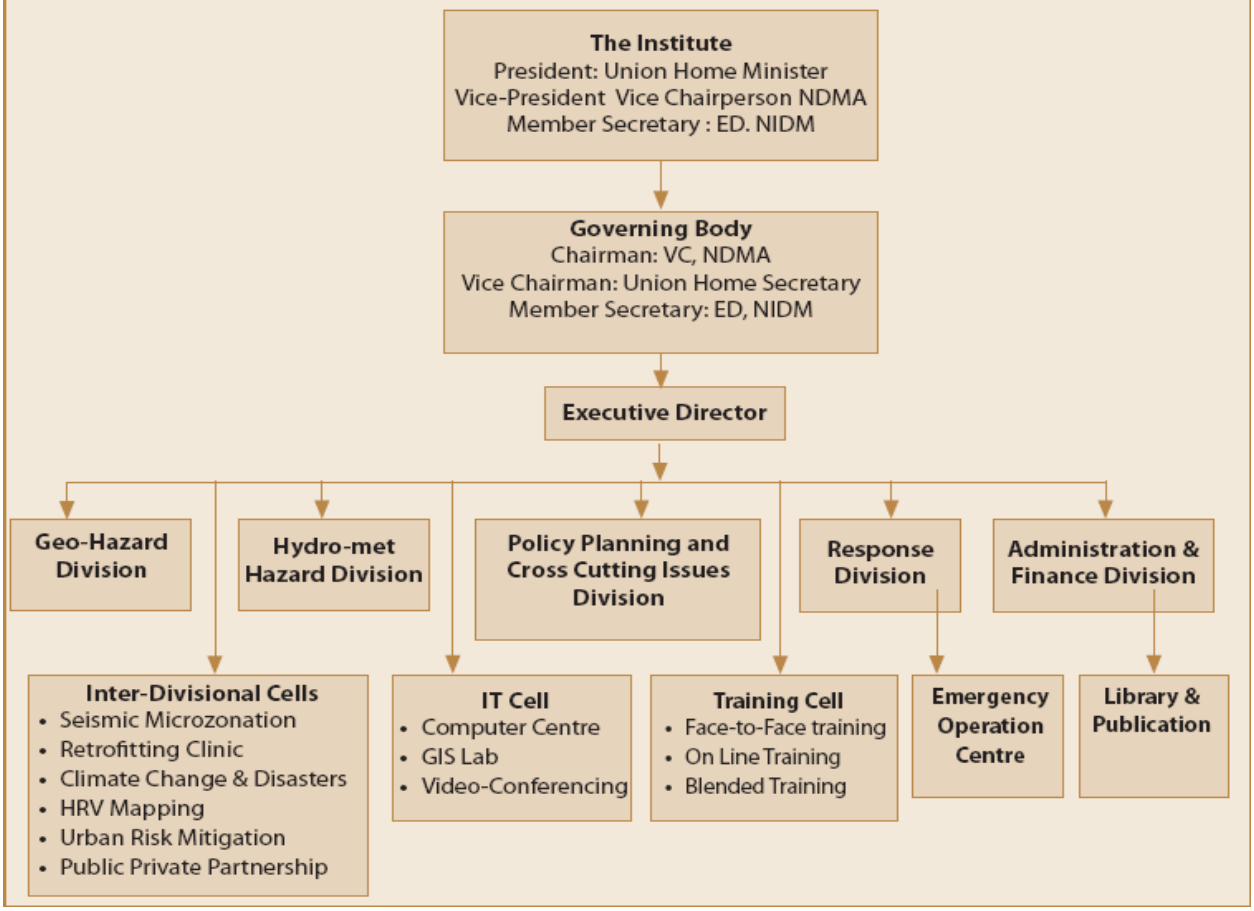
Figure 2.4: Governing Body of National Institute of Disaster Management

In terms of Section 42(4) of the Disaster Management Act, 2005 read with Rule 6 of the Disaster Management (National Institute of Disaster Management) Rules, 2006, Governing Body of the NIDM has been constituted vide Order No. 45/1/2007-NDM-IV dated 3rd May, 2007 with following members:-

i.	The Vice-Chairperson, National Disaster Management Authority (NDMA)	Chairperson
ii	Union Home Secretary	Vice-Chairperson
iii	Secretary (BM)	Member
iv	Secretary, Ministry of Finance, Department. of Expenditure	Member
v	Secretary/ Additional Secretary, NDMA	Member
vi	Additional Secretary and Financial Advisor, Ministry of Home Affairs	Member
vii	Secretary(Disaster Management), Government of Gujarat	Member
viii	Vice-Chancellor, Guru Gobind Singh Indraprastha University, Delhi	Member
ix	Director, Indian Institute of Technology, Roorkee	Member
x	Director, Indian Institute of Management, Kolkatta	Member
xi	Director, National Eco-physical Research Institute, Hyderabad	Member
xii	Secretary, Department of Space	Member
xiii	Secretary, Department of Science and Technology	Member
xiv	Executive Director, NIDM	Member Secretary

Organizational structure

Figure 2.5: Organisational Structure of NIDM



सत्यमेव जयते

NATIONAL INSTITUTE OF DISASTER MANAGEMENT

(MINISTRY OF HOME AFFAIRS, GOVERNMENT OF INDIA)

nidm
Towards a disaster free India.....

हिन्दी में

Forthcoming Events

09-13 March 2015
Training Programme on "Geo-Informa... Application in Disaster Management" IIPA

16-18 March 2015
Training Programme on "Management of Large Congregations (Stampede) Risk Reduction" at HCMRIPA, Jaipur

16-20 March 2015
Training Programme on "Gender & Disaster Management" at NIDM

18-20 March 2015
Training Programme on "Databases for Disaster Management w.r.t. climate-change and DRR" at ISI, Kolkata

More...

Recent Activities

- Consultative Workshop on Modules Developed under the study "Preparing Long Term Training and Capacity Building Strategy for Disaster Risk Reduction in India", under NCRMP & IRS at Gandhinagar, Gujarat, 12-13 Februray 2015

More...

Photo Gallery

...anagement in India : National Level

...p or select from Andhra Pradesh Go

Forthcoming Online Course
Comprehensive Disaster Risk Management Framework
16th Apr to 24th May 2015

Important Links

- National Portal of India
- National Disaster Management in India
- National Platform for Disaster Risk Reduction
- EAS-INDIA Workshop-2012
- National Disaster Management Authority
- National Disaster Response Force

More...

Videos

NIDM Documentary

More...

National Disaster Response Force:

- Under section 44 of Disaster management act 2005
- 2 battalions each from
  - Border security force
  - Indian Tibetan border police
  - Central industrial security force
  - Central reserve police force
- 8 battalions of NDRF has 144 specialized teams

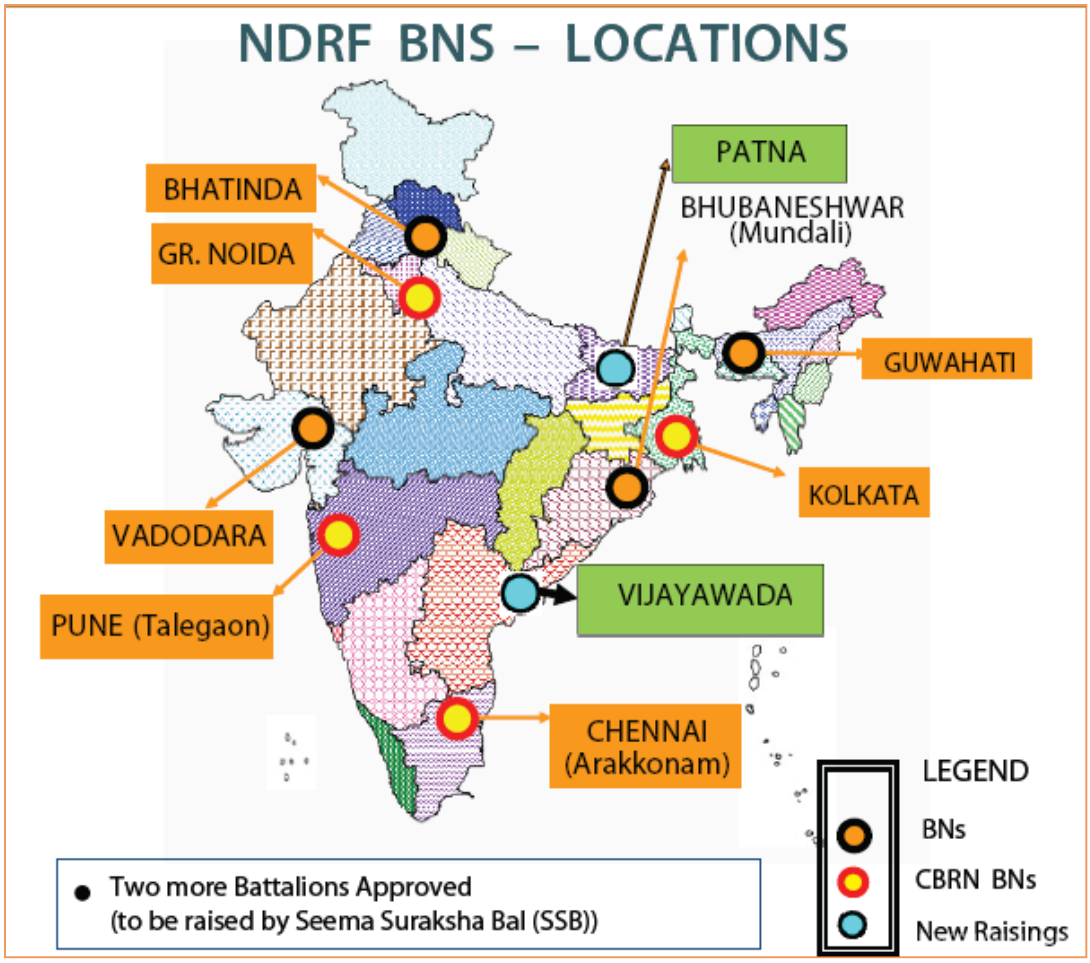
- 72 teams designed to cater to chemical, biological, radiological and nuclear calamities
- Has 1149 personnel

Task and role of NDRF

- NBC disaster = decontamination of area and personnel
- Removal of debris
- Extrication of victims = live or dead
- First medical response to victims
- Extend moral support to victims
- Assistance to civil authorities in distribution of relief material
- Coordination with sister agencies
- Providing assistance to foreign countries

Other activities of NDRF

- Conducting familarization exercise
- To conduct mock exercises in coordination with other stake holders
- To conduct community awareness program
- To organize demonstrations and exhibitons
- To undergo different kinds of training
- To train state disaster response force, community and NGO in disaster management



State disaster response force

- Advised to set up their own specialist response force
- State government advised 10% of state disaster response fund and capacity building grant

Civil defence:

- Civil defence act in 1968
- Act was amended in 2010
- To utilize services of civil defence volunteers to enhance public participation in disaster management related activities

Role of Civil defence

- Guards the hinterland
- Supports armed forces
- Mobilize citizens
- Helps civil administration in saving life and property
- Minimize damage
- Maintain continuity in production centers
- Raising public morale
- Protects public against nuclear weapons, biological and chemical warfare

3 tier structure is formulated

- Civil Defence Advisory Committee under the Chairmanship of Union Home Minister,
- Civil Defence Committee under the Chairmanship of Home Secretary
- Civil Defence Joint Planning Staff Committee under the Chairmanship of Director General Civil Defence.

Eligibility to become volunteers

- A person to apply for appointment to a civil defence corps must fulfil following
  - Citizen of india or Bhutan or Nepal
  - Completed Age 18 yrs
  - Passed at least primary standard
  - Physically fit and mentally alert
  - Any service in national volunteer force and in armed forces of union
  - Serve in voluntary and honorary capacity

Directorate General of Civil defence

- IPS officer = heads the organization
- Has dual charge of Directtorate general national disaster response force and civil defence

Components of disaster relief = includes water, food and hygiene

Before a disaster or emergency

UNIT V - components of disaster relief

- Includes water, food, hygiene

Before a Disaster or Emergency

Food and Water Needs: Preparing for a Disaster or Emergency

Prepare an Emergency Food Supply

A disaster can easily disrupt the food suppl, so plan to have at least a 3-day supply of food.

Keep foods that:

- Have a long storage life
- Require little or no cooking, water, or refrigeration
- Meet the needs of babies or other family members who are on special diets
- Are not very salty or spicy,

How to Store Emergency Food

- Check the expiration dates on canned foods and dry mixes.

- Use and replace food before its expiration date.

The ideal location is a cool, dry, dark place. The best temperature is 40° to 70°F.

- Store foods away from ranges or refrigerator exhausts..
- Store food away from petroleum products, such as gasoline, oil.
- Protect food from rodents and insects.
- Items stored in boxes or in paper cartons

Preparing Food

Preparing food may be difficult due to damage to your home and loss of electricity, gas, and water.

Cooking utensils

- Knives, forks, and spoons
- Paper plates, cups, and towels
- A manual can- and bottle-opener
- Heavy-duty aluminum foil
- Propane gas or charcoal grill; camp stove
- Fuel for cooking, such as charcoal

Prepare an Emergency Water Supply

- Store at least 1 gallon of water per day for each person and each pet.
- Store at least a 3-day supply of water for each person and each pet. Try to store a 2-week supply if possible.

- Observe the expiration date for store-bought water; replace other stored water every 6 months.
- Store a bottle of unscented liquid household chlorine bleach to disinfect your water and to use for general cleaning and sanitizing.

Water Containers (Cleaning and Storage)

Unopened commercially bottled water is the safest and most reliable emergency water supply.

Use of food-grade water storage containers, is recommended if you prepare stored water.

Before filling with safe water, use these steps to clean and sanitize storage containers:

- Wash the storage container with dishwashing soap and water and rinse completely.
- Sanitize the container by adding a solution made by mixing 1 teaspoon of unscented liquid household chlorine bleach.
- Cover the container and shake it well.
- Wait at least 30 seconds and then pour the sanitizing solution out of the container.
- Let the empty sanitized container air-dry before use.

Avoid using the following containers to store safe water:

- Containers that cannot be sealed tightly
- Containers that can break, such as glass bottles

- Containers that have ever held toxic solid or liquid chemicals, such as bleach or pesticides
- Plastic or cardboard bottles, jugs, and containers used for milk or fruit juices

For proper water storage:

- Label container as “drinking water” and include storage date.
- Replace stored water that is not commercially bottled every six months.
- Keep stored water in a place with a fairly constant cool temperature.
- Do not store water containers in direct sunlight.
- Do not store water containers in areas where toxic substances such as gasoline or pesticides are present.

After a Disaster or Emergency

Safe Food

Keep Food and Water Safe after a Disaster or Emergency

If you are in a disaster or emergency, it’s important that you take steps to prevent illness from unsafe food and water.

After A Disaster:

Food: Throw away food that may have come in contact with flood or storm water; and those with unusual odor, color, or texture

Water: Do not use water you suspect or have been told is contaminated to wash dishes, brush your teeth, wash and prepare food, wash your hands, make ice, or make baby formula.

Food

Identify and throw away food that may not be safe to eat

Do the following with food and containers that may have had contact with flood or storm water.

Throw away the following foods:

Food Items in a Refrigerator

- Food that has an unusual odor, color, or texture. When in doubt, throw it out.
- Perishable foods (including meat, poultry, fish, eggs and leftovers) in your refrigerator when the power has been off for 4 hours or more.
- Food not in packages or cans.
- Canned foods or food containers that are bulging, opened, or damaged. Throw away the food if the container spurts liquid .

How to reuse commercially prepared cans and retort pouches (like flexible, shelf-stable juice and seafood packages):

- Remove labels if they are removable.
- Brush or wipe away dirt or silt.
- Wash cans and pouches with soap and water, using hot water if available.
- Rinse cans and pouches with water that is safe for drinking, if available.
- Sanitize cans and pouches in one of two ways. 1.) Place them in a solution of 1 cup (8 oz/240 mL) of unscented household bleach in 5 gallons of water

for 15 minutes. OR 2.) Submerge in a pot of water, bring to a boil, and continue boiling for 2 minutes.

- Re-label cans or pouches with a marker. Include the expiration date.
- Use food in reconditioned cans or pouches as soon as possible.

Packaged food: Throw away food containers with screw-caps, snap-lids, crimped caps, twist caps, flip tops, and snap-open, and home-canned foods because they cannot be disinfected. Store food safely

While the power is out, keep the refrigerator and freezer doors closed as much as possible. Throw away food in cardboard containers, including juice/milk/baby formula boxes.

Feeding infants and young children when your tap water is unsafe

- If water is contaminated with a chemical, boiling it will not remove the chemical or make it safe to consume.
- If you prepare infant formula with boiled water, let the formula cool sufficiently before giving it to an infant. Put a couple drops of formula on the back of your hand to see if it is too hot.
- Clean feeding bottles with bottled, boiled, or treated water before each use. Throw away baby bottle nipples or pacifiers that have been in contact with flood waters; they cannot be sanitized.
- Wash your hands before preparing formula and before feeding an infant. You can use alcohol-based hand sanitizer if water is limited or unsafe.
- Clean and sanitize food-contact surfaces that have been flooded

Throw out wooden cutting boards, baby bottle nipples, and pacifiers if they have come into contact with flood waters because they cannot be properly sanitized. Clean and sanitize food-contact surfaces in a four-step process:

- Wash with soap and hot, clean water.
- Rinse with clean water.
- Sanitize by immersing for 1 minute in a solution of 1 cup (8 oz/240 mL) of unscented household chlorine bleach in 5 gallons of clean water.
- Allow to air dry.

Note: Do not use your fireplace for cooking until the chimney has been inspected for cracks and damage. Sparks may escape into your attic through an undetected crack and start a fire.

Safe Drinking Water

Water Testing

Overview

The U.S. Environmental Protection Agency's (EPA) rules that protect public drinking water systems do not apply to individual water systems.

What to test for

- Several water quality indicators (WQIs) and contaminants that should be tested for in your water are listed below.
- A WQI test is a test that measures the presence and amount of certain germs in water.

Examples of Water Quality Indicators:

Total Coliforms

- Coliform bacteria are microbes found in the digestive systems of warm-blooded animals, in soil, on plants, and in surface water
- If the total coliform count is high, then it is very possible that harmful germs like viruses, bacteria, and parasites might also be found in the water.

Fecal Coliforms / Escherichia coli (E. coli)

- E. coli is part of the fecal coliform group and may be tested for by itself.
- Fecal coliforms and a positive test may mean that feces and harmful germs have found their way into your water system.
- They cause diarrhea, dysentery, and hepatitis

pH

- The pH level tells you how acidic or basic your water is.
- The pH level of the water can change how your water looks and tastes.

Examples of Contaminants:

Nitrate

- high levels of nitrate in drinking water can make people sick.
- Nitrate in your well water can come from animal waste, private septic systems, wastewater, flooded sewers, polluted storm water runoff, fertilizers, agricultural runoff, and decaying plants.
- A nitrate test is recommended for all wells.
- If the nitrate level in your water is higher than the EPA standards, you should look for other sources of water or ways to treat your water.

Volatile Organic Compounds (VOCs)

- VOCs are industrial and fuel-related chemicals that may cause bad health effects at certain levels.
- VOCs to ask about testing for are benzene, carbon tetrachloride, toluene, trichloroethelene, and methyl tertiary butyl ether (MTBE).

Tests could include testing for lead, arsenic, mercury, radium, atrazine, and other pesticides.

When to have your well tested

The best way to start is to consult a local expert, such as the local health department, about local contaminants of concern. You should also have your well tested if:

- There are known problems with well water in your area
- You have experienced problems near your well (i.e., flooding, land disturbances, and nearby waste disposal sites)
- You replace or repair any part of your well system
- You notice a change in water quality (i.e., taste, color, odor)

Who should test your well?

State and local health or environmental departments often test for nitrates, total coliforms, fecal coliform, volatile organic compounds, and pH (see above).

Water for Personal Use

Keep Food and Water Safe after a Disaster or Emergency

If you are in a disaster or emergency, it's important that you take steps to prevent illness from unsafe food and water.

After A Disaster:

Food: Throw away food that may have come in contact with flood or storm water; perishable foods that have not been refrigerated properly due to power outages; and those with an unusual odor, color, or texture..

Water: Do not use water you suspect or have been told is contaminated to wash dishes, brush your teeth, wash and prepare food, wash your hands, make ice, or make baby formula. Safe water for drinking, cooking, and personal hygiene includes bottled, boiled, or treated water.

Making Water Safe in an Emergency

In an emergency, water contaminated with germs can often can be made safe to drink by boiling, adding disinfectants, or filtering.

Sanitation and Hygiene

Personal Hygiene and Hand washing after a Disaster or Emergency

Good basic personal hygiene and hand washing are critical to help prevent the spread of illness and disease. Clean, safe running water is essential for proper hygiene and hand washing.

Disaster Supplies Kit (Hygiene Supplies)

- Before an emergency, make sure you have created a Disaster Supplies Kit.

Hand washing

Keeping hands clean during an emergency helps prevent the spread of germs. If your tap water is not safe to use, wash your hands with soap and water that has

been boiled or disinfected. Follow these steps to make sure you wash your hands properly:

- Wet your hands with clean, running water (warm or cold) and apply soap.
- Rub your hands together to make lather and scrub them well; be sure to scrub the backs of your hands, between your fingers, and under your nails.
- Continue rubbing your hands for at least 20 seconds.
- Rinse your hands well under running water.
- Dry your hands using a clean towel or air dry them.

Septic and waste water concerns

Septic & Onsite Wastewater Systems

A well-maintained and constructed septic system will better withstand the stresses of heavy rains or flooding. Regular inspection is necessary to ensure proper functioning.

Signs that a septic system is not working properly include the following:

- Sinks drain slowly
- Toilets drain slowly
- Floor drains overflow
- Sewage becomes visible outside the home

Before an Emergency

To prepare your septic system before an emergency such as a flood, hurricane, or earthquake:

- Seal the manhole and/or inspection ports to keep excess water out of the septic tank
- Be sure your septic tank is at least half full to prevent it from collapsing or floating
- If your septic system requires electricity,
- Turn off the pump at the circuit box before the area floods
- Waterproof all electrical connections to avoid electrical shock or damage to wiring,

National Disaster Management Plan (NDMP), 2016 is the first ever national plan prepared in the country for disaster management.

With National Disaster Management Plan 2016 India has aligned our National Plan with the Sendai Framework for Disaster Risk Reduction 2015-2030, to which India is a signatory

National Disaster Management Plan 2016: The history

- National Disaster Management Act, 2005 – Provided the legal basis for disaster management.
- National Disaster Management Authority (NDMA) – Coordinates activities of disaster management.
- National Policy on Disaster Management (NPDM), 2009 – Institutional mechanisms.
- National Disaster Management Plan (NDMP), 2016 – Aligned with Sendai Framework

Unit-4

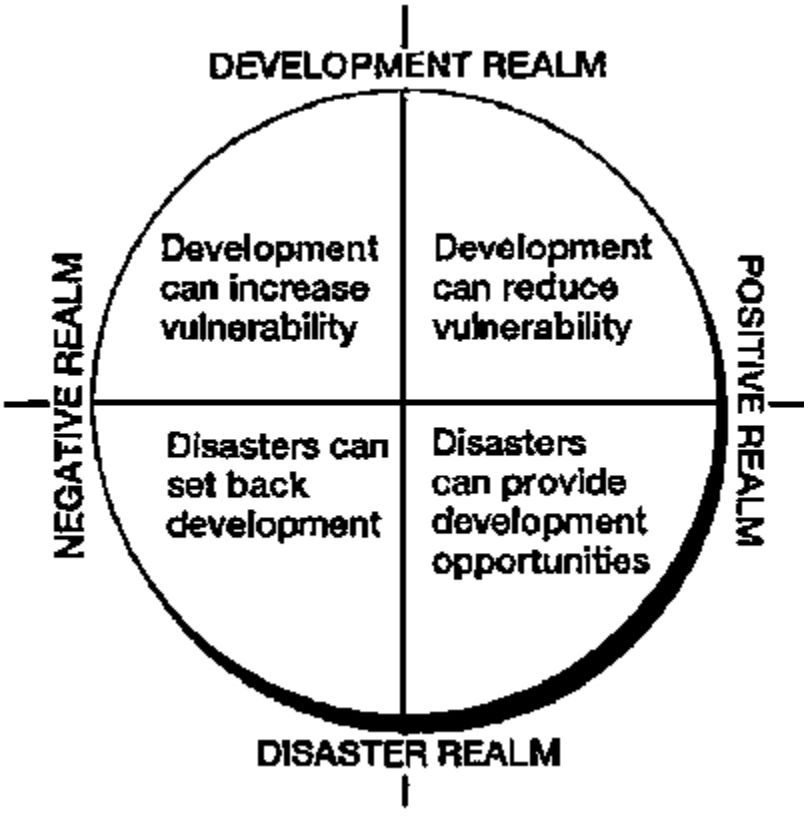
Relationship between Disaster and Development

- Disasters can both destroy development initiatives and create development opportunities.
- Development schemes can both increase and decrease vulnerability.

- When a disaster did occur, the response was directed at meeting emergency needs and cleaning up.
  In the current approach, it has been realized that much more can and need to be done to reduce the severity of hazards and disasters.
- A growing body of knowledge on the relationships between disasters and development indicates four basic themes as follows:

➢ Disasters set back development programming
➢ Rebuilding after a disaster provides significant opportunities to initiate development programmes.
➢ Development programmes can increase an area's susceptibility to disasters.
➢ Development programmes can be designed to decrease the susceptibility to disasters

Projects are thus being designed to include disaster recovery programmes and with long term development needs in mind.



□ The relationship between disasters and development can be summed up with 4 concepts:

- development can increase vulnerability
  - development can reduce vulnerability
  - disasters can set back development
  - disasters can provide development opportunities

□ Disaster effects vary with the hazard type causing the disaster

□ Vulnerability varies between different societies and economies

- newly industrializing economies
  - rural/agricultural economies
  - small island economies
  - highly stressed economies

Dams and their Effects on Forests and Tribal People!

dams constitute a major direct and indirect cause of forest loss

most users of hydro-electricity live far away from the impacted areas

the sites selected for dam building are inhabited by indigenous peoples, tribal people, ethnic minorities.

The fact is that more than 40,000 large dams — those that measure more than 15 metres in height — are currently obstructing the world's rivers, whose reservoirs cover more than 400,000 square kilometers of land.

They have also resulted in deforestation elsewhere, as farmers displaced by the dams have had to clear forests in other areas in order to grow their crops and build their homes.

dams imply road building, thus allowing access to previously remote areas by loggers and “developers”, resulting in further deforestation processes.

At the same time, dams imply a number of health hazards, starting with diseases - AIDS, syphilis, tuberculosis, measles, malaria, schistosomiasis, river blindness, etc.

In far too many cases, dam-building has resulted in widespread human rights violations

Local people have increasingly been able to organize themselves and to establish local, national and international alliances with other concerned organizations.

Major examples are the Narmada Bachao Andolan movement in India, the Bio Bio Action Group in Chile, the Coalition of Concerned NGOs on Bakun in Malaysia, the People Affected by Dams movement in Brazil among many others. It has now become possible to stop large hydro dams. They are definitely not a symbol of development but one of economic and political power resulting in social and environmental degradation.

Impact of change in land use

Socio economic Impacts of Land–Use Changes

• Conversion of farmland and forests to urban development

• Soil erosion, salinization, desertification, and other soil degradations

• Urban development has encroached upon some rural communities to such an extent that the community’s identify has been lost

• Suburbanization intensifies income segregation and economic disparities among communities

• Land use regulations that aim at curbing land development will raise housing prices,

• Land use regulation must strike a balance between private property rights and the public interest

Environmental Impacts of Land–Use Changes

• Runoff from agriculture is a leading source of water pollution

• Draining wetlands for crop production and irrigation water diversions has had a negative impact on many wildlife species

• Irrigated agriculture has changed the water cycle and caused groundwater levels to decline in many parts of the world

• Intensive farming and deforestation may cause soil erosion, salinization, desertification,

• Deforestation adds to the greenhouse effect, destroys habitats that support biodiversity

• Urban development causes air pollution, water pollution, and urban runoff .

• Habitat destruction, fragmentation, and alteration associated with urban development are a leading cause of biodiversity

• Urban development and intensive agriculture in coastal areas and further inland is a major threat to the health

Climate change

Disaster risk is magnified by climate change; it can increase the hazard while at the same time decreasing the resilience of households and communities.

projected impacts of climate change that will drive disaster risk include:

- **Decreasing agricultural yields in warmer environments due to heat stress**
- **Rising sea levels**
- **More severe and frequent extreme precipitation events,** which will intensify **existing patterns of extensive risk**
- **Changes in the geographic distribution of weather-related hazards,**
- **Decreasing resilience,**

Application of technology in disaster management

Though it is not possible to completely avoid the natural disasters, but the sufferings can be minimized by creating proper awareness of the likely disasters and its impact by developing a suitable warning system, disaster preparedness and management of disasters through application of information technology tools.

There are mainly applications we can use to manage disasters:

• GIS and remote sensing

GIS provides a tool for effective and efficient storage and manipulation of remotely sensed data and other spatial and non-spatial data types for both scientific management and policy oriented information. This can be used to

facilitate measurement, mapping, monitoring and modeling of variety of data types related to natural phenomenon.

The specific GIS application in the field of Risk Assessment are:- Hazard Mapping to show earthquake, landslides, floods or fire hazards. Theses map could be created for cities, districts or even for the entire country and Tropical Cyclone Threat Maps are used by meteorological departments to improve the quality of the tropical storm warning services and quickly communicate the risk to the people likely to get affected by the cyclone.

Remote sensing makes observation of any object from a distance Remote sensing comprises Aerial Remote Sensing which is the process of recording information, such as photographs and images from sensor on aircrafts and Satellite Remote Sensing which consists of several satellite remote sensing system which can be used to integrate natural hazard assessments into development planning studies. These are: Land sat, SPOT Satellite, Satellite Radar System, Advanced Very High Resolution Radio.

GIS can also be used in carrying out search and rescue operations in a more effective manner by identifying areas that are disasters prone and zoning them accordingly to risk magnitudes.

• **Internet**

In the present era of electronic communication, the internet provides a useful platform for disaster mitigation communications. Launching of a well-defined website is a very cost-effective means of making an intra-national and international presence felt. It provides a new and potentially revolutionary option for the rapid, automatic, and global dissemination of disaster information.

• **Warning and forecasting system**

An advance system of forecasting, monitoring and issuing early warnings plays the most significant role in determining whether a natural hazard will assume disastrous proportions or not.

IMD provides cyclone warnings from the Area Cyclone Warning Centers (ACWCs) It has developed the necessary infrastructure to originate and disseminate the cyclone warnings at appropriate levels. It has made operational a satellite based communication system called Cyclone Warning Dissemination System for direct dissemination of cyclone warnings to the cyclone prone coastal areas.

Seismological observations in the country are made through national network of 36 seismic stations operated by the IMD, which is the nodal agency.

These stations have collected data over long periods of time.

Flood forecasts and warnings are issued by the Central Water Commission (CWC) , Ministry of Water Resources. These are used for alerting the public and for taking appropriate measures by concerned administrative and state engineering agencies in the flood hazard mitigation. Information is gathered from the CWC's vast network of Forecasting Stations on various rivers in the country

GIS

GIS is defined as a system for capturing, storing, checking, integrating, manipulating, analysing and displaying data which are spatially referenced to the earth.

Remote Sensing

Remote sensing is defined as the art and science of obtaining information about

an object, area or phenomena, through the analysis of data acquired by a device that is not in contact with the object, area or phenomena under investigation.

GIS in disaster management

GIS can be useful in the following ways in disaster management:

1. to create hazard inventory maps
2. locate critical facilities
3. to create and manage associated databases
4. for effective vulnerability assessment

APPLICATIONS OF REMOTE SENSING & GIS IN DISASTER MANAGEMENT

1. Space technologies and disaster mitigation communities helps to develop accurate methods for prevention, preparedness and relief measures.
2. Disaster preparedness focusses on warnings and forecasts of impending disasters.
3. Disaster relief occurs after (and sometimes during) the emergency.
4. Satellite monitoring involves assessment of damage incurred during the disaster.
5. Satellite technology helps in identifying escape routes.
6. Remote sensing and GIS are among the many tools available.

7. The spectral bands in VIS (VISible), NIR (Near Infra Red), IR (Infra Red), SWIR (Short Wave Infra Red), TIR (Thermal Infra Red) and SAR (Synthetic Aperture Radar) provide adequate spectral coverage. This data can be enhanced using a computer and used for effectively managing disasters.

8. Repetitive or multi-temporal coverage is justified since the data can be used to study dynamic phenomenon whose changes can be identified over time. For example:

    1. Natural hazard events
    2. Changing land use patterns
    3. Hydrologic and geologic characteristics of a region

9. Experts in disaster management:

    1. Monitor the situation
    2. Accurately simulate complex natural phenomena
    3. Suggest appropriate contingency plans and
    4. Prepare spatial databases

10. The following are the characteristics of remotely sensed images:

    1. Spatial continuity
    2. Uniform accuracy and precision
    3. Multi-temporal coverage
    4. Complete coverage regardless of site location

11. Use of remotely sensed data:

    1. Planning efficient escape routes

2. Charting quickest routes for ambulances to reach victims

3. Locating places for shelter for victims or refugees

4. Calculating population density in disaster prone areas

5. Rapidly identifying hardest-hit disaster areas

6. Pre-disaster assessments to facilitate planning

7. Monitoring reconstruction or rehabilitation

8. Developing, maintaining or updating accurate base maps.

Earthquakes

- Faults associated with earthquakes can be identified on good resolution satellite imagery.

1. Land-use and geological maps give vital pointers towards potential earthquake zones.

2. Satellite sensors that are active in VIS (VISible) and NIR (Near Infra Red) spectral bands are useful for the above mentioned purpose.

3. IRS, NOAA, SPOT, LANDSAT and IKONOS collect required data. However, LANDSAT imageries are popular as they have a huge historical archive data and are cost effective.

According to the seismic classification of India, Zone V that covers the following locations is most prone to earthquakes:

1. North-East India

2. Jammu & Kashmir
3. Himachal Pradesh
4. Uttarakhand (Due to movement of Indian and Asian plate) and
5. Gujarat

Tsunami

1. Tsunamis are water waves or seismic sea waves caused by large-scale sudden movement of sea floor.
2. They are less than 1m surface height in mid ocean where they originate.
3. They travel at speeds touching 900 kmph.
4. Time between successive waves is almost 20 to 40 minutes.
5. Near the coastline, sea receedes lower than the lowest tide and then rises as a giant wave.
6. Satellite or aerial photography when combined with a good GIS database of an area, provides critical information to emergency managers.

Floods : Floods are a result of excess run-off, which could increase or decrease depending upon various factors such as:

1. Intensity of rainfall
2. Snow melt
3. Soil type
4. Soil moisture condition
5. Land use / Land cover

Flood plains and flood prone areas can be identified on remotely sensed imagery.

Remotely sensed imagery is used for:

1. Flood mapping using images of peak flood and post flood
2. Flood forecasting based on cloud patterns

The major hurdle in recording floods is that optical satellites cannot penetrate clouds that are present in atmosphere during rainfall.

Optical satellites perform passive remote sensing while Synthetic Aperture Radar (SAR) uses remote sensisng which is active remote sensing.

Fire:

Fire detection by satellites provides a highly efficient means of detecting and eradicating forest fires without large number of ground based workers.
Thermal Infrared imagery shows 'HOTSPOTS'

Instruments used to predict occurrence of natural disasters

- Continuous television and radio broadcasts of severe weather by real-time
- near real-time data from meteorological stations and satellite images for prediction of cyclones or floods
- Seismic instruments are used to measure low-frequency ground motion caused by earthquakes.
- Instruments that are used to predict earthquakes include the following:
  1. Creepmeters, to warn of movement of the earth's soil;
  2. Global positioning systems, to warn of movement of the earth's crust;
  3. Laser light, to warn of disrupted light beam transmission from one side of a fault line to another;

4. Magnetometer, to warn of magnetic field changes;

5. Strainmeters, through the coordinated use of the seismometer and the seismograph, to warn of underground vibrations or shock waves.

- A drought can be predicted by the consistent lack of rainfall
- A Tsunami can be predictted using a 'tsunameter'

Landslides and use of remote sensing to predict their occurrence

Predicting occurrence of landslides using remote sensing techniques:

Landslides are one of the most damaging natural hazards in mountainous terrain.

Weathered material soaked with rain water slides down due to gravity.

This sudden downward slip movement of rock material is called landslide.

Landslides can occur due to:

- condition of soil
- moisture and
- angle of slope

The main factors triggering landslides are:

- heavy and prolonged rainfall
- cutting and deep excavation on slope for construction of buildings, roads, canals
- earthquake shocks and tremors

Widespread deforestation for development activities and increasing population pressure has forced people to conduct agriculture on steeper slope.

Remote sensing images provide useful land use information that can be used in conjunction with GIS software along with other spatial factors to predict the occurrence of a landslide.

Satellite images can be used to recognise and interpret detailed geomorphic characteristics of large and small landslides and determine the likelihood of a landslide.

Remote sensing techniques have been widely used to study characteristics of land surface due to advantage of repetitive data acquisition of a large area in a short time.

Elevation and terrain slope can be determined from Digital Elevation Model (DEM) generated from aerial photographs using stereo correlation techniques.

All the risk maps are combined using spatial analysis and a final risk map is produced taking into account all the factors.

Crowdsourcing and ICT in disaster management

Crowdsourcing:

- Crowd-sourcing is a method of information collection that utilizes data collected from volunteers.

- It is being increasingly used to produce information before a disaster takes place and thus aiding in disaster preparedness.

ICT:

Information and Communications Technologies (ICTs) are used in anticipating, communicating and organizing actions before, during and after disaster events.

'Sahana' and 'Ushahidi' are two software programs that focus on crisis management.

The lifecycle of a crowdsourced emergency report consists of:

- the local observer
-a web-user with some knowledge of linked open-data and
-the information manager working for a relief organisation

Crowdsourcing linked open data is the next step towards a full exploitation of crowdsourced information in disaster management.

Climate change

Climate change refers to the sum of all statistical weather information of the atmospheric elements, with specified area over a long period of time.

Climate is a dynamic process and changes to a lesser or greater degree.

The Earth's surface and lowest part of the atmosphere have warmed up to an average by almost 0.6C during the last 100 years.

The United Nations Framework Convention on Climate Change (UNFCC-1992) and the Kyoto Protocol (KP-1997) represent the first steps taken by the international community to protect the climate system.

Several countries have agreed to reduce greenhouse gas emissions by about 5% by 2008 to 2012.

In practical terms, this means

1. using resources, particularly fossil-fuel-derived energy more efficiently
2. reusing and recycling products wherever possible and
3. developing renewable forms of energy that are inexhaustible and do not pollute the environment

Causes of climate change

1. Variation of Earth's orbital characteristics
2. Atmospheric carbon dioxide variations
3. Volcanic eruptions and
4. Variations in solar output

Effects of climate change

1. Mean Sea Level (MSL) is increased by around 1.8mm per year.
2. Many ecosystems of the world will have to adapt rapidly
3. The rate of species becoming extinct will be increased.
4. Human health, agriculture, forestry and water resources will be affected.
5. Increasing change in surface temperatures, changing rates of evapo-transpiration and precipitation
6. unexpected flooding and drought
7. Societies experiencing social, economic and climatic stress will be worst affected.

Global warming - Definition, Effects, Control and Remedial measures

Global warming is defined as the increase in temperature of Earth, that causes change in climate

An increase in industrial, agricultural and other human activity results in release of more green house gases in the atmosphere. These gases cause the atmosphere to trap increasing amounts of heat energy in the Earth's surface making the planet warmer than usual.

The global temperature is now 1C higher than in 1900.

The warmest year of the millenium was 1998.

The International Red Cross and Red Crescent have analyzed the past 33 years of natural disasters and 90% of them were weather related.

Effects of Global Warming

1. More heat waves
2. Expansion of desert area
3. Natural fires in forest lands
4. More evaporation of water from oceans and water bodies
5. Melting of Ice caps in Arctic and Antarctic regions
6. More cloud formation in the atmosphere
7. Shorter and warmer winters coupled with longer and hotter summers
8. Changes in rainfall pattern
9. Rise in sea level
10. Flooding and submergence of low lying coastal areas

11. Disruption in farming

12. More drought

13. Impact on plants, animals and humans

Control and remedial measures:

1. Reduction in consumption of fossil fuels such as coal and petroleum

2. Use of bio-gas plants

3. Use of nuclear power plants

4. Increasing forest cover

5. Use of unleaded petrol in automobiles

6. Installation of pollution controlling devices in automobiles

Ozone layer depletion process

Ozone is a colourless, odorless gas composed of three atoms of oxygen (O3).

Ozone is formed naturally in the upper stratosphere when wavelengths less than 240nm are absorbed by normal oxygen molecules which dissociate to give O atoms. The O atoms in combination with other oxygen molecules produce ozone.

In the stratosphere, about 19 to 30 km above the Earth's surface, ozone is constantly being produced and destroyed naturally.

This production and destruction makes stratosphere with ozone layer that filters the Ultra-Violet radiation from the Sun and protects life on Earth.

Man-made chemicals called Chloro Fluoro Carbons(CFCs) are used as aerosol sprays, refrigerants and coolants etc destroy ozone molecules in the stratosphere.

The equations involved are:

$Cl + O_3 = ClO + O_2$

$ClO + O = Cl + O_2$

Hence, net effect: $O_3 + O = 2O_2$

Chlorine atom in the above reaction functions as a catalyst and is not consumed in the reaction. Chloro-Fluoro-Carbons are very stable molecules and can live upto 100 years.

Ozone Depletion Potential (ODP)

The ozone depletion potential of a compound is defined as the measure of its ability to destroy stratospheric ozone. It may be defined as the ratio of total amount of ozone destroyed by a particular agent to the amount of ozone destroyed by the same mass of CFC-11.

The ODP of CFC-11 is always taken as 1.0 ODP is a relative measure with CFC-11 taken as a standard reference.

Factors affecting ODP

1. Nature of the halogen

2. The number of chlorine or bromine atoms in a molecule.

3. Molecular mass and

4. Atmospheric lifetime

Effects on human health

1. Reddening of skin in sun shine (Sun burn)

2. Skin cancer

3. Reduction in body's immunity to disease

4. Eye disorders like cataracts and blindness

Other living organisms

1. UV rays are particularly harmful to small plants and animals living in the sea called 'plankton'.

2. UV rays damage certain crops like rice

3. UV radiation can damage polymers used in paint, clothing.

Green house gases:

Greenhouse gases are those that absorb and emit infrared radiation .

In order, the most abundant greenhouse gases in Earth's atmosphere are:

- Water vapor (H_2O)
- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Ozone (O_3)
- Chlorofluorocarbons (CFCs)
- Hydrofluorocarbons (incl. HCFCs and HFCs)

Atmospheric concentrations are determined by the balance between sources (emissions of the gas from human activities and natural systems) and sinks (the removal of the gas from the atmosphere by conversion to a different chemical compound)

The proportion of an emission remaining in the atmosphere after a specified time is the "airborne fraction" (AF).

The *annual airborne fraction* is the ratio of the atmospheric increase in a given year to that year's total emissions.

Without greenhouse gases, the average temperature of Earth's surface would be about −18 °C (0 °F), rather than the present average of 15 °C (59 °F).

The atmospheres of Venus, Mars and Titan also contain greenhouse gases.

Human activities since the beginning of the Industrial Revolution (around 1750) have produced a 40% increase in the atmospheric concentration of carbon dioxide (CO2), from 280 ppm in 1750 to 406 ppm in early 2017.