BCLE212

NATURAL DISASTER MITIGATION AND MANAGEMENT

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Course objectives

1. Provide adequate knowledge about disaster mitigation, preparedness, response, and recovery to face disaster among government bodies, institutions, NGOs, etc.

2. Obtain knowledge of different disasters and their preparedness and mitigation methods.

3. Provide adequate knowledge about applications of space technology in disaster monitoring and information dissemination.

CONTENTS

Course outcome

1. Understand the safety precautions and how to handle the disasters.
2. Develop skills in different disasters and their mitigation methods.
3. Examine how quickly to respond and prepare for different disasters.
4. Understand how space and communication technology is used in disaster monitoring and early warning.
5. Learn the current affairs on disaster management and resilience to disasters

45

Lectures

Monday: 04 00 to 04 50 p.m.

Wednesday: 05 00 to 05 50 p.m.

Thursday: 02 00 to 02 50 p.m.

Course components

Component	Maximum marks	Weightage (%)	Date
Quiz I	20	10	After CAT I
CAT I	50	15	As per academic calendar
CAT II	50	15	As per academic calendar
Assignment	10	10	20.04.24
Quiz II	20	10	After CAT II
FAT	100	40	As per academic calendar

Module 1: Introduction to Disasters

Natural Disasters Principles, Elements, Important Community Needs – Hyogo Framework For Action (Hfa)– Sendai Framework For Disaster Risk Reduction – Disaster Management System – Hazard, Vulnerability And Risk – History Of Disaster Management In India – disaster Management Act – Disaster Management Structure In India – Nodal Agencies For Disaster Management In India – Disaster Types

Introduction to natural disasters

Hazard

A process, phenomenon, or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption, or environmental degradation.

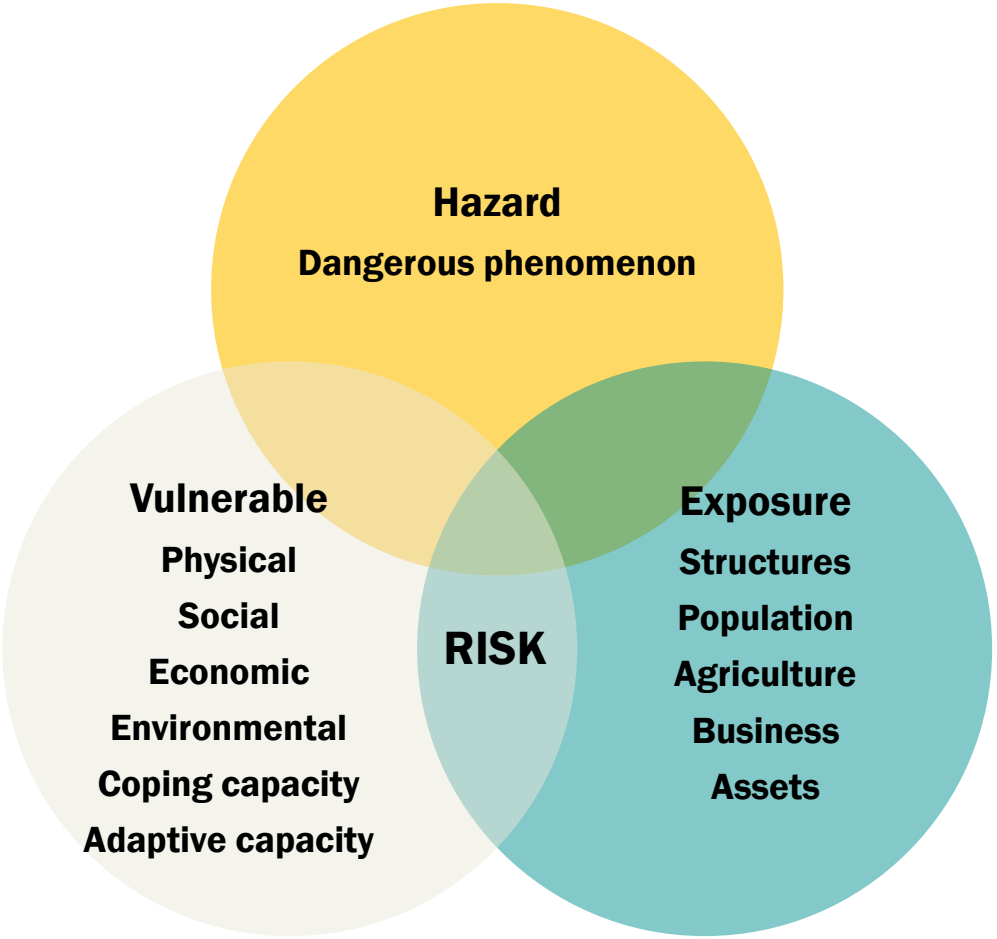
Example: Wildfires (small magnitude)

Disaster

A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic, and environmental losses and impacts.

Example: Earthquake of 7.6 magnitude (1 January 2024)

1. Source: https://www.undrr.org/terminology/hazard,
2. Source: https://www.undrr.org/terminology/disaster



Exposure

The situation of people, infrastructure, housing, production capacities, and other tangible human assets located in hazard-prone areas. Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability and capacity of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest.

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Vulnerability

The conditions determined by physical, social, economic, and environmental factors or processes which increase the susceptibility of an individual, a community, assets, or systems to the impacts of hazards.

Capacity

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

Disaster example

On 1 January 2024, at 16:10 JST, an MJMA7.6 earthquake struck 7 km north-northwest of Suzu, located on the Noto Peninsula of Ishikawa Prefecture, Japan.

Disaster group definition and classification

Disaster Subgroup	Definition	Disaster Main Type
Geophysical	Events originating from solid earth	Earthquake, Volcano, Mass Movement (dry)
Meteorological	Events caused by short-lived/small to meso scale atmospheric processes (in the spectrum from minutes to days)	Storm
Hydrological	Events caused by deviations in the normal water cycle and/or overflow of bodies of water caused by wind set-up	Flood, Mass Movement (wet)
Climatological	Events caused by long-lived/meso to macro scale processes (in the spectrum from intra-seasonal to multi-decadal climate variability)	Extreme Temperature, Drought, Wildfire
Biological	Disaster caused by the exposure of living organisms to germs and toxic substances	Epidemic, Insect Infestation, Animal Stampede


Earthquake


Volcanic eruption

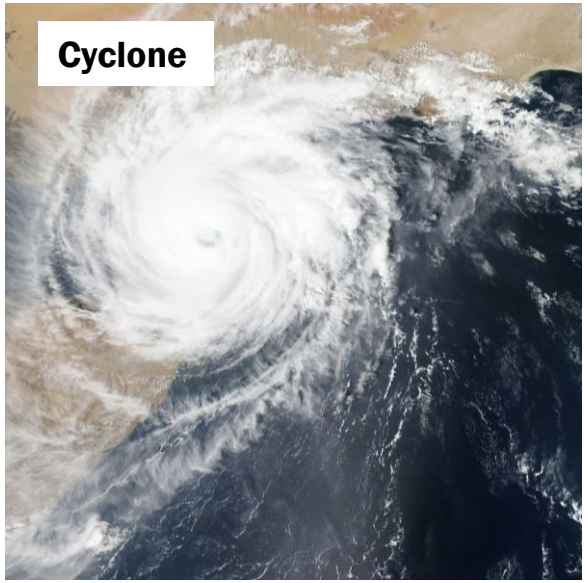

Drought


Avalanche


Floods


Tsunami


Wildfires


Cyclone

Natural Disasters

Geophysical

Earthquakes, tsunamis, volcanic activity

Hydro-meteorological

Floods, tropical storms, drought

Climatological

Extreme weather events

Biological

Epidemic diseases

- **Small-scale disaster**: a type of disaster only affecting local communities which require assistance beyond the affected community.
- **Large-scale disaster**: a disaster affecting a society that requires national or international assistance.
- **Frequent and infrequent disasters**: depend on the probability of occurrence and the return period of a given hazard and its impacts. The impact of frequent disasters could be cumulative or become chronic for a community or a society.
- **A slow-onset disaster** is defined as one that emerges gradually over time. Slow-onset disasters could be associated with, e.g., drought, desertification, sea-level rise, and epidemic disease.
- **A sudden-onset disaster** is triggered by a hazardous event that emerges quickly or unexpectedly. Sudden-onset disasters could be associated with, e.g., earthquakes, volcanic eruptions, flash floods, chemical explosions, critical infrastructure failure, or transport accidents.

Disasters around the world: overview

Figure 1

Number of disasters by continent and top 10 countries[8] in 2022

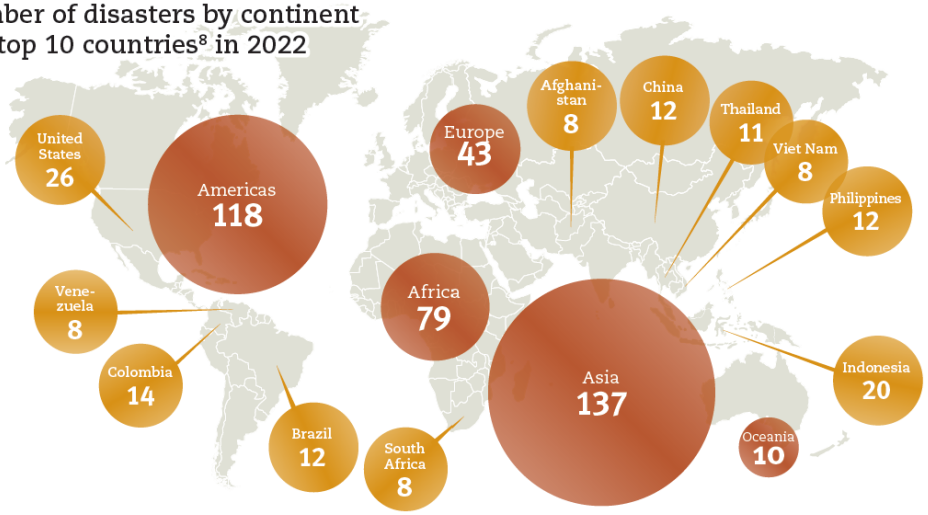


Figure 2

Occurrence by disaster type: 2022 compared to the 2002-2021 annual average

370 2002 to 2021 ❮ 387 in 2022

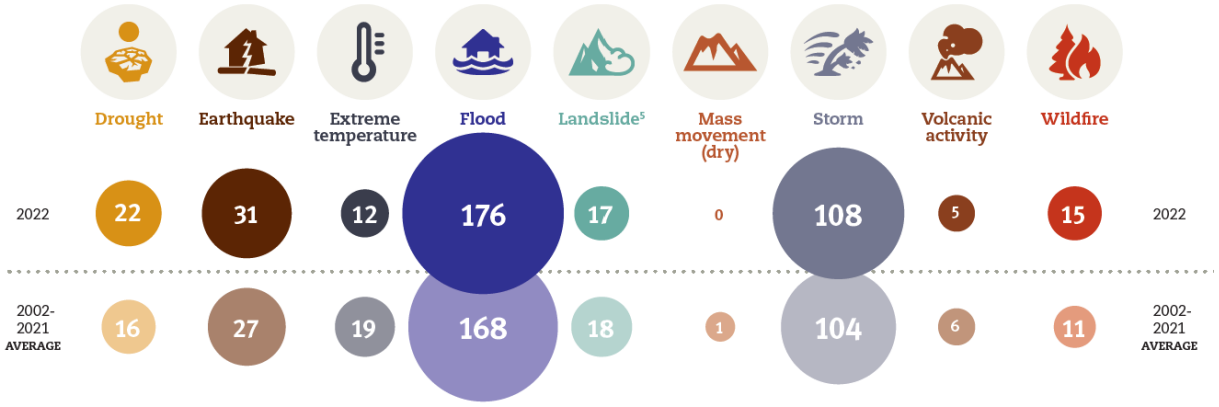


Figure 3

Share of deaths by continent in 2022

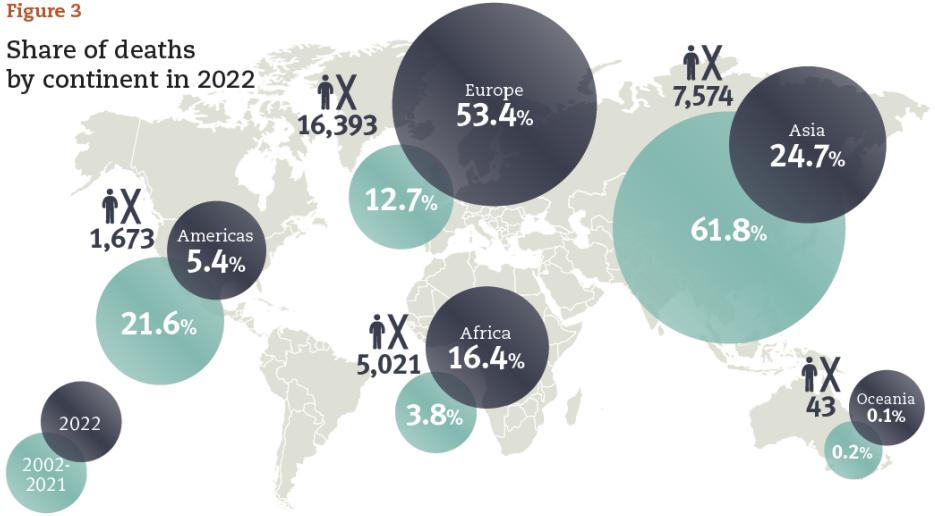
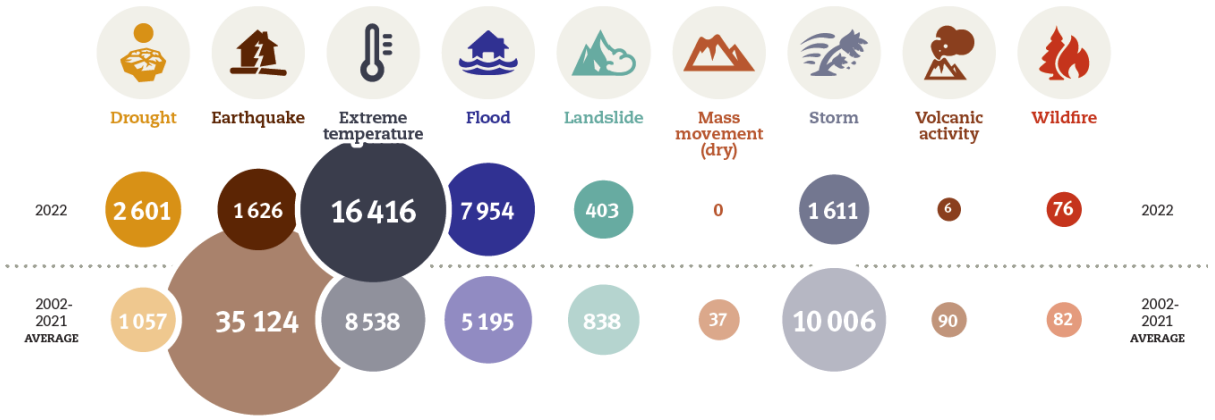


Figure 4

Number of deaths by disaster type: 2022 compared to the 2002-2021 annual average

60,955 2002 to 2021 ❯ 30,704 in 2022



Observe the number of affected persons according to disaster type.

Figure 5

Share of affected by continent in 2022

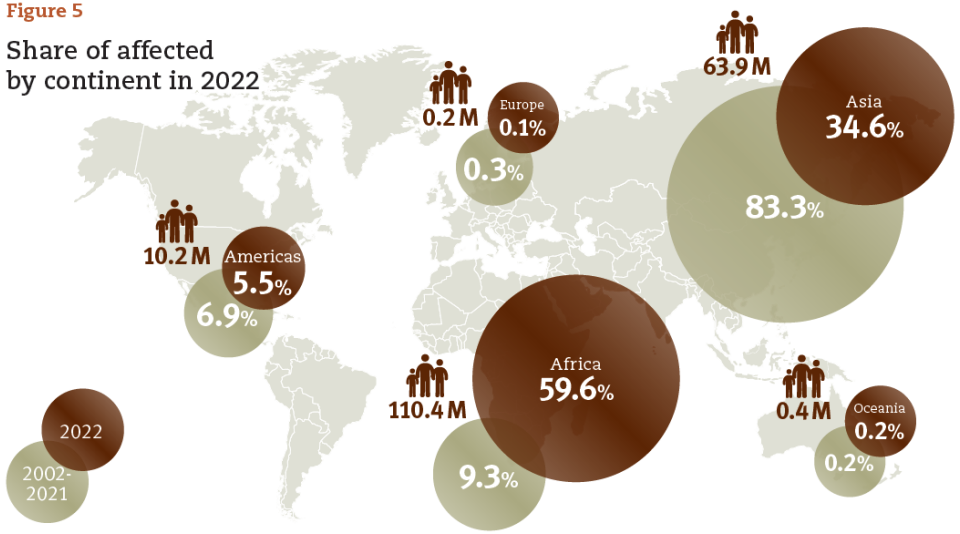
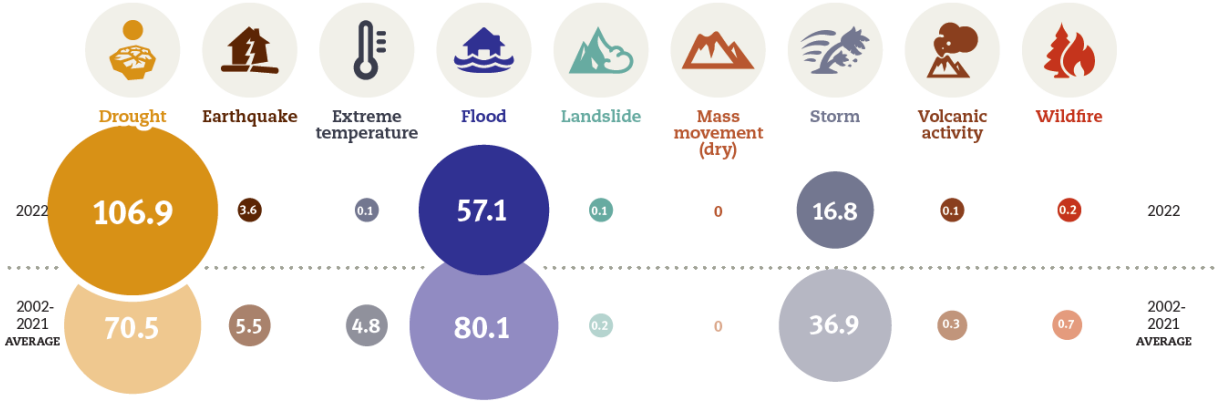


Figure 6

Number of affected (million) by disaster type: 2022 compared to the 2002-2021 annual average

198.9 2002 to 2021 > 185 in 2022



Observe the economic losses according to disaster type.

Figure 7

Share of economic losses by continent in 2022

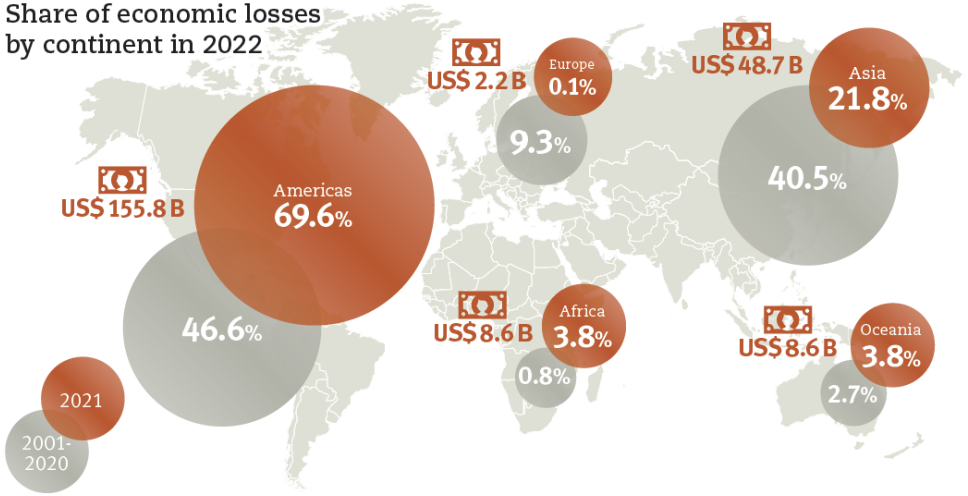
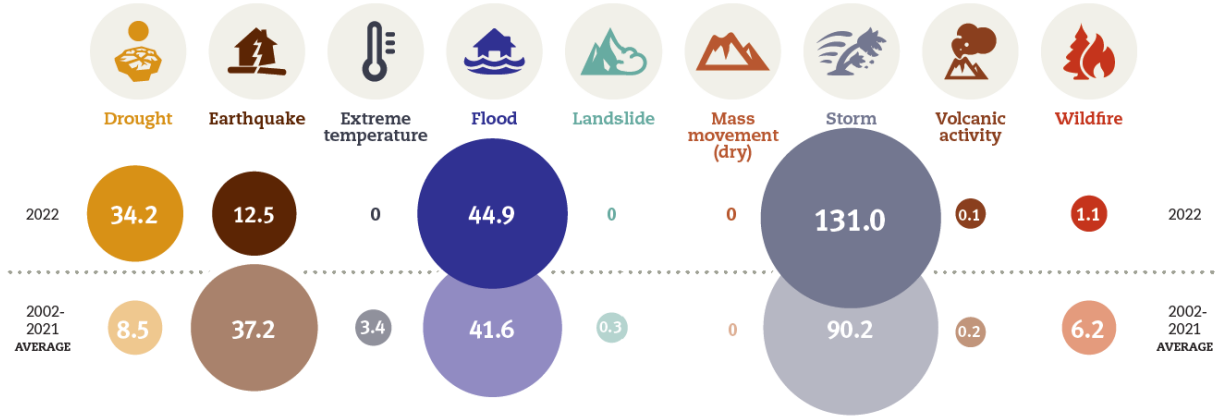


Figure 8

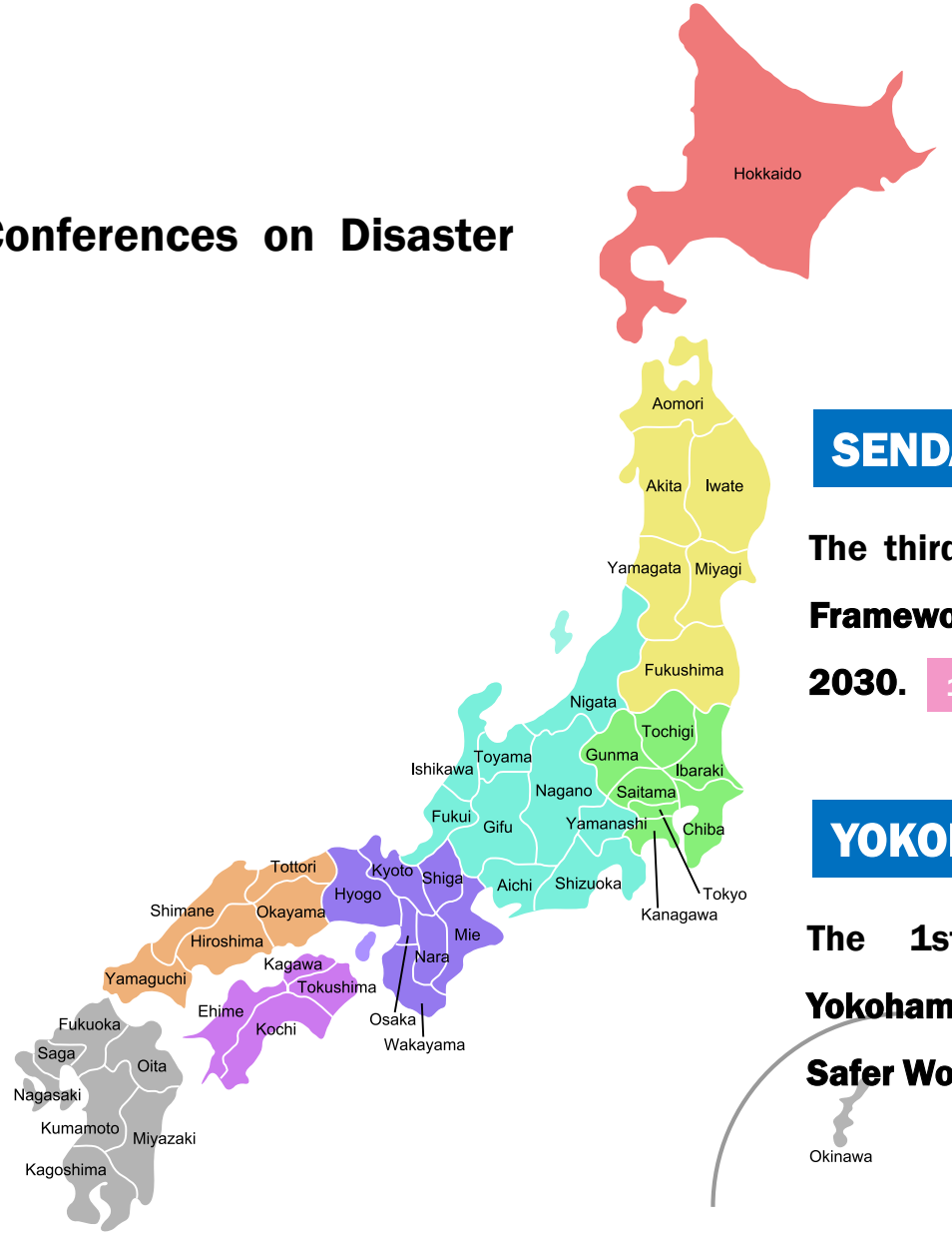
Economic losses (billion US$) by disaster type: 2022 compared to the 2002-2021 annual average

187.7 2002 to 2021 < 223.8 in 2022



Evolution of principles

The UN has convened three World Conferences on Disaster Risk Reduction (WCDRR).



HYOGO

The 2nd WCDRR 2005 adopted the Hyogo Framework for Action 2005-2015: Building the Resilience of Countries and Communities to Disasters. 168 countries

SENDAI

The third WCDRR in 2015 adopted the Sendai Framework for Disaster Risk Reduction 2015-2030. 187 countries

YOKOHAMA

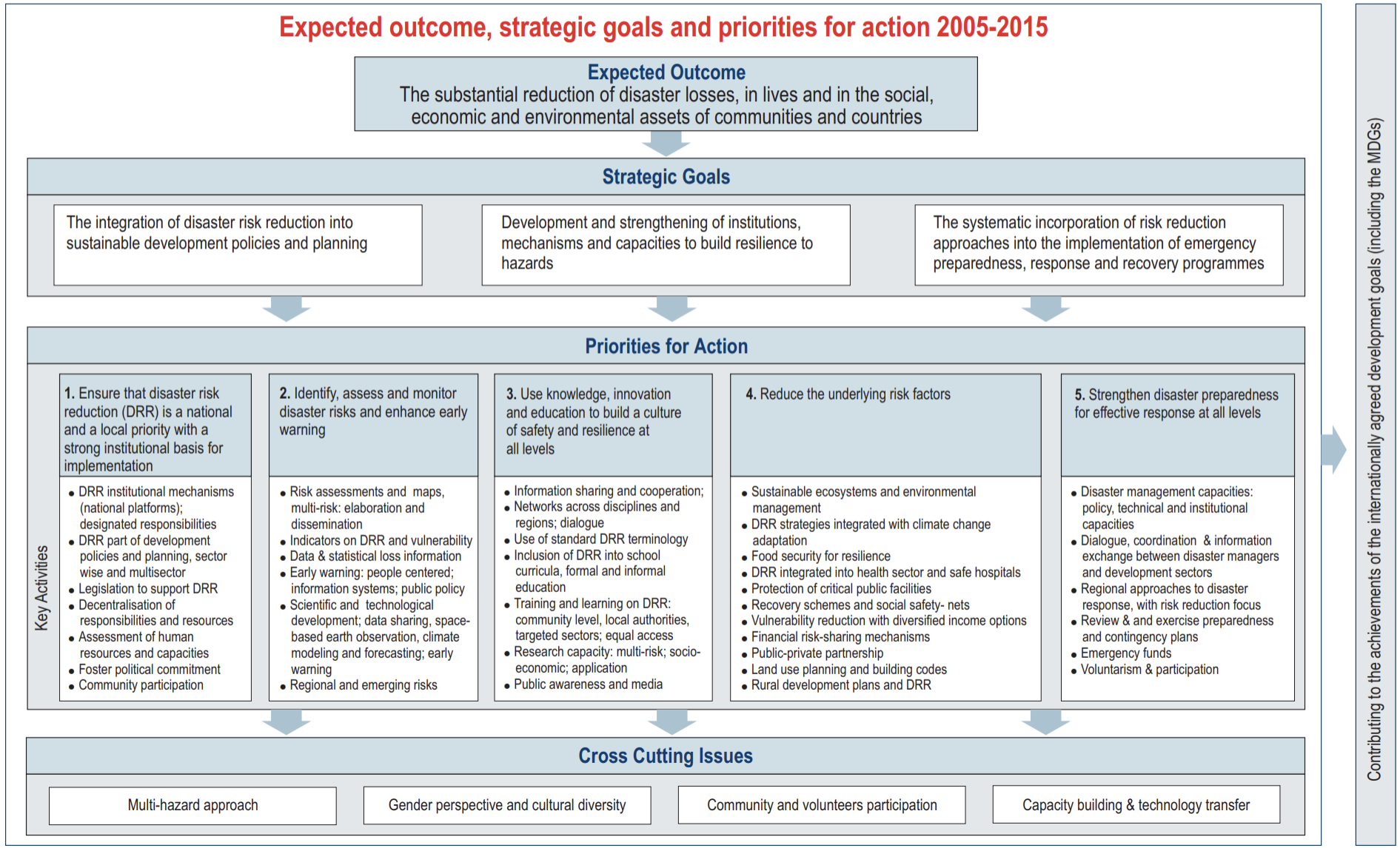
The 1st WCDRR 1994 adopted the Yokohama Strategy and Plan of Action for a Safer World. 147 countries

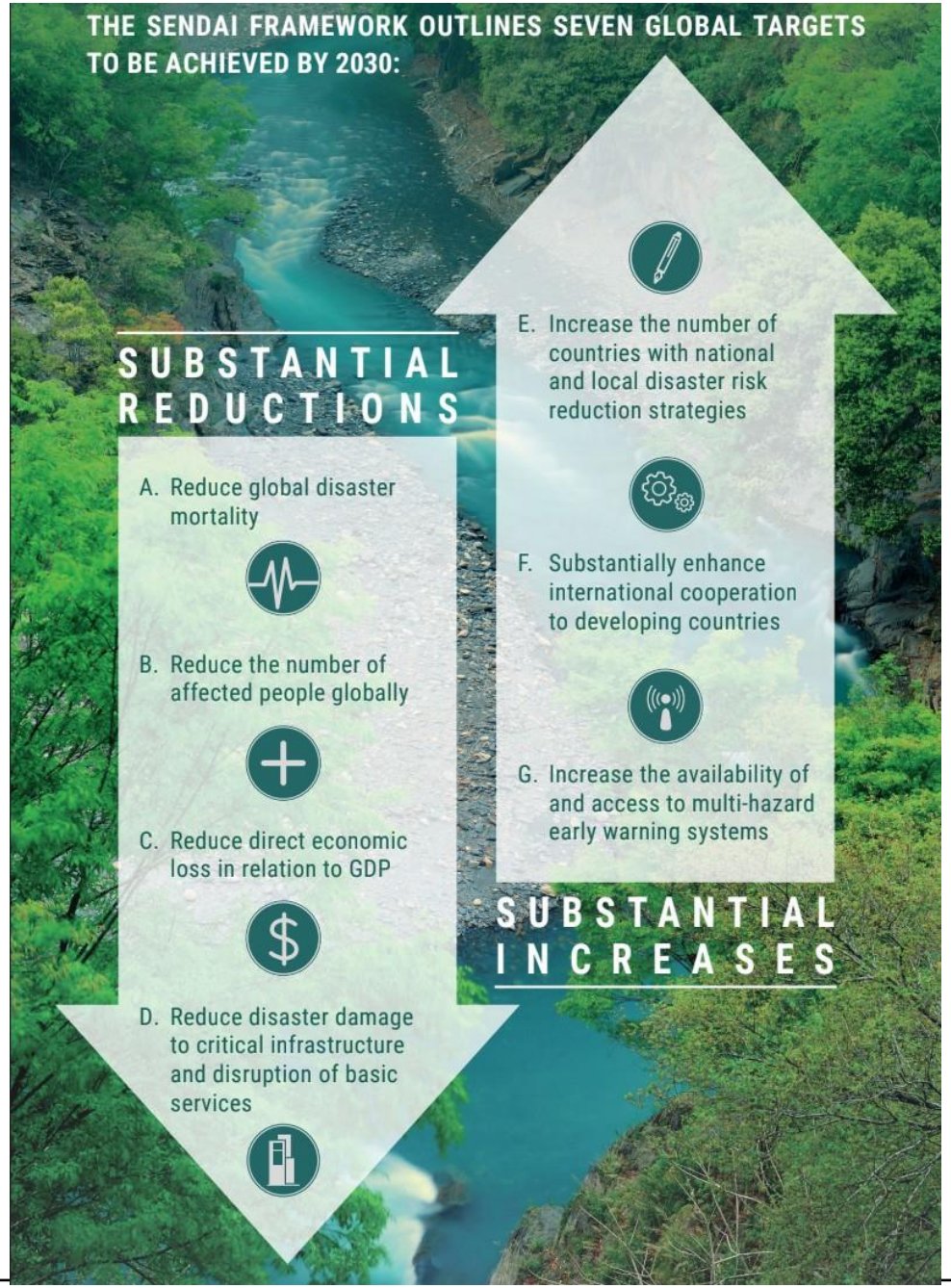
Hyogo framework for action

The Hyogo Framework for Action (HFA) was the global blueprint for disaster risk reduction efforts between 2005 and 2015.

International Strategy for Disaster Reduction

SUMMARY of the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters (Hyogo Framework)





Sendai framework for action

- The Sendai Framework is the successor instrument to the Hyogo Framework for Action (HFA).
- The Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted at the Third. UN World Conference in Sendai, Japan, on March 18, 2015.
- The Sendai Framework works hand in hand with the other 2030 Agenda agreements, including The Paris Agreement on Climate Change, The Addis Ababa Action Agenda on Financing for Development, the New Urban Agenda, and ultimately the Sustainable Development Goals.

Priorities for action – SENDAI FRAMEWORK

Priority 1: Understanding disaster risk

Disaster risk management needs to 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

Priority 2: Strengthening disaster risk governance to manage disaster risk

Disaster risk governance at the national, regional and global levels is vital to the management of disaster risk reduction in all sectors and ensuring the coherence of national and local frameworks of laws, regulations and public policies that, by defining roles and responsibilities, guide, encourage and incentivize the public and private sectors to take action and address disaster risk

Priority 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. These can be drivers of innovation, growth and job creation. Such measures are cost-effective and instrumental to save lives, prevent and reduce losses and ensure effective recovery and rehabilitation

Priority 4: Enhancing disaster preparedness for effective response, and to «Build Back Better» in recovery, rehabilitation and reconstruction

Experience indicates that disaster preparedness needs to be strengthened for more effective response and ensure capacities are in place for effective recovery. Disasters have also demonstrated that the recovery, rehabilitation and reconstruction phase, which needs to be prepared ahead of the disaster, is an opportunity to «Build Back Better» through integrating disaster risk reduction measures. Women and persons with disabilities should publicly lead and promote gender-equitable and universally accessible approaches during the response and reconstruction phases

Guiding principles

Primary responsibility of States to prevent and reduce disaster risk, including through cooperation	Shared responsibility between central Government and national authorities, sectors and stakeholders as appropriate to national circumstances	Protection of persons and their assets while promoting and protecting all human rights including the right to development	Engagement from all of society	Full engagement of all State institutions of an executive and legislative nature at national and local levels	Empowerment of local authorities and communities through resources, incentives and decision-making responsibilities as appropriate	Decision-making to be inclusive and risk informed while using a multi-hazard approach

Coherence of disaster risk reduction and sustainable development policies, plans, practices and mechanisms, across different sectors	Accounting of local and specific characteristics of disaster risks when determining measures to reduce risk	Addressing underlying risk factors cost-effectively through investment versus relying primarily on post-disaster response and recovery	«Build Back Better» for preventing the creation of, and reducing existing, disaster risk	The quality of global partnerships and international cooperation to be effective, meaningful and strong	Support from developed countries and partners to Developing countries to be tailored according to needs and priorities as identified by them

History of disaster management in India

1887 Great Famine of India

1984 Bhopal Gas Tragedy

1999 Super Cyclone of Odisha

2001 Earthquake in Bhuj, Gujarat

- Turning Point: The Gujarat Earthquake and the Birth of NDMA

- The devastating Gujarat earthquake in 2001 exposed gaps in India's disaster management system.

- In 2005, the Disaster Management Act established the National Disaster Management Authority (NDMA) as the apex body for disaster management.

- NDMA led the development of a National Disaster Management Plan, focusing on prevention, mitigation, preparedness, and response.

Disaster management act, 2005

The Disaster Management (DM) Act, of 2005 provides the core legal and institutional framework at the national, state, and district levels for the effective management of disasters. Salient features of the DM Act, 2005 are given under

- It establishes a National Disaster Management Authority (NDMA) at the National Level under the chairmanship of the Prime Minister.
- It establishes State Disaster Management Authorities (SDMA's) at the State Level under the chairmanship of the Chief Minister.
- It establishes District Disaster Management Authorities (DDMA's) at the District Level under the Chairmanship of Collectors/District Magistrates.
- Set up the National Institute of Disaster Management (NIDM) to provide training and capacity building.
- Set up the National Disaster Response Force (NDRF) to respond during the relief operations.
- Makes provisions for the National Disaster Mitigation Fund
- Preparation of National Policy on Disaster Management by NDMA

National Disaster Management Authority (NDMA)

—Precursors to NDMA (1999-2005)

- Establishment of High-Powered Committee (HPC) in 1999
- National Committee formed after the Gujarat earthquake (2001)
- Inclusion of Disaster Management in 10th Five-Year Plan
- Review of financial arrangements by 12th Finance Commission

—Birth of NDMA (2005)

- Enactment of Disaster Management Act, 2005
- Creation of NDMA led by Prime Minister
- Establishment of State Disaster Management Authorities (SDMAs)
- Holistic and integrated approach to disaster management

Functions of NDMA

1. Lay down policies on disaster management;
2. Approve National Plan;
3. Approve plans prepared by the Ministries or departments of the Government of India following the National Plan;
4. Lay down guidelines to be followed by the State Authorities in drawing up the State Plan;
5. Lay down guidelines to be followed by the different Ministries or departments of the Government of India to integrate the measures for the prevention of disaster or the mitigation of its effects in their development plans and projects;
6. Coordinate the enforcement and implementation of the policy and plan for disaster management;
7. Recommend provision of funds for mitigation;
8. Provide such support to other countries affected by major disasters as may be determined by the Central Government;
9. Take such other measures for the prevention of disaster, or the mitigation, or preparedness and capacity building for dealing with the threatening disaster situation or disaster as it may consider necessary;
10. Lay down broad policies and guidelines for the functioning of the National Institute of Disaster Management.

National Executive Committee (NEC)

1. Composition:

Secretary-level officers from key ministries: Home, Agriculture, Atomic Energy, Defense, Water Resources, Environment & Forests, Finance, Health, Power, Rural Development, Science & Technology, Space, Telecommunications, and Urban Development.

Chairperson: Home Secretary (ex officio).

2. Responsibilities:

National Disaster Management Plan:

- Preparation and annual review/update for the whole country.
- Aligns with national policies and guidelines.

Coordination and Monitoring:

- Oversees implementation of national disaster management policies and plans.
- Coordinates disaster response and mitigation efforts across ministries.
- Monitors progress and provides technical assistance to states.

Other Functions:

Approving guidelines for state disaster management plans.

Providing emergency support during disasters.

Advising the National Authority on disaster management issues.

3. Importance:

Ensures a holistic and coordinated approach to disaster management at the national level.

Facilitates collaboration and resource sharing between ministries.

Promotes effective disaster preparedness, response, and mitigation measures.

State Disaster Management Authority (SDMA)

Establishment: All states are mandated by Section 14 of the Disaster Management Act, 2005.

Composition:

- **Chairperson: Chief Minister of the State.**
- **Members: Up to eight members appointed by the Chief Minister.**

Responsibilities:

- **Overseeing disaster management in the state.**
- **Drawing up and implementing the State Disaster Management Plan (SDMP) aligned with the National Plan.**
- **Ensuring all state departments have disaster management plans as per national and state guidelines.**

District Disaster Management Authority (DDMA)

Establishment: Headed by the Collector/District Magistrate/Deputy Commissioner of the district.

Composition:

- **Chairperson: Collector/District Magistrate/Deputy Commissioner.**
- **Co-Chairperson (ex officio): Elected representative of the area.**

Responsibilities:

- **Coordinating disaster management at the district level.**
- **Implementing the SDMP within the district.**
- **Preparing and updating the District Disaster Management Plan (DDMP).**
- **Overseeing disaster preparedness, response, and mitigation activities within the district.**

National Disaster Response Force (NDRF)

What is NDRF?

- A specialized force was established under the Disaster Management Act, of 2005.
- Deployed during "calamities of severe nature" on request of affected states.
- Works under the National Disaster Management Authority (NDMA).
- Mission: To provide specialist response to disasters and mitigate their impact.

Structure and Composition

- Top-heavy organizational structure with the Director General (IPS officer) at the helm.
- Comprises 12 battalions manned by personnel from Indian paramilitary forces:
  - 3 Border Security Force (BSF) battalions
  - 3 Central Reserve Police Force (CRPF) battalions
  - 2 Central Industrial Security Force (CISF) battalions
  - 2 Indo-Tibetan Border Police (ITBP) battalions
  - 2 Sashastra Seema Bal (SSB) battalions
- Each battalion has 1,149 personnel, including 18 specialized search and rescue teams.

https://www.ndrf.gov.in/

NDRF

Capabilities and Services

- 18 self-contained search and rescue teams per battalion (45 personnel each).
- Teams consist of engineers, technicians, electricians, dog squads, and medical/paramedics.
- Expertise in various disaster scenarios: floods, earthquakes, landslides, cyclones, etc.
- Additional services:
  - Rescue operations: trapped victims, collapsed structures, flood rescues.
  - Emergency medical aid and casualty evacuation.
  - Damage assessment and infrastructure repair.
  - Community awareness and preparedness programs.

Role of Central, and State Governments and district administration

Central Government:

- Leading Coordination: Ministry of Home Affairs (MHA), Ministries (e.g., Agriculture, Health) in NEC, oversee agencies and offer support.
- Preventative Focus: Integrate disaster considerations in development, allocate pre-disaster funds, and mitigate risks.
- National Crisis Management Committee (NCMC) for Major Crises: High-level officials (e.g., Cabinet Secretary) handle critical situations with NDMA involvement. NCMC Collaborates with:
    - Crisis Management Groups (CMGs) of Central Nodal Ministries: Provide technical expertise and support for specific crisis aspects related to their ministries.
    - National Executive Committee (NEC): Offers overall disaster management coordination and resources.
    - National Disaster Management Authority (NDMA) Secretary: Provides disaster management expertise and insights.

State Governments:

- Primary Responsibility: Manage disasters effectively using institutional mechanisms.
- State Plans and Integration: Develop disaster plans, integrate prevention/mitigation into development, and allocate funds.
- Early Warning Systems: Implement early warning systems and assist the Central Government in various aspects.

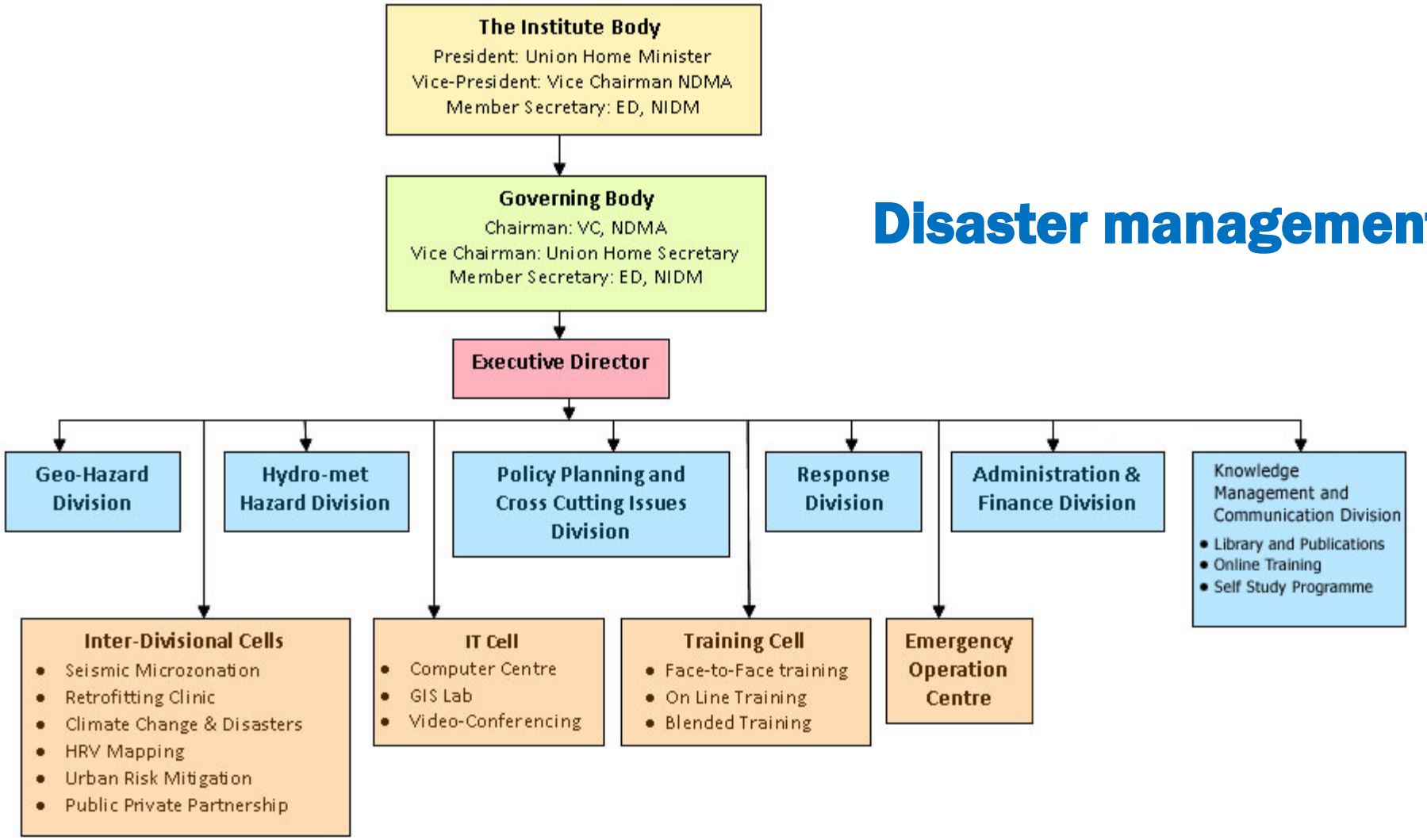
District Administration:

- DDMAs Lead the Way: Plan, coordinate, and implement disaster management at the district level.
- Local Action: Take all necessary measures following NDMA and SDMA guidelines.

Other institutional forces

- Armed forces: They are called when the situation is beyond the coping capacity of the Civil Administration
- Central Armed Police Forces (CAPFs)
- State Police, Fire Services, and Home Guards
- Civil Defense (CD) and Home Guards
- Local elected bodies
- Community participation in disaster response
    - Non-Governmental Organization (NGO)
    - Self-Help Groups (SHGs)
    - Youth Organization
    - National Cadet Corps (NCC)
    - National Service Scheme (NSS)
    - Nehru Yuva Kendra Sangatham (NYKS)
    - National Rural Health Mission (NRHM)
    - Integrated Child Development Services (ICDS)
- International cooperation

Disaster management structure in India



Nodal Agencies for Management of Disasters in India

1. Floods: CWC, Ministry of Water Resources
2. Cyclones: Indian Meteorological Department (IMD)
3. Earthquakes: Indian Meteorological Department (IMD)
4. Epidemics: Ministry of Health & Family Welfare
5. Chemical Disasters: Ministry of Environment & Forests
6. Industrial Disasters: Ministry of Labor
7. Rail Accidents: Ministry of Railways
8. Air Accidents: Ministry of Civil Aviation
9. Fire: Ministry of Home Affairs
10. Nuclear Incidents: Department of Atomic Energy
11. Mine Disasters: Department of Mines

General impacts of disaster

Disaster impact is the total effect of a hazardous event or disaster, including negative (e.g., economic losses) and positive effects (e.g., economic gains).

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.

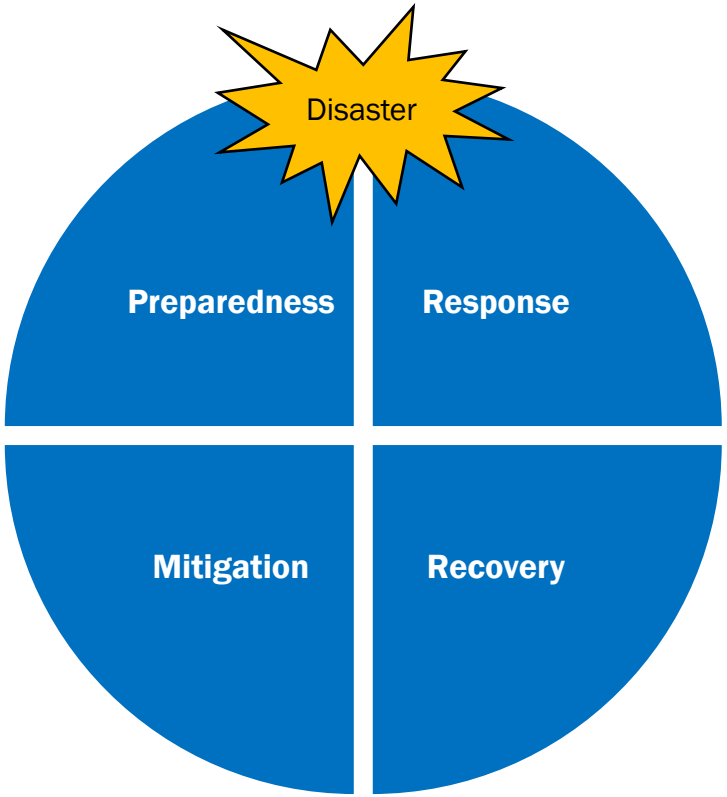
List the effects of Tsunami in terms of

- Environment
- Economic and
- Human impacts

Disaster management (DM) – a cycle with phases that reduce or prevent disasters.

Disaster risk management is the application of disaster risk reduction policies and strategies to prevent new disaster risks, reduce existing disaster risks and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses.

- DM is a cyclical process
- The end of one phase is the beginning of another. Although another phase can start before the completion of the previous one.
- Often several phases are taking place concurrently.
- Mitigation and preparedness phases occur as improvements are made in anticipation of an event.



1. Measures are put in place to minimize the results of a disaster.

2. Planning how to respond

3. Initial actions are taken as the event takes place. It involves efforts to minimize the hazards created by a disaster

4. Returning the community to normal. Ideally, the affected area should be put in a condition equal to or better than before the disaster.

Source:
1. https://www.undrr.org/terminology/disaster-risk-management
2. The Disaster Management Cycle" (Warfield, 2005)

The disaster risk management cycle

Phases of disaster

1. Pre-disaster

- It includes all activities that reduce human and property losses due to a potential hazard.
- The pre-disaster measures include the mitigation and preparedness activities discussed earlier.
- Pre-disaster activities could include awareness campaigns, strengthening protective structures, preparing comprehensive disaster management plans at various levels, involving all stakeholders, etc.

2. Disaster

- Initiatives are taken to ensure that all the needs and provisions of victims like food, shelter, medical care, etc. are met, and their sufferings are minimized to the maximum possible extent.
- Activities taken during a disaster occurrence are called emergency response activities.

3. Post-disaster

- All the initiatives are taken after the disaster to recover early and properly rehabilitate affected communities for post-disaster activities.
- These initiatives can be considered recovery, as presented in the DM cycle.

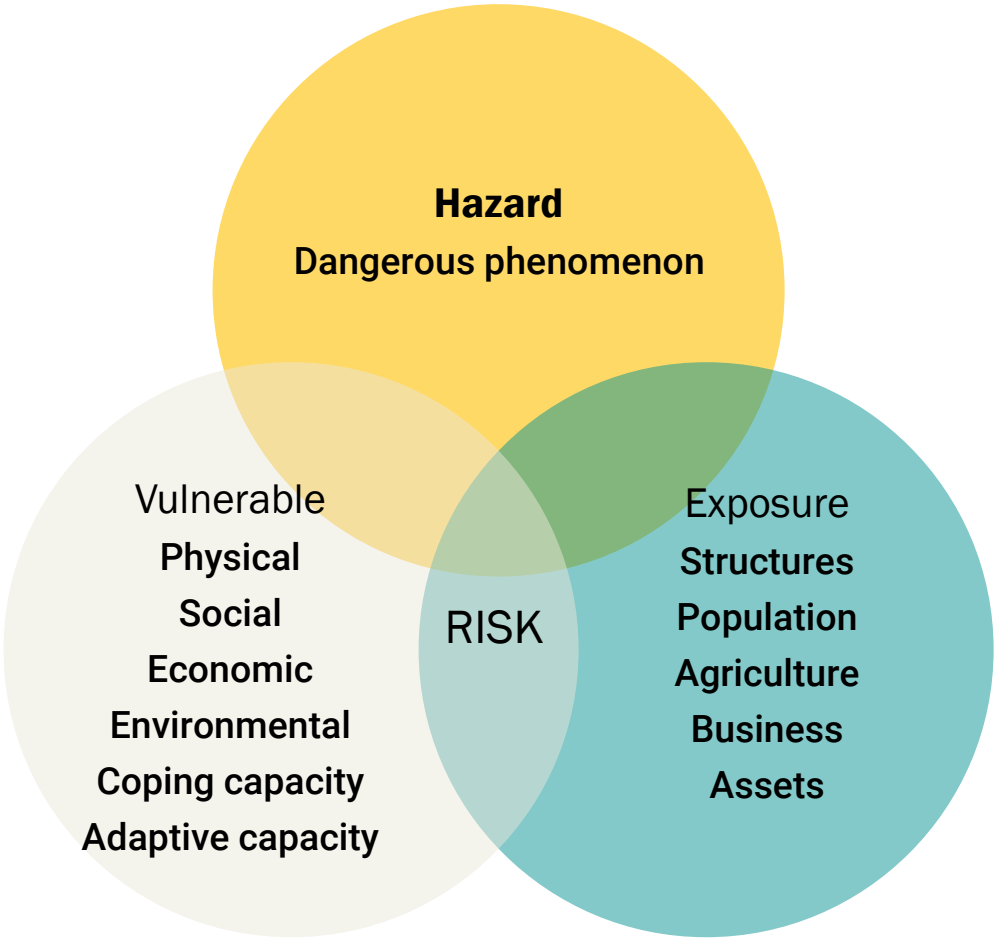
Disaster risk assessment

Probability of meeting danger or suffering harm or loss.

Which approach to choose?

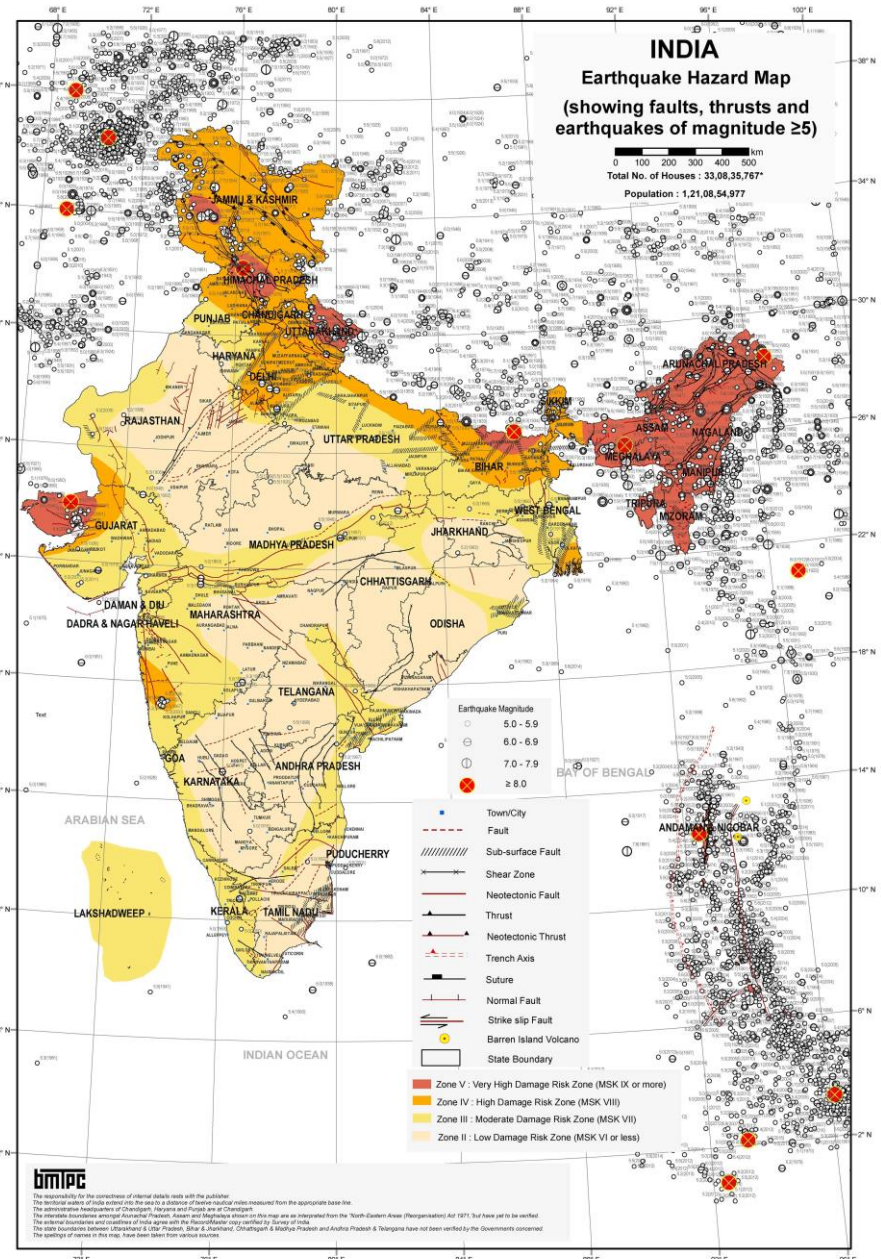
A qualitative or quantitative approach to determine the nature and extent of disaster risk by analyzing potential hazards and evaluating existing conditions of exposure and vulnerability that together could harm people, property, services, livelihoods and the environment on which they depend.

1. **Hazard assessment**
2. **Vulnerability analysis**
3. **Resource Requirement and decision making**



Conceptual framework for disaster risk assessment

1. Source: https://www.undrr.org/terminology/disaster-risk-assessment
2. Graphics source: Cardona et al., 2012 (IPCC report)



BMTPC : Vulnerability Atlas - 3rd Edition : Peer Group, MoHUA, GOI; Map is Based on digitised data of SOI; Seismic Zones of India Map IS 1893 (Part I): 2002, BIS; Earthquake Epicentre from IMD; Seismotectonic Atlas of India and its Environs, GSI; Houses/Population as per Census 2011; *Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic presentation.

1. Hazard assessment - the first step in taking any mitigation measures is to assess the hazard.

1. Identification of hazards - consider the direct effect of the hazard not its effect on the socioeconomic environment (vulnerability analysis).
2. A review of the technical characteristics of hazards such as their location, intensity, time, frequency and probability.
    a. Is there existing assessments and hazard maps, scientific data (meteorological, hydrological, seismological etc.,) and other maps (topographical and geological, etc.,)

3. Probability scientific data and historical records.

Graphics source: https://vai.bmtpc.org/eq.html
Source: Disaster management handbook by Asian development Bank

2. Vulnerability analysis - Identification of vulnerable conditions exposed to natural hazards.

1. Multiple hazards (do individually analysis for each hazard).
2. Vulnerability map provides information on sectors at risk:
    a. Physical (buildings, infrastructure, critical facilities, agriculture);
    b. Social (vulnerable groups, livelihoods, perception of risk, local institutions, poverty);
    c. Economic (direct losses, indirect losses); and the type of risk (damage to public infrastructure, production facilities, housing, or casualties).

3. Resource requirements and decision making

1. The resources required for mitigating the risks need to be evaluated. Balance – risk, and resources
2. To decide who or what to protect and to what level of safety.
    a. An economic Appraisal, b. Levels of safety and priorities for protection and c. Acceptable level of risk.

Disaster mitigation

The lessening or minimizing of the adverse impacts of a hazardous event. Natural hazards often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions.

Mitigation activities fall broadly into two categories:

1. **Structural mitigation** – any physical construction to reduce or avoid possible impacts of hazards or the application of engineering techniques or technology to achieve hazard resistance and resilience in structures or systems.

Examples: dams, flood levies, ocean wave barriers, earthquake-resistant construction, and evacuation shelters

2. **Non-structural activities** – measures not involving physical construction that use knowledge, practice, or agreement to reduce disaster risks and impacts, particularly through policies and laws, public awareness raising, training, and education.

Examples: building codes, land-use planning laws and their enforcement, research and assessment, information resources, and public awareness programs

Mitigation strategies

1. Hazard identification and vulnerability analysis

- hazards that are the most likely in a location (hazards can be one or a combination)
- prepare for the most likely scenario
- addressing both natural and man-made hazards
- vulnerability assessment can also be extended to social groups or economic sectors

2. Various mitigation strategies or measures

- adjusting normal development programs to reduce losses
- economic diversification
- developing disaster-resistant economic activities

Source: https://meghomeguards.gov.in/sites/default/files/course-manual.pdf

Disaster preparedness

Stakeholders

The knowledge and capacities developed by governments, response and recovery organizations, communities, and individuals to effectively anticipate, respond to, and recover from the impacts of likely, imminent, or current disasters.

Disaster mitigation and preparedness go hand in hand.

Who should be prepared for what?

Example of preparedness (scenario-based):

Covid 19 first-wave – Unprepared – loss of lives and economy

Covid 19 second wave – Prepared medical assistance and awareness (dos and don'ts)

Elements of preparedness

Elements	Details
Laws and Authorities	Laws and authorities empowered by law.
Hazard identification and risk assessment	Identify and assess hazards in an area using appropriate tools, considering impact intensity, vulnerability, and potential impacts on facilities, structures, infrastructure, and populations.
Hazard Mitigation	Mitigating hazards requires individual, community, society, local, and national actions.
Resource Management	Hazards often arise from improper management, not resource scarcity. Proper resource management involves acquiring equipment and supplies, considering area needs, and mobilizing resources to continue operations in case of resource destruction.
Management, direction, and coordination	Effective disaster management requires proper procedures, division of labor, preparedness committees, and networks for efficient coordination and coordination.
Communication and Warning	Establish early warning systems, communicate disaster steps, and provide stakeholders with hazard information for effective disaster preparedness.

Elements of preparedness

Elements	Details
Training	Training officials, volunteers, and community members is essential for preparedness.
Exercises, evaluations, and corrective Actions	Periodical drills assess preparations and identify shortcomings, requiring evaluations and corrective actions.
Operations and procedures	Community preparedness during disasters requires proper operations, education, training, and periodic drills.
Logistics and facilities	Implement proper logistics and facilities to aid victims in potential hazards, train staff, identify unrecognized resources, and develop logistics capabilities.
Crisis communication, public education and information	Effective communication resources are crucial for response activities, ensuring infrastructure, information, and public education.
Finance and administration	Adequate and proper financial allocation and administration are crucial for successful activities.

Early warning systems (EWS)

Early warning, How early?

From a few minutes to a few days

An integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication, and preparedness activities systems and processes that enable individuals, communities, governments, businesses, and others to take timely action to reduce disaster risks in advance of hazardous events.

Effective "end-to-end" and "people-centered" early warning systems may include four interrelated key elements:

1. Disaster **risk knowledge** based on the systematic collection of data and disaster risk assessments;
2. Detection, **monitoring, analysis, and forecasting** of the hazards and possible consequences;
3. **Dissemination and communication**, by an official source, of authoritative, timely, accurate, and actionable warnings and associated information on likelihood and impact; and
4. **Preparedness** at all levels to respond to the warnings received.

Why do you need an EWS?

The first one is public safety and protecting human lives.

The second is protecting the nation's resource base and productive assets (infrastructure, private property, or investments) to ensure long-term development and economic growth.

Conversely, by reducing the impact of disasters, a government avoids the financial –and political- burden of massive rehabilitation costs.

Source: https://nidm.gov.in/easindia2014/err/pdf/themes_issue/technology/early_warnings.pdf

Key elements in EWS

01

RISK KNOWLEDGE

Systematically collect data and undertake risk assessments

Are the hazards and the vulnerabilities are well known?

What are the patterns and trends in these factors?

Are risk maps and data widely available?

02

MONITORING AND WARNING SERVICE

Develop hazard monitoring and EWS

Are the right parameters being monitored?

Is there a sound scientific basis for making forecasts?

Can accurate and timely warnings be generated?

03

DISSEMINATION AND COMMUNICATION

Communicate risk information and early warnings

Do warnings reach all those at risk?

Are the risks and warnings understood?

Is the warning information clear and usable?

04

RESPONSE CAPABILITY

Build national and community response capabilities

Are response plans up to date and tested?

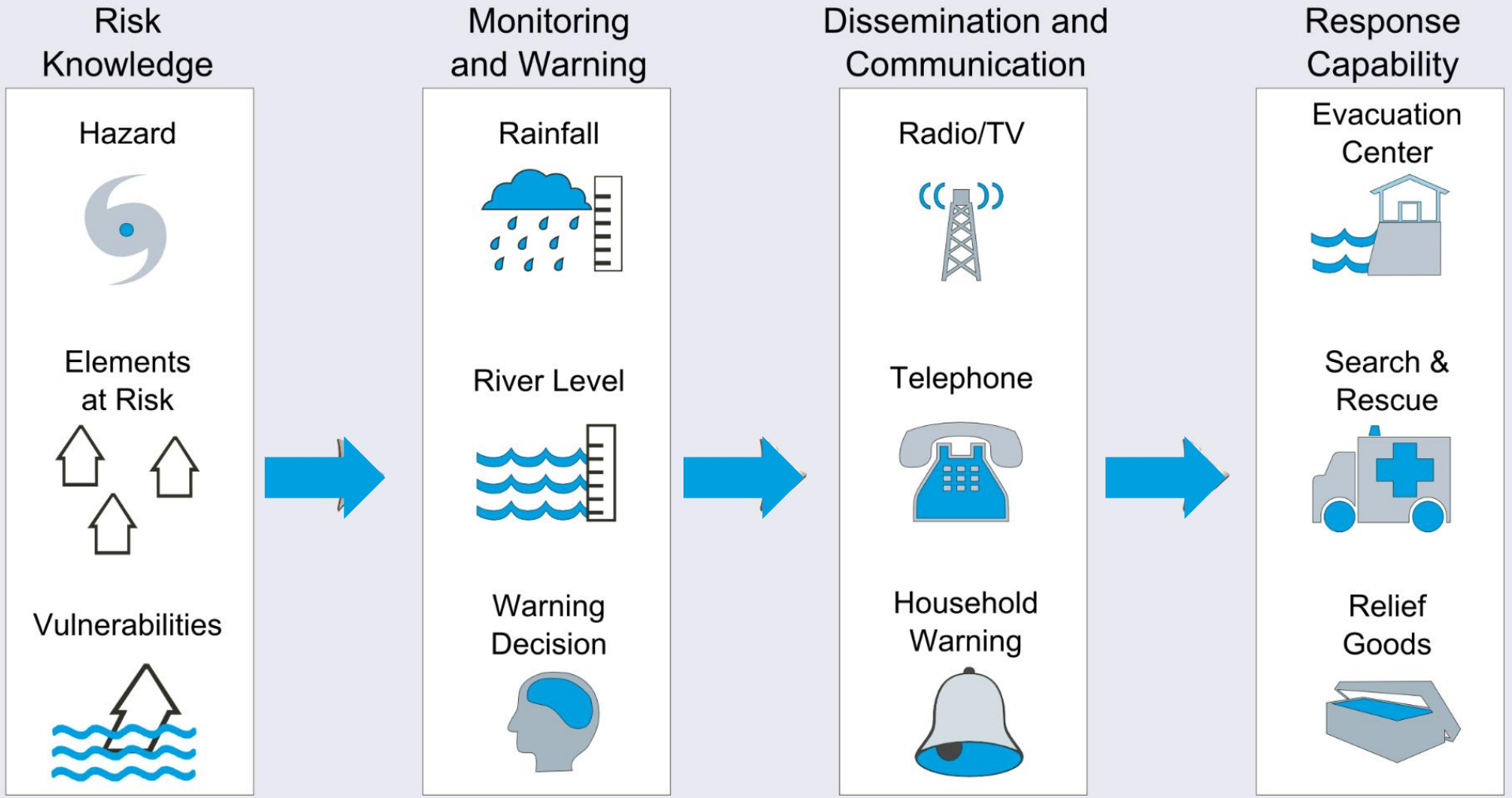
Are local capabilities and knowledge made use of?

Are people prepared and ready to react to warnings?

Source: UN/ISDR Platform for the Promotion of Early Warning

Early Warning System

Example: Flood



Source: https://www.kyinbridges.com/the-importance-of-early-warning-systems-in-disaster-management/

Who is designated for EWS in India?

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

Response

Actions taken directly before, during, or immediately after a disaster to save lives, reduce health impacts, ensure public safety, and meet the basic subsistence needs of the people affected.

- Predominantly focuses on immediate and short-term needs and is sometimes called disaster relief.
- Effective, efficient, and timely response relies on disaster risk-informed preparedness measures, including developing the response capacities of individuals, communities, organizations, countries, and the international community.

Disaster response activities

1. Warning
2. Evacuation and migration
3. Search and rescue (SAR)
4. Post-disaster assessment
5. Response and relief
6. Logistics and supply
7. Communication and information management
8. Survivor response and coping
9. Security
10. Emergency operations management
11. Rehabilitation
12. Reconstruction

Recovery

The restoring or improving livelihoods and health, as well as economic, physical, social, cultural, and environmental assets, systems, and activities, of a disaster-affected community or society, aligning with the principles of sustainable development and “build back better,” to avoid or reduce future disaster risk.

1. **Short-term recovery**

The short-term recovery involves restoring utilities, clearing roads, and repairing damaged buildings while providing food and shelter for displaced individuals. It may continue for weeks. Overlaps with the response.

2. **Long-term recovery** Emergency recovery may involve activities like redevelopment, focusing on community restoration to a better state, lasting months or years depending on damage severity.

Source: https://meghomeguards.gov.in/sites/default/files/course-manual.pdf
https://www.undrr.org/terminology/recovery

Basic steps in recovery

The plan should have at least the following seven steps:

1. Gathering basic information
2. Organizing recovery
3. Mobilizing resources for recovery
4. Administering recovery
5. Regulating recovery
6. Coordinating recovery activities
7. Evaluating recovery

CASE STUDY

AI and disaster management

Semantic segmentation was used to assess the severity of the damage in the disaster area

Marash, Turkey: Satellite imagery (left) from earth imaging company Planet Labs PBC and the xView2 (right) output attributed to UC Berkeley, the Defense Innovation Unit, and Microsoft.

References

Reference materials for each slide are quoted at the right end of the PowerPoint.